Intro to High Dynamic Range Photography

Why do I need to know about HDR?

- **Dynamic Range**: the range between the brightest and darkest parts of the scene.
- **Human Eyes** constantly adjust to see almost twice the dynamic range of current digital cameras;
- **Cameras and Printers** have limited dynamic range reproduction;
- **Exposure of Digital** is different than of **Negative** film (**Digital** needs exposure for the highlights)

Who can do HDR imaging, and what is needed?

- **A Photographer That Knows** – "**Auto Exposure Bracketing**" (**AEB**), "**Histograms**" & "**Profiles**";
- **The Computer** – **2GHz** with at least **4GB** of **RAM** and lots of storage (**1TB** or more);
- **Calibrated** monitor for consistent colour reproduction (**Spyder 5** colorimeter ~**$180**);
- **HDR** software & techniques – see "**how do I create hdr images**" below…

When is HDR best used?

- **Static** scenes with no moving objects (to avoid "ghosting" of objects in scene);
- **Indoor** shot with outdoors visible through window;
- **Large** dynamic range scenes (Side-lit buildings with direct sun and shade);
- **Landscapes** with jagged horizons where graduated **Neutral Density** filters would not work.

What do I need to know about HDR capture?

- **Stability** of camera is essential, tripod, remote release or self-timer, mirror lock-up all help;
- **Use of Aperture Priority** required (keeps depth of field constant);
- <u>**Manual Focus**</u> to prevent **Auto Focus** from shifting during bracketed exposures;
- **AEB 3** raw exposures, process into **3 16**-bit tiff's (optional), merge into **1 HDR**, then "tone map" or "exposure fusion" for final file, save as **16**-bit tiff. (**Exposure Fusion** reduces noise and is subtle)

How do I create HDR images? (See "**Intro HDR – Workflow Images Handout**")

- **NEWS FLASH!** Many cameras now do "**HDR'ish**" captures as a shooting mode **IN CAMERA!**
- **Single** raw file multiple processing into **16**-bit tiff's, then blended in **Photoshop Elements**;
- **Dual Exposure** blending in **Photoshop Elements**;
- **Bracket**, processed and "**merge to HDR**" in **CS6**, or "**Photo>Photo Merge – HDR…**" in **Lightroom**;
- **Bracket**, processed and merged in **Photomatix Pro 6.0** (by hdrsoft.com) **$39-$119** depending on version of **Photomatix**, or "**Aurora HDR 2019**" by **Skylum** software (formerly **MacPhun**);
- <u>**Exposure Fusion**</u> or <u>**Tone Mapping via Tone Compressor**</u> or <u>**Tone Mapping via Details Enhancer**</u>;
  - **Tone Mapping - Global Operator "Tone Compressor"** is **Faster**;
  - **Tone Mapping - Local Operator "Details Enhancer"** is more **Realistic**;
- "**Aurora HDR 2019**" by skylum.com – developed with **Trey Ratcliff** (HDR Guru)
- "**HDR Photography: From Snapshots to Great Shots**", **Tim Cooper**, ISBN - 10: 0134180283

Homework: Week 1 Auto Exposure Bracketing

	-2 EV
	0 EV
	+2 EV

Histograms Explained

The Histogram is the best way to confirm that your image has been exposed/processed properly. They describe image brightness.

After the sensors' pixels record the light, the onboard image processor calculates a graph of the exposure. This graphical representation of the pixels tones vs amounts is what is called a "Histogram".

The various tones that were captured are represented along the Bottom Axis. The left starts with the darkest tones moving to the right for the brightest tones. Hence the phrase "Left to Right, Dark to Light".

The vertical axis is simply the amount of each of the tones recorded.

ACTIVITY:
Below are three images, and below them a Histogram. Which of the 3 images does the Histogram represent?
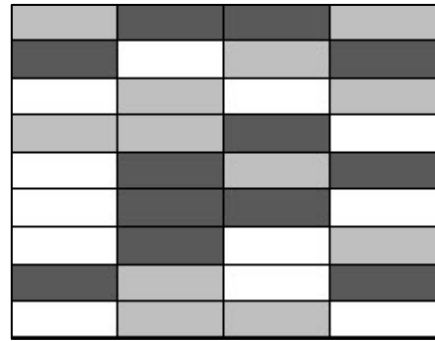
HINT: Count the tones, count the amount.
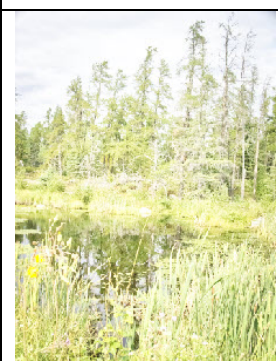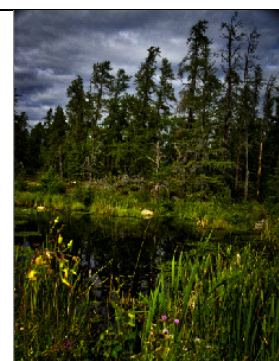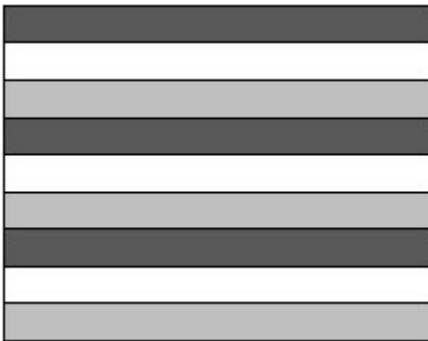

Image 1.

Image 2.

Image 3.

To ensure you get the best exposure/processing possible, always check your Histogram.

Over Exposed		Under Exposed	
	Pixels are distributed along the Histogram based on their Brightness value. Pixels stacked up on the very right indicate possible overexposure…		Pixels stacked up on the left of a very dark image indicate possible underexposure…

Since Images 1,2 & 3 each have the same *amount* of the three tones, all are correct!
The Histogram is about *how much* of each tones are present, not *where* they are located.

High Dynamic Range Workflow Images Handout

Instructor: Roger Buchanan   Notes Available at: www.thenerdworks.com

Start with Three Bracketed Images (either RAW or JPEG. RAW is best!) at -2EV, 0EV and +2EV

-    2 EV   0 EV   + 2EV

Process all files into 16bit TIFF files

-    2 EV tiff   0 EV tiff   + 2 EV tiff

Use Photomatix Pro to merge the three 16-bit tiff files into ONE HDR file

Note: Because of the extremely high bit depth of the HDR image it will not display in a very attractive manner. It needs to be processed before your monitor can display it, or your printer produces it!

With the HDR file loaded, process with one of two methods

NOTE: with either of these two methods you will need to try many different option settings for the various sliders before you attain the look that you find to be satisfactory.

"Exposure Fusion" Natural   **"Tone Mapping" Options**

Photomatix Pro 5.0 (by hdrsoft.com) $39-$119 depending on version of Photomatix (Either "Essentials", "Pro" or "Pro Plus Bundle")

Mac users take note! "Aurora HDR" by MacPhun.com – developed by Trey Ratcliff (HDR Guru)

Tone Mapping

Exposure Fusion

What are the differences between Exposure Fusion and HDR/Tone mapping?
Both processes start from the same source files: differently exposed Low Dynamic Range (LDR) images. And both attempt to produce as final result an LDR image that shows tonal details of the entire dynamic range captured by the different exposures.

The differences are in the process itself.
Exposure Fusion consists in combining the differently exposed images in such a way that highlight details are taken from the underexposed photos and shadows details from the overexposed ones. Since the bit-depth does not change throughout this process, the basis of Exposure Fusion algorithms is a type of **weighted average of the source images**.

One of the advantage or Exposure Fusion is that it is easy to understand and you can see what you are doing. Also, it is rather familiar to photographers who are used to doing this process manually in image editing applications. Another advantage of Exposure Fusion is that it reduces noise.

HDR Tone Mapping is composed of two steps. The **first step** creates an HDR image from differently exposed photos. This HDR image cannot be displayed correctly on a Low Dynamic Range monitor, which is why a **second step** called Tone Mapping is necessary. Tone Mapping consists in 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).

Tone Mapping algorithms vary from a simple gamma curve (which is often what cameras are doing when converting 12-bit RAW data to 8-bit JPEGs) to more complex operators commonly divided into two categories:
· *Global* operators: mapping depends on the pixels' intensity and global image characteristics, but not on spatial location
· *Local* operators: mapping takes into account the pixels' surroundings (in addition to intensity and image characteristics).

The main advantage of global operators is fast processing. Local operators require longer processing times but they are better at producing a "good looking" photograph (the human eye adapts to contrast locally). In Photomatix Pro, the Tone Mapping method "Details Enhancer" belongs to the category of local operators and the method "Tone Compressor" to the category of global operators.

What is the best workflow: Exposure Fusion or HDR Tone Mapping?

See other side of this page.

What is the best workflow: Exposure Fusion or HDR Tone Mapping?
This depends on the dynamic range of the scene, the characteristics of the differently exposed images and the effect you want to achieve. Our recommendation is to systematically try both, using Batch Processing from the Automate menu.
What we usually do for any set of image, is to first run the batch with the three following methods:
· Tone Mapping with Details Enhancer
· Tone Mapping with Tone Compressor
· Highlights & Shadows – Adjust

The table below lists the main pros and cons of both processes.

	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.

Samples of different HDR
software processing results.

AdobeCameraRAW_ShadowAndHighlightBlended_in_PSE

PhotoshopElementsExposureBlend

PhotoshopCS6MergeToHDRPro

PhotomatixProToneMapped_ToneCompressor

PhotomatixProToneMapped_DetailsEnhancer

PhotomatixProExposureFusion

PhotomatixEssentials

LightroomMergeToHDR