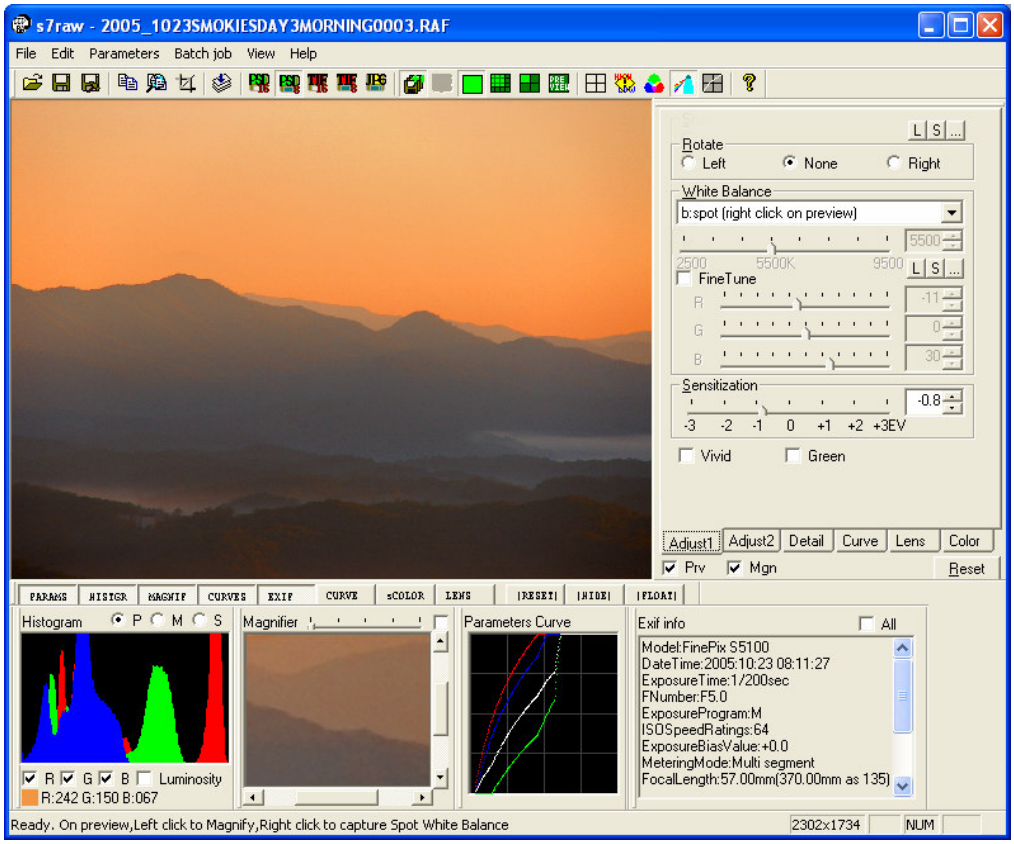
Matt Spinelli
PHOTOGRAPHY

Raw Photo Editing with s7raw

A TUTORIAL AND USER GUIDE



1st Edition
By Matt Spinelli, 10/26/2006

Preface

At www.mattspinelli.com tutorials regarding s7raw are available. Several readers have requested a PDF version of these articles for easy printing and off-line reference. I am glad to now provide the s7raw articles in PDF format. I do have a couple points that I would appreciate your consideration regarding this PDF file.

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Special thanks go to Marco van Dam for his help in putting together this PDF as well as to all those that visit my website and those who help support articles like these.

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1. Introduction

Do you wish you could get more resolution out of your photographs without having to purchase a new, higher mega pixel, digital camera? Do you long for more control over your photographs? Well then, have you heard of RAW capture and RAW photo editors? It is all the more common for digital cameras to offer RAW modes for capturing photographs. Nowadays this feature isn't limited to expensive Digital SLR cameras. RAW capture can be found on cameras costing as little as $300 (US). RAW photo editors are also easy and inexpensive to obtain. In this user guide we will look at a free program called **s7raw**. What advantages and disadvantages are there to using RAW capture verses using JPEG? How do the final results of editing a raw photo compare to editing a JPEG photo of the same subject? What are the pros and cons of using the s7raw photo editor?

1.1 Why Use RAW Mode?

For everyday use the best quality JPEG mode is just fine for digital photography. However, times may exist when we may want a little more 'oomph' out of our digital cameras. Perhaps a detailed landscape or a sentimental portrait is the subject we want to photograph. Why would RAW mode be better suited than JPEG? First, RAW captures are lossless. Nothing is lost when making the digital file. JPEG on the other hand will throw away 83-92% (compression ratios 6:1 to 12:1) of the original picture before saving to the memory card. Most of the time it is hard to see a difference, but upon close inspective, or if you want to print at large sizes, the compression can be very noticeable.

The second advantage, and perhaps even more important, is in order to obtain a RAW image the digital camera will by pass all of it's processing to give you an untouched image. Not only is there no compression, but also the image doesn't have any sharpening, noise reduction, color adjustment, or other digital manipulations applied to it. This may sound like a disadvantage but it really isn't. RAW mode will give you the opportunity to make these adjustments as you see fit. You will have more control over how the photograph is processed, and ultimately, what the photograph will look like.

There is even a third advantage. Many RAW images have 12-bits per color whereas JPEG have only 8-bits. A 12-bit image has 4,096 different brightness levels. A JPEG image has only 256. Why does this matter? When adjusting things such as levels, curves, and colors in a photo editor it will throw out some of these brightness levels. If too many are thrown out (i.e. many edits are preformed) the darker areas of the image will begin to have a banding or posterization effect. Below is an example of posterization. By using the RAW format you can reduce the chances of this happening.

Posterization

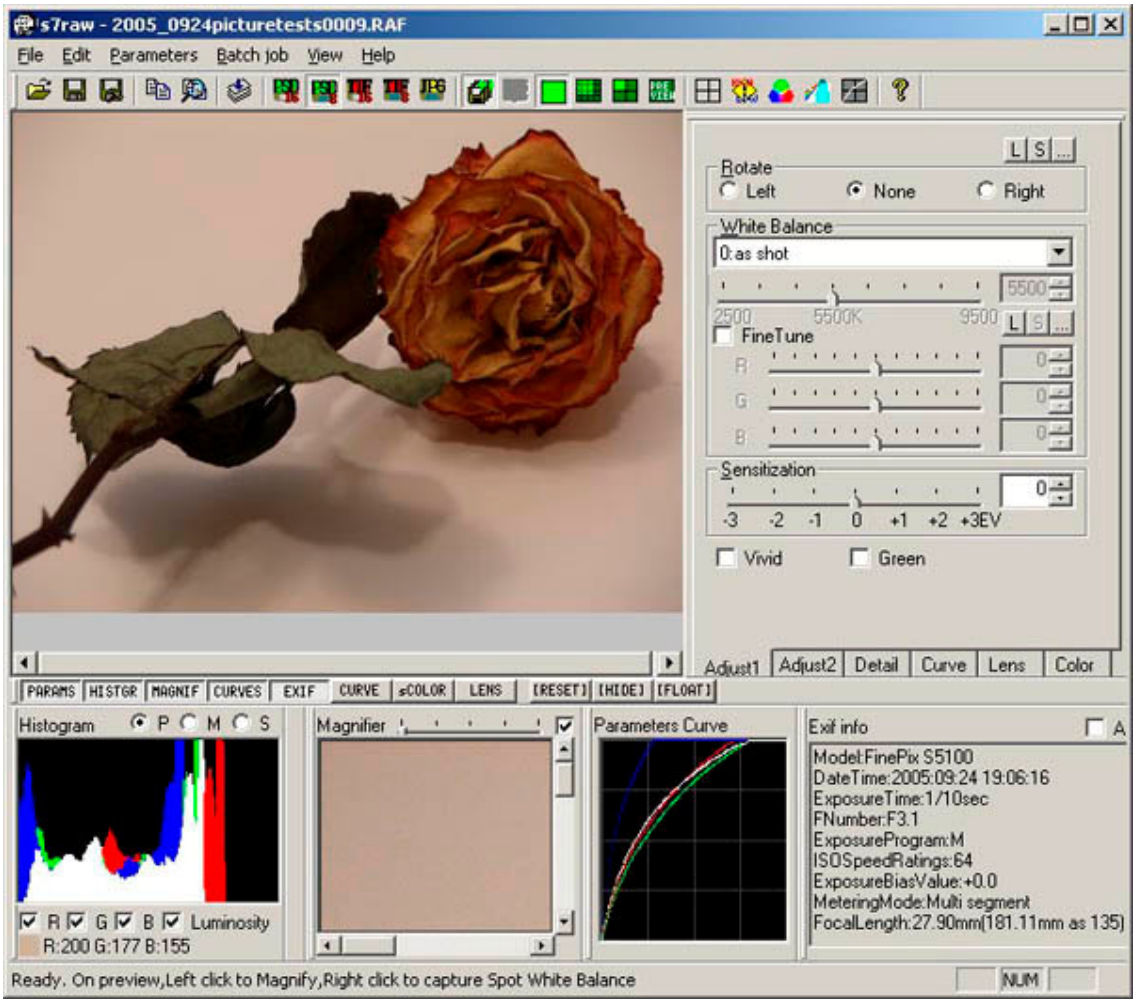
No Posterization

There must be some disadvantages right? Since RAW files are uncompressed they take up more space. A high quality JPEG from a four mega pixel camera may be around 2MB whereas a RAW file will be around 8MB. So if you shoot in RAW mode plan on having a few extra memory cards around.

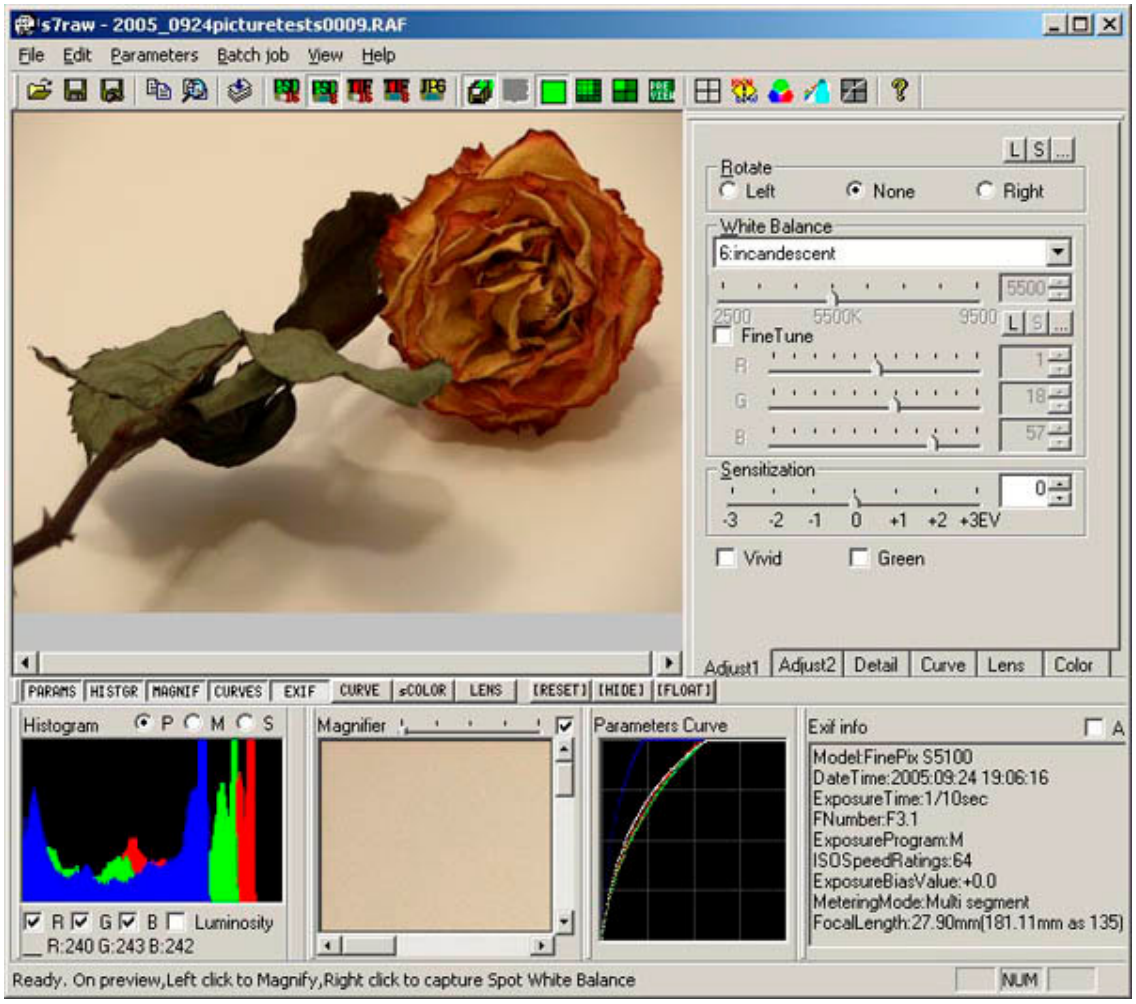
Also some cameras will not let you use burst modes with RAW files since their internal buffers cannot process the larger files fast enough. Not to be overlooked is the fact a RAW file has to be processed before it can be used. This can take hours if you have taken a lot of photos.

1.2 Comparing Results Using s7raw - Test One

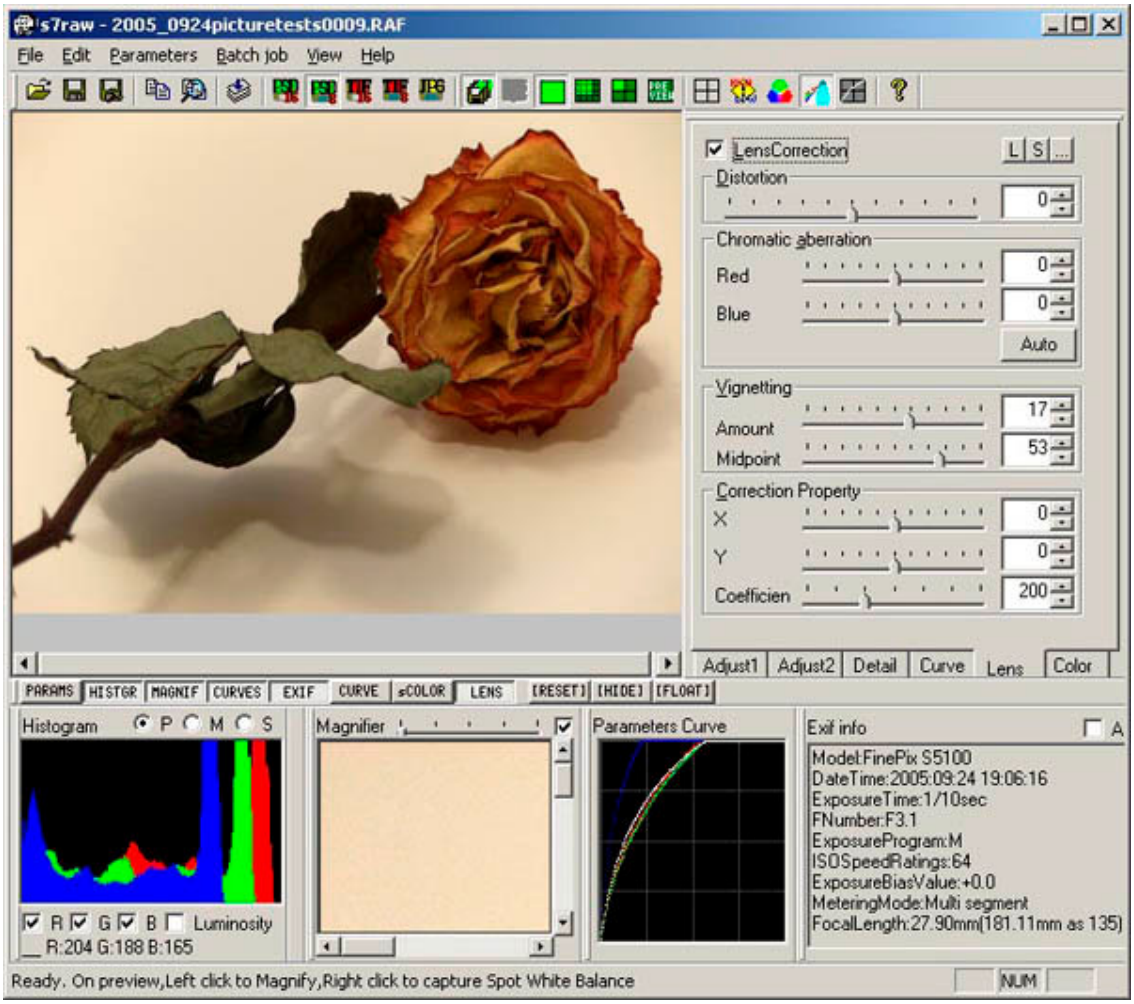
Now we can finally discuss the s7raw photo editor. In this user guide I will compare two sets of photographs of a natural subject and a resolution chart. Each subject has been shot in both RAW mode and the highest quality JPEG mode found on my Fujifilm FinePix S5100 digital camera. Each set of photos was taken under the exact same conditions and with the same settings.



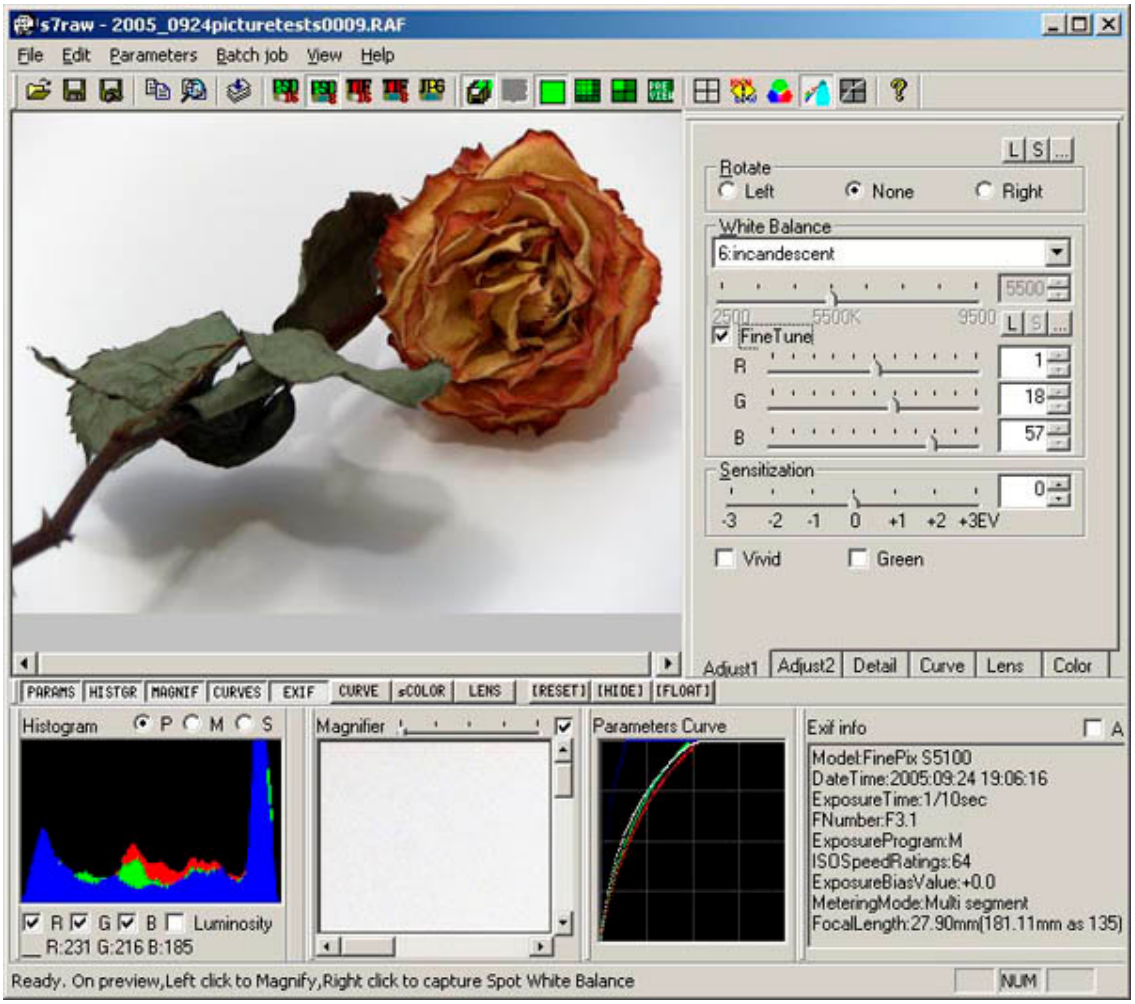
To start, above you will see a screenshot of the s7raw program. The picture is the first test subject, a fallen rose. It is beyond the scope of this article for me to get into all the features of s7raw, but I will explain how to convert the above test image to the final photograph. If you look at the screen capture it is evident that s7raw is not the easiest program to use. However, it offers a wide array of customizations that can be preformed. For this test I am primarily concerned about fixing this underexposed image. To do this I will first adjust the white balance to be incandescent since I took this shoot indoors with normal lighting.



Next I go to the lens tab to fix the slight vignetting.



Then I head back to the Adjust1 tab and set the Red, Blue, and Green sliders under the fine-tune check box to make each channel's histograms expose properly.



At this point I could adjust the gamma, contrast, brightness, saturation, hue, sharpness, moiré, curves, chromatic abbreviation, and selective color manipulations. But I will leave this tutorial to just white balance, vignetting, and histogram adjustments. I plan to explore the other options in chapter two. At the time of this writing s7raw version 0.4 allows for saving in both 8-bit and 16-bit Photoshop and tiff formats. For this comparison I will only use the 8-bit Photoshop format, as it will make it easier to compare to the JPEG test. Once converted the only adjustment I make in Photoshop Elements is unsharp mask in an effort to make the RAW photo as sharp as the JPEG image (I prefer the sharpening found in Photoshop compared to s7raw).

With the JPEG image I use Photoshop Elements and will adjust the histogram for each channel and the lens vignetting (using the PTlens 6.3 plug-in) to get the photograph as close as possible to the RAW photo. Since the camera applied it's own white balance I will not adjust that aspect of the photo. It was also apparent that the in-camera processing added more saturation to the colors so I had to reduce some of the saturation to bring it close to the levels found in the RAW image. So what was the result?

Final Raw photo

Final JPEG photo

So what is different? The vignetting is still noticeable on the RAW image, but that is my fault and should be ignored. When viewing the image as a whole like this the differences are subtle. One thing you might notice is that the subject looks smaller for the RAW photo. The reason is that I resized both files to be a maximum width of 500 pixels. With my S5100, when shooting in RAW mode and using s7raw, it actually gains some physical resolution.

The full size RAW photo was 2302 x 1734 pixels (3.99 MP) and the JPEG was 2272 x 1702 (3.87 MP). As such, shooting in RAW mode on a Fuji S5100 creates a resolution gain between 1.3-1.9%. As a result, when resizing to the same width as the JPEG photo this creates the illusion of smaller image.

Does this mean there isn't an advantage to using the s7raw, or RAW modes for that matter? Let's look at a few 100% full zoom crops to find out. Be prepared though that the difference will not be gigantic.

RAW Leaf Crop

JPEG leaf Crop

Besides the difference in color, you should be able to notice that the veins of the leaf are more detailed in the RAW photo. Especially is this the case when looking on the right side. Some portions of the JPEG photo are a little smeared. Lets move on to another area.

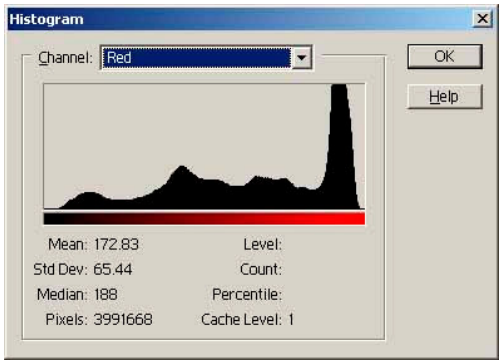
RAW Flower Crop

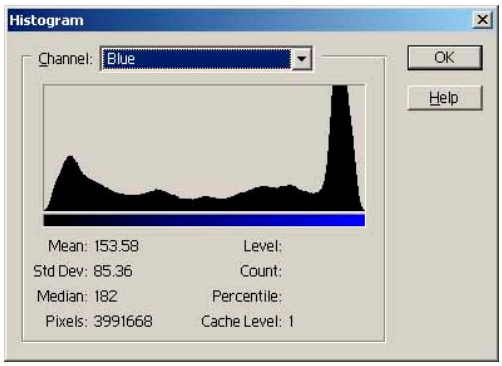
JPEG Flower Crop

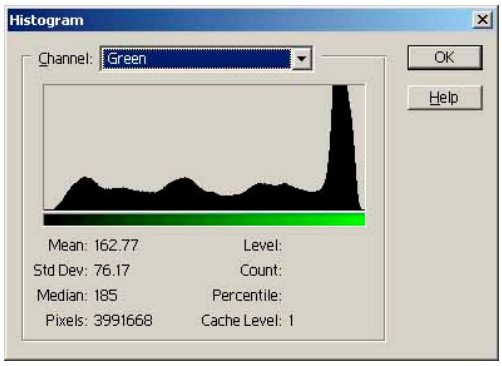
Look closely and you'll be able to notice that the RAW file has a much smoother look to it. Both images are sharp but the RAW photo has fewer artifacts in the image. Also noteworthy is the lines on the flower are more defined in the RAW photo than compared to the JPEG.

Now that you have seen some of the physical differences that can be viewed on a computer screen let's look at one of the biggest differences between the two formats. To do this we have to look at histograms again.

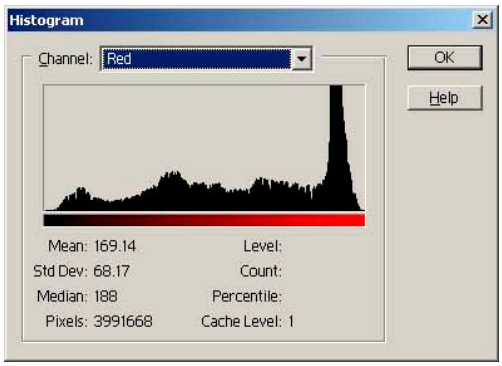
RAW Histograms

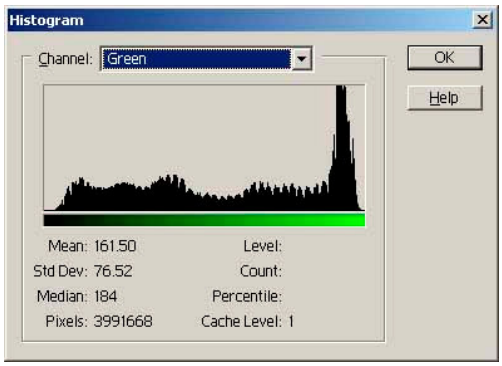


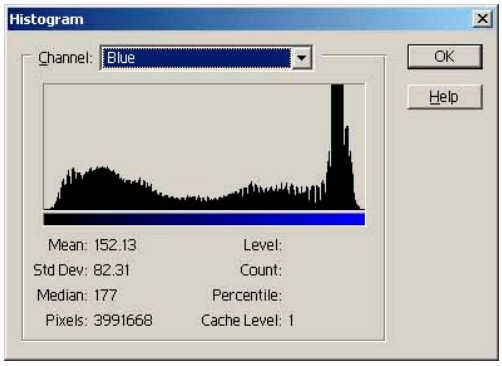




JPEG Histograms





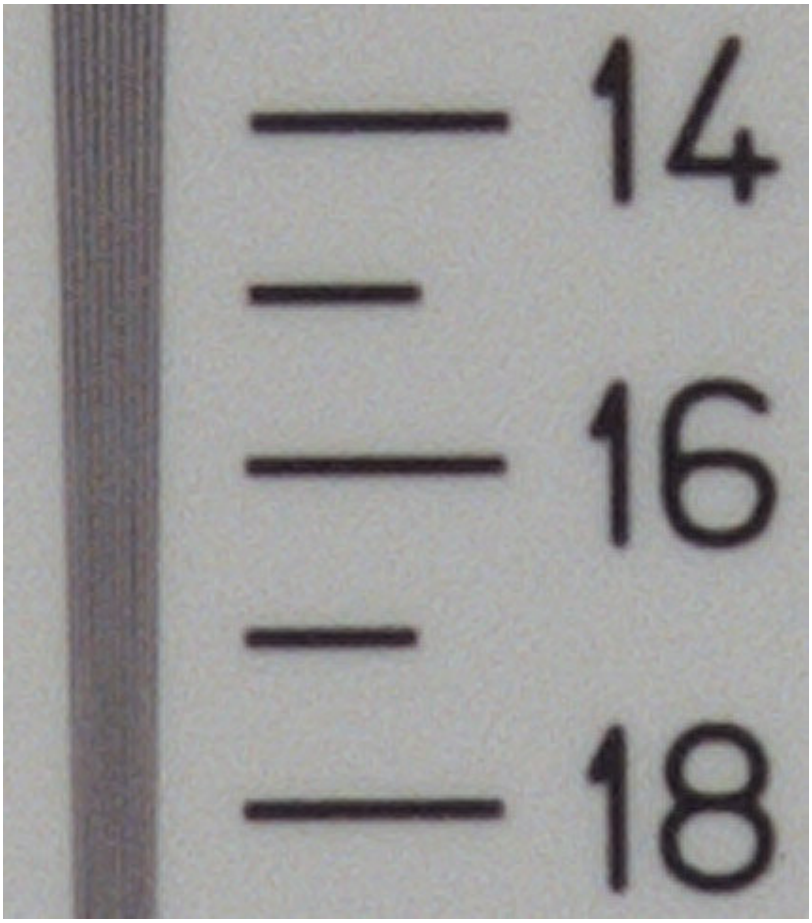


The histograms for the RAW image are smooth whereas the JPEG image contains a comb-filtering effect. The jagged histogram of the JPEG image isn't desirable because it means that the photo has less variation form one brightness level to the next. In extreme cases this can produce color banding to appear when printing. At best it reduces how much processing can be applied to the photograph and thus limiting the potential of the JPEG image. Since all the manipulations to the RAW file were done in s7raw, which processes the files in a 16-bit color space before saving the image as an 8-bit file, there is no banding or posterization found in the RAW photo.

1.3 Comparing Results Using s7raw - Test Two

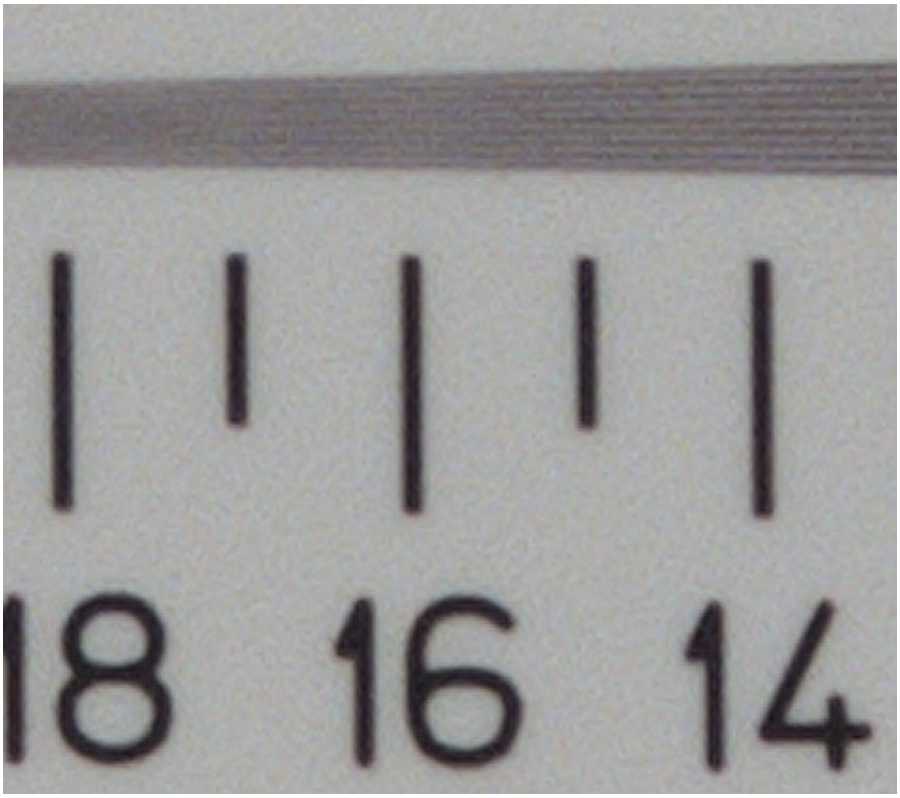
The second test I did with s7raw was to use a resolution chart. Please understand that this test wasn't designed to find the resolution of the camera but simply to compare the differences between RAW and JPEG. We will look at both the horizontal resolution and the vertical resolution. The goal is to see if more detail can be resolved from s7raw and using RAW mode than when using the in-camera JPEG mode. For this test no manipulations were done to the files except a slight unsharp mask on the RAW image and some color adjustments on both files in Photoshop. For this test resolution will be determined by finding the point were detail is no longer found and where multiple lines blur together. The below images are at 200% crop.

RAW horizontal Resolution (detail to ~1700 lines)

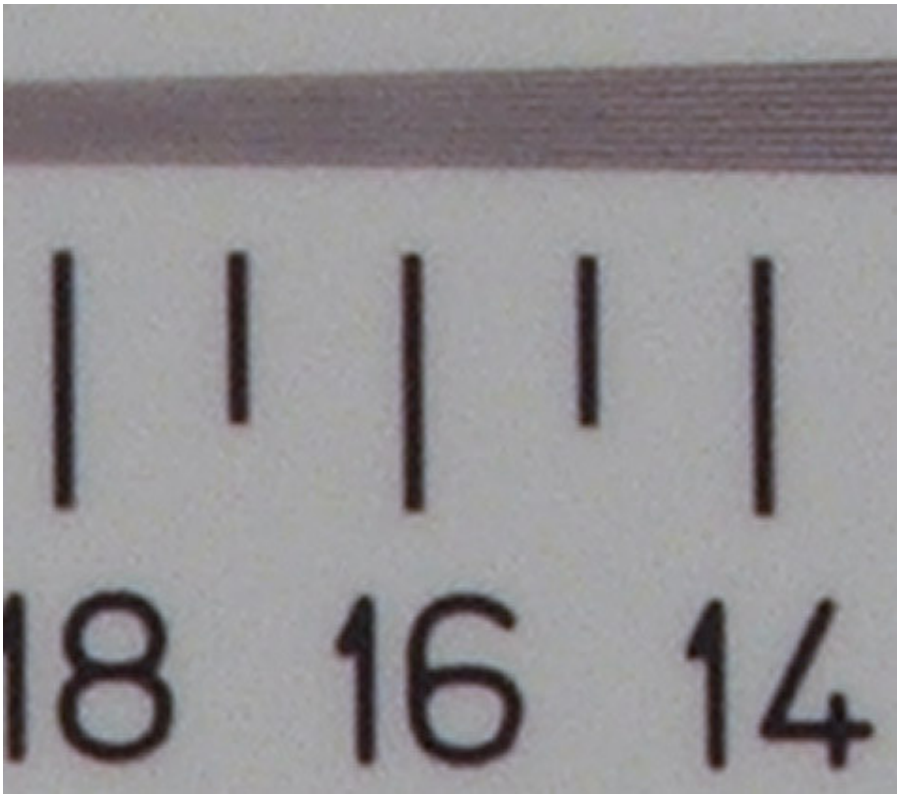


JPEG horizontal Resolution (detail to ~1550 lines)

RAW vertical Resolution (detail to ~1700 lines)



JPEG vertical Resolution (detail to ~1550 lines)

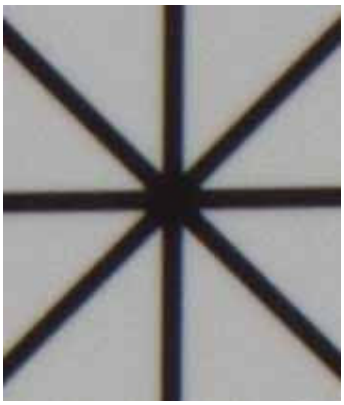


In both sets of crops the RAW photo benefited form a near 10% gain in resolution. Earlier I mentioned that shooting in RAW mode provides around 1.5% more physical resolution, however that doesn't factor into this test since the additional physical resolution is actually added outside the frame which means the crops above are the same exact size. The gain in resolution from using RAW verses JPEG is comparable from upgrading a 5-megapixel camera to a 6-megapixel camera.

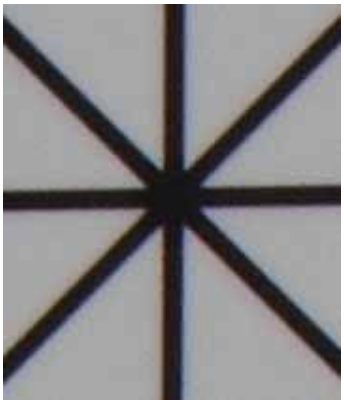
1.4 Pros and Cons of Using s7raw

s7raw has many things going for it. The software is a beta program and is still being improved upon. All indications point to s7raw as being freeware for future versions. I find it amazing the number of adjustments and customizations that can be done with s7raw. The fact that the software can produce a near 10% gain in resolution in my test and produce more dynamic photographs is very commendable. Some have mentioned that it doesn't handle diagonal lines near 45 degrees well by creating a step effect instead of a smooth line. I have not found this to be the case with the camera and version of the software that I use. Below is a 45-degree angle with both the RAW photo and the JPEG photo at 100% crop. As you can see there doesn't appear to be any stepping effect. (Note: The PDF is buggy and needs to be zoomed closer than 100% for this to be seen.)

Raw diagonal



JPEG diagonal



The only negative thing I have noticed about s7raw is that it appears to add artifacts into the image. These are small random looking lines that appear in detail areas of an image. Below is an example from the resolution chart at 200% crop. There should only be horizontal lines in the image but yet some vertical artifacts appear.

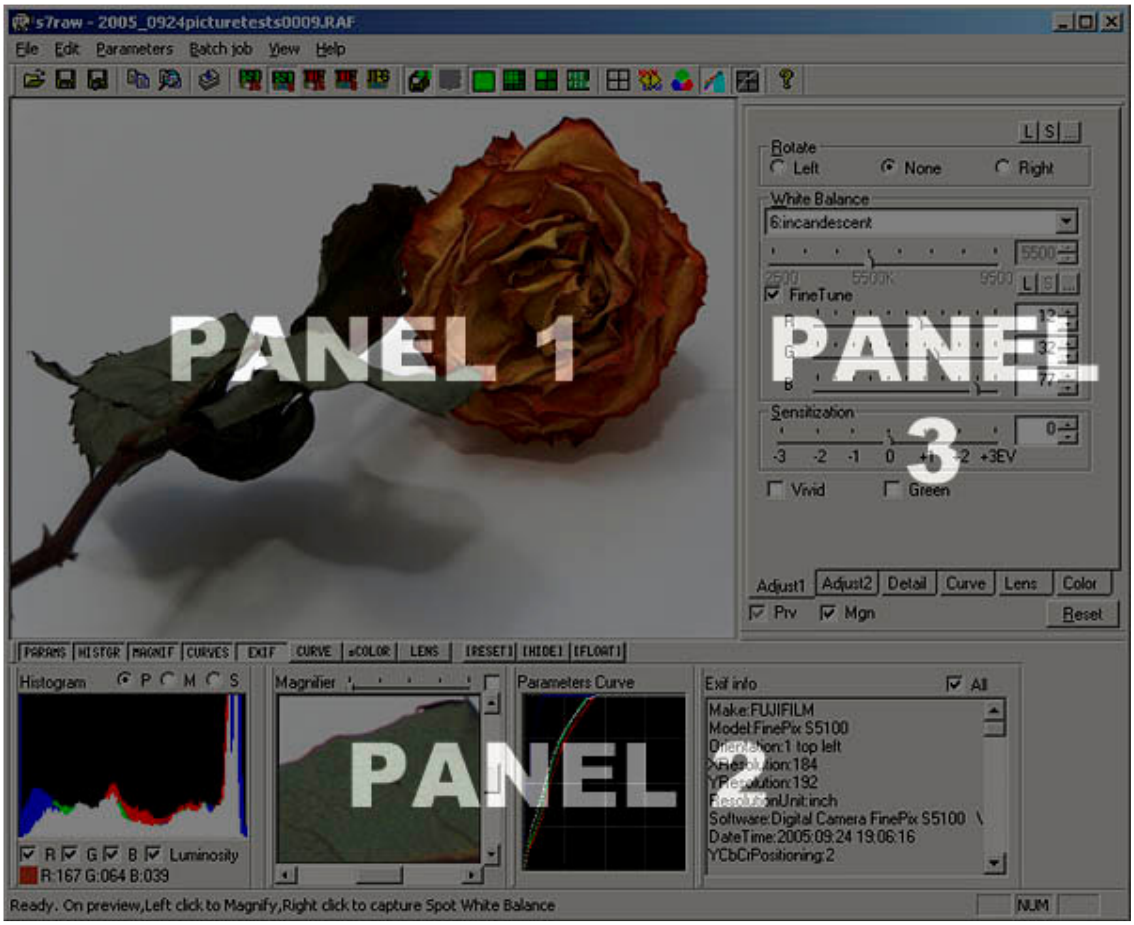
1.5 Conclusion

Using s7raw along with a digital camera's RAW mode can increase image resolution, provide cleaner, more dynamic photographs, and allow for processing to be done in multiple ways by the photographer instead of the camera. I use s7raw because of the sterling results it provides and would recommend it to anyone looking for a free, powerful, RAW editor.

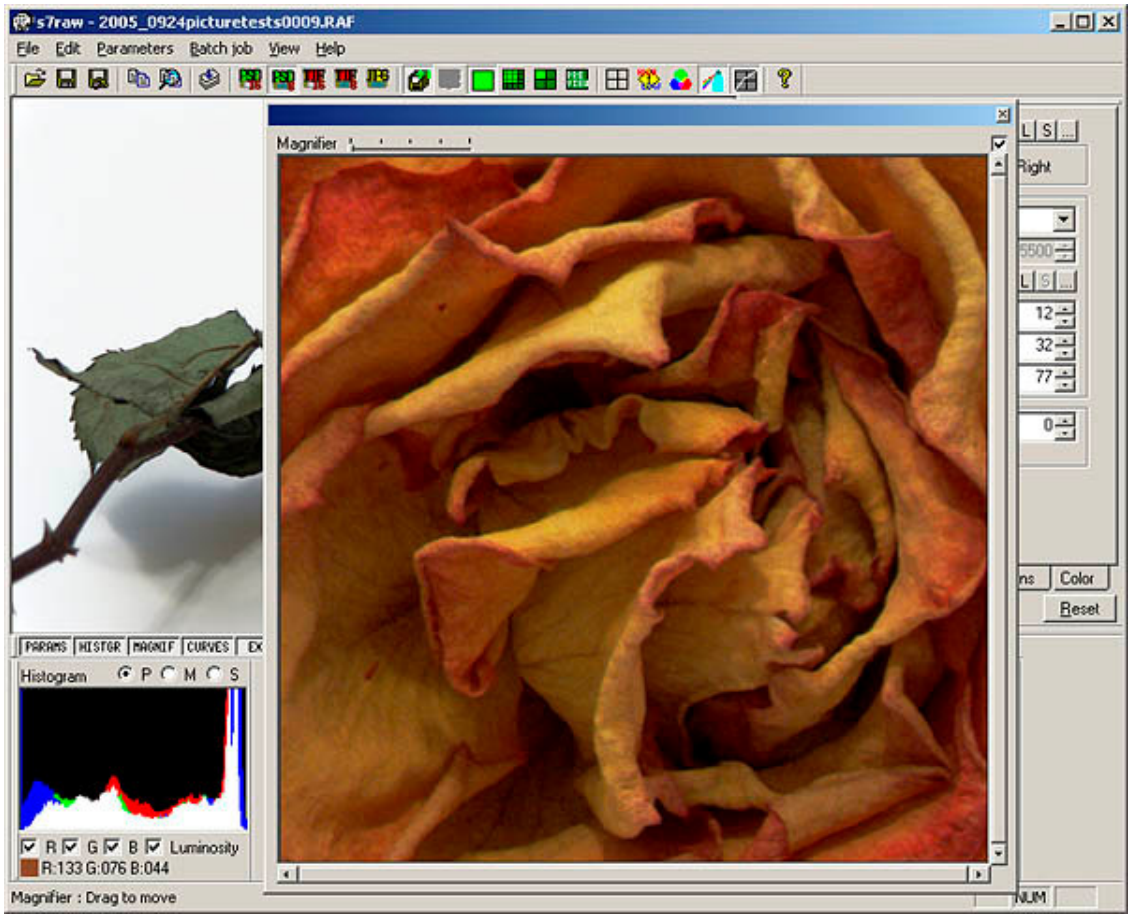
2. s7raw, The user interface

Previously in chapter one, I wrote about the merits of raw photo editing with s7raw. Now we will take a more in-depth look at this photo editor in this user guide. Please keep in mind that the s7raw editor is still in a beta stage and this tutorial is based of off version 0.4.1 (now revised to include up to 0.4.3). I have tried to make this tutorial easy to follow, concise, and informative by splitting it into three main sections - understanding the user interface, making adjustments, and using advanced features.

2.1 Understanding the User Interface

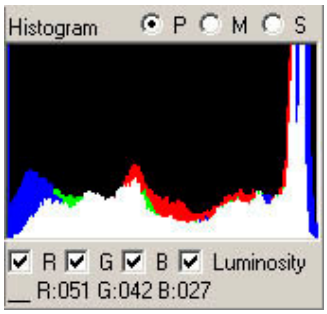


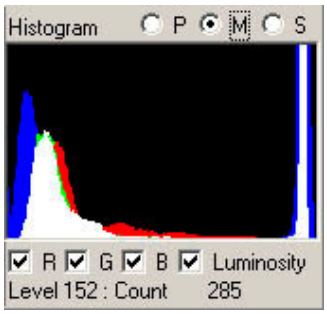
The raw editor's user interface is split into three main frames or panels - the preview window, the display panel, and the adjustment panel. Most of the controls found within each of these panels can be moved and docked to one of the other panels. The magnifier window, when having its check box checked, can be undocked from the main form and enlarged for better viewing. For this tutorial will focus on the default layout.

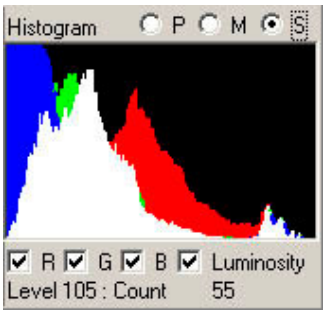


Raw images are displayed in the preview window of this raw photo editor. It is not possible to zoom within the window as it only shows the entire image as a whole. To be able to zoom in closer, the display panel contains a five level magnifier window. This window will display a selectable 256 x 256 or 512 x 512 crop of the image at 100-500% magnification.

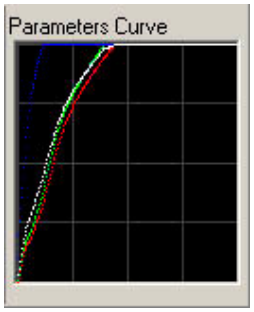
In addition to the magnifier, the display panel also contains a histogram, parameter curves, and Exif data. The histogram separates the RGB channels as well as luminosity. Each channel can be toggled on or off. The P, M, and S options of the histogram are also selectable. The preview (P) option displays the histogram of the whole image, the magnifier (M) option displays the histogram of the image inside the magnifier window, and the selection (S) option displays the histogram of a selected part of the image. To select a part of the image press CTRL and the left mouse button while dragging the mouse in the preview window.







Next, the parameter curves show the level curves of each RGB and luminosity channel. The last member of display panel shows the Exif data with the option of viewing just a summary, or all of the available information. Selecting all will display a very long list of information regarding the photograph.



The third panel contains the raw photo editing adjustments. This panel has six adjustment tabs - Adjust1, Adjust2, Detail, Curve, Lens, and Color. We won't go over what each tab contains in this section, but will instead address it in the making adjustments portion of the tutorial.

The last topic in this section is the menu. Just about all features found on the three main panels can be accessed from the Parameters and View menu. File, Edit, and Help are the normal fare. Batch Job will be discussed in the *advanced features* portion. The menu also contains buttons. Below you will find a brief description of each one:

	**Open** - Opens an existing document or parameters.
	**Save** - Saves the active document.
	**Save Parameters** - Saves the active parameters.
	**Copy Preview** - Copies preview image and puts in on the clipboard.
	**Copy Magnifier** - Copies magnifier image and puts it on the clipboard.
	**Crop Tool** - Affects histogram when in S mode and will crop the image upon output.
	**Batch Job** - Converts multiple files.
	**16-bit PSD** - Sets output to be a 16-bit per channel PSD (Photoshop) file.
	**8-bit PSD** - Sets output to be an 8-bit per channel PSD (Photoshop) file.

	**16-bit TIFF** - Sets output to be a 16-bit per channel TIFF file.
	**8-bit TIFF** - Sets output to be an 8-bit per channel TIFF file.
	**JPEG** - Sets output to be an 8-bit per channel JPEG file.
	**Increment** - Increments output file number if file already exists.
	**JPEG Option** - Adjust the JPEG quality.
	**Full Size** - Sets output to be full size.
	**9/16 Size** - Sets output to be 9/16 of the original image size.
	**Quarter Size** - Sets output to be ¼ of the original image size.
	**Preview Size** - Sets output to be the preview size, 512x384.
	**Grid Menu** - Displays a grid with the preview being divided by 2, 3, 4, 8, 12, or 16.
	**Highlight/Shadow Warning** - Displays blown or lost shadow detail.
	**SelColors** - Toggle selection color adjustments.
	**LensCorrection** - Toggle lens correction adjustments.
	**FreeCurve** - Toggle free tone curve.
	**About** - Display program information, version number, and copyright.

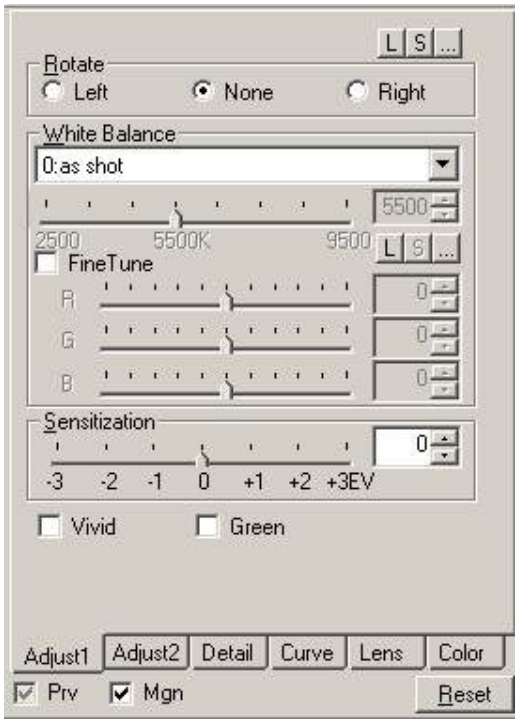
UPDATE: It was brought to my attention that some checkboxes have three states (checked with a white background, checked with a gray background, and not checked). Well after hearing back from the s7raw's development team, apparently a gray checked Prv checkbox indicates that after the parameters are changed by the sliders, the program waits a few seconds before updating the preview (white background does not have this delay).

Also the Mgn checkbox (this one is just two states, on or off) determines whether or not the magnifier is updated when the parameters are changed by the sliders.

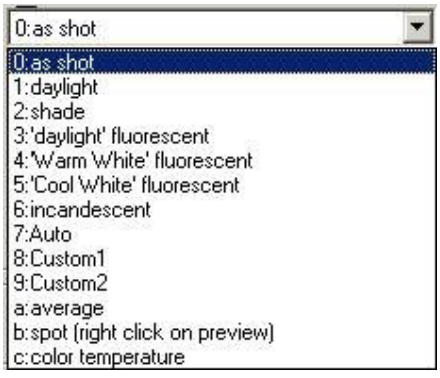
3. Making adjustments

In chapter 2.1 of this user guide we evaluated the user interface. Now we will look into the photo editing aspect of s7raw. All photo editing adjustments are made within the third panel of the editor and contain the following tabs: Adjust1, Adjust2, Detail, Curve, Lens, and Color. In this section of the tutorial we will focus on each individual tab, one at a time.

3.1 Adjust1 Tab - Rotate, White Balance & Sensitization



The first tab, Adjust1, has three primary functions. The first function is **rotate**. This simple control will either rotate the image to the left or right by 90 degrees. The second function is **white balance**. The white balance of the raw image can be adjusted in three ways. The first way is by selecting a preset white balance from the first 11 options in the drop down box. The below screen shot displays the options available:

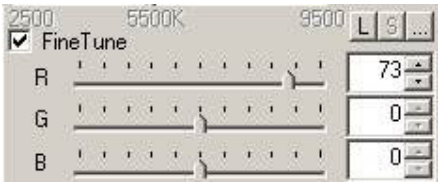


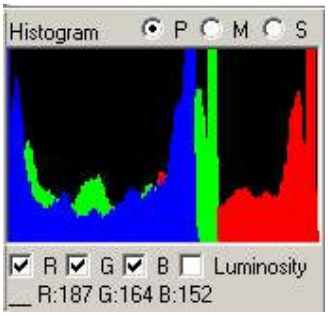
Please note that the **custom1** and **custom2** options do not appear different from each other, nor are they editable. This most likely will be addressed in a future version of s7raw, or perhaps I have not figured out their use. In any case, most of the other options are self explanatory. The most useful white balance option is **spot**.

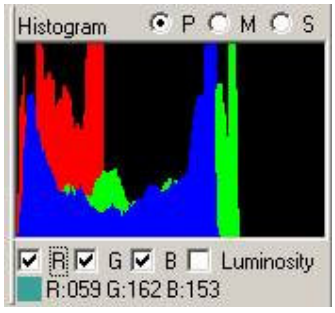
Spot allows us to select a portion of the image that we know to be a neutral gray point. In other words, we should click on an area that should be void of color. For example, if an image has a red, or some other color tone, in an area that we know should be white, black, or gray, clicking on this area will correctly change the white balance. This is one of the most accurate ways to adjust the white balance of the raw image.

The twelfth option available is the second way to adjust white balance. When **color temperature** is selected it enables the slider below the drop down box to be adjusted. The higher the number is, the warmer the colors; the lower the number, the cooler the colors. Unfortunately, the current version's white balance by color temperature is not accurate. This is acknowledged on s7raw's website.

The third way to adjust white balance is to **fine tune** the RGB channels ourselves. This can be adjusted in addition to the above mentioned methods. Moving the sliders to the right does not add brightness to a channel. Checking the histogram verifies this. What happens is that when a channel is adjusted to a higher value (slider moved to the right), it expands the channel to cover a wider range, not merely shifting the histogram as in a simple brightness adjustment. The opposite is also true when the slider is moved to the left (lower value), as it collapses the channel into a smaller range. Interestingly, this has a similar effect to that of the next function, Sensitization, but done on an individual color channel.

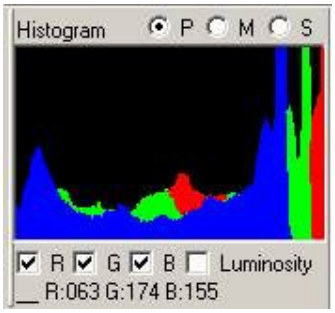


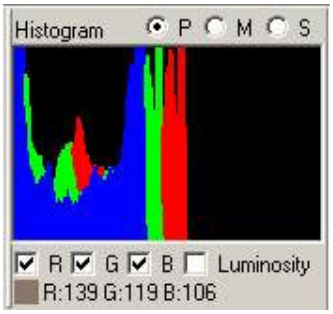




Sensitization, also know as exposure compensation, is similar to white balance in that it will expand (slider moved right) or collapse (slider moved left) the colors and brightness levels of the raw image as a whole. It is best used in conjunction with the white balance options. Lastly, the **vivid** and **green** check boxes will toggle on and off vivid color

processing and green color enhancement. Basically these two options adjust the colors as described.





UPDATE: It was brought to my attention that some checkboxes have three states (checked with a white background, checked with a gray background, and not checked). Well after hearing back from the s7raw's development team, apparently a gray checked vivid color or green enhancement checkbox indicates that the effect is applied at 50% instead of in full (white background).

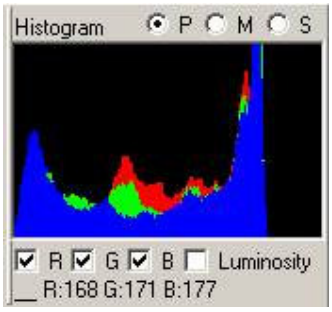
3.1.1 Adjust1 Tab Tutorial

To summarize the photo editing adjustments that can be made on this tab lets walk through a short tutorial for adjusting white balance and sensitization. To start with we will use the same image that was used in chapter one. This image works really well in demonstrating the power of raw editing with s7raw because it was purposely shot underexposed in incandescent (normal indoor) lighting. This causes the image to appear dark with a very warm cast. Remember, there are two ways (not including color temperature) to adjust the images white balance and we will walk through each method. The raw image also has severe vignetting at the corners. All of this makes it a great example off showing of the power of raw photo editing. However, vignetting won't be addressed until we go over the lens tab.

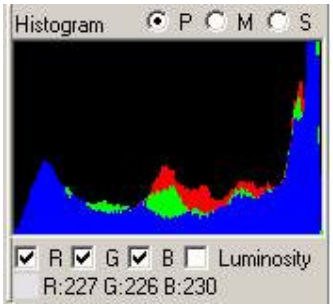
The original RAW image can also be downloaded so that those who would like to walk through these tutorials can practice in addition to reading. This raw image will be used as an example in the majority of this user guide. At http://www.mattspinelli.com/s7raw/2005_0924picturetests0009.zip you can download the raw image. **Note:** the file size is 5.9 Mb and is in the zip format.

Example #1 - Using the Presets

Step 1: Determine which preset it best to use. In this example, the background of the image should be white, or a shade of white such as grey. Selecting incandescent does not properly adjust this image as there still is a yellow cast to the background even though that was the lighting in which the photo was shot. Auto does slightly better but the background still isn't white or grey. Using spot and clicking on the open background changes the white balance correctly. Notice that the background is grey and the RGB channels are lined up similarly.

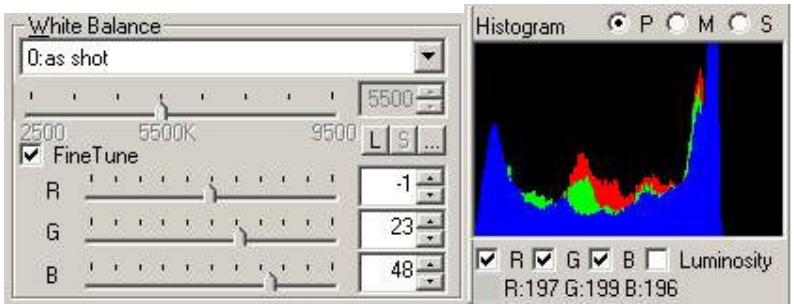


Step 2: Look at the histogram. After the white balance has been adjusted we can easily see that the image is still dark and that the histogram doesn't have any information in the brightest levels. To compensate we adjust the sensitization by +0.7.

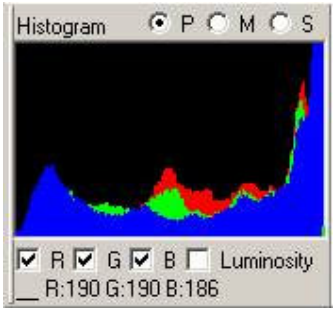


Example #2 - Fine Tuning

Step1: Leave the preset to as shot and make sure the check box next to fine tune is checked. Adjust each channel until all three colors line up with each other, or until the areas of the image that are suppose to be white or grey become as such.



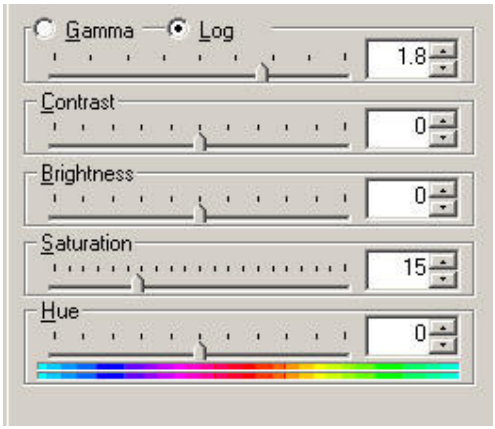
Step 2: Look at the histogram. Depending on how we adjusted the white balance we may need to adjust the exposure compensation. Since fine tuning each channel has a similar effect to what the sensitization function applies, we have a choice to make. We can either boost the fine tuning values or we can boost the exposure compensation to achieve the same result. Again, the goal is to have the histogram expand across all available brightness levels. In this case we will adjust by using exposure compensation by moving the sensitization to +0.8.



As we have seen, the Adjust1 tab primarily edits a raw image's white balance and this can be done in multiple ways. The above two examples show that near identical results can be achieved from various methods of editing. Next we will talk about the Adjust2 tab.

3.2 Adjust2 Tab - Tone Curves, Contrast, Brightness, Saturation, and Hue

In paragraph 3.1 of this user guide we began to talk about the photo editing aspect of s7raw, namely color balance and exposure adjustments. We will continue this section by going over the Adjust2 tab that features tone curves, contrast, brightness, saturation, and hue.

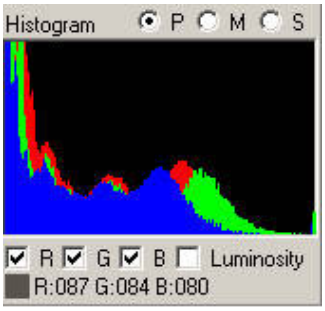


Tone Curves

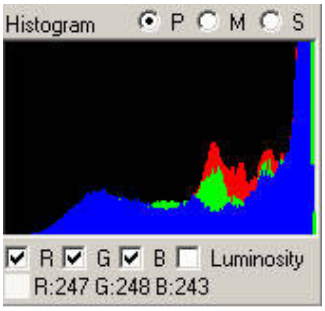
The gamma and log control affects the tone curve of an image. Tone curves are not as easy to master, or explain, as other controls. Nevertheless, I'll try to make it as easy as possible to understand. Please note though, that s7raw has an even better control that allows for more customization called the free tone curve found on the curve tab that allows for more advanced and precise adjustments. We will discuss this in a later tutorial. In this section, I will focus on how the gamma and log control affects the tone curve.

Moving the slider to the left when using either gamma or log will cause the image's histogram to shift and condense to darker tones. Sliding to the right will cause the histogram to shift and condense to brighter tones. Subtle adjustments are useful for bringing out (or hiding) detail in primarily the shadows and mid-tones of the image. Extreme adjustments will alter the entire image to become either bright or dark. Some examples of the effects are seen below.

Very dark tone curve



Very bright tone curve



Tone curves do not cause any clipping to occur to the image as can happen when using sensitization (exposure compensation), contrast, brightness, saturation, and hue. Clipping is when the values in the histogram go below the darkest value possible or above the brightest value possible. In other words, highlight detail or shadow detail is lost if clipping occurs. Tone curve adjustments work within these boundaries to prevent clipping due to the logarithmic nature of the control.

Lastly, most editors do not have a log adjustment but instead have only gamma that is generally used for image correction. After contacting the makers of s7raw, I found out that Fuji raw files (RAF) have their data stored in what appears to be a logarithmic curve.

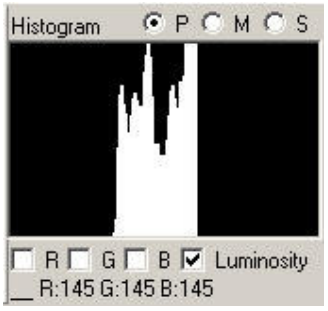
Thus s7raw kindly allows us to adjust our raw images in like manor. Gamma adjustments are similar to log, but mathematically they are not the same. You can see the difference in switching between the two. Which one is best? Which ever looks right to you!

Contrast

Simply, contrast is the difference between the darkest and lightest tones in the image. Increasing contrast results in a heightened difference between dark and bright areas of an image. Decreasing contrast will reduce this difference. Unlike the white balance and exposure compensation adjustments, contrast expands or condenses the brightness and color values away from or toward the midpoint of the histogram depending on which way the slider is moved.

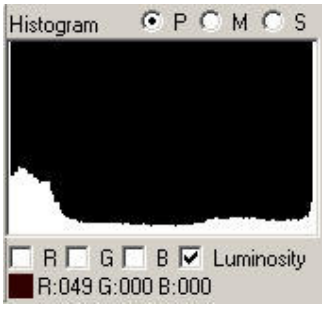
For example, using the test image, drastically decreasing the contrast will compress the tones towards the middle of the histogram. This will produce a grayish effect as is shown below.

Decreased contrast



If we were to drastically increase contrast it will expand the tones away from the histogram. This will produce a very bright and dark image as is shown below.

Increased contrast

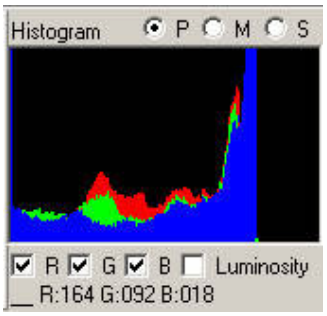


Obviously, the goal under normal circumstances would not be to produce images with extreme contrast or the lack there off. Nevertheless, this illustrates quite well how the contrast control affects the image.

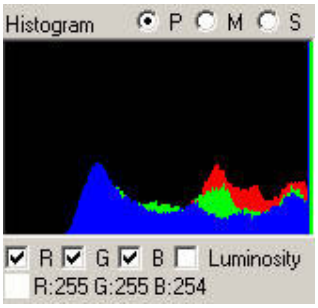
Brightness

Brightness behaves in a similar fashion to that of exposure compensation in that it too will affect the overall brightness or darkness of the image as a whole. However, unlike exposure compensation, which expands or condenses the image's brightness levels and colors, brightness adjustments simply shift the histogram values to the left (darker) or right (brighter) as is shown by the two examples below.

Decreased brightness



Increased brightness



Saturation

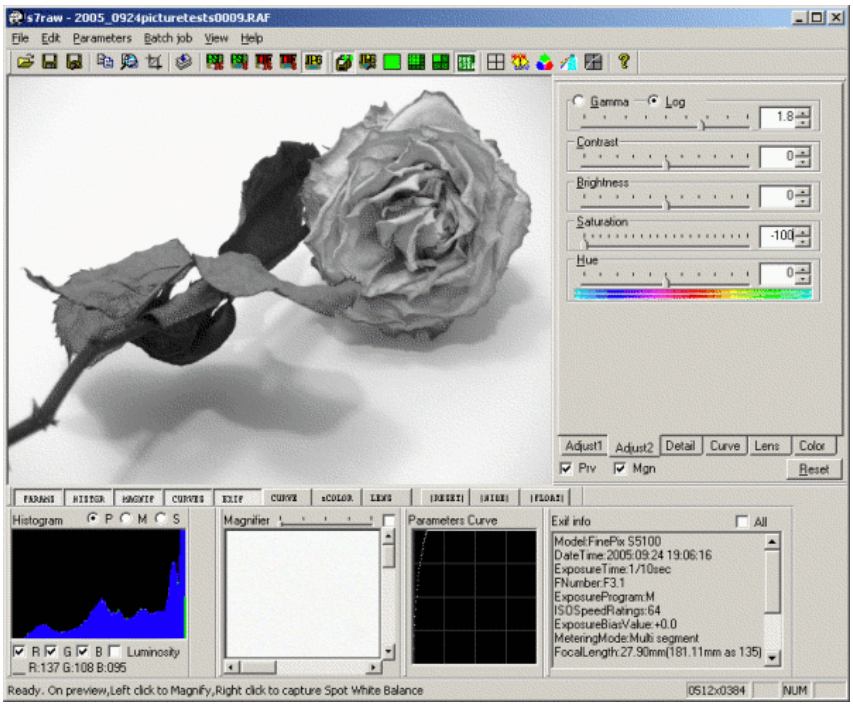
Saturation is best described as the intensity of color. More saturation will bring out and emphasize colors, giving an image more vibrancy. In extreme applications it will bring out color noise and cause severe color channel clipping. Less saturation will cause an image to be more subdued, and in extreme cases will convert an image to become grayscale.

With s7raw, saturation can only be adjusted to the image as a whole, and unfortunately we have no control over individual colors. High saturation may bring out a color we want to accentuate, but as a result less desirable colors too will be emphasized since we don't have control over individual colors. As such, I suggest that saturation be applied only mildly when using s7raw, and instead use Photoshop or some other photo editor to perform saturation on separate colors. However, since raw images do not have any in camera processing applied to them (this includes saturation), modest use of this tool normally is necessary. Just leave the fine tuning to another editor.

Looking at the histogram, it is interesting to see how saturation adjusts our test image. I have created an animated GIF file to show what happens. I started with the saturation control at -100 (all the way to the left). Then I adjusted it to -50, 0, 50, 100, 200, and 300 (all the way to the right). Saturation appears to amplify the difference between the primary red, green, and blue channels. Visually, the dominate colors, and in this case red, will become the strongest when more saturation is applied. Notice too that some clipping in the darker values occurs (as seen by the blue and green channels on the left side of the histogram).

NOTE: The animations do not work within the PDF file. Please see the article online at http://www.mattspinelli.com/s7raweditor2b.html for this functionality.

Animation of Saturation



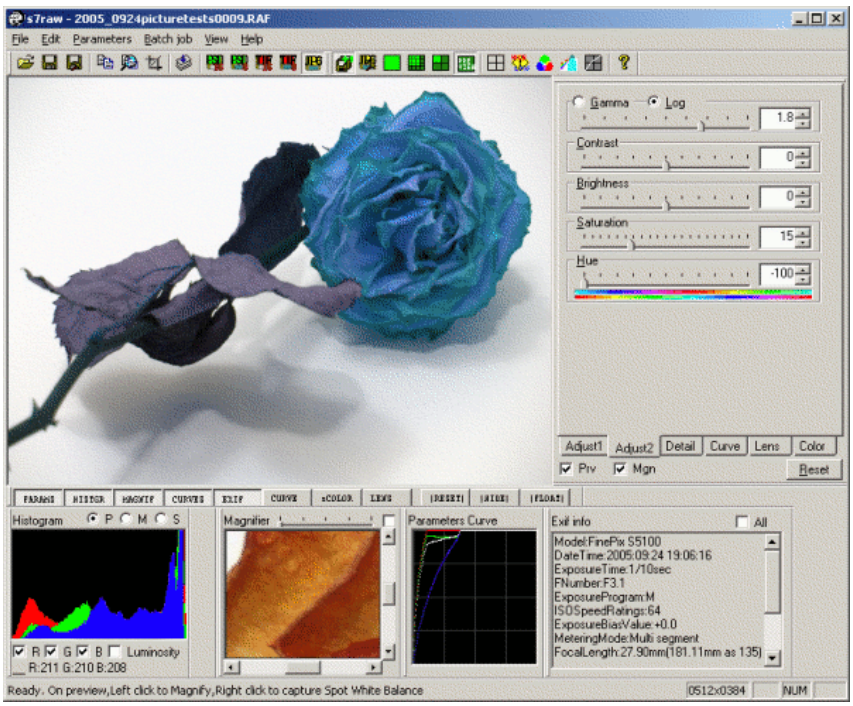
Hue

Hue shifts the color of an image. Moving the hue control to the left will introduce a more violet or blue tone. Shifting the hue control to the right will introduce a more yellow or green tone. The exception is that shifting to either extreme will produce near identical results. Basically having a hue value of -100 or 100 is essentially the same.

The histogram isn't as useful in using the hue control as it is in the previous ones, but it will tell you if you are clipping any of the color channels. If the hue values are at -100 or 100 it will show that the color channels have swapped places compared to when it is set to 0.

In s7raw, the hue control itself shows what happens when it is adjusted. This too I have animated. There are two color strips below the control. The top one shows the colors before a hue change. The bottom strip shows what the corresponding color in the strip above will become after the hue is changed.

Animation of Hue



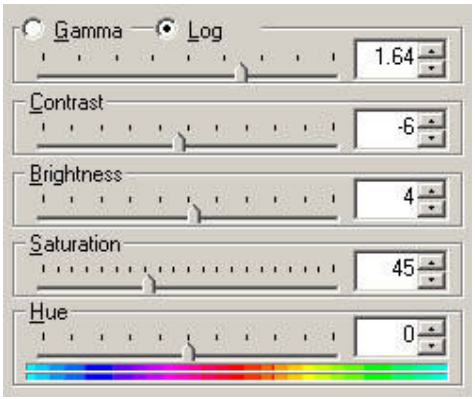
3.2.1 Adjust2 Tab Tutorial

After discussing the two main adjustment tabs in s7raw, it can become a little confusing to know in what order to make these adjustments. While not a hard fast rule, here is a possible order of adjustments to make to give pleasing results:

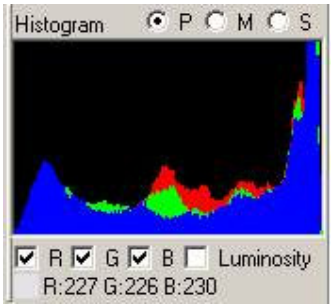
1) White balance (Adjust1 tab)
2) Sensitization (Adjust1 tab)
3) Saturation and Hue
4) Contrast and Brightness
5) Gamma or Log

Using the sample image and the settings discussed in paragraph 3.1.2 (I used example #1) we are going to add contrast, brightness, saturation, hue, and log adjustments to the sample image. These adjustments will be much more subtle than the above examples. The before and after of the image is shown below, as well as the parameters used. The results are not very dramatic as the image is pretty good as is. If you look closely you'll see more detail in the darker tones of the leaf area, more vibrance in the colors, and slightly less contrast.

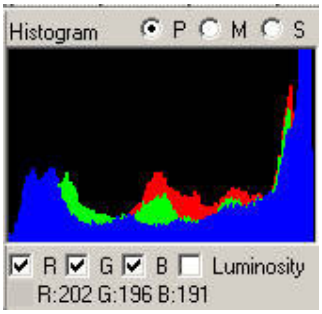
Adjust 2 parameters



Before Adjust2 adjustments



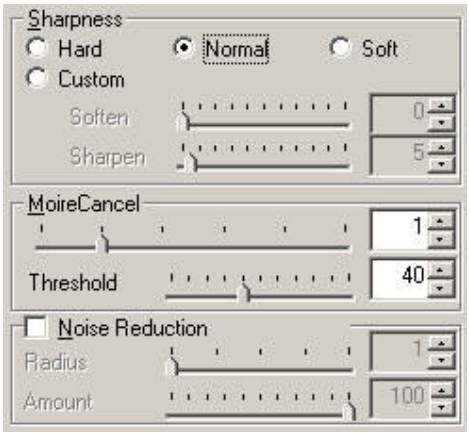
After Adjust2 adjustments



Lastly, I've mentioned a lot about using the histogram. The reason is that it will help us understand what is happening and when we might be clipping any of the red, green, or blue channels. However, do not forget to look at the image as the final determining factor in whether or not to apply an adjustment. Oftentimes there is more than one way to achieve the same, or similar, result by using a combination of the adjustment tools. In our next article we will discuss the detail tab.

3.3 Detail Tab - Sharpness, Moire Cancel, and Noise Reduction

In paragraph 3.2 of this user guide we discussed how to apply tone curves, contrast, brightness, saturation, and hue adjustments using the Adjust2 tab. In this section we will examine the Detail tab which contains the sharpness, moire cancel, and noise reduction controls.



Sharpness

In the most basic terms, sharpening enhances the edges of an image. Almost all digital cameras that provide RAW capture need their images sharpened. This is primarily due to the demosaicing process, which converts the data saved from the sensor into data that when viewed thru an editor becomes a picture to our eyes. This demosaicing process produces images that are not very sharp and thus most cameras apply some amount of sharpening to the image. As mentioned before, with RAW capture in-camera processing is by passed. As such we need to sharpen the image.

With s7raw we have four options when it comes to sharpening. The first three are the presets of Hard, Normal, and Soft. The forth option is Custom. Below you will see how the presets compare to the non-sharpened test image. For sharpening comparisons, moire cancel has been set to 0 and noise reduction has been disabled. These images are 100% view crops.

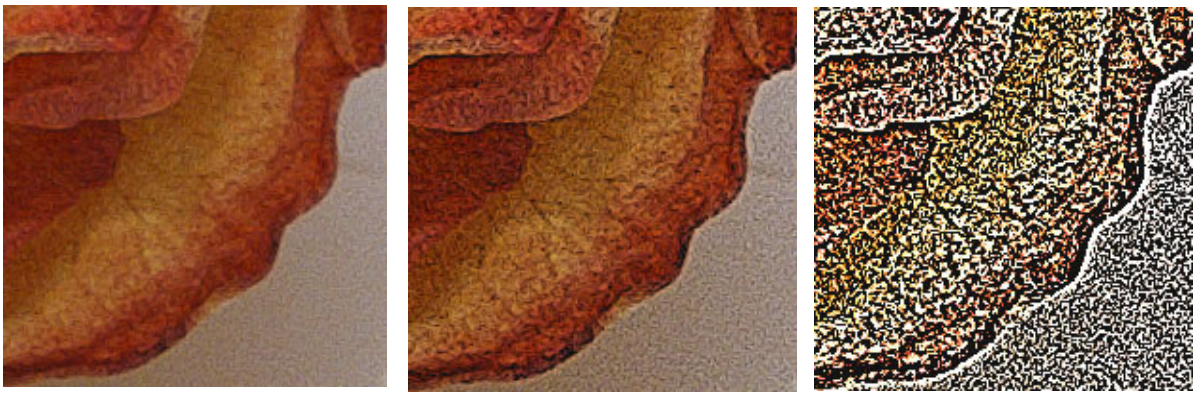
No Sharpening:

Sharpening - Soft, Normal, Hard (from left to right):

The forth option, Custom, allows us to adjust the amount of sharpening to apply precisely as needed. This is more useful than the presets as the amount of sharpening to apply normally varies form one image to the next. Below you will see six images, ranging from a sharpness amount of 0 to 100.

Sharpening - Amount 0, 20, 40 (from left to right):

Sharpening - Amount 60, 80, 100 (from left to right):

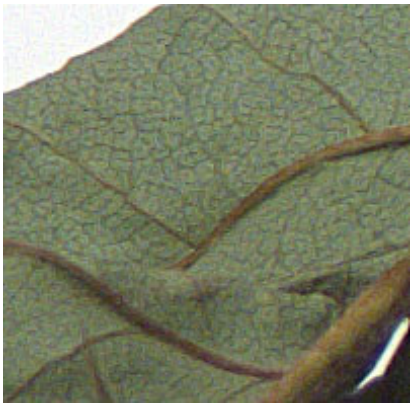


As we can see the higher the sharpening amount the more the edges are enhanced.

Once we get to around 60 it begins to become too much. I am not sure what type of sharpening algorithm is being applied in s7raw, but just for comparison purposes below is the s7raw sharpening (set to 60) verses Photoshop's unsharp mask set to a radius of 1.0 and amount of 350% (this is an high amount, but was the closest match with regards to sharpness and detail to the 60 setting in s7raw).

s7raw sharpening:


Photoshop Unsharp Mask:

It is obvious that s7raw's performance with regards to sharpening is close to the standard Photoshop unsharp mask filter. But I did notice some obvious dark tracing around the larger edges on the s7raw images. This is best seen in the top left area of the leaf crop. I think unsharp mask is a little better overall, but as long as s7raw's sharpening tool is set somewhere **below** 40 the results seem great and the dark tracing is not noticeable.

Lastly, we can also both sharpen and soften the image at the same time. Adding a bit of softening to the image while sharpening will reduce some of the coarseness of a sharpened image, but at the cost of some detail.

Moire Cancel

Moire is a complicated subject. It is beyond the scope of this article to talk about it in technical detail. Nonetheless, I will cover the basics as they apply to how we would come across this effect in digital photography. Simply, moire is distortion and undesirable in

images. The word moire comes from a French word that means "to water" referring specifically to the rippled, water-like look caused by the distortion. There are two primary types of moire that can show up in digital images. The first type is a wave pattern. The second type is color artifacting that occurs along with the wave pattern. To visualize a simulated wave pattern of the effect surf to http://www.mathematik.com/Moire/

The large wave-like patterns are caused by fine detail patterns in a scene interfering with the resolution of a camera's sensor. Unfortunately, I was unable to find any detail patterns in the test image we have been using throughout this tutorial that showed moire. As such I took a picture of a sports coat that had a pattern on it. I shot the photo from such a distance that the detail in the pattern conflicted with the resolution of the camera. In other words, each pixel in the image would be close to the size of the fine detail (or since it is a pattern, a grouping of detail) in the scene. This took some trial and error, but I finally produced the effect.

With s7raw, the moire cancel function seems unable to remove the ripple pattern. However, what the control does remove is the color artifacting (which helps reduce the visibility of the ripple pattern). Below is a before and after example of moire cancel being applied to the sports coat example. The images are 100% view crops.

Moire Cancel (before on left, after on right):


Moire cancel has 5 levels of adjustment, with the higher numbers resulting in stronger cancellation. Higher levels will work better with larger ripple patterns and lower levels will work better with smaller ripple patterns. Once the amount of moire cancel needed is determined, next focus on adjusting the threshold.

The threshold control should be adjusted to the highest value that still eliminates the color artifacting. Start at 0 and slowly increase the threshold amount. Once it is noticeable that the moire cancellation is loosing effect, decrease the threshold amount some. The reason for doing this is because we only want to cancel moire in trouble areas and limit its effect on the rest of the image if possible. The higher the threshold the more likely non-moire areas of the image won't be affected by the moire cancel.

Just how does moire cancel affect non-moire parts of an image? Well, it reduces some of the sharpness and detail of an image to a small degree. It also reduces color accuracy near color boundaries. The below images illustrate this when moire cancel is applied to the test image. The negative effects are very minor, but they do exist. If we look closely along the border of the flower edge and white background, it should be somewhat visible

that some of the red and orange color of the flower has turned grayish in appearance. Notice too that some areas appear to be slightly blurred as a result of moire cancel. However, I don't see the negative effects of this control preventing it being used if moire is present in an image.

Moire Cancel (before on left, after on right):


Noise Reduction

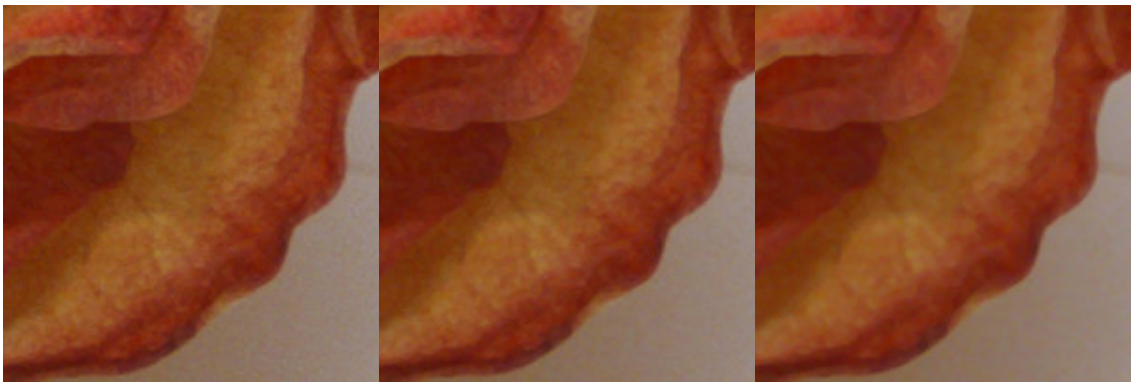
Noise comes in two main categories: grain (luminance noise) and color blotches (chroma noise). Most consumer digital cameras produce moderate to high noise depending on the ISO setting (higher is worse), lighting conditions (darker is worse), and the pixel density of the sensor (denser is worse). Often the camera has built in noise reduction to minimize it's presence in the final image. However, with raw images there is no in camera processing. Too much noise will severely lower picture quality. Keep in mind, however, that **any** noise reduction will result in some loss of detail. The best noise reduction algorithms try to reduce noise while maintaining as much detail as possible. In an effort to reduce noise, s7raw has a noise reduction control.

I have created a series of 100% view crops of the flower and background area of the test image. I have set the radius and amount values of the control to a variety of combinations ranging from a radius of 1-5 and an amount of 25-100. Sharpness has been set to normal and moire cancel to 0. Keep in mind that the test image was shot under conditions that do not produce overly noisy pictures to begin with. However, I wanted to be consistent with the rest of the s7raw tutorials in using the test image so that you too can play with s7raw to produce the same results illustrated below.

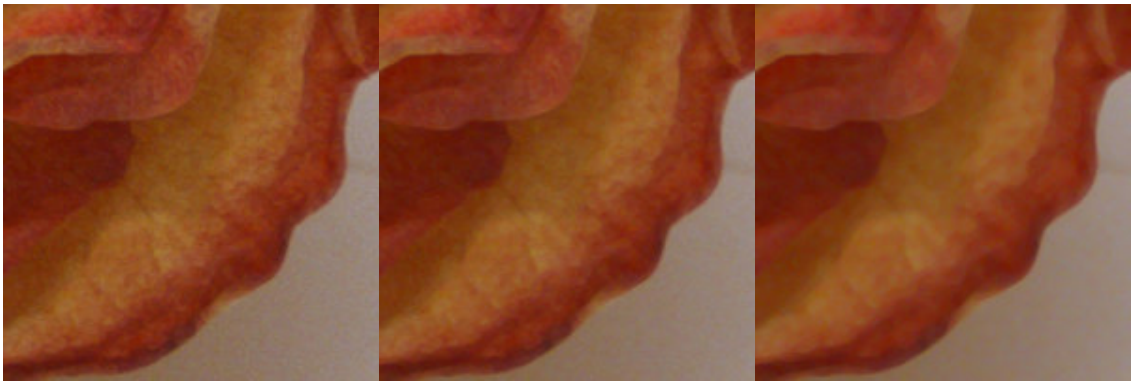
No Noise Reduction:

Noise Reduction - Radius 1, Amount 25, 50, and 100 (from left to right):

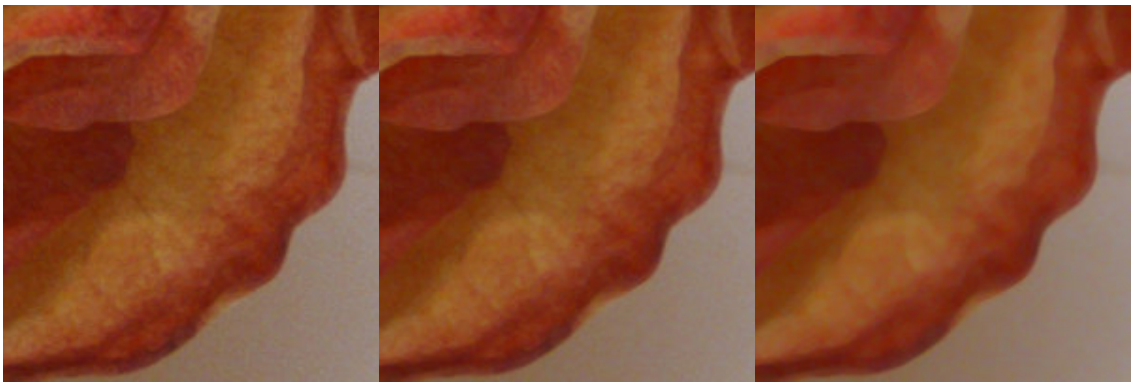
Noise Reduction - Radius 2, Amount 25, 50, and 100 (from left to right):



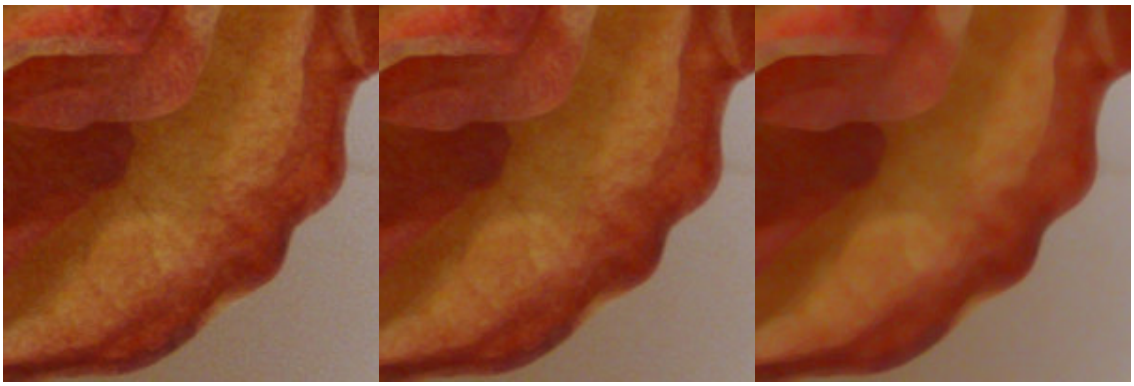
Noise Reduction - Radius 3, Amount 25, 50, and 100 (from left to right):



Noise Reduction - Radius 4, Amount 25, 50, and 100 (from left to right):



Noise Reduction - Radius 5, Amount 25, 50, and 100 (from left to right):



Out of all the above options, a radius of 2 and an amount of 50 seems to be best to my eye if our goal is to reduce noise and maintain a reasonable amount of detail. Overall, I'm somewhat disappointed in s7raw's noise reduction system as it seems to be a bit weak in its current version (v0.4.3). The RAW editor apparently uses a median filter. This is virtually the same as using the median filter in Photoshop (filter -> noise -> median), except s7raw has an extra slider to adjust the amount between 0-100% to apply. A median filter calculates each pixel value by taking a median value of the surrounding pixels. As a result, fine noise is removed, but so too is fine detail. With s7raw, luminance

noise is removed fairly well, but chroma noise seems unaffected and possibly a bit worse than in the non-noise reduced image. Hopefully s7raw will improve this feature in a future version.

I would suggest using a more sophisticated noise reduction solution such as PictureCooler 2, Noise Ninja, or Neat Image. Those three options are not free however. For those of you that have Photoshop 6 or newer, look for De-noise Deluxe (http://www.2morrow.dk/75ppi/coolpix/actions/#denoise). These sets of actions are the best free option that I am aware of.

Also those that have Photoshop Elements 1 or 2 can also install these actions using the method described at http://www.geocities.com/rnlnero/PE2stuff.html. Lastly, for more information about how well these other noise reduction programs work, Michael Almound wrote up a very nice and extensive comparison (http://www.michaelalmond.com/Articles/noise.htm) of many noise reduction solutions.

For our comparison purposes, I will show the non-noise reduced image, the best s7raw noise reduced image, and the results from PictureCooler 2. Overall, PictureCooler 2 maintained more detail, sharpness, and had less noise, especially chroma noise in the gray area of the flower crop, than s7raw's result. Notice too, that the veins in the leaf loose detail the most with s7raw's noise reduced image. Remember, though, that the test image used in this tutorial and user guide was shot at ISO 64 on a 4 megapixel camera. Noise is not terribly high to begin with so you will need to look closely at these images to see the subtle differences.

No Noise Reduction:

s7raw Radius 2, Amount 50:

PictureCooler 2:

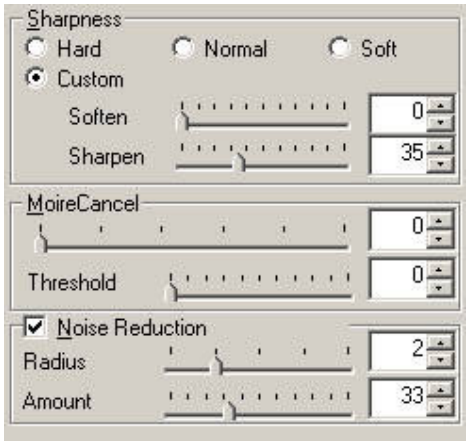
UPDATE: It was brought to my attention that some checkboxes have three states (checked with a white background, checked with a gray background, and not checked). Well after hearing back from the s7raw's development team, apparently a gray checked noise reduction checkbox indicates that noise reduction is on (just like if it had a white background), but it **also** means that moire cancel is boosted by +5. Thus a white background means no moire cancel boost and no check of course means noise reduction is off.

Also, for those interested, s7raw uses an ordinal Laplacian filter for sharpening.

3.3.1 Detail Tab Tutorial

To sum up the adjustments in this article lets continue with editing the test image. Below are the settings I felt worked best with the image. Even though I am not a fan of s7raw's current implementation of noise reduction, I decided to apply it considering that some may want to use s7raw as their primary or only editor. The before and after shots don't show much difference, but the full resolution images do differ to a noticeable degree.

Detail Tab Parameters



Before Detail Adjustments

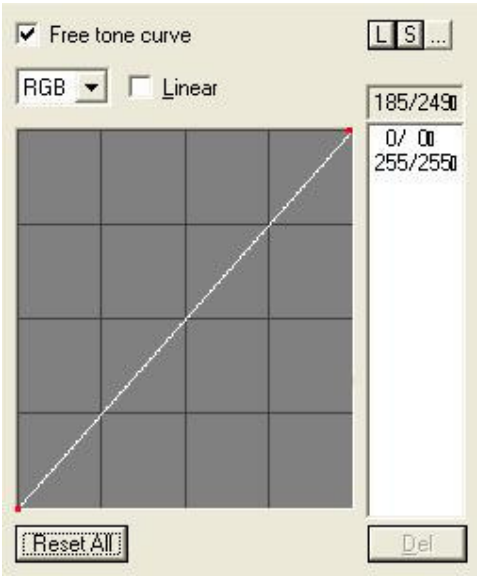
After Detail Adjustments

Up to now, we are able to adjust the orientation, white balance, exposure, tone curves, contrast, brightness, saturation, hue, sharpness, moire cancel, and noise reduction. This is a lot of fine tuning that can be applied! However, we aren't done yet. In our next article we will cover the Curve tab which contains a more advanced version of Adjust2 tab's tone curve control.

3.4 Curve Tab

In paragraph 3.3 of this user guide we went over the Detail tab which contains the sharpness, moire cancel, and noise reduction controls. In this section we will examine the Curve tab which contains the free tone curve control. Curves can be a little intimidating to those that do not know how to use it. This article will help to explain the basics on how to use curves in s7raw.

Making Adjustments - Free Tone Curve

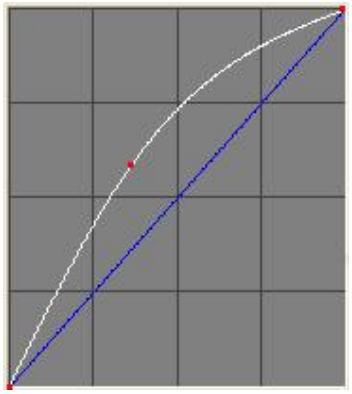


Understanding Curves

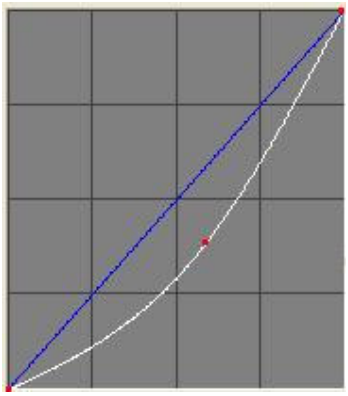
To comprehend how the curve control works we need to understand what is going on when adjustments to the diagonal line are being made. The diagonal line is perfectly straight in its default state. This means that nothing is altered to the image. When we click on the line and create a control point and then move it, the entire line curves.

Curving the line above its original state (the original state is represented in the background as a blue line) causes the image to become brighter. Curving it below its original state will cause a shift to darker tones.

Curving Above



Curving Below



At this point we have 3 control points (small red dots on the curve), 2 of which were there by default. The first one is at the bottom left hand corner, the second at the top right, and the third is the one we created when clicking on the line.

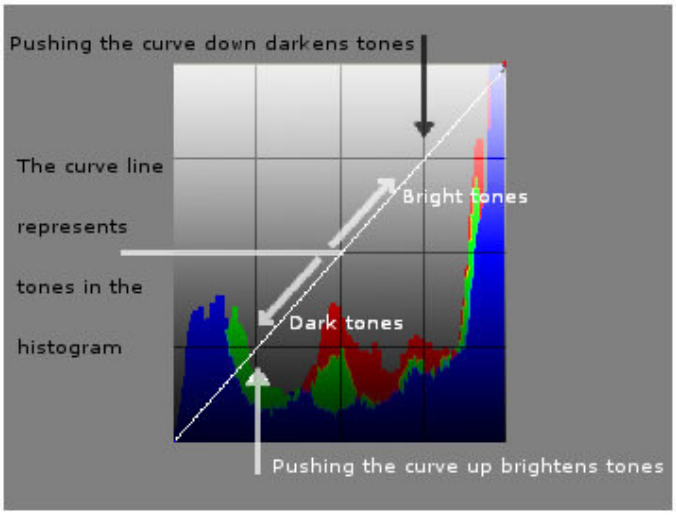
Notice the box to the right of the curve control? The first set of numbers correspond to where on the curve the mouse cursor is when it is pointing to the curve. Go ahead, move the mouse around the curve control and you will see these numbers change.

The first number is the input level (the brightness level of the tone before the curve is applied) and the second number after the slash is the output number (the brightness level of the tone after the curve is applied).

These numbers represent brightness values ranging from darkest (0) to brightest (255). The box contains the input and output values for each control point. If the output value is greater than the input value then that tone becomes brighter. If the output value is less, then the opposite happens. If you click on the numbers in the box it will select the control point it corresponds to.

Normally though the curve control is not used with just 3 control points. More can be added. Click on the line again to create another control point. Moving this forth point around causes the curve to curve some more. This time though the curve can be moved into different shapes not just up or down.

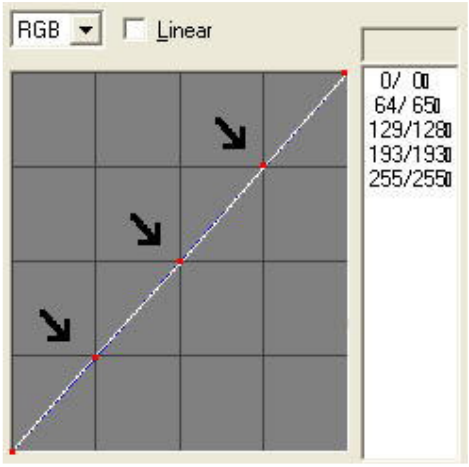
Below I made an illustration to summarize how to understand the curve control. First, notice that there is a gradual transition from bright towards the top and dark towards the bottom. Thus as has been mentioned, when the curve is pushed up the tones become brighter. When pushed done, they get darker. Notice too that I superimposed the histogram on the curve graph. I did this to illustrate how the curve line corresponds to the histogram. The center of the line represents the center of the histogram (brightness level of 128). Moving down the line is the same as moving to the left on the histogram, which represent darker tones. Likewise, moving up the line is the same as moving right on the histogram, which signify brighter tones.



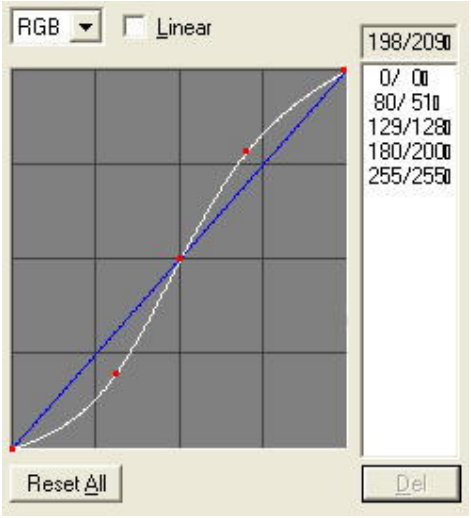
Contrast adjustments

If you have played around with the control for a while you probably have noticed that the image can be severely affected by changing the shape of the curve. In most cases only subtle changes are necessary with this control. One of the most useful things it can do is apply custom contrast adjustments.

To start, let us reset the curve by clicking "Reset All." To adjust the contrast to become stronger we need to add 3 control points. To start, use the grid as a guideline and add control points where the grid lines intersect the diagonal line.



Next, curve the control to look as follows:

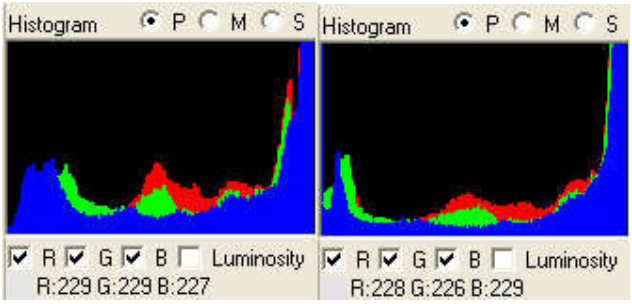


The result is that more contrast is applied overall to the image and the histogram is expanded to the left and right. This is called an S-Curve since it resembles the shape of an S. Why does this happen? Remember if the curve is above the original line tones become brighter and if the curve is below tones become darker. In this case the curve is both above and below the original line. The control point we added to the lower left has an input value of 80 and output value of 51. This shows that the darker tones become darker. The third control point has an input value of 180 and an output of 200. This

causes the brighter tones to become brighter. The middle point stays the same and thus middle tones around this point are either not affected or slightly changed by the curve.

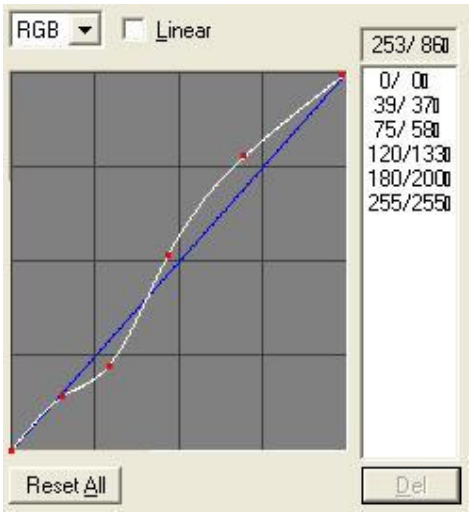
S-Curve Applied

Histogram before s-curve (left) and afterwards (right)



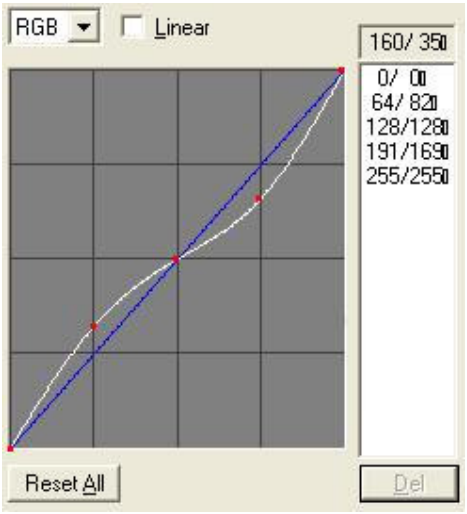
The contrast can be fine tuned by adding additional control points. Let's say the darkest shadows are too dark and we want to brighten them up a bit. To do this we can move the lower left control point up a little bit but still have it be below the blue line. Then add another control point to the left of it and move the new point up to meet the blue line. Also, maybe we want to brighten up the middle tones a bit and moving the control point in the center up slightly. After these adjustments the curve and resulting image should look something like this:

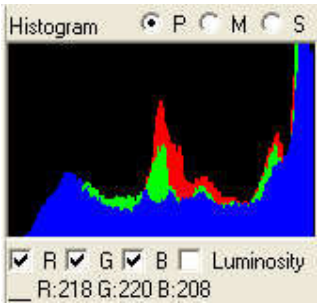
Fine Tuned S-Curve Applied



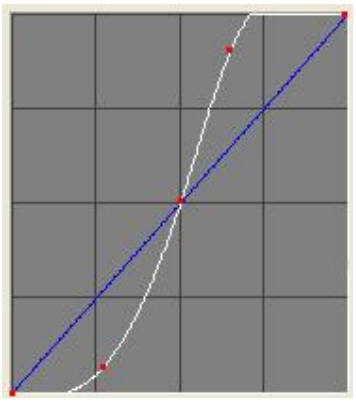
Fine tuning like this can be applied anywhere on the curve. If we want to reduce contrast overall in an image we cause the curve to be an inverse S shape. In other words move the curve such that the bottom left section is above the original line and the top right is below it.

Inverse S-Curve Applied





One thing to watch for when using curves is to be careful not to clip the image. If the output values become 0 or 255 for tones that were not already completely dark or bright, you will loose shadow or highlight detail. An easy way to prevent this is to make sure the curve does not create straight lines at the top or the bottom of graph as pictured below. Notice that all tones above the brightness level of 140 will be shifted to 255, and all tones below the level of 40 will be 0. This should be avoided unless the effect is desired.



Instead make sure the curve gradually bends to the bottom left (brightness level of 0) and top right (brightness level of 255). By doing this the contrast of the image can be adjusted without fear of clipping the highlights or shadows.

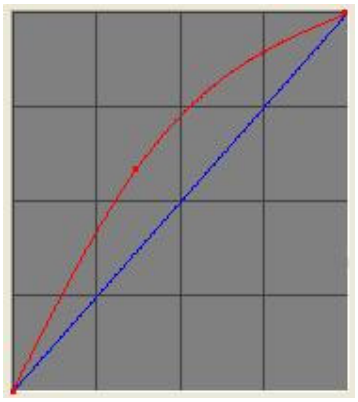
Color Adjustments

Curves can be used to adjust color as well. Although I find the selective color replacement tool and the fine tuning of the white balance in s7raw to be more useful, I will still discuss this as it is a feature of the curve control.

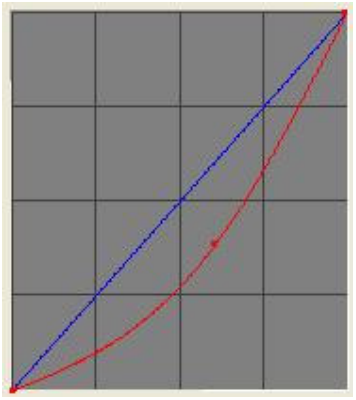
Notice the drop down box that currently reads RGB. This means that the curves are applied to the entire image and to all colors equally. However, each of the color channels can be adjusted, whether red, green, or blue.

For the red channel, moving the curve above the original state will cause a color shift towards more red, whereas moving the curve below the original state will add cyan. For the green channel, moving above will shift towards green, and below will add magenta. Likewise for the blue channel, moving above shifts towards blue, below adds yellow. Below is an example of the effect on the red channel.

Red Channel Curve Up

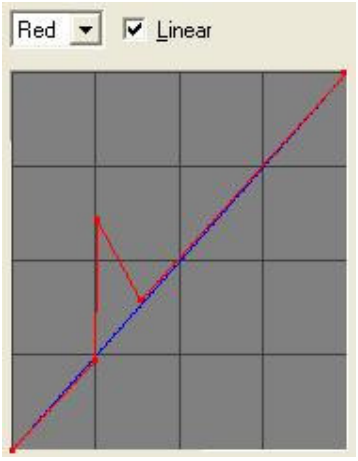


Red Channel Curve Down



S7raw's curve tool also has a linear option. Enabling this prevents the curve from curving and instead forces the line to be angular. When using a linear curve on the color channels it is possible to precisely change the values of a specific tone without affecting other tones. The example below shows this on the red channel. A very small section of red tones in the flower and elsewhere are more pronounced than the rest of the tones. On the test image this is not a modification that we would want to keep, but it does show how the linear option can be used to select a very narrow portion of tones and change their values. Also note that the linear option can be used much less aggressively than in this example. It can be used anytime that a curving line would not work well.

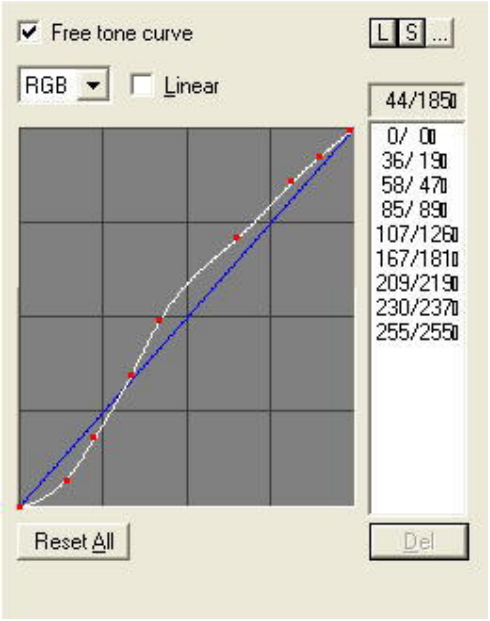
Red Channel Linear Curve



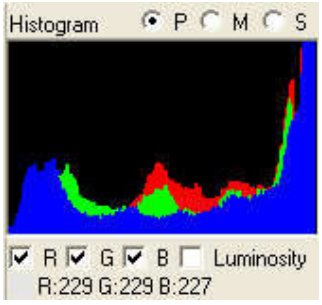
3.4.1 Curve Tab Tutorial

To sum up the adjustments in this article lets continue with editing the test image. Although the contrast, brightness, and gamma curve controls have already been used to correct the image, we can use curves to further fine tune the contrast of the image. Below is the curve that I feel works best. The curve is applied only to the RGB setting. No adjustments need to be done to the individual colors. Notice too that the curve adjustment had a positive side effect in that it helped reduce the vignetting to some degree.

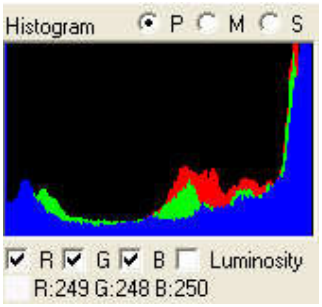
Curve Parameters



Before Curves



After Curves



I hope you have found this tutorial useful. In our next article we will cover the Lens tab which contains controls to adjust lens distortion, chromatic aberration, vignetting, and correction.

3.5 Lens tab

Not completed yet

3.5.1 Lens Tab tutorial

Not completed yet

3.6 Color tab

Not completed yet

3.6.1 Color Tab tutorial

Not completed yet