

HOW TO CAPTURE AND STITCH PANORAMA PHOTOGRAPHS

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The information in this paper is the result of my personal experience with taking, stitching and printing digital panorama photographs. Along with a lot of reading and a liberal dose of plagiarism.

Let's start with what I consider the most important part of a successful panorama. Like any photographic effort the better the initial capture the easier it is to end up with an outstanding final image. This was true when working with film and a wet darkroom and is just as true; if not more so, when working with digital capture and a lightroom.

Turn Auto Exposure Off

Set your camera to manual exposure mode (M).

Why: When the camera automatically adjusts the exposure for each shot, changes in light can make the corresponding areas of two overlapping photos look totally different. When this happens, the final panorama can have big bands of light and dark making it next to impossible to blend one frame with next.

Turn Auto White Balance Off

Turn the camera's auto white balance feature OFF. Manually set the white balance and use that same setting for all of the shots in the panorama.

Why: Slight changes in lighting conditions can cause the colors in one frame to differ greatly from the colors in the next.

Use One Exposure Setting

Before you begin shooting, use the camera's light meter to find an exposure that works well for the entire range of images. Use it for all images.

Why: In general, panorama images stitch better in more even light. Changes in exposure setting can make the same exact (overlapping) areas of two photos look totally different. When this happens, the final panorama will show banding.

Use One Focal Length

Use the same focal length setting for all of the shots in the panorama.

Why: Using different focal lengths can present inconsistencies that cannot be overcome during the stitching process.

Turn off the Flash

Do not use a flash. Turn off the camera's auto-flash feature if it has one.

Why: A flash can create shadows that change shape and position from shot to shot. These inconsistencies make it difficult for the software to recognize corresponding parts of adjacent photos.

Do Not Change Size or Quality Setting

Use the same photo size (resolution) and photo quality (ie. raw) for all shots.

Use a Tripod Whenever Possible

When shooting photos for a panorama, it's critical to keep the camera on the same plane throughout all of the shots. The easiest way to do this is to use a tripod. Not only do you need the tripod you need a method of ensuring it is level. A lot of tripods have built in levels which will do to get the tripod level. But, you are not done; the camera must also be level. Buy a small two way spirit level that mounts in the camera hot shoe. This will save you a lot of grief.

Go Without a Tripod, Only If You Must

If a tripod is not available, act as one yourself by locking your elbows into your body and pivoting on one foot to turn in place. Pay close attention to the framing of each shot (horizon line) - keeping the camera as level as you turn.

Use 25% to 50% overlap

Shoot the photos using between 25% and 50% overlap. You do not need the same amount of overlap for each shot – estimating the amount of overlap is fine.

For wide angle lenses use more overlap (50%). Stay a way from focal lengths smaller than about 35mm (film equivalent) if you are shooting in vertical mode or 28mm if you are shooting in horizontal mode. Any tilt in the vertical axis will result in significant perspective distortion which makes the stitching process very difficult.

Insert Divider Shots Manually

A simple way to divide one sequence of panorama photos from another is to insert (shoot) a blank photo between them. Before beginning a new sequence, use the lens cap or a piece of cardboard or your hand to cover the lens and take a shot. After you transfer the photos to your computer, it will be easy to see where one sequence ends and the next begins.

This bit of advice may be unnecessary but it sure will help figuring out which groups of images belong together. After taking two or three groups with different exposures it can be very difficult to determine which images belong together. Some software will auto select a group if they are all taken in a short time span of each other.

Vertical Verse Horizontal Images

Most people take multiple horizontal images. This is effective but can lead to very narrow panoramas with little vertical detail. An alternate method is to take the photos in vertical mode. This has two major advantages. First, there is 1.5 times as much vertical information and therefore resolution. Second, longer focal length lenses can be used that induce less perspective distortion.

No Polarizer

Do not use a polarizer on days with a blue sky. The polarizer darkens the sky most at a 90 degree angle to the sun. Since you will be doing a panorama that usually takes up a significant arc of the sky, unnatural looking dark areas will occur. If you want to darken the sky, use a split neutral density filter instead. Some times a polarizer can be a problem even without a blue sky. The amount of reflection from water and vegetation will also vary but not as pronounced as sky color.

Shot in Camera Raw

Shooting in camera raw if at all possible as it is easy to edit your images without ending up with different exposures and colors in each image. Open all the images in a set at the same time with CS2's raw converter. Select all of the images so that the changes you make on one image are made on all images. Do not make any changes in Photoshop itself until after the stitching is complete.

Nodal Point

Let's take time to discuss that mysterious thing referred to as the nodal point of a lens. The vast majority of the time the nodal point of a lens is defined as the point at which an image inverts as it passes through a lens. This is not technically correct but it will serve our purpose. The thing to remember is that there is an ideal point about which to rotate your camera while taking images for a panorama. It is not the film/sensor plane or the tripod socket. This is important because if you have something fairly close to your lens it might appear in two images but will have different relationships to other items in each image.

There are a couple of ways around this problem. You can determine the point for each focal length and each lens you use. An adjustable rail similar to a macro rail is required. If you want to go this route do an internet search for help. There are several different sites that go into painful detail.

There are two other ways that I have found to be much more practical. First and foremost is not to have anything within three or four feet of the lens. This works well for most landscapes but not all panoramas. If you must have some item, like a post or tree close to the lens make sure it only appears in one of the frames. Both of these solutions work very well and you will not have to worry about nodal points.

Photo Shooting Checklist

You might want to print this checklist and take it with you when you go out to shoot panoramas.

- Turn Auto-exposure OFF
- Turn Auto White Balance OFF
- Use the same exposure setting for all images in the sequence
- Use one Focal Length for all images in the sequence
- One Size/Quality for all shots in the sequence
- Use a TRIPOD whenever possible especially when objects are near to the camera
- If a tripod is not available, lock elbows and pivot in one spot keep camera level.
- Use at least 25% overlap for each shot
- Use 50% overlap when using a wide angle lens
- Insert visual dividers (blank shots) between sequences
- Be aware that an object in motion may cause problems when stitching
- Be aware that scenes without much detail (cloudless sky over flat sea) are more difficult to stitch

Stitching Software

There are many different softwares available to stitch images together. Any Google search will find lots of them. They range from free to several hundred dollars. Most allow a free trial download. Photoshop CS2 can be used but I think it is cumbersome and more trouble than it is worth. Read, "Takes a lot of time to do well."

For the last four years I have used ArcSoft's Panorama Maker 3 which has been replaced with Panorama Maker 4. I am not sure I like the new version. It does not have as many options for fine tuning the final results as version 3 but then it does not seem to have as much need for fine tuning.

I have tried a total of five different packages. They are not necessarily the best or the worst. Just the ones I happened to download and try. Each were used with two sets of images. One an easy to stitch group and the other a hard to stitch group.

Panorama Maker 4 by ArcSoft, www.arcsoft.com \$40

See above remarks. I will demonstrate this if there is time.

Creates horizontal, vertical and 360° panorama pictures

Automatically selects a whole group of photos with one click

Automatically orders and stitches pictures seamlessly

Works with JPG and RAW image files

Available for both PC and Mac

Supports banner paper and multi-sheet printing

Ulead Cool 360 by Ulead www.ulead.com/cool360 \$40

I do not like this one; it has a poor interface, but you might like it.

PanoStitcher by Pixtra www.pixtra.com \$30

This could be the best buy of the bunch at \$30 but I would like to have support for RAW and PSD files. It gives you a lot of control and blends images well.

File types: Input: JPEG, BMP, TIFF; Output: JPEG, TIFF, QuickTime

Allows zooming (So they say.)

Two manual stitching methods

Handheld capability (So they say.)

AutoPano Pro by Kolor www.autopano.net \$120

Very good but a little pricey, may be worth the money

Fully automatic stitching

Powerful color correction

Full HDR support

Support for lots of file formats (including RAW from many camera manufacturers)

Output formats : JPG, PNG, BMP, HDR and Adobe PSD, PSB

Virtual file writer for Adobe Photoshop PSD or PSB, layered or not, 8 or 16 bits

PC (Mac and Linux version coming really soon)

The Panorama Factory by Panorama Factory www.panoramafactory.com \$70

I will demonstrate this one

Reads and writes Windows BMP, JPEG, TIFF and PNG images.

Exports to layered Photoshop image format.

Automatic image alignment with manual override.

Multi-threaded execution on multi-processor systems (including multi-core systems).

64-bit processor support for the x64 Edition of Windows XP or Windows.

A Wizard helps you create stitching projects with just a few mouse clicks.

Automatic detection of focal length.

Detection of camera rotation and tilt.

Includes a large library of camera models including SLRs.

Software Recommendations

Do not put too much faith in my likes and dislikes. We all have our own preferences and seeing that they have free trial downloads use them and decide for yourself.