Photography Techniques Part 1: Close-up Photography – Bob Young

The last 5 months have given me a surplus of spare time. Thanks to the internet, it is easy to keep up-to-date with "new" techniques and the new application of a number of older ones.

Photomerge combined with high dynamic range (HDR) processing; advancements to photomerge to provide high resolution, HDR, 180^0 and 360^0 images; focus stacking; and extreme depth of field are some examples.

In this article, I will look more closely at the procedure of focus stacking to increase the depth of field in close up photography. Future articles will look at the other techniques; the next article in this series will continue with a detailed procedure and introduction to the software and hardware to produce a 360^0 HDR image. To whet your appetite I have created a Flash file of such an image; unfortunately, this image uses free trial software and has numerous 'Logos' watermarked into it. You can download the Flash File created from 12 wide angle images - it is not video - from the BirdLife Photography website birdlifephotography.org.au/photogallery/experimental.

Before we proceed further, I need to define three terms for the purpose of this article:

Close-up photography refers to images where the subject to camera distance is less than the standard minimum focus distance for the lens used, but produces an image with less than a 1:1 magnification. Magnification refers to the ratio of the size of the subject to the size of the image on the film or image sensors.

Macro photography refers to images where the magnification of the image is greater than 1:1 but less than 10:1.

Micro photography or photomicrology refers to images taken typically through a microscope and having a magnification greater than 10:1. Micro photography will not be discussed in this article.

Depth of field is a significant problem when engaged in close-up photography, but becomes extreme when involved in macro photography where the depth of field is frequently limited to less than 10 mm.

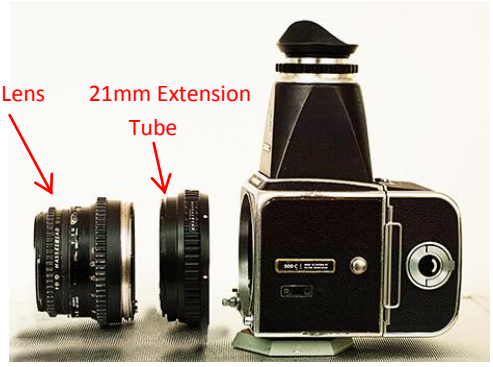
3X Macro Image of juvenile Magpie feather
f11 @ 1 second

Equipment for close-up and macro photography

By implication, there must be additional equipment involved which allows the camera to focus at a distance less than the minimum focus distance of a normal lens.

Close up adapters: Typically provided for point and shoot cameras, these are similar to a glass or plastic filter which screws onto the front of the lens. These have a reputation for degrading the image and *should only be considered as a serious option if they are the only option*.

Extension tubes: These fit between the lens and the camera body and permit the lens to be focused at a closer distance. Their disadvantage, compared with extension bellows, is that the extent of the extension is fixed depending on the size of the tube, although two or more tubes can be stacked together. For most camera brands it is possible to get extension tubes which maintain auto focus and auto exposure.



Extension Bellows: Think of these as a variable length extension tube. While offering the advantage of being able to vary the amount of magnification, they must be used on a tripod and auto focus is not available. Limited auto exposure may be available depending on the manufacture of the camera, lens and bellows unit. With my Nikon PB4, neither auto focus nor auto exposure are available. The image of the Magpie feather on the previous page was taken with this setup.

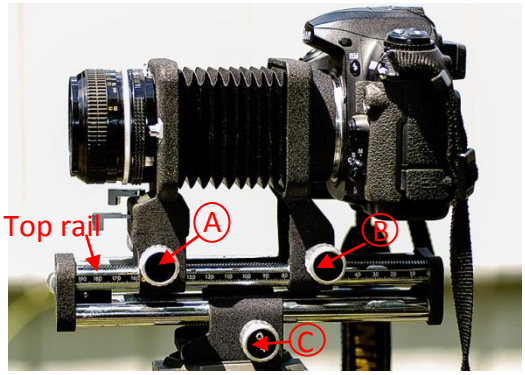
For the benefit of members who may not be familiar with the operation of extension bellows, the following is an overview of the equipment and how to adjust it.

There are a number of ways to use this equipment, but the two commonly used are:

1. Set image size

    a. Rotate knob B until the image size as seen through the viewfinder is correct
    b. Rotate knob A unit the image is sharply focused

2. Set reproduction ratio



    a. Using the table provided in the user manual, adjust knobs A and B to the prescribed settings on the top rail. e.g With a 50mm f1.4 lens and 3:1 magnification, the distance between the outer edges of the lens panel and the camera panel should be 104mm.
    b. I would start by setting the camera panel for the image size required and then move the lens panel to provide 104mm between the outer edges of the 2 panels
    c. Set the focus distance on the lens to infinity
    d. Rotate knob C until the image is in sharp focus. Do not use the A or B knobs to focus or you risk changing the magnification.

Macro lenses: There are true macro lenses and there are pretenders. Price is not necessarily an indicator of quality.

Lenses such as the Nikon f2-8 60mm Macro focus to a 1:1 ratio and offer an aperture range of f2.8 - f32. This is a very good lens, although somewhat pricey, and it can be handheld; it produces a 1:1 ratio for subjects of about postage stamp size.

On the other hand, the Nikon f2.8 35 - 75mm zoom lens ($1100) offers 'macro' capability at the 35mm focal length only, and will only produce about a 1:10 reproduction. In reality this should only be classified as a close-up lens.

By comparison, the macro capability on the Fuji FinePix E500 (an entry-level point-and-shoot camera, costing about $300) will produce a near to 1:1 reproduction. Image quality is inferior to that of the much more expensive dedicated macro lenses available for DSLR cameras.

Image taken on Fuji FinePix E500 on Macro setting

Exposure

Whenever we add an extension to the focal length of the lens, either by adding extension tubes or extension bellows, there is a reduction in the amount of light falling on the film or image sensor. This must be compensated for to prevent the image being underexposed.

The formulae for calculating the increase in the exposure factor and f-stop are:

Exposure Factor = $((Fl + Ex)/Fl)^2$ and
Aperture adjustment = Log(Ef)/Log(2)
where
Fl = Focal length of lens
Ex = Length of extension
Ef = Exposure Factor

	A	B	C
1	Focal Length of lens:	80	
2	Extension length:	16	
3	Exposure factor:	1.44	
4	F-stop Adjustment:	1/2	stop

To make things easier, I use a simple spreadsheet which includes these formulae to do the calculation; an example of this is shown. You may need to round the calculated adjustment to the nearest $^1/_2$ or $^1/_3$ stop, according to your camera's adjustment levels. *If you are fortunate enough to be able to use your TTL exposure meter, then there is no need to make any adjustment.* Otherwise the adjustment can be made to the aperture, shutter speed or ISO setting. My preference is to adjust the shutter speed, as any adjustment to the aperture will affect the depth of field which is already very limited. [Editor's note: Bob's article included an embedded spreadsheet, but this does not work reliably in the .pdf file of this newsletter. If you would like a copy, please email me: robpparker@optusnet.com.au]

You may find that it is impossible to get an accurate exposure reading using your TTL meter in the camera due to the lack of connectivity between the camera and lens. My D100 seems OK, but the D2X produces questionable results. I find it easier to use a hand held meter and make the adjustment based on the calculation from the spreadsheet. Since I have an Android Excel App on my smart phone, I theoretically have the spreadsheet available at all times.

Problems I found - and some solutions

Apart from the exposure problems mentioned above, my first problem was that the bellows unit would not allow me to attach the Nikon D2X due to the extra depth in the body to accommodate the battery and vertical grip/shutter controls. This was not a problem with the D100.

The next problem is the focusing screen (commonly a smooth screen) makes it very difficult to focus manually in the low light associated with high magnification using the bellows attachment. This is not something which I could overcome on the D100 as the focus screen is not interchangeable.

If you cannot use TTL exposure, then you may have a serious problem with some of the latest lenses as there is no electrical connection for the camera to set the aperture, and many current model lenses do not have an aperture ring to allow for manual setting. I am using a very old F1.8 50mm lens on my bellows, as the newer f1.4 50mm lens has no manual aperture setting – aperture can only be changed via the command wheel on the camera.

A further problem associated with the need to use a hand held exposure meter is that there is very little distance between the subject and the lens when mounted on the extension bellows. Adding a teleconverter will increase this distance without changing the magnification. However this may not work in all cases. An old Nikon 1.7X converter works perfectly, but the new 1.4E converter will not; there is not sufficient room for the back element of the lens to fit into the barrel of the converter without contacting the front glass element of the converter.

1.6X Teleconverter fitted with 60mm f2-8 macro lens

Focus stacking

The purpose of focus stacking is to provide sharp focus over a greater area of the image. In this example, I used a flower as my subject.

The process for taking the images is not unlike that required to produce an HDR (High Dynamic Range) image, except that we vary the focus rather than the exposure.

Our friendly Magpie dropped in to check out the setup as I photographed the flower

Since I would be creating a set of 9 images that had to align perfectly, it was imperative that a strong tripod was used. I also used an electronic remote shutter release to further guard against any vibration. Each image had to be exposed identically, so setting the camera to manual exposure was essential. Similarly manual focus was a must – you cannot move the camera to try and automatically focus on each individual point and hope that you can return to exactly the same point to take the next image.

The intention was to start at the closest and furthest points and then to focus on the cluster of stamens which need to be in focus. At this point I realised that there was probably not going to be sufficient depth to ensure that the inside of the trumpet and the right hand petal were going to be sharp, so I added two more focus points.

The focus points I chose were:

1. Foreground petal
2. Background petal
3-7. Heads of individual stamens and pistil
8. Right hand petal
9. ¾ of the way down the inside of the trumpet.

Focus points for the 9 images for stacking

When all nine images were completed they were loaded into Adobe Lightroom 4.3 but no adjustments were made at this time. Experience has shown that I get a better alignment and blending if the RAW image is used rather than a .PSD or .TIFF.

The next step, in Photoshop CS6, was to load each of the nine images as separate layers. *Do not be tempted to use the Lightroom option* **Open as Layers in Photoshop** – *it doesn't work for this application.* My method was to select all nine thumbnails and then select the option **Edit in Photoshop CS6**. This opens all the images as tabbed items in Photoshop. Starting with image 1 selected, click on the image 2 tab, then drag-and-drop that image as a separate layer in image 1. Close image 2 and repeat the process for each of the other seven images. Holding down the Shift key as you drag-and-drop ensures that the images are correctly registered and you are more likely to get a good alignment of images for blending.

When finished, all the images are visible in the Layers palette. Select all images in the Layers palette (left click the top layer and then, while holding down the shift key, left click the bottom layer). Under the **Edit** menu, click on **Auto-Align Layers**. Depending on the capacity of your computer this may take several minutes. Once aligned, go back to the **Edit** menu and select **Auto-Blend Layers**, and on the next dialogue box check **Stack Images** and **Seamless Tones and Colors**. This will probably take a bit longer than the alignment process.

In this screen print from Lightroom, the stacked image is displayed. Along the lower edge you will see the thumbnails of the 9 images which were stacked and blended.

Job done, and the final result is an image with far greater depth of field than I can achieve with a single image.

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