

## CHAPTER 10 - PANORAMAS

Panorama photography is one of my favorite creative techniques. The basic approach is to take a series of images that will be stitched together into one large image. This is usually a series of horizontal images stitched into wide landscape. But it can be a vertical panorama or a collage of images.

The stitching process requires some overlap of content to align the images with about 20% overlap recommended. In older versions of Photoshop, panoramas had to be manually stitched and color matched. With Photoshop CS3, panorama stitching got incredibly accurate and easy. Alignment and color matching are fully automatic and virtually perfect. Photoshop CS4 adds some exciting new features, such as the 'collage' panorama, which will align images both up and down and left-to-right. Thus you can easily build images reminiscent of David Hockney's collages. The panorama capabilities in Photoshop are phenomenal; you can hand hold a multi-image collage panorama, as long as you are careful to assure the needed overlap. Never hesitate to try a panorama handheld; you can rely on the auto-stitching capabilities of Photoshop pretty heavily.

That said, getting a really good panorama that is well framed and composed requires attention to the details of camera alignment and set up. This requires a sturdy, stable tripod. Most landscape images need good depth-of-field and the slower shutter speeds will also require a tripod. When I started out experimenting with panoramas, I frequently found that one or more of the images was too blurry, or out-of focus, thus ruining the whole panorama. So I use a tripod whenever I can. Tripods and tripod heads are typically sold separately, although there are products that integrate the two. In general, being able to select a tripod and tripod head from different manufacturers offers more flexibility and retains the value your investment should you have to replace one of these items. See the chapter on 'Hardware'.

### CAMERA SETTINGS AND TECHNIQUE

While Photoshop can automatically align and blend your images extremely well, you may still find unexpected frame-to-frame variations in color, focus, or depth-of-field that spoil your panorama. The reason for this is that the automatic mode of your camera is likely to change focus, change color balance and change exposure for every frame. I learned this while stitching my very first panorama!

In 'Auto' mode, your camera is evaluating each image for best exposure, lighting conditions, color balance, sun-shade balance and focus. Cameras with face recognition may force the focus to be on a person's face in one image, and on the mountains in the background in the next. In addition, if the camera refocuses between images, there will be slight changes in effective focal length that will introduce distortions into your panorama.

The solution is an 'all manual' approach: manual focus, manual white balance and manual exposure. Allow your camera to autofocus, and then set the auto-focus switch to manual. Set the white balance to an appropriate preset: sunny, cloudy or shade, etc. If your auto-exposure settings are giving you're a good histogram, check your camera's exposure readout and duplicate those settings in manual. (Most cameras will retain the automatic settings when you switch to manual.) Since you are working on a tripod, shutter speed is less of a concern and you can use a small aperture for good depth-of-field.

I like to make my panorama images from left to right simply because that's how they will be displayed in Bridge. You can always move them into a different order in Bridge so it's not critical. As you pan the camera between shots, use the viewfinder's grid to assist with obtaining sufficient overlap. Visually note some object in the scene

near the right edge of the viewfinder image. Then pan slowly to the right, stopping for your next shot as it approaches the left edge of the viewfinder.

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## PANORAMAS VS. WIDE ANGLE CROPPING

I started creating panoramas because I didn't own a super wide angle lens. It was the only way I had to achieve a really wide image. Even though I own a super wide angle lens now, I still rely on panoramas for truly good wide format images. Why? More pixels! When you shoot a panorama with a super wide angle lens, you fill the frame horizontally, and then end up cropping unwanted pixels from the top and/or bottom. You are reducing the number of pixels. This means lower image quality. With a panorama, you can use a normal or telephoto to fill the frame vertically, then pan horizontally to get the desired width, thus keeping more pixels. In fact, you can maximize your image resolution by shooting horizontal panoramas with your camera in portrait orientation. So while I cannot afford a 23 MP camera, at least for now, I can stitch several 10 MP images together to get the same, or better, pixel count. Want to make big prints? More pixels means bigger high resolution prints.

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## HORIZONTAL OR VERTICAL?

Most people think of panoramas as sweeping horizontal images. But vertical panorama are sometime required. At Kaaterskill Falls, shooting from the edge of the trail under the upper waterfall requires a vertical panorama. You are just too close to the waterfall to get the whole thing in one frame.

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## PANORAMA ISSUES

These are the issues that can be resolved by proper technique.

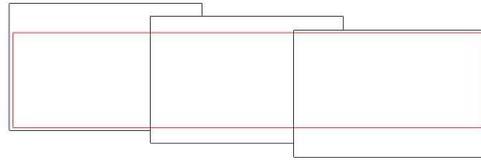
Exposure	Color temperature	Environment
Leveling	Focus	Parallax

*Exposure:* It is not uncommon for different parts of you panorama to have different lighting conditions. Watch your exposure meter as you pan across your intended image. Set your exposure for the brightest part so you do not blow out highlights. For best results, you should check the histograms for each frame of your panorama afterward to be sure there were no exposure problems. You can always redo the panorama with an adjusted exposure setting. (I love being able to identify and delete problem images in the field. You couldn't do this with film!)

*Color temperature:* In auto mode, your camera is evaluating every frame in order to set the best exposure and color balance. On my first panorama, one frame had contained a small white storage building that caused the camera to slightly change the color balance of that frame. As an individual image it was not very noticeable, but once stitched into the panorama, it spoiled the whole panorama. So for consistent color balance, use a fixed lighting choice instead of auto. I typically use 'Cloudy' or 'Sunny'. If you are shooting RAW, this can be easily adjusted later.

*Environment:* The biggest problems you will have with panoramas are associated with changes in the scene that you cannot control. These will be moving objects (clouds, water, windblown tree branches). If you are aware of these at the time, you can deal with most of them easily. Clouds do not move quickly, so making your panorama quickly will be sufficient. Water in quick moving streams is quite chaotic but generally blends quite well. Moving branches are harder, and it is advisable to attempt to wait to make individual frames when the wind stops. Most vegetation will return to the same resting position when the wind lets up momentarily.

*Leveling:* To get the best alignment of panorama images, it is important that the panning motion is exactly parallel to one side of the image. If you don't get this correct, you will see a stair step effect when the images are aligned. When cropped, as indicated by the red crop area in the example, parts of your image will be missing. This may seem inconsequential, but I guarantee that some item at the edge of the image was important in the composition and you will be disappointed when you are forced to crop it out!



I use a special panorama head on my tripod so that I know that the camera is level once the head is leveled. When doing a vertical pano, the bubble level on the pano head is useless; so I also use a two-way bubble level that works well for both landscape and portrait camera orientations. (See the hardware chapter.) But note that visually centering a bubble level is not highly precise; allow some extra space in your frame to account for minor cropping. Newer cameras have artificial horizons or artificial bubble levels that are much more accurate. Use it if you have one!

*Focus:* If you leave your camera on autofocus, it may decide to change focus from frame-to-frame. Most lenses actually change focal length slightly as they focus at different distances. Allow the camera to autofocus on your subject, and then switch to manual focus.

*Parallax:* Parallax is a difference in the apparent position of objects when viewed along two different lines of sight. This is somewhat hard to explain, but easy to demonstrate. Stick your arm straight out in front, then stick up your thumb like Caesar at the Coliseum. Close one eye, then line up your thumb with an object in the distance. Now simply turn your head from side to side. You can see how your thumb and the object change their alignment even though neither actually moves at all! When your head turns from side to side it pivots around your spine, which is a few inches behind your eye. Your eye moves left and right as your head turns and your line-of-sight changes accordingly.

The same thing happens when your camera pans left and right when creating a panorama. It pivots around the tripod mount, not the lens. Like your eye, the lens is several inches in front of the pivot point and near objects do not line up with distant objects in different frames. The way to solve this problem is to use a nodal slide. A nodal slide allows you to move the camera backward so the pivot point falls under the lens. Although modern lenses are complex, there is one 'nodal point' that eliminates the parallax problem. You have to do some experimentation to find this point; it may even be in front of the lens, not under it! And a zoom lens may have a nodal point that shifts for different focal lengths.



In the field, finding nodal points requires some testing. With your camera and nodal slide on a tripod as in the illustration above, find two objects to line up, one near, and one far. Any two objects will do as long as it is easy to see their alignment. They do not have to be your subject; any two items that can be aligned will suffice! Start with the middle of the nodal slide over the tripod's pivot point. Then simply look through the camera as you pivot the camera left and right. Does the alignment change? If not, you have found the nodal point. Most likely it does change; move the nodal slide back an inch and try again. Does the alignment still change? Does it change more or less than before? If less, continue to move the slide back another inch and try again. If it got worse, move it an inch forward.

With a fixed focal length lens, there is only one nodal point. For a zoom lens, the nodal point may be different at each focal length. In the field, choose your focal length first, and then find the nodal point. You should practice this at home; it is quite easy to do after a small amount of practice!

You can make this process much easier. With a notebook and a little experimentation, you can easily set the correct nodal position for all your lenses. See the 'Moment of Geek' at the end of the chapter for details!

## WORK FLOW

Once you have your panorama sequence, you will load it into Photoshop for automatic stitching. There are a few adjustments you will make before full Photoshop processing. The approach is to make simple Camera Raw adjustments to reduce frame-to-frame differences, then run the Photomerge in Photoshop. After the merge is complete, flatten the image and save it as a TIFF file. This can be re-opened in Camera Raw for a normal workflow.

## CAMERA RAW

Begin your Photoshop work by opening all the images for your panorama in Camera Raw. The adjustments we make in Camera Raw will be those that apply to all the images in the set. Since all the images were made at the exact same settings, the same correction will apply to them all. Note that we are not making any changes to exposure or tone curves at first, only global changes. You can make these adjustments in any order. These are the 'global' ACR settings to visit:

**Tool Bar:** White Balance, Spot Removal (sensor spots only).

**Basic Tab:** Recovery, Fill.

**Detail Tab:** Sharpening (capture level only), Noise Reduction.

**Lens Tab:** Chromatic aberration, Lens distortion and Vignetting problems.

If you find any spots on your images due to dust on your photo sensor, take care of them in Camera Raw. Pick the frame that shows the spots clearly, then click the Select All button. The spots will appear on all frames in the same place so we can handle them all at the same time. Once you have the spots on the target frame fixed, review the other frames individually. We have to do this because Camera Raw uses an automated system to choose the best match to cover the spot and does not always make the best guess. By going from frame to frame, we can change the blending areas if necessary. It's actually quite remarkable how often Camera Raw gets each frame right.

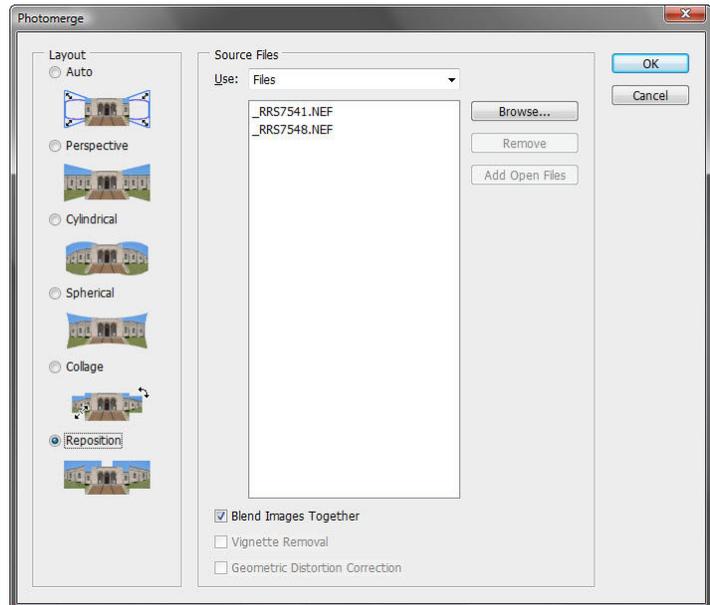
Next, select each image one-at-a-time and look at the histogram. Note any image which has a highlight or shadow clipping problem. With that image selected, click the select all button to choose the rest. Use the recovery slider to fix highlights if necessary. You may have one frame with a highlight problem and another with a shadows problem so be sure to check each. These should be 'gentle' fixes.

To be sure all images have the same color balance, select a frame with a known white or grey object, then select all the frames and use the White Balance (eye dropper) tool to set the proper value. I like to include an extra shot in the panorama sequence in which I hold a grey card to use in this step. The extra image is not included in the final panorama, but I do include it in the stack.

In general, these are all the initial adjustments I do in Camera Raw. Photoshop offers the same or better tools for tone curve adjustments, color balance, saturation, vibrance etc. The key to working with multiple frames is to be sure clipping and exposure are handled, and that each frame gets treated identically. When you are finished, click the Done button to return to Bridge.

## BRIDGE

Select your panorama frames, then use the menu sequence Tools, Photoshop, Photomerge. You will see Photoshop itself launched, then the Photomerge dialog. The files you selected will be listed. If all are not present, Cancel and retry. There a number of options here. The settings I prefer for panoramas are 'Reposition' at the bottom of the Layout column, and 'Blend Images Together' under the source file list. We will look at the 'Collage' option later. If you fixed vignetting issues in Camera raw, you will not need it here. If your final images shows dark bands where the images are blended due to vignetting, simply retry using the 'Vignette Removal' option.



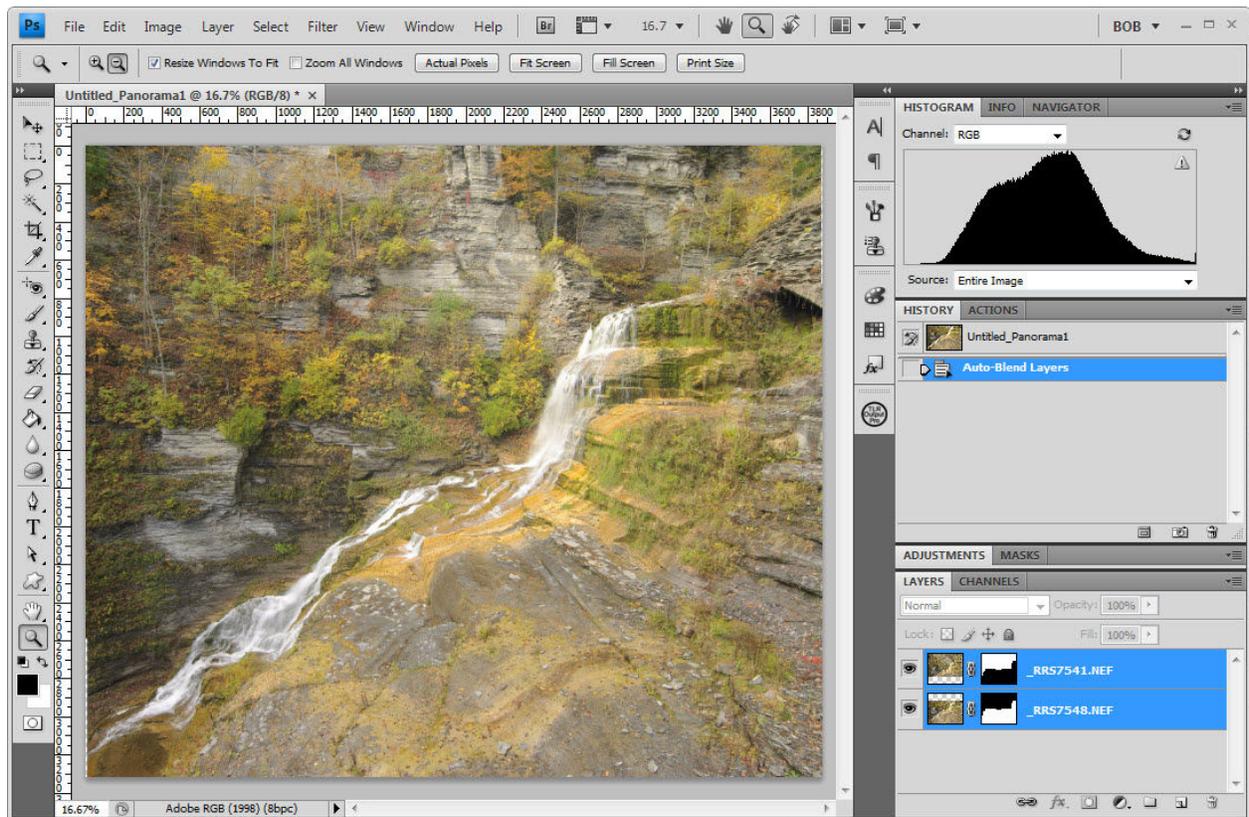
The 'Perspective' option I do use on rare occasions, but it is indeed rare. The purpose of this option is to straighten lines that may appear to taper due to perspective foreshortening. You are likely to be most familiar with perspective foreshortening if you ever noticed that when you point the camera up to photograph a tall building, the vertical sides of the building seem to tilt inward, and the top of the building appears narrower than the bottom. The 'Perspective' option corrects this by warping the image to make the top wider correction.

## PHOTOSHOP

Here are two images of Lucifer Falls, the tallest waterfall at the Robert Treman State Park near Ithaca, New York. The one on the left was made using the 'Perspective' option of Photomerge clearly has some 'issues' introduced by the warping of the image. In this case, the image was made with an extreme wide angle lens at 16mm, so the degree of warping is substantial. The curious thing is that the frame in the top half image was made with the camera essentially level using a bubble level on the camera platform, while the lower half was made with the lens pointed down. So I'm not sure how Photoshop makes the decision about which frames to warp.



The left image requires substantial cropping, and the warp causes the trees to lean away from vertical and simply looks wrong. The right hand image has a small transparent area in the lower left and upper right corners due to a very slight misalignment of the camera. (These small imperfections in alignment are common due to the relatively low accuracy of bubble levels.) The image will also be cropped, but the amount of cropping is quite small. The 'Perspective' correction just doesn't work often in nature photography. Here is what the right hand image looks like once opened in Photoshop.



The Layers Panel shows how Photoshop repositions each image then applies a mask to each layer so that they match up correctly. Photoshop's ability to align and merge panorama images is simply phenomenal in CS4 and later. The only thing left to do at this point is flatten the image to single layer (Menu sequence: Layer, Flatten Image) and apply some cropping. Since I am just starting to work with this image, I will only crop out the small alignment problems at the upper right and lower left. Final cropping will be done later if desired. This is the starting point for further adjustment using the full tool set of Photoshop. I save the flattened image as a TIF so I can start my workflow with it in Camera Raw.

For collages, you will of course choose the 'Collage' option on the Photomerge dialog. When the final image appears in Photoshop, you have a number of interesting options. You can simply flatten the image and crop as desired. This gives you a nice hi-res image, which is a good reason to do collages in the first place.

If you would like to get a 'David Hockney' look, you can do this with layer styles. Do not flatten the image! Instead, select one layer then apply a layer style by clicking on the effects button [fx] at the bottom of the Layers Panel. Apply a slight drop shadow and a broad inner stroke effect. When you are happy with this one frame, right click on that layer and chose 'Copy Layer Style' then one-by-one, selected each of the other layers, right-click and select Paste Layer Style. After you have all the frames with the desired style, you may have to rearrange layers to get a

good look. I like to have the center image be fully on top of the image; just drag that layer to the top of the layer stack!

On a big collage, it can actually be quite difficult to determine which layer holds which frame in the final image. The easy way to figure out which layer you want is to momentarily turn off the visibility of the layer and check what part of the image disappears. Just click the eye icon on the layer!

## SAMPLES IMAGES

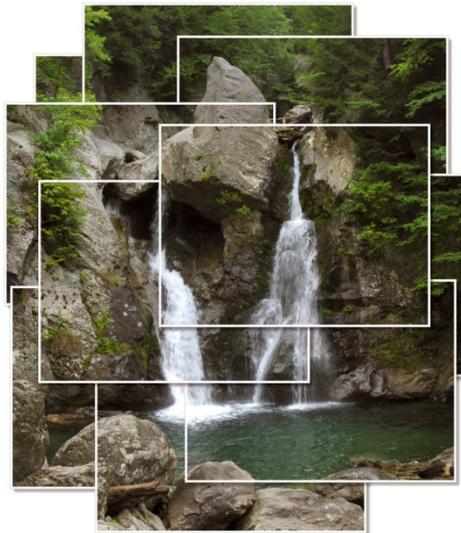
Catskills and Hudson River – 5 panel panorama.



Bash Bish Falls (Hockney-ized collage)



10 single images merged in Photoshop as collage.



Layer styles added for borders.

## MOMENT OF GEEK : NODAL POINTS MADE EASY

You can make setting nodal points exceptionally easy with a little experimentation and an intelligent choice of equipment. Some nodal slides have engraved scales on the edge that allow you to read specific positions relative to the tripod head.

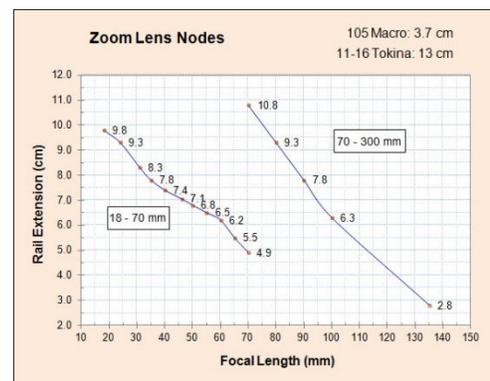
Set your camera and nodal slide on a tripod as in the illustration above. The nodal slide pictured is one that has laser engraved scales on each side. You need to find two objects to line up, one near, one far. I use an old broom stick stuck vertically in the ground as the near object, then move the camera and tripod so the broomstick aligns with the edge of my neighbor's barn. Any two objects will do as long as it is easy to see the alignment.

Start with the middle of the nodal slide over the tripod's center. Then simply look through the camera as you pivot the camera left and right. Does the alignment change? If not, you have found the nodal point. Most likely it does change; move the nodal slide back an inch and try again. Does the alignment still change? Does it change more or less than before? If less, continue to move the slide back another inch and try again. If it got worse, move it an inch forward.

This is quite easy to do after a small amount of practice. With a fixed focal length lens, there is only one nodal point. Just note the position of the nodal slide using the engraved scale. Since the pano head has center lines also engraved on it, it is easy to note and set the exact position of the nodal slide for each lens. But be careful! The nodal slide has scales on each side; one numbers distance from back-to-front, the other from front-to-back. Choose one and be consistent.

For a zoom lens, the nodal point may be different at each focal length. You do not need to find the nodal point for each mm of focal length. Use focal lengths at 10mm or 20mm intervals. Then graph the results in a spreadsheet. Here are the results I got.

Note that the 105mm Macro and 11-16 zoom have a single nodal slide setting. The settings for the 18-70 and 70-300 are variable but form a smooth curve. This is because modern zoom lenses shift the several lens groups smoothly as you zoom. Only 10mm increments or greater are needed to make a useful chart.



A little scientific experiment and setting the nodal point becomes trivial in the field! After you have your camera set up to make the panorama, check the focal length and set the nodal slide. Easy! Print the chart on card stock and keep it in your camera bag!

I made my nodal slide chart in Microsoft Excel. If you don't have Excel, you can use the spreadsheet application in Open Office ([www.openoffice.org](http://www.openoffice.org)), Calc. And Open Office free! I like free! Plot your values using an X-Y, or scatter plot, with lines.

The terms 'nodal point', 'principle plane', 'entrance pupil' and 'no-parallax point' are all found in articles about panoramas. Rather than debate which is correct, you only have to know what problem you need to solve!

*By the way, I mention Really Right Stuff (RRS) throughout this document. Just wanted you to know that I have no connection whatever to RRS, other than purchasing and using their gear. Same with Kirk Enterprises gear as well. I use my own money and get nothing from either. Both companies produce solid well made equipment.*