CS 112 - Introduction

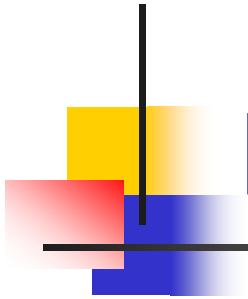
Why Graphics Research?

A picture is worth a thousand words.

- Anonymous

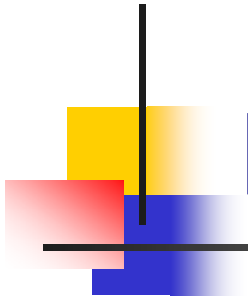
But a picture requires thousands of instructions!!

- Aditi



Main Stream Graphics

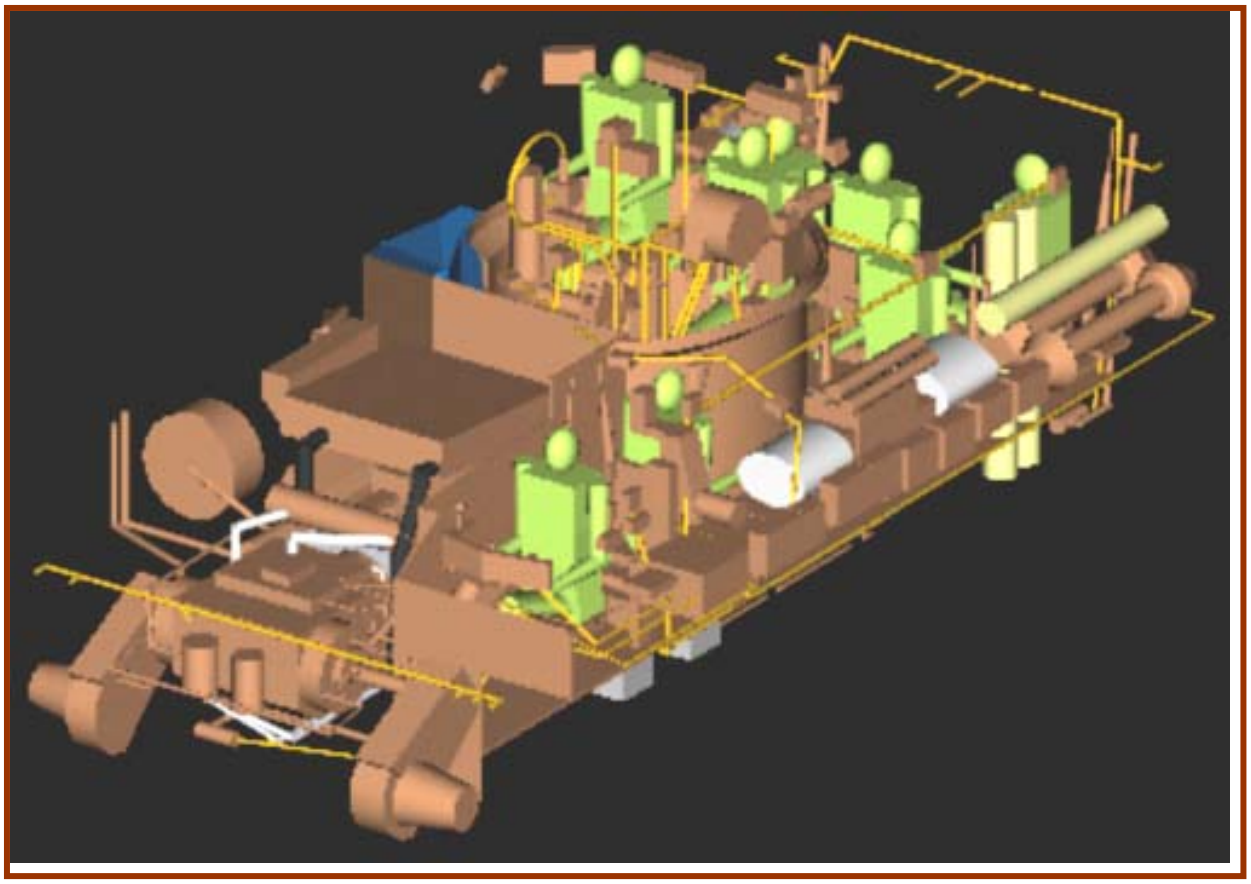
- Modeling
- Analysis
- Rendering



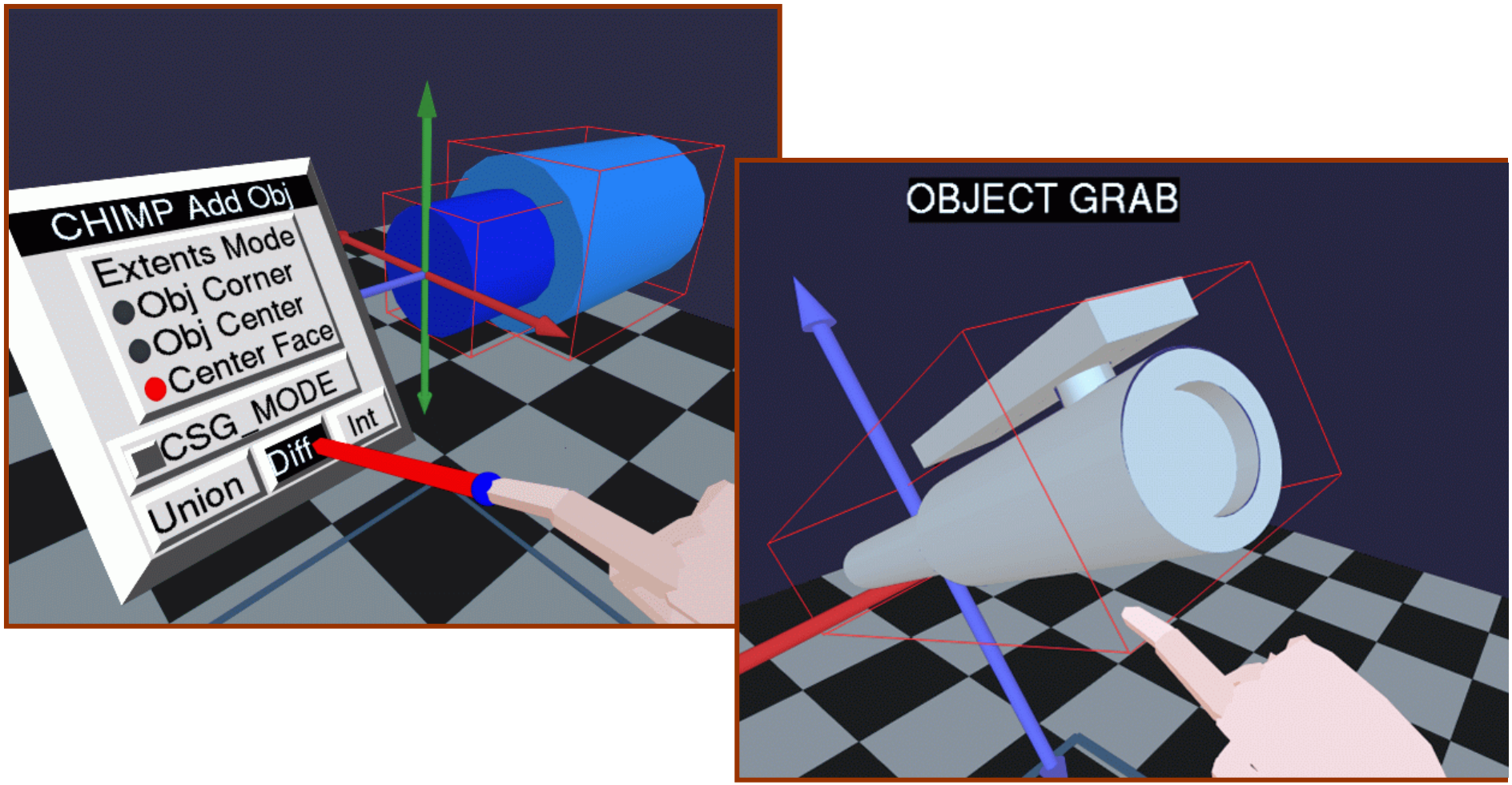
Main Stream Graphics

- Modeling
  - Objects
  - Phenomenon
  - Natural or Artificial
- Analysis
- Rendering

Modeling: Solid Modeling



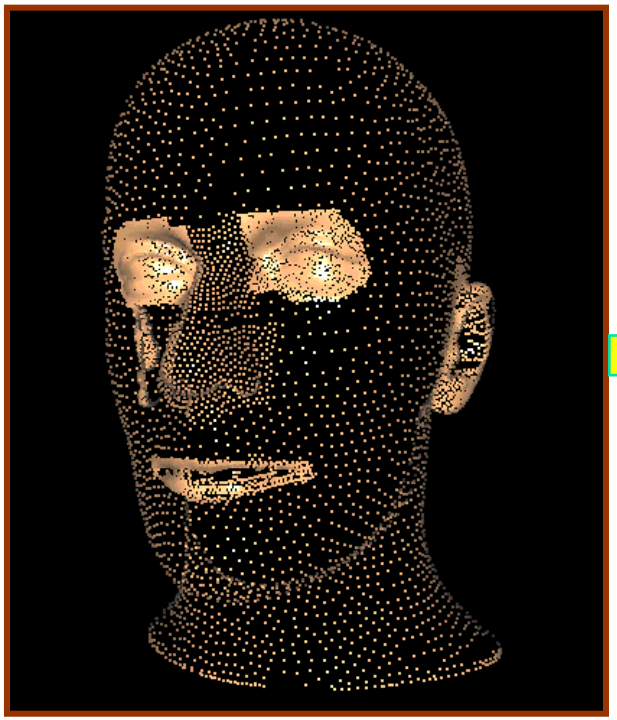
Modeling: Interactive Solid Modeling

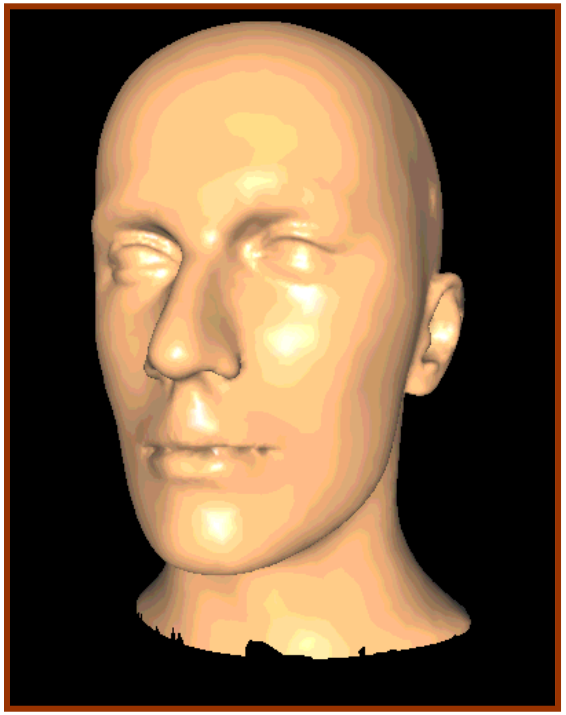


Modeling: Surface Reconstruction

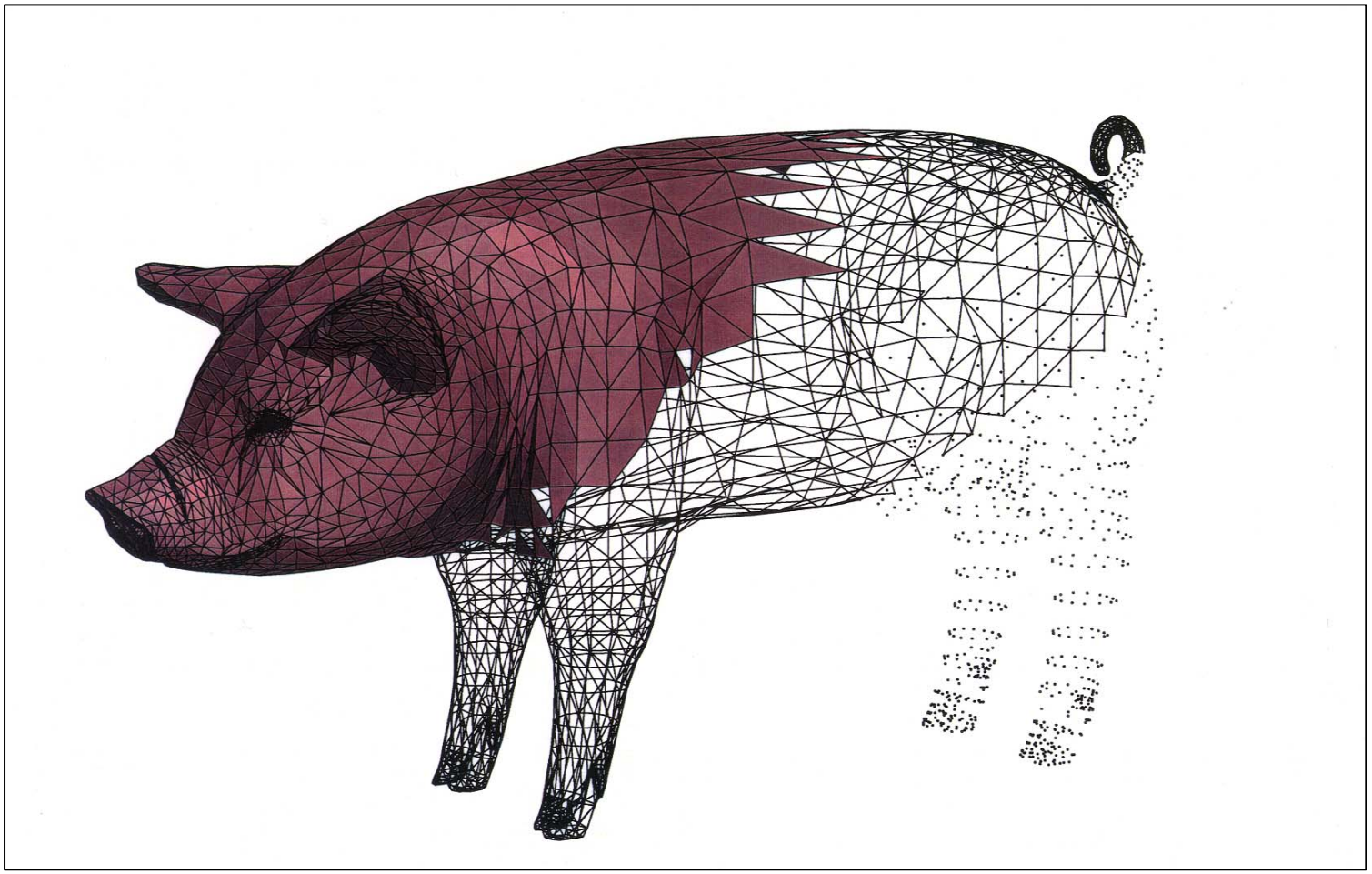
Sampling

Reconstruction

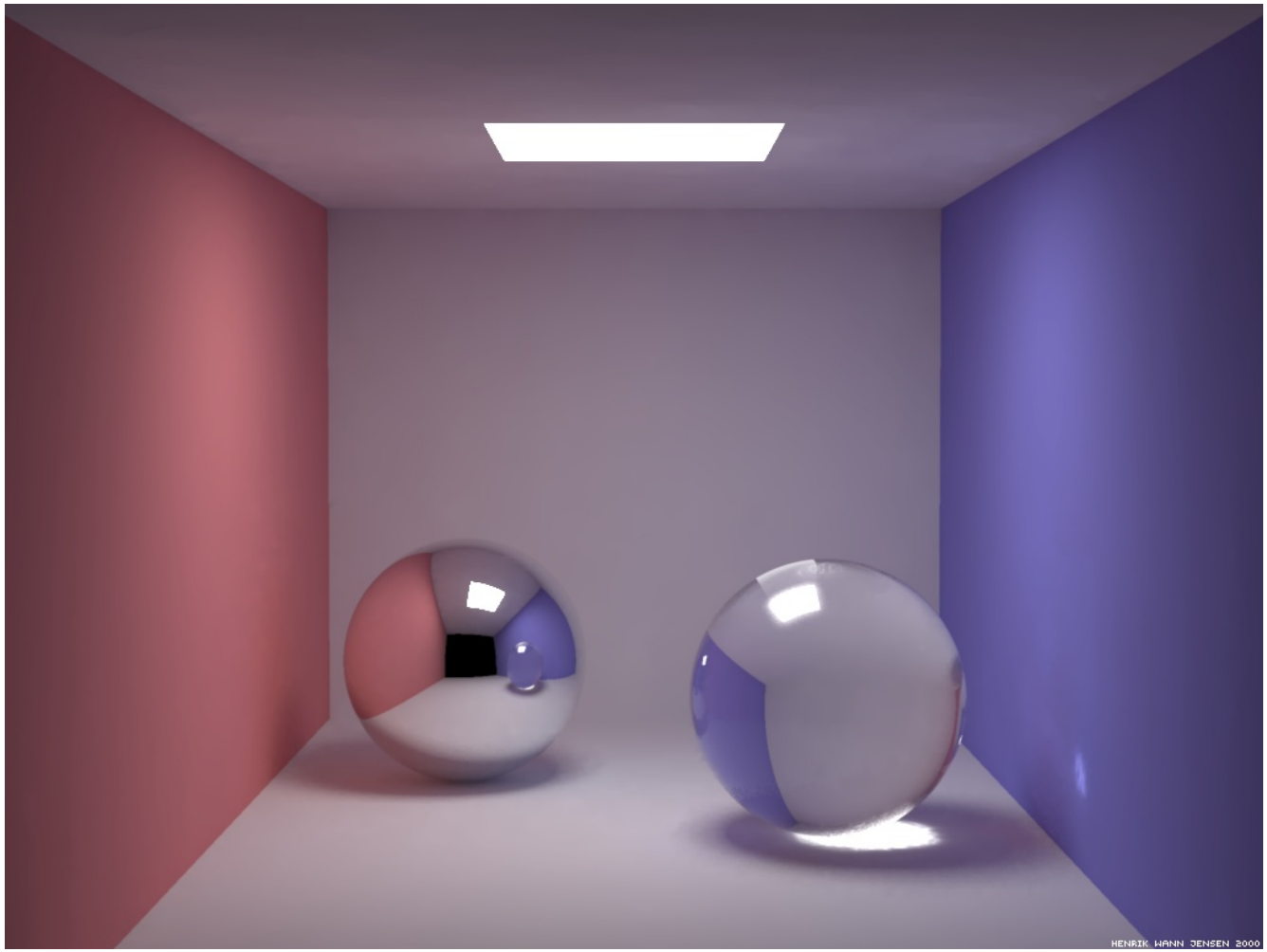




Modeling: Surface Reconstruction



Modeling: Global Illumination



Modeling: Subsurface Scattering

Modeling: Transluscency

Different levels of subsurface scattering (increasing from left to right) on Venus

Modeling need not be physically correct

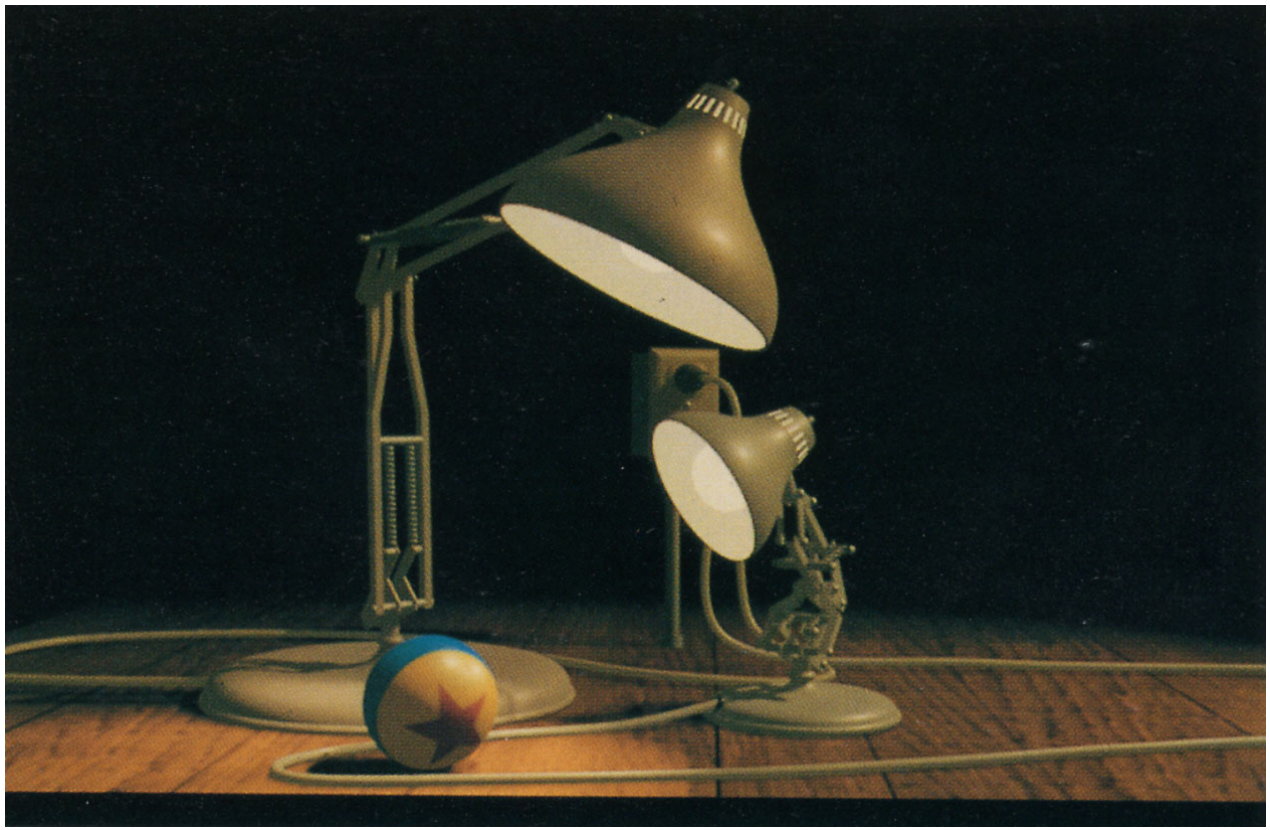
- Water in ‘Finding Nemo’

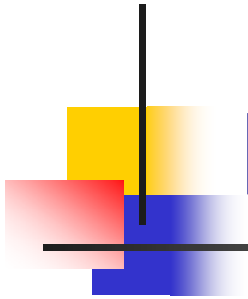
Modeling need not be physically correct

- Water in ‘Finding Nemo’

Modeling need not be physically correct

- Lighting in “Luxo Junior”

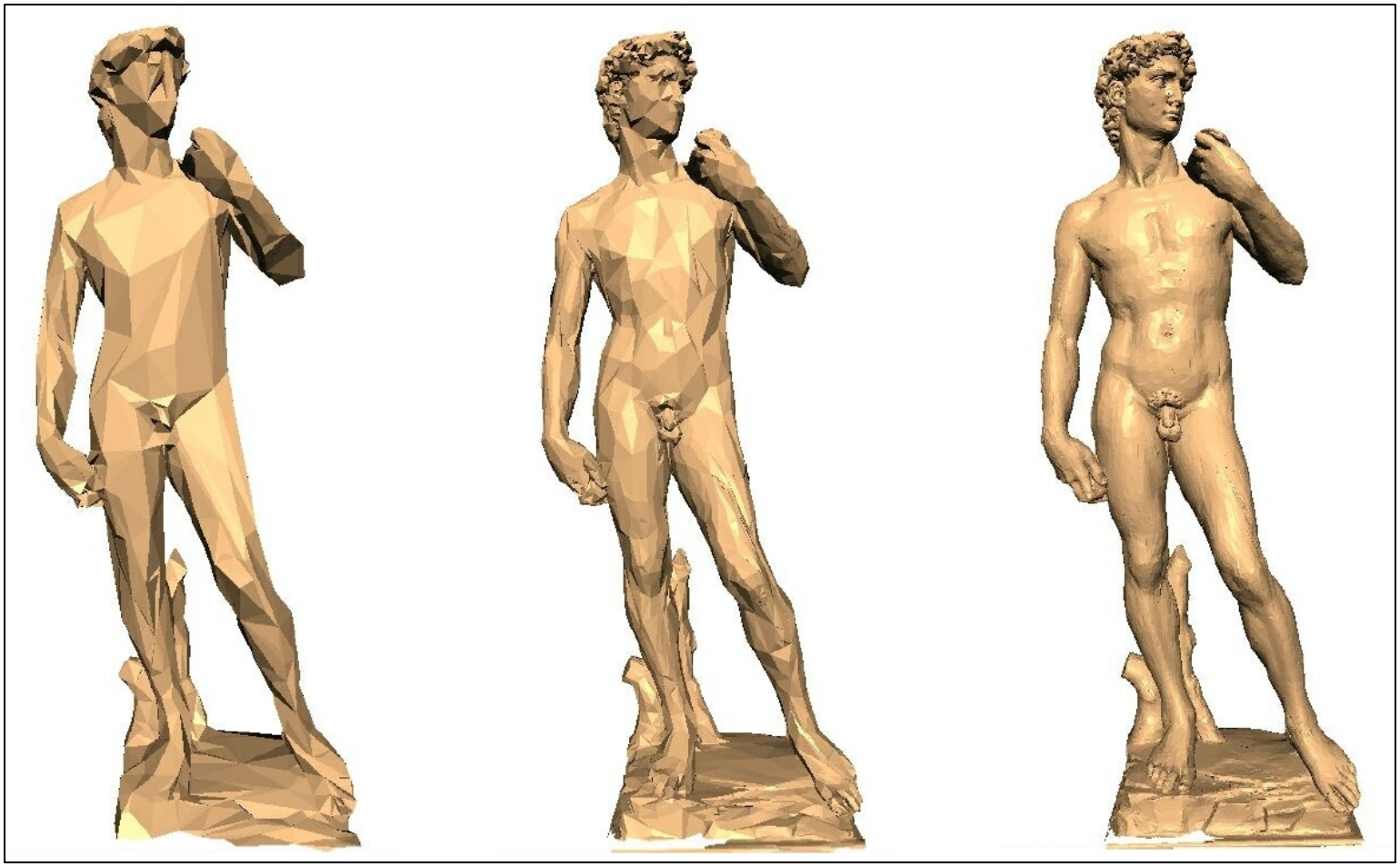




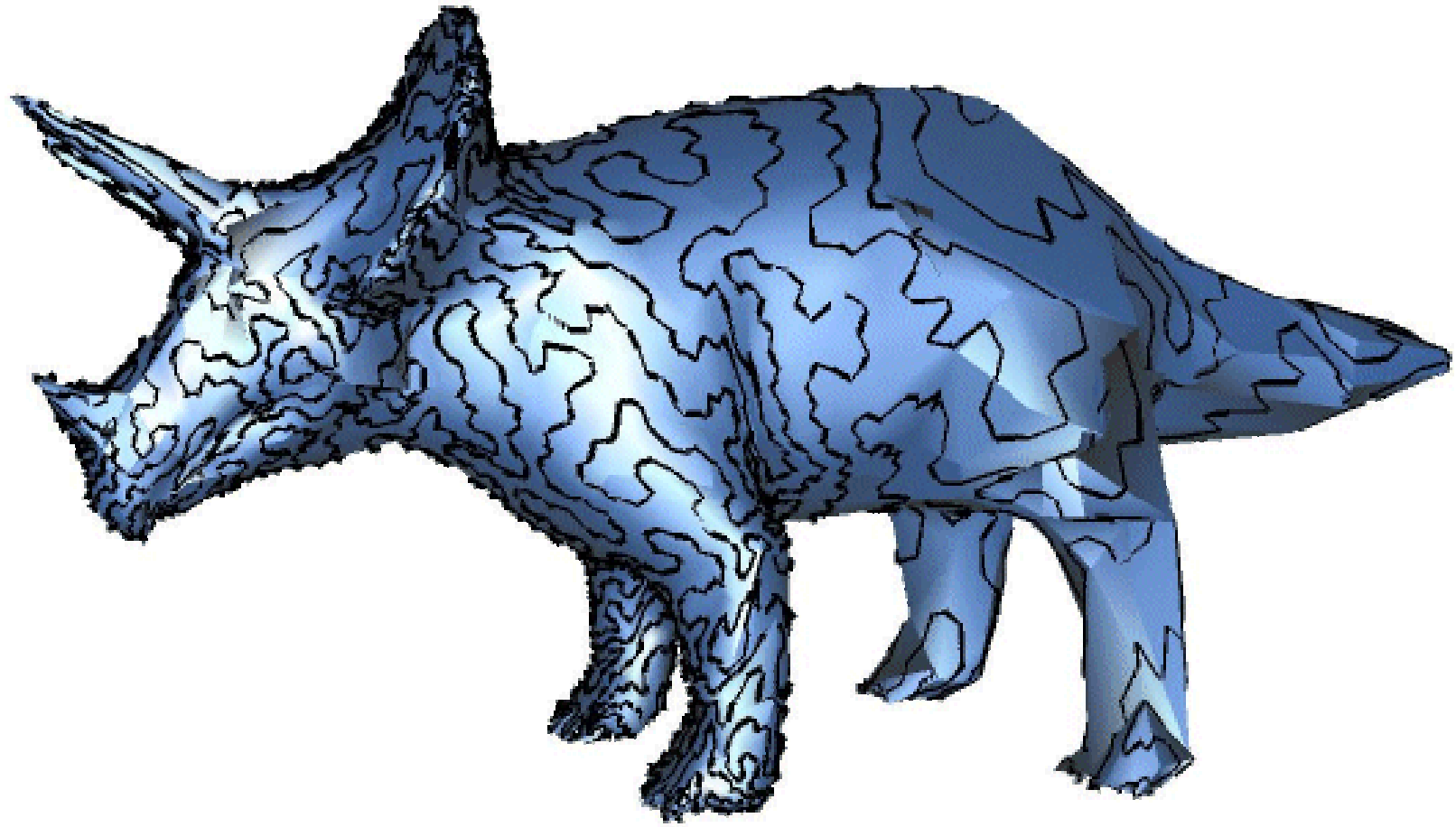
Main Stream Graphics

- Modeling
- Analysis
  - Models
  - Phenomenon
  - Driven by faster rendering
- Rendering

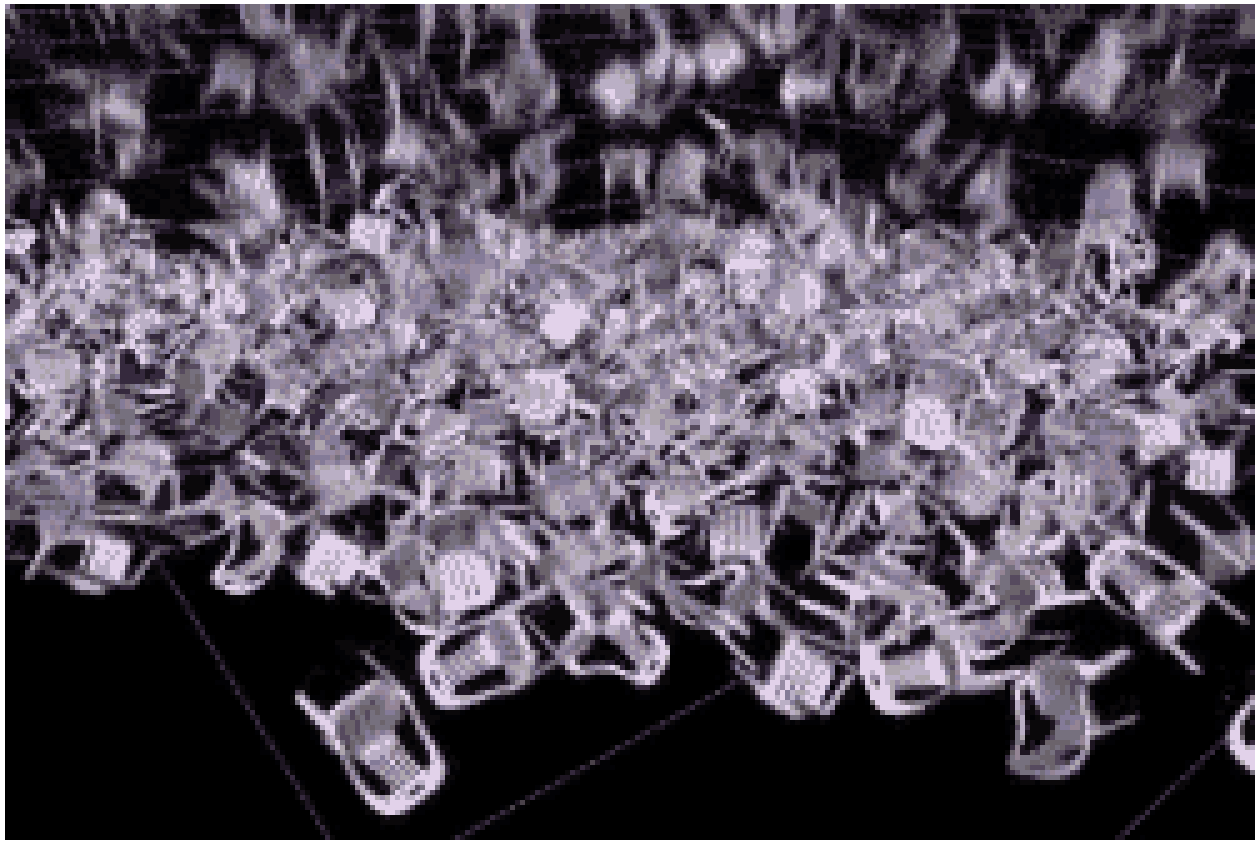
Analysis: Model Simplification



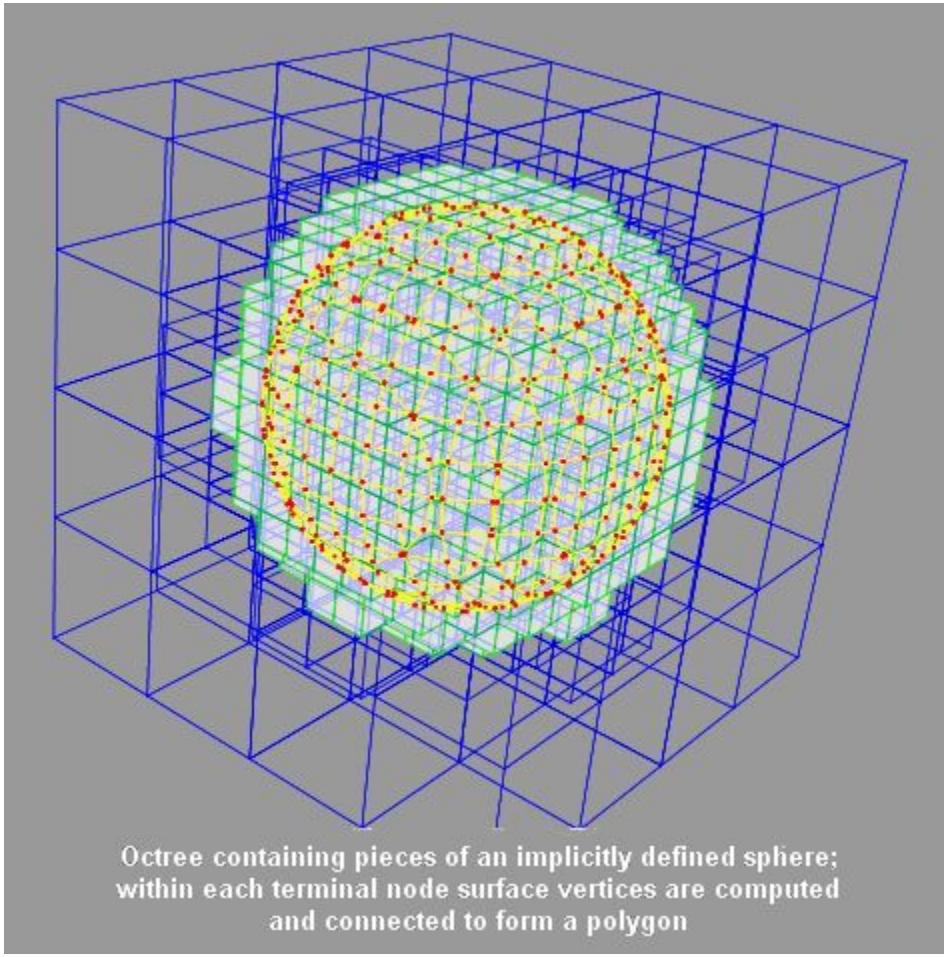
Analysis: Model Stripification



Analysis: Collision Detection



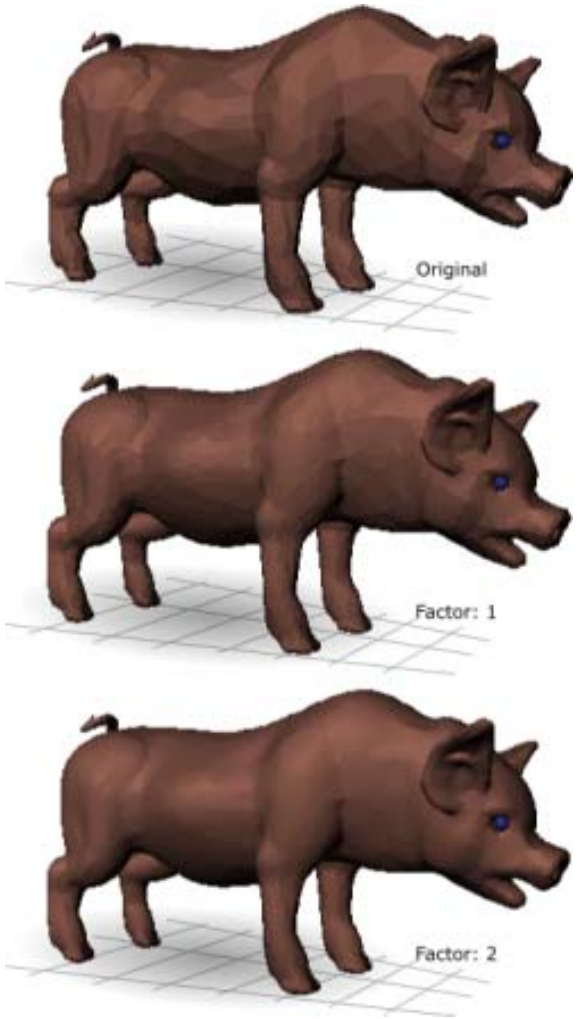
Analysis: Octree

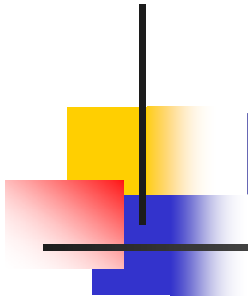


Octree containing pieces of an implicitly defined sphere; within each terminal node surface vertices are computed and connected to form a polygon

Analysis: Subdivision Surfaces

- Used in all Pixar movies from Toy Story 2
- Best understood when see the same characters in Toy Story 1 and 2

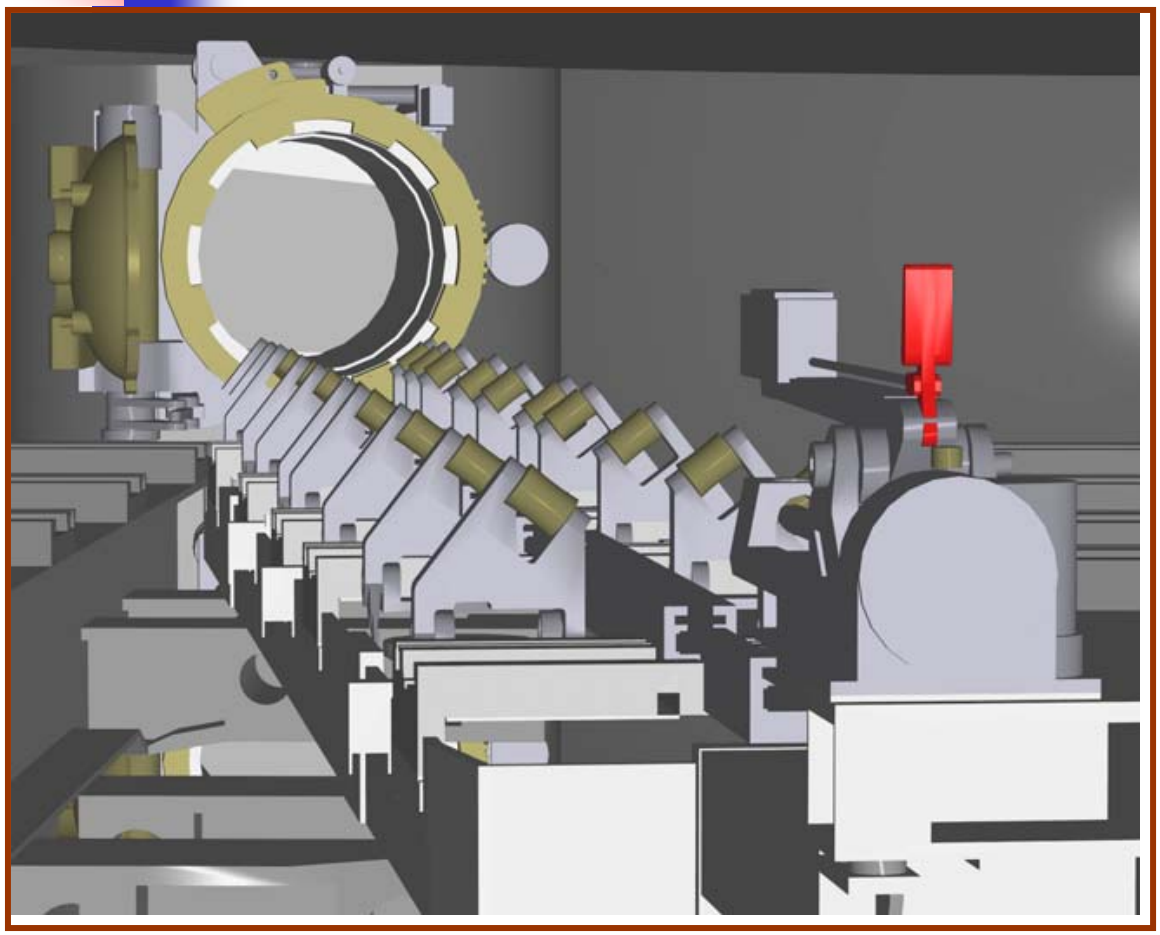


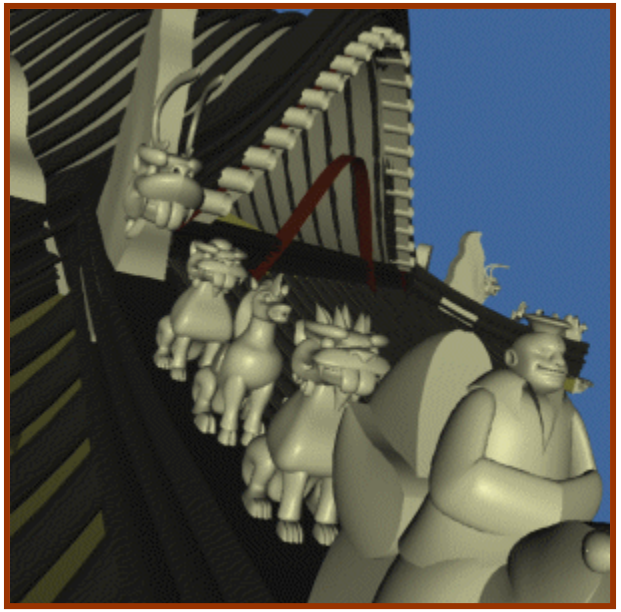


Main Stream Graphics

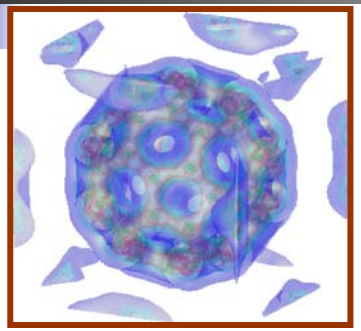
- Modeling
- Analysis
- Rendering
  - Speed
  - Appearance
  - Quality
  - Progressive

Rendering: Spline Rendering





Rendering

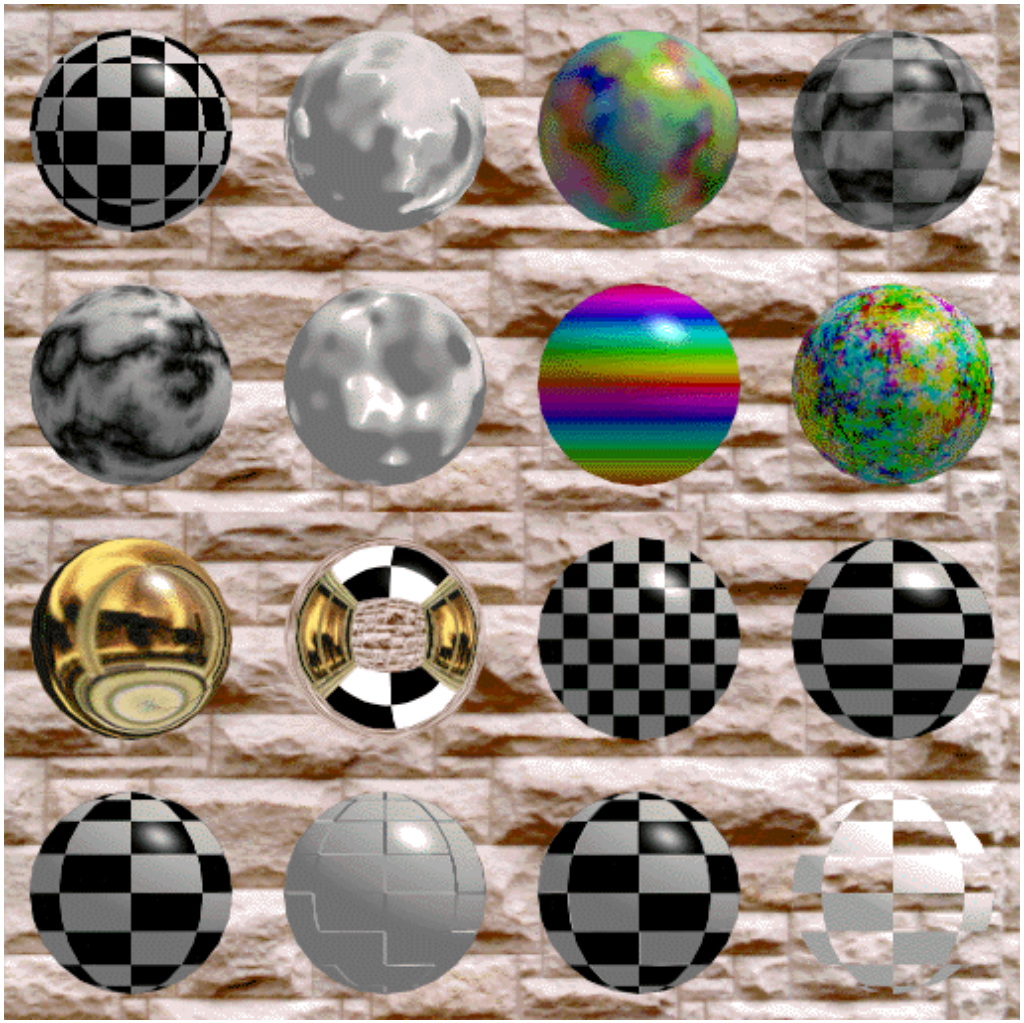


Isosurface Extraction

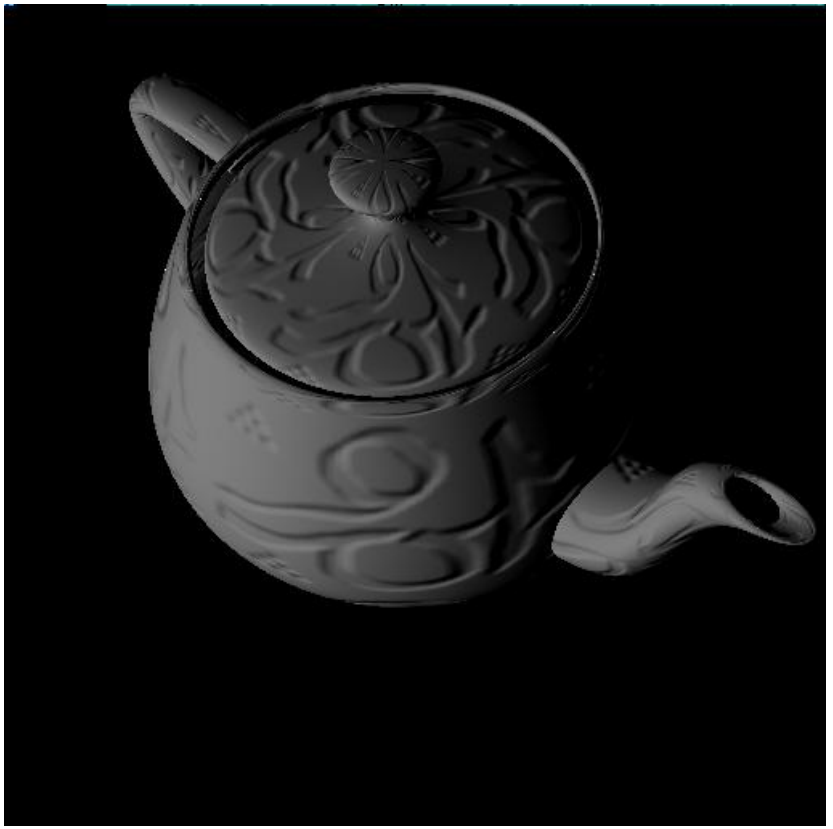
View-dependent Simplification

Silhouette Preserving Simplification

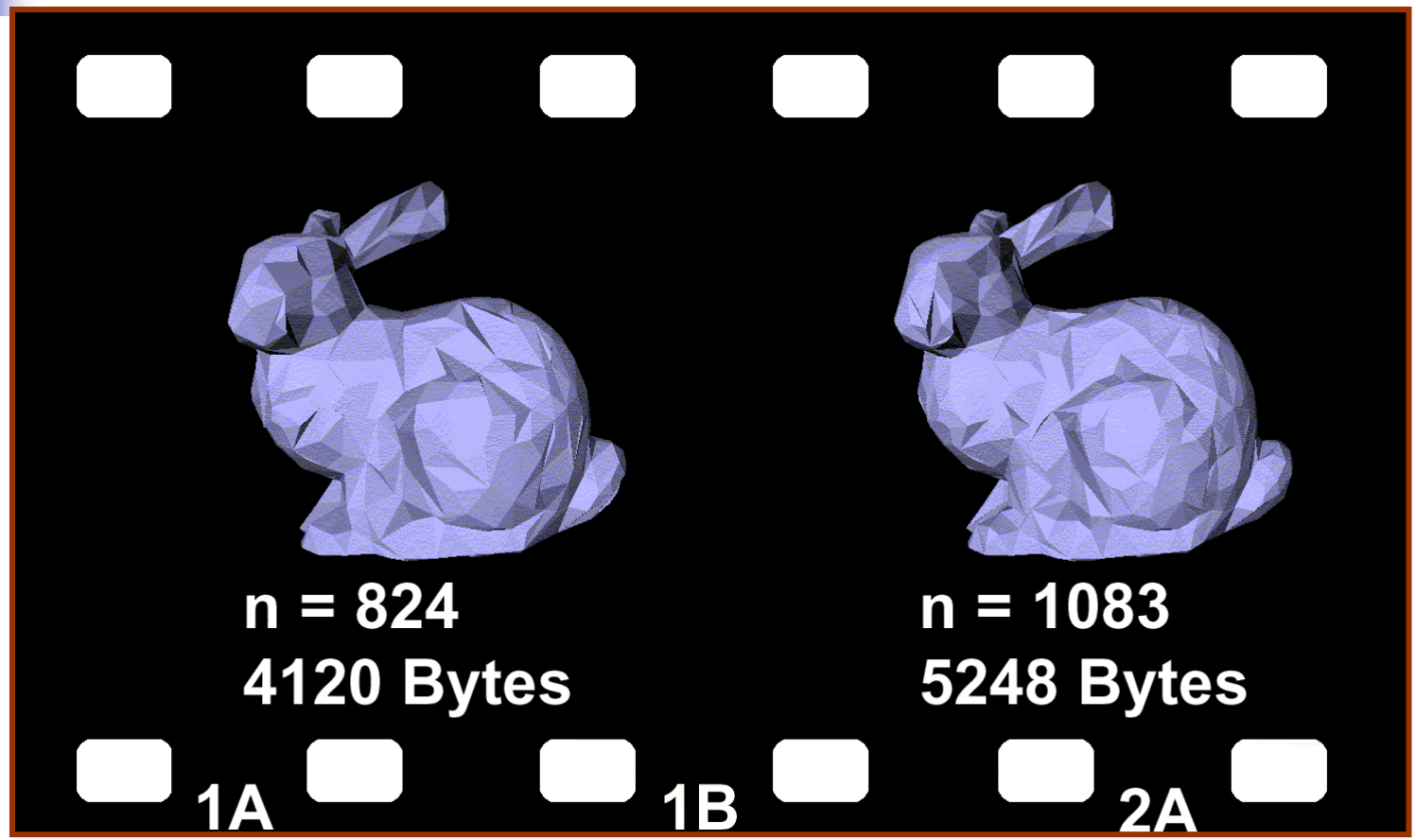
Rendering: Texture Mapping



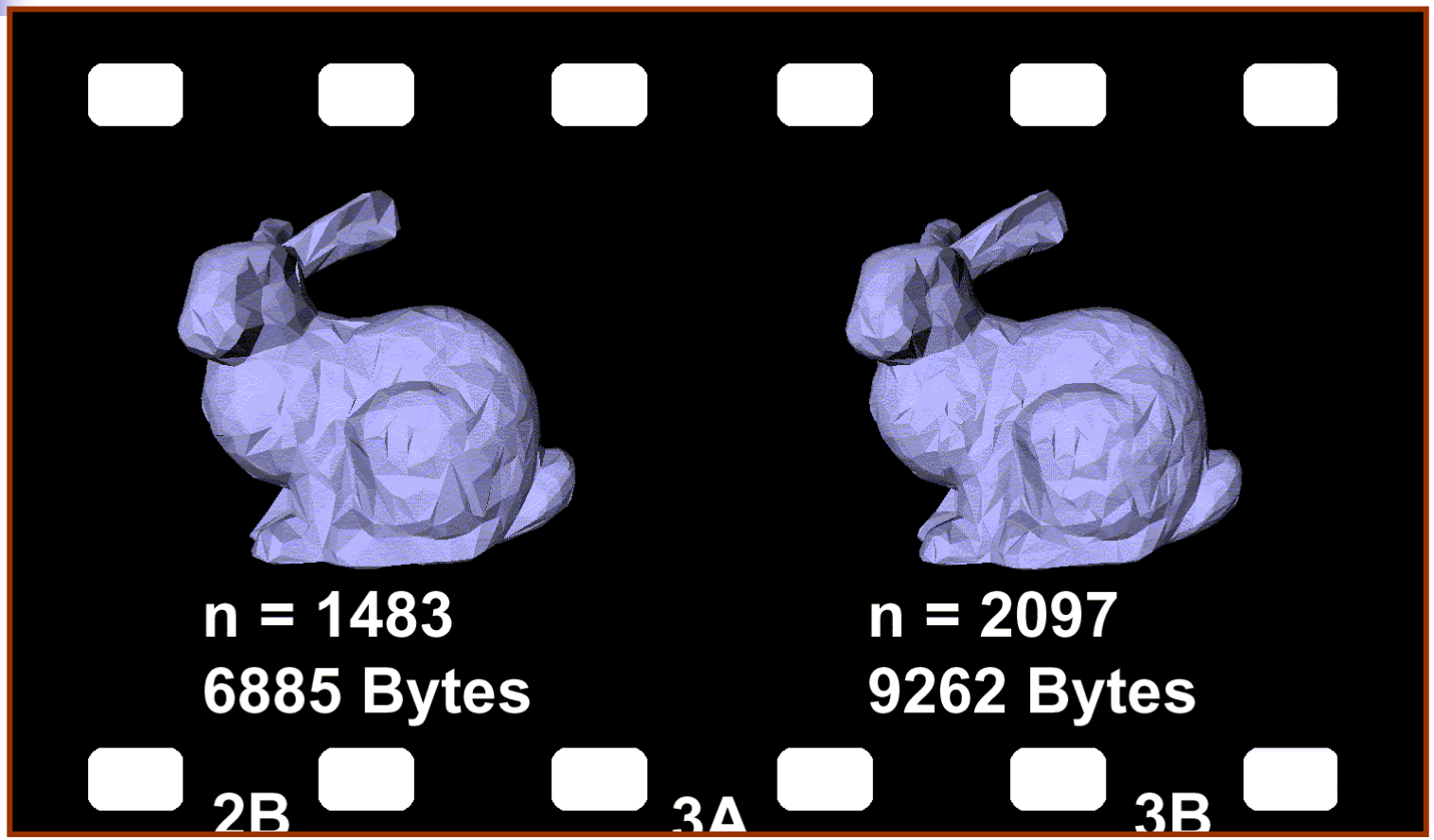
Rendering: Bump Mapping



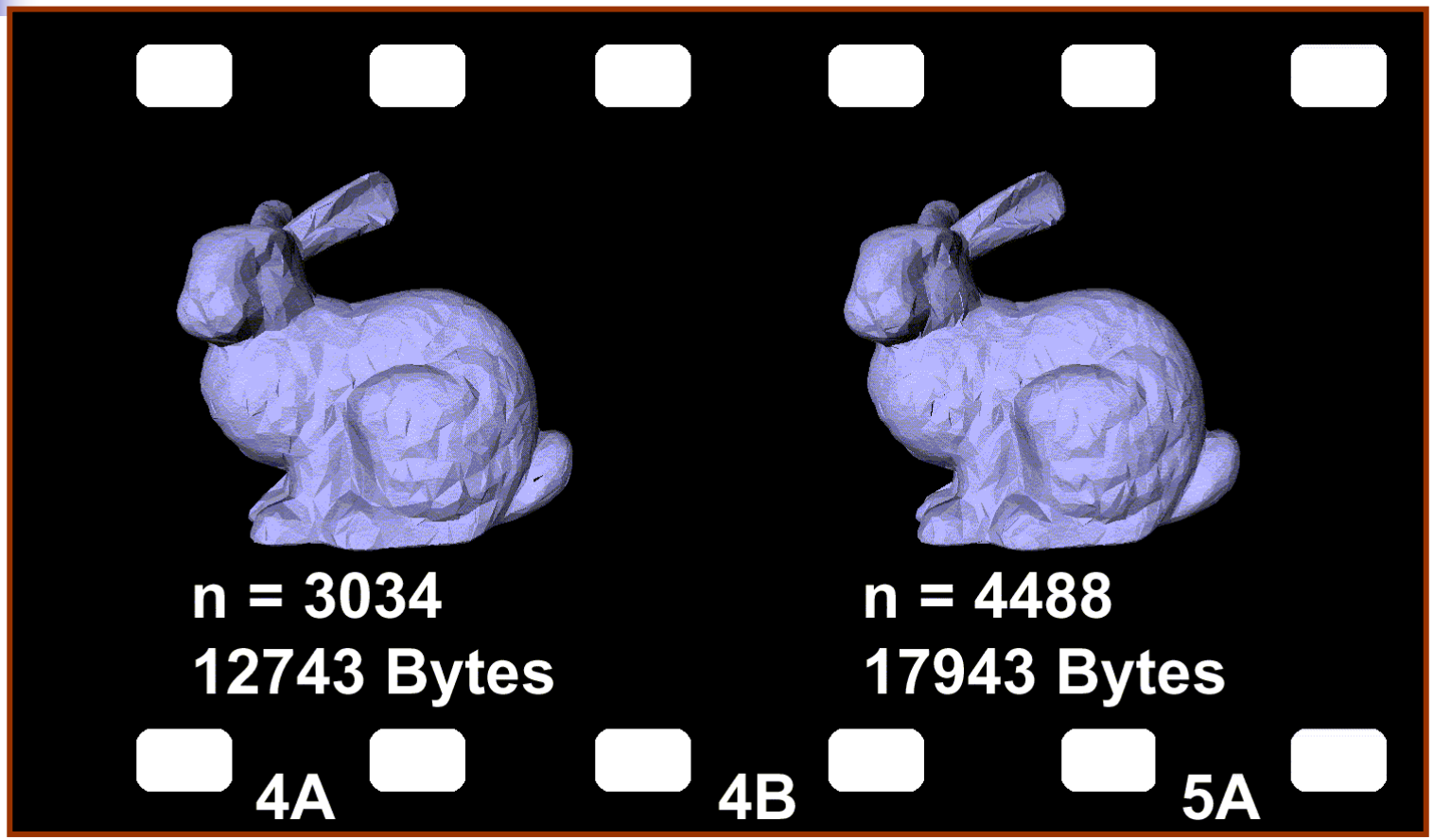
Rendering: Progressive Transmission



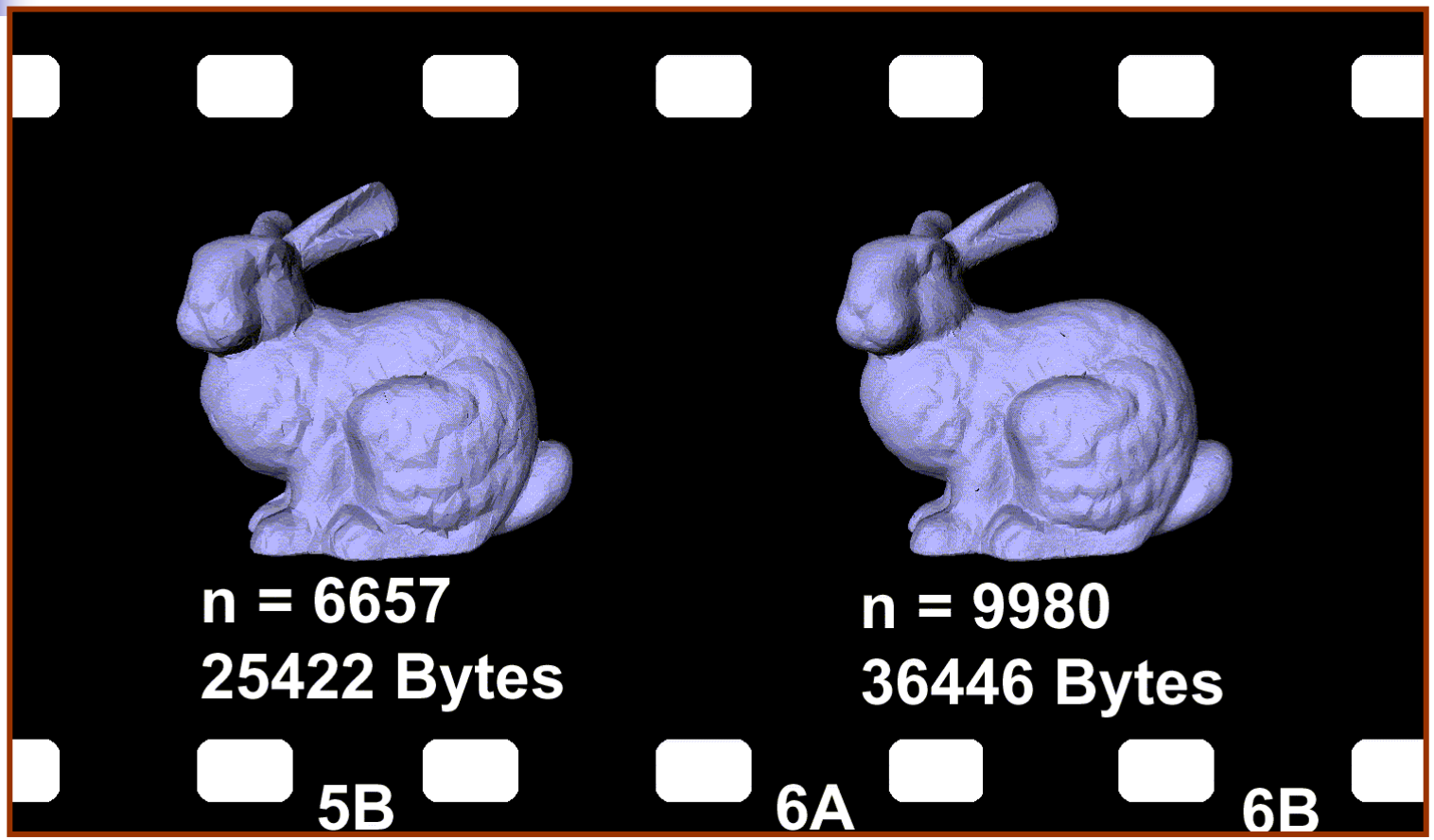
Rendering: Progressive Transmission



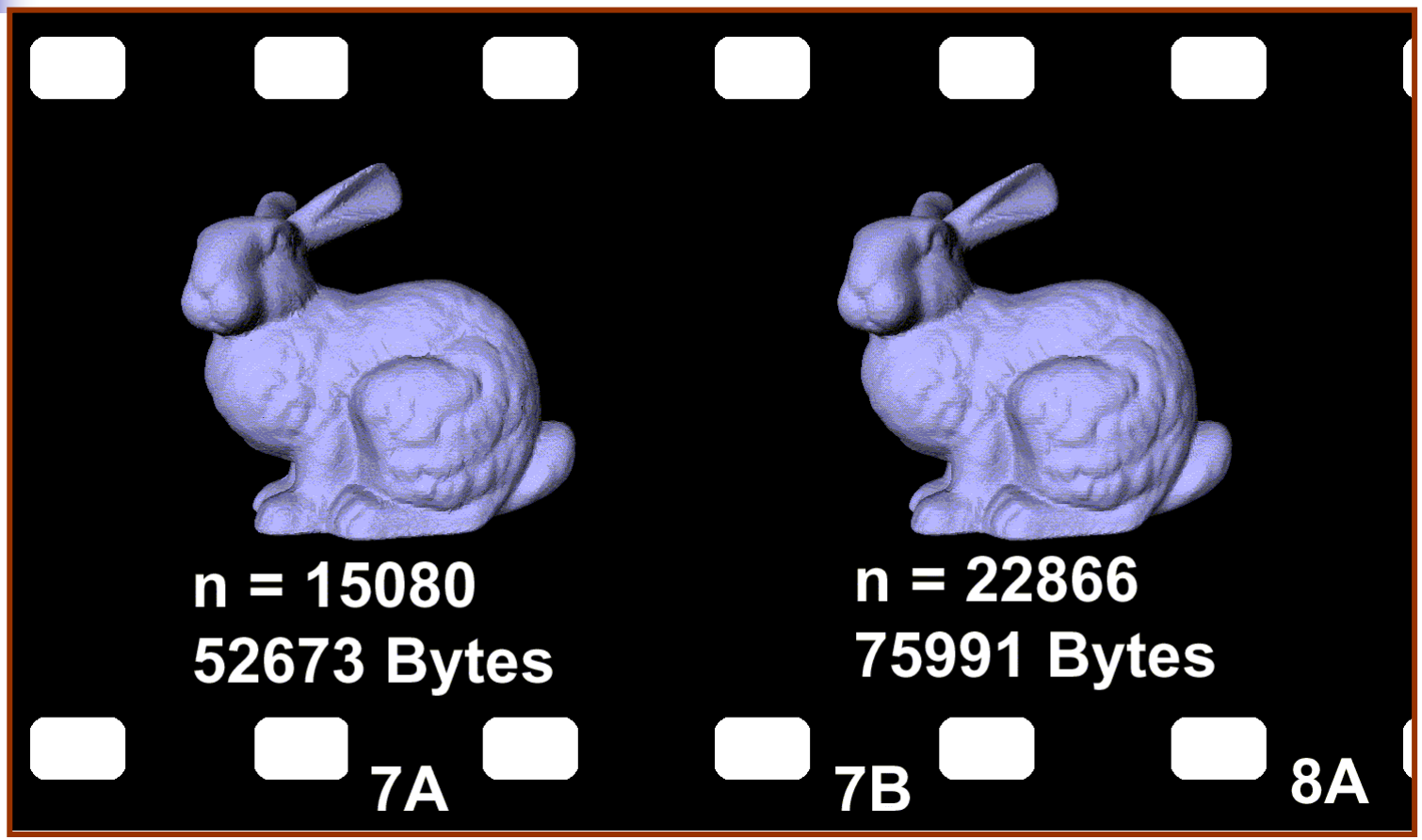
Rendering: Progressive Transmission



Rendering: Progressive Transmission



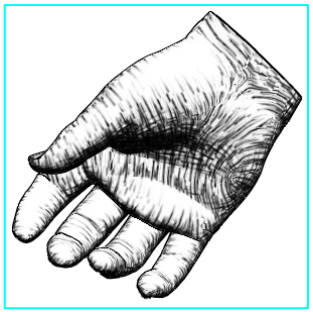
Rendering: Progressive Transmission



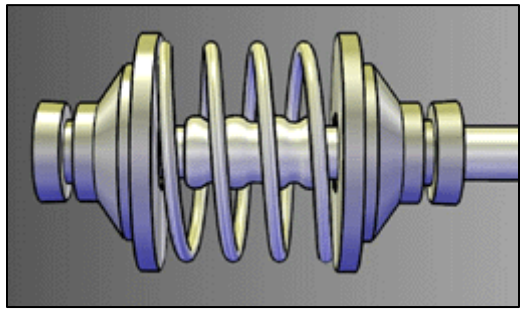
Rendering:
Non Photorealistic Rendering

Photorealistic

Pen and Ink



Painterly Rendering



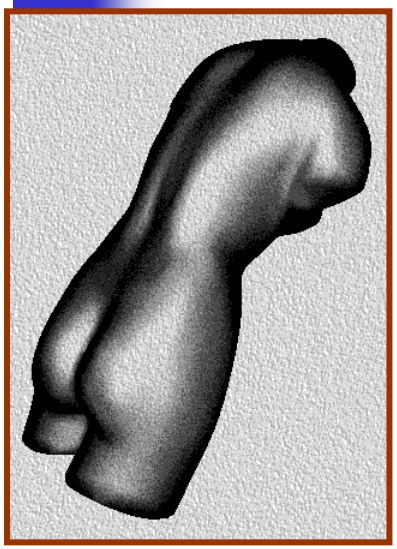
Illustrations

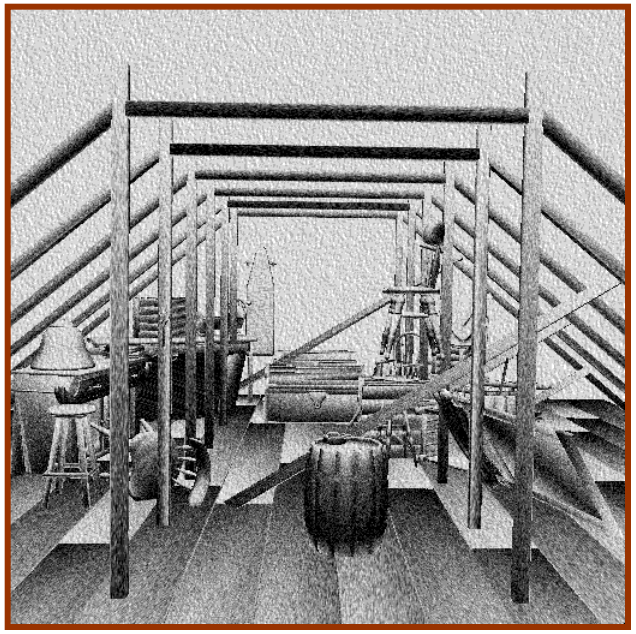
Dithering

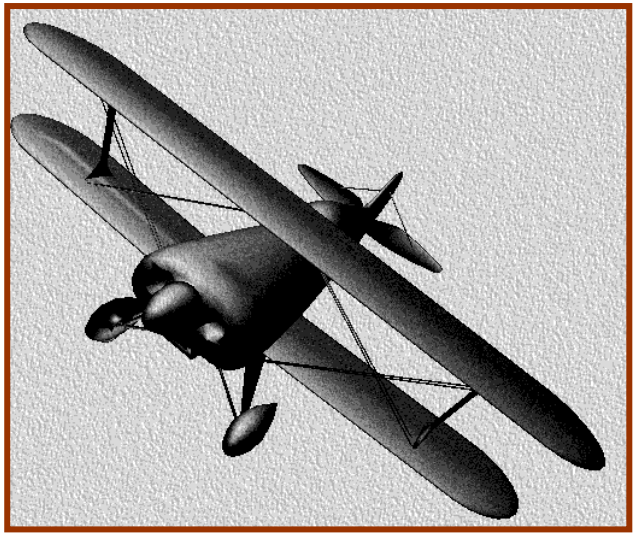
Engraving

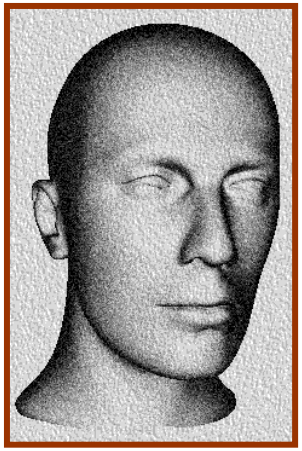
Fur and Grass

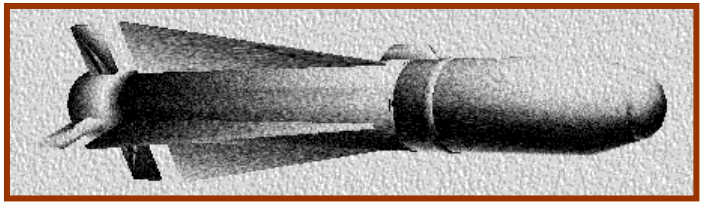
Real Time Charcoal Rendering

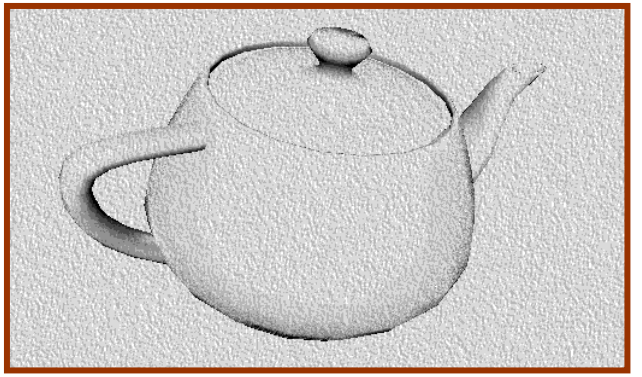


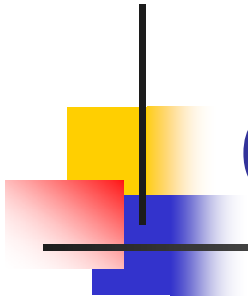










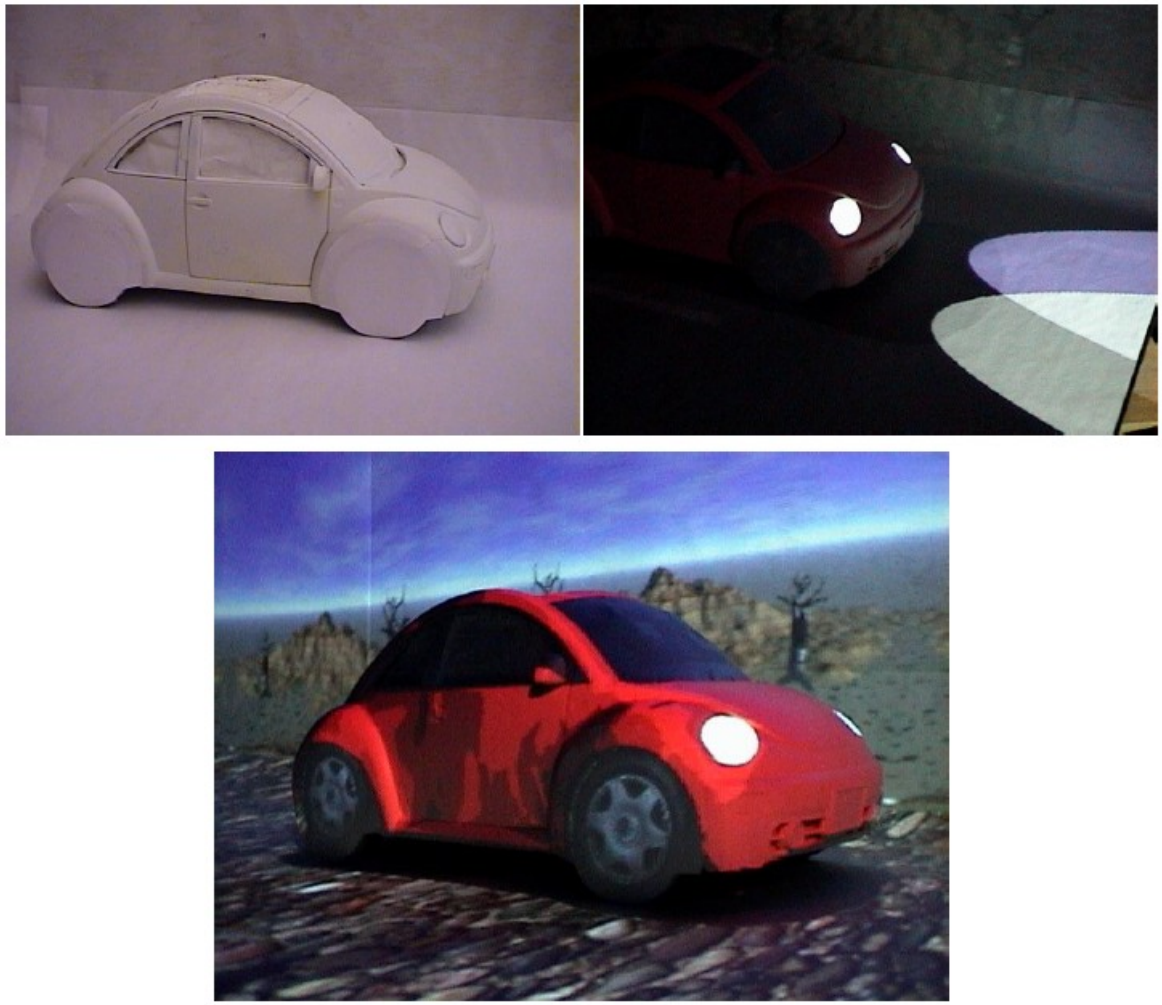


Graphics Applications

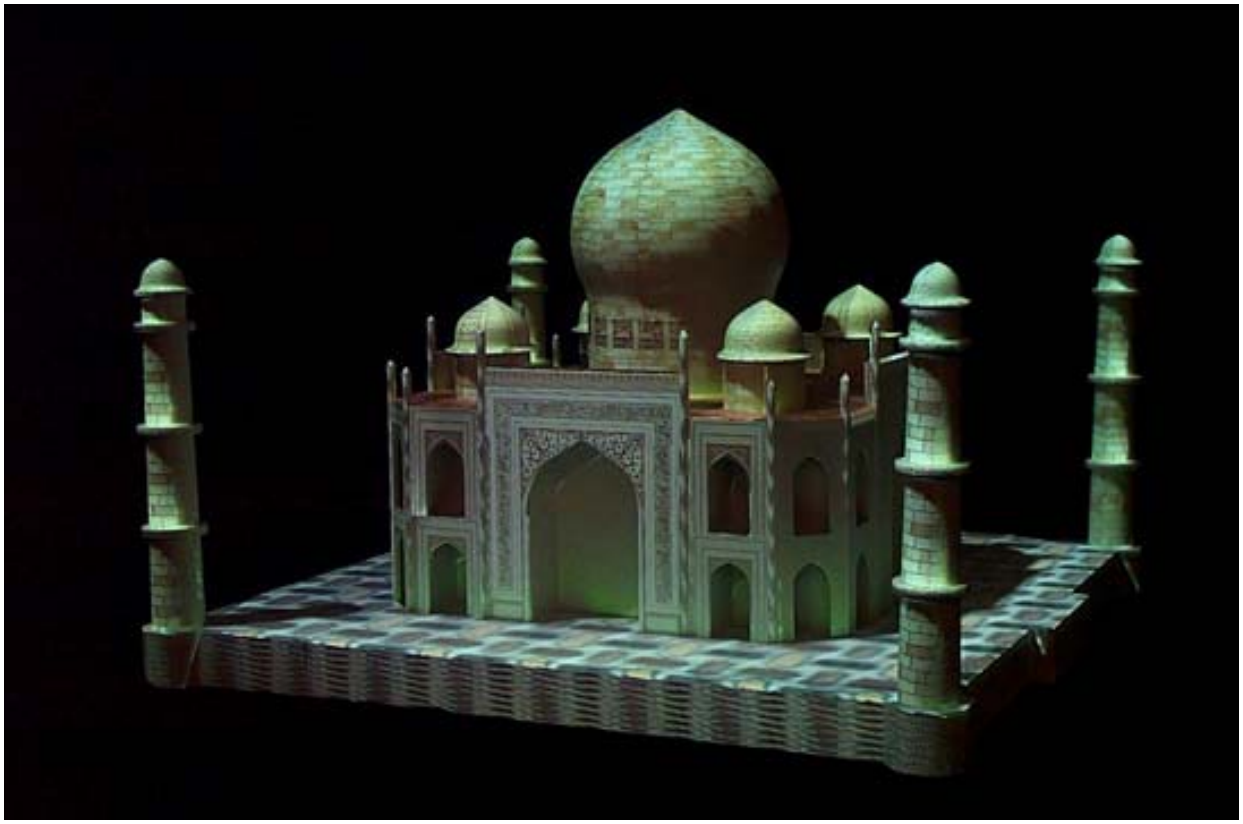
- Virtual Reality
- Gaming
- Immersive Teleconferencing
- Telemedicine
- Animation
- Large Area Seamless Displays
- Visualization
- Simulation and Training

Virtual Reality: CAVE

Augmented Reality: Shader Lamps



Augmented Reality: Shader Lamps



Telemedicine

- Spatially augmented reality
- Guided by images projected on the body of the patient

Immersive Teleconferencing: Capture

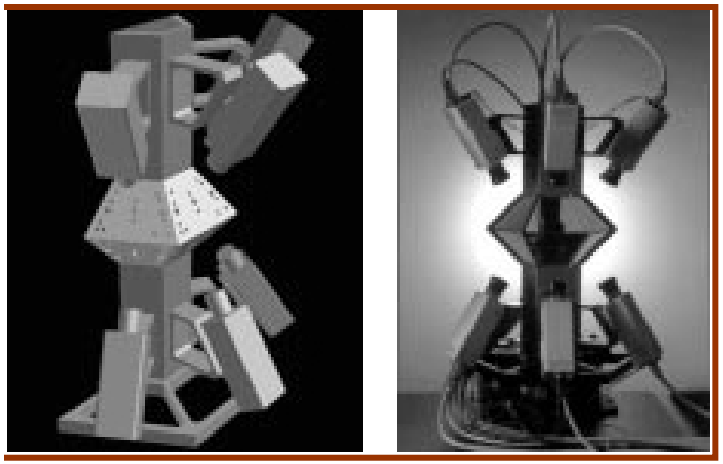


Image Capture

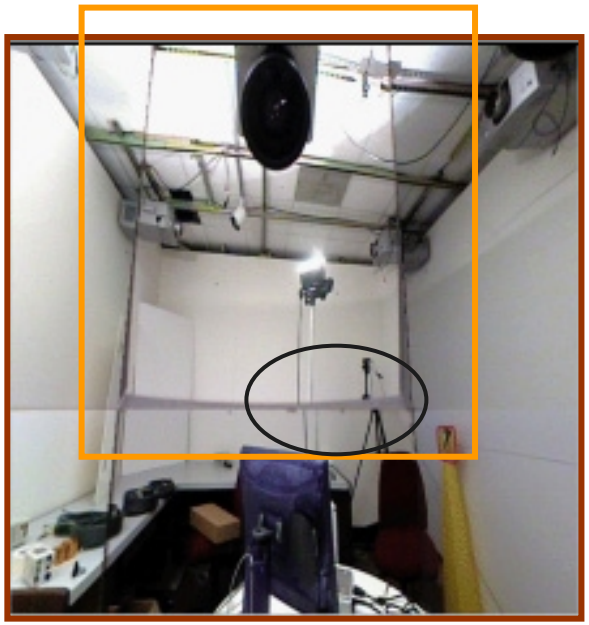
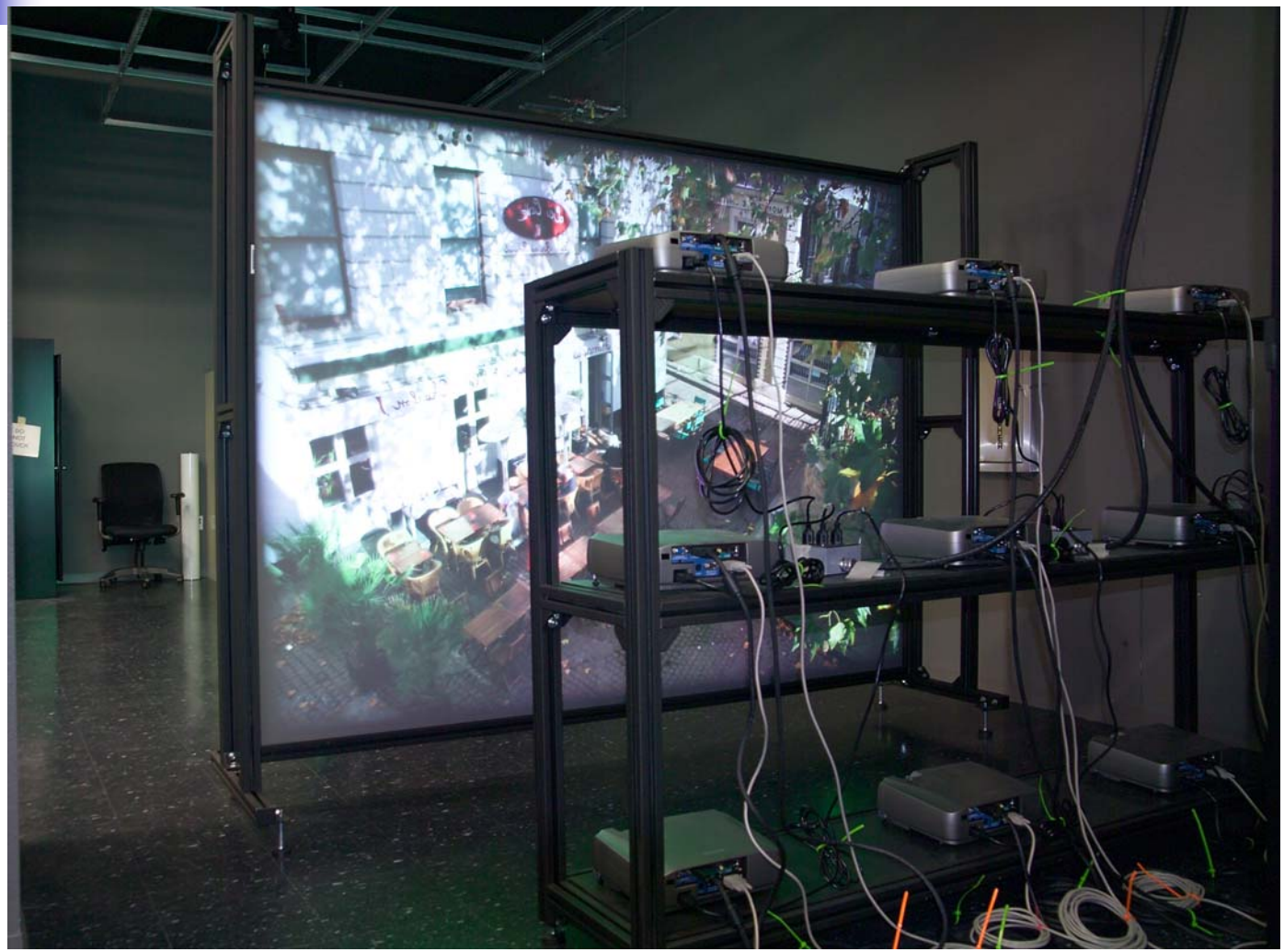


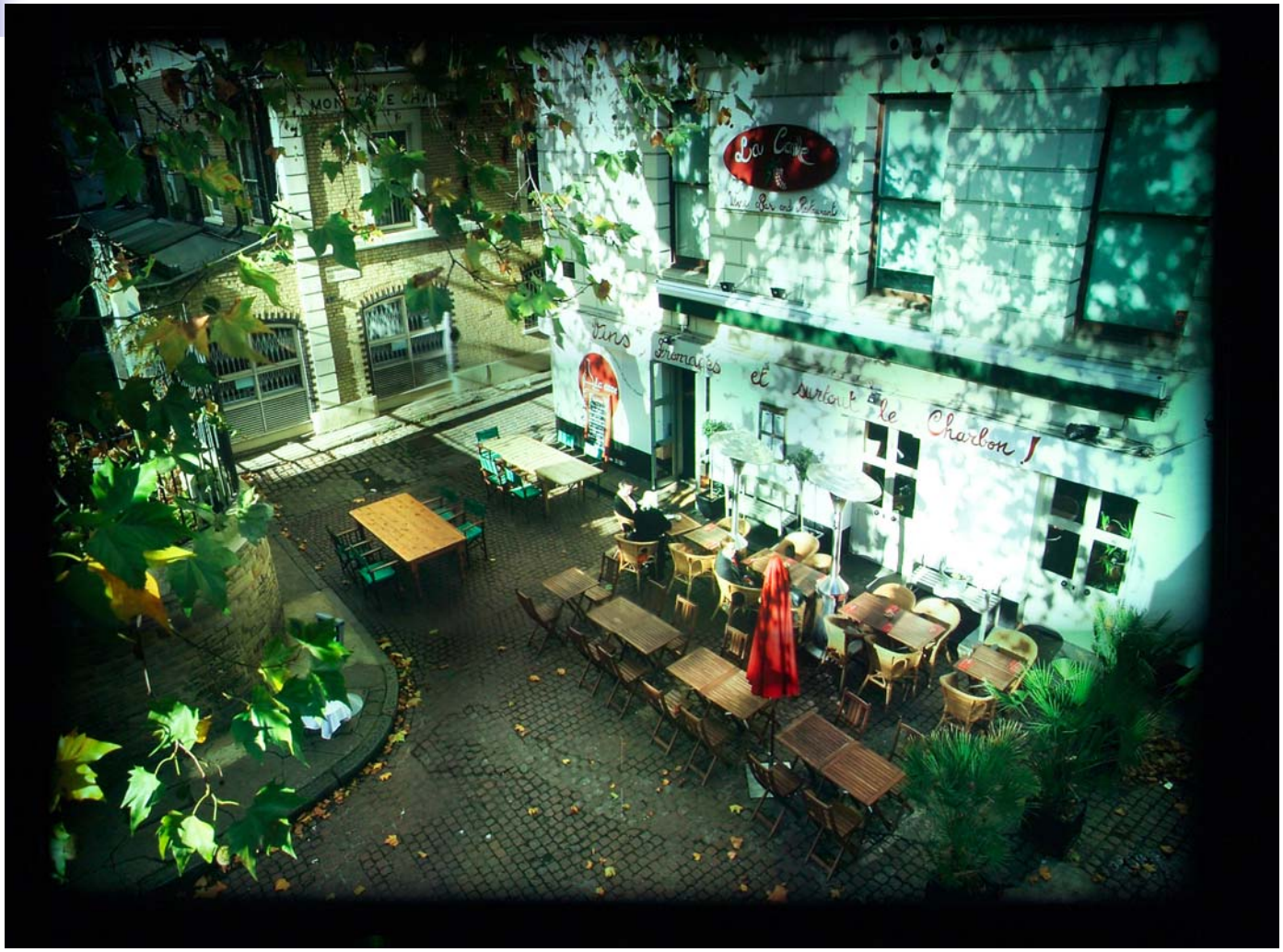
Image Correction

Immersive Teleconferencing: Stitching

Large Area Seamless Display



Large Area Seamless Display

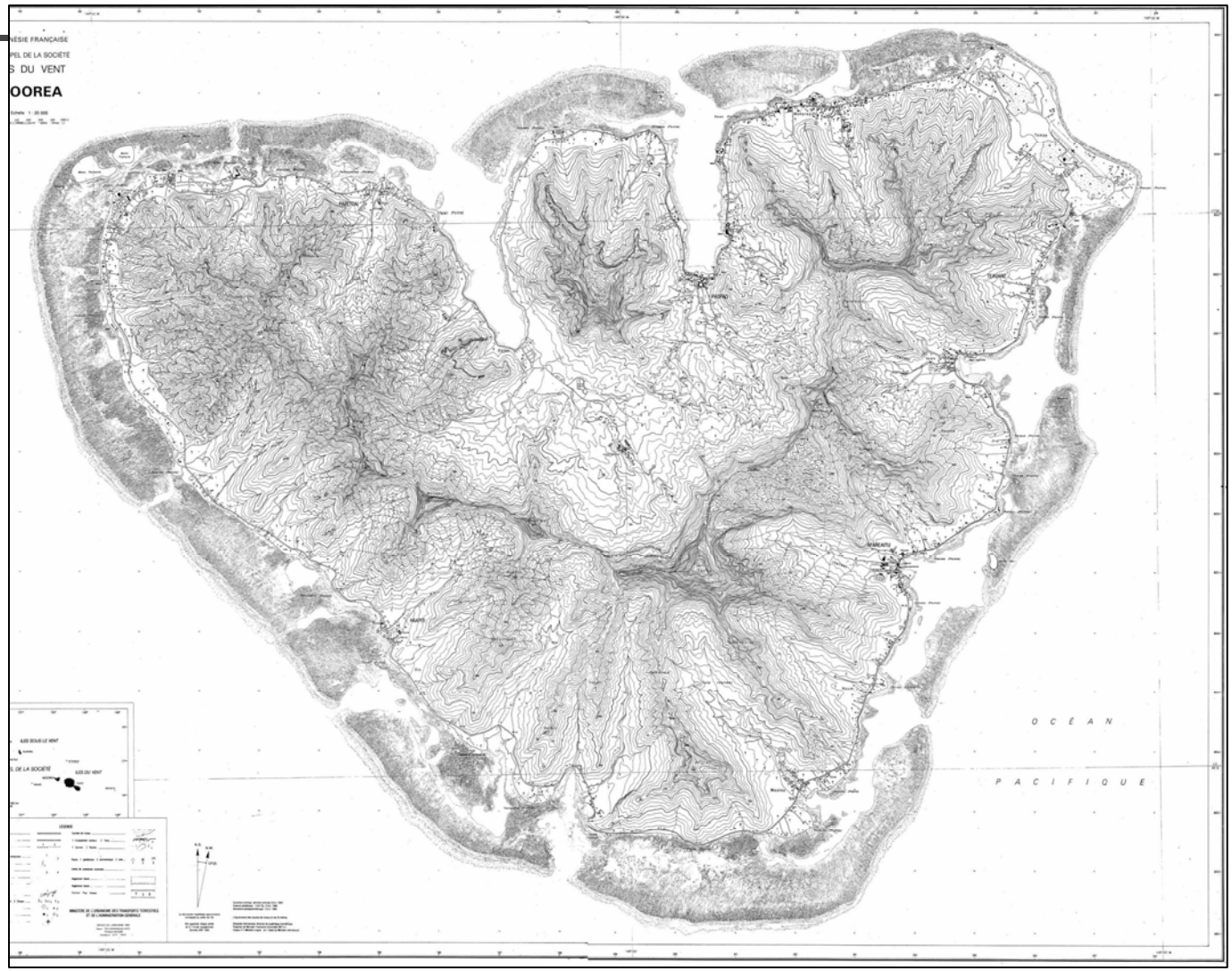


Geometric Seamlessness

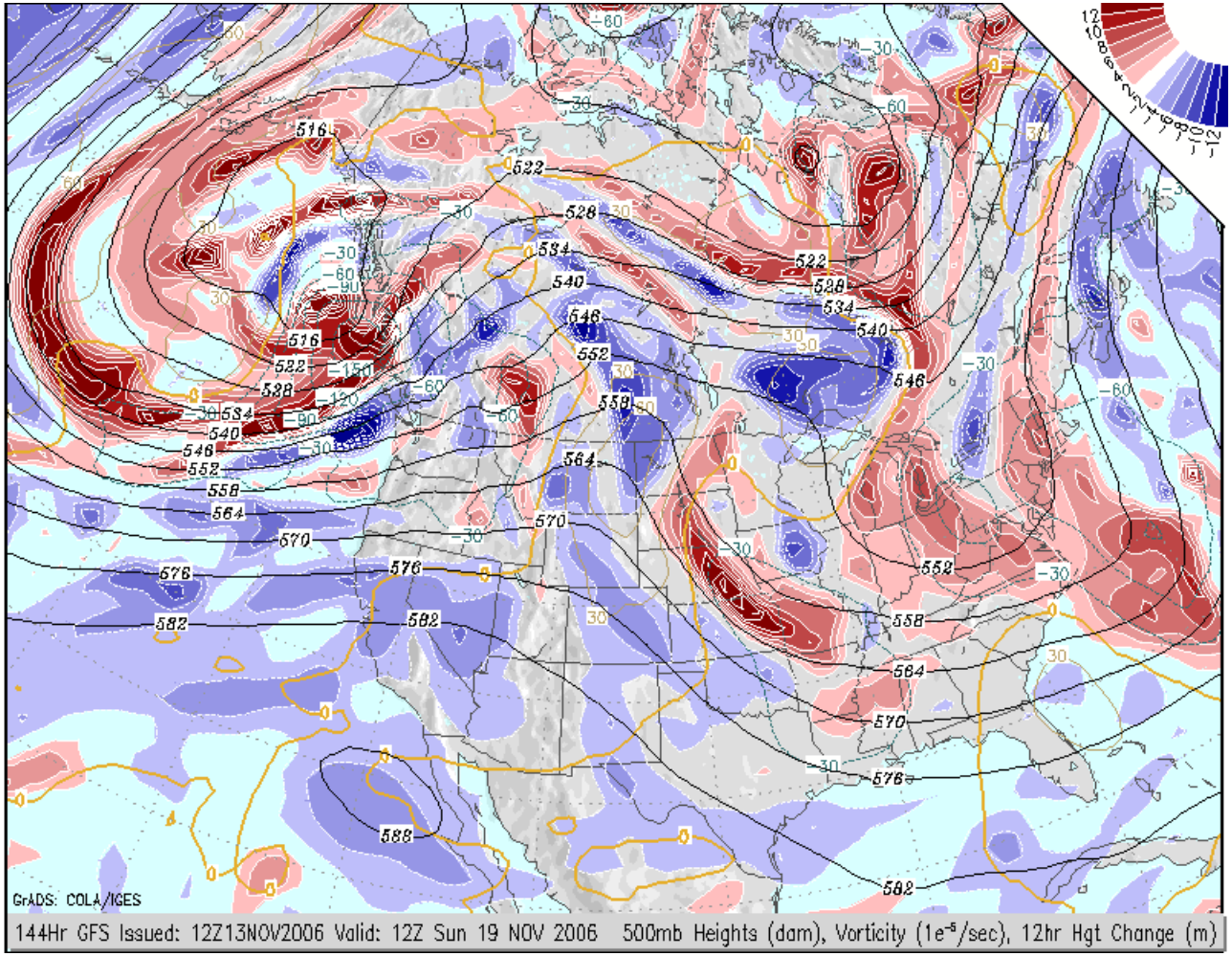
Geometric Seamlessness

Color Seamlessness

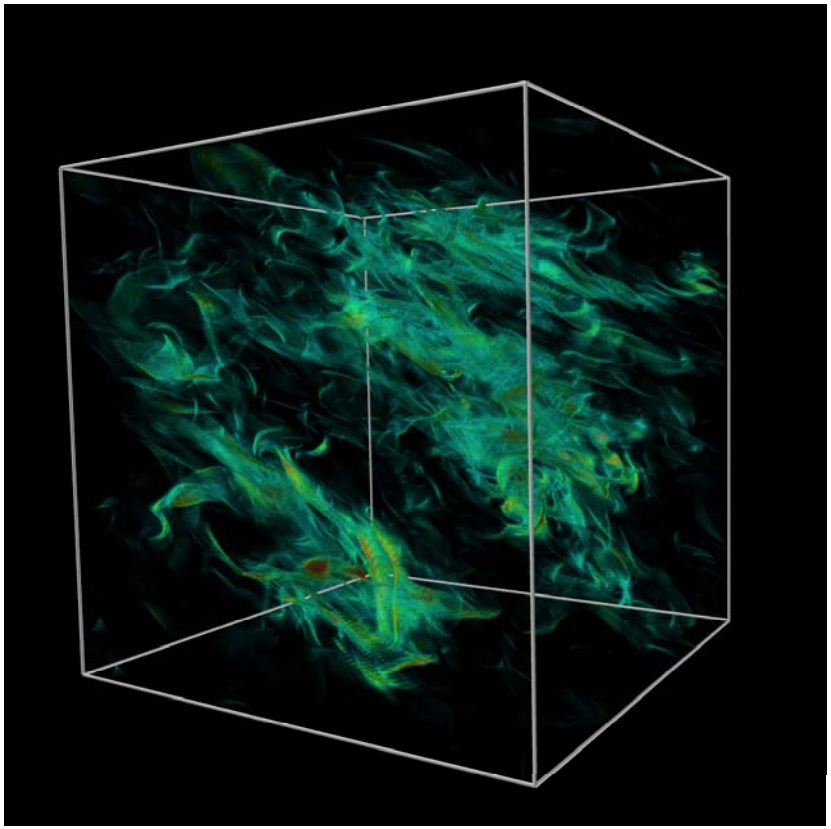
Visualization: Seismic

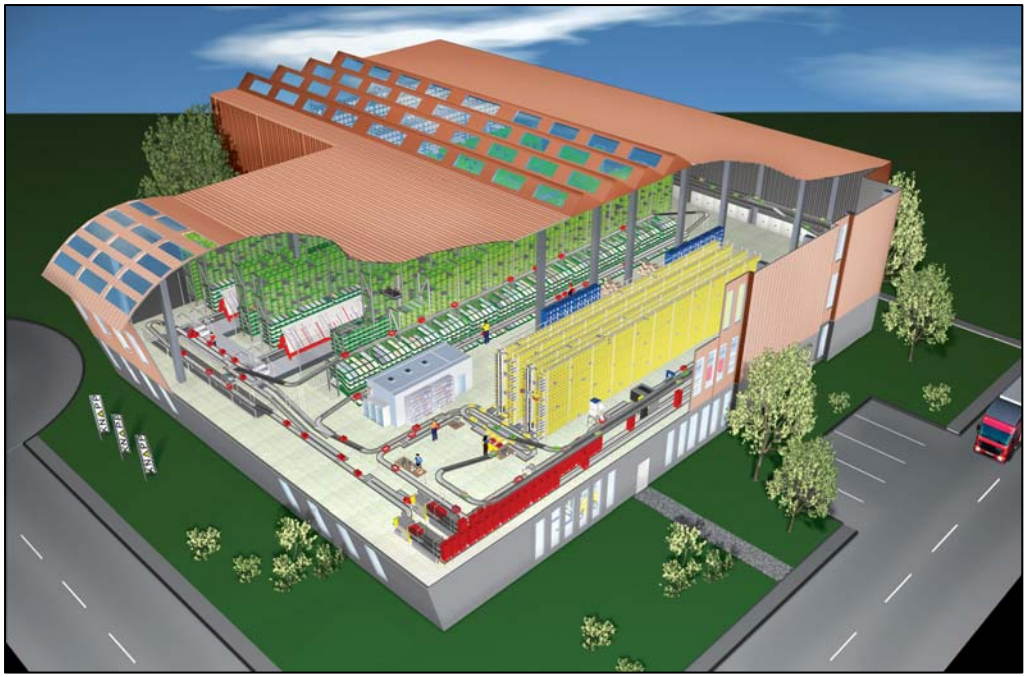


Visualization: Weather



Visualization: 3D

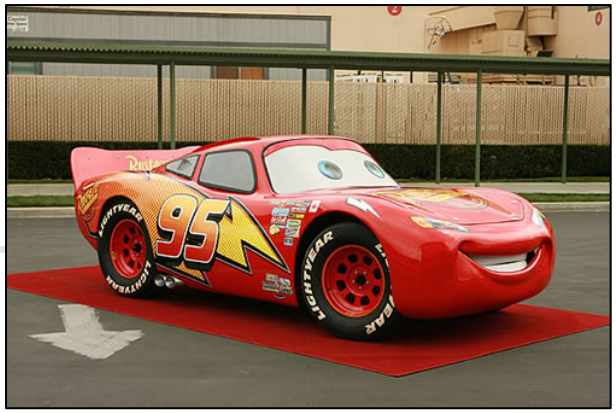


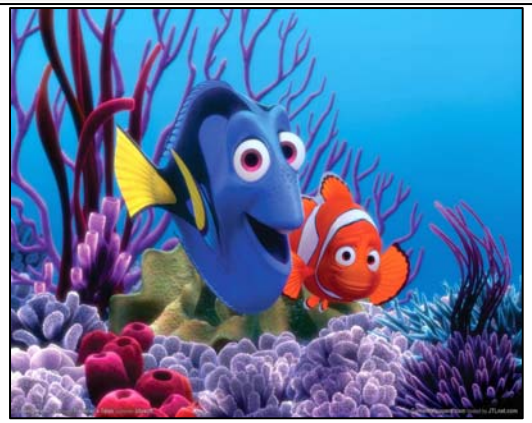


Simulation and Training

Animation

Toy Story, 1995, First animated movie





Special Effects