Techniques to Expand the Capability of Your Camera

- **High Dynamic Range - Mar 2**
  - **Combine images with range of exposures to increase dynamic range**

- Panorama - Mar 16
  - Stitch together adjacent scenes to expand the field of view

- Focus Stacking - Apr 6
  - Combine images taken at diferent focal distances to increase depth of field

High Dynamic Range (HDR) Imaging

What Is HDR Imaging?

- HDR allows us to capture the full shadows to highlights tonal range of an image that exceeds the dynamic range of the camera.

- The HDR image dynamic range can then be reduced to a Low Dynamic Range (LDR) image that can be displayed or printed. The resulting LDR image is what we often refer to as an HDR image.

- Bracket exposures to provide detail over the full brightness range of the scene from very dark shadows to very bright highlights.

- Combine images so that all brightness levels are represented (HDR)

- Post process to reduce dynamic range so that image can be displayed or printed (LDR)

The HDR Look

Aesthetics of LDR image with the "HDR look"

- Hyper-realistic - pronounced shadow and highlight detail
- Accentuated edge contrast and texture
- Highly saturated with saturation distortions
- Halos

HDR Image Examples

Photos by Ferrell McCollough

- HDR software does not control how your image looks – you do
- HDR can look natural and doesn't have to be in your face
- A range of looks
  - Extreme (hyper realistic, surreal)
  - Painterly (middle ground)
  - Natural (photo realistic)
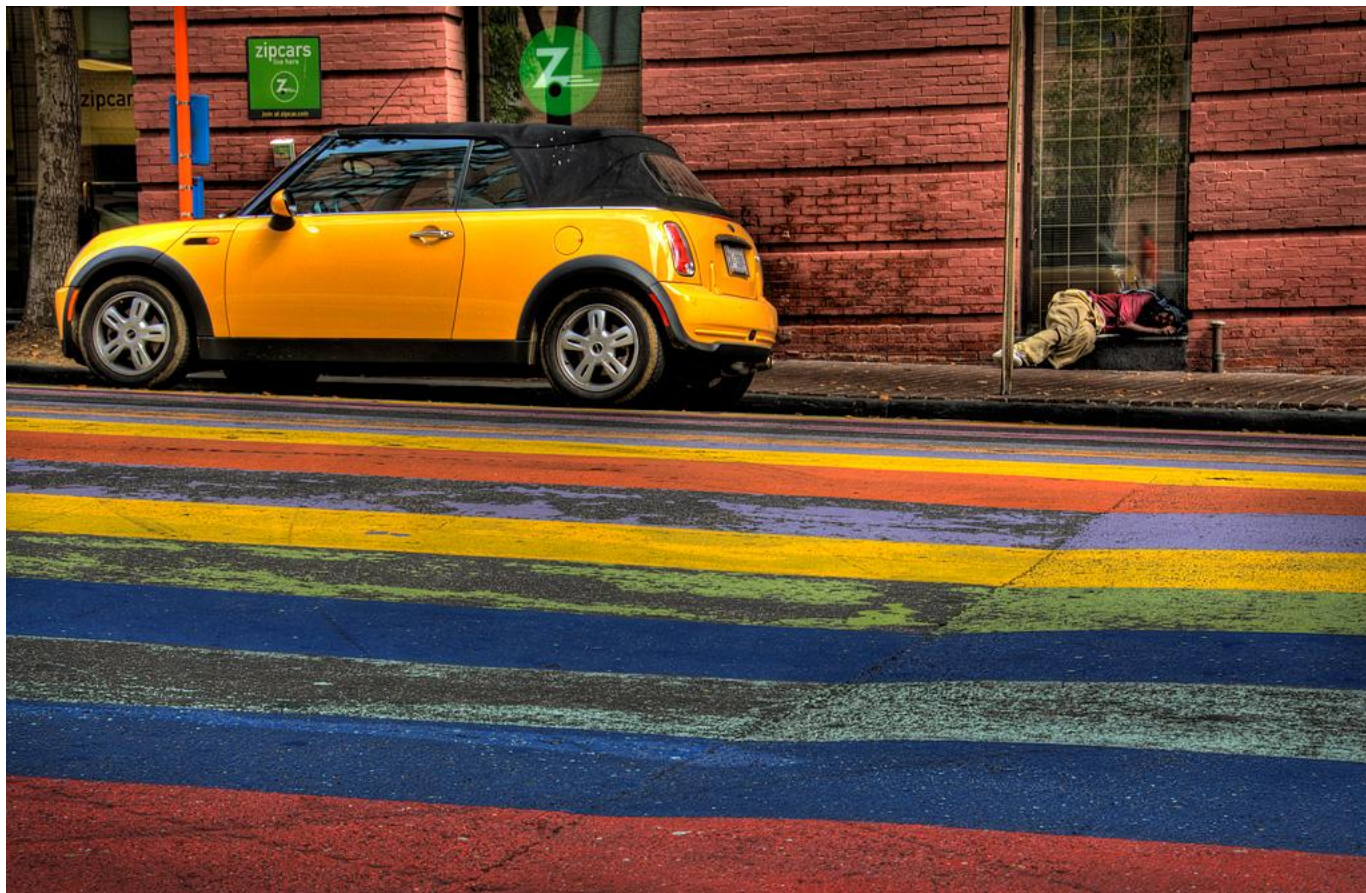
Extreme

Extreme

Extreme
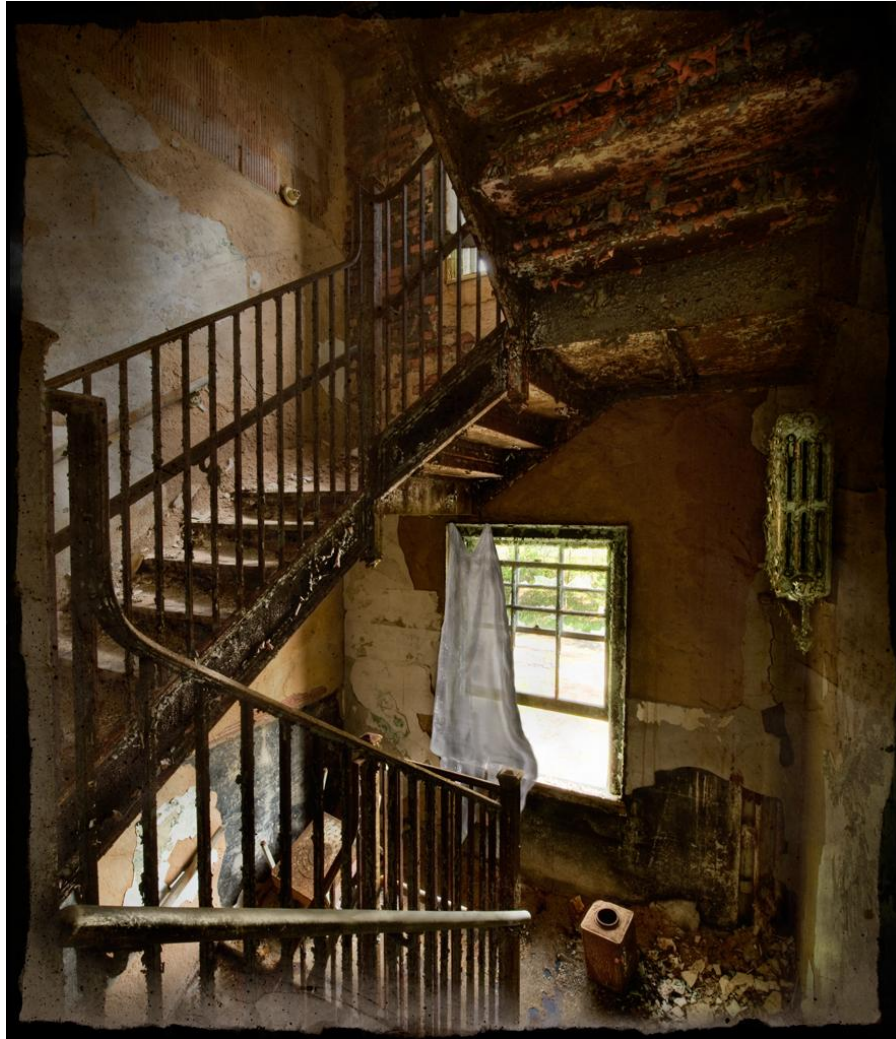
Extreme

Painterly

Painterly

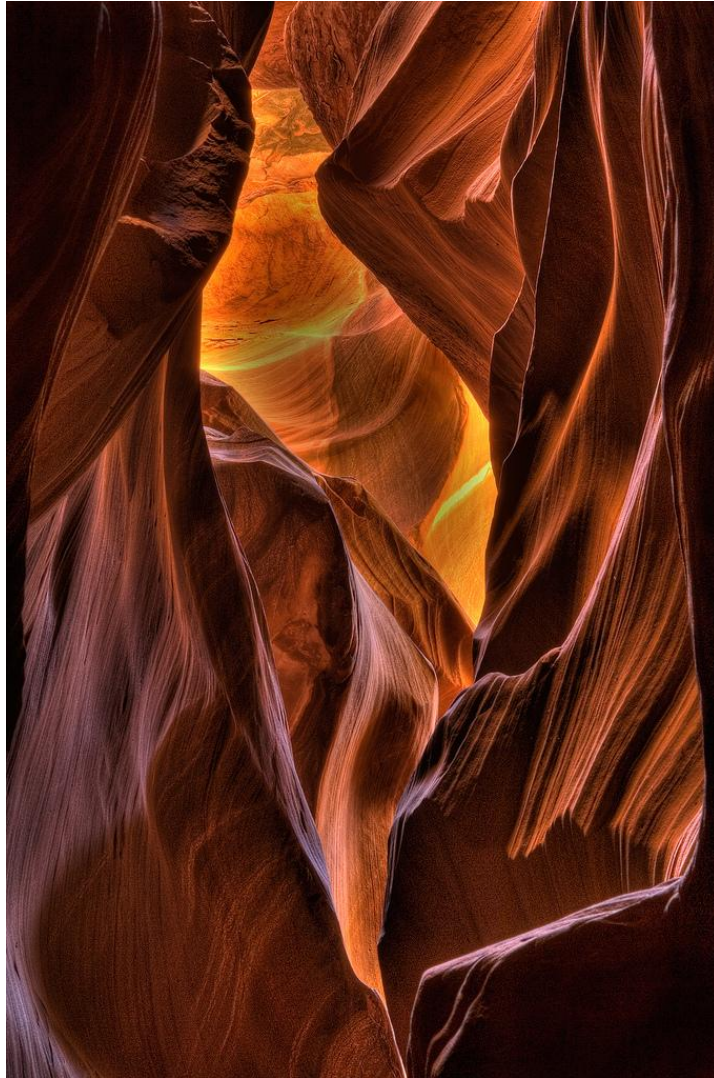# Painterly

Painterly

Natural
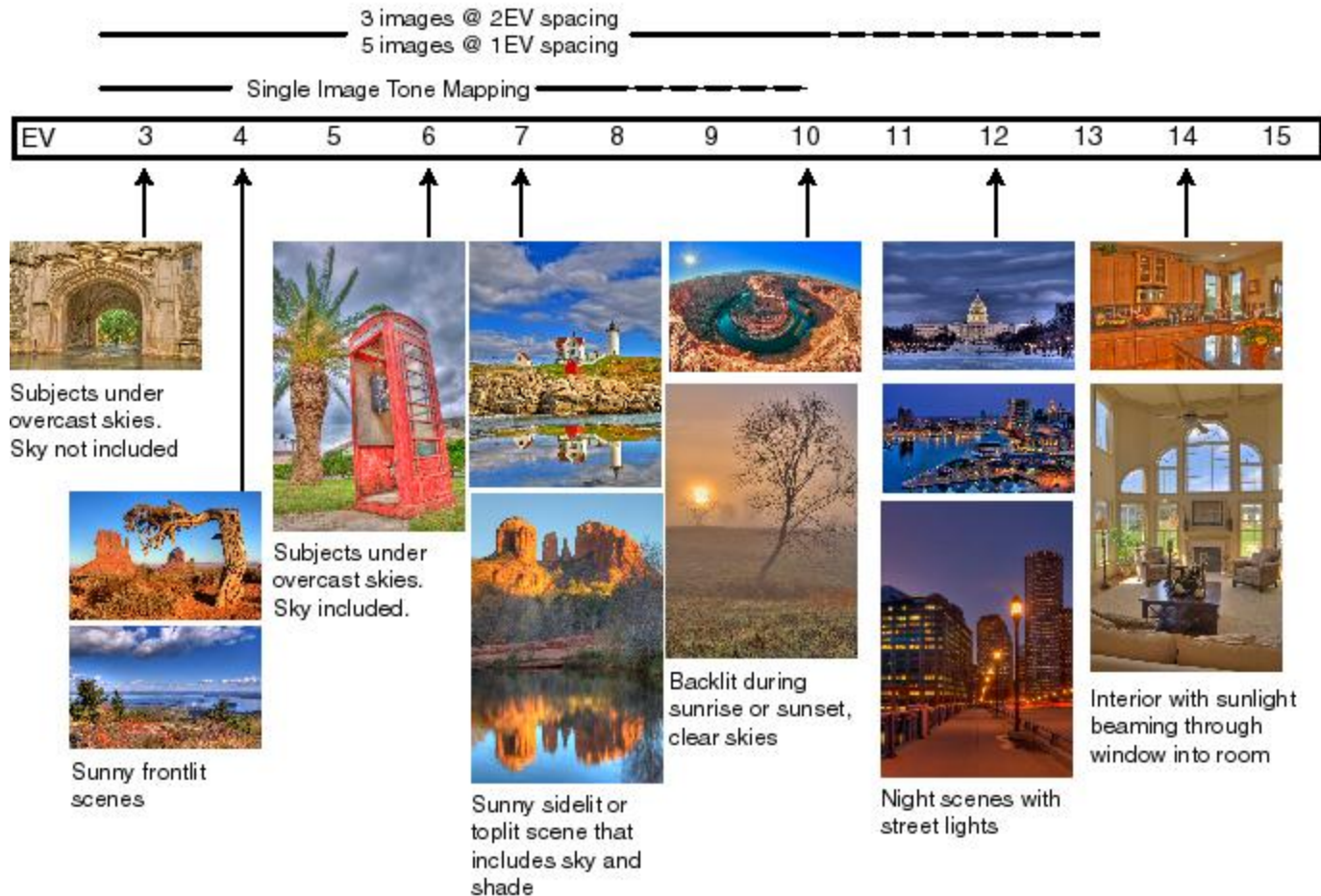
Natural

Natural

Natural

Dynamic Range

- 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
Digital Camera (16 bit RAW)	12-14 EV
Negative Film	10-11 EV
Computer Monitor	9 EV
Glossy Print	6-8 EV
Digital Camera (8 bit)	6-8 EV
Matte Print	5-6 EV
HDR	30+ EV

Dynamic Range

* Graphic by Ferrell McCollough

HDR Imaging Process

Bracket exposure to capture full tonal range

In camera histograms can be used to
    determine needed exposure range.

Images are merged into single HDR image
    Sized, rotated and registered
    Contain complete tonal range recorded
    at the true luminance levels

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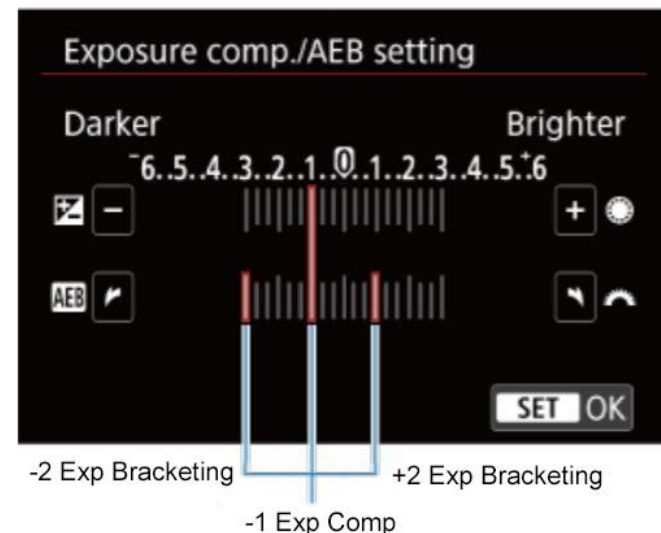   image that can be displayed and printed

Capture

- Key to good HDR image is not to take too few or too many images
  - Too few images leaves gaps in tonal range
  - Too many images ups the chance of excessive digital noise and chromatic aberrations
- Use camera meter and histogram to determine exposure range needed
- Bracket exposures to capture full tonal range of scene
  - Sweet spot is 1 or 2 f-stop increments
  - Provides 4 to 6 stops of tonal overlap
  - Can extend dynamic range up to 4 stops with 3 exposures
  - Most digital cameras have some form of Auto Exposure Bracketing (AEB)
  - Common AEB range of +/- 2 EV will cover many situations
- Ghosting – frame to frame image motion (wind, water, boat, car, person…)

Camera Setup

- To merge HDR images, you need images with constant
  - Size and rotation
  - Perspective
  - Focal point
  - Depth of field
  - Color
  - In camera processing
- To capture consistent images, 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 low ISO
  - Vary shutter speed to change exposure
  - Set AWB or change exposure manually
  - Shoot 16-bit RAW

Auto Exposure Bracketing

- Most digital cameras have AEB mode. It's a great tool.
- Can shoot series of consecutive images at different exposures over a specific range of stops . Good starting place 3 exposures at 2EV spacing or 5 exposures at 1 EV spacing.
- Can be combined with exposure compensation.
- Use auto-drive mode for rapid exposure sequence to
  - Maintain alignment
  - Provide consistent lighting
  - Reduce subject movement
- Can also change exposures by manually adjusting shutter speed

Processing

- Steps in constructing an HDR image and preparing LDR image for display or print
- Do not adjust images prior to HDR processing
- Size, align and merge images
  - Layers
  - HDR algorithm
- Tone map - reduce dynamic range
  - 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

Techniques to Generate "HDR" Image

- There are many ways to extend dynamic range to achieve HDR image
- Single RAW image processed for shadows and highlights, layer and mask
  - Photoshop or any photo editor that can work with layers
- Exposure Blending – To manually combine images
  - Stack the bracketed images in layers and mask to preserve tonal range
  - Photoshop or any photo editor that can work with layers
- HDR Software – To create true HDR image
  - Lightroom (Photo > Photo Merge > HDR)*
  - Photoshop (File > Automate > Merge to HDR Pro) *
  - Photomatix Pro (longtime standard)
  - Aurora HDR by Skylum (Tim Grey's goto favorite)
  - Nik HDR Efex Pro (good reviews and a lot of us have it)

* The original algorithms developed for the Lightroom (ACR) engine were actually designed to process HDR images and retain the ability to process HDR images.

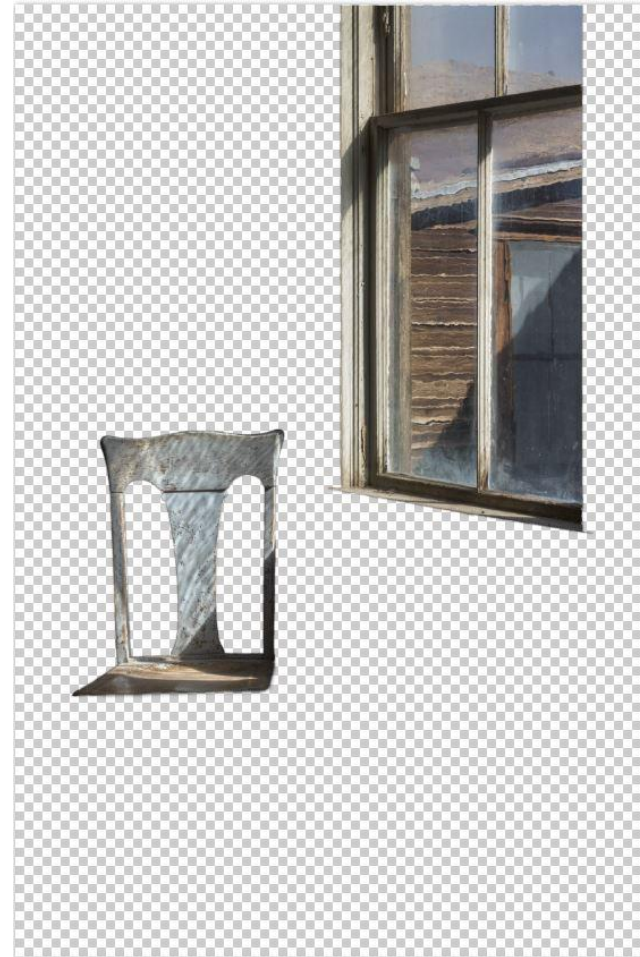# Mojave National Preserve
Lightroom HDR

+3

0

-1

Final

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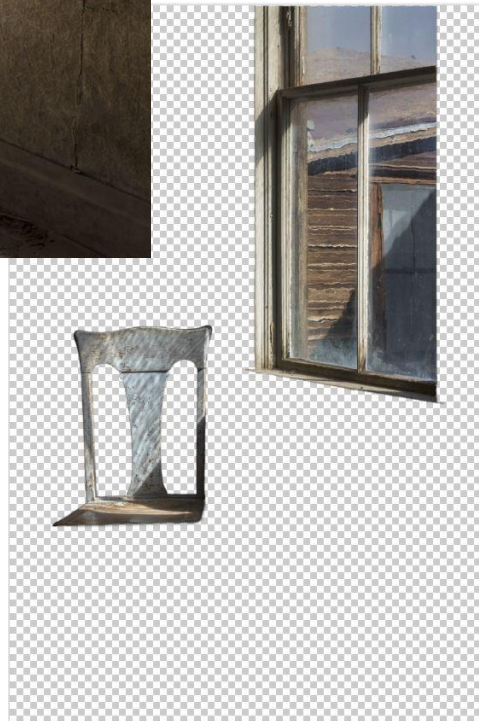# Exposure Blending in PS (+3 EV)

Bodie Historical Park
Exposure Blending in PS (0 EV)

Bodie Historical Park
Exposure Blending in PS

Echo Lake
Lightroom Processing Example

Resources

- Complete Guide to High Dynamic Range Digital Photography – Ferrell McCollough
  - Well balanced overview. 2008, out of print, but still relevant.
- Creating HDR Photos – Harold Davis
  - Well written introduction. 2012, still available
- The HDRI Handbook – Christian Bloch
  - Encyclopedic deep dive into HDR. 2007 2nd edition

- Beginner's Guide to HDR - https://digital-photography-school.com/setting-up-your-digital-camera-for-hdr-shooting/
- Ferrell McCollough website – https://beforethecoffee.com/
- Photomatix and HDR Photography - https://www.hdrsoft.com/resources/
- Best HDR Software - https://www.photoworkout.com/best-hdr-software-business/