Advanced Near-Realistic 3D Lighting: Capturing, Creating, and Using Image-Based Lighting
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DG4325

Intended for Autodesk® 3ds Max® 2012 and Autodesk Showcase® 2012 software users, this class will outline state-of-the-art workflows for creating original 360-degree high dynamic range (HDR) panoramic images for use in 3D applications designed to achieve highly realistic illumination with image-based lighting. We will cover the process of capturing existing real-world environment lighting using hardware, software, and photographic equipment. From there, we will review the steps involved in creating 360-degree HDR image maps used in 3ds Max and Showcase for near photo-realistic scene lighting. Finally, we will break down in-application camera and lighting techniques to create great effects that combine computer graphics and real photographs to produce near-realistic imagery.

Learning Objectives
At the end of this class, you will be able to:

- Describe the current best practices for leveraging image-based lighting within a 3D application into your own workflows
- Identify situations where image-based lighting is advantageous
- Implement HDR and low dynamic range image-based lighting setups in 3ds Max or Showcase
- Create original 360-degree HDR images for use in image-based lighting scenarios

About the Speaker
Chris Murray is a production veteran, experienced instructor, published author, and kid that never grew up. He has created digital 3D content for clients such as CNN.com, Walt Disney Attractions, Johnson & Johnson, CanonUSA, ABC television, Nickelodeon, and Sega. Murray has maintained a career-long relationship with learning. He was guest instructor in the School of Film and Digital Media at the University of Central Florida and was a department chair in Digital Production at Full Sail University. Now he’s living one of his dreams at Autodesk as a technical marketing specialist playing with his favorite toys, the 3ds Max® suite of tools (including Mudbox™, Matchmover™, and Composite). Chris is an experienced presenter (conferences, trade shows, universities, and corporations) and has authored a book, Mastering 3D Studio Max<em>. He holds an MFA in computer animation. Follow Chris on Twitter @chrismmurray.
Top 5 things you need to know about HDR Acquisition:

1. The process of HDR (refresher in pictures from class)
2. Secret tools
3. Software
4. Camera Gear
5. File Structure and Organization tips.

Number 1: What is HDR? Refresher from the class

An HDR image is usually a photograph of an existing environment or setting taken with a digital camera and refined through a specific process to create the aforementioned image. These digital images show a much broader color range per pixel than standard digital images. A standard digital image is any other digital image in any of the well-known common formats (such as jpg, tif, png, tga, bmp, etc.).

These are commonly referred to as low dynamic range images or LDR images. HDR images capture a broader range of values that allow more of the image, especially areas in shadow, to be revealed.
What you need to know about capturing HDR images

- You should know basic photographic terms like f/stop and shutter speed, ISO, and exposure. Add to that the implications on a photograph by changing those settings.
- You should also be comfortable with basic 35mm DSLR operation. You really need to know your camera—meaning you should be able to operate it quickly in the field. Fumbling with gear when you are losing light is not fun.
- You should know how to take meter readings and define a range of f-stops.
- Finally, you need to understand that you can’t actually see all image data (contrast) that you capture with your camera. HDR images are 32 bits per pixel. Any of today’s commercial grade LCD’s or CRT’s cannot display that bit depth and resulting contrast ratio. You will need to tone map the image to make it presentable to you and others. It is not necessary for image based lighting.

Part 1: Taking an HDR Photograph

What you will need:

1. A digital SLR camera with the ability to manually control white balance, shutter speed and f/stop, ISO, & Exposure bracketing (preferred).
2. A sturdy tripod with bubble level (necessary for the next section)
3. A subject with a wide tonal range and exposure.

Step 1. Prepare the camera. Set your ISO, then meter to find the known optimal exposure for the scene (f/stop+shutter speed), plus the shutter speed settings for two* specific EV’s (exposure values) above and below the optimal exposure settings. This is also called "bracketing".

NOTE: The above step is unnecessary if your camera does “auto exposure bracketing” Just set the number of exposures you want to take, meter (adjust SS if necessary) then shoot.

* I say two but this could be one, it could be nine. It depends on how much range you need and how much work you want to do. I generally do the optimal and +/- 7 or 9 EV’s.

Figure: Exposure Bracketing
Step 2. Now for the simple part. Take the photograph including the bracketed EV's.

Here's an Example of an HDR image exposure set.

Figure: The exposure set that will be compiled into a single HDR image.

In the above figure you can see the series of exposures going from very bright (over exposed) to very dark (under exposed). These sequences are combined to create an HDR image.

Step 3. Merge the images into an HDR with Photomatix Pro, CS5, or HDR shop.

This is the actual HDR image created from the above sequence, then saved out as a single BMP file so it could be viewed in this document (it no longer a true HDR image).

Figure: The merged HDR image (down sampled to an LDR for printing) This is un-tone mapped.
Step 4. Tone map the image. This step is totally optional and NOT required for IBL. Tone mapping is done in something like Photomatix Pro or HDREfx (Nik Software)

Figure: The merged HDR image (down sampled to an LDR for printing) Tone mapped version.
Part 2: Panoramic HDR image creation

Using the same steps as above, we repeat the process with “slices” from our 360 photo shoot. A panorama is created by stitching together a series of photos taken in a specific sequence in a 360 degree radius.

Landscape or portrait? I take portrait with a 10.5mm lens (fisheye). It requires more photos (and thus more file management) but I get more “sky and ground” and the extra processing isn’t that significant.

TIP: Landscape or portrait? I take portrait. It requires more photos (and thus more file management) but I get more “sky and ground” and the extra processing isn’t that significant.

Figures: 360° Portrait and landscape orientations (top). Each exposure set “slices” (bottom).
Figure: One “slice” of the pano 360º in portrait orientation.

For this part of the process you will need at minimum the following equipment.

- A digital camera with manual exposure/aperture control and auto exposure bracketing
- A sturdy tripod with a spirit level (+ one for the camera)
- A wide angle lens (optional, but let’s face it, if your serious, get one)
- Some photo stitching software (Autopano GIGA)
- HDR Merging software (i.e. Photomatix Pro, HDREfx, HDR Shop)

**Step 1.** Meter your scene as described in the previous section. Determine your optimal exposure and what shutter speeds you will use. Don’t meter a really dark area or a really light area. Find a “generally” exposed area to meter.

**Step 2.** With the camera mounted and level, on the tripod, you will shoot a series of images around you in a 360 degree pattern. Be sure to leave some overlap between in each of the different slices. This overlap is required for the stitching algorithm to properly align and blend the photos.

While shooting, be sure to take all the exposures necessary for the HDR image generation. Each slice may be as many as 5-9 exposures (you could do as few as three).

**Step 3.** Bring those exposure sets into a stitching program like AutoPano Giga (shown below) and create a single panoramic HDR image. Suffice it to say, it may take you several practice shoots to get it down and learn the nuances of the stitching application you are using.

TIP: I strongly recommend that you try working with a single exposure (non-HDR) panorama first. This will help you work out the kinks in the process (see step 3).
Figures: Stitching in "AutoPano GIGA". The exposure set "slices" (top). The complete pano ready to edit (bottom)
Figure: A final pano. This still needs to be tone mapped, but I like this look.

**Number 2: Secret tools: Improve the probability of success**

The goal of the following tools is for one thing only, to reduce the introduction of error into the alignment of the panoramic images.

- **Nodal Ninja**: This is how I take rock solid panoramas quickly. Second only to the camera or tripod as the most important piece of gear… this obscure device is critical to fast accurate work in the field. (www.nodalninja.com)

- **Bubble Level for hot shoe**: This is invaluable in the field. I don’t trust the bubble level on the tripod. Especially since the attachment of the camera to the tripod is relative to the type of attachment. Level alignment is critical not only to good stitching solutions, but to your sanity as well.

- **10.5mm lens**: What can I say? How about “the wider the better.” Yea… that says it.

- **Shutter Release remote**: This is very important because you want to physically touch the camera as little as possible while shooting and you want to shoot as quickly as possible. This does both.
Number 3: Software: The right tool for the job.

- Autopano giga: This impressive tool (get the GIGA version) automatically identifies panos and exposure sets simultaneously. It allows you to edit and export solid panos.
- PhotoMatix Pro: Besides a great tone mapper, this has a nice “batch processing” tool for merging large exposure sets into a single HDR image for tone mapping later.
- Adobe Bridge: Stay organized. In ½ day (4 hours) of location shooting specifically for panos, I shot 1,283 images. Its shows HDR thumbnails.
- sIBL: Handy but not required, make all the relevant “versions” of the HDR image for use in CGI.

Number 4: File Structure and Organizational Tips

- Use a file management tool like Bridge
- Keep sub folders
- Name folders deliberately

Figures: My directory structure. It might be overkill, it might not. But I know what I’m looking at, and more importantly, I will be able to find something specific 2 months from now. Do it.
Number 5: Camera Gear

- A list of my entire HDR/Pano gear can be found online here: http://www.cme3d.com/photogear/
- NOTE: The Nodal Ninja listed on that site is not the one I actually own. I own the NN “Ultimate R1” found here: http://www.nodальнinja.com/products/panoheads/ultimate.html

Thank you for your time.

I appreciate your interest in my presentation. Please remember to fill out the session evaluations and let me know how I did.

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My personal collection of links and resources:

http://groups.diigo.com/group/hdri_apps
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Photographs by Chris Murray, taken on location at Florida Southern College, Lakeland, Florida. Florida Southern is home to the single largest collection of original Frank Lloyd Wright buildings in one location.

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