Essentials of HDR

excerpted from
Real World Digital Photography, 3rd Edition by
Katrin Eismann, Seán Duggan & Tim Grey
©2010, All Rights Reserved

Extending Exposure with HDR

Just as shooting multiple exposures to blend into a panorama can help to extend the frame, High Dynamic Range (HDR) imaging techniques allow you to extend the limits of camera exposure and create images that contain a range of contrast and brightness values that better reflect how you see the play of lights to darks, which would be impossible to capture in a single shot. The ability to easily create and combine multiple exposures of a scene into an HDR image has been one of the most groundbreaking aspects of digital photography, freeing photographers from the technical limitations of the image sensor in their cameras.
When to Shoot HDR

In many scenes, the dynamic range of contrast from the deep shadows to the bright highlights exceeds the capabilities of image sensors to capture all the tonal detail present in the scene in a single exposure. High-contrast outdoor scenes on bright, sunny days; sunsets (Figure 6.21); twilight photography; and interior locations that combine darker areas with artificial illumination or views through windows to brightly lit exteriors are all situations in which you can use HDR techniques to capture a full range of tonal values.

Because HDR involves taking multiple shots of the same scene, each at a different exposure optimized to record a different level of brightness in the scene, it is not suited for all types of photography, especially where fast motion in the main subject is an integral part of the story, such as with sports photos. It is an excellent match, however, for landscapes, cityscapes, architecture, nature, travel, and still lifes, and can even be used to create an intriguing look for highly stylized portraits. For longer exposure times, a tripod is necessary, but for scenes where the shutter speeds are fast enough for handheld photography or where you can artfully brace the camera to reduce camera shake, your camera’s Auto Exposure Bracketing feature will let you create HDR images of many different subjects.

Figure 6.21  This HDR image of Bass Harbor Head lighthouse in Maine was created from six exposures.
Photographing for HDR

To make a great HDR image, the first step is recognizing situations in which this technique will work well for the scene. As noted previously, any high-contrast scene with a wide range of brightness values is perfect for HDR. But even scenes with tamer contrast ratios can be enhanced in interesting ways when rendered in HDR.

Exposure considerations

Recording a scene in HDR involves taking a series of shots so that all levels of the brightness range are recorded with a good exposure. The number of shots you create will vary depending on the range of contrast present in the scene. Three to seven are a typical number that work for many situations, but more may be necessary in extreme situations, especially when the light source, usually the sun, is in the frame. The number of shots you use will be determined by the lighting conditions and also by how much detail in the deepest shadows you want to reveal. To get the most benefit from HDR, shoot in RAW to capture as much tonal information as possible.

Here are some additional exposure considerations to keep in mind:

- **Aperture.** In terms of camera exposure, the main thing to remember is that, as with panoramas, the aperture needs to be the same for all the shots in the sequence so that the depth of field is consistent. Differences in depth of field will cause alignment issues when the images are blended together.

- **Shutter speed.** Because the aperture will not change, adjusting the shutter speed will create the range of different exposures. If you will be using an Auto Exposure Bracketing feature and holding the camera, keep an eye on what the shutter speeds are for the different shots. If the shutter speed gets too low, it may not be feasible to hold the camera for the shot without some trace of camera shake being recorded. Vibration reduction lenses can help you get by when holding the camera, even at lower shutter speeds like 1/15th and 1/8th of a second. But you should test the camera’s ability to record a sharp handheld shot at those slower speeds before relying on it for a photograph that really matters. When in doubt, try to steady the camera as best you can, and for best results, use a tripod.
• **Exposure range.** The classic approach to HDR exposure is to bracket the shots so that they are one stop apart in exposure (Figure 6.22), although some photographers use a 2-stop difference between images. In a shot where the “normal” exposure would be f/8 at 1/125, a 1-stop range would result in shutter speeds of 1/30 and 1/60 on the overexposed end, which will record more detail in the darkest shadows, and 1/250 and 1/500 on the underexposed side, which will record detail in the brightest highlights. This would produce a sequence of five images with an exposure difference of one stop each.

![Figure 6.22](image)

**Figure 6.22** The six source exposures for the lighthouse HDR image in Figure 6.21. These are exposed at 1 stop apart at f/20 and range from 1/15th of a second to 2 seconds.

• **ISO.** If the camera is not on a tripod, the ISO should be set to a number that produces exposures with shutter speeds than can be adequately handheld. Onsite testing will determine the best ISO for handheld shooting. If you do have the luxury of using a tripod, choose a lower ISO, such as 100 or 200, to minimize noise.

![Tip]

For tripod-mounted HDR work, consider using an electronic remote release or the camera’s self timer. When longer exposures are necessary, this will reduce the chance that motion or vibration from pressing the shutter button is transmitted to the camera body.
Auto Exposure Bracketing for HDR

Some DSLR cameras feature some form of Auto Exposure Bracketing (AEB). When you set your camera to high-speed, continuous shooting mode, it allows you to take a range of shots bracketed to different exposure settings. The amount by which the exposures are bracketed will vary depending on the camera, but typically you can change the exposure in 1/3 to 1/2-stop increments (Figure 6.23). Likewise, the camera determines the number of frames that can be exposed. Three auto bracketed shots are the norm for most cameras that offer this feature, but some high-end pro cameras let you take seven to nine shots.

Figure 6.23  The Auto Exposure Bracketing screen on a Canon 5D. The camera has been set to take three shots at one stop apart.

To use Auto Exposure Bracketing for HDR, set the shooting mode to Aperture Priority and choose an aperture that will yield the right amount of depth of field for the shot (remember that you can use the depth of field preview button to see the actual depth of field through the viewfinder). The use of Aperture Priority mode ensures that the aperture remains consistent across all the shots. Brace the camera so that it is steady, and take the bracketed shots. When you’re done shooting HDR sequences, be sure to remember to go back into the menu system and turn off AEB; otherwise, your next non-HDR shot will be bracketed.
HDR styles

Once you have made the actual exposures and have downloaded them to your computer, you can begin the process of using HDR software to blend the different source files together into a single, high dynamic range image. It is in the processing of the files that creative and aesthetic concerns arise in how the image will look when the HDR merge is complete.

There is a range of different stylistic approaches to HDR imaging, and having an idea of where you want to go with the image will help you once you begin working with the software. Some HDR results are very exaggerated with intense color saturation, implausible shadow details, and over the top glowing edges. This style of HDR often looks more like an illustration than an actual photograph (Figure 6.24). Many photographers like this punchy, cartoon style of HDR, whereas just as many view it with disdain and feel that it is too much of a departure from what a photograph should be.

Figure 6.24  This style of HDR looks more like an illustration than a photograph, with overly saturated colors, hyperdefined details, and obvious glowing edges.
At the opposite end of the style spectrum are images that use HDR technology only to create an extended tonal range. This method results in images that have excellent (though not implausible) detail in both the highlights and the shadows, and a full, rich range of tones (Figure 6.25). They look like photographs, not candy-colored illustrations, and many times you wouldn’t even know they were HDR images.

Figure 6.25 An HDR process was used to create this image of New York City, but the result looks much more like a well-exposed photograph instead of an exaggerated HDR shot. Image by Robert Anthony DeRosa

Of course, like any creative medium, photography is very personal, and only you can say what the best approach is for your images. Knowing the styles that you like will help you chart a course through the myriad controls for fine-tuning and seasoning your image in HDR software.

Processing the HDR Image

The source files are the first step in the HDR process. The second step takes place in the digital darkroom. The most widely used HDR program and the one that has set the standard for HDR processing is arguably Photomatix Pro by HDRSoft (www.hdrsoft.com). This is a stand-alone program that is also available as a plug-in for Photoshop, Lightroom, and Aperture.

HDR capabilities have been available in Photoshop for a number of years, but they have been pretty lackluster and not really usable. Many photographers
would simply use the Merge to HDR feature in Photoshop CS3 and CS4 to create an initial 32-bit file that they would then import into Photomatrix for most of the HDR processing. With the release of Photoshop CS5, however, Adobe greatly enhanced the HDR features with the introduction of Merge to HDR Pro, a much needed improvement over what was available in previous versions. Adobe also created an HDR Toning feature that lets you apply HDR styling to single images.

We'll take a look at both programs in the following section. Our coverage of HDR processing techniques is not meant to be the definitive exploration of this topic. The goal here is to introduce you to the basic workflow and processing concepts, and provide an overview on techniques that can help you get started with your own explorations of HDR.

**Merge to HDR Pro**

We'll begin our look at HDR processing with Merge to HDR Pro in Photoshop CS5. Just as with images that you will merge into a panorama, apply any overall adjustments and image cleanup, such as dust spotting and fixing chromatic aberration, before you launch the HDR process. Adjustments can be applied to one image and then synchronized with the other files in the sequence (see “Pre-panorama adjustments” earlier in this chapter).

When you're ready to start the HDR process, select all the thumbnails for the source images in Lightroom or Bridge. Merge to HDR Pro can be accessed from within Lightroom by choosing Photo > Edit In, from Adobe Bridge CS5 by choosing Tools > Photoshop, or from the Tools icon in the Mini-Bridge panel in Photoshop CS5.

When the Merge to HDR Pro dialog appears, you will see the source image thumbnails arranged below an initial preview of the merged image (Figure 6.26). If you feel you do not need to use all the source files for the HDR, you can click in the check boxes to remove them from the merged result.

**TIP** Lightroom will always import images into Photoshop at the full camera resolution. If you just want to do a quick proof to see how an image will work in HDR, you can process smaller size files by starting in Bridge, opening one of the files in Camera Raw, and setting the image size to something smaller than the native camera resolution. Then click the Done button and return to Bridge. When you launch Merge to HDR Pro from Bridge, it will use the previous image size setting specified in Camera Raw. This will make the entire process go much faster because there is less pixel data to process. Just remember to set the Camera Raw image size back to native camera resolution when you are done.
Presets

A preset menu is located at the top of the dialog. Test-driving a few of these presets will give you an idea of some of the different ways you can style the HDR effect. To be honest, we find that most of these are pretty useless without additional intervention and should only be considered as a starting point for further explorations. But they are good for seeing how the sliders are configured to achieve a certain type of look. This is information you can use to help you find the look you want. For photographic-looking results, the Default or Photorealistic presets are a good place to start.

Bit Depth and Mode

Under the Mode section, use 16 Bit to ensure that you have a file with high-bit tonal information to work with once the HDR process is complete. When 32 Bit is selected, the dialog reverts to the functionality of earlier versions of Merge to HDR; you don’t have all the cool new creative controls, but it is useful if you want to create a 32-bit merged file to import into other HDR applications like

Figure 6.26  The Merge to HDR Pro dialog in Photoshop CS5.
Photomatix. Local Adaptation should be selected, because this will give you the full set of tone mapping controls as well as access to a tone curve.

**Edge Glow**

One of the hallmarks of a certain type of HDR style is a noticeable glow around contrast edges in an image, and this is where you can control this effect. A good way to see what different sliders do in a software program is to move them drastically back and forth and pay attention to the results. Radius and Strength work in tandem, and adjusting one will affect the results of the other (Figure 6.27):

- **Radius.** Controls the size of the glow effect. Smaller amounts create a thinner edge halo that hugs a contrast edge, whereas higher amounts not only increase the size of the glow but also soften it by spreading it into other areas of the image.

- **Strength.** Controls the intensity of contrast in the glow effect. Just as these sliders influence each other, the sliders in the Tone and Detail section can also affect them, so you may need to revisit them after configuring those controls.
Tone and Detail

The Tone and Detail section contains five sliders that affect the overall tonal balance of the image (Figure 6.28):

**Figure 6.28** The sliders in the Tone and Detail section create the overall balance between brightness and contrast in the image.

- **Gamma and Exposure.** The Gamma slider adjusts the brightness difference between highlights and shadows, but it can initially be a bit confusing because it is reversed in terms of how sliders normally work: moving it to the left results in higher values and moving it to the right results in lower values. With a low setting there will be a pronounced difference between the highlights and shadows, with the former being very bright and the latter quite dark. Moving the slider to the right gradually removes the differences between the two tonal regions until the image takes on a flatter appearance, with highlights and shadows having a similar level of brightness.

Exposure affects the overall tone and brightness of the image. It is fairly sensitive, and small movements can create very noticeable shifts in brightness. Just as with the Radius and Strength sliders, think of Gamma and Exposure as a tandem adjustment.
• **Detail, Shadow, and Highlight.** Detail sets the amount of contrast in the details of the image. Low values create a dreamy, diffuse look, whereas high values render a stark, high-contrast effect. Shadow and Highlight adjust the luminance (brightness) of those regions. Lower values darken and higher values lighten.

Working with all the sliders in the Edge Glow and Tone and Detail sections involves a lot of back and forth because they are interdependent; changes to one may prompt you to make further refinements to sliders you have already set. That's why developing a sense of exactly what each slider does is so important.

**Color and Curve**

The Color sliders can be thought of as a way to fine-tune the color saturation, and the Curve offers you a great deal of control over contrast and brightness that can have a big impact on how the image looks.

• **Color settings.** These settings are similar to how Vibrance and Saturation are implemented in Camera Raw or Lightroom. Saturation affects all colors equally, whereas Vibrance has a more refined approach, affecting lower-saturation colors more and higher-saturation colors less.

• **Curve.** If you know how Curves works in Photoshop, this feature will be familiar to you. The lower-left corner controls the black point, whereas the upper-right corner controls the white point. You can click on the curve line to manually place a point and drag to adjust it. Think of the Curve as way to fine-tune the overall contrast in the image after you’ve set all the sliders in the section above it. Keep in mind that you may need to revisit some of the previous settings to compensate for changes created by the Curve adjustments (Figure 6.29).

**TIP** If you have created an HDR look you like and you feel it might work well on other images that are similar in overall tone and contrast (such as landscape images), it’s a good idea to save your settings as a preset so you don’t have to start from scratch every time. Click the menu icon just to the right of the Presets menu and choose Save Preset.
Remove ghosts

If your image contains elements that might have traces of motion in them, such as moving water or tree branches, select the Remove Ghosts check box near the top of the dialog. Merge to HDR Pro will select the source file that is best for the motion-affected areas in the image (the thumbnail will be highlighted in green). You can also make your own choice by clicking on a thumbnail (Figure 6.30).

Figure 6.30 Ghosting is obvious in the surf in image A. Image B is a result of using the Remove Ghosts option in Merge to HDR Pro.
Although the entire interface is a great improvement over the previous HDR functionality in Photoshop, this simple feature is a great addition that addresses one of the classic problem areas in HDR photography: moving elements within the image. Keep in mind that for some images, ghosted motion in the scene, such as movement caused by cars or people, may look interesting and might create an effect that works well with a particular photo (Figure 6.31).

Edge inspection at 100%

Before clicking OK to complete the HDR process, be sure to zoom in to 100% or more and scroll around the image to check the edges. A zoom menu is located in the lower-left corner of the dialog. You can move through the image by pressing the spacebar and dragging in the image.

Some combinations of settings can create hard and jagged pixilation along contrast edges (Figure 6.32). Low Strength settings are often to blame for hard “crackly” edges, so if you see any, try increasing the value of this setting. And keep in mind that changes to Strength may require slight modifications to Radius, Detail, and other settings. After clicking OK, inspect the
edges again because Photoshop provides a much better view than the low-res preview in Merge to HDR Pro.

Figure 6.32 Inspecting the preview at 100% is a good way to check for problems with the edges.

Photomatix Pro

As mentioned earlier, Photomatix Pro is the application that set the standard for HDR software and is still the program that many HDR photographers prefer. The Tone Mapping settings offer many more controls for fine-tuning the image than Photoshop’s Merge to HDR Pro, and the initial results without changing any of the sliders are likely to be more pleasing and have a more “finished” look.

Photomatix Pro’s HDR features are divided into two sections. In the first you select the images from which an HDR image will be made. In the second you apply HDR Tone mapping. The tone mapping features are also available as a Photoshop plug-in that can be used with 32-bit HDR or 16-bit stand-alone images (Figure 6.33).

Generate HDR

If you’re using Photomatix to create the initial HDR, you’ll use the Generate HDR feature to specify the files you want to use. In the Generate HDR Options dialog you can choose to have the software automatically align the source images and reduce noise and chromatic aberrations. There is also an option for reducing ghosting artifacts that lets you specify whether the ghosting is due to background movement such as water or foliage, or moving subjects like people or cars.
HDR Tone Mapping on a Single Image

Photoshop CS5 has an HDR Toning feature that lets you create an HDR look for a single exposure. This is very useful for those shots where you either don’t have multiple exposures, or making them does not work for the subject (such as people or action scenes). To access this feature, choose Image > Adjustments > HDR Toning. The controls are exactly the same as those in Merge to HDR Pro, and you can even use saved HDR Pro presets. It’s not the same as creating a real HDR because the tonal range will be limited to what was captured in the single exposure you’re using. But it is a handy way to apply HDR styling to a stand-alone image (Figure 6.34). Additionally, you can combine the bracketed exposures in HDR Pro, save the result as a 32-bit file, and open it in HDR Toning to take advantage of the ability to zoom to a true 1:1 or 100% pixel view of the file, which is not possible in HDR Pro.

Before

After

Figure 6.34 The HDR Toning dialog in Photoshop CS5 lets you apply an HDR look to a single image.

After clicking the Generate HDR button, the image is created from the source files and displayed onscreen. Initially, it looks pretty bad with
excessive contrast, blown-out highlights, and totally black shadows. This is due to the fact that the HDR file is still unprocessed and also because standard monitors cannot display the wide range of tonal values available in an unprocessed HDR image. An HDR Viewer panel is supplied, which shows you the actual detail present in different areas of the image when you mouse over them (Figure 6.35). Once the HDR image is processed with Tone Mapping, the details in the highlights and shadows will be revealed.

**Figure 6.35**
The Photomatix HDR Viewer shows the detail that is really present in the image.

### Tone mapping

Tone mapping is the real heart of the Photomatix Pro software. The controls appear in a long panel and are divided between Details Enhancer and Tone Compressor. The Details Enhancer section is where all the HDR magic takes place and where crafting a classic “HDR look” is accomplished (Figure 6.36). There are no fewer than 15 sliders available for fine-tuning the many different qualities that create the look of the image, which is far too many to go into here. Check out the video tutorials for the latest version of Photomatix Pro at www.hdrsoft.com.
Figure 6.36  The Photomatix Tone Mapping interface is where most of the HDR styling action takes place.

This increased level of control is the reason many photographers who specialize in HDR use this software (Figure 6.37). Until the revamped Merge to HDR Pro in Photoshop, Photomatix was the primary HDR program, and for many it is likely to retain that status. Although its interface is more complex (and likely more intimidating to those new to HDR), the initial results are much closer to the mark of what most people think an HDR photo should look like.
Figure 6.37  This photograph of New York’s Manhattan Bridge was created from three source files that were combined into an HDR image using Photomatix Pro. Image by Robert Anthony DeRosa

Customize with Adjustment Layers

No matter what program you use for creating an HDR image and applying a tone mapping effect, one very important detail to remember is that simply running a series of files through HDR software does not necessarily make a finished image. At best you will have a really good combination of all the source exposures with a full range of tones as well as good color and detail that gives you a solid platform on which to continue enhancing the image. Nearly all HDR images can be improved with further enhancements and “seasoning” in Photoshop. The use of adjustment layers with layer masks
that affect specific areas in the photo can greatly improve the overall look of the final image. In the example shown in Figure 6.38, several adjustment layers have been added to apply separate modifications to the lower half of the photo, the sky, and just the river. A final Vibrance adjustment layer was added at the top of the layer stacks to fine-tune the color saturation.

Figure 6.38  After blending three source photos to create an HDR file, this image was further customized with several adjustment layers in Photoshop CS5.