Close-Up Photography of Stationary Objects:

How to Take Advantage of the latest Digital Technology

by John Butterworth

What is the difference between close-up and macro photography? For present purposes I will define it this way: if your image of a bee fills most of the frame, you are engaged in macro-photography. On the other hand, if your image shows the bee and its natural setting, you are engaged in close-up photography, as shown here:

In this article I will focus on photography of stationary objects such as botanicals, typically using a tripod. Close-ups have very limited depth-of-field, so focusing is critical and better performed manually rather than relying on autofocus.

The disadvantage of using the optical viewfinder on DSLRs is that there is no built-in image magnifier and so achieving critical focus is hit-and-miss, especially when using a relatively slow zoom lens and even more so under poor lighting conditions.

Further, if you are taking photos of ground-level subjects, lying down to view the image may be unattractive. One solution is a right-angle magnifying viewfinder attachment, as shown. These are expensive—the Canon model ranges from $240 to $285. The magnification is limited to 2.5x at best.

This method is really a left-over from the film-camera era and today we have another choice—one that does not require further expenditure in many cases.

I am referring here to cameras which have a swing-out LCD display and “Live-View.” This includes examples from all the major manufacturers: the Canon 60D, 600D, Rebel T3i, Nikon D5100, Olympus E620, Sony α33, Panasonic G3, etc.

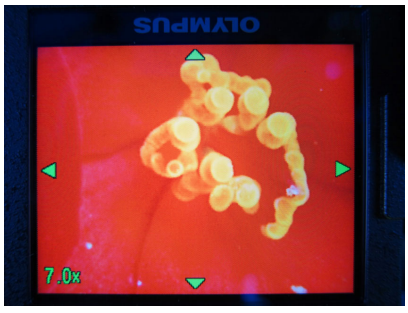
Here is how to proceed: with your camera on a tripod and in manual focus mode, swing out the LCD to face you. Switch on “Live View” if using a DSLR; hybrid cameras are full-time live-view devices. Here is a photo of the setup:

At this point, you need the display magnifier function. Some cameras may switch to this on selecting manual focus, with others you must select it yourself. When you have this display mode set, you will see a green “magnifier”

rectangle in the centre of the display (Canon and Olympus) or a navigation thumbnail in the lower-right corner (Nikon). Here is the Olympus display:

Let us suppose we wish to focus critically on the stamens of the flower on the right. Move the magnifier rectangle over this area using the four way controller:

Now press the dedicated magnifier button (Canon, etc.) or the OK button (Olympus) to get a view centered on this area which is magnified by 5x, 7x or 10x at your choice. You can now focus on this area with considerable precision—better than would be possible any other way.

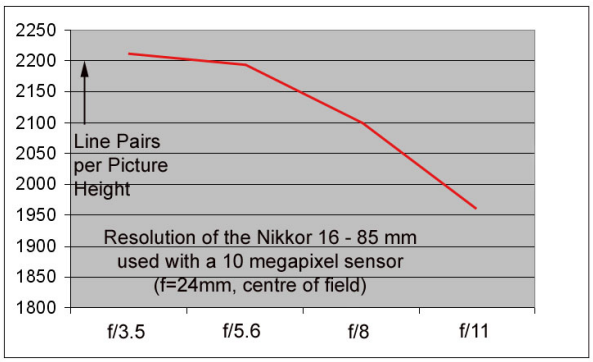


This works well even under poor lighting conditions as the LCD maintains a display of constant brightness.

At this point you can take the shot with assurance of getting a sharp image.

Improving the Depth-of-Field

We can improve the limited depth-of-field of our images by stopping down the lens. However, reducing the aperture size eventually runs into reduced image sharpness due to diffraction effects. The graph below shows the resolution of a high-quality zoom lens as it is stopped down:

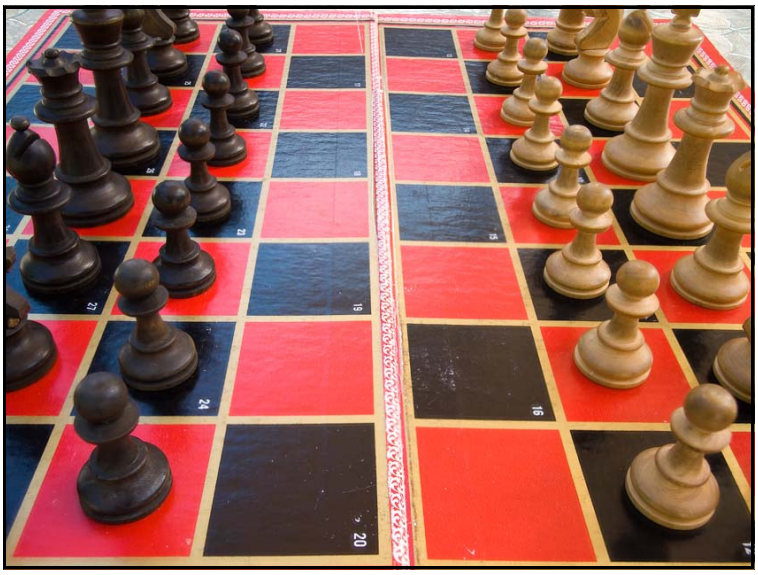


From personal experience, I would not stop down an APS-C lens beyond f/11 or f/8 for a four-thirds camera. As for depth of field, these figures are both equivalent to f/16 on a full-frame camera.

To get more depth of field, essentially as much as we want, we need to take advantage of another digital technology—focus stacking. This consists of taking a number of images while focused on different planes in our subject and then combining the in-focus part of each image in post-processing. While this may sound complicated, the process has been automated in Photoshop CS4 and CS5 (File>Automate>Photomerge). If you don't have either of these expensive programs, there are dedicated applications such as PhotoAcute Studio ($119) which make the process easy. PhotoAcute can be downloaded as a trial version.

To see how well PhotoAcute works with a

difficult subject, let's look at an example where the nearest part of the subject was only 12 cm from the front of the lens and the farthest more like 50 cm—a four-to-one ratio. Four images were taken of a chessboard at the full-frame equivalent of f/8. The camera was not moved but the focal plane was changed between the exposures from the nearest edge of the chessboard to the farthest. This causes the image to increase in size as the focal point becomes more distant. Here are the images focused nearest (top) and farthest (bottom):



At the top of the next column is the combined, focus-stacked image produced by PhotoAcute Studio.

Needless to say, a considerable amount of computing has gone on behind the scenes to produce such a clean image, not the least being the alignment made necessary by the different sizes of the four images.

Because of the sophistication of modern focus-stacking software, the use of expensive focusing rails (which move the camera backwards and forwards) is not necessary for close-up work. Macro photography may have different requirements not considered here.

Getting Even Closer

There are several techniques for increasing magnification. The most obvious method is to use your zoom lens at maximum telephoto. This does not usually affect the closest focusing distance. If this does not provide enough magnification, then other options must be considered. These include:

A Macro Lens: the best but most expensive solution ($500-1000). Can still focus to infinity.

Teleconverters: moderate price ($150); do not increase the minimum focusing distance but increase magnification by the conversion factor of 1.4x or 2x. Also they are lightweight and can be used with any lens. The downside is that you lose one stop of aperture (1.4x) or two stops (2x).

Extension Tubes: also light and moderate in price, but you can no longer focus to infinity. A loss of image brightness occurs as magnification increases.

Close-up Lenses: these are like a reading glass for your lens and do not affect image brightness, however you can no longer focus to infinity. This is the cheapest solution, so let's take an in-depth look at this option.

Firstly, there are the type of simple lenses which are often sold in sets of three, such as 1,2 and 4 diopters. These relatively weak lenses work best with long-focus camera lenses (150mm or more). To illustrate the point, let's say you use one of these lenses with the popular 18-55mm zoom lens, used at 55mm. The strength of your camera lens is 1000/55=18.2 diopters. If you add a 4 diopter lens to this, you end up with a total strength of 22.2 diopters, a 22% increase—useful, but not huge.

On the other hand, if you use a 150mm lens (6.7 diopters) and add 4 diopters, you have increased your lens strength by 60% - significant! At the same time, you have much more working distance than with the 55mm lens.

The disadvantage with simple lenses is that they introduce chromatic aberration which will reduce the quality of your images. Achromatic close-up lenses are available at somewhat more cost. Here is a photo of a simple 3 diopter lens (left) and an achromatic doublet (right):

Even higher-power close-up lenses are available at reasonable cost. Here, for example is the Opteka 10 diopter lens, a four-element high-quality coated achromat which sells for $15—a true bargain. It is available in 52, 55

and 58mm screw-in filter sizes. On my camera this lens does introduce some vignetting when my camera zoom lens is set to the 28mm (equivalent) end of its range: not where I'd usually use it for close-ups!

A list of achromatic close-up lenses can be found at:

http://fuzzcraft.com/achromats.html

Not all are still available as new items.

Conclusion

Advances in digital technology continue to provide us with new and better tools to achieve images which would have been all but impossible in the film camera era.

As we have seen here, you do not need to spend much to be able to take close-up images of an accomplished nature. You may already have most of what you need.