LOW LIGHT

The ends of the day, life indoors and the entire range of night-time activities offer a rich and large source of subjects for photography, now more accessible than ever before. And it is digital photography, with its many continuing advances that has made it more accessible. What we are talking about here is extending the shooting range into situations that, because of insufficient light, could not be handled as freely as film photographers would have liked.

Photography has always had technical limits, but then photographers have always learned to accommodate and work within them. In fact, they are not always thought of at the time as limits, and it is only when these are about to be broken, or have just been broken, by technological improvements that we can see just how restricting they have been. The quantity of light and the sensitivity of the recording medium has always been one of the most basic limitations. In the early days of photography, it restricted shooting to bright daylight, and even then the exposure times were not short. As film emulsions improved in sensitivity, and as lenses became faster and cameras smaller, it became possible, but only just, to shoot in artificial light. The first photojournalist was, arguably, Eric Salomon, who made use of the 1924-designed Ermanox 858. This camera, designed by Ludwig Bertele, had a maximum aperture of *f*/1.8 and shutter speeds up to 1/1200 second, making it possible for Salomon to capture his celebrated "candid" pictures of society life in Berlin. Developments were rapid, and Leica soon announced a camera with similar capabilities that accepted the more convenient 35mm film rather than rigid plates.

Digital photography and its recent changes have ushered in a new era in low light photography by extending the range of time and situations that can reasonably be captured, making it possible to use a camera under conditions that would have been unthinkable without resorting to invasive techniques such artificial setups and flash. Sensor sensitivity has improved hugely in recent years, and this, combined with new in-camera and post-production processing, has reduced the collateral damage to images from noise—a major preoccupation in this kind of shooting, and in this book. In this first chapter, we'll look at how the digital process—from sensor to in-camera processing, to post-processing—handles light when it comes in quantities significantly less than during a normal day.

ARTIFICIAL LIGHTING

Shooting interiors can often present white-balance challenges due to artificial lighting, as well as those of low light levels.

Light on the Sensor

As we'll see throughout this book, low light photography pushes limits. It pushes the limits of technique, demanding constant attention to steadying the camera, subject movement, and changing camera settings to suit the conditions.

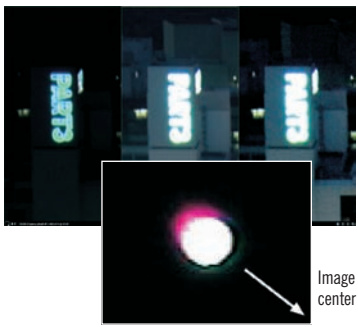
It also pushes the technical limits, beginning with the sensor and lens. The special conditions found in many low light situations tend to highlight deficiencies of the sensor. Notable among these are blooming and noise. In effect, these operate at opposite ends of the brightness range; blooming is flare surrounding overexposed highlights, while digital noise is at its most apparent in the shadows, in longer exposures, or at higher sensitivities.

Blooming is the leakage from a photosite on the sensor that has reached full capacity (complete white) into adjacent photosites. High-quality sensors show less of this than cheaper ones, but some flaring is inevitable in the typical low light situation where there are bright lights against dark backgrounds. The city night view here is typical. Nevertheless, we are so accustomed to seeing flare in images that it is not necessarily a problem. In most photographs, the flare from the lens is greater than that from sensor blooming.

Another defect noticeable in isolated highlights—or along strong luminosity edges—is chromatic aberration. There are two kinds, axial and lateral, and in modern lenses it is the lateral aberration that tends to be the culprit. The role played in this by sensor blooming (see box below) is disputed, and is probably tied to a different aberration known as "purple fringing." Lateral chromatic aberration shows itself as two opposed colors, usually red-cyan or blue-yellow, and is

Sensor blooming and purple fringing

Another detail from the Tokyo night shot, highly magnified, shows the effects of blooming, or flare, when highlights are overexposed. Sensor blooming occurs when photosites fill up and the charge leaks to adjacent wells. The left image was shot at 1/3 sec and the center one at 2 sec. In the 2 sec exposure light is spilling over from the edges of the neon display. The right-hand image is the 1/3 sec exposure processed for an increase of nearly 3 stops to bring it to approximately the same brightness as the center. This creates a very noisy image with exaggerated fringing, but blooming is not noticeable to the same degree.



PURPLE FRINGING

This detail of a light source from a night shot shows purple fringing, believed to be caused by sensor blooming or from the microlens, or both. It differs from normal chromatic aberration in that it is a single color in one direction.

CHROMATIC ABERRATION

A night view of Shibuya, Tokyo, shows lateral chromatic aberration from a wide-angle zoom.

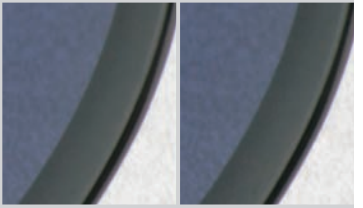
increasingly common because of wide-range zooms, which are difficult for lens manufacturers to correct across the range. Also, every photographer is now a few clicks away from a magnified view of every image, so these things are simply noticed more. There are several solutions depending on the software. Most typical is a manual operation, moving a slider, and this works by expanding one channel relative to another. There is also defringing software that works on the edges themselves. A more automated solution is to use a pre-calculated lens module that corrects for the aberration in known lens-camera combinations, such as DxO Optics Pro and Lightroom.

Noise is one of the special problems that arrived with digital photography, although it is less of an issue now. It appears as a random pattern of pixels, usually bright and multicolored, superimposed on the image. The comparison that is frequently made with grain in film is far too generous, as grain structure in an emulsion can contribute a gritty texture that is possible to like. Nobody to my knowledge has ever made a case for digital noise being aesthetically pleasing. In terms of appearance (rather than cause), there is luminance noise (the random pattern of pixels varies from dark to light), chrominance noise (the pixels vary in hue), "dead" pixels (bright dots) and JPEG artifacts, if you shoot JPEGs (blocks of 8 × 8 pixels can be prominent as these are used in the compression). Noise is a particular issue for low light photography because whether you increase the ISO for handheld shooting, or increase the exposure time for tripod-mounted shooting, noise will be created.

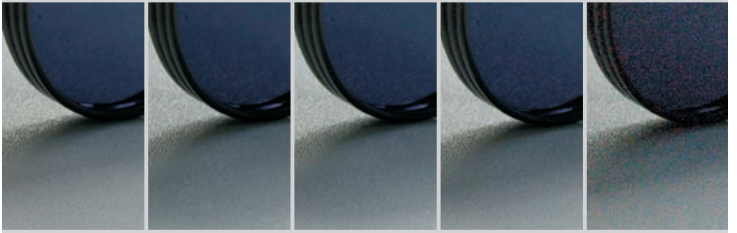
Digital noise

A simple comparison of noise at different camera settings. Noise is always most apparent in smooth areas that are dark, but above black. Practically, the major difference in noise comes from changing the ISO sensitivity. This sequence runs from an ISO setting of 100 to 6400. A point to note is that in terms of appearance, these noise effects are exponential—meaning they set in quite late on the scale, but at the high end of ISO choices quickly become objectionable.

The second most common kind of noise is dark noise from long exposures, and here, at a one-minute exposure, the noise is less of an issue with this sensor and this camera than the random noise from high ISO. There is a barely noticeable difference between the camera's dark-frame subtraction process switched on and switched off. The temperature is critical, however. This sequence was shot at a reasonable room temperature of 21ºC, but this kind of noise tends to double every 6ºC to 8ºC.



LONG-EXPOSURE COMPARISON
Left is 60 sec NR on, while right is 60 sec NR off.



ISO 100 ISO 400 ISO 800 ISO 3200 ISO 6400

We will look at noise and noise reduction in detail in Chapters 2 and 3, but in practical terms it is essential to be thoroughly familiar with the appearance of noise as created by your camera in images that you typically shoot.

Few people would disagree that noise is best avoided, but the amount of effort you go to in order to control it should depend on how important it is to you. Long-exposure noise can generally be taken care of quite well in the camera by selecting the noise-reduction option in the menu, but the immediate cause of most noise is setting a high-ISO sensitivity. You may well find that for certain kinds of image, you can tolerate a higher ISO setting than you imagined. As an important first step, make some tests at different ISO settings in a range of low light situations, and examine them

THE CASE FOR LOWER KEY

For shots taken in low light to convey that impression, the key of the finally processed image needs to be lower than normal. This is entirely a matter of taste, but here, the darker of the two versions is more faithful to the original impression—something that only the photographer can decide. The histogram is always a good check—the bulk of the tones centered is a normal key; shifted to the left is low key.

side by side. At 100 percent magnification, you can expect to see increasing noise with higher-ISO settings most obviously in smooth shadow areas. Decide for yourself at what setting it becomes objectionable. As noted on the previous pages, you need to find an acceptable balance between the usefulness of a high-ISO setting and the degree of noise.

There are several variables when it comes to making this decision. One is the medium that you would normally use for displaying your images. If this is a print, then you should make tests using your preferred paper type. The appearance of noise will be different between a 100 percent screen view and a print. A related variable is the size at which the images will be used. A fully magnified print will obviously show more noise than a 640 × 480 pixel screen image posted on a website. A third variable is the kind of image. A reportage shot with visible noise is likely to be tolerated by more people than would be a still life or landscape. Yet another variable is knowing how much you can expect to, or are willing to, reduce the noise later with software.

Ultimately, when shooting, you should be armed with enough information and judgment so that you can confidently select the appropriate ISO setting. You may, for instance, see hardly any difference in noise between shooting at ISO 100 and ISO 200, in which case the extra shooting speed carries no penalty. The ISO setting is one of several ways of achieving a certain shutter speed, and the others include supporting the camera, sacrificing depth of field by opening up the aperture, and switching to a faster lens. Each carries some disadvantage, even if minor, so consider the ISO selection in this context. Maximizing shooting efficiency may mean altering the ISO frequently, and some cameras allow it to be changed by means of a dial, which is faster than going to the menu.

As well as technical matters of exposure, such as holding highlights and avoiding shadow noise, which are all the more critical with artificial light sources, you need to decide whether a scene should look dim rather than fully bright—in other words, the key of the shot. With a night image, this is perfectly expected—it would look strange otherwise—but there are many less obvious situations where there is room for interpretation. The example I've chosen here is deliberately not a clear-cut case: a Hakka communal dwelling in China, where the atmosphere inside the circular three-storey structure, open to the sky, was distinctly subdued.