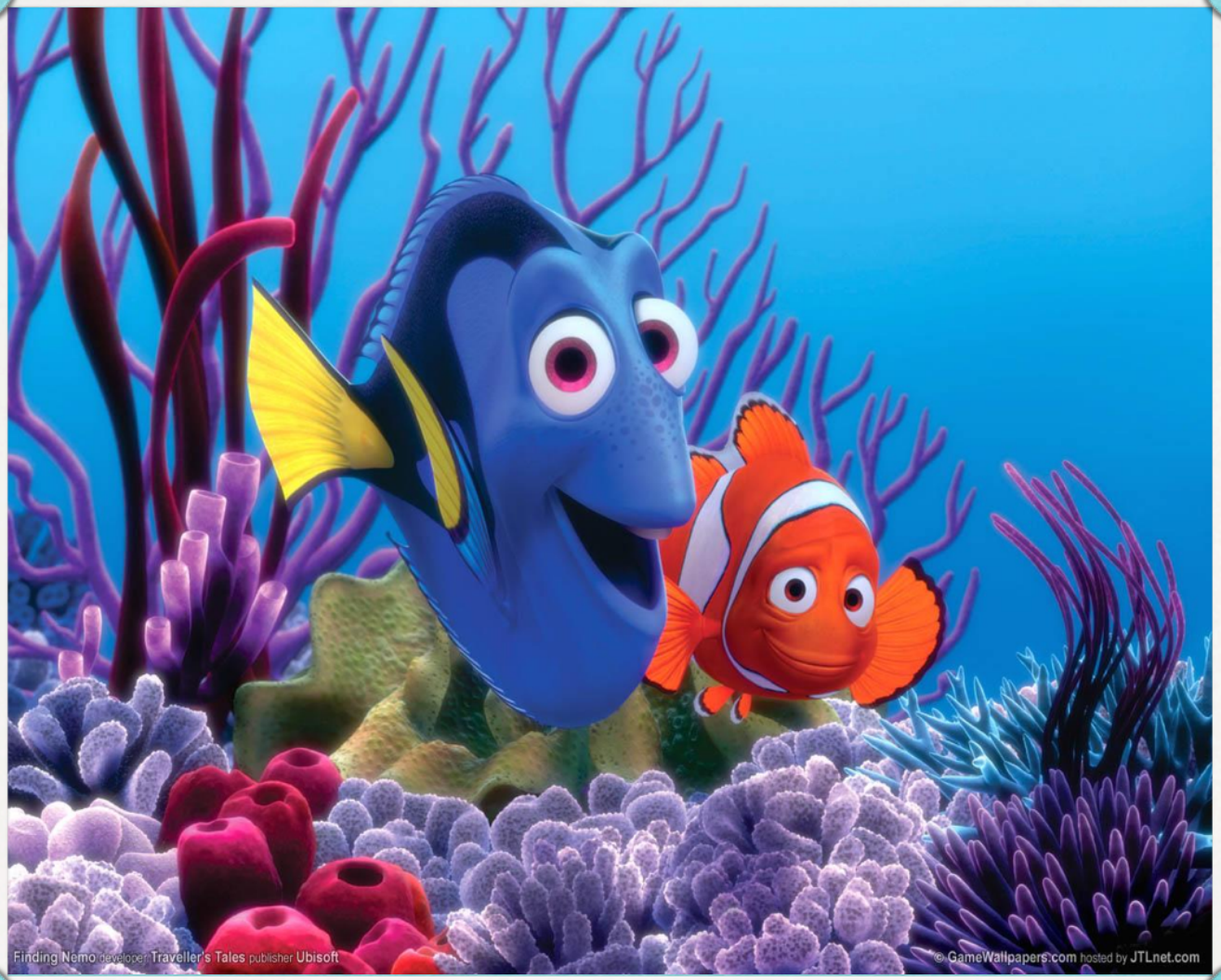
Project Ideas

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*


Finding Nemo developer Traveller's Tales publisher Ubisoft
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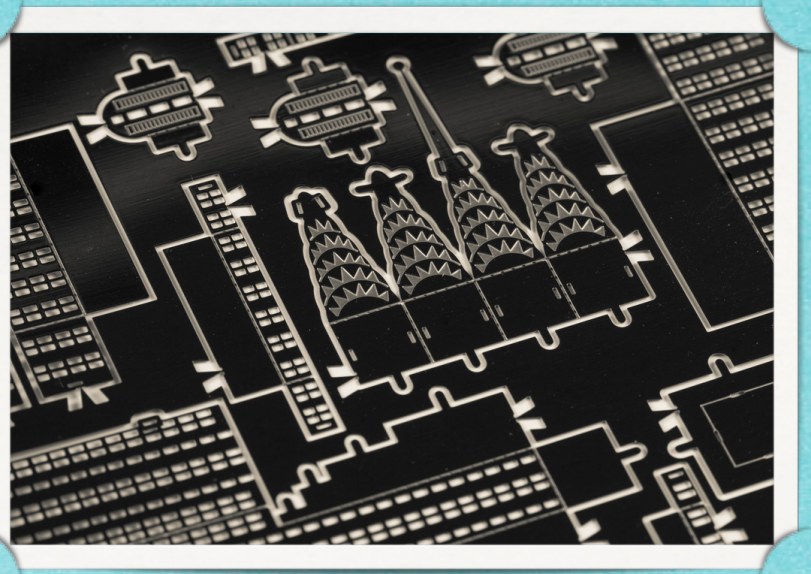
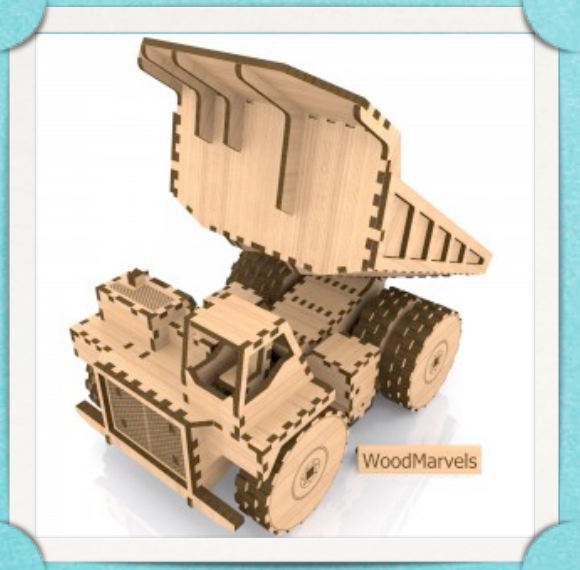
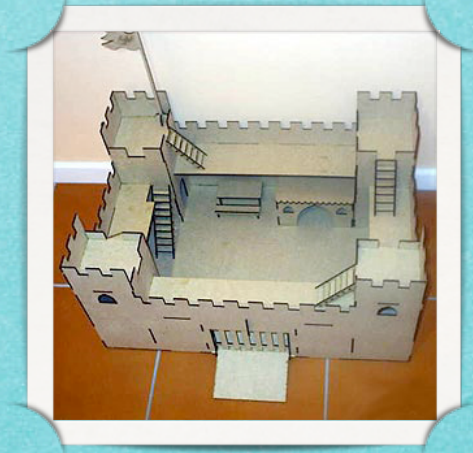



WoodMarvels

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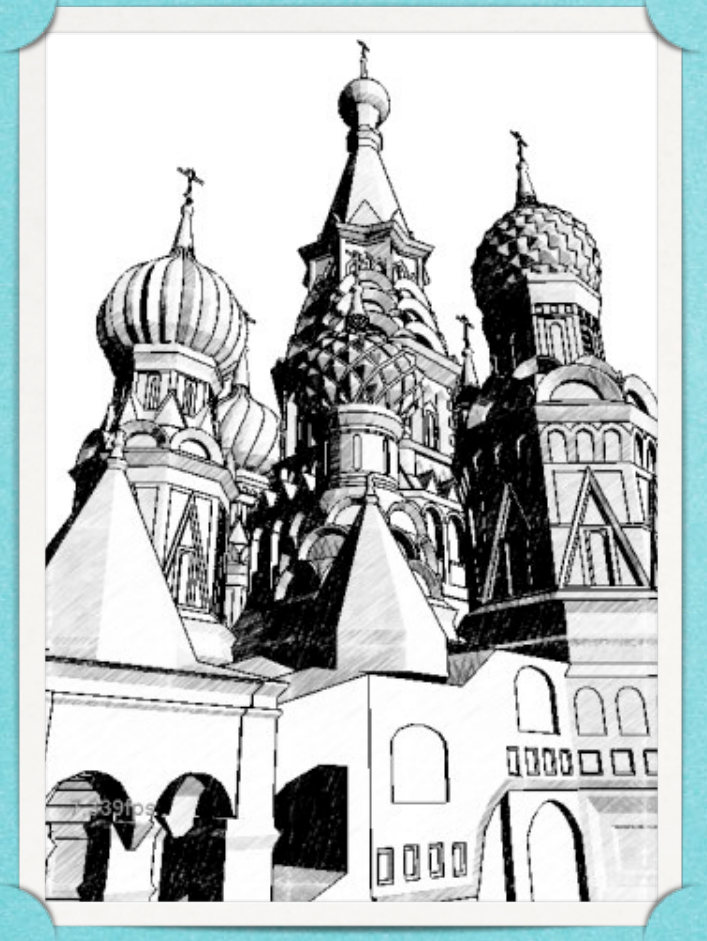


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Rendering

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 **integrate over exposure time** by casting multiple rays per pixel
- See especially Cook et al. SIGGRAPH 1984

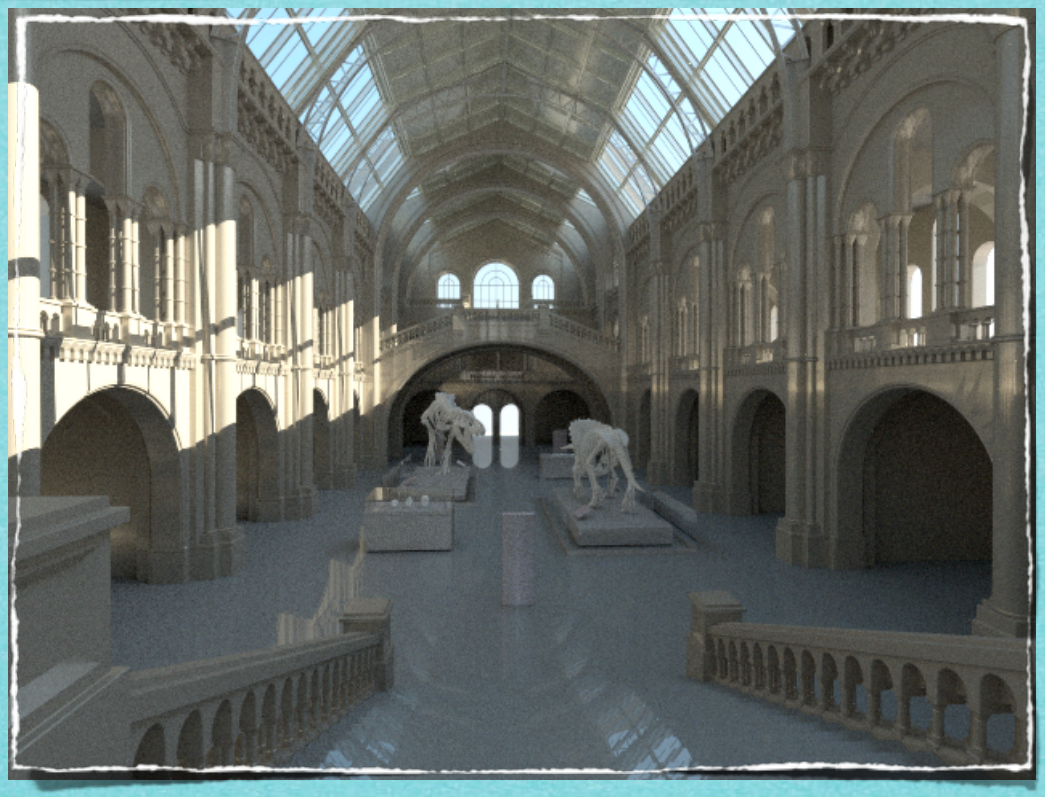
Depth-of-Field

- 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

Participating Media

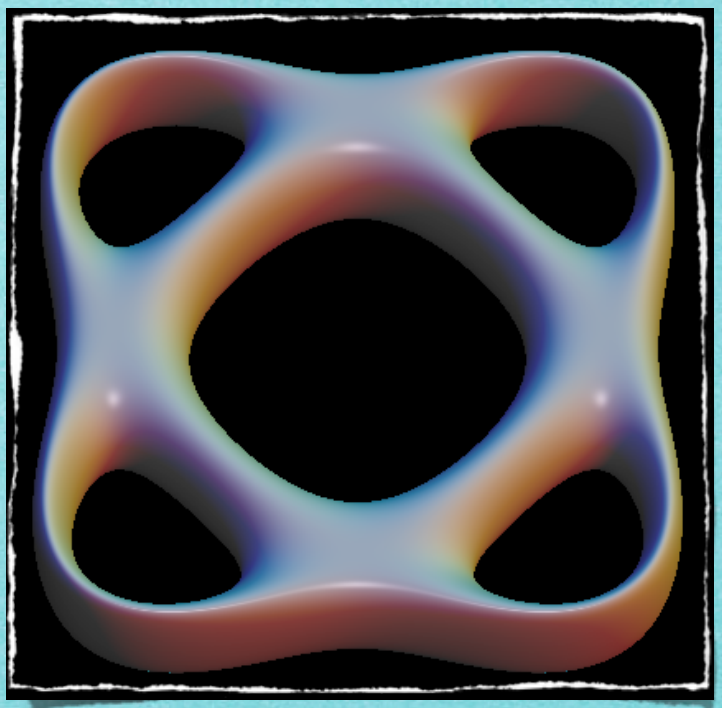
Modeling

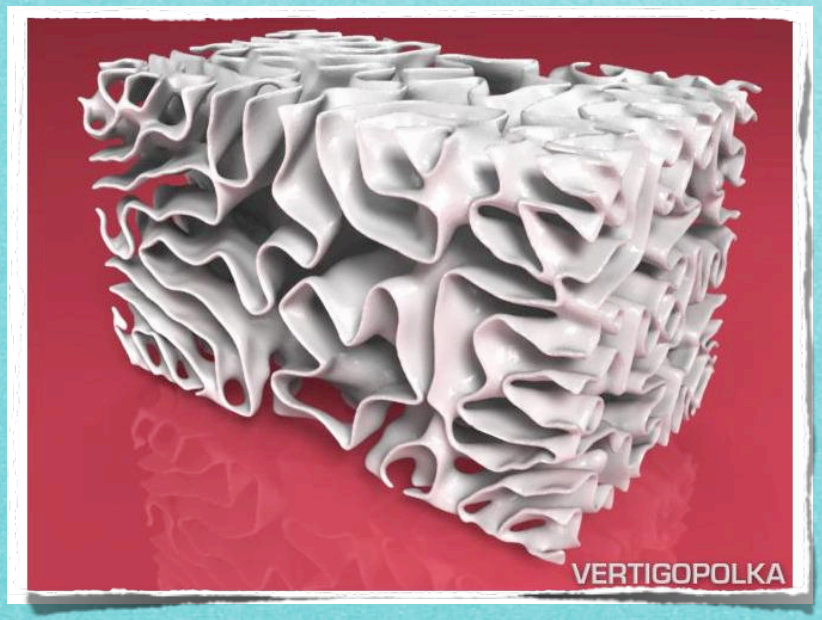
Voxels

Implicit Surfaces

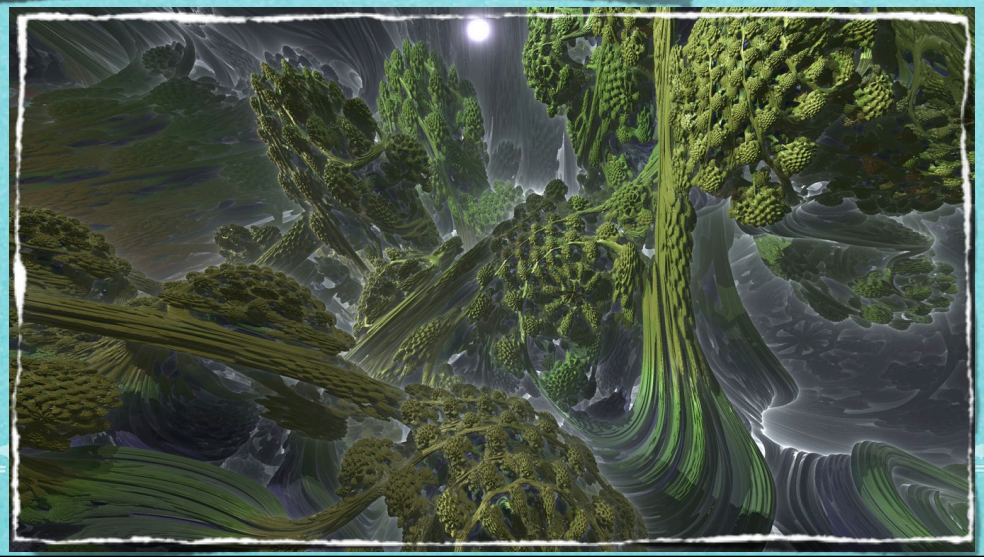
```
f(x,y,z) =  (x^2 + (y^2)/4 - 1) * ( (x^2)/4 + y^2 - 1) - k
```

- Why settle for triangles?



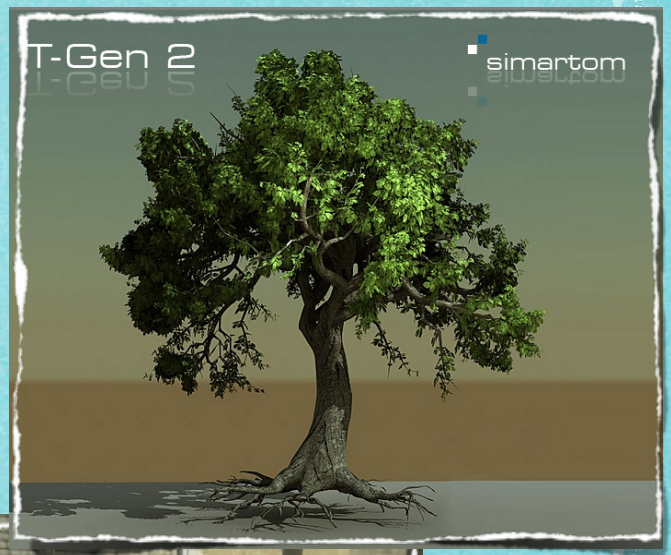


3D Fractals



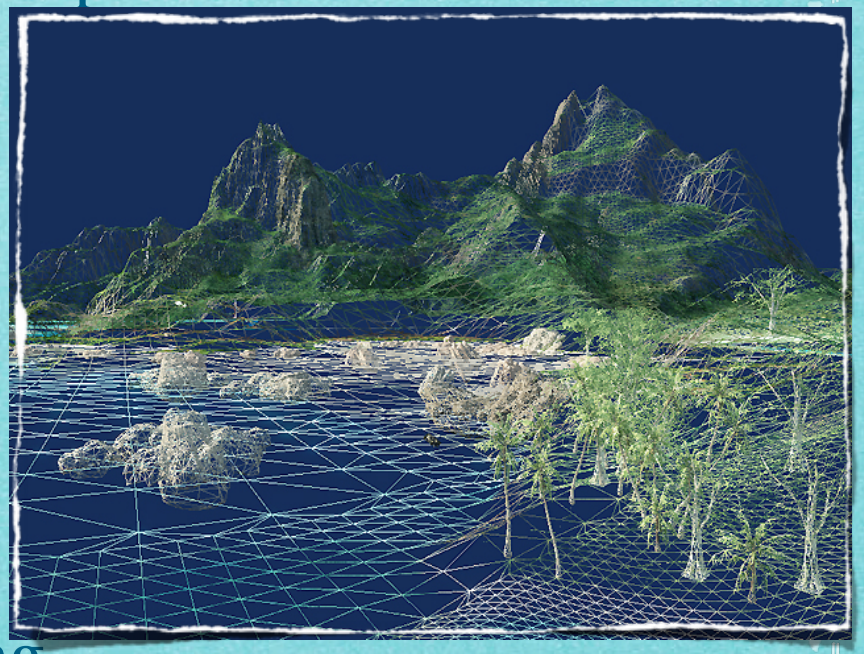
Procedural Modeling

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



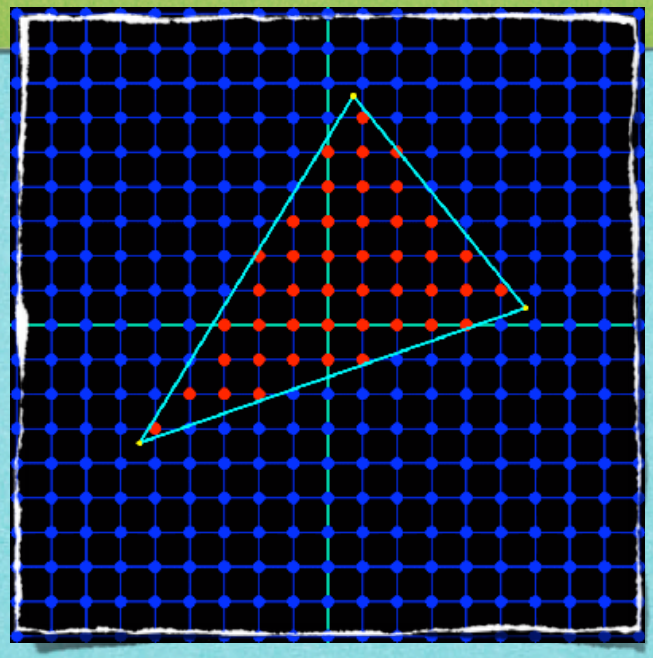
Heightfields

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



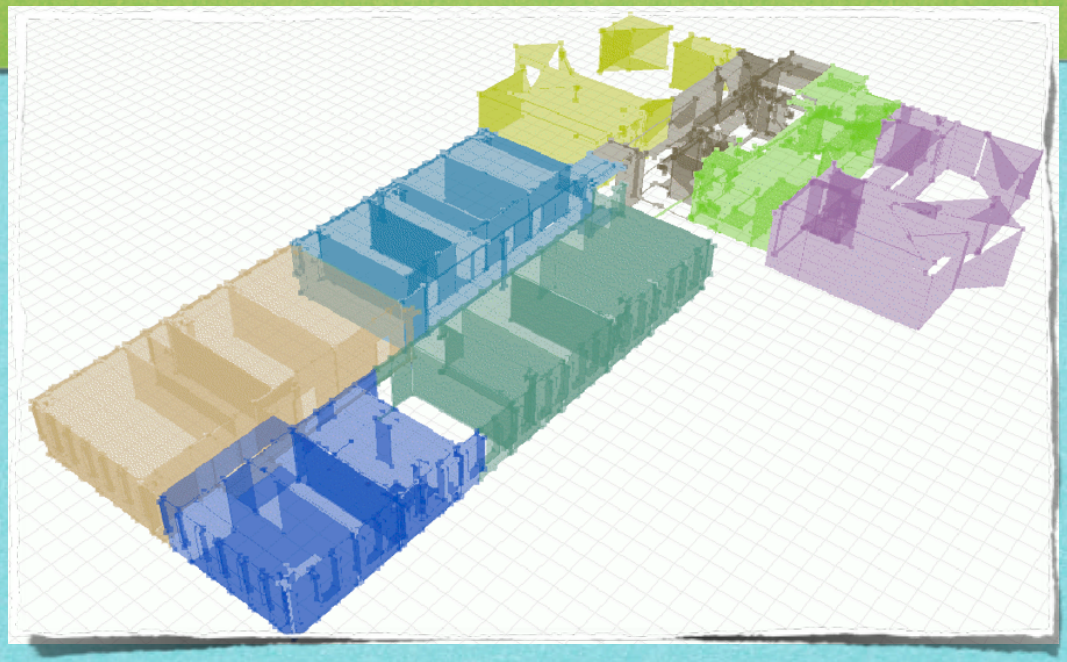
Performance

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)

Spatial Data Structures



- 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