Photorealistic Rendering vs. Interactive 3D Graphics

(An Introduction to Digital Image Synthesis)

Short Film Festival

• I will show a short film at the beginning of each class, so don’t be late!
Course Positioning

- This course focuses on the picture quality, not on the rendering speed.

<table>
<thead>
<tr>
<th>CS5502</th>
<th>CS6500/CS5500</th>
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<tr>
<td>Photorealism; Complex lighting simulation e.g., ray tracing, radiosity, photon map.</td>
<td>Rendering speed; Simplified lighting models e.g., transformation and lighting, rasterization, graphics hardware.</td>
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How Do You Draw a Picture (Without a Computer)?

- What is your subject?
- Viewing Parameters:
  - Camera, Picture Frames, Resolutions
- Many ways to specify it:
  1. eye, focus length, image plane
  2. eye, direction, FOV, up vector
3D to 2D Projection

• OK, so we can map a 3D point (or vertex) to 2D image.
• But what about a 3D surface?
• Polygons are made from points.
• Actually, we only need triangles!
Scan Conversion

• Also called rasterization.
• The 3D to 2D Projection gives us 2D vertices (points).
• We need to fill in the interior.

Shading
An Overview of 3D Pipeline

• The above can be implemented in hardware.
• Z Buffer to detect hidden surfaces.
• Other transformations not mentioned here: Modeling and Viewing.
• Browse Chapters 5 & 6 of Watt’s book if you’re not familiar with it.

“…But They Don’t Look Real.”

• Most things are not flat or simple geometry like spheres and cones.
• We need correct surface colors and shapes (and more)
• We also need correct lighting.
• Textures help, but not enough.
• Even simple things like CD can be challenging.

Real-time Graphics

• They’re becoming darn good!

With the help of the GeForce FX, RailQsport achieves a new level of realism with the self-shadows, incredible reflections, extremely high-polygon cars, and incredibly detailed environments.
But...

• Some effects are hard to do in hardware, such as the caustics:

A Different View: Ray Tracing
• Actually **inverse** ray tracing.