

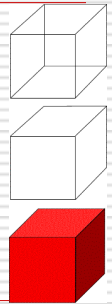
Introduction to Computer Animation

Lecture 10

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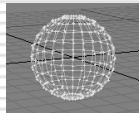
Rendering

- The process of producing a 2D image from 3D data
- Wireframe
- Hidden-Line
 - Lines hidden from view are not rendered
- Shaded
 - Lighting effects are rendered



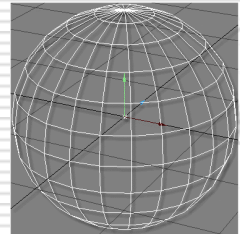
Wireframe

- Simplest rendering technique
- Fast rendering
- Advantages:
 - fast
 - Allows for real-time interaction
- Disadvantages:
 - transparent models
 - ambiguous



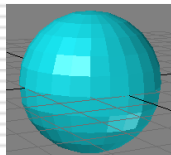
Hidden-line Rendering

- Lines out of line of sight not visible
- Advantages:
 - still quite fast
 - better object definition in a crowded scene
- Disadvantage:
 - no surface information



Shaded Rendering

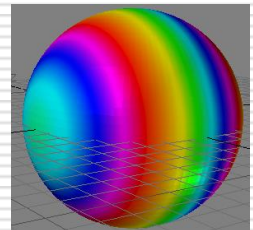
- Takes more time to do
- Gives surface information
- Varying degrees of complexity

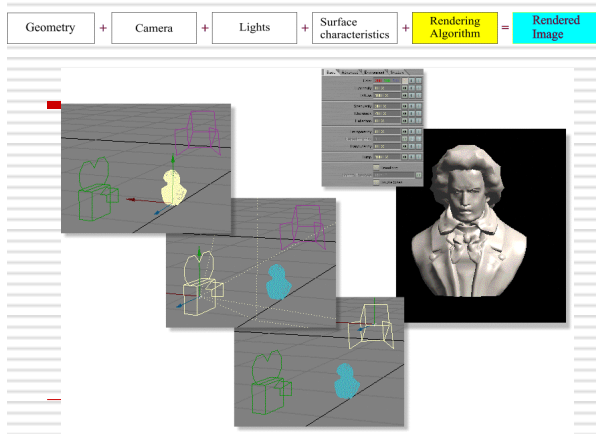


Fully textured



- More shading = more processing





Real-time Rendering?

- ☐ Real-time interaction
 - OK with simple shading/low polygon count
- ☐ Helps if you have a (very) powerful computer!



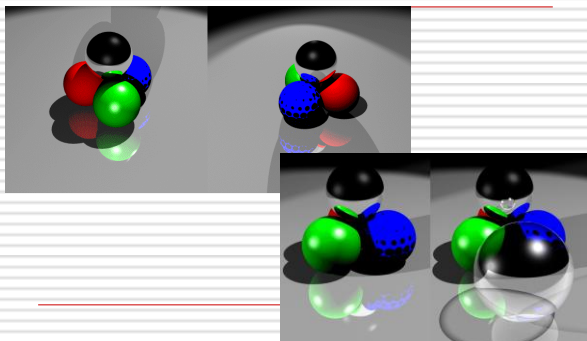
Surfaces

- ☐ Shader
 - Grouping of object surface characteristics
- ☐ Colour
 - Hue
 - Saturation
 - Luminance

Surfaces (2)

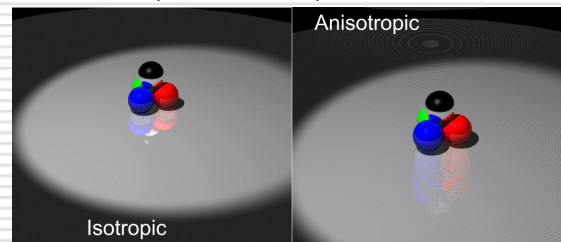
- ☐ Diffuseness
- ☐ Specularity
 - Highlight size/colour
- ☐ Reflectivity
- ☐ Transparency
- ☐ Refractivity
 - Refractive index
- ☐ Incandescence

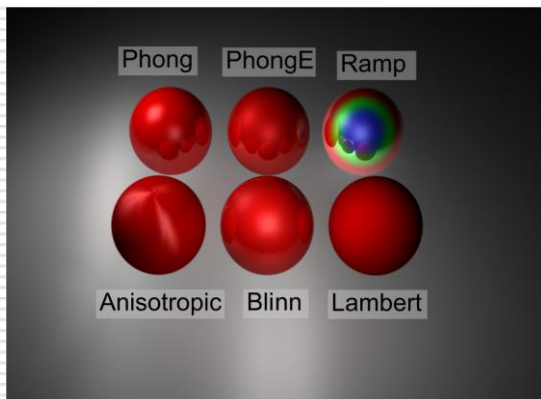
Surface characteristics



Surfaces (3)

- ☐ Isotropic & anisotropic





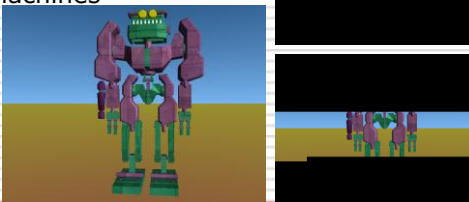
Rendering Algorithms

□ Algorithm?

- "A well thought out, logical procedure for doing something"
- Scan line rendering
- Shading
- Cast shadows
- Ray-tracing
- Shadow Depth map

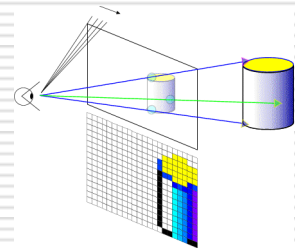
Scan-line Rendering

- Jobs can be easily split between machines



Ray Casting

- Identifies pixel colours one pixel at a time along a scan-line

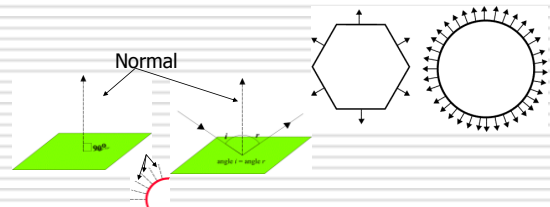


Shading Algorithms

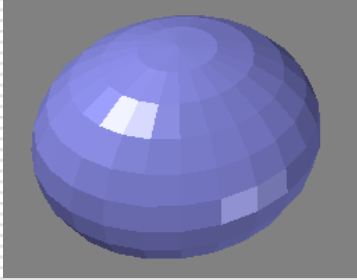
- Faceted shading
 - surface normals
 - Triangulation
- Smooth shading algorithms

Faceted Shading (1)

- Normals

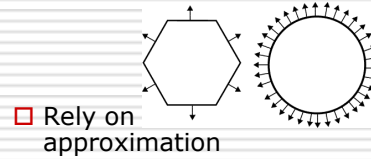


Faceted Shading (2)



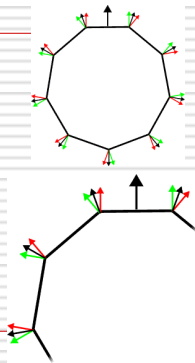
Smooth-shading Algorithms

- Gouraud shading
- Phong shading



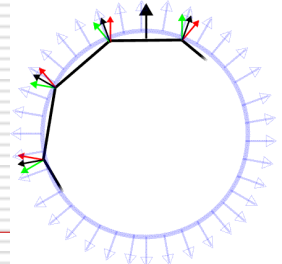
Gouraud Shading

- Pronounced Guh-roe
- Very common
- Quite fast
- Based on normals at the vertices of the polygons
- Interpolates normals at the vertices.

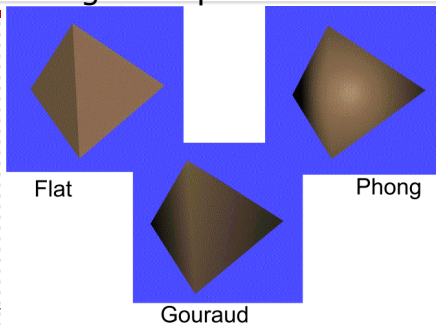


Phong Shading

- Also called 'normal interpolating shading'



Shading examples:



From: http://www.cc.gatech.edu/classes/AY2004/cs4451a_spring/shading_models/linint.html

Depth

- Painter's algorithm
- Z-buffer algorithm

Painter's Algorithm

- ❑ Objects rendered according to distance from view point
- ❑ Furthest away is rendered first
- ❑ Time consuming!



Z-buffering

- ❑ Small block of memory used to store information on the distance from the view point each object
- ❑ Every point has a value
 - Higher value = further away from camera
- ❑ Speeds up ray-casting
- ❑ Objects can be rendered in any order

Z-buffer image



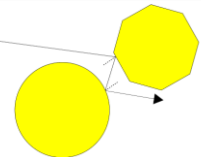
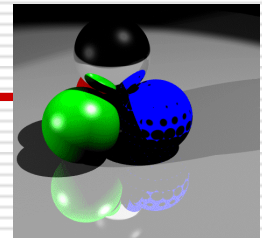
3D rendered image

3D Z-buffer image
Brighter = Closer

From: <http://www.scriptspot.com/bobo/mxs2/stoons/>

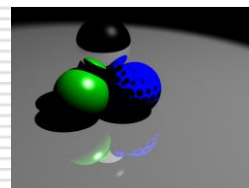
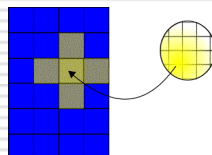
Ray-tracing

- ❑ Takes all objects into account
 - Gives excellent reflection/shadow effects
- ❑ Complex
 - complexity can be reduced using 'depth' parameter
- ❑ Creates very sharp shadows – no soft edges

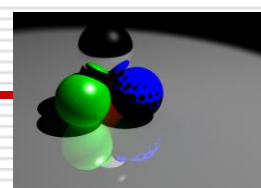


Global Illumination

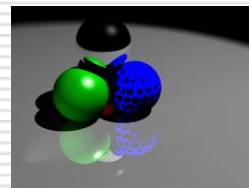
- ❑ Calculates the lighting effects of surfaces on one another
- ❑ Good diffuse effects
- ❑ Poor specular results
- ❑ Compliments Ray-tracing



No radiosity - 4 second render

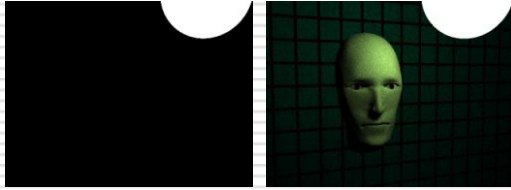


Radiosity - 1.2 minute render



Fake Radiosity - 6 second render
Faked with two extra spotlights

Luminosity, with and without Global Illumination



Assessment

- Week 11 (next week!)
 - Multichoice quiz (based on lectures) – 1 hour, during the first hour of the lab period – in the lab (10.00-11.00)
- Week 12
 - Final animation – 3 hours, time beginning at the start of the lecture period (09.00-12.00)
- Model submission
 - The model must be complete and ready for submission to Blackboard by Friday of Week 12

Today

- Practice modelling
- Practice the animation exercises for this week and last week
- Create a model for submission for assessment in Week 12
 - you'll get time in the Week 11 lab to work on this as well