Next Quiz on Textures & Lighting

Hand back Quiz 1

Tutorial Session

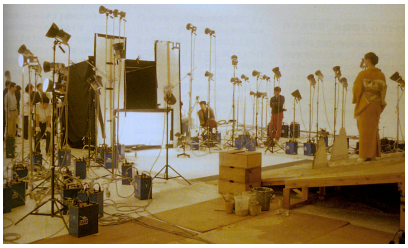
- Today after class and Friday at 2
- Not at the Library, but at the T-Lab
  - 1890 Maple (corner of Emerson & Maple Ave)
  - Need ID card from 3rd floor secretary
    - $20 deposit
  - Need CS account:
    - www.cs.northwestern.edu/support
      - Submit a ticket requesting a new account

Camera and Lighting for Animation

Amy Gooch
CS 395: Intro to Animation
Summer 2004

Think about film & lighting…

Reality!



Cameras & Viewpoint

Visual Literacy

- Design principles or composition
  - unity, balance, emphasis, scale
- Design elements
  - color, tone, line, texture

Visual Meaning

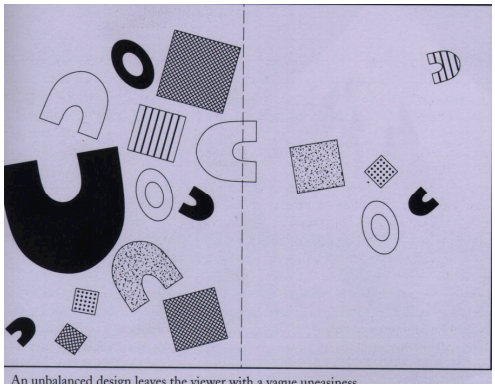
- Cumulative effects of the arrangement of the basic elements
- The perceptual mechanism that is universally shared by humans

Composition

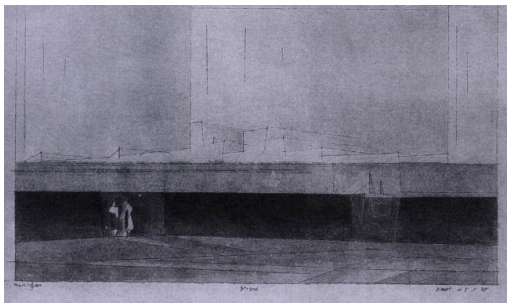
- Rules
- Breaking the Rules

Balance == Eye Control

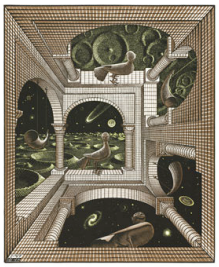
- Visual weight
- Physics, reality (gravity)
- Horizontal-vertical relationship
- Lack of balance disturbs us

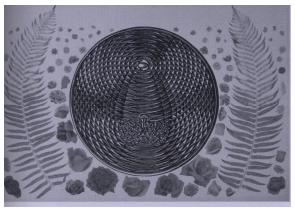


An unbalanced design leaves the viewer with a vague uneasiness

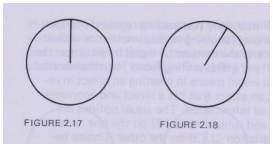


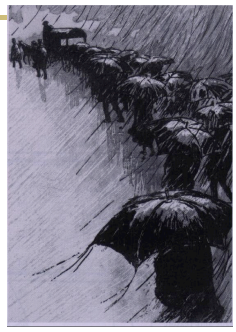
Symmetry





Imbalance





Lighting in animation

- Same goals as real world lighting
  - Bringing out or pushing back shapes of visible objects from the camera's view
  - Emphasize 3rd Dimension in a 2D image

But it can do more…

- Personality
- Feelings
  - Happiness
  - Sorrow
  - Fear
  - Etc.

Lighting is hard…

- Hard to make images photorealistic
- Harder still to convey emotions

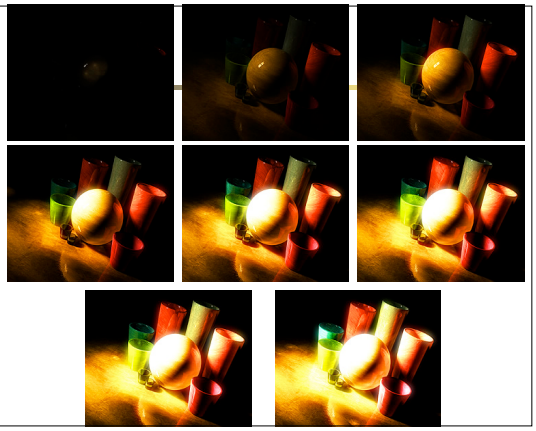
- Best way to achieve goals is to have goals to start with

Properties and components of light

- Also known as “quality of light”
  - Intensity
  - Direction
  - Color
  - Size

Light Intensity

- Amount of light emitted from a source of light
- Example: light a sphere in scene (changing intensity only)



Light Intensity

- Under lit

Light Intensity

- Light reflection is visible
  - but too dark

Light Intensity

- Objects visible
- Textures almost visible
- No statement

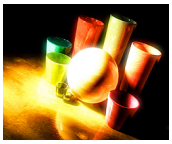
Light Intensity

- All objects visible
- No light reflection
- Texture on third of sphere is lost


Light Intensity

- All objects clear
- Sphere's colors oversaturated
- Other objects oversaturating





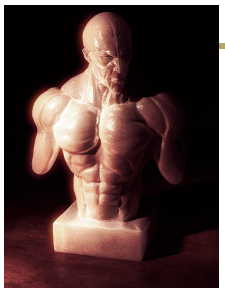
Light Direction

- Imagine a scene
  - Black background
  - Light of equal intensity and color is incident on a human face from all directions
  - What do you see?

Light Direction

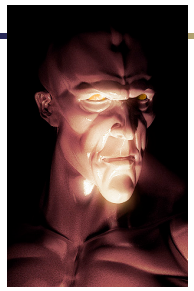
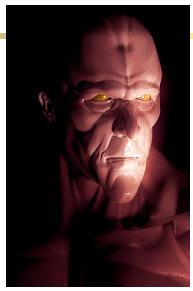
- We recognize shape of an object because light rays of *different* intensities hit from *different* directions
  - Paint object with highlights and shadows
  - Direction of light can
    - Enhance shape
    - Emotion

Lighting Direction can effect the shape…


Lit from single light source to left of camera; see base on surface, folds, etc


Single light source directly behind camera; Loose detail in front because cast shadows are washed out

Lighting Direction can effect the mood..

Lit from below produces a dramatic effect

Menancing

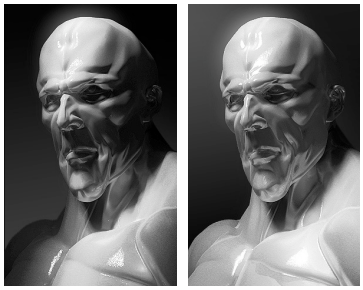
Subtle Menacing

Realistic lighting

- Comes from above

Emphasizing characters

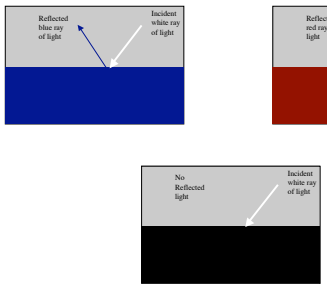
- Features
  - Positive or negative influence on personality
  - Lighting those features



Emphasizing characters

- Features
  - Positive or negative influence on personality
  - Lighting those features

Color of Light



Color affect depth

- Cool color recede
- Warm colors advance

- Far objects lose color saturation (fog)

Color and time of day

Early Morning | Mid-day-winter | Evening-summer

Gramps (modeled and textured by David Maas).

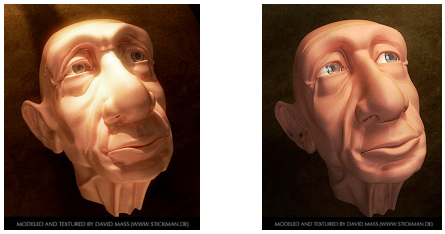
Color and time of day

Summer Mid-day Evening-summer Illusion of Night

Gramps (modeled and textured by David Maas).

Light Source Size
Effects overall feeling of scene

- Small = very sharp & distinct shadows (tension)
- Bigger = softer shadows (relaxed)

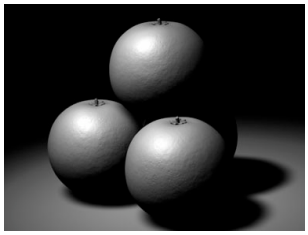


Basic Kinds of Lighting

- From film
  - Key Light
  - Fill Light
  - Rim Light

Key Light

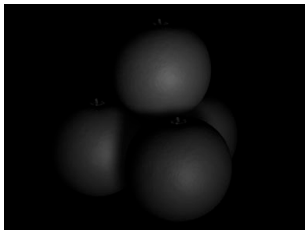
- Primary light
  - Placed to create highlights and shadows



http://www.andrew-whitehurst.net/3point.html

Fill light

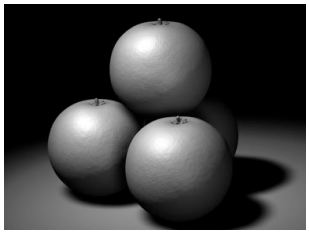
- Illuminate areas of image in shadow with key light
- Placed after and in relation to key light



http://www.andrew-whitehurst.net/3point.html

Key and Fill

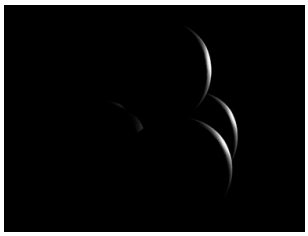
- Still missing right edges



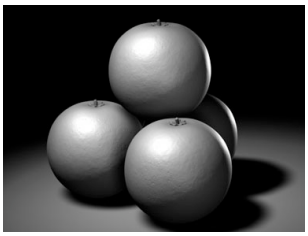
http://www.andrew-whitehurst.net/3point.html

Rim light

- Placed behind objects and angled so light glances off surface
- High intensity to create bright light around object
- Separate object from background



Key + Fill + Rim



http://www.andrew-whitehurst.net/3point.html

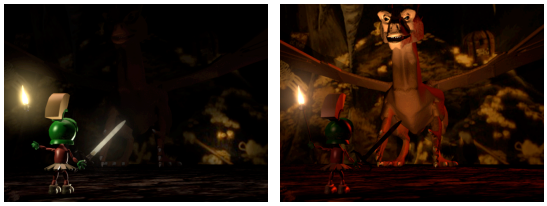
Project 3

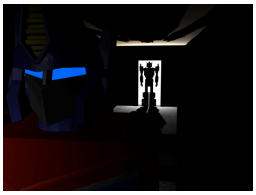
Hero

Mood (change of character)

Project 3

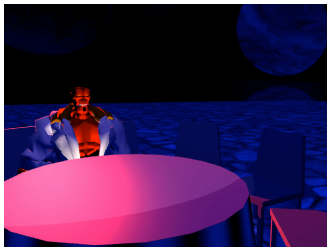
- Artistic (Optional)





Look at previous student's work:

- What's wrong with this?



What do you think of this?

(Switch to web page)

Rendering with Light
Lights and shadows

Ray Tracing

http://www.cs.berkeley.edu/~efros/java/tracer/tracer.html

http://www.siggraph.org/education/materials/HyperGraph/raytrace/rt_java/raytrace.html

Animations

The Cathedral
Parkland College Film Reel
http://www.anzovin.com/javanoir.html

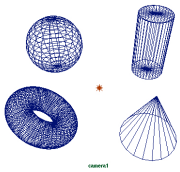
Types of lights in Maya

- Ambient
- Point
- Directional
- Spot
- Area

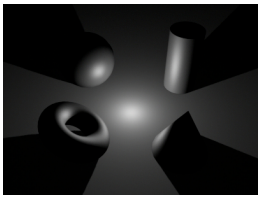
Ambient

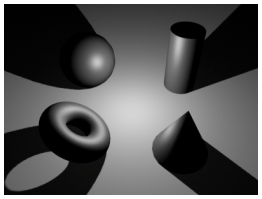
Point Light

- Create > Light > Point Light
- Light shines evenly in all directions from a single location
- Dependent upon position
- Independent of direction



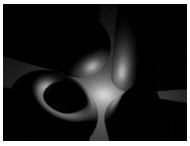
Point Light

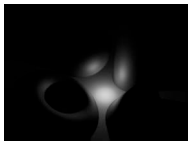




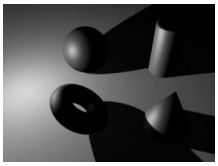
Point Light Properties

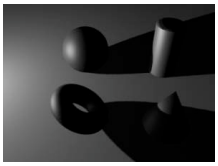
- Decay : degree to which brightness decreases with distance from source
  - None, Linear, Quadratic, Cubic (left to right, top to bottom)

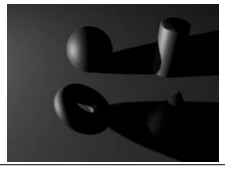




Moving Point Light to get Directional Light



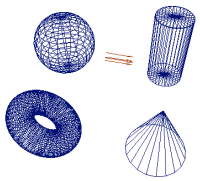


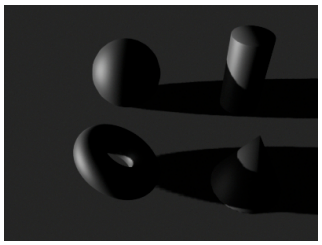


Directional Light

- Create > Lights > Directional Light
- Simulates light shining evenly in one direction
- Dependent upon direction
- Independent of position
- Similar to sun
- Useful as fill light

Directional Light





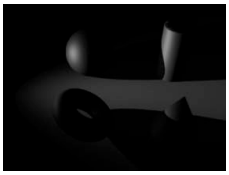
Spot Light

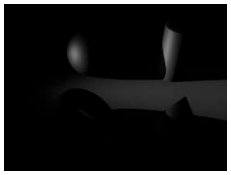
- Create > Lights > Spot light
- Simulates light shining evenly within a coned region from a single location
- Similar to point, but confined and directed by cone
- Dependent upon position and direction

Spot Light

Spot Light properties

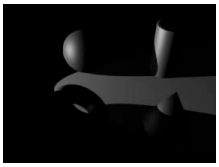
- Decay – brightness decreases with distance from source (same as point light)
- Dropoff – brightness decreases from center of beam to beam edges
- Dropoff values: 20, 40 (left to right)

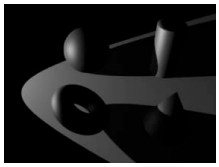


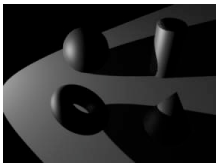


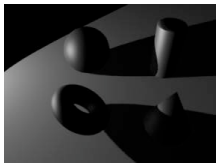
Spot Light Properties: Cone Angle

- Angle of cone (radius) measured from cone middle to cone edge (0.0 – 180.0);
- Cone angle values: 35, 55, 75, 95



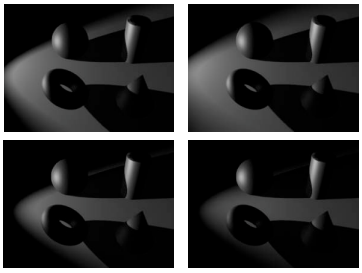






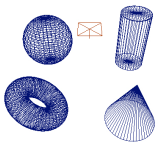
Spot Light Properties: Penumbra Angle

- Angle measured from edge of cone to where intensity drops to zero (linearly)
- Light falls off gradually from edge of cone through penumbra angle
- Provides a softness to spot light edges; Softness makes the spot light's actual location less obvious
- Positive values add to cone edge, negative values subtract from cone edge
- Penumbra angle values: 10, 20, -10, -20



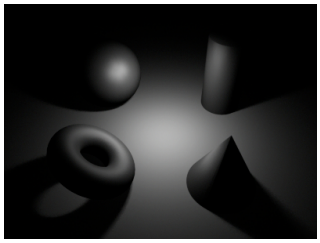
Area Light

- Create > Lights > Area Light
- Simulates light emanating from rectangular region
- Like real lights
- Physically-based on distance
- Manipulate through standard transformation tools (scale, rotate, translate)
- Larger area lights (scaling) emit more light
- Increased rendering times



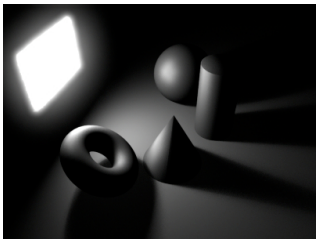
Area Light

- Ray-traced, depth-mapped shadows



Area Light

- Ray-traced, depth-mapped shadows, object with glow



Shadows

- Shadows are created with….

  1) Shadow casting light(s)
     - Depth Map Shadows or Ray Trace Shadows on/off (attribute)

  2) Surface(s) that cast shadows
     - Render Stats attribute -> Casts Shadows (checked/unchecked)

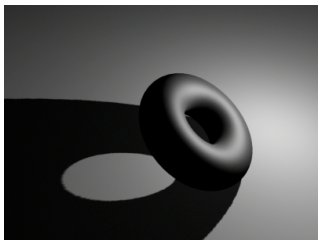
  3) Surface(s) that receive shadows
     - Render Stats attribute -> Receive Shadows (checked/unchecked)

Shadow Properties

- Color
- Softness: Gradiation/blurring of shadow edges
- Graininess: smoothness of shadow edge

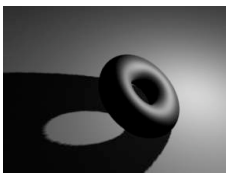
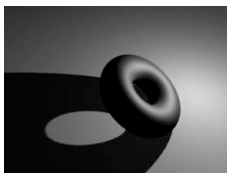
Depth Map shadows

- Per light, shadows section, attribute editor > Use Depth Map



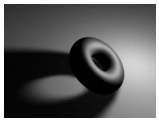
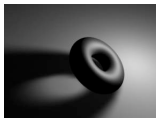
Depth map Properties: Graininess

- Shadows attribute > Dmap resolution (on light)
- Higher resolution increases rendering time
- Dmap resolution 256 512

Depth map properties: Softness

- Shadows attribute – Dmap Filter Size (on light)
- Tip: drop Dmap resolution size, increase filter size
- Higher filter size increases rendering time
- Dmap res = 128, filter size = 3, 5, 7

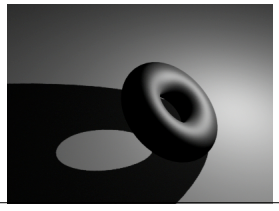




Trouble Shooting Dmap

- http://woodall.ncsa.uiuc.edu/dbock/Class/csc187/Lecture/LightingAndShadows.html

Ray-traced shadows

- Per light, shadows section, attribute editor – Use Ray Trace Shadows
- Window->Render Globals, Raytracing quality, turn on raytracing



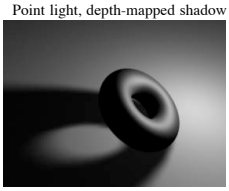
Ray-traced shadow properties

- Softness/Graininess – smoothness of shadow edges
- Shadows attribute – Light radius (point, spot) or light angle (directional)
- Shadows attribute – Shadow Rays (on light)
- Tip – time consuming for soft edges w/ ray-tracing
- Light radius = 0.5, Shadow Rays = 10 (similar to area light)

Compare

- Depth map shadows create soft edges by blurring
- Ray-traced shadows simulate a more natural softening with distance

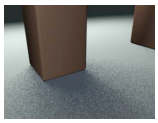
Point light, depth-mapped shadow

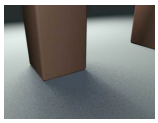


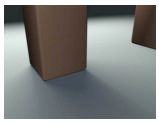
Point light, ray-traced shadow

Area lights & Ray Traced shadows

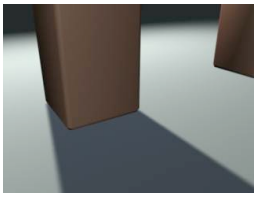
- Increase number of shadow rays (1, 5, 20)







Depth Map Shadows



Project 3

- Groups?
- Due Date?

References

- "Painting with Light" by the late, great John Alton

http://www.andrew-whitehurst.net/3point.html

Credits:

- Images and source from
  - http://warpedspace.org/lightingT/part1.htm
  - http://www.andrew-whitehurst.net/3point.html
  - http://woodall.ncsa.uiuc.edu/dbock/Class/csc187/Lecture/LightingAndShadows.html

Check out:
http://www.itchy-animation.co.uk/light.htm