High Dynamic Range (HDR) Imaging

HDR Imaging

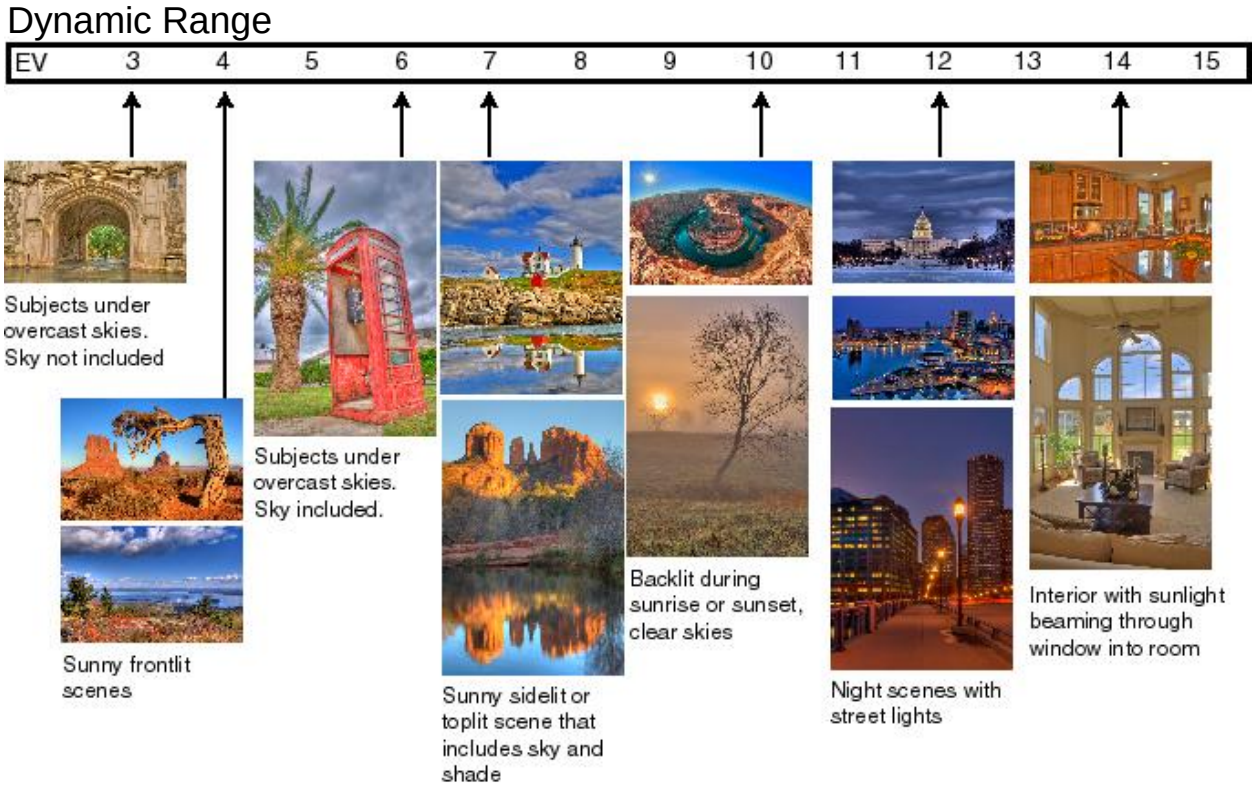
- HDR allows us to capture the full tonal range of an scene that exceeds the dynamic range of the camera by combining several images.
- The HDR image dynamic range can then be reduced to an LDR image that can be displayed or printed. The resulting LDR image is what we usually refer to as an HDR image.

- Bracket exposures to cover full brightness range of the scene
- Combine images so that all brightness levels are included (HDR)
- Reduce dynamic range so that image can be displayed or printed (LDR)

Scene Dynamic Range

Varies Based on Lighting

- Dynamic range is ratio of lightest to darkest brightness (luminance) in scene.
- Photographers think in terms of f-stops (Exposure Values - EV).



Dynamic Range
Limited Throughout the Process

- Dynamic range is ratio of lightest to darkest luminance (brightness) in scene.
- Photographers think in terms of f-stops (exposure values - EV).

Sunny Day	16-25 EV
Human Eye (long term adaptation)	20 EV
Human Eye (without adaptation)	14 EV
Negative Film	10-11 EV
Digital Camera (8 bit)	6-8+ EV
Digital Camera (16 bit RAW)	11-14+ EV
Computer Monitor	8-10 EV
Glossy Print	6-8 EV

HDR Image Examples

Photos by Ferrell McCollough

- HDR can look photorealistic or in your face hyper-realistic
- HDR software does not control how your image looks – you do
- Examples of HDR processed images
    - Extreme (hyper-realistic, surreal, HDR look
    - Painterly (somewhat exaggerated middle ground)
    - Natural (photorealistic)

Extreme - HDR Look

Aesthetics of LDR image with the “HDR look”

- Pronounced shadow and highlight detail
- Accentuated edge contrast and texture
- Highly saturated with saturation distortions
- Halos

Extreme

Painterly

Painterly

Natural

Natural

HDR Imaging End to End

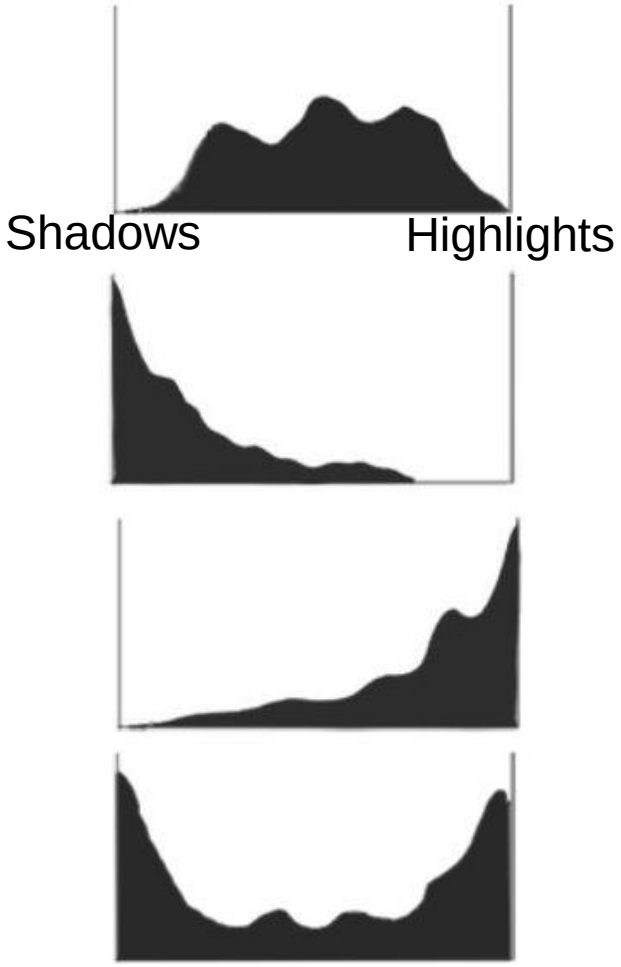
Bracket exposure to capture full tonal range of scene

In camera histograms can be used to determine needed exposure range Use overexposed and underexposed images to capture shadow and highlight detail. Use 1 or 2 f-stop increments. Overlap exposures

These images are merged into single HDR image which contains complete tonal range recorded at the true luminance levels

Tone-map HDR image to compress to LDR image that can be displayed and printed

Histogram
(Camera's Dynamic Range)



Normal scene that can be captured in single exposure

Underexposed – shadows blocked up and do not have detail

Overexposed - highlight are blowout and do not have detail

Dynamic range of scene exceeds cameras capabilities

Camera Setup

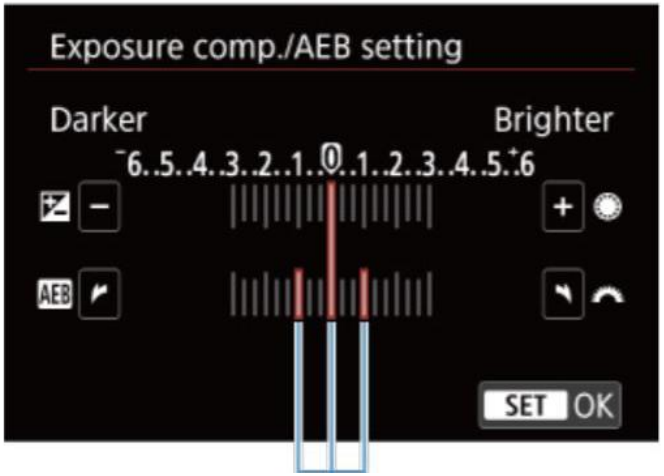
- To merge HDR images, you need images with constant
  - Size and rotation
  - Perspective
  - Focal point
  - Depth of field
  - Color temperature
  - In-camera processing (jpeg)
- To capture consistent images, ideally use
  - Tripod - can handhold in a pinch, but need steady hand for longer exposures
  - Cable release or self-timer and mirror lockup
  - Aperture priority mode
  - Manual focus
  - Fixed focal length
  - Fixed ISO
  - Shoot RAW
  - Vary shutter speed to change exposure

Capture

- Use camera meter and histogram to determine exposure range
- Most cameras have some form of auto exposure bracketing (AEB)
- Bracket exposures to capture full tonal range of scene
  - 1 or 2 EV increments work well
  - Common AEB range of +/- 2 EV will cover many situations, but extend as necessary
    - Add 4 stops - 3 exposures at 2 EV spacing or 5 at 1 EV spacing
    - Add 8 stops - 5 exposures at 2 EV or 7 at 1 EV spacing
    - Add 12 stops – 7 exposures at 2 EV spacing
  - Ghosting – caused by frame to frame image motion (wind, water, boat, car, person…)

Auto Exposure Bracketing

- Use camera's built in AEB capability. It's a great tool.
- Can shoot series of consecutive images at different exposures over a specific range of stops . Camera will vary shutter speed
- Can be combined with exposure compensation.
- Use continuous drive mode for rapid exposure sequence to
  - Maintain alignment
  - Provide consistent lighting
  - Reduce subject movement



Set exposure increment.
Can apply exposure compensation if needed

Techniques to Generate “HDR” Image

- There are several ways to extend dynamic range to achieve HDR image
- Single RAW image processed for shadows and highlights
- Stack the bracketed images in layers and mask to preserve tonal range
  - Photoshop or any photo editor that can work with layers
- Special HDR Software – To create true HDR image and tone-map output
  - Lightroom (Photo > Photo Merge > HDR)*
  - Photoshop (File > Automate > Merge to HDR Pro) *
  - Photomatix Pro (longtime standard)
  - Other 3rd party vendors

* Lightroom and Photoshop have very capable HDR processors. The original algorithms developed for the Lightroom (ACR) engine were actually designed to process and tone-map HDR images and retain that ability to process HDR images.

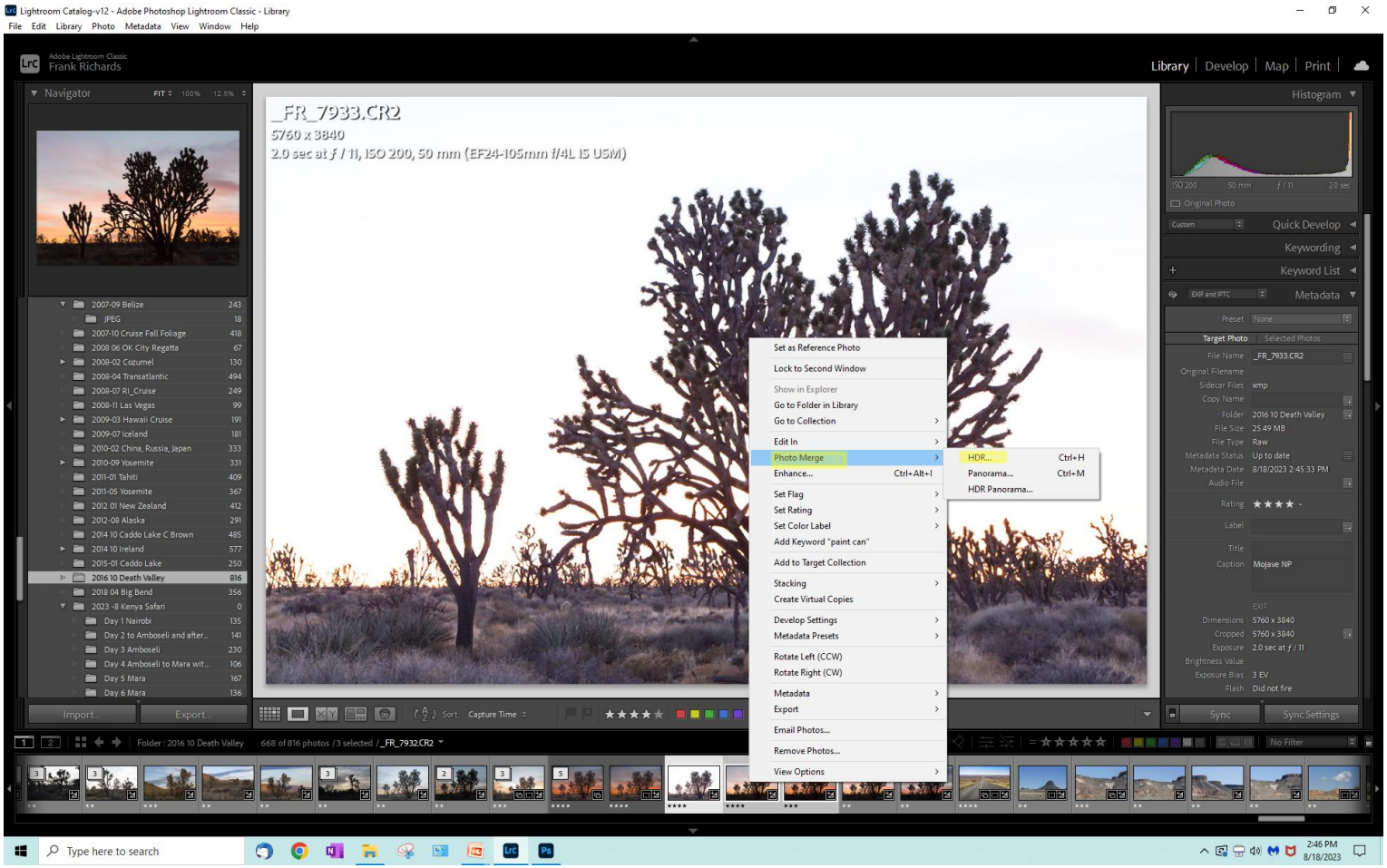
Processing

- These are the steps in constructing an HDR image and tone-mapping an LDR image for display or print
- Do not adjust (process) RAW images prior to HDR processing
- Size, align and merge images into an HDR image
  - Layers
  - HDR algorithm
- Tone-map - reduce dynamic range for LDR output
  - Exposure blending via masking
  - Tone mapping – HDR software or photo editing software
- Post process LDR image in photo editing software
- Size and sharpen to display or print

Mojave National Preserve
Lightroom HDR

Highlight Selected Images

Photo Merge to HDR

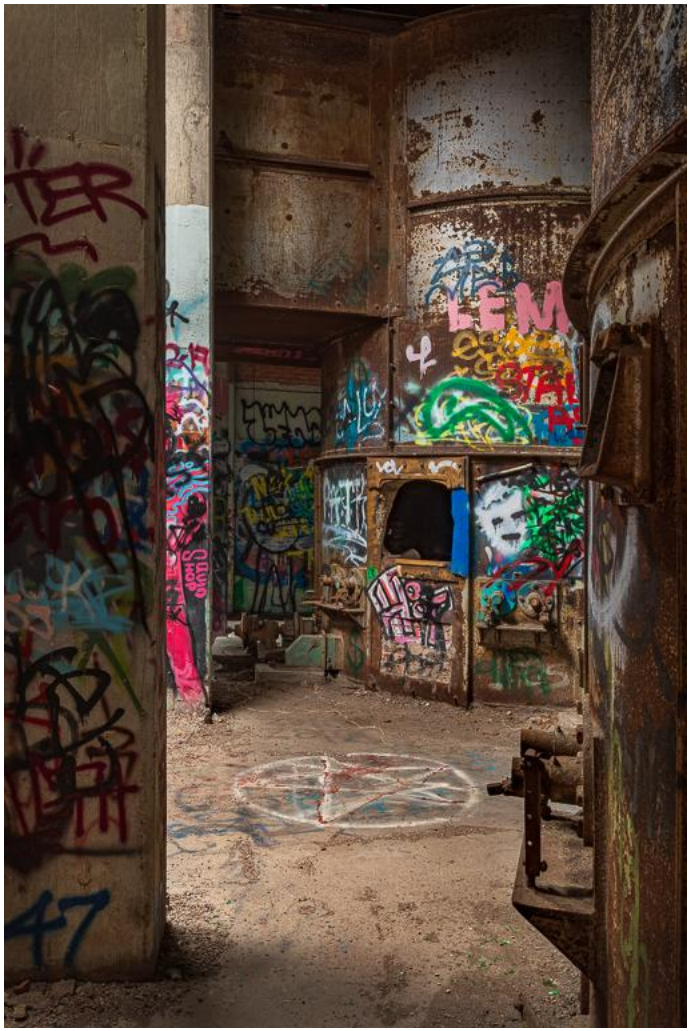


Process Merged Images

Finish Processing HDR as dng Image

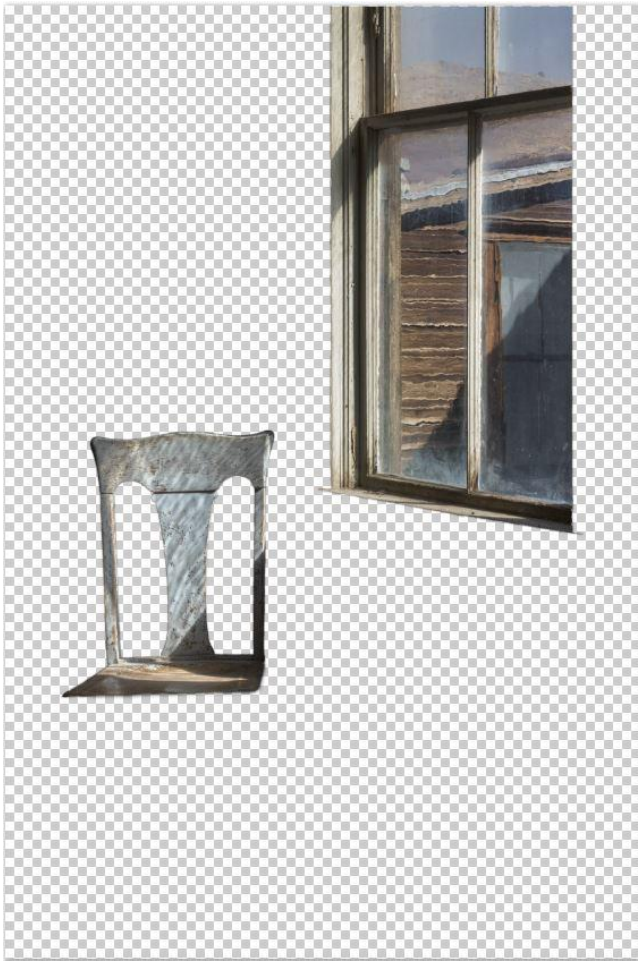
Expanding Camera's Capabilities 3
Focus Stacking to Increase DOF
Nov 14

Echo Lake
Lightroom Single Image Processing



Bodie Historical Park
Exposure Blending in PS (+3 EV)

Bodie Historical Park
Exposure Blending in PS (0 EV)



Bodie Historical Park
Exposure Blending in PS