CS123 Final Project
Stuff we’ll be discussing

1. Project Topics
2. Not Project Topics
Project Topics
Normal Mapping

- **Resources**
  - The book: page 647

- **Related topics**
  - Frenet frame: [https://en.wikipedia.org/wiki/Frenet%E2%80%93Serret_formulas](https://en.wikipedia.org/wiki/Frenet%E2%80%93Serret_formulas)
  - Tangent space: [https://en.wikipedia.org/wiki/Tangent_space](https://en.wikipedia.org/wiki/Tangent_space)
Deferred Lighting

- Resources:
  - That lecture we all just saw
HDR and Bloom

● Resources
  ○ Wikipedia explanation:
    ■ https://en.wikipedia.org/wiki/High-dynamic-range_rendering
  ○ OpenGL 4.0 Shading Language Cookbook

● Example Implementations:
  ○ This lovely PDF
Shadow Mapping

- **Resources**
  - OpenGL 4.0 Shader Language Cookbook Chapter 7
  - OGLDev Tutorial

- **Example implementations**
  - [http://alteredqualia.com/three/examples/webgl_shadowmap.html](http://alteredqualia.com/three/examples/webgl_shadowmap.html)

- **Improvements**
  - Percentage close filtering (PCF)
  - Point light shadow cube map

- **Advanced implementations**
  - Cascaded shadow mapping
Screen Space Ambient Occlusion (SSAO)

- **Resources**
  - [http://john-chapman-graphics.blogspot.com/2013/01/ssao-tutorial.html](http://john-chapman-graphics.blogspot.com/2013/01/ssao-tutorial.html)

- **Example implementations**
  - [http://threejs.org/examples/#webgl_postprocessing_ssao](http://threejs.org/examples/#webgl_postprocessing_ssao)

- **Note:** You’ll probably want to do deferred lighting for this
Procedural Terrain

● Resources
  ○ GPU Gems!
  ○ Inigo Quilez
    ■ http://www.iquilezles.org/www/articles/terrainmarching/terrainmarching.htm
  ○ Casual effects (with implementation)

● Example implementations
  ○ https://www.shadertoy.com/view/MdX3Rr
  ○ https://www.shadertoy.com/view/XsX3RB
  ○ https://www.shadertoy.com/user/iq

● Related topics
  ○ Fog, SSAO, Raymarching, Water surface simulation
L-Systems

● Resources
  ○ Wikipedia
    ■ https://en.wikipedia.org/wiki/L-system
  ○ Algorithmic botany

● Example implementations
  ○ http://morphocode.com/3d-branching-structures-with-rabbit/
  ○ http://www.carl-olsson.com/project/l-system/ (ME!!!)

● Related topics
  ○ Fog, Procedural terrain
Tessellation Shader

- **Resources**
  - OpenGL 4.0 Shading Language Cookbook
  - [OpenGL Wiki](https://www.opengl.org/wiki)
  - [OGLDev Tutorial](https://www.ogldev.org/)

- **Related Topics**
  - Geometry shaders
Crepuscular Rays

● Resources:
  ○ Wikipedia explanation of phenomenon:
    ■ https://en.wikipedia.org/wiki/Crepuscular_rays
  ○ GPU Gems tutorial:

● Example implementations:
  ○ http://fabiensanglard.net/lightScattering/
Depth of Field (DoF)

● Resources
  ○ GPU Gems!
  ○ Casual effects
  ○ Bart Wronski

● Example implementations
  ○ http://threejs.org/examples/webgl_postprocessing_dof.html

● Related topics
  ○ HDR, Lens flare, Anisotropic filtering
Particle systems

- **Resources**
  - Wikipedia
    - [https://en.wikipedia.org/wiki/Particle_system](https://en.wikipedia.org/wiki/Particle_system)
  - Gamasutra
  - Direct to video (advanced)

- **Example implementations**
  - [http://threejs.org/examples/#webgl_gpgpu_birds](http://threejs.org/examples/#webgl_gpgpu_birds)
  - [http://threejs.org/examples/#webgl_gpu_particle_system](http://threejs.org/examples/#webgl_gpu_particle_system)

- **Related topics**
  - Fluid simulation, smoke, GPGPU simulation
  - Geometry shaders
Shadertoy Demo

● Resources
  ○ Mike: Raytracing
  ○ Carl: Raymarching
  ○ Iq’s blog:
    ■ http://www.iquilezles.org/

● Example Implementations
  ○ shadertoy.com
  ○ http://glslsandbox.com/
Other topics/resources/cool links

- http://threejs.org/examples/
- http://alteredqualia.com/
Not Project Topics

Unless you set the difficulty setting to Jedi

Which the Jedi Council may still overturn...
Fluid dynamics

- **Resources**
  - GPU Gems!
  - Direct to video (**advanced**)
    - [https://directtovideo.wordpress.com/2011/05/03/numb-res/](https://directtovideo.wordpress.com/2011/05/03/numb-res/)

- **Example implementations**
  - [http://29a.ch/2012/12/16/webgl-fluid-simulation](http://29a.ch/2012/12/16/webgl-fluid-simulation)

- **Related topics**
  - Caustics, Particle systems, Smoothed-particle hydrodynamics
Advanced Physics Simulations

- Particle fluid simulations
- Hair
- Lots of rigid body stuff
Path Tracers

● Resources
  ○ CS224: Spike, Eric, other nerds
  ○ The book!
  ○ Mike the TA :)

● Example implementations:
  ○ Smallpt: http://www.kevinbeason.com/smallpt/
  ○ GLSL implementation of smallpt: https://www.shadertoy.com/view/4sfGDB
    ■ Swing for the fences: Use FBOs to make this really converge
WebGL Stuff

- Learning OpenGL is rather tedious
- WebGL is very similar to OpenGL
  - It’s got that “GL” part, right?
  - Same oversight board, right?
- Now imagine constantly doubting your reality
Photon Mapping
Metropolis Light Transport
CUDA