PANORAMAS MADE SIMPLE

HOW TO CREATE BEAUTIFUL PANORAMAS WITH THE EQUIPMENT YOU HAVE—EVEN YOUR PHONE

HUDSON HENRY

COMPLETE
DIGITAL
PHOTOGRAPHY

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How to create beautiful panoramas with the equipment you have—even your phone

By Hudson Henry

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PREFACE MY PASSION FOR PANORAMAS

My first panorama, created from three frames of medium-format film.

I GREW UP WITH ADVENTURESOME EXTENDED FAMILY MEMBERS WHO LOVED TRAVELING, CLIMBING, AND sharing slideshows of far-off places. As I kid, I couldn't wait to head into the world with a camera. I started with 35mm slide film and studied the work of Galen Rowell and Art Wolfe.

As I scanned and edited my photos in early versions of Adobe Photoshop I found myself becoming obsessed with image quality. Like many similar photographers, I shifted to medium-format film for the bigger frame and the higher image quality. And that's when I encountered a problem: as a poor college student, I couldn't afford the wide-angle lens that I needed to capture the grand landscapes I loved photographing.

Then, one amazing pink dawn while out shooting in my hometown of Portland, Oregon, I decided to cap-

My first digital panorama, taken in the Arctic National Wildlife Refuge.

ture the entire scene in my mind's eye by photographing it in three overlapping medium-format frames. I then spent untold hours scanning, hand-merging and blending these images into a single frame with Adobe Photoshop (shown on the previous page). It was my first simple panoramic merger. When I printed it six feet wide, the image was crisp and detailed, and it permanently changed the way I thought about creating photographs and big prints. I was hooked.

Before long I purchased my first DSLR, a Nikon D70, and took that camera on a long backpacking trip through Alaska's Brooks Range. One of my goals for the trip was to create a highly detailed photograph of the Arctic National Wildlife Refuge's coastal plain, one

that I could print at an extremely large size. I set my lens to 135mm and pivoted that 6-megapixel camera through the scene, ultimately creating a 55-megapixel image (shown above) from overlapping vertical frames. It was my first fully digital panoramic merger. After creating huge prints of that scene, I set aside my film equipment and began focusing instead on digital panoramas.

Since those early days, I have continuously photographed panoramas, both at home and in my travels around the world. I have moved from simple, single-row images to more complex panoramas comprised of multiple rows, using precision equipment. And, at the heart of it all is my passion for producing these

beautiful, high-resolution images that represent a much closer rendition of the world beyond my lens. With this book, I hope to show you how easy it is to get started with panoramic photography, and to pass along some of my passion for this medium.

HOW IS THIS BOOK ORGANIZED?

This book is the first of a two-book series on creating effective and compelling panoramas. This book is focused on simple panoramas, which are the ones most people will want to create. I'll get you up and running with a minimum amount of effort or cost, and you will be amazed at the results you can achieve with a few simple guidelines.

All you will need is a camera that takes good photos—even a modern smartphone will do—a Mac or Windows computer and a version of Adobe Lightroom Classic CC (the new Lightroom CC doesn't have a panorama feature), Adobe Photoshop CC, or ON1 Photo RAW 2018.

After a brief description of the different types of panoramas, I will cover how to use your equipment in the field to capture the individual frames needed to create a successful panorama. Finally I'll delve into how to organize, process, and merge your panorama using Lightroom, Photoshop or Photo RAW.

The second book in this series is designed for the person who wants to go all in and create complex, multiple-row and other specialty panoramas, ones that require extreme precision during the capture process. It will cover the equipment necessary for building these advanced panoramic images and how to calibrate your camera and lenses. It will also offer more advanced editing techniques utilizing Photoshop and other powerful software.

But if you're new to panoramas, don't worry: in no time, I'll have you creating great panoramas with the equipment you have on hand. It's that simple.

1 AN INTRODUCTION TO PANORAMIC PHOTOGRAPHY

This ultra-wide panorama was taken on Denali, in Alaska. If you look carefully, you'll notice that its field of view is actually wider than 360°.

PANORAMIC PHOTOGRAPHY IS THE MERGING OF MULTIPLE INDIVIDUALLY CAPTURED PHOTOGRAPHS INTO A SINGLE, LARGER, IMAGE. The first panoramic photograph I remember seeing was a series of overlapping Kodak prints that my cousin laid out on his kitchen table to show the incredible view from atop a peak in the Pacific Northwest. I was amazed at the scale of the combined scene: it was big, with an ultra-wide angle, and highly detailed. Today, with the advent of digital cameras and sophisticated editing software, we can leave the kitchen table behind and easily merge individual digital photographs into high-quality, seamless panoramic mergers.

You don't have to invest a lot of money in gear to create panoramas. You can begin using the simple panoramic techniques I cover in this book without purchasing any specialty camera gear whatsoever. If you have a decent tripod, that will help, but you can also create shockingly good panoramas without one. I've sold large prints of panoramic mergers made with a handheld, point-and-shoot camera. With some care, you can even capture surprisingly good panoramas

with nothing but a smartphone. Many newer phones (and some digital cameras) have automated panoramic capture modes, but I'll show you some better techniques to create consistently higher-quality panoramas than any automatic panorama mode can create on its own.

GO WIDE AND WITH MORE DETAIL

Panoramic photography enables a photographer to go really wide; wider even than an ultra-wide angle lens. Take a close look at the photo on the previous page, which I created at the 11,000-foot camp on Denali (known until recently as Mount McKinley). If you look at the edges of the frame, you'll notice that the field of view is actually greater than 360 degrees. Panoramic mergers let us create images that are much wider than fish-eye lenses—and with far less distortion.

Another huge benefit of panoramic mergers is the ability to create much higher quality images than you can with a single frame. Let's say you are working with a 12-megapixel camera. You could capture a single 12-megapixel frame, or you can zoom in a bit and capture that same composition in six overlapping images and merge them into a 48-megapixel panorama. In doing so you have increased the resolution of your camera by 400 percent. The image is less distorted, crisper, and capable of greater enlargement. Think

This panorama of Oregon's wine country is comprised of 32 images shot with a 50mm lens, and resulted in a 13-foot-wide print for a client. Had I shot it with a wide-angle lens, the image would have had extreme distortion, and would have lost significant detail when printed that large.

Sometimes, you'll find interesting things when you zoom in to look at a finished panorama. Looking at my wine country scene one morning, I noticed for the first time that there was another photographer working among the vines on that beautiful morning.

of the difference between old standard-definition televisions and our modern higher-resolution HD and Ultra HD screens. A similar increase in quality is possible with panoramic mergers vs. single-frame captures with a wide-angle lens.

I consider panoramic mergers whenever I want to create a huge print, be able to heavily crop an image, or zoom into an image to see crazy, spy-movie-like levels of detail.

For example, I created a panorama of Oregon's wine country for a client who wanted a 13-foot-wide print for their office. I could have captured the image with my ultra-wide lens and cropped it, but the scene would have appeared distorted and the print quality would have suffered at this level of enlargement. Instead, I captured 32 images with my 50mm lens and combined them into a panorama that provides high levels of detail at a large print size.

And sometimes you'll find something interesting: if you look at the detail crop (above), you'll see that there was another photographer working among the vines on that beautiful morning. I never saw him until I zoomed in to examine the final panorama on my computer.

SIMPLE PANORAMAS DEFINED

My sole focus in this book is to help you create simple panoramas. What do I mean by this? Well, simple panoramas have several important characteristics:

- First, they are composed of a **single row of images**. You can turn your camera vertical to capture more sky and foreground, but you are only going to capture and merge a single row of images.

- Second, simple panoramas **avoid fast-moving subjects**. You can include a person standing still in your composition or slow-moving clouds, but avoid including ocean surf, crowds of people, birds in flight and the like.

- Finally—and most importantly—simple panoramas **do not include elements that are close to the camera**.

This last point is key. Every camera's lens—even one on a smartphone—has a focus distance setting, called infinity, at which everything at that distance and further away appears to be in focus. The best simple panoramas do not include subjects or elements that are closer than your lens' infinity setting. For example, if you look at the panorama of Mount Hood with a crescent moonrise (page 9), you can see that the foreground trees and fog in this image are all further away than the infinity focus setting of my lens.

NOT ALL PANORAMAS ARE NARROW SLICES

A common misconception is that all panoramas are wide, short compositions. While I do create wide panoramas to capture ultra-wide scenes, I frequently capture panoramic images that are shaped like traditional single-frame rectangles, squares, or even tall, narrow, vertical compositions. I flipped my camera vertically and photographed Patagonia's Lago Torre (page 10) in five overlapping frames, simply because I wanted to capture the scene with more quality and resizability than was capable with a single frame.

Conversely, I kept my camera horizontal to capture a vertical panorama of the Empire State Building (also on page 10). As you can see, panoramas can be any shape you want them to be.

EQUIPMENT FOR SIMPLE PANORAMAS

Simple panoramas can be created without any specialized equipment. A solid tripod with the ability to do level panning moves from left to right is something I'd

This simple sunrise panorama of Mt. Hood works because the foreground objects are all further than the infinity focus setting of my lens.

Don't get hung up on the idea that all panoramas are wide. The photo above, of Patagonia's Lago Torre, is made up of five overlapping frames with my camera oriented vertically. Conversely, the image of the Empire State Building, on the right, was taken with a horizontal camera orientation. Panoramas like these give me much higher quality and better resizing capabilities than I could get with a conventional single frame.

highly recommend, but a handheld camera or a smart-phone can yield great results when you pay attention to the setup of your intended panorama when you're in the field.

ADVANCED PANORAMAS

While we will not be creating advanced panoramas with this book, I think it's worth discussing what you can do after you've mastered the art of the simple panorama. Advanced panoramic techniques allow photographers to create seamless, higher-resolution, multiple-row panoramic images, panoramas with subjects in the frame much closer than infinity. Other types of advanced panoramas include 360° captures and HDR (high dynamic range) panoramas.

Advanced panoramas require a tripod head that allows level panning, as well as a nodal slider. The nodal slider allows the camera to slide back, position-ing the lens over the head's axis of rotation. As a result, the slider must be calibrated for each different lens used.

Multiple-row captures require a few more special-ized camera support pieces to ensure that the camera's vertical movements do not interfere with the nodal slider's calibration.

Not everyone wants to go that deeply into the world of panoramas, and, with the simple panoramic skills learned in this book, a few specialty camera support tools, and a bit more training, you will find that pan-oramas are a great way to capture higher resolution, wider angle, and less-distorted images in nearly any photographic situation you encounter.

2 THINKING ABOUT LIGHT, FOCUS AND SETUP

PANORAMIC IMAGE MAKING IS CHALLENGING. YOU HAVE CHOSEN TO BREAK THE BOUNDARY OF A SINGLE FRAME and push your camera to create images at a higher quality than it was designed to capture. As a result, you can't see your entire composition through the camera's viewfinder or on its LCD screen. Instead, you must examine the scene before you with care and make deliberate choices about where to position your camera to organize elements as it sweeps through the scene. Don't lose sight of the fact that composing a compelling simple panorama also involves all of the same considerations as composing any other photograph, in addition to excluding subjects close enough so that you don't run into an effect called parallax. (Which I'll explain shortly.)

LIGHT AND COMPOSITION: THE RULES STILL APPLY

The quality of light plays a huge role in making any successful image. For example, using dramatic light when capturing a panorama holds your viewer's atten-

The dramatic soft light of a winter sunrise on the Portland waterfront demonstrates how the quality of light, when combined with effective composition, can make a panorama sparkle.

While the beauty of a Portland snowstorm makes for a lovely composition, the lighting is flat, and lacks the punch of the dawn panorama—taken on a less snowy morning—shown on the previous page.

tion. Compare two of my recent simple panoramas of the Portland skyline (page 13 and above). Despite being a rare Portland snow scene, the image above, taken in the middle of a flat overcast day, is nowhere near as compelling as the dawn photograph with soft colorful light (and with less snow).

We can't always photograph in perfect light, but there are alternative ways to create atmospheric drama in your panoramic composition. I always look at changing weather as a photographic opportunity; fog or approaching storm clouds offer a chance to capture emotionally powerful panoramas. Whether a forest of fall color, a city mural, or an exceptional sunrise cloudscape, color is another visual element I use to

Fog, color and changing weather are all ways to add atmospheric drama to your panoramas.
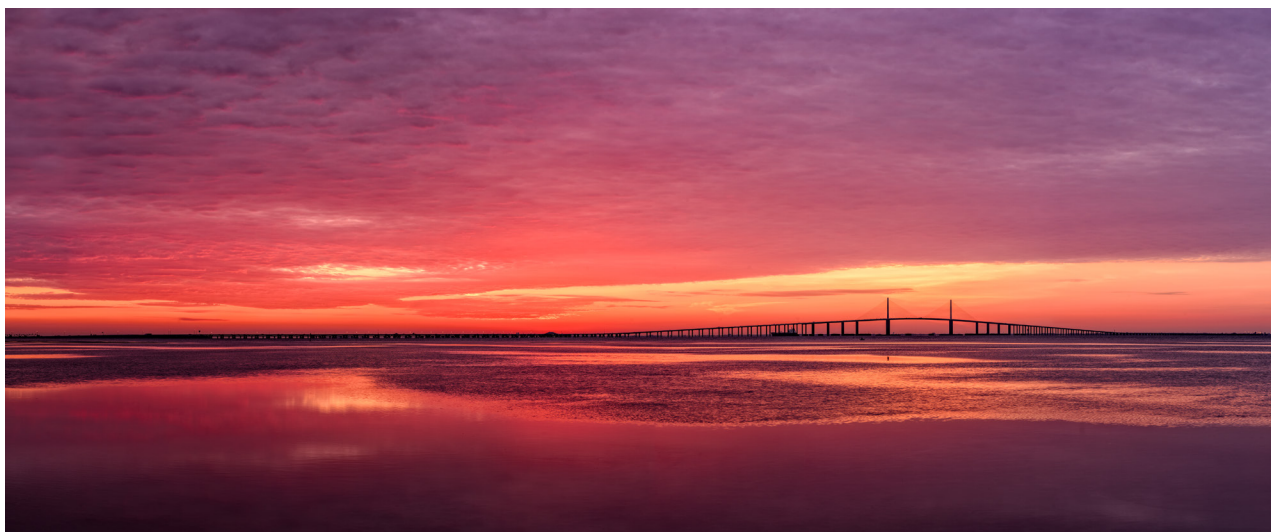
Approaching storm clouds, such as the ones shown here in Patagonia, also present a great opportunity for compelling, dramatic panoramas,

draw and hold a viewer's attention.

Remember the rule of thirds when composing your panoramic images. If you divide your frame into three vertical and horizontal parts like a tic-tac-toe grid, then the most compelling place to position important elements is at the intersections of those grid lines. For example, of the two crops of the panoramic truck image (right), the top one, with the truck positioned dead center in the frame, is far less interesting.

The more compelling crop with the truck in the lower left third of the frame also illustrates a deliberate compositional use of what I like to call 'line of sight.' If your composition contains a person, an animal, a vehicle, or anything with a capacity for sight or motion, you should ideally position it off center but facing into the frame. The viewer's eye will be drawn to that element and then explore the rest of the frame along its line of sight.

Along with the rule of thirds and line of sight, look for lines you can use to lead the viewer's eye into your composition. When organizing lines in your panoramic scene, diagonal lines are better than straight lines. Diagonal lines create triangular shapes which are more interesting than the rectangles formed by straight lines. My favorite lines in composition are diagonal leading lines. Look how the diagonal line of the Golden Gate Bridge (page 18) leads the eye from left to right, and then how the diagonal lines of the suspension cables draw our attention to the sky above.

Approaching a panoramic composition and organizing elements within it is more challenging than composing a scene within a single frame. You must envision where you want the frame to begin and end before working to position yourself to organize the elements within it accordingly. Much like a traditional film photographer, who tested exposure with a Polaroid, I often use my phone's automatic panoramic mode to test and fine-tune different compositions before settling on a camera position. Using a
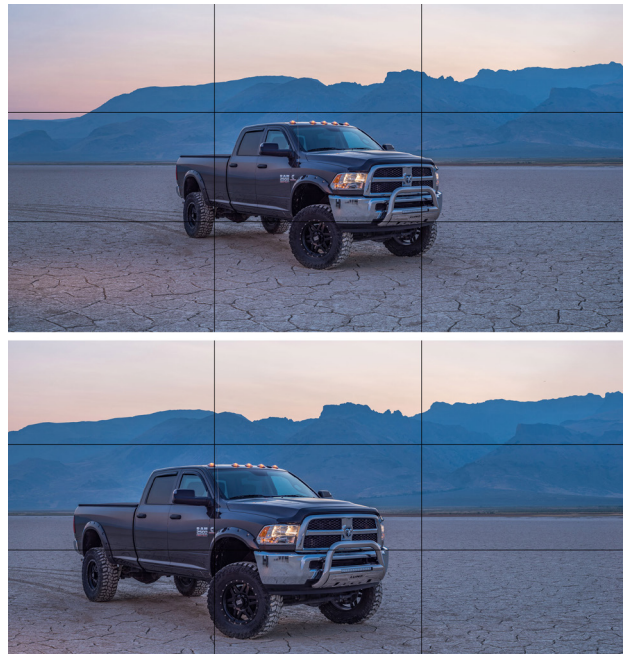
Use the rule of thirds to place important scenic elements in the frame. In the two shots above, the bottom one is a more compelling image than the one with truck dead-center in the frame.

Diagonal leading lines, like the ones in this panorama of the Golden Gate Bridge, lead the viewer's eye into the frame and make for a more pleasing composition.

tripod can be beneficial to ensuring that you set up your camera in way that panning from left to right includes elements that you want included, but also excludes distracting elements, particularly on what will become the edges of your frame. With practice and a bit of trial and error, you'll soon start seeing and composing scenes the go beyond your camera's frame.

WATCH OUT FOR PARALLAX

As I noted earlier, simple panoramas do not include elements that are closer than your lens' infinity-focus distance setting. Without special equipment and

advanced techniques, panoramic compositions with elements closer than that infinity setting cause problems when merging because of something called parallax. Parallax is defined as "the effect whereby the position or direction of an object appears to differ when viewed from different positions."

To get a better idea of parallax, try this exercise. Hold one finger up in front of you at arm's length and close one of your eyes. Focus on that finger and where it appears in relation to the background behind it. Now close your open eye and open your closed eye; your finger will appear to have moved in relation to the background. That effect is parallax, but it's easy to deal with, and I'll show you how to avoid parallax without any fancy equipment when creating simple panoramas.

When attempting to merge panoramic images with significant parallax, software like Lightroom Classic, Photoshop or Photo RAW 2018 will often yield results with ragged misaligned elements like the fronds of the palm tree (right)—or will simply fail to merge the images at all. Composing your scene with all important elements at or beyond your lens' infinity focus setting will eliminate such parallax.

FINDING THE INFINITY DISTANCE

How do you know whether all of your composition's elements are at your chosen lens' infinity distance or beyond it? How far away is that? The answer varies depending on what lens you are using.

Look at the distance scales of the two lenses shown on page 20. The ultra-wide 10mm Voigtländer lens on the left reaches infinity approximately 10 feet from the camera, while the 400mm Nikon telephoto doesn't focus to infinity until somewhere near 300 feet away. This illustrates a fundamental rule to keep in mind: the longer the focal length of your lens, the further its infinity focus setting is away from you. With time you will develop a sense of where infinity is for each of the lenses you

Parallax can cause misaligned elements in your photos. For example, the panorama above looks fine when viewed full-screen, but the palm tree wasn't beyond my lens' infinity setting. Zooming in, you can see that the fronds don't line up (shown right) after my base images were merged inside Lightroom.

Infinity distance is different for every lens, as shown by the settings on these two lenses.

commonly work with.

Many modern lenses, especially the fixed ones found in point-and-shoot cameras and in smartphones, do not have distance scales, but it isn't a problem: any lens' infinity setting is easy enough to find without too much trouble.

NOTE: Many zoom lenses have inaccurate distance scales, and the infinity mark shifts as you move through their zoom range. It's best to determine the infinity setting on your own for the lenses you wish to use for panoramas.

As you begin to scout and compose your panoramic scene, find an object in the distant background that you believe will certainly be beyond the infinity setting. With your camera set to your lens' widest aperture setting (i.e. the smallest aperture number), focus on that distant background feature and check to see if any elements in the scene's foreground now appear out of focus. If one does, then it is closer than

your lens' infinity setting and you should move your chosen location or recompose your scene to avoid such close elements. (Smartphone users: the lenses in most phone cameras are fixed at a single aperture, so you don't need to worry about that when looking for infinity distance.)

LEARNING HOW TO LOCK YOUR CAMERA SETTINGS

Now that you're paying attention to light, composition and infinity when setting up your scene, there's one more thing to learn about panoramas. No matter what camera you use, it is important to use the same exact camera settings for each of the individual images you capture for your panorama. If exposure settings change, the focus distance shifts or the white balance setting changes, then you risk not getting a seamless panoramic merger. The good news is that it is very easy for you lock these settings in both your phone and with more traditional digital cameras, including DSLRs, mirrorless cameras, simple point-and-shoots and rangefinders.

When using a smartphone

Today's smartphones have become capable digital cameras and, if you're like me, it's rare that you don't have yours with you. Not all that long ago, I thought

of my (older) phone's camera merely as a scouting tool to help me find compositions for bigger, higher-resolution cameras; now, I find myself frequently shooting high-quality photos with my phone. By capturing overlapping frames to blend into simple panoramas you can dramatically increase your phone's image quality and resolution as well as capture wider scenes than its lens would otherwise allow.

It doesn't matter whether you prefer iPhones or Android phones; the important settings are exactly the same. You need to turn off the flash and lock focus, shutter speed, ISO and white balance. Not all phones' stock camera applications allow you to lock these settings, but Adobe's free Lightroom CC mobile app includes a camera that lets you lock these settings on any iPhone, iPad or Android device. Lightroom CC's camera also has a number of excellent options, including a handy, visual leveling aid, multiple grid overlays to help with composition, and the ability

to capture raw files instead of lower-quality, compressed JPG files.

NOTE: We're using Lightroom CC mobile in our examples because it has the manual features we need; saves images in raw (DNG) format; works on iOS and Android; and integrates well with Lightroom Classic CC, our panorama-editing app of choice. If you don't want to use Lightroom, any good, manual-capable phone app will do. The Resources section has links to iOS and Android camera apps with manual settings options.

To gain access to these controls in Lightroom CC you need to switch into Professional mode—not Automatic or High Dynamic Range modes.

To do that, tap the Auto label to the right of the shutter button (above right). Also, make sure you tap the flash icon at the top and set it to off, and switch the saved image format from JPG to DNG by tapping on the JPG label at
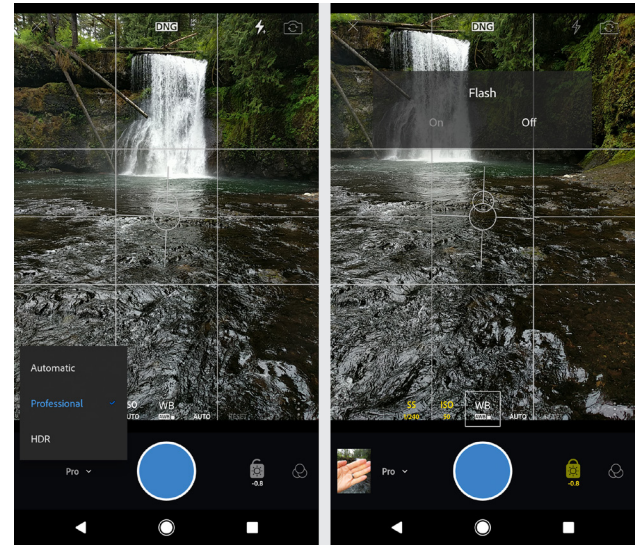
When shooting panoramas with Lightroom CC, set the camera to Professional mode (left) and turn the flash off (right).
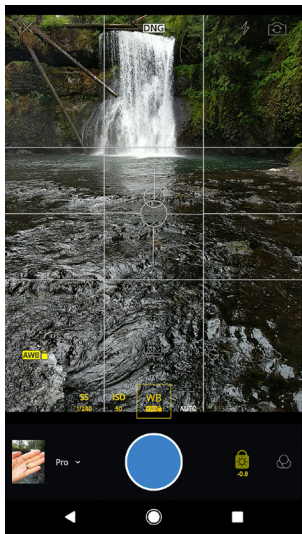
Lock in your exposure, shutter speed, white balance and ISO settings (left), then set your focus distance to infinity (right).
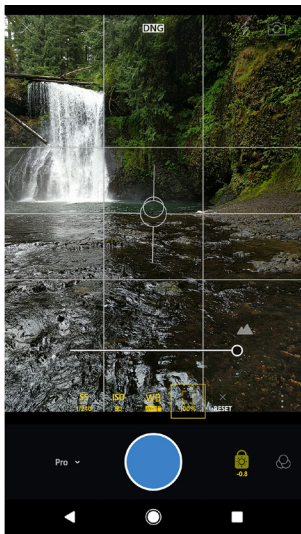
the top center of the screen. DNG give you broader latitude to edit your photos later.

To lock exposure settings in Lightroom CC's camera app I suggest moving your phone to frame up a part of the scene with both highlights and shadows and then dragging your finger left and right to adjust exposure compensation to achieve the look you want before tapping the exposure lock button on the bottom right, next to the shutter button. The exposure lock button will turn yellow, as will the shutter speed and ISO settings labels to indicate they are now locked. Next, tap the WB—white balance—button to the right of the ISO button. Here you can choose from the following settings: AWB (auto white balance), tungsten, fluorescent, daylight, or cloudy. Tap one of the choices to lock in the white balance setting. Tapping AWB here will lock the phone's automatically chosen white balance. Now the white balance button should also be highlighted yellow.

Finally you need to lock focus. Tap the square bracket symbol to the right of WB and drag the slider all the way toward the mountain symbol. The focus bracket symbol will turn yellow and the number below it should read 100%. You just locked your focus to infinity, the distance subjects must be from us for simple panoramas. Your phone's settings are now locked and ready to capture a panoramic scene. To unlock these settings after capturing a panorama, simply click the Reset button to the right of the focus bracket symbols. All of the settings will return to automatic and change from yellow to white.

Locking your settings with a traditional digital camera

Whether you use a DSLR, a mirrorless camera or a point-and-shoot, you'll need to lock the same settings described in the previous section. In addition, you'll need to lock your aperture, something that can't be adjusted on smartphones.

To lock the needed settings, turn off

your flash, switch your camera into manual exposure and manual-focus modes, and then turn off automatic ISO and automatic white balance. I also recommend setting your camera to capture images in raw format to maximize both image quality and editing flexibility when working in post-production.

By selecting manual exposure mode you will need to set the aperture and ISO to achieve a correct exposure. Your camera should have some sort of metering display in manual mode to help you set the correct exposure. (I'll talk more about how to meter a scene properly in the next chapter.)

Auto ISO is the setting I find the easiest to forget to turn off. Even with your camera's aperture and shutter speed locked in manual mode, auto ISO will continue to alter the exposure of each image by amplifying your sensor's recording of the light striking it, causing variations in exposure from frame to frame, especially if you have a scene that has a wide dynamic range.

A lot of students ask me why I recommend a fixed white balance when capturing raw files. While it's true that a raw file's white balance can easily be changed in post-production, it's also very easy to forget to synchronize white balance before attempting to blend images into panoramas. I prefer to lock in a single setting for all the images during the capture process.

Why shouldn't I use my phone's automatic panorama mode?

While most modern smartphones—and many newer digital cameras—have built-in panorama modes, you will get higher resolution and much better quality by capturing a series of overlapping frames and assembling them into a panorama in post-production. This technique also lets you exercise much greater creative control when editing and merging the panorama.

That's not to say that I never use my phone's panorama mode: I use it frequently when scouting potential panoramas. It is a fast and easy way to determine whether and where to capture a higher quality panorama either with my phone or one of my larger cameras.

And, if you chose to capture lower-quality JPG files to create panoramas, then locking in a white balance is essential, because you cannot change the white balance later without affecting the image data in a destructive manner.

Manual focus is particularly important: you don't want your camera to adjust focus automatically each time you capture a frame for your panorama. That's not to say that you have to put your camera into manual-focus mode and focus your scene that way—although I think this is generally a good thing to do. If

Set your camera to Manual (M) mode (above), and your lens to manual focus mode (below).

you want to use your camera's autofocus capabilities, just make sure that you can lock that focus so that it does not shift from one image to the next.

Most digital cameras are set at the factory to apply autofocus when you press the shutter button halfway; this is something that I feel every photographer should change immediately, even if you're not shooting panoramas. Many digital cameras give you the option to use a button on the back of the camera to apply autofocus and lock that focus. Check your camera's manual on how to set this feature up.

NOTE: Some cameras override back-button focus and attempt to autofocus each time you use a cable release, timer or remote control. Consult your manual, or test these options in the field, to find out if this is case. If so, you will need to put your camera in manual-focus mode to avoid focus changing as you capture your panorama.

The big advantage of this is that you can apply focus to the elements you want, and then recompose your scene accordingly. I am a firm believer in always using this back-button autofocus approach in every shooting scenario.

Why is manual exposure so important?

Adobe Photoshop and Lightroom have had excellent panoramic stitching options for years, and those apps have gotten remarkably forgiving when you're blending images together, even images that have different shutter speeds. So why not just let the software take care of it?

To that I say: "Why take the chance?" You don't want to get back from a shoot and discover that one frame had a lower shutter speed, or a different ISO setting, and your panorama ends up with light or dark bands across parts of it. You have the best chances for creating a successful panorama when every frame has the same exposure values.

If you look at the two images on the right, the top one is comprised of seven frames, all shot with the same aperture, shutter speed and ISO settings. When blended into a panorama, this image has a smooth range of tones and exposure.

The image on the bottom was created with the same aperture and ISO settings, but the shutter speed changed during the capture process, due to changing brightness across the scene. The resultant panorama suffers from variations in brightness, which shows up as dark vertical bands in parts of the sky. Unfortunately, there is very little you can do to fix these problems without extensive editing in post-production—and sometimes they are not fixable at all.

Captured with manual exposure settings, the final image is well-balanced across the entire scene.

Captured with auto exposure settings, this image has dark vertical bands that detract from the final panorama.

3 CAPTURING THE FRAMES

YOU'RE IN THE FIELD, AND YOU'VE GOT THE SCENE IN FRONT OF YOU—AND IN YOUR MIND'S EYE—FOR YOUR PANORAMA. What's next? Well, there are a lot of variables to think about, but they are easily broken down into a simple checklist:

- Get as close to complete manual mode as you can with your camera or phone.
- Choose the lens that you feel will give you the best representation of your scene.
- Survey the scene, panning across it to make sure the elements you want will be in your finished panorama.
- Meter using your camera's built-in exposure meter, paying attention to the highlights and shadows across the entire field of view for your panorama.
- Use a level tripod, if possible. If you don't have one, make sure you pan across your scene as level as possible.
- Set up your camera in a vertical orientation, unless you intend to create a vertical (ground to sky) composition.
- Lock in your focus, using live view if available, accounting for infinity focus distance.
- Note the beginning and end of each panorama capture with some sort of 'dark slide' frame marker.
- And finally, capture wide, with lots of overlap.

While this list might seem daunting, it really isn't. You have already learned how to make sure you are in

control of light, composition and your camera settings. The rest of this is easy.

LENS SELECTION

If you're using a traditional digital camera, you can create successful simple panoramas with just about any lens you have. I've captured simple panoramas with everything from 12mm ultra-wide to 400mm telephoto lenses. My most frequent panoramic focal lengths are 35mm, 50mm, 14mm, 70mm and 105mm, in that order. Because they have the least distortion, the simplest lenses to use are those in the 'normal' range, from 35mm to 70mm. Just about any lens you choose to use should yield fine results when you're following my process; experiment with the lenses you have to find your own best focal lengths.

EXPOSURE METERING

Now that we've turned off all our camera's automatic settings, how do we manually meter a scene wider than a single frame? The answer is that we have to use a similar mindset to the great photographers who worked in the days before light meters were small enough to be built into cameras.

Ansel Adams didn't have an auto-exposure mode on his large-format cameras; he metered the highlight areas of his composition and the shadow areas and exposed his film accordingly. We don't need to go that far, however. The sophisticated light meters built into our modern cameras make this process a breeze. (Even our phones have incredibly accurate light meters built into them.) With a little forethought, combined with a bit of trial and error, we can get perfectly metered panoramas very easily.

Metering with your phone

In the previous chapter, I recommended framing a part of the scene with both highlights and shadows, adjusting Lightroom CC's exposure compensation to taste and locking the exposure settings. Once you've locked those settings, you should slowly pan your phone through the entire scene watching to be sure the exposure looks balanced overall. If part of the scene looks drastically overexposed (or underexposed), then adjust your shutter speed or ISO accordingly and lock them again afterward. Be careful not to overexpose the highlights of your scene. We can recover surprising amounts of detail in slightly underexposed shadows, but overexposed highlights are often impossible to recover.

Metering with your camera

The process is very similar when working with a larger

digital camera. Many cameras offer multiple exposure modes. I leave mine set to its most sophisticated mode: often called matrix (or evaluative) metering mode. In its manual-exposure mode, your camera should provide you with an exposure display to represent what its light meter reads in a given frame. To meter your panorama, look at the overall scene and find a part to frame that contains both highlights and shadows in as equal a measure as possible and zero out the exposure meter by adjusting your shutter speed and aperture.

Now slowly pan your camera through the scene you wish to capture, moving from one side to the other while watching the meter reading. It's common to see the meter fluctuate as you pan. Balance the meter's reading by adjusting shutter speed, aperture and ISO, while being cautious not to overexpose important highlight details in the scene. Take test shots and review them on your camera's screen to check your exposure and leave all the settings locked.

USE A TRIPOD, WHERE POSSIBLE

While it is possible to capture a simple panorama handheld in good light, using a solid tripod with a level panning axis will let you keep your camera level; make small, finely tuned adjustments to your composition; focus much easier with live view; and, most importantly, relax while capturing your panorama images. If you are working in low-light conditions with longer shutter speeds, then a tripod is essential to capture sharp images.

Staying level and in a straight line throughout the panoramic capture is critically important to capturing a usable set of images to merge. I personally use a lightweight pan-and-tilt fluid head with a bowl-style leveling adapter between the head and the tripod, examples of which are shown on the right. This lets me freely pan or tilt the camera through a scene while keeping it perfectly level.

Ball heads, while more popular than fluid heads, present a challenge for pan-

When capturing a panorama, I prefer to use a fluid tripod head attached to a bowl-style leveling adapter, like the ones shown below, but a standard ball head can work, especially if you ensure that the tripod's legs—and the ball— have been leveled appropriately.

The importance of being level

The three merged, but uncropped, panoramas shown here (from Kauai's Hanalei Valley) illustrate how much more usable image area you get with a completely level tripod.

The top image was captured while panning on a level fluid head. The result is a level horizon with very little cropping required.

The middle image was taken with a ball head that was set to level, but without ensuring that the legs were also level; As I panned, the head left its level position, and the horizon of the resultant panorama is quite warped. Significant cropping and post-production will be required to correct it.

The bottom photo was taken handheld. The images don't line up perfectly and some sky and foreground will have to be cropped, but the horizon is relatively straight.

oramic photography. They make it easy to compose a single image, but when shooting a panorama with a ball head, you must recheck your level with every movement of the camera, which adds time and difficulty to the capturing process. Many ball heads have a mechanism that lets you pan beneath the ball, but this immediately throws the camera off-level unless both *the legs and the ball* have been painstakingly leveled first. It is possible to do this, but it is just not as easy leveling a ball-head system as it is with a fluid head and a leveling adapter.

To make capturing panoramas with a ball head easier, an inexpensive panning clamp adapter can be added to go between the ball's clamp and your camera. You can then level the ball head and pan across your scene without having to readjust the ball.

Capturing frames without a tripod

Whether you're using a smartphone or a traditional digital camera, capturing a series of panorama images without a tripod takes concentration and multitasking skills. Having both a grid and a level display in your viewfinder or live-view screen is critical. Watch the level indicator to keep the camera from tilting out of level as you carefully pan through the scene capturing your images. Simultaneously use

the intersecting lines on the grid display to ensure you are keeping the line along which you pan the camera straight. I do this by watching for small elements in the landscape that correspond to the intersecting grid lines and keeping them along the same horizontal line as I pan.

ORIENT YOUR CAMERA VERTICALLY (MOST OF THE TIME)

Creating a simple panorama with your camera oriented vertically will let you capture more of the scene in a single row of images. It also creates a higher resolution image, since your sensor is capturing more pixels on its wide axis, and you will be sweeping that axis through the scene from left to right.

Occasionally a scene calls for a tall panorama. In that case you should set your camera's orientation to horizontal, to sweep the wider axis of your camera's sensor vertically as you tilt the camera from down to up.

FOCUS USING LIVE VIEW

One night, years ago, I was in Death Valley. I had a spectacular sunset in front of me, but found my composition a bit late and raced to set up a panorama. It wasn't until I got home that I realized I had forgotten to make sure that my focus was locked in, and my

Beware of polarizers or graduated filters

I always travel with my favorite polarizing filter in my camera bag, but I never use it when capturing a panorama. Polarizers help cut reflections, bring out colors and dramatize skies, but they work best when oriented 90 degrees from the sun. If you shoot directly into the sun or with the sun at your back, then a polarizer will have very little effect. Unfortunately, as we pan along capturing the images for a panorama, a polarizer is likely to have a dramatic effect on one part of the scene and nearly no effect on other parts. This polarization differential makes it impossible to smoothly blend the captured images.

In the latter days of film, I rarely ventured out without three or four graduated neutral-density filters. However, I haven't used them in years. These days I get much better results bracketing my exposures and blending the exposures in post-production to boost shadow detail and darken highlights. It's much faster than in the field and the results are generally much more nuanced. If you are a determined graduated filter aficionado, then I still suggest you forego them when creating panoramas. It's far too complicated and time consuming to adjust the filter to match the landscape in each image as you pan through the scene in a way that will blend smoothly into a panorama in post-production.

image was not sharp. I learned a painful lesson that night: slow down and make sure not to miss a single step in the panorama capture process.

I have found great success with utilizing my camera's live-view mode to manually focus at 100% magnification. Live view projects the scene through the lens onto the rear LCD, and most cameras let you zoom in and out to check focus. While zoomed in, scroll around and manually adjust the focus until the entire scene is as sharp as possible. (Reading glasses can come in handy for this.) Once focus is set, be sure to lock your camera in manual-focus mode, so that no button press can accidentally trigger its autofocus system.

MARKING YOUR PANORAMAS

In the digital age I capture more images than ever before. After a long trip or assignment I find myself sorting through thousands of images shot weeks before. It is too easy to accidentally delete panorama images during large batch culling. To avoid this mistake I always create a marker image on either side of my panoramic image series. Before capturing the first frame and after capturing the last frame of the panorama I place my hand (or the lens cap) in front of the lens to capture a 'dark slide' that will stand out when I cull the images on my computer. When I'm review-

ing images on-screen and I see images sandwiched between a pair of dark slides or the dark outlines of my hand, that's a signal to me that the images in between are parts of a greater whole. (I also use this same technique to flag time-lapse and HDR composite captures.)

COMPOSE WIDE AND USE LOTS OF OVERLAP

One of the biggest mistakes photographers make when capturing panoramas is being frugal: They don't use enough frames. I advocate composing your panoramas wider than you think necessary and overlapping your images by about two-thirds. Why? Here are four good reasons:

- It's easy to crop a merged panorama down, but it is nearly impossible to add pixels that you didn't capture. Software-based technology—like Adobe's content-aware fill—can only do so much.

- Increased overlap lets you merge the sharper, and less-distorted, center projection of your lenses, doing away with the more problematic edges.

- One of your captures might suffer from camera shake or another problem; with a larger amount of overlap, you often can lose a frame without ruining your panorama.

- Finally, digital storage is cheap these days, so why be frugal? Just carry a few more memory cards.

Whether working handheld or on a tripod, activate the grid view on your camera's live-view display while capturing panoramas. With your camera oriented to the left of the scene you wish to capture, align the furthest right grid line on the part of the scene you envision as the left side of the frame. Capture your dark slide by placing your hand in front of the lens and then the first image of the panorama. Now stay level and pan the camera through your scene, capturing an image every time an object intersects one of the grid lines, until the furthest left grid line intersects what you envision as the right side of the frame. Shoot another dark slide to signal the end of the panorama and use your rear screen to check that each image in your proposed panorama is exposed and focused properly.

For vertically oriented captures, you will use the same technique, but tilting from the bottom of the scene to the top, capturing frames as details in your composition pass through each grid intersection. Be careful to start with the bottom edge of your scene aligned with the top grid line and finish with the top edge of the scene aligned with the bottom grid line.

MOVE QUICKLY AND CAREFULLY

The most dramatic panoramas tend to include moving clouds and dramatic, rapidly changing light. In these

conditions it is very important to capture panorama images without long delays between each frame. Pan the camera carefully through the scene, taking care to stay level and not alter any settings or the focus. When working in low light, if you can, use a cable-release, mirror-lockup mode, front-curtain shutter release and pause just long enough between movements and captures to avoid camera shake, but still try to waste as little time as possible between shots so that the images will merge smoothly in post production.

4 ASSEMBLING YOUR PANORAMA

Arches National Park, Moab, Utah.

NOW THAT WE HAVE MEMORY CARDS BURSTING AT THE SEAMS WITH PANORAMIC CAPTURES, IT'S TIME TO MERGE THEM INTO SEAMLESS PANORAMAS. As I mentioned in the introduction, my app of choice for merging is Lightroom Classic CC. I've found it to be the best all-around tool for assembling panoramas, and I'll detail that process initially as I discuss my personal workflow. At the end of the chapter, I'll also show you how to build panoramas using Photoshop or ON1 Photo RAW, if either of those are your image-editing program of choice.

One note: If you find that your computer is taking long periods of time to preview, merge, and edit these big files, then welcome to the world of panoramic photography. While the process is not complex, it does demand more intensive computing power than when editing single frames from your camera. Patience is required, and as you grow addicted to processing

panoramas, don't be surprised to find yourself dreaming of a system with more RAM, faster processors, and better video processing power.

Before we get too much further into post-processing, I should note that my workflow is just that: my workflow. You might find, after some experience building your own panoramas, that you want to alter the process. To that, I say, "Go for it!" The most effective workflow for a photographer is the one that works for them. Use my process as a starting place, and feel free to alter it where it fits your needs.

MY WORKFLOW AT A GLANCE

- Import images into Lightroom Classic.
- Identify the markers (dark slides) used in the field to stack separate panoramic frames into groups.
- Assign color labels to panorama frames for easy discovery later.
- Working with each group, process the master frame for tone and color, syncing those settings with the remaining frames in that set.
- Select all of the photos in a set and choose Panorama Photo Merge.
- Add the merged panorama to the working stack as the master image, to help with identification later.
- Apply any additional styling to the finished panorama.

BUILDING PANORAMAS WITH LIGHTROOM CLASSIC CC

Once you've imported your images into Lightroom Classic, activate the grid view in the Library module. Adjust the thumbnail size slider at the bottom right to make them small enough to view 30 to 60 images on-screen at a time. (If you don't see the thumbnail slider, press the **T** key to show the Toolbar.) You can also press **Command-+** and **Command--** (Control on Windows) to increase and decrease the sizes of the thumbnails.

Before doing any further culling or sorting, scroll through your thumbnails looking for the dark slides or other markers that you used in the field to mark your panoramic captures. Select all of the images between each pair of dark slides and right-click on one of the selected images. In that menu, hover your mouse over **Set Color Label** and click a color you wish to use for your panoramic photography. (I label all of my panorama work blue.) The color you pick doesn't matter, but I have found that I need to remain consistent to stay organized.

Now with all of the images still selected, right-click them again and choose **Stacking>Group Into Stack**. Your batch of panoramic images will collapse into a stack. The stack uses the first image that was selected

**I identify my pan-
oramic sequences** by
the markers I used (the
images of my fingers
here), then I set the color
label to Blue to distin-
guish the sequences
from any single frames
I might have captured
while in the field.
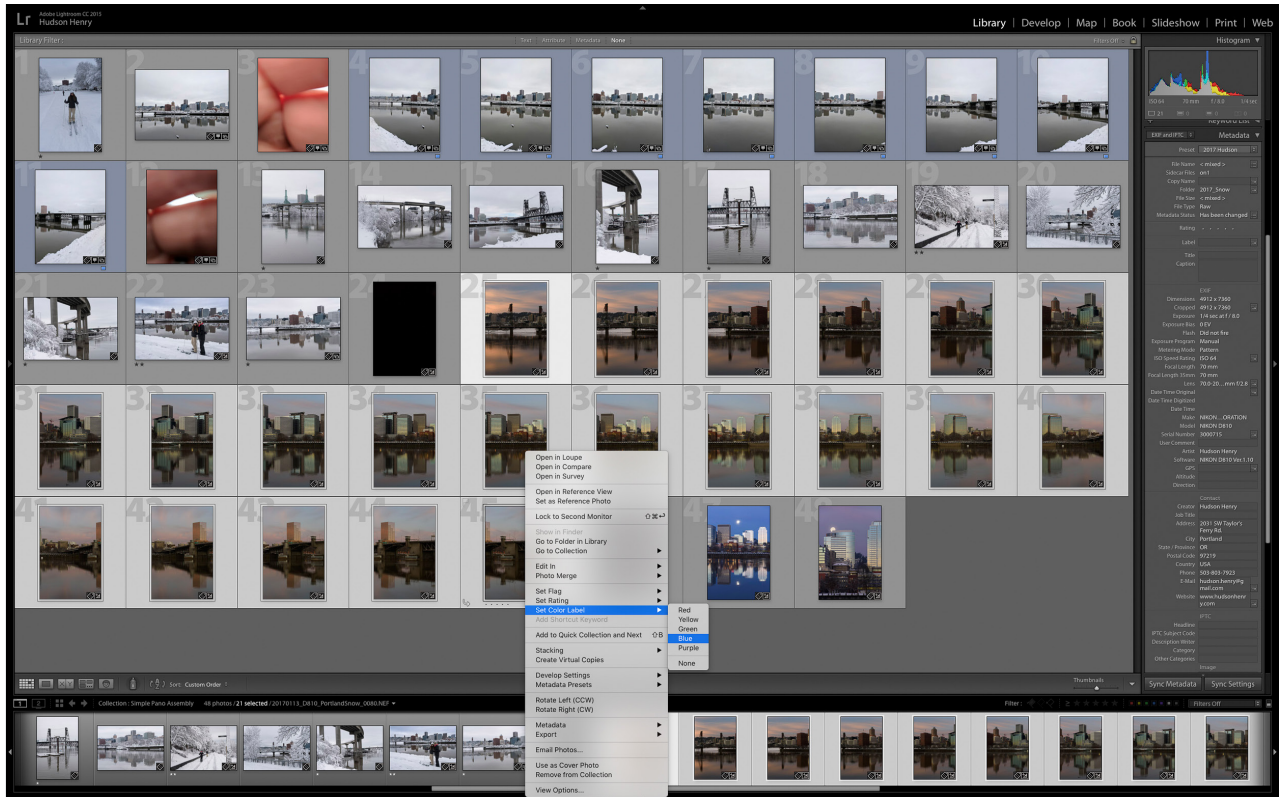
when you created it to represent its contents. The square, white, numbered badge at the top left of your new stack's thumbnail identifies it as a stack and lets you know the number of images it contains. Clicking on this numbered badge will expand or close the stack to display or hide the images it contains.

NOTE: When you select a group of images in Lightroom (or the other apps used in this chapter), you'll notice that the frame around one of the images in a group is brighter than the others. This image is known as the *super-selection*, which means that it is the primarily selected image in the group. If you stack a group of photos, the super-selected image in the stack will be the thumbnail for the group. To change the super-selection before you stack photos, use the arrow keys to move among the group.


Develop adjustments and synchronization

Before blending my panoramic files, I process them for tone and color. With your panorama's stack expanded, select all the of the images in it and then click to highlight a single frame that has both highlight and shadow detail. Now move into Lightroom's Develop module (press the **D** key, or click on the Develop label in the main Lightroom widow) and adjust the Basic

panel's White Balance, Tone and Presence sliders to process the raw file to your taste.

I typically start by holding down the **Option** key (Alt on Windows) and adjusting the Blacks and Whites sliders to maximize the image's contrast without clipping important highlights and shadows. Then I move the Contrast, Highlights and Shadows sliders to taste before adjusting the White Balance sliders. I find that making large exaggerated moves with sliders before moving them back to the look I want is helpful to figure out exactly where I want them set.

If your Lightroom editing process involves other global adjustments like sharpening, noise reduction, split-toning, curves or HSL/Color/B&W adjustments, feel free to add them at this point. On the other hand, you want to avoid local adjustments like cropping, graduated filters, spot healing and the application of local-adjustment brushes. Those types of adjustments are best employed after the panorama is merged.

Keep all of the images in your stack selected—with
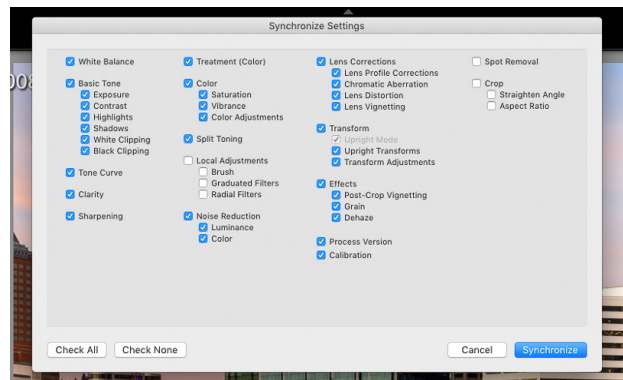
Once I have edited the central image in my panorama sequence in Lightroom's Develop module, I then synchronize those edits across the entire set.

Lightroom's Panorama Photo Merge window has options for the type of perspective, as well as settings for automatically cropping a merged image, and warping the edges of the frame by filling in blank space without cropping it.

the image you just processed highlighted as the super-selection—and click the Sync… button at the bottom right of the Develop panel. You'll now be presented with the Synchronize Settings dialog box. Click on Check All at the bottom left of this dialog box and then deselect the Local Adjustments, Spot Removal, and Crop settings before clicking Synchronize at the bottom right (if you didn't make any of these adjustments, then don't worry about it). Click the Synchronize button.

Now all the global adjustments you have made to the highlighted image have been applied to each and every image in your stack of panoramic images. Using your keyboard's left and right arrow keys, closely examine each of the selected images to check that the settings you just synchronized are suited to the entire range of images. If you find a particular image needs further adjustment, be sure to click the Sync button again and re-synchronize images' global settings to these new adjustments before moving to the next image.

Merging your panorama in Lightroom

Once you have all of your stacked and selected panoramic images satisfactorily processed and syn-

In the two versions of the merged panorama on the right, both images were set to Auto Crop. The top image was built with Boundary Warp set to 0; the bottom image was built with Boundary Warp set to 100. Depending upon the type of scene you are capturing, Boundary Warp can help fill out the edges of a panorama, but it rarely gives you a lot of extra space (as shown here). Also, you want to make sure to inspect the final photo carefully to make sure it didn't introduce artifacts or smudges.

chronized, control-click them, and choose **Photo Merge>Panorama** from the **Photo** menu. It may take a bit of computing time, but you should soon see a new Panorama Merge Preview window, with your selected images merged into an initial attempt at a panorama.

The Panorama Photo Merge window contains a few powerful options to direct Lightroom's pano engine. The projection options are the primary mechanism for tuning your merger, and consist of three options,

spherical, cylindrical, and perspective:

- **Spherical** maps your panoramic as if it were inside of a sphere and is well suited to extremely wide-angle panoramas without a lot of straight vertical lines.

- **Cylindrical** maps your panorama as if it were inside a straight cylinder (like a rolled-up poster). This projection is often useful for maintaining straightness with such vertical lines as trees and buildings.

- **Perspective** attempts to map your panorama onto a

flat surface and is really mostly useful for architectural images. With this option, the center of the projection tends to keep vertical and horizontal lines straight, while the outer edges get distorted.

Experiment by on each type of projection to determine what looks best with your images. For my work, I generally choose between spherical and cylindrical projections.

The other two options in the Panorama Merge Preview window involve the edges of your panorama. The Auto Crop box will crop your image to the widest rectangle possible without including any negative white space. If you think that you might want to create a different crop than the one suggested by Lightroom, then leaving Auto Crop unchecked might make the most sense.

The other option, Boundary Warp, uses Adobe's content-aware-fill technology to warp the edges of your panorama by filling in any blank space without cropping it away. Boundary Warp often works quite well for skies, water and grassy foregrounds. Highly detailed subjects like architecture are not so well suited to it. Sometimes, you'll find that using a bit of Boundary Warp adds some balance to your finished panorama that was missing in the original merge. Other times, when you zoom into your finished panorama, you'll find that the feature added some unwanted artifacts that detract from the finished pano. This is another one of those things that you need to play with to determine whether it helps or hurts your end result. The good news is that you can easily rebuild your panorama from the original frames at any point.

Once you have chosen your projection type, and the crop and Boundary Warp options, click the blue Merge button at the bottom right and watch the progress slider at the top left of the Lightroom interface. Reentering the Library's grid view should reveal the new panorama just behind your stack of merger files. **Command-click** (Control-click on Windows) the merged panorama to select it, and use the left- or right-arrow keys to make the panorama the super-selection. Then right-click on the pano and choose **Stacking>Group Into Stack** from the pop-up menu. Congratulations! You now have a fully merged panorama, saved as a DNG that resides on the top of your stack of merger images.

If you examine your new panorama in Lightroom's Develop module you will find that all of the raw adjustments we made before blending the individual files have been non-destructively maintained in the resultant DNG file. This makes it simple to

readjust your global adjustments to taste looking at the entire panorama as a whole. Now you are also free to add local adjustments, like graduated filters, brushes, and spot removal.

My advice is to edit your panorama file in Lightroom first without applying any vignetting, extreme color adjustments or cropping. Save those adjustments for the very end, before exporting files for printing or sharing. Your panorama has so much resolution and detail that it can be cropped and edited in many different ways without a loss in quality (Lightroom's Virtual Copy feature can be a huge help here). Saving these types of edits for last will leave you the flexibility to use it for purposes you may not have thought of at this initial editing phase.

WORKING WITH PHOTOSHOP CC TO CREATE PANORAMAS

Photoshop and Adobe Camera Raw make merging your simple panoramas a breeze. Here's how:

Use Adobe Camera Raw for basic tone and color adjustments

Before merging panoramas in Photoshop, you will want to process the individual raw files in Adobe Camera Raw. Open your panorama sequence inside Photoshop by selecting **File>Open**, and selecting the group of images you wish to process. (If you use Adobe Bridge, you can select them there, and choose **File>Open in Camera Raw**.) Then, look through the Filmstrip on the left side of the window for the image that best exemplifies your scene's highlights and shadows. With that image selected, right-click it and choose Select All. Now all the files are selected with your chosen image highlighted.

NOTE: This method assumes that you are using raw files to build your panoramas. If you are using JPG files, it is best to merge them with the instructions in the next section, and perform your image editing adjustments on the merged panorama afterwards.

Camera Raw applies each editing adjustment you make to all of the selected files in the open group, freeing you from having to synchronize those edits afterwards.

Inside Camera Raw, I typically start by holding down the **Option** key (Alt on Windows) and adjust the Blacks and Whites sliders to maximize the image's contrast without clipping important highlights and shadows. Then I move the Contrast, Highlights and Shadows sliders to taste before adjusting the White Balance sliders. Making large exaggerated moves with sliders before moving them back to helps to achieve just the adjustment I want.

If your raw processing involves other global adjustments like sharpening, noise reduction, split-toning, curves or HSL/Color/B&W adjustments, feel free to add them at this point from the tabs on Camera Raw's right panel. On the other hand, you want to avoid such adjustments as cropping, graduated filters, spot healing and local-adjustment brushes. Those adjustments are best employed after the panorama is merged.

Unlike Lightroom, Adobe Camera Raw will apply each adjustment you make to all of the selected files, so there

is no need to synchronize the settings. Using your keyboard's left and right arrow keys, closely examine each of the selected images to check that the settings you just synchronized are suited to the entire range of images. If you find a particular image needs further adjustment, any change will apply to all of the selected files.

Merging your panorama in Photoshop

Make sure that all of your processed images are selected in Camera Raw's filmstrip, then click Open Images at the bottom right of the window. Each image in your group will now open as a separate file inside Photoshop.

NOTE: If you prefer Lightroom's approach to building panoramas—as detailed in the previous section—you can right-click on the selected images inside the Camera Raw window and choose Build Panorama from the pop-up menu. You will then see a window that is nearly identical to Lightroom's.

Once they have all loaded, choose **Automate>Photomerge** from Photoshop's **File** menu. This opens the Photomerge window. Now click **Add Open Files** on the right, which will bring all of your base images into the Photomerge engine.

The Photomerge window contains a number of powerful options you can use to direct Photoshop's panorama engine. The projection options are the primary mechanism for tuning your merger; there are six options, although only a few will matter for your panoramas:

- **Auto** lets Photoshop analyze your scene and choose the optimal projection to apply. I find that this option frequently does a fine job when creating simple panos.

- **Perspective** attempts to map your panorama onto a flat surface and is really mostly useful for architectural images. With this option, the center of the projection tends to keep vertical and horizontal lines straight, while the outer edges get distorted. I almost never use this projection.

- **Cylindrical** maps your panorama as if it were inside a straight cylinder (like a rolled-up poster). This projection is very useful for maintaining straightness with such vertical lines as trees and buildings.

- **Spherical** maps your panoramic as if it were inside of a sphere and is well suited to extremely wide-angle panoramas without a lot of straight vertical lines.

- **Collage and Reposition** are what I tend to think of as scrapbooking modes. They don't really transform and blend your images and I never use them.

Feel free to experiment with each type of projection. For my work, I generally choose between Auto, Spherical and Cylindrical. Since the example panorama contains the straight lines of buildings, I will choose Cylindrical.

At the bottom of the Photomerge window are more options. It is critical that you check Blend Images Together to make sure that the edges of the merged files blend smoothly. Vignette Removal
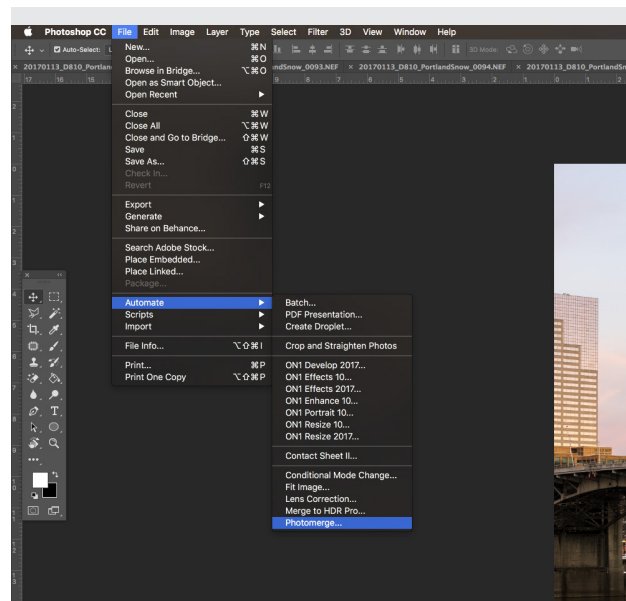
When all of your images have been opened inside Photoshop, choose Photomerge from the File menu's Automate sub-menu.
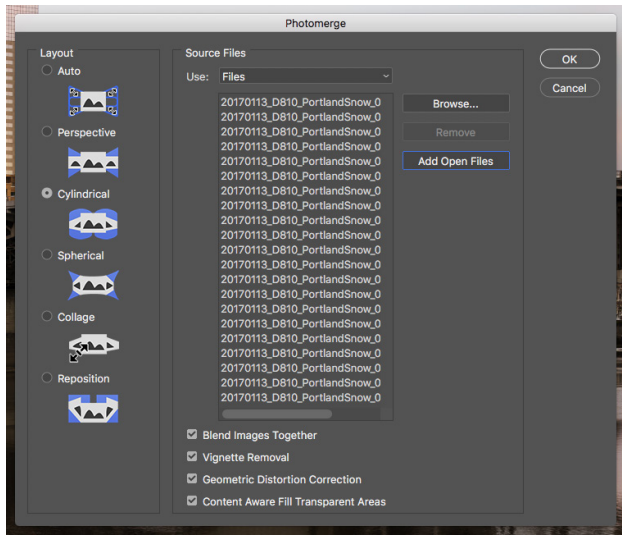
Photoshop's Photomerge feature offers numerous options for creating panoramas including multiple projection types, image blending and vignette removal, distortion correction and content-aware fill for transparent areas.

requires extra processing time, but does a fantastic job of removing darkened edges from lens vignette. Geometric Distortion Correction also takes some processing time as it corrects for lens distortion as the files are merged.

The final option, Content Aware Fill Transparent Areas, uses Adobe's content-aware-fill technology to warp the edges of your panorama by filling in any blank space without cropping it away. Content-aware fill often works quite well for skies, water and grassy foregrounds. Highly detailed subjects, such as architectural scenes, are not so well suited to it.

Sometimes, you'll find that using content-aware fill adds balance to a finished panorama that was missing something in the original merge. Other times, when you zoom into your finished panorama, you'll find that the feature added some unwanted artifacts that detract from the finished panorama, which you will need to edit or crop away. This is another one of those

things that you need to play with to determine whether it helps or hurts the end result. The good news is that you can easily rebuild your panorama from the original frames at any point.

Once you have chosen your projection type, and the other options you want applied in the process, click the OK button at the top right and watch the progress slider. When the merger process is complete you'll be presented with your finished panorama open in Photoshop with each individual merged image open in its own masked layer. To save hard drive space I usually combine these layers by selecting **Flatten Image** from Photoshop's Layer menu before saving and finish editing my panoramas.

If you have lots of storage space and wish to preserve the layers, select them all and create a stamped layer by pressing **Command-Shift-Option-E** (Control-Shift-Alt-E for Windows). This new stamped layer will combine the content of all the selected layers.

My advice is to edit and save your
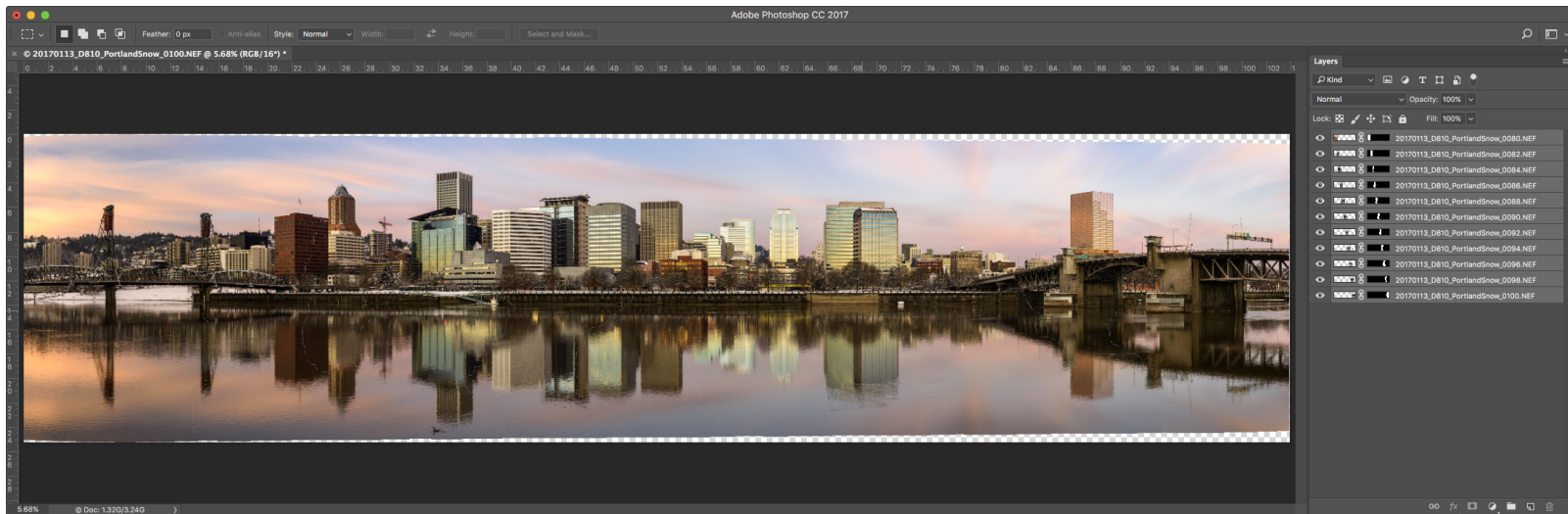
master panorama file without applying any vignetting, extreme color adjustments or cropping. Save those adjustments for the very end, before exporting files for printing or sharing. Your panorama has so much resolution and detail that it can be cropped and edited in many different ways without a loss in quality. Saving these types of edits for last will leave you the flexibility to use it for purposes you may not have thought of at this initial editing phase.

BUILDING PANORAMAS IN ON1 PHOTO RAW 2018

ON1's Photo RAW 2018 has some exciting new capabilities, including a very simple way to merge panoramic images.

Using Develop for basic tone and color adjustments

Before merging panoramas, I raw process the individual files. To do this, navigate to the folder containing your merger files in Photo RAW's Browse module and look through the thumbnails for the image that best exemplifies your scene's highlights and shadows. With

Photoshop's merged panorama will be a layered file. You can save a copy of this file and then choose Flatten Image from the Layers menu to create a final composite that you can use for further editing.
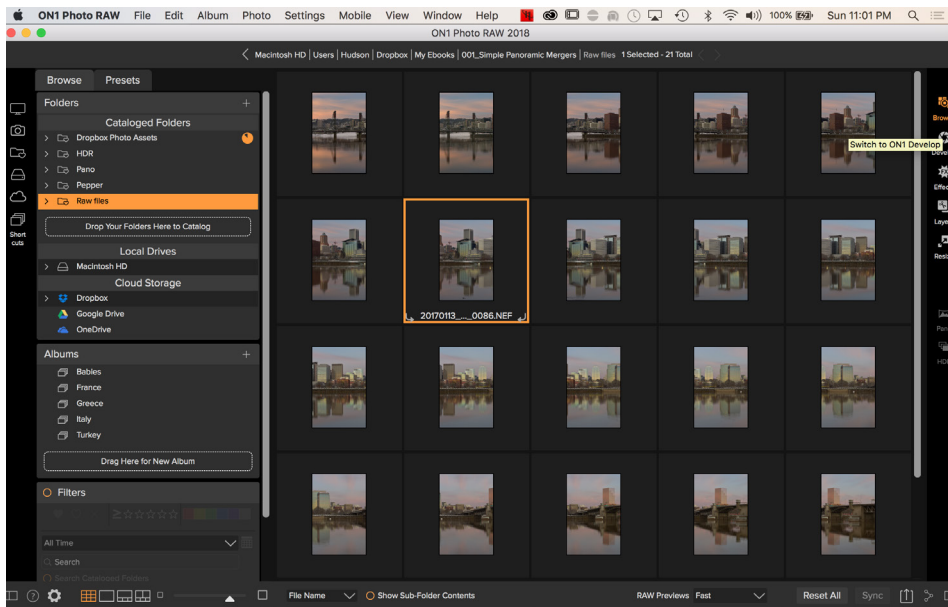
In Photo RAW's Browse module, select the image in your panorama group that best exemplifies your scene's highlights and shadows. Click on the Develop icon to edit the image in that module.

that image selected, click Develop in the right sidebar to enter the Develop module.

Much like I do in Lightroom and Photoshop, I typically start by holding down the J key while adjusting the Blacks and Whites sliders to maximize the image's contrast without clipping important highlights and shadows. Then I move the Contrast, Highlights and Shadows sliders to taste before adjusting the White Balance sliders. Making large exaggerated moves with sliders before moving them back to helps to achieve just the adjustment I want.

If your raw processing involves other global adjustments like sharpening, noise reduction, split-toning, curves, color or black-and-white adjustments feel free to add them at this point from Develop's right panel. If you don't see the adjustment you want, try clicking Show More near the top of the panel. Keep in mind that you want to avoid adjustments like cropping, graduated filters, spot healing and the application of local-adjustment brushes. Those types of adjustments are best employed after the panorama is merged. (I would also avoid excessive editing in the Effects module until after your final file has been generated.)

After processing your single image, click Browse at the top right to move back into ON1 Browse. To synchronize the processing across the group, you must

select all of your panoramic images by clicking the first image and then shift-clicking the final image in the merger series. Super-select your processed image by clicking on it and then click the Sync button near the bottom right of the window.

Press the **F** key to enter Filmstrip view. Using your keyboard's left and right arrow keys, closely examine each of the selected images to check that the settings you just synchronized are suited to the entire range of images. If you find a particular image needs further work, click on Develop, make your adjustments, return to Browse, re-synchronize all the files and check them again using Filmstrip view. Once you are satisfied with your images' raw processing, you're ready to merge the panorama.

Merging your panorama

Return to Browse's Thumbnail view by pressing the **G** key. Now select all of your panoramic images by clicking the first image and then shift-clicking

the final image in the series. Now click the Pano button in the middle of the right panel. This will open the Create Panorama window.

At the bottom of Photo RAW's Create Panorama window are several options. The first drop down menu involves the edges of your panorama. None will leave the edges of the image as they are. Crop will crop your image to the widest rectangle possible without including any negative space. If you think that you might want to create a different crop than the one suggested by Photo RAW, then leaving Auto Crop unchecked might make the most sense.

The other edge option, Warp to Fill, uses ON1's content-aware-fill technology to warp the edges of your panorama by filling in any blank space without cropping it away. Warp to Fill often works quite well for skies, water and grassy foregrounds. Highly detailed subjects like architecture are not so well suited to it. Sometimes, you'll find that using a bit of Warp to Fill adds some
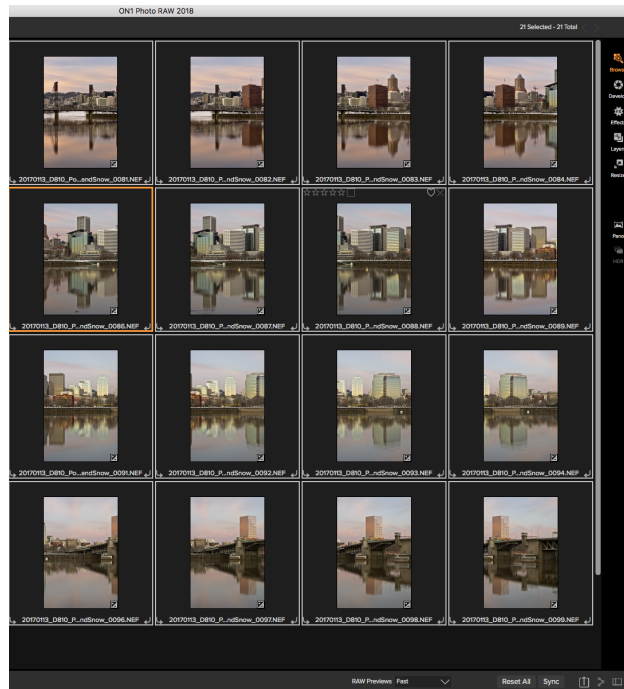
Once you have edited your master image and synchronized those edits with the rest of the images in your group, select the group inside Browse and click the Panorama icon on the right side of the window.

Photo Raw's Panorama window gives you basic auto crop and autofill options, and you can also add panoramic metadata to the final image, if you'd like.
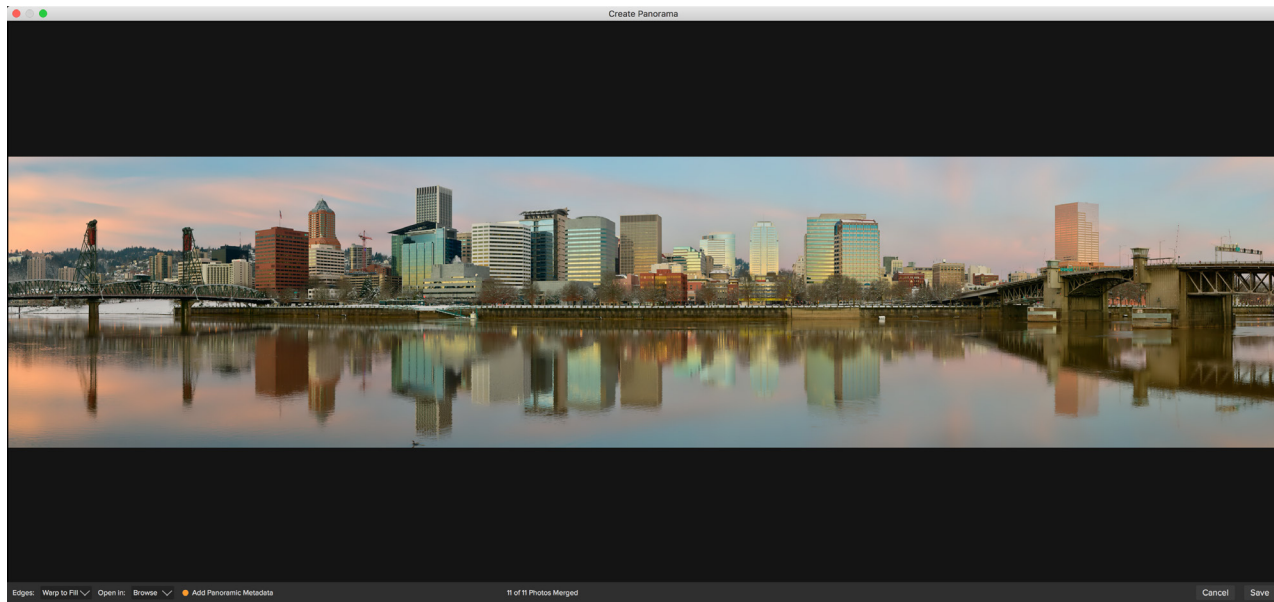
balance to your finished panorama that was missing in the original merge. Other times, when you zoom in, you'll find that the feature added some unwanted artifacts that detract from the finished panorama. This is another one of those things that you need to play with to determine whether it helps or hurts your end result. The good news is that you can easily rebuild your panorama from the original frames at any point.

After choosing your edge treatment and which

Photo RAW module you wish to open the new file, you should choose whether to add Panoramic Metadata to the panorama. Panoramic Metadata will signal special viewing software—and social media sites like Facebook—to enable VR interaction with the panorama. Finally click the Save button at the bottom right and watch the progress slider. When the merger process is complete you'll be presented with your finished panorama open in the Photo RAW module of choice ready

to finish edit as you see fit.

My advice is to edit and save your master panorama file without applying any vignetting, extreme color adjustments or cropping. Save those adjustments for the very end, before exporting files for printing or sharing. Your panorama has so much resolution and detail that it can be cropped and edited in many different ways without a loss in quality. (Photo RAW's Versions feature can be a huge help here). Saving these types of edits for last will leave you the flexibility to use it for purposes you may not have thought of at this initial editing phase.

5 RESOURCES

WITH THIS BOOK, I HOPE I'VE HELPED YOU ON YOUR WAY TO CREATING HIGHER-QUALITY, MORE CONSISTENT AND COMPELLING SIMPLE PANORAMAS. Using the techniques we've covered, go out and find your own unique panoramic compositions to capture. Don't be afraid to experiment and play with the techniques we've covered both in the field and in post production. With time and practice, you'll find yourself creating dramatically different images than most other photographers visiting the same locations. If you're anything like me, you'll soon be completely addicted to capturing scenes larger than a single frame.

Mount Adams, Trout Lake, Washington.

LINKS

What follows are some links to my work, sample files, videos and other topics mentioned in this book:

You can always find more information about me and my photography over on my website. The site contains links to my Facebook page, Instagram feed, email, and much more.

hudsonhenry.com

I regularly blog on many topics related to photography, and you can find that here.

hudsonhenry.com/blog

I mentioned in the book that I prefer a fluid head over a ball head for my photography. Below is a link to a video I made that talks about why I feel this way.

hudsonhenry.com/blog/fluidheads

I have an email newsletter that I send out on a semi-regular basis, which has early announcements of workshops and new products, online training tutorials, prints, subscriber discounts, and more. The newsletter is private, and I will not spam you or sell your name.

Click this link to sign up for my newsletter.

In the "Assembling Your Panorama" chapter, I used the images from my Portland sunrise panorama (shown on Page 13). If you'd like to follow along, I have made these images available for you to download and practice building your own panoramas. These images are provided for your personal use only, and may not be used for any other purpose without permission. (The link is to a Dropbox folder, which contains a ZIP file of the complete image set, as well as the individual images, if you prefer to download them separately.)

Panos Made Simple Examples

We used Lightroom CC as our camera of choice for shooting panoramas with a phone. If you don't want to use that app, here are links to a couple of our favorites for iOS and Android (you'll need to have a relatively newer—2 years or so—camera to capture raw files with your phone):

Halide (our favorite iOS camera)

VSCO Cam (iOS/Android, although the Android version lacks some manual camera controls found in the iPhone version)

Camera FV-5 (Android)

Manual Camera (Android)

ABOUT THE AUTHOR

Hudson's passion for creating dramatic still and motion imagery is infectious. He is well-known for his adventure, travel and expedition field work, and is a renowned workshop leader, with an innate sense for helping students of all levels to improve their photographic skills.

In addition to his workshops, Hudson spends a great deal of time writing, producing instructional videos, and designing programs to help fellow photographers increase their technical, shooting and editing skills and develop their own distinct creative vision. Hudson finds this time coaching incredibly rewarding.