CHAPTER 1

DYNAMIC RANGE AND DIGITAL PHOTOGRAPHY

Although digital photography is a compelling and satisfying endeavor, there are significant limitations to the technology. You don't often hear of them as such, but they affect you every time you press the Shutter button. The most serious of these limitations, as it relates to High Dynamic Range (HDR) photography, is dynamic range.

The simple truth of the matter is that digital cameras are unable to fully capture what you see with your eyes much of the time. The world is a deeply complex subject whose own dynamic range from dark to light far and away exceeds the digital camera's ability to record it. To make matters worse, you often limit yourself to an averaged or compromised exposure when you rely on a single photograph and normal processing techniques to capture and present everything. This chapter prepares you for the wealth of HDR information and techniques presented later in the book by illustrating the problems inherent in digital photography today. You learn about dynamic range, exposure, metering, and see examples of how photographs are typically compromised by limited dynamic range. You briefly see several traditional solutions to these problems so you can compare their effectiveness to HDR.

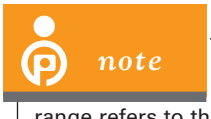
DYNAMIC RANGE

Within the context of photography, *dynamic range* is the range of light, from little to much, that can be measured and recorded, normally by a single exposure. It is not how little light can be measured; nor is it how much light can be measured. It is the difference between the two. Dynamic range is often characterized by the terms exposure value (EV) levels, zones, levels, or stops of range.

Blown-out details, quite often skies, are the result of limited dynamic range. Too much light overexposes parts of the scene and the camera literally cannot measure any more light. The resulting image has no details in the overexposed areas.

Quantifying dynamic range can be a problematic affair. There is no official standard, per se; nor do camera manufacturers list each model's dynamic range as part of their specifications. The specific dynamic range of your camera is something you will have to experience, positively and negatively (see 1-1), firsthand.

If you understand a few technical factors behind the scenes, as explained in the following sections, it will help you understand why dynamic range often seems so limited.



Throughout the course of this book, the context of the term dynamic range refers to the range of brightness in a scene. It is, in essence, the contrast ratio of the least illuminated area to the most. In a larger sense, dynamic range can refer to any system where you compare two extremes, such as in audio.

SENSOR WALKTHROUGH

To understand how a camera's sensor works, it helps to use an analogy. Begin by imagining a bucket. This bucket holds electrons and represents an effective pixel-sized sensor in your digital camera. The sensor absorbs photons that strike it during the exposure and generates an electron charge that is held in the bucket until the exposure ends. The strength of the charge reflects how much light was measured. This value is passed to an analog-to-digital (A/D) converter with data from the rest of the sensor and turned into an image file.

ABOUT THIS PHOTO *This photo was taken outside on a bright, sunny day of a vintage World War II aircraft. The dynamic range of the scene was too much for the camera to handle. The dark plane looks fine, but the sky and concrete are too light. (ISO 100, f/9, 1/125 second, Sony 18-70mm f/3.5-5.6 at 60mm) © Robert Correll*

As you might imagine, the size of the bucket (called full-well capacity) dictates how much light the sensor can measure. The difference between a full bucket and an empty bucket is the theoretical maximum dynamic range of the sensor. The larger the bucket, of course, the greater the dynamic range of the system.

There are a number of factors that reduce a sensor's dynamic range. These range from electron noise (see 1-2), which interferes with a sensor's ability to record extremely low levels of light, to pixel size and sensor efficiency. Simply put, no sensor is perfect.

note

Another factor indirectly affecting dynamic range, and beyond the scope of this book, is the linear nature of a digital camera's response to light. They do not work as our eyes do. The linear quality of the sensors makes digital cameras incredibly valuable in astrophotography. The direct result is the ability to combine many short exposures, which are more easily attained, into longer ones.

ABOUT THIS PHOTO *This high-ISO shot of jellyfish amplifies sensor noise along with valuable light. (ISO 3200, f/4, 1/20 second, Sony 18-70mm f/3.5-5.6 at 18mm) © Robert Correll*

BIT DEPTH

The *bit depth* of a camera is analogous to the stop scale. Each stop doubles or halves light, which is exactly how bits work. Adding a bit to a binary number doubles it. Conversely, removing the leading bit of a binary number halves it. Each bit,

therefore, provides a stop's worth of dynamic range. Thus, a 12-bit camera has 12 stops of potential dynamic range, which results in 4096 levels of light-to-dark discrimination in each color channel.

If you're wondering where 4096 comes from, it is 2 to the 12th power. The base is 2 because we are dealing with a binary system. Bit depth provides the exponent. If your camera takes 14-bit raw photos, 2 to the 14th power equals 16,384 levels.

That may seem like a lot, but unfortunately, even a 12-bit camera which can measure 4096 discrete shades of light in each color channel does not have the dynamic range necessary to capture a simple scene at the zoo without blowing out highs and losing details in shadow (see 1-3).

Finally, bit depth can also be used to describe the number of colors a camera can capture and store in a file. In this sense, a camera with a greater bit depth has more color-sensing ability. Each color channel of a 12-bit camera can contain up to 4096 different shades of that color, resulting in a tremendous number of total colors that the three channels can combine to reproduce. However, dynamic range is the story of brightness, not color. As mentioned previously, the shades of color are not evenly distributed across the bit-depth system, which results in a skewed intensity range for each color. Therefore, having 4096 possible shades of each color is not enough to capture the true dynamic range of a scene without compromise. If it were, you would never need worry about a blue sky turning white.

ABOUT THIS PHOTO
This photo, processed from a 12-bit raw image. (ISO 100, f/5.6, 1/160 second, Sony 18-70mm f/3.5-5.6 at 35mm)
© Robert Correll

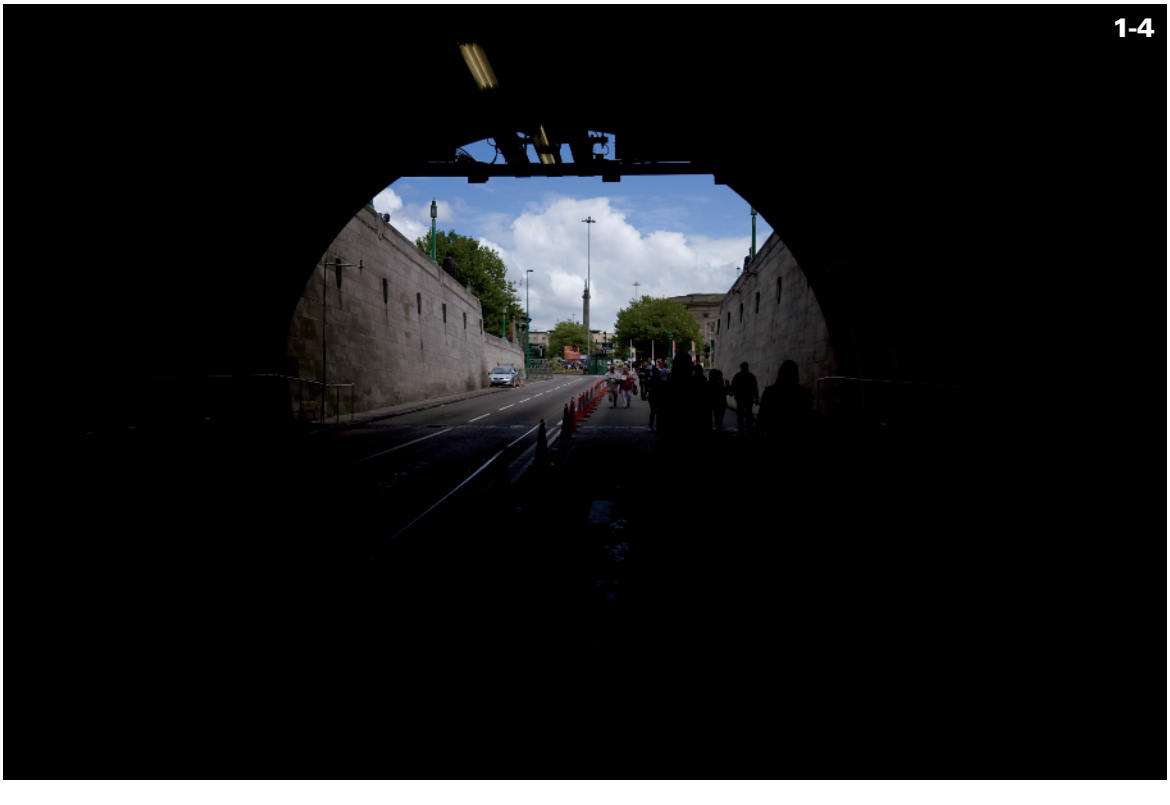
WRANGLING WITH EXPOSURE

Like wrestling a steer to the ground in a rodeo, exposure can be a difficult beast to control, especially if you don't want to resort to flash photography, EV adjustments, changing ISO, or other techniques. This difficulty is a practical effect of limited dynamic range.

EXPOSURE EXPLAINED

Exposure is how much light reaches the camera's sensor during a single photograph. There are many ways to manage light and its effect on the process, but there are two central ways to control exposure: shutter speed and aperture.

- **Shutter speed.** Measured in minutes, seconds, or fractions of a second, shutter speed sets how fast the shutter opens and closes. The longer it remains open, the more light makes it into the camera. Faster shutter speeds let in less light. The typical dilemma for a photographer is finding the right shutter speed for scenes with high contrast and movement, as illustrated in 1-4. It is clear that the interior of the tunnel would need a longer exposure to allow the details to be seen. However, slowing the shutter speed to take a longer exposure would increase the amount of light the camera senses and not only lighten the inside of the tunnel, but it would cause the action in the scene outside the tunnel to be reduced to a blur. Additionally, the longer exposure would cause the sky to be blown out.



ABOUT THIS PHOTO *Standing in a tunnel, the outside is perfectly exposed, but the image lacks detail inside the tunnel. (ISO 100, f/4, 1/200 second, Sigma 10-20mm f/4-5.6 at 16mm) © Pete Carr*

- **Aperture.** This describes the size of the opening in the lens that focuses light past the open shutter and onto the sensor inside the camera. A larger opening lets more light in and a smaller opening permits less light in. Artistically, larger apertures result in a shallower depth of field, blurring deeper area of the foreground and background. Along with the focal length of a lens, the aperture is used to determine f-stop.

Depth of field refers to the size of the area you perceive as in focus, extending in front of and behind the plane the lens is focused on (most often the subject). Shallow depths of field have a narrow area in focus, with blur elsewhere. This often results in a wonderful artistic effect. Deeper depths of field have more in focus, both in front of and behind the focal distance. Deeper depths of field are important in landscape and architecture photography because a much deeper area of the photo remains clear and sharp.

Manipulating shutter speed and aperture are no less important in HDR than in traditional photography, although you will do so with a different purpose in mind. In HDR, you often use a handful of photographs to capture a wider dynamic range of light than is possible in one exposure.

For more information on the gear you need for HDR, please refer to Chapter 2.

EXPOSURE VALUE

As a photographer, you manipulate shutter speed and aperture size (through choosing an f-stop) to control exposure. If exposure is a reflection of how much light enters the camera during a photograph, *exposure value* (EV) illustrates the relationship between exposure, shutter speed, and f-number. EV is not a precise calculation of the

F-STOPS The f-stop is an important subject in photography. F-stops allow the effects of aperture on exposure to be expressed between different lenses and focal lengths, which is a great timesaver when determining exposure values. This is because focal length, which is the distance between the lens and its focal point (which is on the sensor when in focus), is different from one lens to another. As a result, you do not dial in a specific aperture size when setting the exposure; you set the f-number (hence the term f-stop).

For a given focal length, setting a larger f-number (sometimes called stopping down) causes the aperture to shrink and lets less light into the camera. It also deepens the depth of field. Setting a smaller f-number (also called stopping up) causes the aperture to grow and lets in more light. This also results in a shallower depth of field.

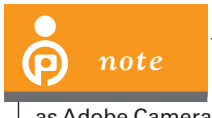
Manipulating exposure is very important in HDR photography, but the f-number normally remains the same across exposures. This keeps the depth of field constant. In addition, HDR excels at shooting landscapes and larger shots where a deeper depth of field keeps everything in focus.

quantity of light during the exposure. It is a working number that allows the effects of altering shutter speed and aperture on exposure to be quickly and easily compared.

For example, 1-5 is a high-contrast scene taken from the inside of a log cabin. The calculated EV is between 11 and 12 for this exposure, which has underexposed the interior and overexposed the view through the door. Looking out the right window reveals the best exposure for the landscape beyond. The dynamic range of the camera wasn't large enough to capture the light and dark extremes in this scene at this EV, and moving the EV (by changing shutter speed or aperture on your camera) just results in a different compromise — not more dynamic range. With HDR, you will often take more than one photo, each separated by ideally 1 or 2 EV, to extend your dynamic range. In situations where you cannot take more than a single exposure, there is a technique that uses one raw photo as the source image for HDR, which is a process detailed in Chapter 3.

It is easy to find EV tables on the Internet that list combinations of shutter speed and f-number to give you the EV number. You can also calculate the range of EV for every combination of f-stop and shutter speed yourself using the formula for EV and a spreadsheet.

Study the relationship between EV, f-stop, and shutter speed, and know that this is the playing field for exposure. The settings you normally choose are limited by your camera's dynamic range and the situation at hand. HDR effectively expands the EV you can capture, allowing you to extend the dynamic range of your camera and properly expose different elements of a photograph without having to sacrifice detail or aesthetic quality.



You can change exposure, and hence EV, directly in software such as Adobe Camera Raw and Photoshop, and indirectly in Photoshop Elements.

ABOUT THIS PHOTO
Shooting from within this log cabin shows how different EV levels make getting the right exposure difficult. (ISO 100, f/8, 1/200 second, Sigma 10-20mm f/4-5.6 at 12mm)
© Robert Correll

METERING

Digital cameras have built-in meters that measure light and help set the right exposure. Prior to this feature, photographers had to eyeball it (using tools such as the Sunny 16 Rule) or carry their own light meter. Metering is an important skill in HDR photography because it allows you to evaluate a scene to arrive at the best overall exposure to bracket around or measure the extent of the highs and lows of a scene in order to extend your brackets. If taking a single photograph for HDR, you will meter to take the best photo to start with.

Many professional photographers carry light meters, and you may find having one convenient for HDR photography as well, especially if you work with a tripod. Once you mount your camera on a tripod and compose the shot, you cannot move the camera to do any further spot metering without disturbing your setup.

Virtually every digital camera today, and certainly every dSLR, has three metering modes, sometimes four. Depending on the camera manufacturer they may be called by slightly different names. They are:

- **Average.** This mode evaluates different areas of the scene in order to arrive at an average exposure. Within the bounds of your camera's dynamic range, this is often the best compromise. The problem, however, is that high-contrast scenes (see 1-6) have a way of overpowering the camera. You typically lose details in shadows and highlights.
- **Center-weighted.** This mode gives the center of the scene more weight in determining EV. It is a better choice if the subject is lit differently than the background, but much of the background will be ignored in determining the proper exposure and so you risk losing it in shadow or highlights.

ABOUT THIS PHOTO
The subject turned out reasonably well but was slightly underexposed because the bright sky overwhelmed the Average metering algorithm. Spot mode on his face would have been a better choice. Notice the broad range of dark shadows to bright sky in this casual photo. (ISO 100, f/5, 1/125 second, Sony 18-70mm f/3.5-5.6 at 30mm)

- **Spot.** This mode meters the center of the scene only, which ensures what you meter will be exposed correctly, but nothing else will be taken into account. Paradoxically, this works great for scenes with a large dynamic range because you choose the one thing that gets exposed correctly. Unfortunately, everything else often suffers.

note

Many Canon models combine Evaluative and Partial modes (their terms for average and center-weighted) into a fourth mode called Center-weighted Average.

The mere fact that there are several methods to meter light in a scene should tip you off to the fact that a camera's dynamic range is limited, and therefore most photographs are the result of choosing the best exposure compromise. If this were not so, you could simply point the camera and shoot, regardless of the lighting, and everything would look great.

tip

Although often expensive, light meters can be far more accurate than in-camera metering and their spot modes can be more precisely targeted.

SINGLE-EXPOSURE LIMITATIONS

Having taken a look at how it is often impossible to capture the full dynamic range of a scene using traditional methods of manipulating exposure via shutter speed and aperture, this section looks at the limitations of trying to capture and present that dynamic range in a single exposure with standard processing techniques, which often results in exposure tradeoffs and compromises.

We aren't saying it is impossible to take outstanding photographs in one exposure. However, you should realize the limitations that have shaped photography to see how HDR fits into the evolution of the art.

SKIES

Skies are notoriously hard to get right when the subject of the scene is not the sky. The problem is that a daylight sky is often too bright compared to other scenery, especially anything in shadow. It is so light (don't confuse bright with blue — you can have a very bright sky that is a deep blue), the sky dominates the exposure. Any attempt to lighten foreground subjects invariably overexposes the sky, blowing it out (see 1-7).

1-7

ABOUT THIS PHOTO *This is an example of a blown-out sky. The person is nicely exposed but the background is completely lost, or blown out. (ISO 400, f/8, 1/3200 second, Canon 24-70mm f/8 at 70mm)*
© Pete Carr

The same photograph processed as HDR (see 1-8), however, reveals the details that were previously hidden in shadow or lost in highlights.

ABOUT THIS PHOTO *Here you can see how HDR brings the sky back into the image shown in figure 1-7. It is an HDR image created from a single raw exposure converted to three bracketed exposures that bring out the full dynamic range saved in the raw file. © Pete Carr*

The problem doesn't go away when clouds are present, especially if it's partly cloudy and the sky has extreme light-to-dark areas of clouds and sky. Overcast days, paradoxically, can be a joy to shoot in because they even out the dynamic range of the scene.

1-8

BUILDINGS

Working with buildings as your subjects is far different than working with portraits in a studio or nearby subjects outside. There are two reasons for this: scale and sky. The scale of a building is normally far larger than other subjects (landscapes as a whole being the exception). You can't use a flash to brighten a building, or use an umbrella to soften the light around it, or turn it in relation to the sun. You're basically at its mercy and must often wait for the perfect lighting and sky conditions to take the photo. Even then, details in the building are often lost because the sky pushes the EV up, which underexposes the buildings, making them darker. Trying to expose the building properly usually blows out the sky, as illustrated in 1-9.

ABOUT THIS PHOTO *This is an example of an overexposed photo with a blown-out sky. (ISO 100, f/5.6, 1/250 second, Sigma 10-20mm f/4-5.6 at 10mm) © Pete Carr*

1-9

When you know you can't expose both the building and the sky correctly, you have a choice: shoot for the building or shoot for the sky. This is often why photographers choose to shoot during the Golden Hour. The light is most forgiving during this time and produces better photographs. HDR won't make the light at noon better than that of the Golden Hour, but it does enable you to bring out more detail in scenes photographed during off-hours and extends your dynamic range throughout the day.

SILHOUETTES AND SUNSETS

Silhouettes and sunsets are at the opposite end of the spectrum from shooting portraits and buildings. Here, you typically want the items in the foreground, such as a person or landscape features to be in very dark shadows that are silhouetted against a brighter sky or sunset.

In other words, the building or landscape is in near total shadow and the sky is properly exposed. The fact that foreground details are lost when shooting silhouettes and sunsets is expected and aesthetically pleasing.

In both cases, you meter for the brightest object in the scene, either the sky or the sunset. This sets the EV high, which is exactly what you want. It underexposes the foreground and turns it to silhouette or shadow. Buildings turn to black shapes carved out of a red sky, as seen in 1-10.

Difficulties arise, however, when you want detail in these situations (low foreground light at sunset and dusk) and cannot achieve it for lack of the

note

The light during the Golden Hour, which is the first and last hour of sunlight each day, is generally softer, more diffused, and the shadows are gentler. Of course, if you are near the Arctic Circle or in Antarctica, your mileage on golden light may vary.

ABOUT THIS PHOTO *This is an example of a photo intentionally showing huge areas in silhouette. (ISO 100, f/22, 1/45 second, Canon 28-105mm f/3.5-4.5 at 45mm) © Pete Carr*

1-10

proper exposure. If you're on the beach with your friends enjoying a summer barbeque, you can't illuminate the entire beach with a flash. HDR photography helps in those situations. You don't have to go overboard, but you can get a beautiful sky, silhouette in the background, and properly exposed subjects without flash using HDR.

TRADITIONAL SOLUTIONS

Over the years, photographers have developed quite a few solutions to getting around the limited dynamic range of their cameras. This section gives you a taste of some more traditional methods so you can see how they compare to the HDR examples shown throughout the book.

LIGHTING

Additional lighting helps you bypass the dynamic range issue by controlling the light differences between subject and background, and hence limiting the contrast. For example, if you are a studio photographer, you have the luxury, and sometimes the burden, of complete control over lighting and environment to achieve whatever artistic

effect you desire, such as in 1-11. It's a perfectionist's dream. If you need less light, you can block out windows. If you want more contrast, you can choose a different background or turn it white and remove shadows for a *high-key* effect (intentionally lowering the overall contrast ratio of a scene). You can put lights above, behind, below, or to the side. You can add reflectors, brollys, softboxes, snoots (if you are in doubt about what these are, check out a lighting or camera sales Web site), or bounce the light off the wall.

It is also easy to get by with less. If you have two lights and a white or black backdrop, you have the ability to create or remove shadows. You can be creative and place a light behind the subject for a nice glow. Many of these options reduce the contrast of the scene, thereby reducing the dynamic range in your photo.

1-11

ABOUT THIS PHOTO *The lighting in this standard studio shot has been carefully manipulated to precisely create this crafted look. (ISO 100, f/13, 1/160 second, Canon 24-70mm f/2.8 at 28mm) © Pete Carr*

Lighting on location is far trickier because you lose total control. You may have no say over the background lighting, which is often up to nature. You do, however, control how bright the model is and can therefore balance that with the background. If you have a few lamps, strobes, or reflectors, you can illuminate the model nicely. Again, this reduces the contrast between your subject and the background, which in turn reduces the dynamic range of the image.

NEUTRAL DENSITY FILTERS

Landscape photographers use Neutral Density (ND) filters to darken portions of their photos. ND filters filter out all wavelengths of light equally, resulting in an evenly reduced exposure.

There are two main types of ND filter: graduated (ND grad) and non-graduated. Both types come in various strengths. Unlike software solutions to exposure, you can see the effect before you take the photo, and can therefore adjust your settings to get the best exposure value.

ND grad filters are particularly well suited to scenes with simple horizons, as shown in 1-12. They sky was very bright and had to be toned down dramatically compared to the beach and water. An ND grad filter was a perfect solution for this scene. Had it not been used, the sky would have been blown out and devoid of detail.

note

A filter is a thin piece of glass (some are made from other materials like plastic) that goes in front of the lens of your camera and is manufactured to filter out certain wavelengths of light. They are often clear, although some are polarized and others colored. Many filters are round and screw onto the front of the lens. Others are rectangular and slide into a mount that attaches to the lens.

ABOUT THIS PHOTO

Here you can see an ND filter in action. This is a straight shot with minimal processing applied, and you can see how nicely the sky has turned out. (ISO 250, f/6.3 1/640 second, Sigma 10-20mm f/4-5.6 at 10mm) © Pete Carr

ND filters are not without their problems, however. If the horizon is not perfectly straight (trees, hills, buildings, and mountains get in the way and complicate things) and you use a graduated filter, details on the intervening scenery are likely to be underexposed and mountains or other objects may look like they have halos around their tops.

In short, ND filters are a great tool to use if the landscape is neat and tidy, but not the best solution for chaotic or complex horizons. HDR works in any of these situations because it is not dependant on the horizon line being level.

CONTRAST MASKING

Contrast masking is a software technique that evens the contrast of an image. The idea is to use a new layer to bring out details in the shadows or darker areas and tone down highlights in the sky (see 1-13).

Without getting into too much depth, contrast masking involves duplicating the photo layer, desaturating the new layer, and then inverting it (it will look like a gray negative). Desaturating the duplicate layer focuses the end result on brightness rather than color and inverting the layer pushes the original highs and lows in the opposite direction. The final steps are changing the blend mode of the duplicate layer to Overlay, which lightens or darkens values from the lower layer, and applying a Gaussian Blur to it so that it doesn't completely mask the original brightness of the photo. In the end, selective erasing of the inverted layer helps restrict the effect to the desired areas.

Despite the fact that contrast masking may work in some situations, it can be an inelegant solution. Rather than spend time duplicating layers,

ABOUT THIS PHOTO
This high-contrast scene includes a very dark tunnel and bright white clouds. While contrast masking has helped bring out more detail in the tunnel, the sky is still blown out. (ISO 200, f/5.6, 1/250 second, Sigma 10-20mm f/4-5.6 at 10mm) © Pete Carr

inverting, blurring, and erasing just to get the right exposure by further compressing the dynamic range of a photo, it's more fun to shoot for HDR and be creative in the processing.

EXPOSURE BLENDING

You could call exposure blending an early form of HDR. In fact, it began (as many software techniques have) in the darkroom. The idea was to take more than one photo and blend them while making the print. Today, exposure blending is predominately a software process, and begins with taking more than one photograph.

For example, to photograph a landscape with a bright sky, take one photo of the land properly exposed, then take another and set the exposure for the lighter sky. You can take as many photos as you want, each differently exposed, as long as you use a tripod and keep the scene composed identically between exposures. Later, blend them in Photoshop as different layers, as shown in 1-14.

There are a number of ways to perform exposure blending in software. You can change blending modes from soft-light to pin-light, or erase parts of the image you don't need and work them until they blend together. Ultimately, this can be a tricky and time-consuming process.

ABOUT THIS PHOTO *Two exposures are merged together in Photoshop to create a balanced photo. (ISO 100, f/4, 1/50 second, Sigma 10-20mm f/4-5.6 at 10mm) © Pete Carr*

HDR photography is very similar to this on the front end (taking the photos), but in software is vastly different. HDR software such as Photomatix automates blending and other aspects of this task.

TWEAKING SHADOWS AND HIGHLIGHTS

Another reasonably simple solution to overcoming your camera's limited dynamic range is to tweak the shadows and highlights of your photo in your favorite image-processing application. You can recover some detail from a JPEG using this technique in Photoshop Elements. It is easy to ruin the image if you try and push too hard, however. JPEGs have only a stop or so of enhancement in them before they are ruined by noise and color banding. Tweaking shadows and highlights can recover some detail in dark and light areas, such as in 1-15. The tree trunk has been lightened and the bright area of the sky has been toned down a bit with Shadows/Highlights in 1-16. If the result was a bit gray, as was the case here, add a moderate amount of contrast back into the photo to clean it up.

Although you may still want to use this shadow and highlight technique, properly shot HDR reduces the need for most shadow and highlight tweaking for anything but aesthetic reasons.

DODGING AND BURNING

Dodging and burning are two techniques that also have their roots in the darkroom. *Dodging* involves lightening specific areas of a photo. For example, if someone's face is a bit too dark, you can dodge to lighten it and make the person stand out more. *Burning* darkens areas of the photo. If, for example, the sky is too light, a small amount of burning can bring it back in line with the rest of the photo. In these ways, different areas can be exposed with different amounts of light, resulting in customized exposure levels across the photo.

In theory, dodging and burning are simple, but the default exposure strengths in Photoshop and other applications are set so high that it's almost impossible to get good results without a good deal of tweaking. The key is to take it easy and set the strengths correctly. If necessary, apply evenly over more than one application. Using a pen tablet helps tremendously.

The Dodge and Burn tools are located together on the Tools palette of Photoshop. The Dodge tool looks like a small paddle that holds back light and the Burn tool is a small hand. Here are some tips to help you dodge and burn:

- After selecting the Dodge tool, set the Painting Mode range to Shadows to bring details out of darker areas.
- Start with the Exposure between 10% and 20% when dodging and then alter as needed.
- Set the Painting Mode range for the Burn tool to Highlights to darken overly bright areas or Shadows to deepen existing dark areas.
- When burning, set Exposure under 10% to start and alter as needed.

Doing a poor job with the Dodging and Burning tools can create halos around the areas you manipulated, so be prepared to experiment and start over. It is also possible to increase noise levels in areas as you dodge. Additional noise may not be a problem, especially if you are working with black-and-white photos (see 1-17). In those cases, a little extra noise looks like film grain and is aesthetically pleasing.

ABOUT THESE PHOTOS *In figure 1-15, the tree is in shadow and the sky is on the verge of blowing out. This called for a Shadows/Highlights adjustment in Photoshop Elements to recover detail. The results are shown in figure 1-16. (ISO 100, f/8, 1/125 second, Sigma 10-20mm f/4-5.6 at 10mm)*

ABOUT THIS PHOTO *This classic black-and-white photo has been enhanced with dodging and burning. (ISO 250, f/6.3, 1/800 second, Sigma 10-20mm f/4-5.6 at 10mm) © Pete Carr*

On the whole, be prepared to continue dodging and burning even when you shoot HDR, but your attention will be much more finely focused on the subtle details rather than trying to rescue the photograph.

FILL LIGHT AND RECOVERY

If you use Adobe Lightroom or Adobe Camera Raw (from within many Adobe products, even Photoshop Elements), there are two very quick and easy ways to rescue hidden details from standard photos: Fill Light and Recovery.

Details get lost in shadow because the limited dynamic range of the camera forces the photo to be underexposed in darker areas to avoid clipping the highlights. Fill Light selectively brightens the dark and midtones of a photo, moving them toward the lighter end of the histogram. If you are using HDR, the multiple exposures capture these details more suitably in the first place, so you don't have to resort to using Fill Light to bring them out.

Overexposed highs normally happen with skies and other bright objects, a problem once more caused by the limited dynamic range of the camera. In this scenario, if the subject is exposed correctly, it leaves the sky white or blown out. To fix this, Recovery works opposite of Fill Light. Recovery takes the highs of a photo and brings them down into a reasonable balance with the rest of the photo.

A gentle application of both techniques is illustrated in 1-18. The bright remains of the setting sun are too bright, resulting in some blown out pixels. In addition, the sky and outer areas of the photo are very dark. Using Fill Light helps lighten those areas up and makes the water clearer from foreground to background. Generally speaking, it is not wise to overdo Fill Light or Recovery or you may lose contrast and tone, or elevate noise.

Both tools attempt to lessen the effects of limited dynamic range by bringing out details that are in the raw file but may be lost in the conversion to JPEG (see the next section for more on raw). They do not actually increase dynamic range, but they can help bring out what is there already.

1-18

ABOUT THIS FIGURE *A sunset image has been enhanced with Fill Light and Recovery in Lightroom. (ISO 100, f/4, 1/15 second, Sigma 10-20mm f/4-5.6 at 10mm) © Robert Correll*

POST-PROCESSING WITH RAW

Processing raw images (which includes Fill Light and Recovery) is a very good technique for increasing exposure flexibility because, unlike 8-bit JPEGs, raw images contain the full dynamic range of the original photograph. In other words, when a camera converts sensor data to a JPEG file, it reduces the dynamic range of the photo. Cameras often let you choose an artistic style such as portrait, landscape, or vibrant for it to use as a guideline when it converts from raw to JPEG, but you will directly control the process if you do it yourself.

The tradeoff to control is an altered workflow, increased time spent post-processing, and space. Photographers who have to process thousands of photos often find the convenience of JPEG outweighs the merits of switching to raw. If this is you, you will find HDR more time consuming than pumping out JPEGs, but HDR will pay dividends for important photos.

In the end, working directly with raw photos is a step towards HDR, but still stops short of it. You have more dynamic range with a raw photo compared to a JPEG out of the camera, but are still limited by processing options of the raw editor. Current raw editors reveal a traditional, single-exposure mindset. You cannot blend exposures, tone map a 32-bits/channel HDR image, or use other techniques unique to HDR.

THE HDR ANSWER

The traditional single-exposure technique is the standard way most people take photographs. It is very powerful and you can take wonderful shots with it. It should be clear to you now, however, that you often can't have it all in one exposure. When you meter for bright areas the dark areas are too dark. They are not an accurate reflection of what you see. When you meter for dark areas the highlights get blown out. When you use the average reading your subject may be exposed properly, but other areas suffer. In high-contrast situations, you have to make a choice. What do you want to see well?

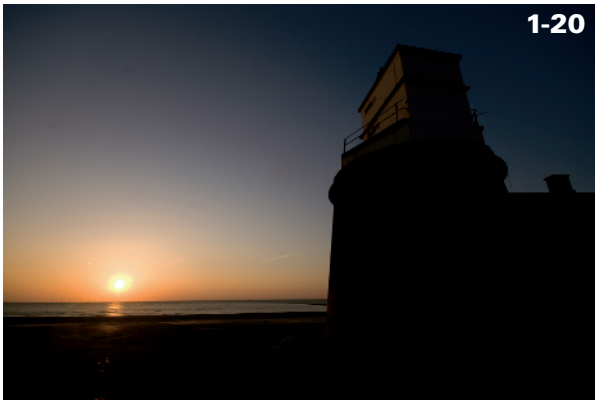
In those situations it is normally best to err on the side of not blowing out highlights. This is good practice, of course, but it can skew your perception of the dynamic range of a camera. You think everything is okay when it's not.

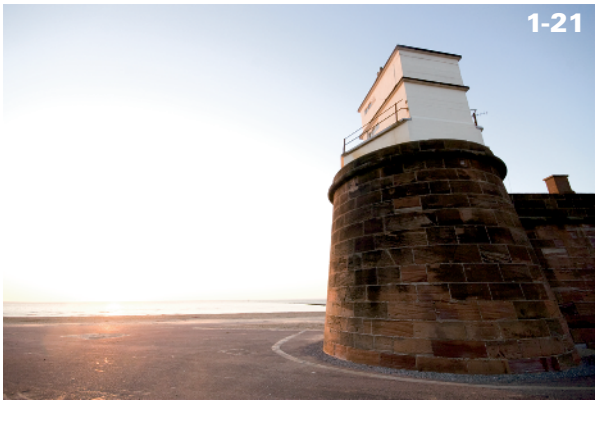
HDR is both a photographic discipline and software process that attempts to overcome the exposure problems discussed thus far. HDR bypasses the limitations of dynamic range using two innovative exposure bracketing approaches. The two approaches differ in how you create the bracketed exposures.

HDR PHOTOGRAPHY

One method of HDR photography is to shoot multiple, bracketed exposures (see 1-19 through 1-21). You can take more, but three is the minimum for good bracketing. The first photo is a normal exposure with a good balance of highs and lows (depending on the subject). This is what you should be shooting already. The second is deliberately underexposed to bring down highlights and keep them from being blown out. The third photo is overexposed to bring up the shadows so you can see what is in them.

ABOUT THESE PHOTOS *Shown here are examples of a normally exposed (1-19), underexposed (1-20), and overexposed photo (1-21). They show the range of light in your average photo and why you need HDR to fully capture all this light. 1-19 shows an average exposure, which is probably what you'd get on a normal day. 1-20 has been underexposed by 2 stops to bring out the detail in the sky. 1-21 has been overexposed by 2 stops to bring out the detail in the building, but at the expense of the sky, which is now just white. (ISO 100, f/8, 1/80 second, Sigma f/4-5.6 10-20mm at 10mm) © Pete Carr*





The other method uses a single raw photo, which is used as the source to create three brackets from. You end up with three bracketed files (one underexposed, one properly exposed, one overexposed), just as you would if you took three photographs. This technique is especially useful for photographs of moving objects and other scenes where you do not have time to bracket, such as in figure 1-22.

HDR PROCESSING

The second aspect of HDR is in software. HDR software such as Photomatix creates high bit-depth images from single (called pseudo-HDR) or multiple lower-depth exposures. After that, you tone map the HDR file to bring out details and create (or avoid) artistic effects. HDR software is specifically optimized for this purpose and automates much of the process. You don't have to create complex masks, use blending modes, or vary the opacity of different image elements to achieve your purpose. After saving the tone-mapped file as a JPEG or TIFF, you can further post-process the photo with your favorite image editor prior to distribution.

A completed HDR file is shown in 1-23. It was taken from three bracketed photos which were merged into HDR, then tone mapped to create the look you see here. Notice that the sun is in view. This should cause the camera to underexpose everything else, resulting in dark shadows or silhouettes. However, details on the facing side of the arch and in fact the rest of the photo are clearly visible. This is the power of HDR. You can retain more detail in your photos, are able to shoot in a wider range of lighting conditions, and craft your final product to suit your artistic tastes.

ABOUT THIS PHOTO *This was taken at a street festival a couple of years ago. The flash wouldn't perform so HDR was used to bring back some of the detail in these dancer's dresses and the sky. (ISO 100, f/4, 1/200 second, Sigma 24-70mm f/2.8 at 24mm) © Pete Carr*

ABOUT THIS PHOTO *The largest Chinese Archway in Europe is located in Liverpool, England. With HDR processing and bracketed exposures, shooting directly into the sunset can be done without sacrificing the detail in the arch. Created from three raw photos bracketed at -2/0/+2 EV (ISO 200, f/6.3, 1/125 second, Sigma 10-20mm f/4-5.6 at 18mm) © Pete Carr*

Assignment

Photograph a High-Contrast Scene Traditionally

This chapter has given you a lot of information about dynamic range and digital photography. Now it's time to become personally involved in the process. Grab your camera and complete this assignment to investigate the effects of limited dynamic range for yourself.

Find an interesting high-contrast scene. It should have a good range of shadows and highlights. Make it a challenge. It can be indoors, outdoors, or some creative combination of the two. Although you may want to experiment with filters, flash, or other exposure techniques, shoot at least one photo relying on the camera's inherent dynamic range to capture the scene to share. Try and take the best photograph you can, and note where you are making compromises.

Robert took this photograph on a bright sunny day from within a gathering pavilion at a local park. The challenge in this situation was trying to strike the right balance between interior and exterior exposure. This photo represents an average exposure, which compromises both extremes. Interesting interior details such as the wood grain within the pavilion are lost in shadows, and although the exterior doesn't look too bad, the play equipment, grass, and sky suffer because of the glare. Taken at ISO 100, f/11, 1/15 second, Sigma 10-20mm f/4-5.6 at 10mm.

Remember to visit www.pwassignments.com after you complete this assignment and share your favorite photo! It's a community of enthusiastic photographers and a great place to view what other readers have created. You can also post comments, read encouraging suggestions, and get feedback.