DEPTH OF FIELD

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Definition: the area in the photograph that is in sharp focus. Measured as the distance between the nearest and farthest objects in focus. There is always twice as much depth of field behind the point of focus as there is in front of it. Depth of field considerations are more important when there is high magnification or when a large range of distance is required to be sharp. The human eye has essentially unlimited depth of field. The camera's depth of field varies depending on the lens focal length, f/stop, and point of focus.

1. Lens focal length. The shorter the focal length (ie. the more wide angle) a lens, the greater the depth of field it produces at any given aperture. For a given image size, all focal length lenses used at the same aperture generate the same depth of field (but a 200mm must be much farther away than a 28mm).Wide Angle Lens. From fisheye and superwide lens to about 35mm. Gives the most depth of field. Use in crowds, small rooms, any tight space or in landscapes where usually a large depth of field is important.Medium Focal Length Lens. 35 – 85mm. Produces pictures with normal perspective.Telephoto Lens. 85 – 1000mm or more. Compress landscapes. Useful for producing selective focus when photographing wildflowers or people. 100 – 150 mm is great for portraiture with sharp images and an out of focus background.

2. Aperture. The smaller the lens opening or aperture, the more depth of field in the photograph, no matter the length of the lens. The common f/stops, in order from the largest opening to the smallest, are f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, and f/32. Each change represents a halving of the amount of light entering the lens and a corresponding increase in depth of field and in shutter speed. To avoid confusion when starting photography, think of each number as an exponential number in a fraction.

3. Focusing distance. The closer you focus on a scene or object, the less depth of field a lens produces at a given aperture and focal length. This is one of the reasons high magnification using macro or telephoto lenses produces less depth of field. For example, with a 50mm lens set at f/8, depth of field is 19 inches when the lens is focused at 5 feet and 8 feet when focused at 10 feet. When the eye must follow elaborate or fine detail through the depth of the picture space, sharp focus is mandatory in order to make the strongest photographic statement. Our eye sees everything in clear detail, except for those things too close for it to focus on. It is disturbing to have foreground or background blurred. If you have to sacrifice one over the other, go for foreground sharpness because of the eye's need to travel into the picture space without a distracting obstacle. [Martha Hill/Art Wolfe]

When it is desirous to limit depth of field and thus have out of focus elements in the picture, for example when doing close-ups of wildflowers, use the selective focus capability of the camera lens to isolate a focused subject against an out of focus background. This diffuses the clutter of busy backgrounds so that nothing detracts from the main subject. This can be achieved by using a telephoto lens, and/or by opening the aperture. This produces faster shutter speeds, reducing movement caused by the wind.

MAXIMUM DEPTH OF FIELD

Methods to increase the area in focus are:

1. Parallel subject and film plane. This is ideal for photographing flat ground patterns of all kinds and for vertical surfaces like walls. Whenever photographing a small grouping of objects such as wildflowers close in, adjust the angle of flowers into the same plane as the film plane.

2. Modifying the shooting angle. Tilt the camera towards the subject in order to make the film and subject more nearly parallel.

3. Wide angle lens.

4. Tilt shift lens. The front element can be tilted to a different plane than the back element producing "bending" of the light. Can achieve extensive depth of field even at relatively open apertures producing faster shutter speeds especially important in windy conditions. Medium apertures also have better optical performance. For example, a 24mm T/S lens set at f/5.6 with full tilt can give a DOF equivalent to a standard 24mm lens at f/22. Canon makes three T/S lens, 24,45,and 90mm. The 24 may not offer much of an advantage for the price. Its shift movement is useful for architectural photography. Most pros find the 90 and 45mm more useful as T/S lenses because of the huge DOF gain. The Canon 35mm f/2.8 TS lens is a manual focus FD lens that can be modified to fit other camera brands.Nikon users can gain tilt movement with the now discontinued Nikon PR-4 bellows, with a Nikkor 105mm f/4 short mount lens. Gilles Delisle

5. Hyperfocal distance. This is the most optimal focus point to ensure that the picture will be sharp from the closest possible point to infinity. Practically everything from one/half the hyperfocal distance to infinity will be in focus. Understanding hyperfocal principles is essential to maximizing the depth of field critical to a fully detailed landscape. It adds emphasis to the foreground of your landscape so that an interesting element up front engages the viewer starting him on a trip through the image. Because wide angles reduce everything to such a small scale, larger elements in the foreground do wonders to your landscapes.

METHODS OF IN-FIELD DETERMINATION OF DEPTH OF FIELD

1. Depth of field by guesswork. Method. This is the f/22 syndrome – use the smallest aperture and probably everything will be in focus. Focus one/third into the frame or 1/3 of the height from the bottom, as 1/3 of the picture in front of the focusing point and 2/3 behind the focusing point is in focus.Advantages. Fast as no computations or tables are required. Disadvantages. Imprecise. Wastes shutter speed if there is no need to be focused at infinity. Often a poor result as the optical performance of any lens is better at middle aperture (f/8 to f/11). Smaller apertures increase diffraction decreasing the overall sharpness of the image. Slow shutter speeds risk camera or subject movement.

2. Depth of field tables and charts.Method. a. FotoSharp depth of field cards. Contact them at 206-248-1840. b. .www.dlc.com. Web site for Picture Window 2.0 has made available a simple program where you fill in the blanks and it calculates depth of field and hyperfocal distance in a fraction of a second. Download the program and make up a series of combinations to print out and take in the field. c. "Applied DOF" by Alfred A. Baker. Focal Press. 1985. Charts that list format, lens focal length, focusing distance, coc diameter, image magnification , total DOF, near limit of sharpness, far limit of sharpness. d. some zoom lenses come packaged with DOF charts.Advantages. Precise. Works for lenses without DOF marks.Disadvantages. Doesn't work for telephoto lenses or close-up work. Need to carry a chart. Need to include infinity as the far distance which is not always necessary, wasting shutter speed.

3. Depth of field preview button. When looking through the viewfinder, the aperture is at the lens's widest, letting in more light and making focusing and composition easier. It stops down to the preset aperture just before the picture is taken. The DOF preview button closes down to allow you to see the scene at the aperture it will be taken at. At small apertures when the viewfinder is quite dark, shield your eye and the eyepiece with your hands and wait for your pupil to adapt to the low light level. Its major use is to locate the edge of half graduated filters.Disadvantages. Not available on every camera. Not precise. Poor way to see what is actually sharp as it is very dark in the viewfinder at small apertures. The focusing can only be guessed at.

4. Depth of field lens markings. Method. Present on fixed focal length lens but not on zoom lenses. Determine the nearest and farthest focusing distances. Place the infinity focus mark on the f stop of the aperture that is being used. Reading the distance scale between the same two f stops will give the total DOF. It roughly approximates the hyperfocal distance chart. For example, there are two f/16 settings on the depth of field scale. Set the infinity mark on the focusing ring beside one of the f/16 settings. Look at the other f/16 noting the distance on the focusing ring beside it on the depth of field scale – let's say 3m. Everything between the two will be in focus – 3 meters to infinity.Advantages. Fairly precise. Provides both hyperfocal distance and aperture.Disadvantages. Zoom lenses do not have DOF markings. Doesn't work well for telephoto lenses. Confusing for many people.

5. Canon DEP – Depth of field program.Method. After picture composed, autofocus on closest and farthest points to be in focus. Lens is automatically focused at the hyperfocal point and the correct aperture is selected for that DOF.Advantages. Fast. Precise for all distances, focal lengths and magnifications. No tables required. Doesn't waste shutter speed. Can be done in dim light.Disadvantages. None, other than requiring a Canon camera with the function.

6. Hyperfocal distance. This is the focusing point at which the lens must be set to provide the maximum depth of field at any aperture. Setting your lens at the hyperfocal distance means that everything from half that distance to infinity will be in focus. Measure from the film plane.The picture will look out of focus but trust the hyperfocal distance setting. When the lens is automatically stopped down at the moment of exposure, everything will come into focus. Considerable DOF is gained (refer to the chart below for examples of DOF gain using hyperfocal focusing.Method. Autofocus is turned off and the hyperfocal distance is set manually on the lens. Determine the hyperfocal distance from:
a. hyperfocal distance formula H=F/f where H is the hyperfocal distance in metres, F is the focal length of the lens, and f is the aperture. Formula #2. H=(F squared)x.04/f (eg.50mm @ f/8 = [50x50]x.04/8=I2.5m)Formula #3. H(inches)= ([F squared] / 625 / f) x coc (circle of confusion, usually .00I) Change 625 to 7500 for answer in feet, or to 24,606 for answer in meters.

b. HYPERLINK "http://www.dlc.com" www.dlc.com

c. Hyperfocal chart. Copy or cut out the following chart. Laminate with plastic and keep handy for reference. Advantages. Precise. Works for lenses without depth of field marks. Disadvantages. Doesn't work well for telephoto lenses or for close-up work. Need to carry card, calculator, or tables. Most cards and tables are very limited. Slow. Many can't perform the calculations. Need to include infinity as the far distance, which if not necessary, wastes shutter speed.

Circle of confusion. Why are there so many different charts with different hyperfocal distances? What is variable is how sharp you want the foreground of the image to be. Different charts are based on different circles of confusion (= size of a point of information). The smaller the coc, the better the resolution and the sharper the image. The standard for critically sharp pictures is a coc of .001.

PRODUCING DEPTH IN YOUR PHOTOGRAPHY

One of the most satisfying powers of photography is its ability to represent the three- dimensional world – where things have length, width, and depth – on a flat two- dimensional surface. Photographs can't actually reproduce depth, they can only simulate it. Making space and depth part of your composition, creates the feeling that one

Hyperfocal Distances

Scale in Feet

Lens	F11	F16	F22	F32
15mm	2.6	1.8	1.3	0.9
16mm	2.9	2.1	1.5	1.0
17mm	3.3	2.3	1.7	1.2
18mm	3.7	2.6	1.9	1.3
20mm	4.6	3.2	2.3	1.6
24mm	6.6	4.7	3.3	2.3
28mm	9.0	6.3	4.5	3.2
35mm	14	10	7.0	5.0
50mm	28	20	14	10
85mm	82	58	41	29
105mm	126	88	63	44

Circle of Confusion is 0.001 inches

Setting HyperFocal Distance

1. Set the focusing mark on the lens to the distance below the f-stop being used from the table at left.
2. The lens will be in focus half the distance from the lens to the hyperfocal distance, continuing all the way out to infinity.
3. Don't refocus the lens once the hyperfocal distance is set–even if it looks out of focus.

EXAMPLE: A 50mm lens at f/16 is set to 20 feet at the focusing mark (using the chart at left). Everything from 10 feet to infinity will be in focus.

Score down the middle Cut on Corner marks & fold in half

ORTON IMAGERY

Involves sandwiching two Slides or Digital Images together in the same mount to get an image reminiscent of a fine watercolour painting.

Compose an in-focus image that is overexposed by about 2 Stops.

Use any aperture for the in-focus shot. Compose an out-of-focus image at your lens' widest aperture (f2 or f4) and overexpose by 1 stop.

To vary the effect try

In-focus	Out of focus
+3 stops	+half stop
+2.5 stops	+1 stop
+2 stops	+1.5 stops

Mix and match the two images

can actually reach into or walk into the picture. Human's binocular vision allows us to perceive three-dimensional space. Visual cues also enable us to judge depth. Converging lines of perspective, diminishing size of objects of textural detail, overlapping objects, atmospheric perspective, and receding and advancing colors all are effective methods of emphasizing depth.

Converging lines of perspective. Parallel lines that appear to converge on a distant vanishing point, such as the rails of a railroad track or the edges of a straight road. Use converging lines to lead the viewer's eye into your picture. Vertical converging lines can create a dizzy feeling of height if you shoot up along a tree trunk or down from a balcony or cliff edge. Diminishing size of objects. If we see two objects of familiar size, and one looks larger than the other, we assume the bigger one is closer.

Diminishing textural detail. In the real world, the spacing between many things tends to be regular: trees in a forest, tiles on a floor. Close up we see detail clearly, but as the pattern recedes into the distance, its components become smaller and less distinct, eventually blending together. You can maximize the effect of diminishing shapes and textures by using a wide angle lens. It changes perspective by increasing the apparent difference in size between foreground and background objects.

Overlapping. If one opaque object is in front of another, the nearer one is hiding the more distant one giving a sense of depth.

Lighting. Even front light (eg, from on camera flash or sunlight coming from behind) creates no visible shadow and is called "flat" as it has a flat, two-dimensional look. Side light models the subject with highlight and shadow creating a three-dimensional, sculptural effect. Backlighting also creates depth as it emphasizes texture and throws shadows forward, leading the viewer's eye into the picture.

Framing. A foreground object that frames a more distant one generates the illusion of depth. Strong dark shapes often make good frames – a tree trunk and branch, an archway, the overhanging ceiling of a porch.

Atmospheric perspective. Haze, smoke, mist, or dust in the air diffuses daylight and makes more distant objects appear paler and less distinct than nearby ones.

Advancing and receding colors. Distant parts of outdoor scenes become lighter, less distinct and bluish, an effect caused by water vapor in the atmosphere. Our eyes and brains are accustomed to the effect that blue colors in general seem to recede into the distance while warmer colors appear to advance (eg. red autumn trees seem to pop toward the viewer). Depth of field. Great DOF can give a strong feeling of space, as in a landscape that rolls away in sharp detail from the foreground into the far distance, taking the viewer's eye with it. Selective focus divides the photograph into two distinct planes with the sharp foreground subject separating itself from the blurred background. Conversely, focusing on a distant object and blurring the foreground pulls the eye deeply into the pic ture.

Arthur Goldsmith