

Introduction to Macro Photography

by Laurence Heine

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Outline

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- What is Close-up Photography?
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(Cont.)

Outline, cont.

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- Macro Photography Accessories and Software
- The Hardest Things About Macro Photography
- Depth of Field
- Focusing and Sharpness
- Focus Stacking
- References

My Background

- I have been interested in photography since childhood
- High school and college yearbook and newspaper photographer
- Electrical Engineering degrees – 35 years in electronics design, Project Management, Product Management
- Have a website design and hosting business since 2001
- I believe almost every photograph has a story which was a major influence is starting our photography blog

Definitions

- **Close-up Photography** – Photographs of relatively small subjects (such as flowers and insects) using non-macro lens that essentially fill the frame
- **Macro Photography** – Macro photography is capturing something small and making it look larger than life. Technically, macro photography is where the image on the sensor is life-size or larger (1:1 magnification or more) – true macro photography provides more fine detail than close-up photography.
- **Magnification** – The size of the subject on the camera's sensor related to the actual size of the subject.
 - 1:1, 1x, and life-size magnification are all the same; 1:2 or ½x indicate the sensor image is 50% of the subject size.

(Cont.)

Definitions, cont.

- **Minimum focus distance** – The smallest distance from the subject to the sensor.
- **Working distance** – the distance from the front of the lens to the subject
- **Depth of Field (DoF)** – The distance between the nearest and the farthest objects that are in acceptably sharp focus in an image. “More” depth of field means that more is in focus. “Shallow” depth of field means that very little is in focus (possibly including much of the subject).
- **Aperture (f-stop)** – f-stop is the lens focal length / lens opening diameter
- **Focus Stacking** – process of taking multiple photographs, each focused at a different point of the subject and combining them with software. The focus points must be separated by less than the depth of field of the specific setup.

Why Macro?

- It's fun and interesting to see the unnoticed tiny details of things you see
- Macro forces you to slow down – you don't see anything if you're moving too fast

Close-up Photography

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What Is Close-up Photography?

- Photographs of relatively small subjects (such as insects and flowers) that essentially fill the camera frame (image)
- Primarily hand-held
- Primarily nature subjects
- Subjects are easily found in your backyard or in easily accessible public spaces
- Typically uses non-macro lenses (telephoto lens preferred – more later)

Typical Close-up Photography Subjects

- Think about commonly available subjects in your backyard or in public places:
 - Flowers
 - Insects
 - Birds
 - Dew on grass
 - Rock layer details
 - Leaves and leaf edges

What Is My Subject?

- With close-up photography, you decide what is your subject, how to frame it, and how much should be in focus – not everything has to be in the image or in focus
- Photograph anything that interests you - what are you drawn to repeatedly?
- Convey what you find interesting using composition and focus
- Consider the 'quality' of the subject – avoid flowers with brown or dying petals, etc.

Pay Attention – Be Aware of What’s Around You

- Be still, look around and listen before moving
- Watch for things that don’t belong
 - What’s been chewing holes in the leaves?
 - What’s that dot on that plant?
- Watch and listen for movement
- If you notice an insect visiting a flower, just wait for it (or another) to come back
- Be aware of lighting on subject – consider time when subject will look best
- Be aware of background and how it contrasts with subject

Cameras and Settings

- Point-and-Shoot Cameras
 - Close-up setting – typically 🌸
 - Use built-in zoom function to enlarge the subject in the frame
- Cameras with interchangeable lenses
 - Close-up setting – typically 🌸
 - Use aperture priority to control depth of field / background focus or shutter priority to minimize motion
 - Set autofocus to single point focus and focus on the subject
- Smartphone with clip-on camera-specific macro lens

Artistic Decisions!

- What type of image do you want to capture?
 - Soft and dreamy
 - Sharp and detailed
- What type of background goes best with the subject?
 - Natural and blurred
 - Contrasting color
- Position the subject to achieve your inspiration – use composition guidelines

Enlarge the Subject

- Telephoto lens
 - Keep distance from live subjects – don't disturb, less light interference
 - Better depth of field
 - Zoom for easier composition
- Close-up Filter
 - Mounts on lens like other filters
 - Needs to be the same quality as the lens to avoid affecting image quality
- Teleconverter
 - Manufacturer specific for compatibility
 - Loss of light: 1 stop for 1.4x, 2 stops for 2x
 - Some impact on image quality due to additional lens elements
 - More effective with longer focal length lenses
 - Some loss of image quality because of additional optical elements

Useful Equipment and Accessories

- Tripod and remote trigger
- Artificial light source (flash, LED panels)
- Light reflectors and diffusers
- Solid color background panels (black, white, colored)
- Fairy lights for background lights – keep out of focus

Composition

- Common portrait composition rules apply to close-up photography
 - Don't chop off the limbs or feet – if you must don't do it at joints
 - Allow the subject to look into the frame, not out of it
 - Focus on the eyes and face, if possible
 - Subject to left side, facing right
 - Rule of thirds
 - Centered images work well for symmetrical subjects
 - Eye line and space – subject looking or moving into image and have room to move within frame
 - Use leading lines in image to direct attention into the frame toward subject

Tips & Techniques

- Start photographing parallel to subject – improves sharpness and depth of field
- Depth of field is small at close distances - use DoF calculator
- Shoot, move closer and shoot again, and repeat – you don't know which shot will be best
- Change your angle often – multiple choices to pick from but watch depth of field
- Experiment with different apertures to determine which works best for the subject and background
- Avoid windy days to minimize subject movement

(Cont.)

Tips & Techniques, cont.

- Avoid clutter in frame; avoid distracting backgrounds
- Not every photo has to be as close as you can get
- Expect to get a LOT of out of focus or blurred images from wind, subject movement, your movement (or breathing), or whatever





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What Is Macro Photography?

- According to the initial definition, the subject of a macro photograph is captured with at least a 1:1 magnification
- The camera lens is the major difference between close-up and macro photography. A close-up picture can be taken with a telephoto lens, but generally, macro photography can only be created with a macro or macro-equivalent lens.

Basic Macro Photography Equipment

- DSLR or mirrorless camera with interchangeable lenses and live view display
 - Macro or macro-equivalent lens
 - Tripod for lower light or long exposure setups
 - Remote shutter release
 - Additional light source (if needed) – LED panels or flash with diffuser

Get Closer to the Subject

- Extension Tubes

- Basically spacers that mounts between the camera and lens. Increases the focal length of the lens and the magnification.
- More effective with shorter focal length lenses
- No optical loss of quality but reduces effective aperture
- Reduction in long distance focusing

- Bellows

- Same idea as extension tubes but no electronic lens capability

(Cont.)

Get Closer to the Subject, cont.

- Lens reversing ring – adapts the lens filter thread to the camera lens mount
 - Short focal length lenses provide higher magnification when reversed
 - No automated options – manual focus, manual lens aperture setting
 - Less expensive but not easy to use
- Teleconverter
 - Manufacturer specific for compatibility
 - Loss of light: 1 stop for 1.4x, 2 stops for 2x
 - Some impact on image quality due to additional lens elements
 - More effective with longer focal length lenses
 - Some loss of image quality because of additional optical element

Get Closer to the Subject, cont.

- Teleconverter and Extension Tubes together
 - Always mount the teleconverter closest to the camera

My Extension Tubes and Teleconverter



Individual Extension Tubes



Extension Tubes, stacked



Teleconverter

My Lenses and the Effect of Extension Tubes and Teleconverter

Lens	Min Focus Distance ¹	Max Magnification	Max Mag w/1.4x TC	Max Mag w/68mm ET ²	Max Mag w/1.4x TC + 68mm ET ²
Canon EF-S 55-250mm f/4-5.6	30.5 in.	0.31x	0.43x	0.58x	0.62x
Canon EF-S 17-55mm f/2.8	12.4 in.	0.17x	0.24x	1.41x	1.12x
Sigma 105mm f/2.8 Macro	12.0 in.	1.0x	1.4x	1.65x	1.86x

¹Actual measurement. Minimum focus distance may not be at maximum magnification

²Calculated at <https://www.cambridgeincolour.com/tutorials/macro-extension-tubes-closeup.htm>

Advantages of Macro Lenses

- Closer minimum focus distance
- Greater magnification
- Optimized for lower distortion and sharper images at minimum focus distance
- Macro lenses are flat field lenses, which means they lack the “field curvature,” or curve distortion at the edges of the image that’s common in general purpose lenses.

Macro Photography Accessories & Software

- Clamps (similar to Wimberley Plamp II or 'third hand')
- Tactical pants with kneepads for outdoor (ground-level) use
- Macro focusing rail for taking multiple shallow depth of field photographs. It provides more precise control than the focusing ring on the camera lens and is necessary for focus stacking.
- *PhotoPills* (or other) smartphone app to calculate Depth of Field, Exposure, Field of View, and more
- *Seek* smartphone app to identify insects, plants, fungi, and wildlife
- *Helicon Focus* app (or other) for post-process focus stacking

The Hardest Things About Macro Photography

- Focusing and razor thin depth of field – the closer you get, the less is in focus
- Sharpness – moving subjects (either subject or wind) or moving photographer (even breathing) can affect sharpness as does poor focus
- Insufficient light – the subject may be in shadow or you can block the light with the camera or your body when photographing close to a subject
- Difficult composition

Depth of Field

- Smaller apertures (larger f/numbers) provide more depth of field – the trade-off is less light which requires either a slower shutter speed or higher ISO
- Closer focusing distances and longer focal lengths reduce depth of field
- Depth of Field is dependent on the lens aperture, its focal length, and the distance to the subject:

$$\text{DoF} \sim 2N \left(\frac{u}{f} \right)^2$$

Focusing and Sharpness

- Use tripod and live view with manual focus and built-in magnification to precisely focus on the subject
- Use higher shutter speed to “freeze” the subject
- Image Stabilization in lens or camera reduces the effect of body and camera movement
- Use larger apertures (smaller f/numbers) to get sharper images
- For slower shutter speeds use a tripod, live view (mirror lockup), and a remote shutter release to stabilize the camera (disable image stabilization when using a tripod)

Focus Stacking

- A method where you combine the in-focus areas from a sequence of images to get a final, focused shot. The in-focus areas **must** overlap.
- Use an app like PhotoPills to determine the depth of field for the specific set-up
- Use a macro focusing rail to insure image alignment and consistent depth of field steps
- Stack images in Photoshop, Helicon Focus, or other focus stacking apps



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Some References

- Depth of Field: <https://digital-photography-school.com/understanding-depth-field-beginners/>
- Digital Photography Macro Photography Search: <https://digital-photography-school.com/?s=macro+photography>
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- Photography Life – Everything You Need to Know About Macro Photography: <https://photographylife.com/macro-photography-tutorial>

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