High Dynamic Range (HDR) Photography

Upcoming Meetings

- February: John Ellert, Non-representational Photography
- March: Mark Bogner, Safe Weather Photography
- April: Rick Hines, Cave Photography
- May: Jim Griggs, Seeing the Extraordinary in the Ordinary Photo Walk
- June: Photo Walk, location undecided
- July: John Ellert and Jim Griggs, Tanzania Photo Safari
- August: Gregg Friesen and Max Voran, Bird Photography
- September: Photo Walk, location undecided
- October: Denny Lammers, Peru Vacation Pictures

What is Dynamic Range

- The ratio between the minimum and maximum values of a physical measurement.
- In photography, this is the ratio between the darkest part of a photograph and the brightest
- Not uncommon for the dynamic range of a scene to 100,000:1

Source: http://www.hdrsoft.com/resources/dri.html#dr

Dynamic Range: Eye vs. Camera

- The human eye has a very high dynamic range (approximately 10,000:1), however we can't always use the entire range at once.
- We can see stars at night and we can see detail in bright skies during the day
- We have "selective vision", what we look at we see
- Dynamic range of the eye estimated at ~24 'stops' but we will always see contrast different than a camera (see point above).
- You won't hear someone say "I cannot see this landscape because it exceeds the maximum dynamic range that my eyes can capture"

Source: http://www.luminous-landscape.com/columns/eye-camera.shtml

Dynamic Range: Eye vs. Camera

- Cameras have limited dynamic range compared to the human eye. Somewhere between 10-14 stops depending on the camera and the A/D converter (most cameras currently use 10-14 bit A/D converter, 16 bit converters may reach 16 stops of dynamic range).

- Cameras can't "selectively see" like our eyes do, they just record all the scene equally (can't record the light from the shadows separately from the light from the highlights).

Dynamic Range: ISO

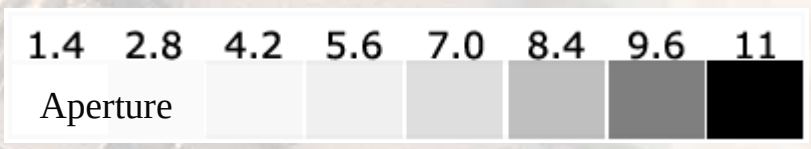
Your ISO also has an effect on the dynamic range of your camera; as you increase ISO, you decrease dynamic range.

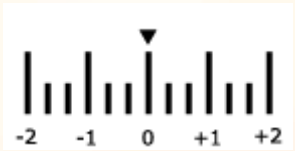
ISO	Dynamic Range
100	~12 stops
200	~12 stops
400	~11 stops
800	~11 stops
1600	~10 stops
3200	~9 stops

Canon EOS 1D mark 11 from: http://en.wikipedia.org/wiki/High_dynamic_range_imaging

What is this "Stop" you keep talking about?

- If you take a given amount of light and double it, you are moving up one stop, if you cut the amount of light in half then you have gone down a stop.
- A stop isn't a specific amount of light, instead it is a measure of difference between the amount of light
- You can accomplish this by adjusting the aperture, shutter speed, or ISO setting





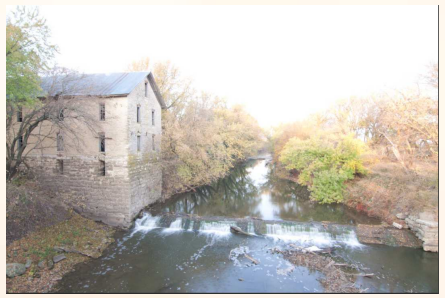
Good Exposure Reading

-1 Stop Under Exposed

Source: http://cameradojo.com/2010/07/04/understanding-light-stops/

How do differences in Dynamic Range of eye and camera impact your photography?

We See



The Camera can only record these

How can you deal with this?

- Use a split neutral density filter
- Combine Exposures
  - Shoot one exposure for the darkest part of the photo, shoot one for the brightest
  - "digital" split neutral density filters
  - Can work well when dark and light parts of photo are easily separated (e.g. foreground and sky)
- **Use HDR software to achieve a dynamic range closer to what the eye sees**

What is HDR?

- HDR is a range of techniques geared toward representing more contrast in pictures.
- Non-HDR cameras take pictures at a single exposure level with a limited contrast range. This results in the loss of detail in bright or dark areas of a picture.
- HDR compensates for this loss of detail by taking multiple pictures at different exposure levels and intelligently stitching them together so that we get a picture that is representative in both dark and bright areas.

Source: http://en.wikipedia.org/wiki/High_dynamic_range_image

HDR is not a new concept

- Combining exposures to extend dynamic range is not a new idea. First pioneered by Gustave Le Gray in the 1850's
- HDR was developed in the 1930's and 1940's by Charles Wyckoff. Used to show detail of nuclear explosions

From:http://en.wikipedia.org/wiki/High_dynamic_range_imaging

HDR Images and Tone Mapped

HDR utilizes multiple exposures covering a wide dynamic range which are then "tone mapped" for the final image. HDR Tone Mapping is composed of two steps.

- The first step creates an HDR image from differently exposed photos. This HDR image can not be displayed correctly on a Low Dynamic Range monitor.
- The second step in Tone Mapping consists of scaling each pixel of the HDR image, so that details in highlights and shadows show correctly on monitors and prints (those details are available in the HDR image but not directly visible in both highlights and shadows because of the low dynamic range of the display).

Source: http://www.hdrsoft.com/support/faq_photomatix.html#differences

HDR and Exposure Fusion

- You can also use bracketed exposures and have HDR software "fuse" them into one exposure.
- Exposure Fusion is a fairly new concept that is the process of creating a low dynamic range (LDR) image from a series of bracketed exposures.
- Exposure Fusion takes the best bits from each image in the sequence and seamlessly combines them to create a final 'Fused' image.
- Or more technically, the fusing process assigns weights to the pixels of each image in the sequence according to luminosity, saturation and contrast, then depending on these weights includes or excludes them from the final image.

Exposure Fusion or HDR Tone Mapping

	Pros	Cons
HDR Tone Mapping	■ HDR image file can be saved, enabling to tone map the same image with other methods or other settings. ■ Ability to preserve details in shadows and highlights even when the dynamic range is particularly high· High degree of parametrization, i.e. tone mapping methods can offer many settings to adapt image to one's liking	■ When source images are noisy, tone mapping may further increase noise. ■ In spite of the availability of settings, controlling the tone mapping operation is not easy.
Exposure Fusion	■ Fusing the images has the effect of reducing noise ■ Fused image is close to the source images giving it a "natural" look ■ Easy-to-understand process, no or few parameter setting	■ Lack of local contrast when dynamic range is high, "flat-looking" results in some cases ■ Memory required for Exposure Fusion increases with the number of source images and bit-depth.

Source: http://www.hdrsoft.com/support/faq_photomatix.html#workflow

Shooting for HDR

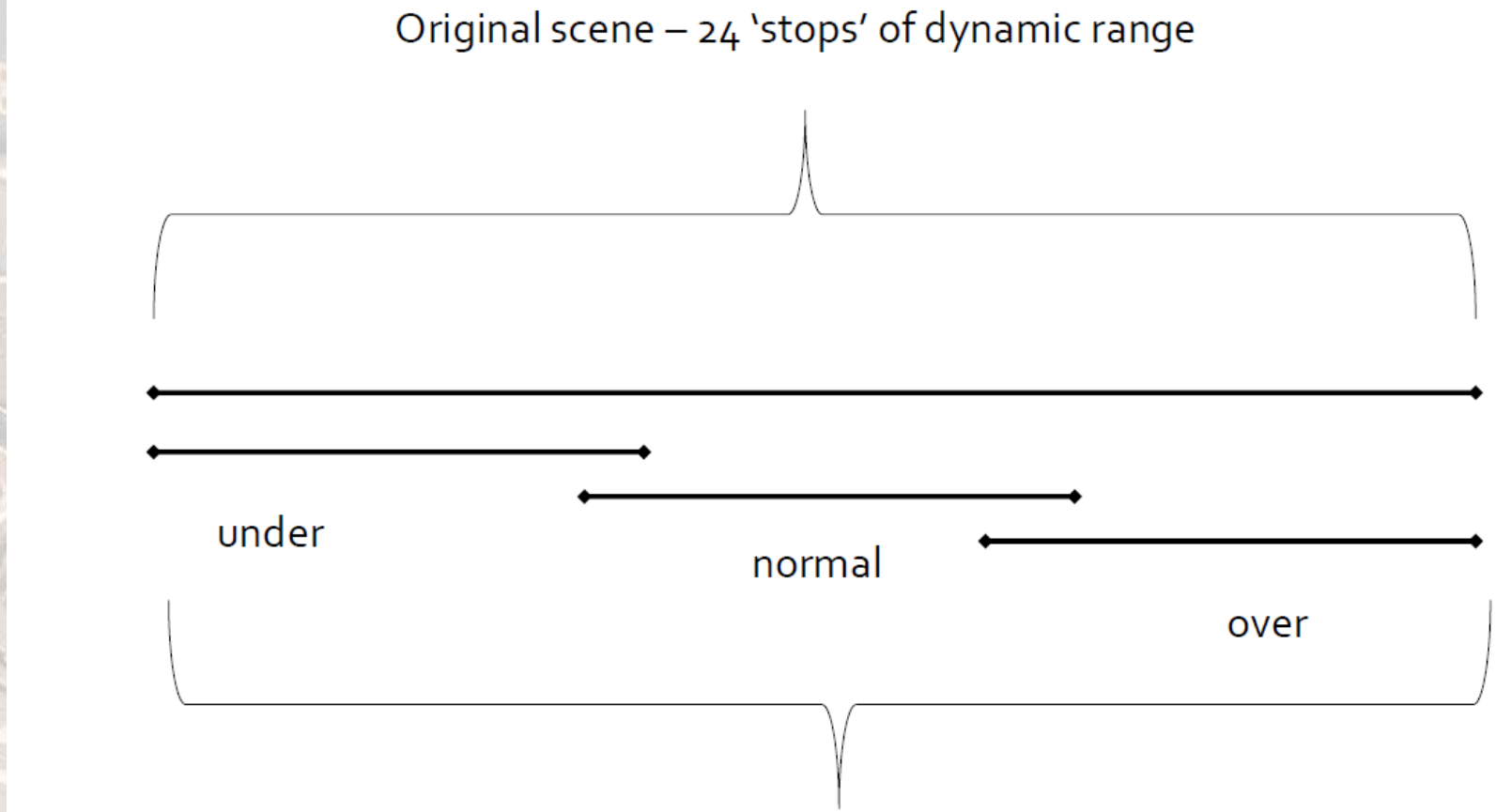
- Need to record a series of exposures spanning the dynamic range you want to capture, i.e. bracket your exposures.
- This can be anywhere from 2-9 exposures. Five exposures will almost always span the dynamic range of your scene.
- I use 3 exposures.

Bracketing Exposures

- AEB (auto exposure bracketing): camera can be set to automatically record a series of exposures from a range you set. Typically this will be 2 to 9 exposures though some cameras can do many more.
- Exposure compensation feature: Exposures can be bracketed by using “plus minus” button.
- Manual Mode: Simply change camera settings to bracket exposures

Whatever method you use, vary shutter speed so that depth of field is not altered.

Bracketing Exposures: Example



HDR Technique

- Shooting HDR from a tripod is best (I have successfully done them handheld, but a tripod is going to give you the best results).
- Still subjects are much easier to deal with (i.e. no wind!).
  - You can deal with some subject movement when processing the HDR
- RAW files will give you more data to work with, can reduce banding and other artifacts

Bracketed Exposures

Result

Software

- Photomatix (http://www.hdrsoft.com/)
- Nik HDR Efex Pro (http://www.niksoftware.com)
- Adobe Photoshop
- HDR Darkroom (http://www.everimaging.com/)
- HDR Express (http://www.unifiedcolor.com)
- Picturenaut (http://www.hdrlabs.com/picturenaut)
- FDRTools Basic (http://www.fdrtools.com)
- Essential HDR community Edition (http://www.imagingluminary.com)

Find the one you like and works best for **you**

Resouces

- http://www.cambridgeincolour.com/tutorials/dynamic-range.htm
- http://en.wikipedia.org/wiki/High_dynamic_range_imaging
- http://www.luminouslandscape.com/columns/eye-camera.shtml
- http://www.hdrsoft.com/resources/dri.html#dr
- http://www.pixiq.com/article/hdr-photography-how-to
- http://visualphotoguide.com/taking-high-dynamic-range-hdr-photos/
- http://thehdrimage.com/?page_id=25
- http://www.stuckincustoms.com/hdr-tutorial/
- http://www.dpreview.com/learn/?%2FGuides%2FThe_art_of_HDR_Photography_part_1_01.htm
- http://www.picturecorrect.com/tips/hdr-photography-with-a-point-and-shoot-camera/

Workflow Demo