Procedural Modeling

Last Time?
- Modern Graphics Hardware
- Cg Programming Language
- Gouraud Shading vs. Phong Normal Interpolation
- Bump, Displacement, & Environment Mapping

Final Project Progress Reports
- What do you plan to show for your progress report next week Thursday?
- Each teammate should make a post outlining their contributions thus far
- Post image(s), e.g., bloopers
- Post revised task list

Today
- Texture Mapping
- Common Texture Coordinate Mappings
- Solid Texture
- Procedural Textures
- Perlin Noise
- Procedural Modeling
- L-Systems

Texture Mapping

Texture Mapping Difficulties
- Tedious to specify texture coordinates
- Acquiring textures is surprisingly difficult
  - Photographs have projective distortions
  - Variations in reflectance and illumination
  - Tiling problems
Common Texture Coordinate Mappings

- Orthogonal
- Cylindrical
- Spherical
- Perspective Projection
- Texture Chart

Projective Textures

- Use the texture like a slide projector
- No need to specify texture coordinates explicitly

Projective Texture Example

- Modeling from photographs
- Using input photos as textures

Texture Chart

- Pack triangles into a single image

Questions?

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Texture Map vs. Solid Texture

Procedural Textures

f(x,y,z) → color

Texture Map vs. Solid Texture

Procedural Textures

Advantages:
- easy to implement in ray tracer
- more compact than texture maps (especially for solid textures)
- infinite resolution

Disadvantages
- non-intuitive
- difficult to match existing texture

Perlin Noise

Properties:
- Looks “random”, but is deterministic (always returns the same answer for a specific coordinate)
- Small memory footprint & fast to compute
- Known amplitude & frequency
- Smooth interpolation when zoomed in

Can be combined/layered:
- Add multiple noise functions w/ different frequencies and amplitudes
- Simple arithmetic operations (thresholding, sine waves, etc.)

Cellular Textures

Perlin Noise

Readings for Today:
  & “Improving Noise”, SIGGRAPH 2002

Cellular Textures

  www.worley.com
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Procedural Displacement Mapping

Procedural Displacement Mapping

L-Systems

Procedural Displacement Mapping

L-Systems

L-Systems

Utility Texturing for Architecture

Cellular Texturing for Architecture

"Feature-Based Cellular Texturing for Architectural Models", Legakis, Dorsey, & Gortler, SIGGRAPH 2001

Procedural Displacement Mapping

L-Systems


http://algorithmicbotany.org/
L-Systems for Cities

Procedural Modeling of Buildings

"Procedural Modeling of Cities", Parish & Müller, SIGGRAPH 2001


Image-based Procedural Modeling of Facades

• Mueller, Zeng, Wonka, & Van Gool, SIGGRAPH 2007

Questions?

Reading for Friday:

• “Artistic Tessellations by Growing Curves”, Li & Mould, Non-Photorealistic Animation and Rendering (NPAR) 2011