4.430 Daylighting

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4.430 HDR Workshop

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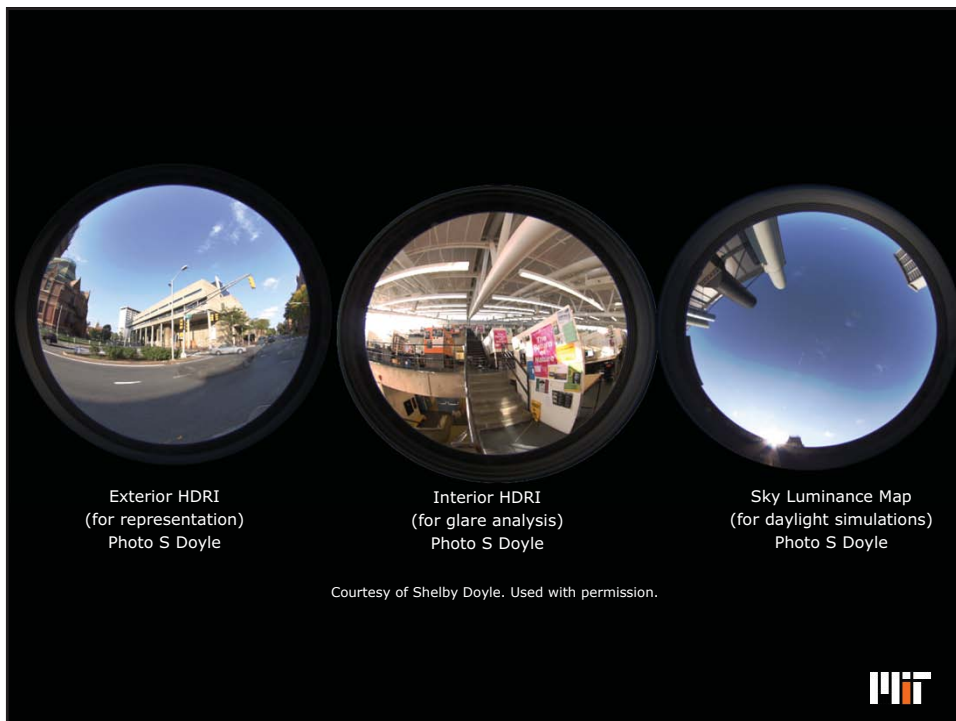Building Technology Program
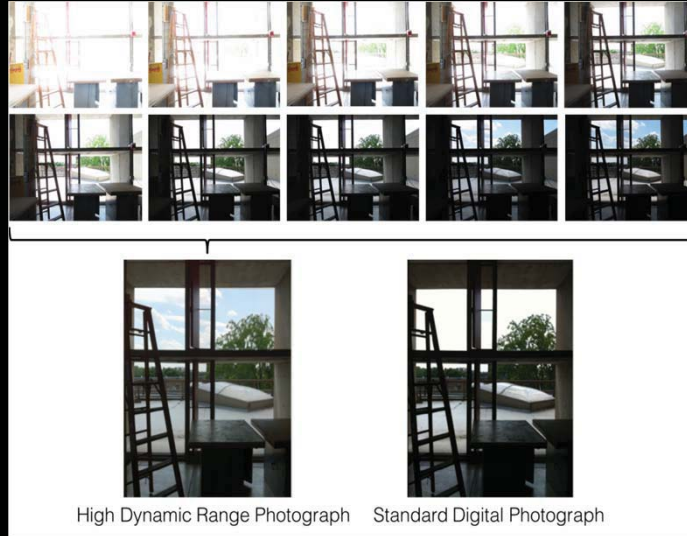

HDR Photography

Goals for Today

❑ Learn how to take a high dynamic range (HDR) image using Photosphere
❑ Calibrate your cameras
❑ Conduct a basic glare analysis of an image that you took. We will do more later in the class.
❑ Learn how to estimate diffuse reflectance and visual transmittance.

Exterior HDRI
(for representation)
Photo S Doyle

Interior HDRI
(for glare analysis)
Photo S Doyle

Sky Luminance Map
(for daylight simulations)
Photo S Doyle

High Dynamic Range Photography

High Dynamic Range Photograph   Standard Digital Photograph

Daylighting = (Reinhart)

High Dynamic Range Photography

Fig 4.33 Guidelines for taking physically based HDR photographs[11]	
What you need.	Digital Camera
	Lens with a large opening angle (ideally a fisheye lens)
	Tripod
	Illuminance Meter#
Camera Settings	If possible set your camera's white balance to daylight.
	Set film speed to ISO 100.
While taking an image.	Try to take photographs in a stable environment (motionless, stable lighting conditions).
	If possible use a fixed aperture size and vary shutter speed to change exposure values.
	Take 6-8 images to cover the overall HDR range of the scene.
	Take the photos as quickly as possible.
	The most overexposed image should not be completely washed with light and the lowest exposure image should not be completely dark.
	Take a vertical illuminance measurement close to the position and orientation of the camera lens.#
Calibrate your camera and lens.*	Select a daylit scene with both low and high luminance values.
	Take a single spot luminance measurement of a mid level luminance patch (preferably gray) in your scene.
	Take as many exposure images as you can (12+).
	Generate an HDR image from the series using a validated program such as Photosphere.
	Enter the measured spot luminance in Photosphere to calibrate the camera and save the response curve for your camera and lens. (It is a good idea to keep the calibration HDR image and luminance reading if case you ever need to change computers.)
Generate subsequent HDR Images	Use the saved response curve for your camera and lens combination in Photosphere to generate future HDR images.

\#) Only if you plan to analyze the HDR image afterwards for glare.
*) Unless you want to conduct a scientific grade analysis you only need to do this once.

HDR Photography Tips

Courtesy of Mehlika Inanici. Used with permission.
Mehlika Ininici, "Introduction to HDR Photography ",
www.gsd.harvard.edu/research/gsdsquare/Presentations/inanici_HDR.2009.pdf

HDR Photography Tips

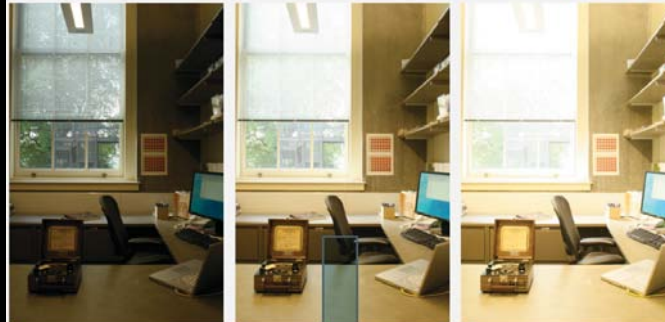Courtesy of Mehlika Inanici. Used with permission.
Mehlika Ininici, "Introduction to HDR Photography ",
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HDR Photography Tips

Capturing process

- Use tripod
- Fix the aperture size
- Vary only the shutter speed
- Fix white balance to daylight
- Fix the film speed to ISO 100
- Take photographs in a stable environment (motionless, stable lighting conditions)
- Capture multiple exposures as quickly as possible!

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Mehlika Inanici, "Introduction to HDR Photography

www.gsd.harvard.edu/research/gsdsquare/Presentations/inanici_HDR-2009.pdf

HDR Photography Tips

#5:

The overexposed image should not be totally washed with light and the under exposed image should not be totally black!

#6:

For a regular HDR assembly, take 6 - 8 exposures to cover the range.

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Mehlika Inanici, "Introduction to HDR Photography

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HDR Photography Tips

#7:

For determining the camera response curve, select a scene that has both low and high luminance values and gradual change within the scene.

#8:

For determining the camera response curve, take as many exposures as you can take with your camera (12+).

#9:

Use the same response curve for generating subsequent HDR images

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Mehlika Inanici, "Introduction to HDR Photography",
www.gsd.harvard.edu/research/gsdsquare/Presentations/inanici_HDR-2009.pdf

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HDR Photography Tips

Assembly process

For good accuracy:

calibrate HDR photographs
with
a **single** luminance measurement of
a mid level grey patch in the scene.

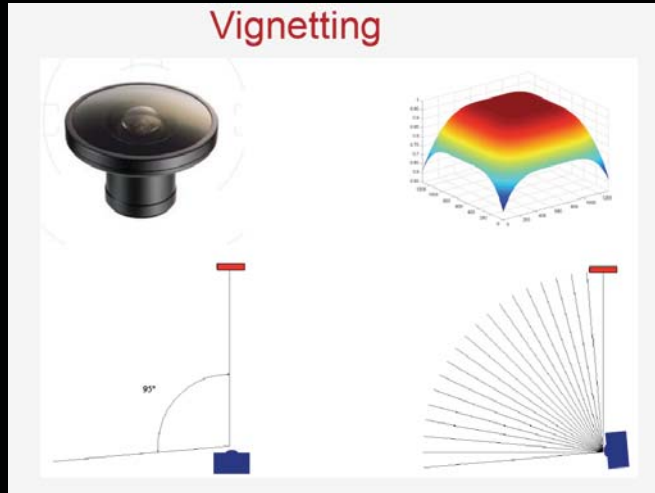Courtesy of Mehlika Inanici. Used with permission.
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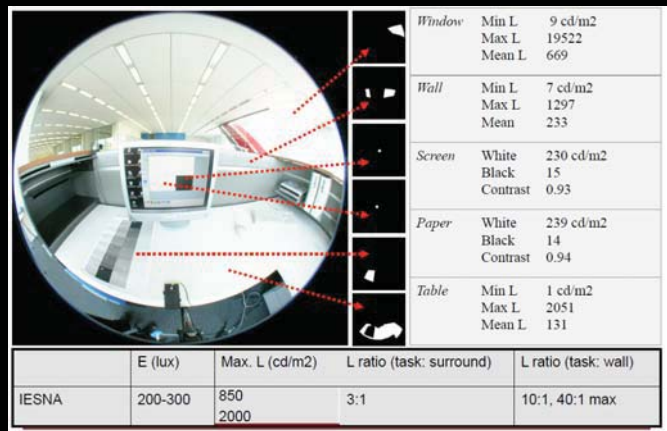
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www.gsd.harvard.edu/research/gsdsquare/Presentations/inanici_HDR-2009.pdf
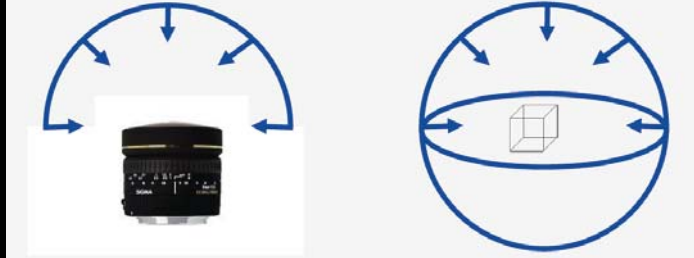
HDR Applications – Luminance Contrasts

Mehlika Inanici, "Introduction to HDR Photography",
www.gsd.harvard.edu/research/gsdsquare/Presentations/inanici_HDR-2009.pdf

HDR Applications

Image based Lighting (IBL)
using HDR Photographs
to Light the Scene

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Mehlika Inanici, "Introduction to HDR Photography ,
www.gsd.harvard.edu/research/gsdsquare/Presentations/inanici_HDR-2009.pdf

Excellent Reference

Reference:
 Lighting Guide 11: Surface Reflectance and Colour (Society of Light and Lighting SLL LG11). Chartered Institution of Building Services Engineers, 2001.

Photograph of Lighting Guide 11 removed due to copyright restrictions.
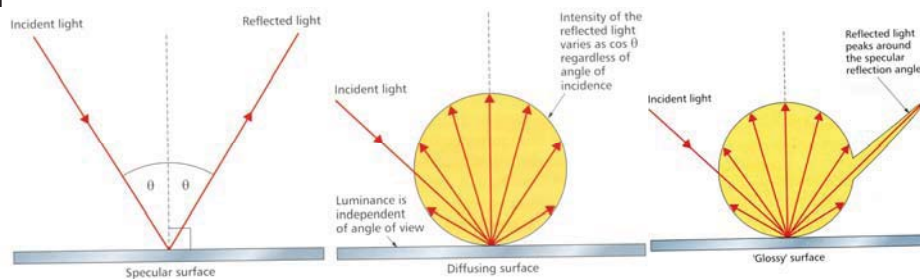
Optical Surface Properties

When assessing a building surface there are three things to consider:

❑ reflectance

❑ color

❑ finish

Note: Surfaces get dirty over time.

Optical Surface Properties

❑ A specular surface reflects like similar to a mirror.

❑ A diffuse (also called Lambertian surface) reflects all incident light

    uniformly into all directions. Examples are paper and drywall.

❑ Glossy surfaces are a combination of the two.

Measuring Diffuse Reflectances

For a Lambertian surface: incident illumiance, E, surface reflectance, ρ, and emitted luminance, L are related as follows.

$$L = \frac{E\rho}{\pi}$$

In order to measure the reflectance of a Lambertian surface one may either use a Reflectance Sample Card or a combination of a luminance meter with an illuminance meter.

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