Project Ideas

Williams College CS371: Computer Graphics

Midterm: Modeling & Rendering
Motivating Approaches

- **Vision-Driven**
  - Draw on films, visuals, and your own ideas
  - You *don’t* have to produce *realistic images*: make a movie--augment an image--create a scene--make a real object...

- **Algorithm-Driven**
  - *In this slide deck and citations from the reading and lectures*
  - *Mix a few together*
Rendering
Antialiasing

Previously assumed that pixels had zero area

Edges and high-frequency materials are noisy!

Now integrate over pixel area by casting multiple rays per pixel

See especially Cook et al. SIGGRAPH 1984
Motion Blur

- Previously assumed an instantaneous shutter
- Now \textbf{integrate over exposure time} by casting multiple rays per pixel
- See especially Cook et al. SIGGRAPH 1984
Depth-of-Field

- Previously assumed a pinhole aperture
- Now integrate over a large aperture by casting multiple rays per pixel
- See especially...Cook et al. SIGGRAPH 1984
Area Light Sources

Previously assumed point lights... now integrate over light area
Path Tracing

Kajiya SIGGRAPH 1986
Modeling
Voxels
Implicit Surfaces

\[ f(x, y, z) = (x^2 + \frac{y^2}{4} - 1) \times (\frac{x^2}{4} + y^2 - 1) - k \]

Why settle for triangles?
3D Fractals
Procedural Modeling

- Place lights & cameras automatically
- Grow plants
- Weather surfaces
- Erode terrain
Heightfields

- Constructing from topo maps
- Auto-texturing
- Caves and bridges
- Infinite
- Optimal tessellation
- 3D printing / laser cutting
Performance
Software Rasterization

- Previously iterated over pixels casting explicit primary rays at triangles
- Now iterate over triangles, casting implicit rays forward towards the camera.
- (This is how OpenGL works)
TriTree gives “$O(\log n)$” ray casts...how does it work?

Build your own Oct-Tree or Bounding Volume Hierarchy to find out!
Distributed Computation

- Trace different frames on different computers
- Trace different parts of each image on different computers