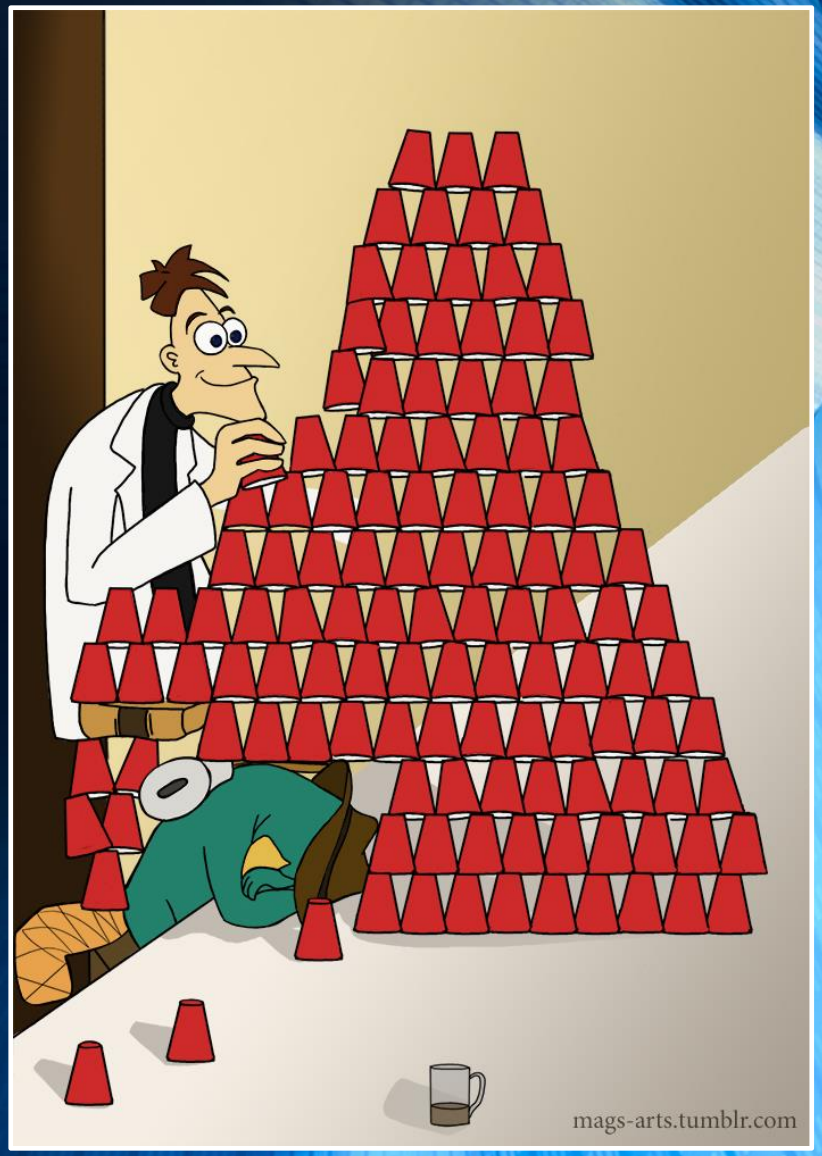
Focus Stacking

JARED FEIN

PRESENTATION TO MODEL SHIPWRIGHTS OF NIAGARA (MSON)
APRIL 2022



Presentation Overview

- Introduction to focus stacking.
- DoF & the key factors influencing it.
- Advantages & disadvantages of focus stacking.
- What do you need to focus stack?
- How to make focus stacked images.

Focus Stacking Intro

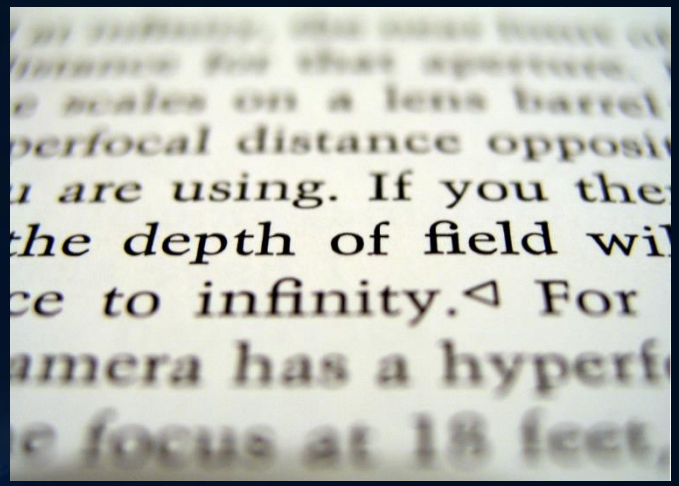
- AKA Focus bracketing, focus blending. It is a powerful digital photography technique which enables the photographer to create images where everything in the entire picture is tack sharp.
- By the end of this presentation, you will have a good understanding of this technique, when you can use it, what you will need to make focus stacked images, and how to do it.

Focus Stacking Intro

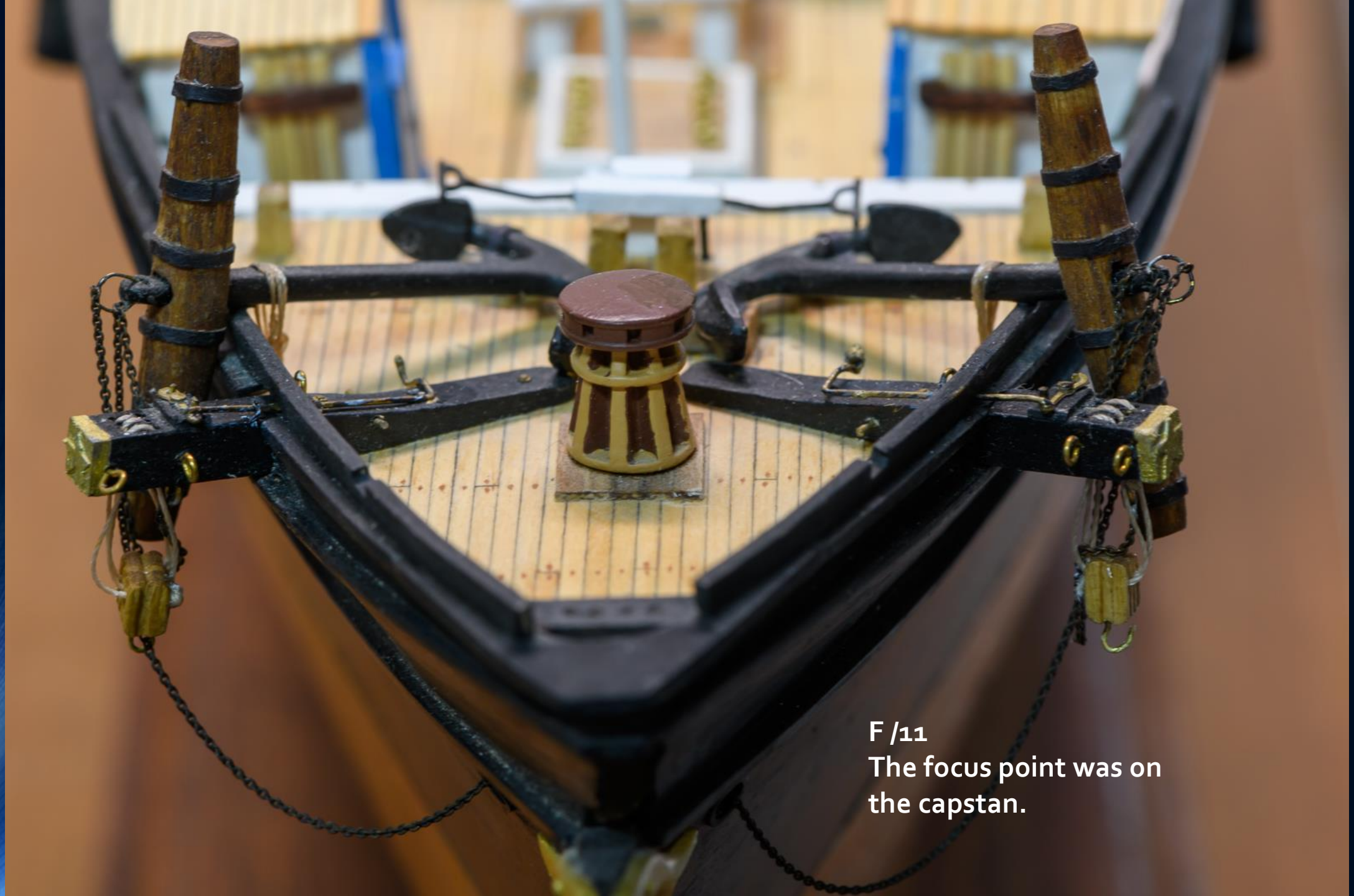
- In today's talk I will be addressing the problem of shallow depth of field in single exposure photography.
- The problem we face as photographer's and model makers is that that regardless how good our camera, lenses and skills are, it is nearly impossible to capture razor sharpness in an entire single exposure photograph, because of the designs of cameras and lenses and the physics of light itself.
- Focus stacking is a powerful photography technique which helps model photographers overcome the limitations of DoF.

Depth of Field (DoF)

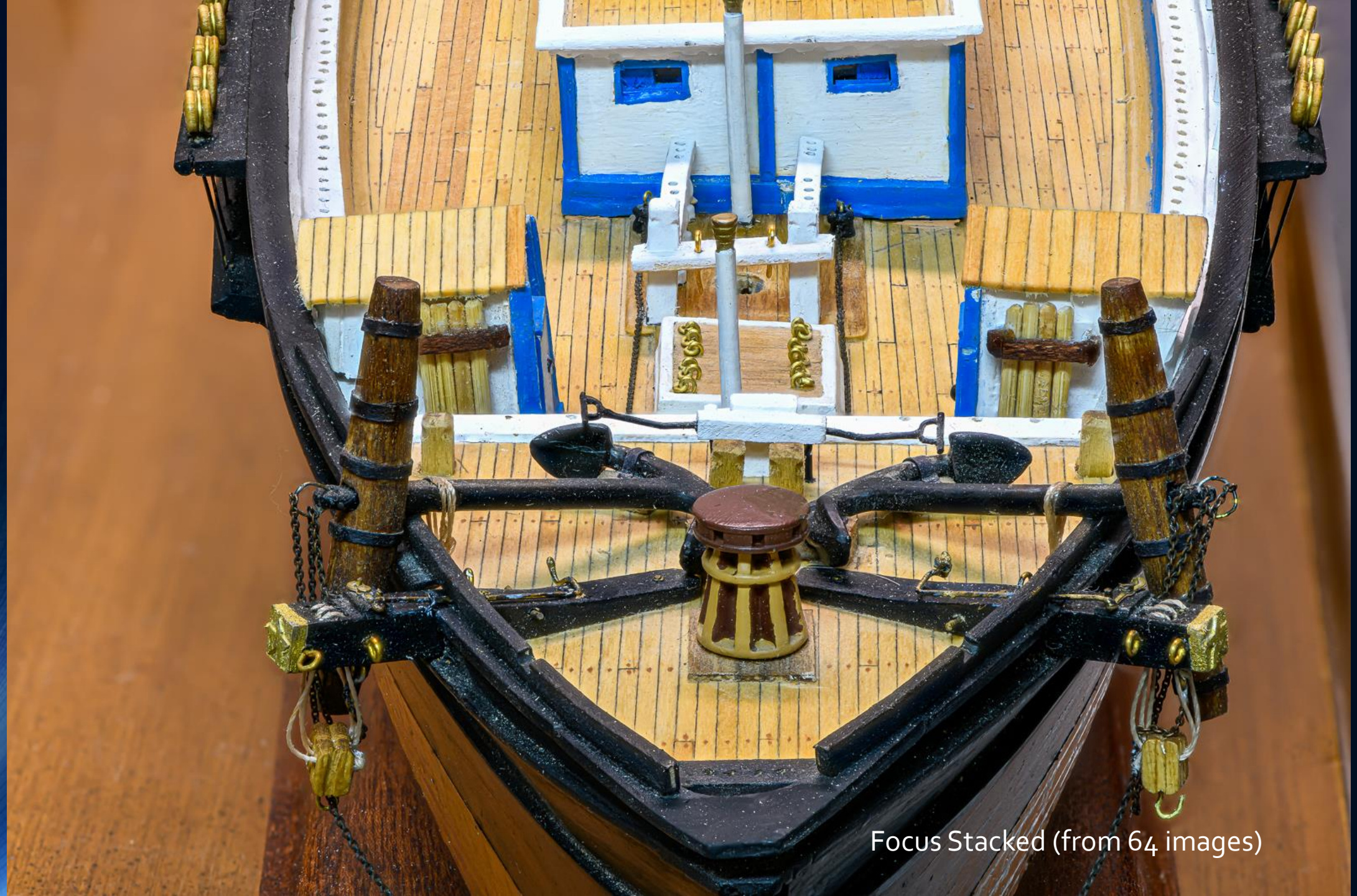
- The term "Depth of Field" or DoF is used to describe the parts of an image that are in acceptable sharpness.
- Best way to understand this is to look at some photos.



Note: All of the photographs in this presentation are from my own work.



F /11
The focus point was on the capstan.


Focus Stacked (from 64 images)

4 Main Factors Influencing DOF

- Choice of Camera Lens (i.e. Focal Length)
- Distance to Subject
- Camera Sensor Size
- Aperture Choice

Distance to Subject

So the more the Zoom, the shallower the DOF

Focal Length of a Lens

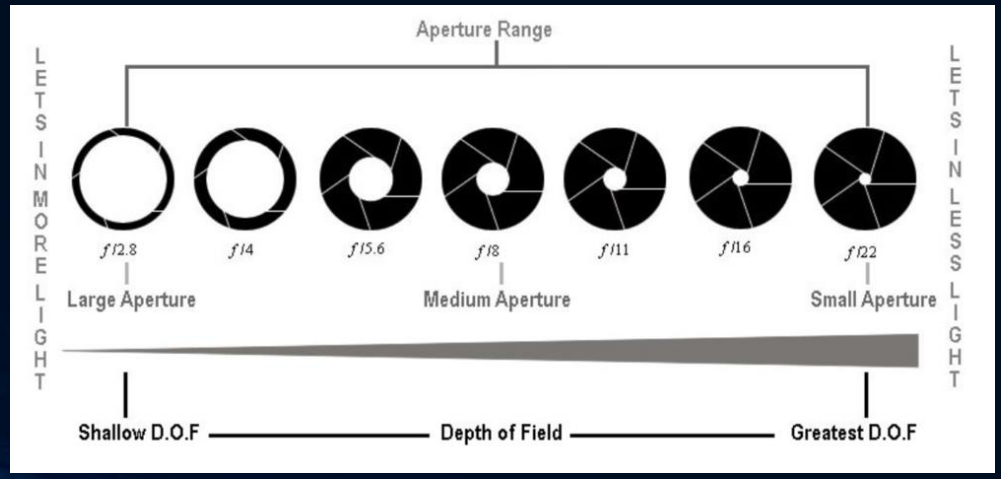
The closer the subject is to the camera lens, the shallower the DOF

Camera Sensor Size

The smaller the camera sensor, the greater the DOF

Camera Sensor Size

The smaller the aperture (i.e. higher f-stop values) the greater the DOF . *Narrow apertures (e.g. f/16) have deep DOFs; wide apertures (e.g. f/2.8), narrow DOFs.*



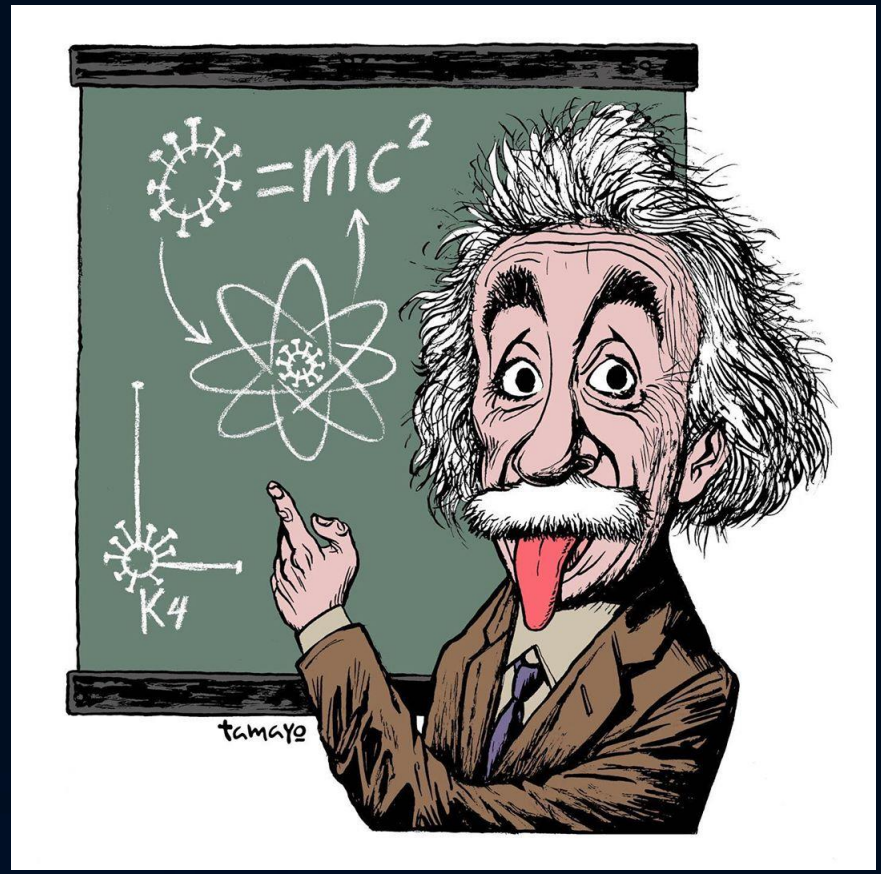
Small Aperture Limitation

- While small aperture is important for attaining a high DoF, there is a noticeable loss in image sharpness in photographs taken at very small apertures (>f/18).

- The sweet spot of a lens is defined as the aperture at which the lens produces its sharpest image (typically around f/5.6 - f/8).

- At the highest lens apertures, the focus become soft. This is due to problem called diffraction, which the physicists among you can look up on Google if you wish to learn more.

- The take home message is that to get a pleasing macro image, you need to choose an aperture setting that strikes a good balance between DoF and image sharpness. (F/11 – /f18)



Small Aperture Macro Photography vs. Focus Stacking

While it is possible to produce a fine single exposure macro photograph of a model ship or of any other Subject if one selects an appropriate lens, chooses optimal camera settings and uses a tripod, the the final image will never be razor sharp throughout the photo.

The only way around this limitation is through a focus blending technique called Focus Stacking.

Focus Stacking in a Nutshell

- It is a 2-step digital photography technique in which multiple images taken at different focus distances (Step 1) are combined in post processing (Step 2) to give a resulting image having a greater depth of field (DOF) than any of the individual source images.
- The sharpest parts of each of the component images are blended in software to make a single composite focus stacked image.

+

How to Focus Stack – Step # 1 : In Camera

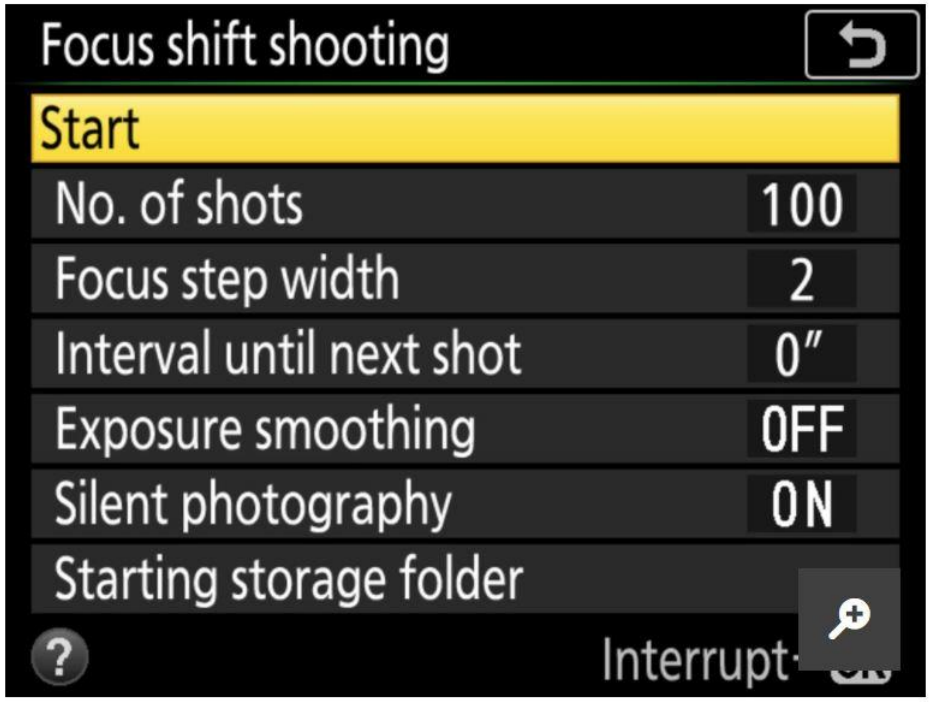
- Measures to minimize camera shake:
  - Tripod for best results & least work in post processing.
  - For DSLR, Mirror up (Mup, Live view, delayed shutter release)
  - Cable release or Remote
- Set your camera settings.
  - Exposure mode: Aperture priority (A) or Manual (M)
  - Close eyelid blind in Aperture priority
  - f/8 to f/11 best aperture settings (sweat spot)
  - VR off if camera is on a tripod
  - AF-S or AF-P lenses (Nikon)
  - Low ISO (where possible)
- Frame your shot .

Manual Focusing (for most camera's)

- Focus on the object closest to the lens & take first image.
- Manually adjust the focus to be further away (how much depends on the distance between the foreground and background & closeness of the subject to the lens). Take another shot.
- Repeat last step until you have enough incremental focused images to make the entire image sharp.
  - Macro ~10->30 images
  - Landscapes ~6-20 images
  - Microscopy ~15->60 images
- Manual focusing can be very difficult to get right.

Automated in Camera Focus Stacking (Advanced Cameras e.g. Nikon D850)

- Focus on the object closest to the lens .
- Select Focus stacking from camera's menu then the desired settings.
- Press "Start"
- Wait for camera to finish shooting

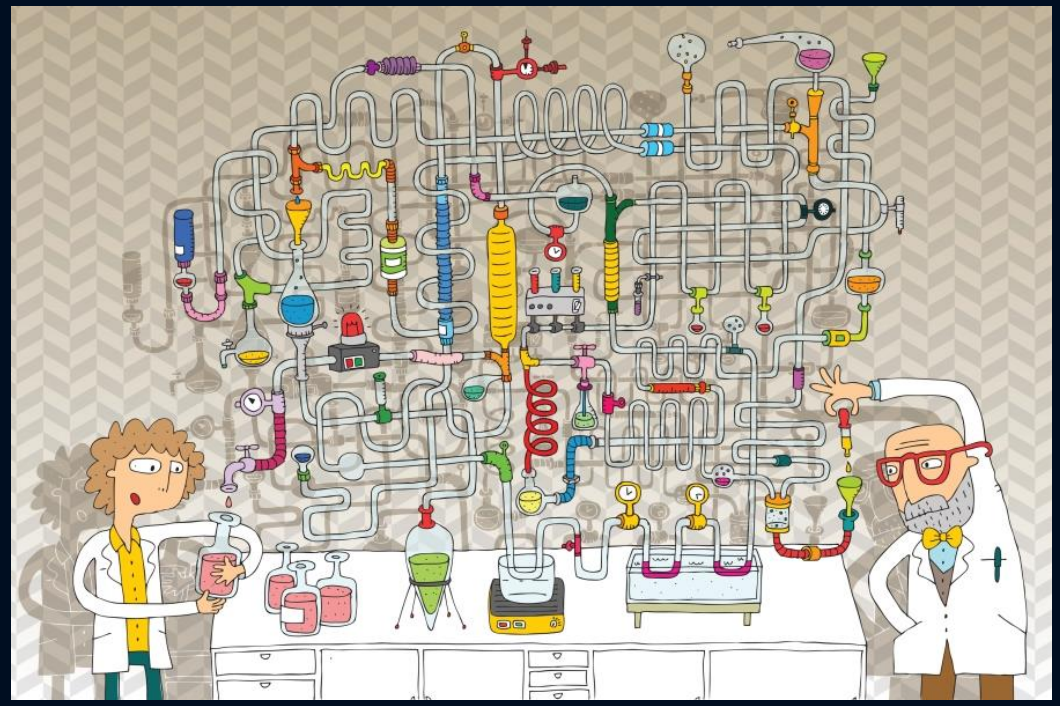


The Focus shift shooting menu on the D850 showing the various settings that can be adjusted.

- Some Olympus cameras can do everything in camera (capture & blending)

Step # 2 : Blending the sharpest parts from each image in Post-processing to make a single composite image

Photoshop ($14.50/m)



- Open the series of images as layers.
- Easy to export from Lightroom to PS
- (->Edit in ->Open as layer in PS)
- Edit -> Auto Align Layers
- Select all layers
- Edit -> Auto Blend Layers
  - Select Stacking Images
  - Check box for seamless tones & colours
  - Click "OK"
  - Use brush tool as necessary to fix "mistakes" (soft spots) on the individual layer masks (i.e. to paint the sharpest parts back").
  - Flatten Image (optional)
- Save the blended image (automatically saves to original directory in Lightroom)

My experience with PS: Slow, Lots of "mistakes", especially with close-up subjects, great for landscapes

Helicon Focus

- Step 1. Import the images into Helicon Focus
- Easy to export from Lightroom to HF (->File->Plugin extras ->Export to HF)
- Step 2. Choose 1 of 3 different stacking algorithms
- Step 3. Click Render
- Step 4. Manually retouch within Helicon Focus if necessary
- Step 5. Save (automatically saves to original directory in Lightroom)

- My experience with Helicon Focus
  - Much easier, much faster, often better than PS
  - Expensive, but worth it if you are really into focus –stacking (Lifetime Pro License $266 CAD)
  - Can tether whole process from camera and computer.

Advantages of Focus Stacking

- Offers unlimited DoF throughout the entire image.
  - Overcomes Dof & diffraction limitations
  - Still allows selective focus (main subject sharp, background bokeh)
- Landscape & macro photography benefit the most.
- Works with any lens that can be manually focused.
- Lenses can be set to optimal aperture for maximum sharpness, as opposed to having to deal with diffraction problems when shooting single exposure images at high aperture values (e.g. f/22).
- Easy to master if you have the right gear.
- Produces images that are unique,
- Fun to do.

Disadvantages of Focus Stacking

- More work & more time.
- More gear to carry (solid tripod)
- Not inexpensive
  - You will want a good camera and a good tripod
  - Specialized software for image blending
  - Powerful computer (fast & with lots of RAM)
- Not well suited for moving subjects or windy days
- If you are manually focusing through a scene, it is easy to mess up, especially if you are doing micro or macro photography.

Jared Fein

https://www.flickr.com/photos/sewerdoc/

Email: sewerdoc@gmail.com