

Basic Techniques in Computer Graphics

Winter 2017 / 2018

- Prof. Leif Kobbelt
- Dr. Jan Möbius
- Patrick Schmidt
- Janis Born
- Moritz Ibing

Language

- Language of the material: English
- Language of the lecture: English
- Language of the exercises: English

Contact

- Announcements are made via L²P.

It is your responsibility to check for new announcements!

- Contact: cg1@cs.rwth-aachen.de

Emails to our individual addresses will not get answered!

Lecture and Exam Registration

- It is your responsibility to register for the exam
- **Erasmus CS:** register with Dirk Thißen
- **Erasmus other programs:** register via email
cg1@cs.rwth-aachen.de
- **Everybody else:** register with ZPA
- Check for the respective deadlines!

Lecture

- Tuesdays at 10:15 in AH V
- Thursdays at 12:15 in AH III

Exercise

- Tuesdays at 18:15 in PPS H2

only one exercise date!

How to find us



How to find us



Exercises...

... are mandatory!

... can be submitted in groups of 3-4 persons

... published every Tuesday

... solutions are due on Tuesday 18:00

... practical exercises are to be handed in via L²P

... theoretical exercises are to be handed in on paper
at our drop box

- you will do some programming in C++
- first exercise will be published today

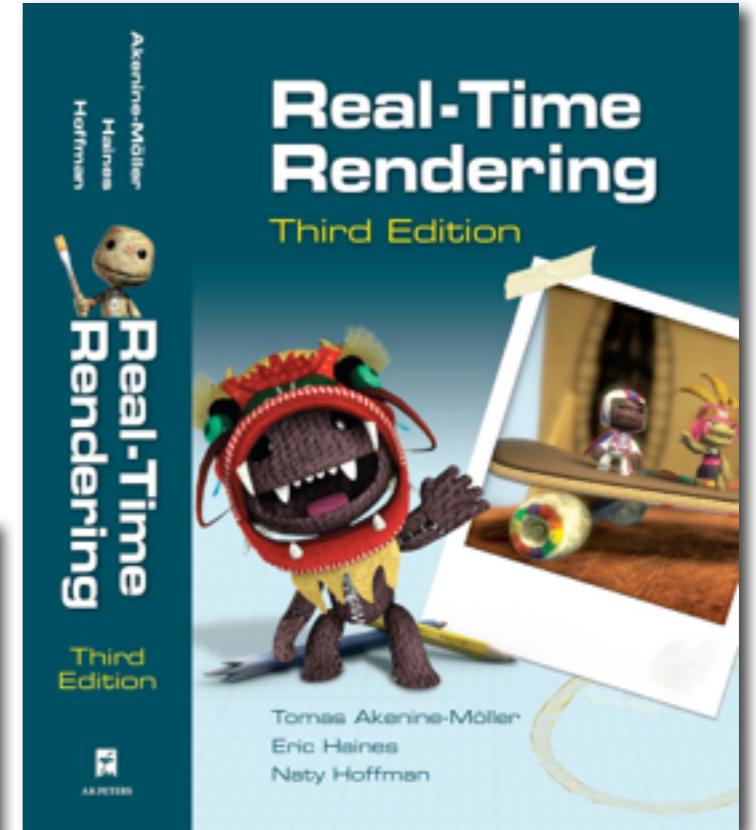
How to find us



- Final Exam: February 5
- 2nd Chance: March 2
- Exam admission requirement:
50% of all exercise points
- Exam bonus requirement:
75% of all exercise points

Literature & Supplementary Material

- Tomas Akenine-Möller
Real-Time Rendering (3rd Ed.)
- Slides on the web
- Old CG lecture notes



Courses in Graphics

- Basic Techniques in Computer Graphics [3+2]
- Real Time Rendering [3+2]
- Geometry Processing [3+2]
- Global Illumination & IBR [3+2]
- Seminars
- Practical Exercise Courses

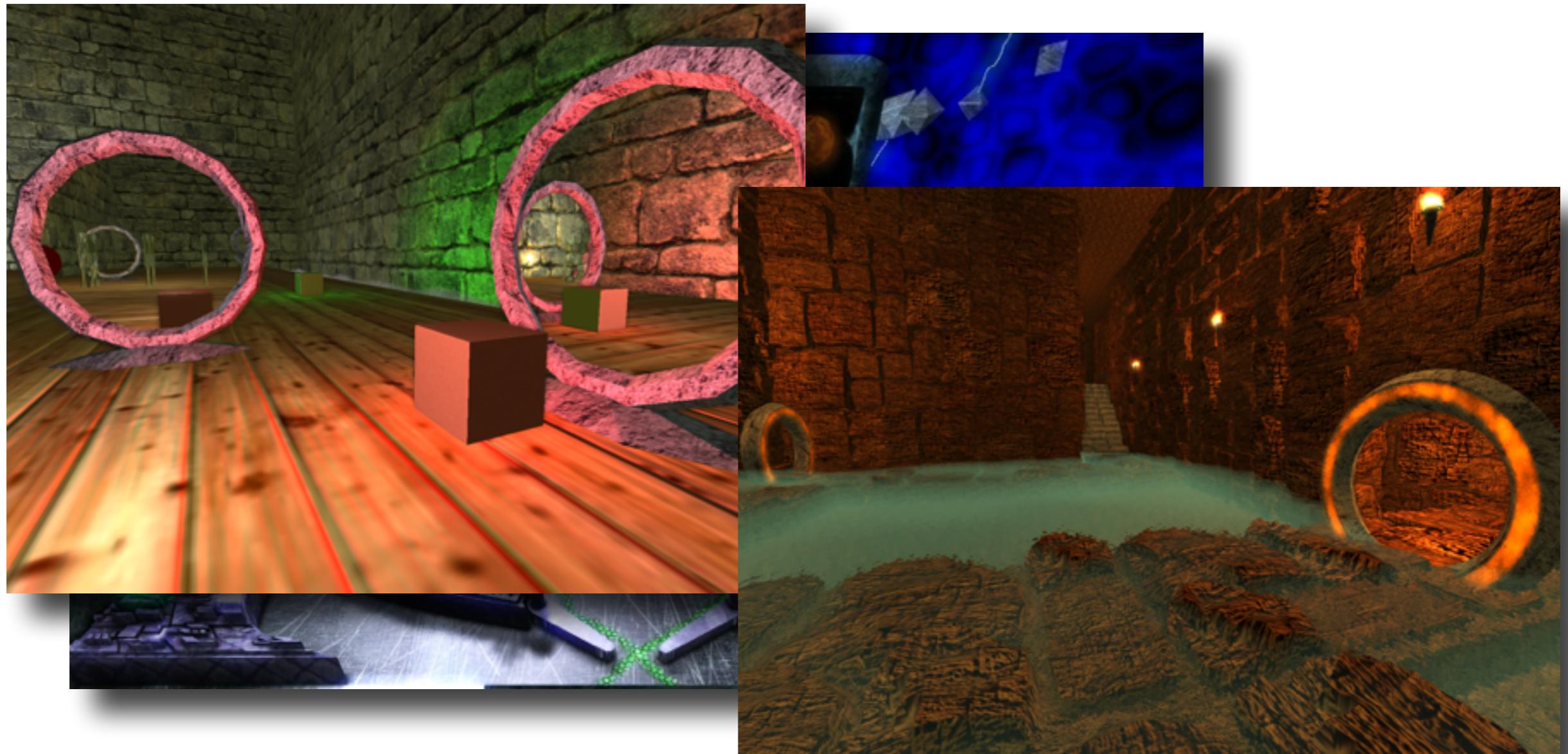
After this course, you will...

- ... have a good overview of the general field of Computer Graphics
- ... have a deeper understanding of the basic techniques
- ... have the required background to follow more advanced CG lectures

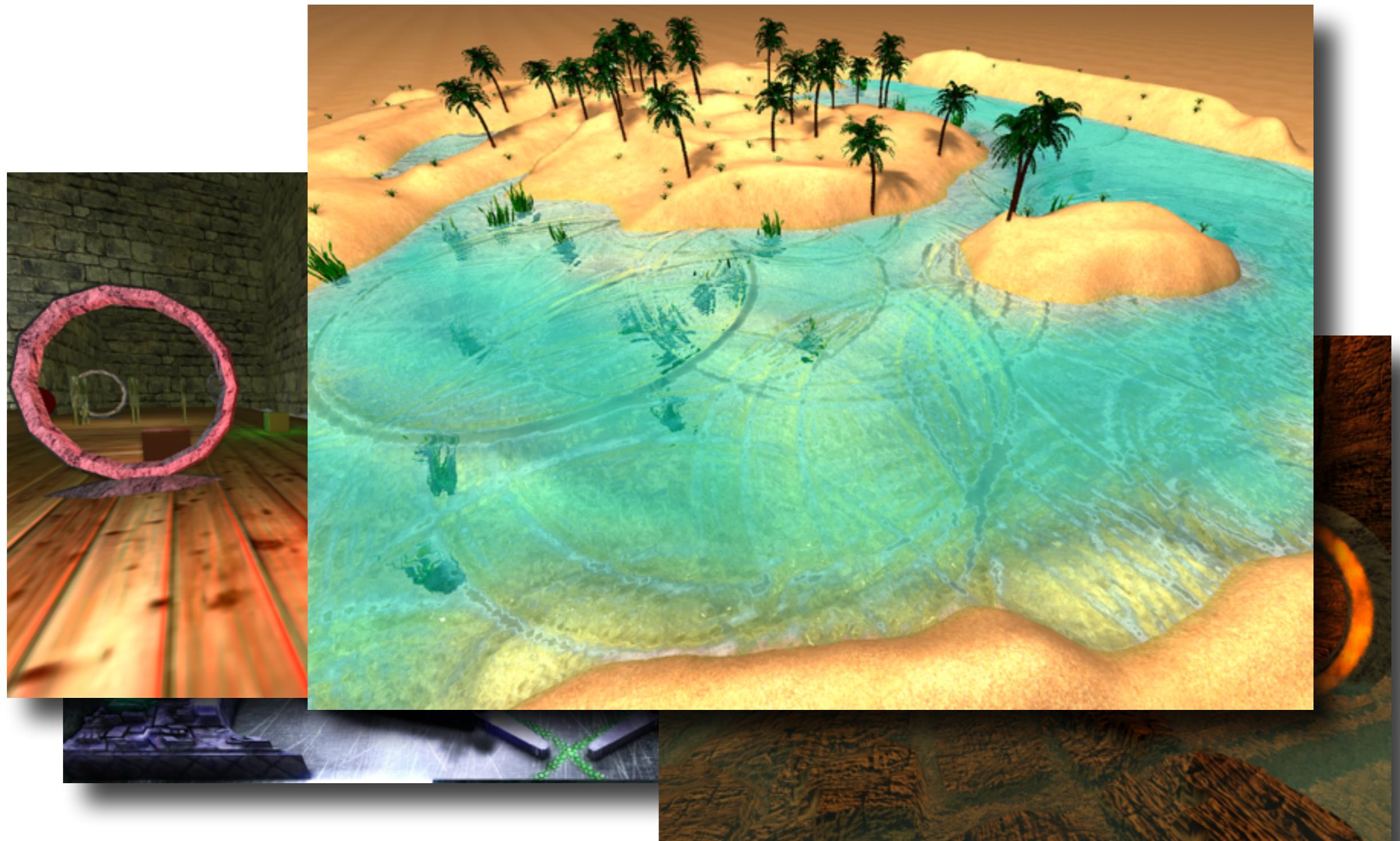
Graphics applications implemented by students



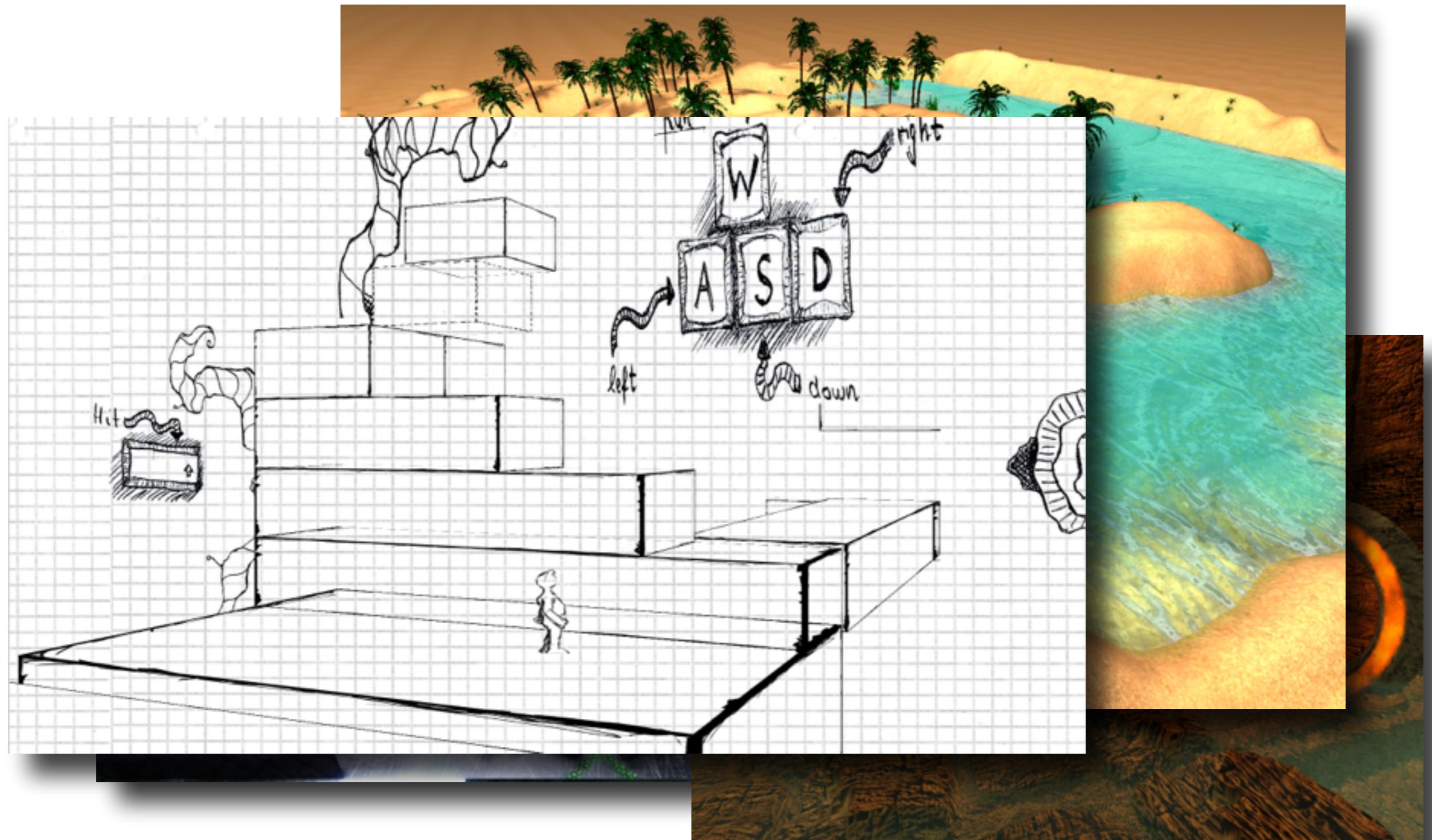
Graphics applications implemented by students



Graphics applications implemented by students



Graphics applications implemented by students

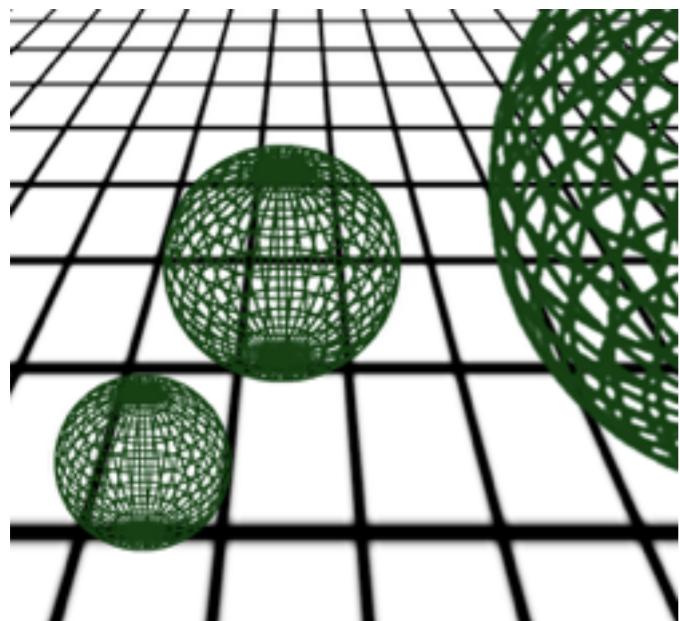


Structure of the Course

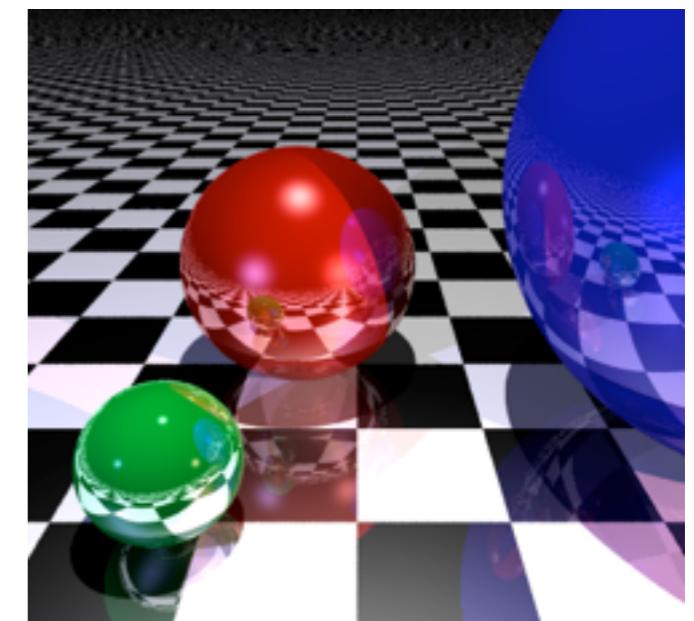
1. Overview
2. Geometry I
3. Perspective
4. Rendering Pipeline
5. Textures
6. Light and Shadow
7. Geometry II
8. Alternative Rendering Techniques
9. Voronoi / Delaunay
10. Curves and Surfaces
11. Colors
12. Image Based

Structure of this Lecture

1. Overview



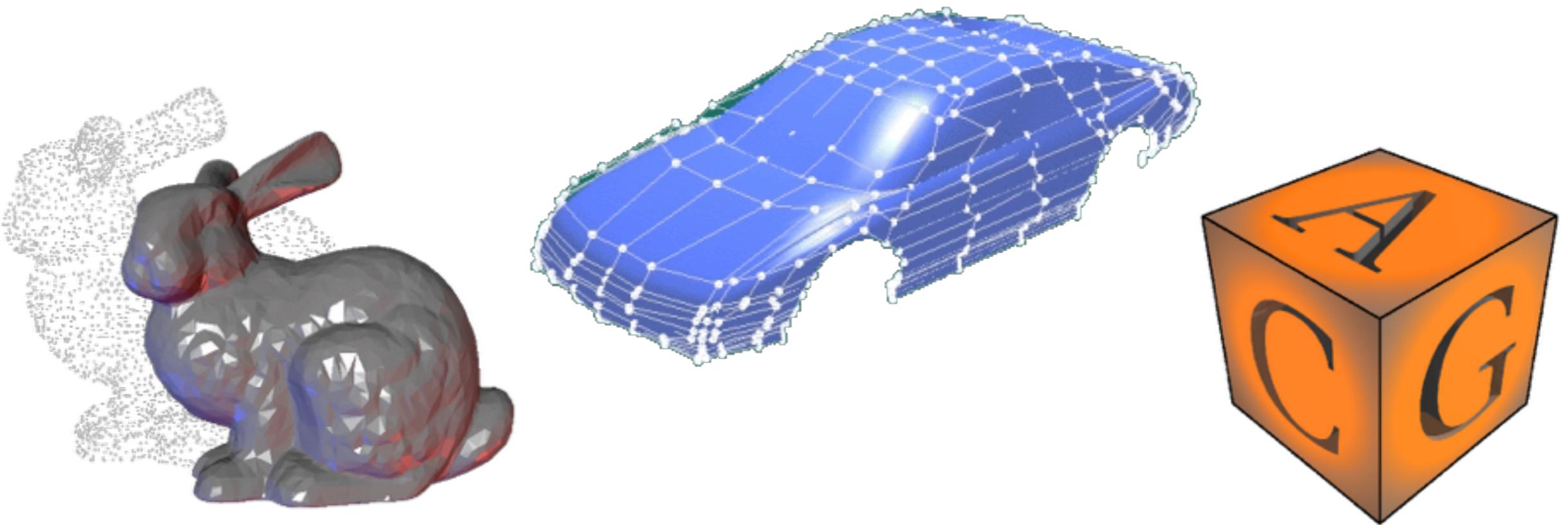
continuous, 3D



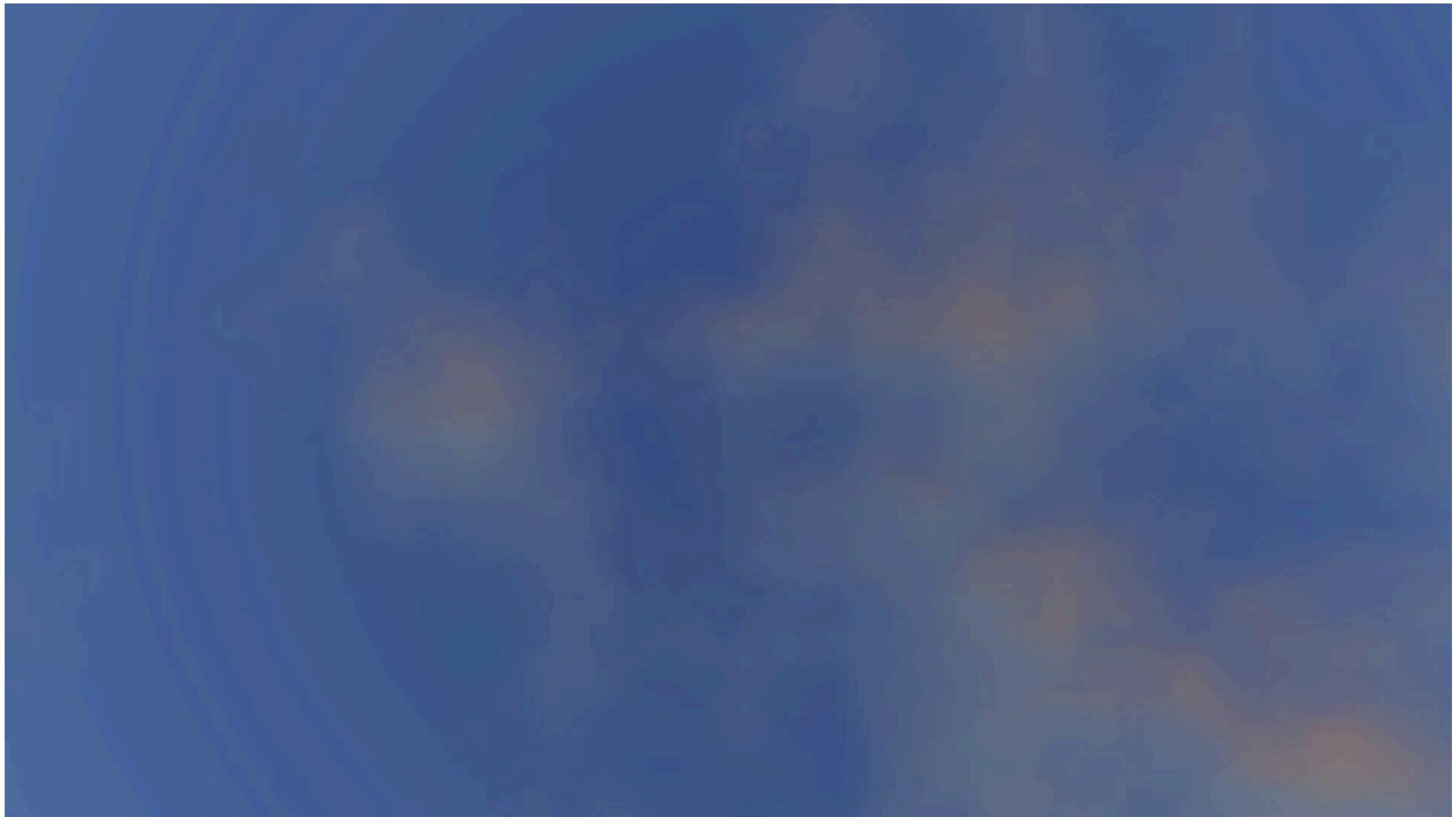
discrete, 2D

Structure of this Lecture

2. Geometry I



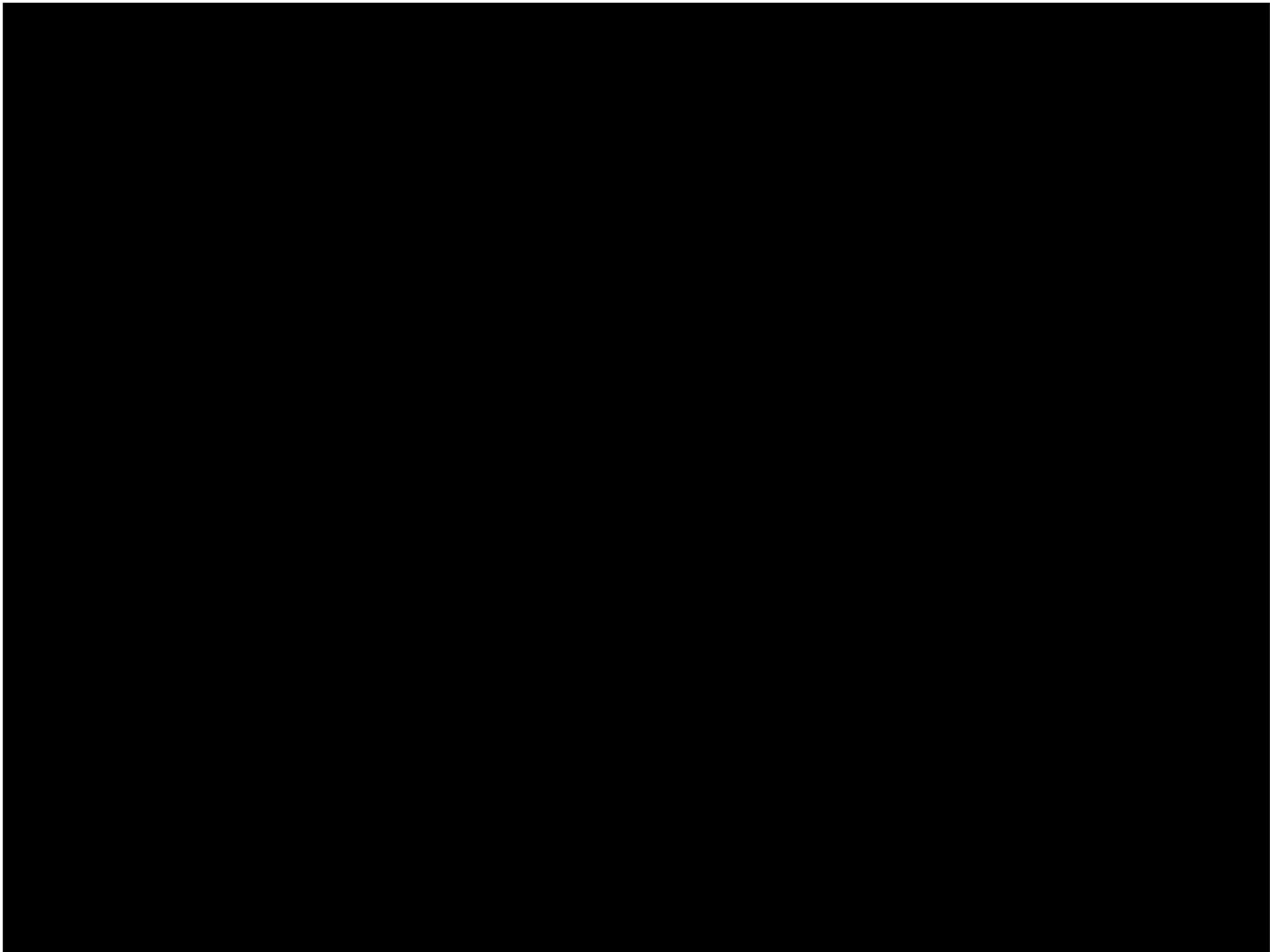
Example: Polygon-Based Rendering



Example: Point-Based Rendering



Example: Point-Based Rendering



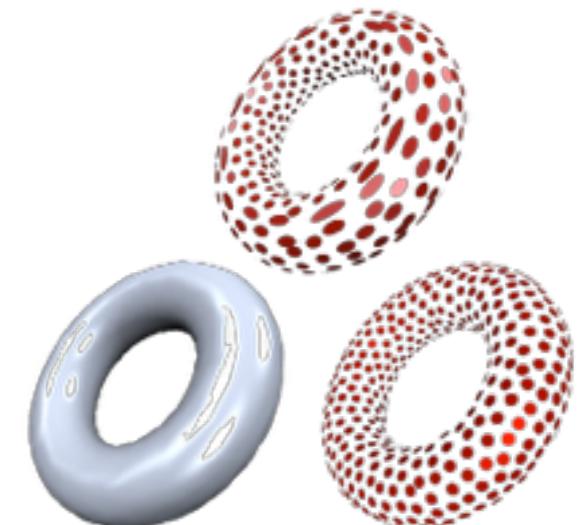
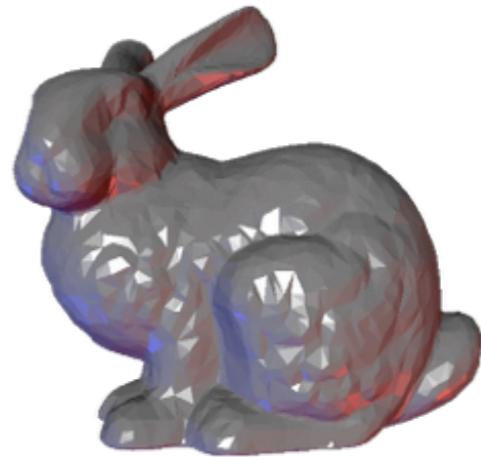
Example: Point-Based Rendering



Structure of this Lecture

2. Geometry I

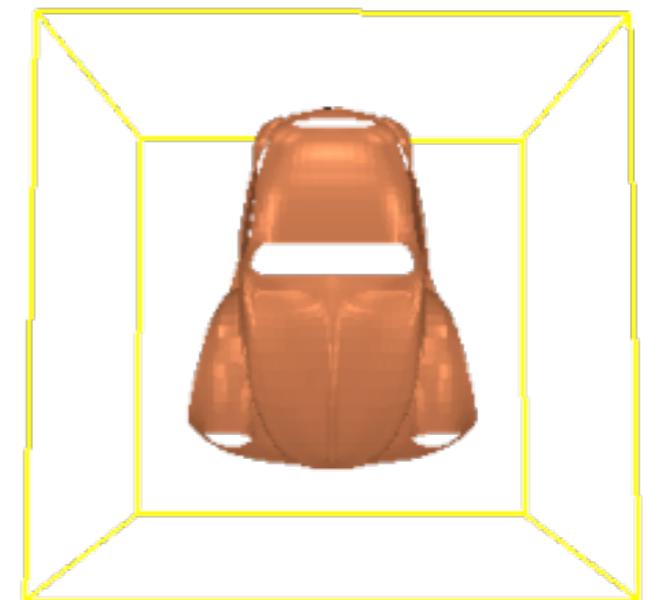
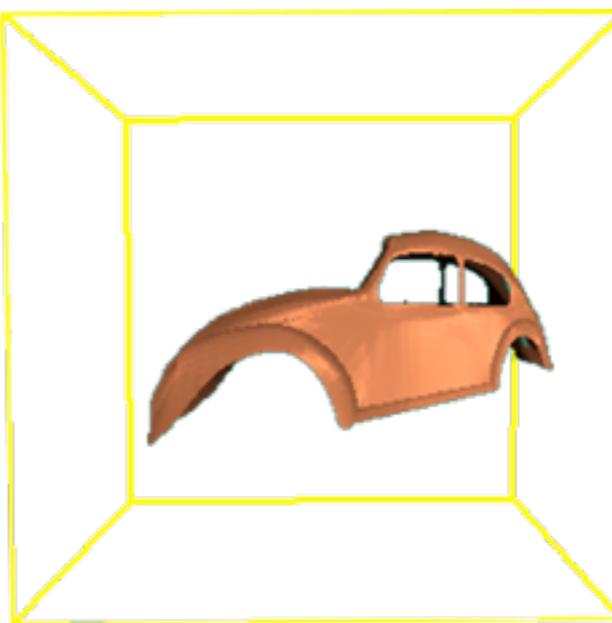
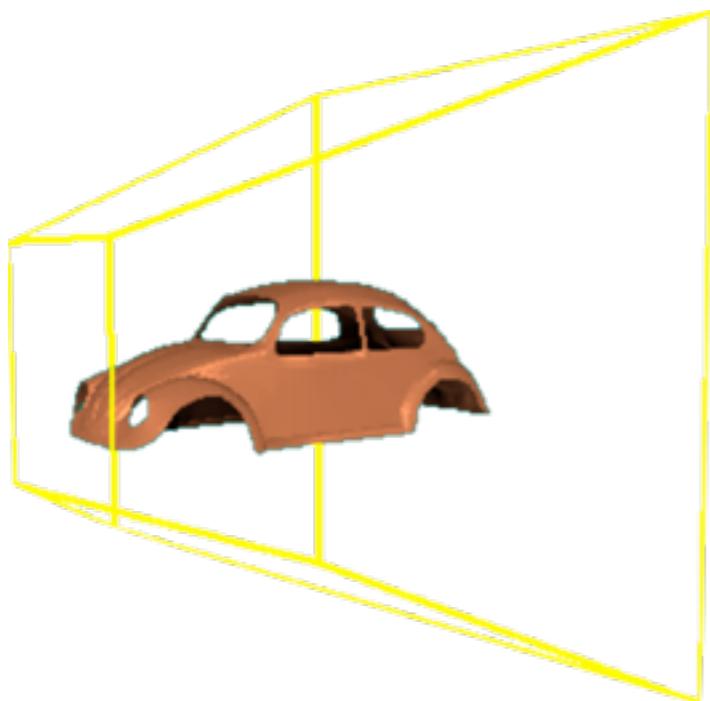
- Polygonal meshes
- Parametric & Implicit Representations
- linear / affine transforms



Structure of this Lecture

3. Perspective

- Projections
- Homogeneous Coordinates



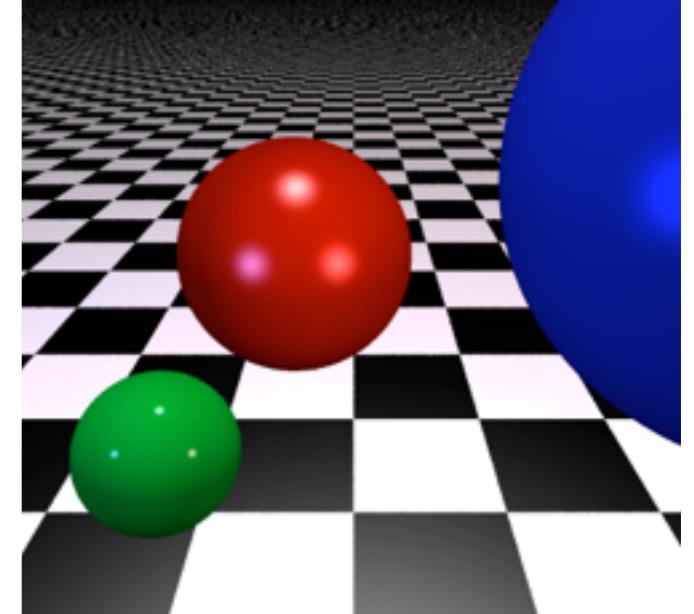
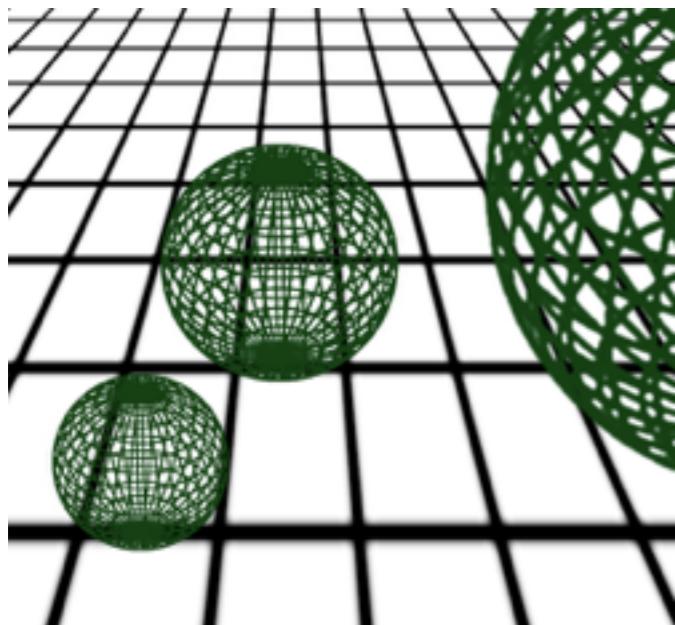
Structure of this Lecture

4. Rendering Pipeline polygons \leftrightarrow pixels

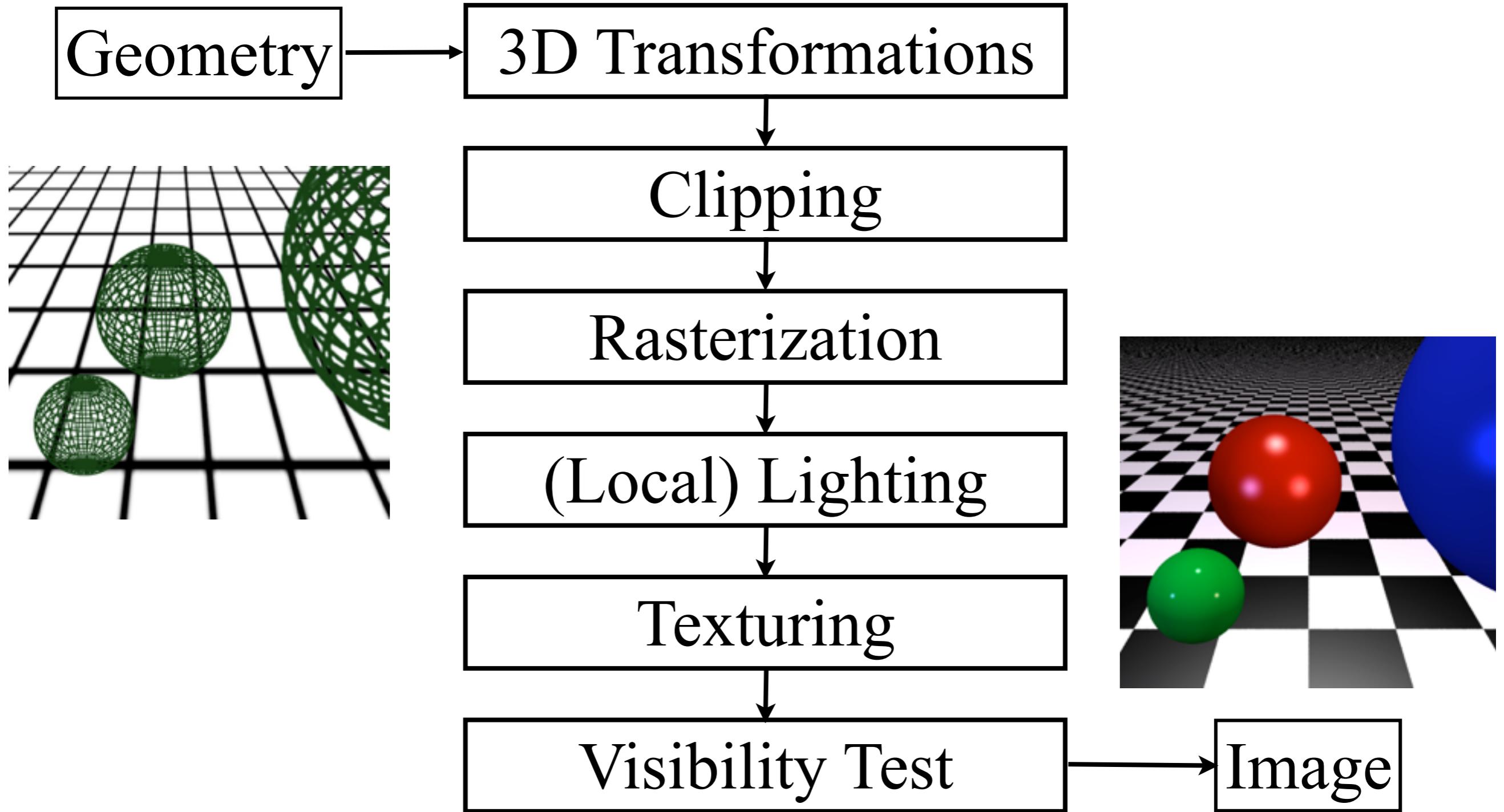


rasterization: for all polygons ... map to pixels

„forward mapping“



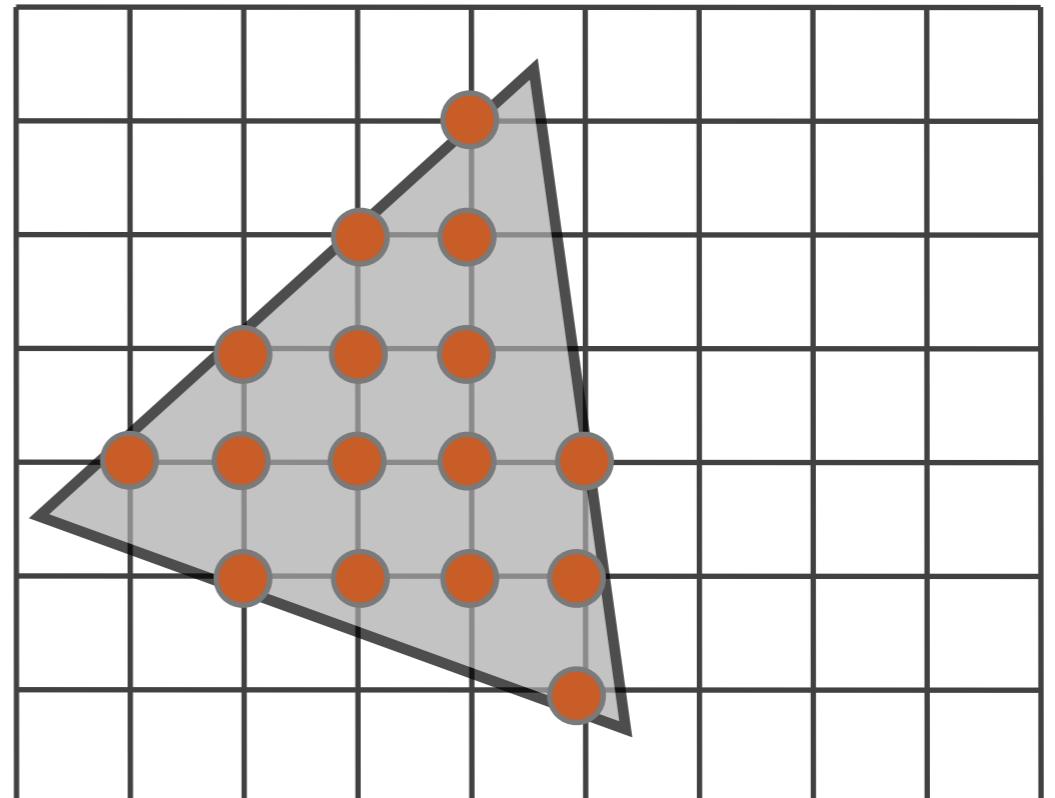
Structure of this Lecture



Structure of this Lecture

4. Rendering Pipeline

- Virtual cameras
- Rasterization
 - polygon-based
 - point-based



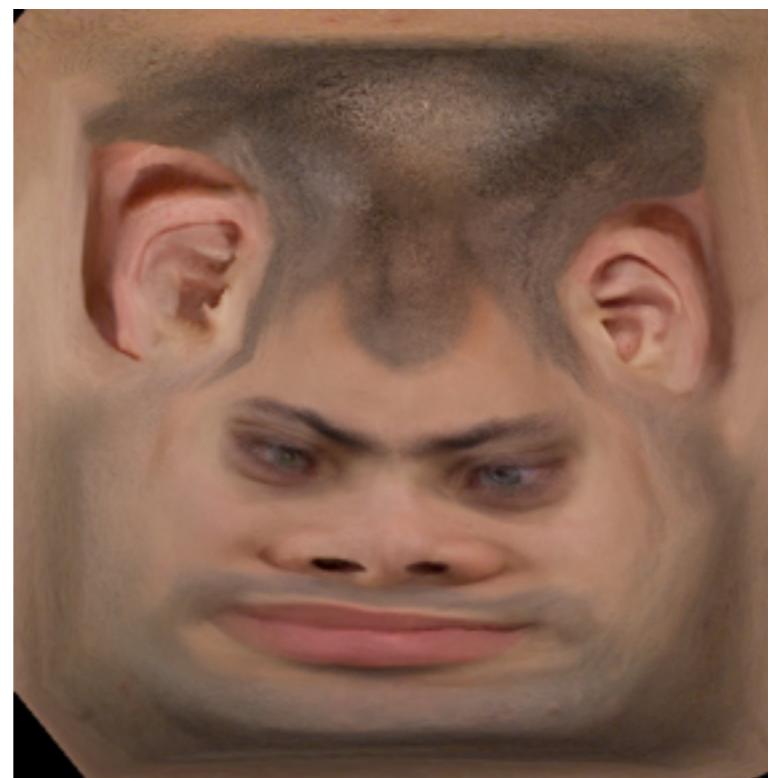
Structure of this Lecture

5. Textures



Structure of this Lecture

5. Textures



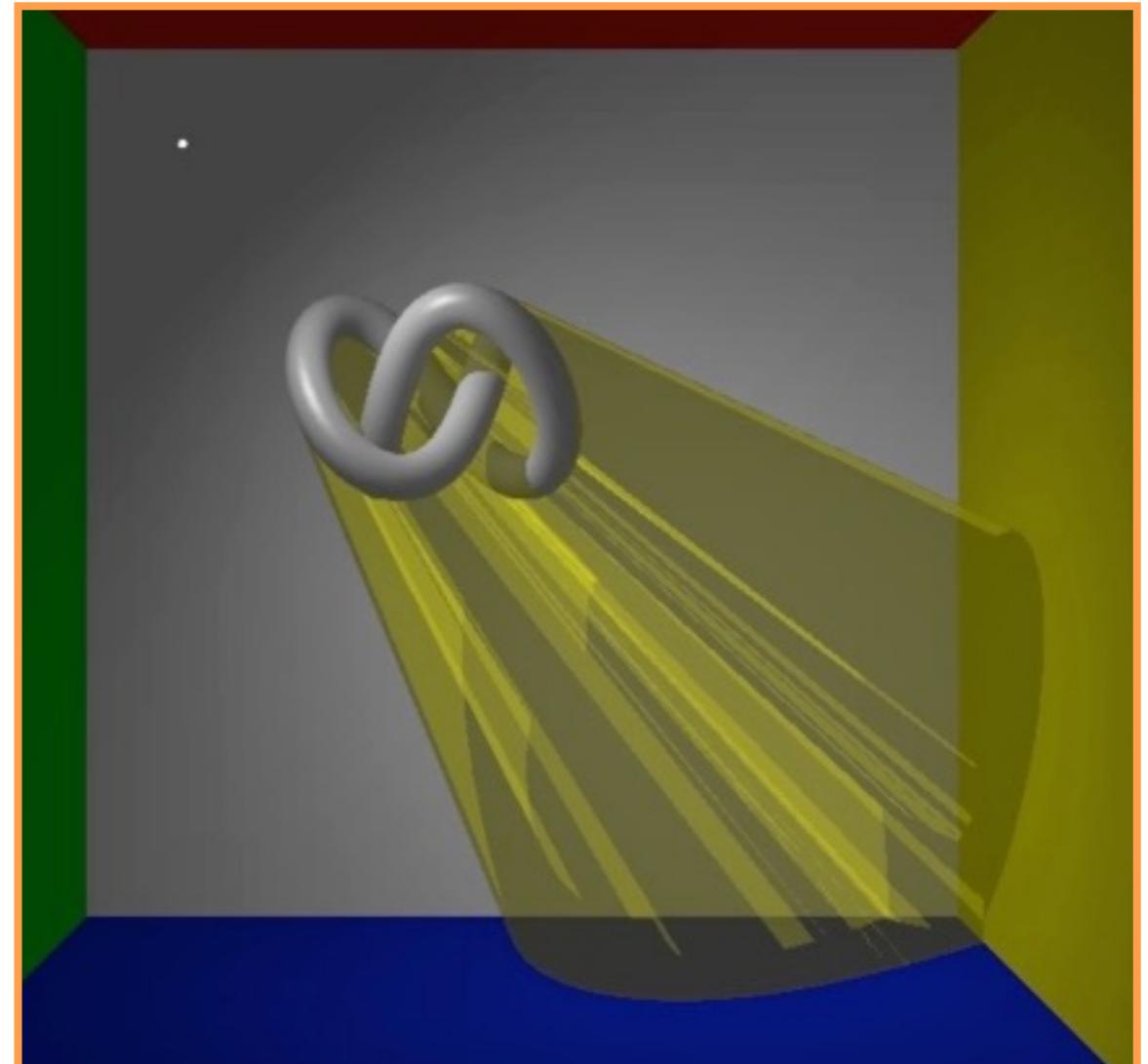
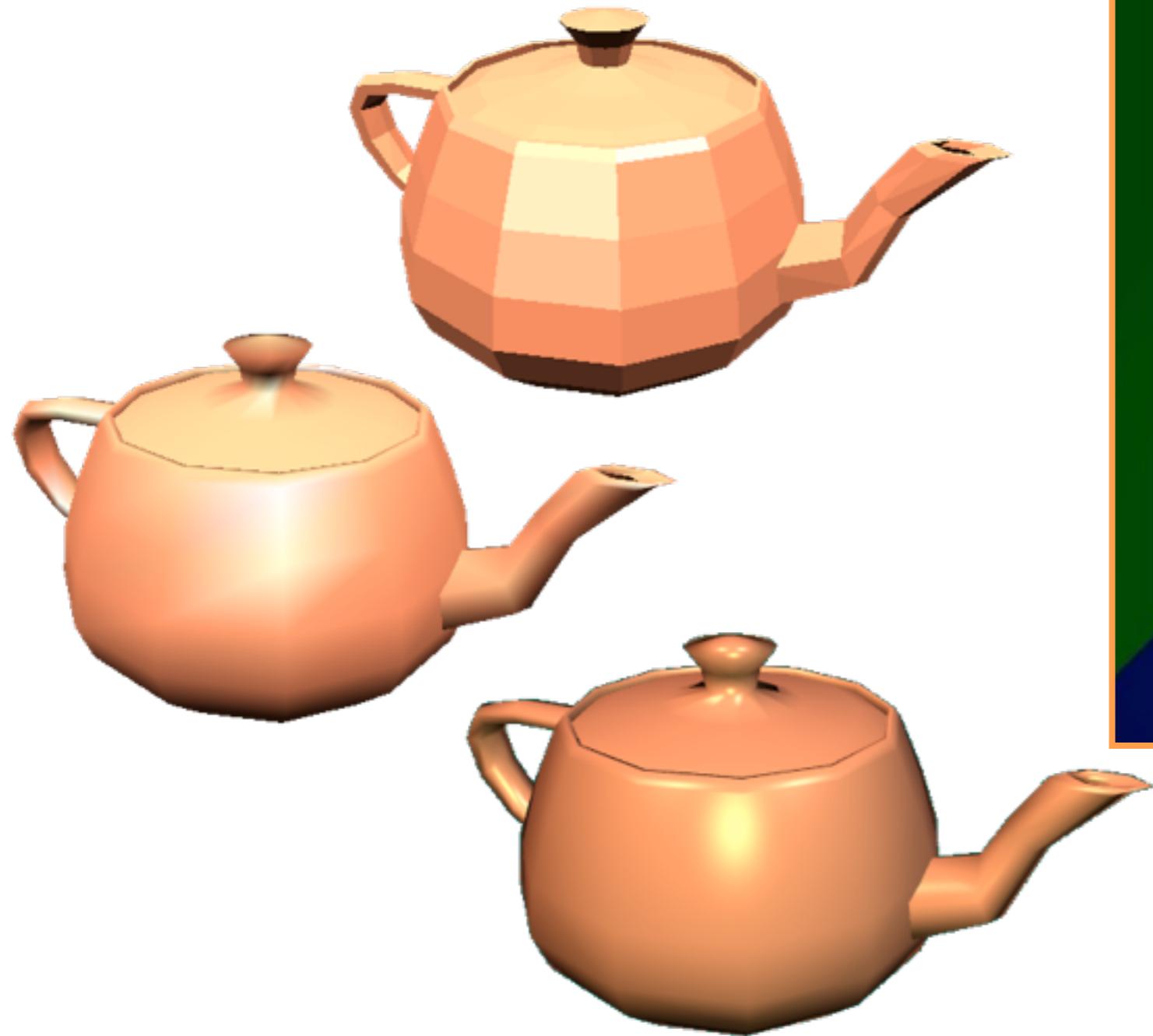
Structure of this Lecture

5. Textures



Structure of this Lecture

6. Light and Shadow



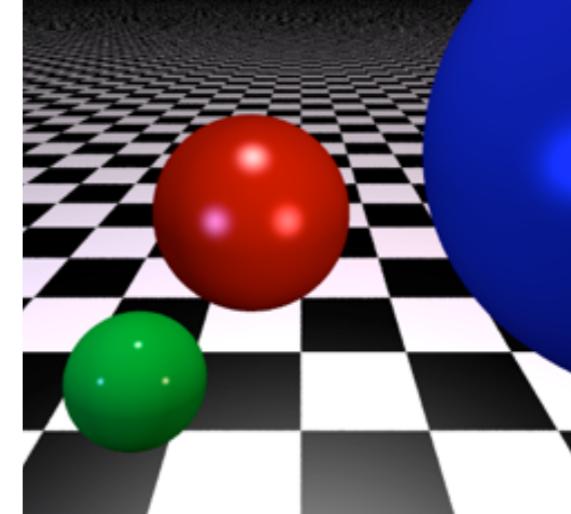
Structure of this Lecture

6. Light and Shadow

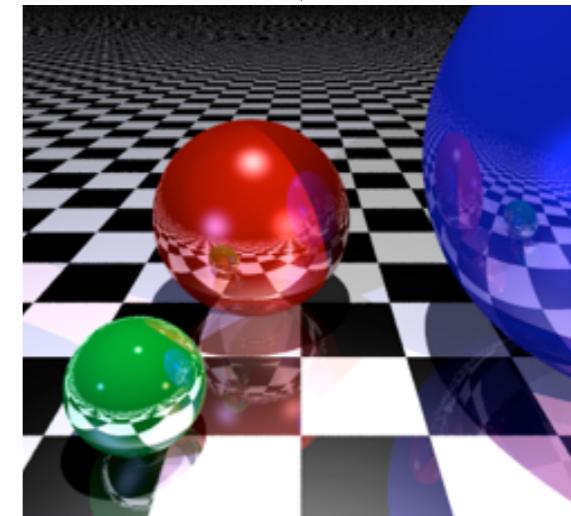
Global Illumination

- Visibility
- Shadows

local

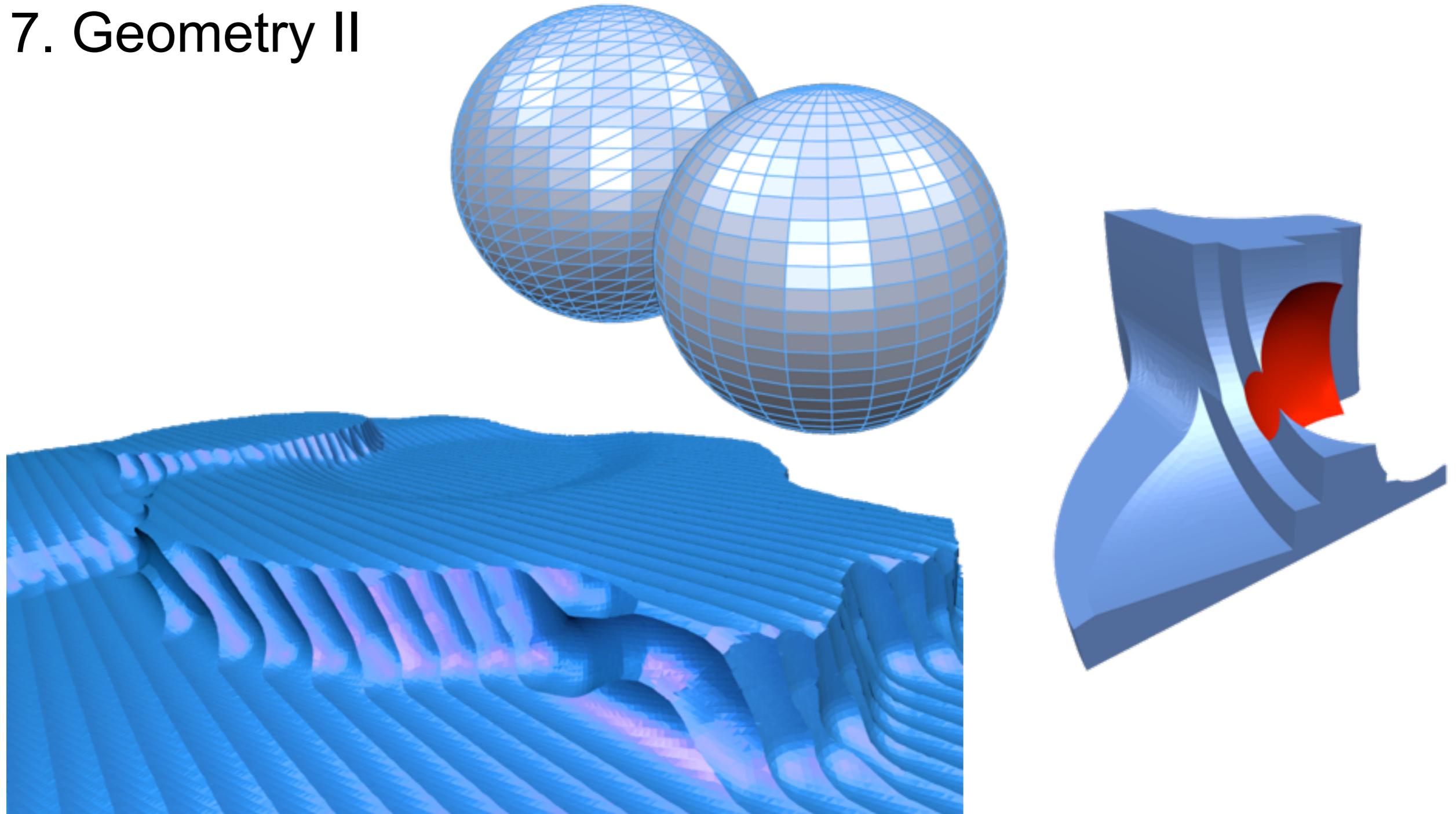


global



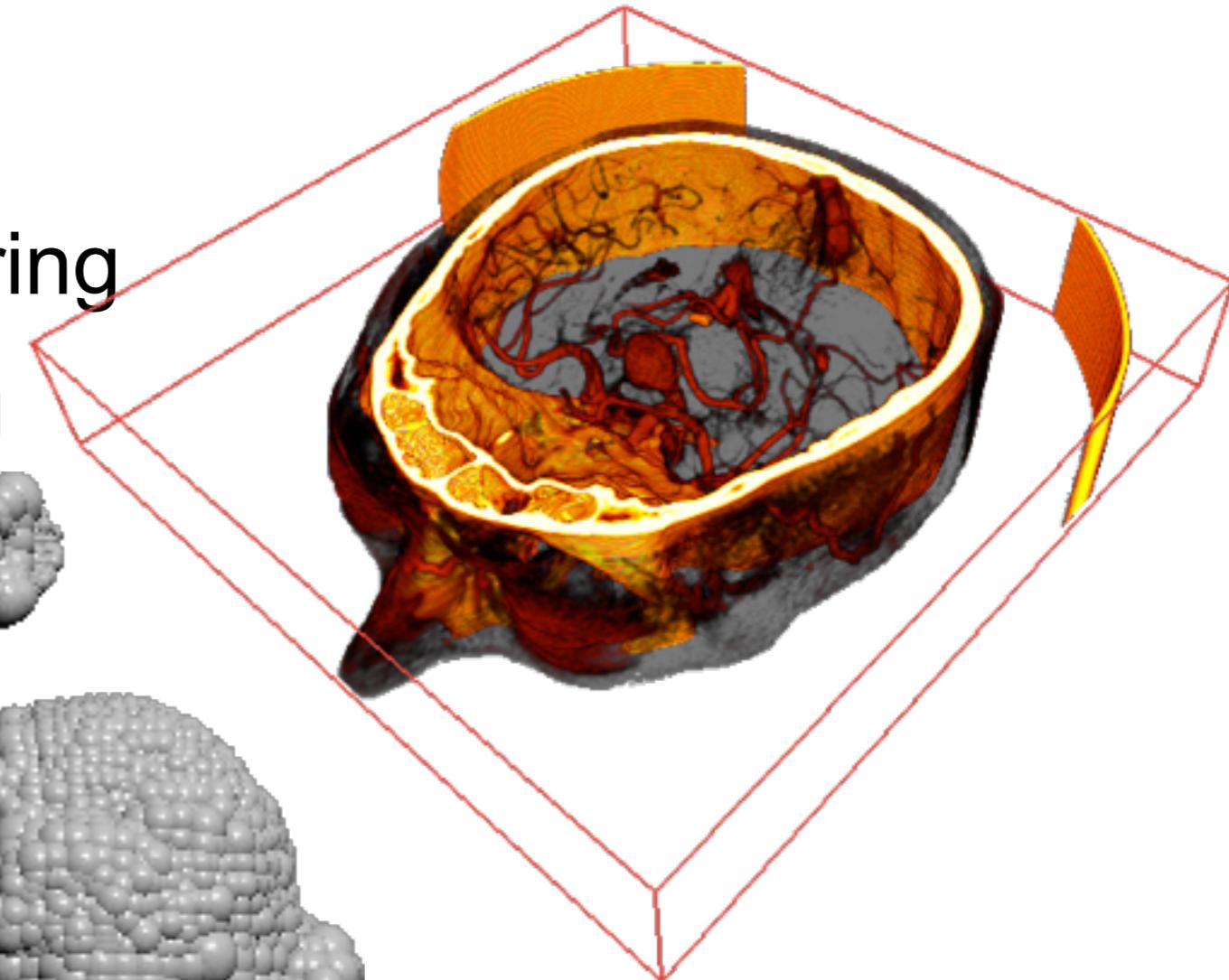
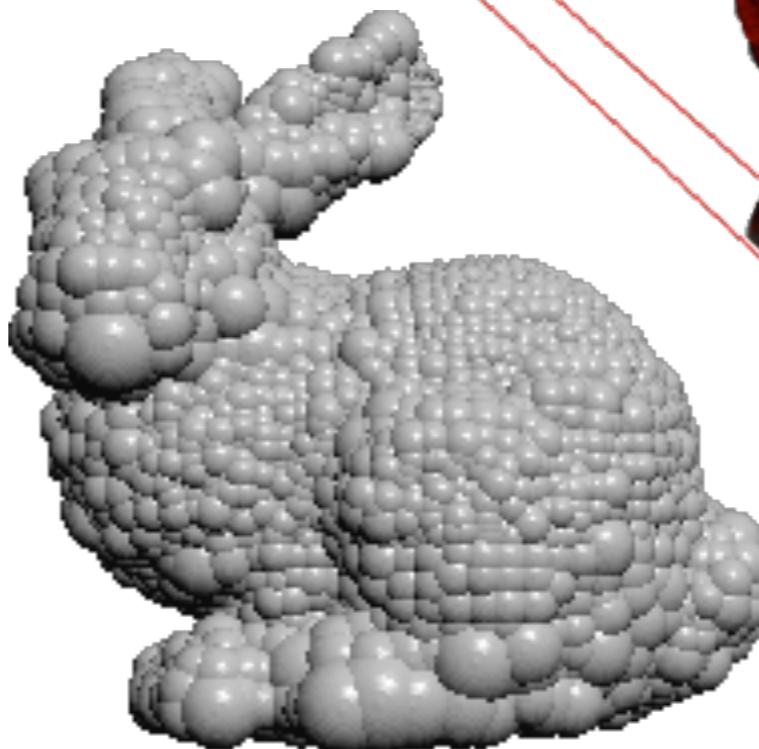
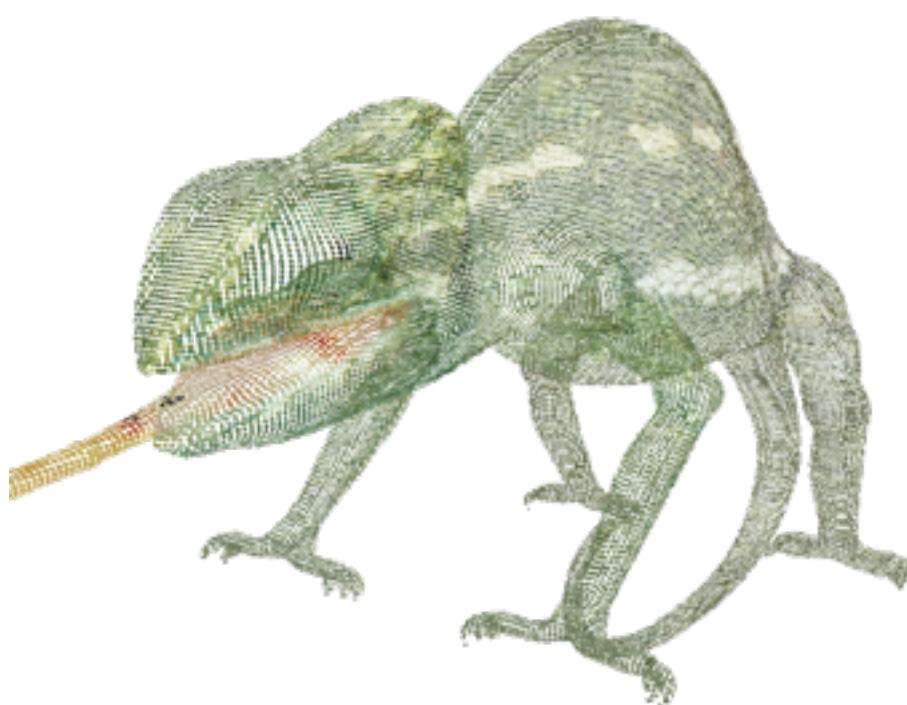
Structure of this Lecture

7. Geometry II



8. Alternative Rendering Techniques

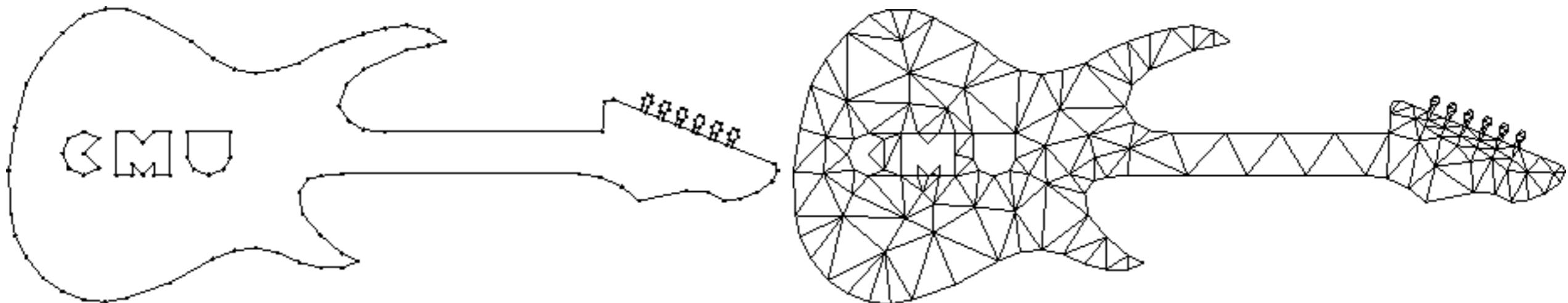
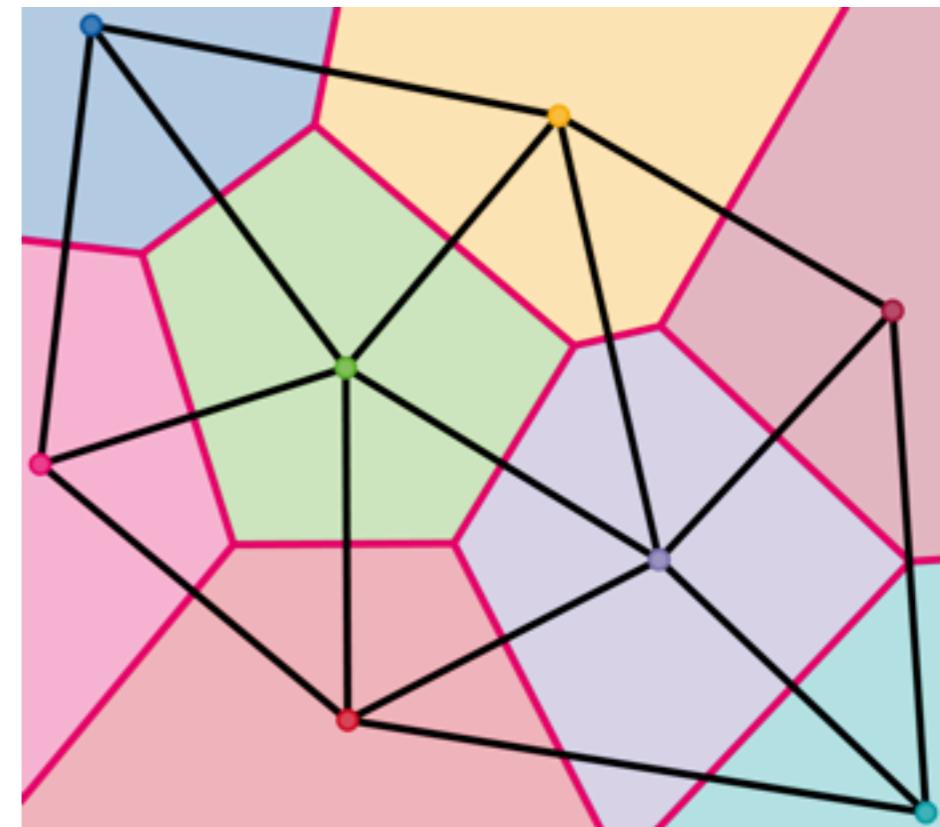
- Volume Rendering
- Direct / Indirect Rendering
- Point Based Rendering



Structure of this Lecture

9. Voronoi / Delaunay

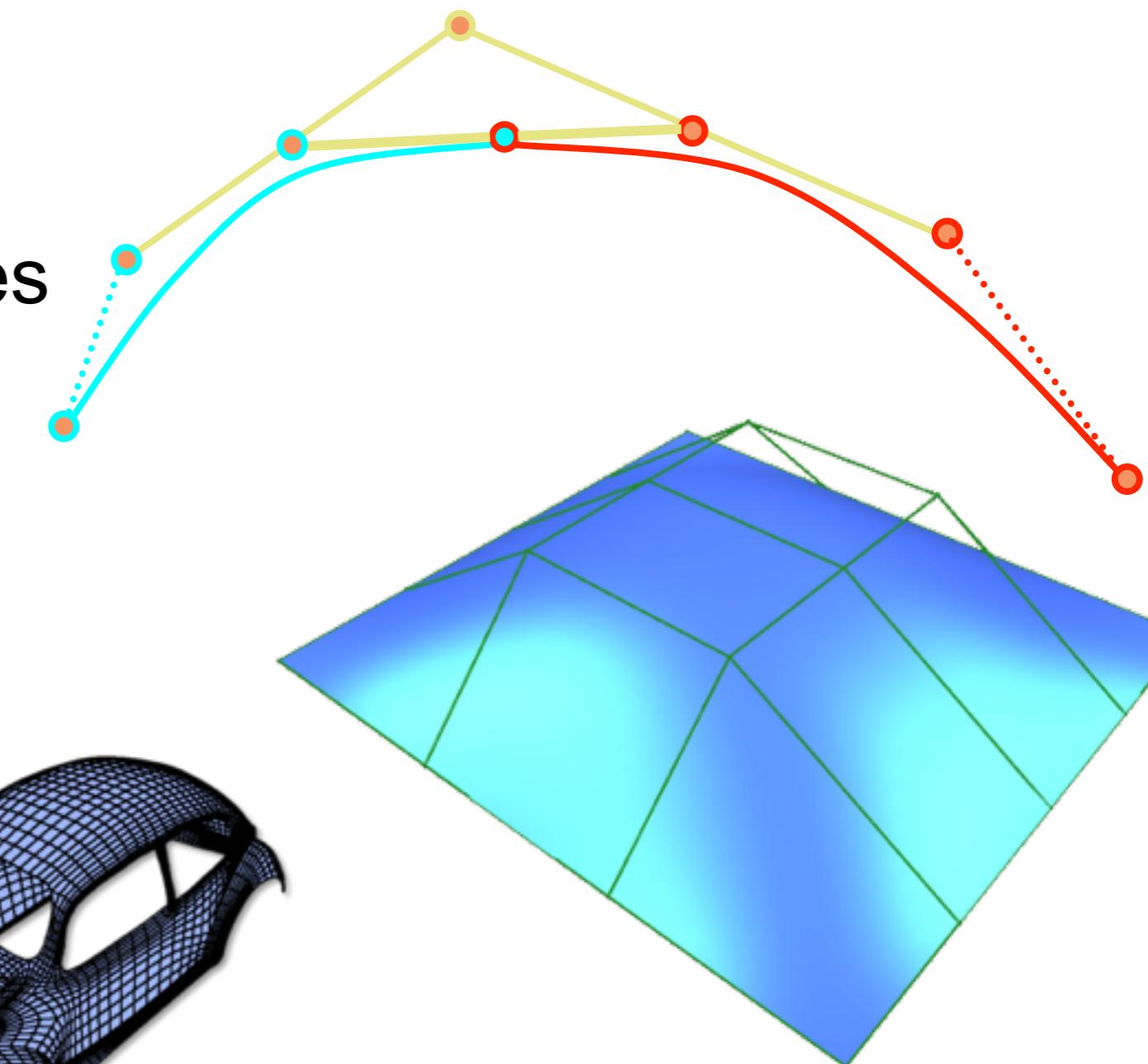
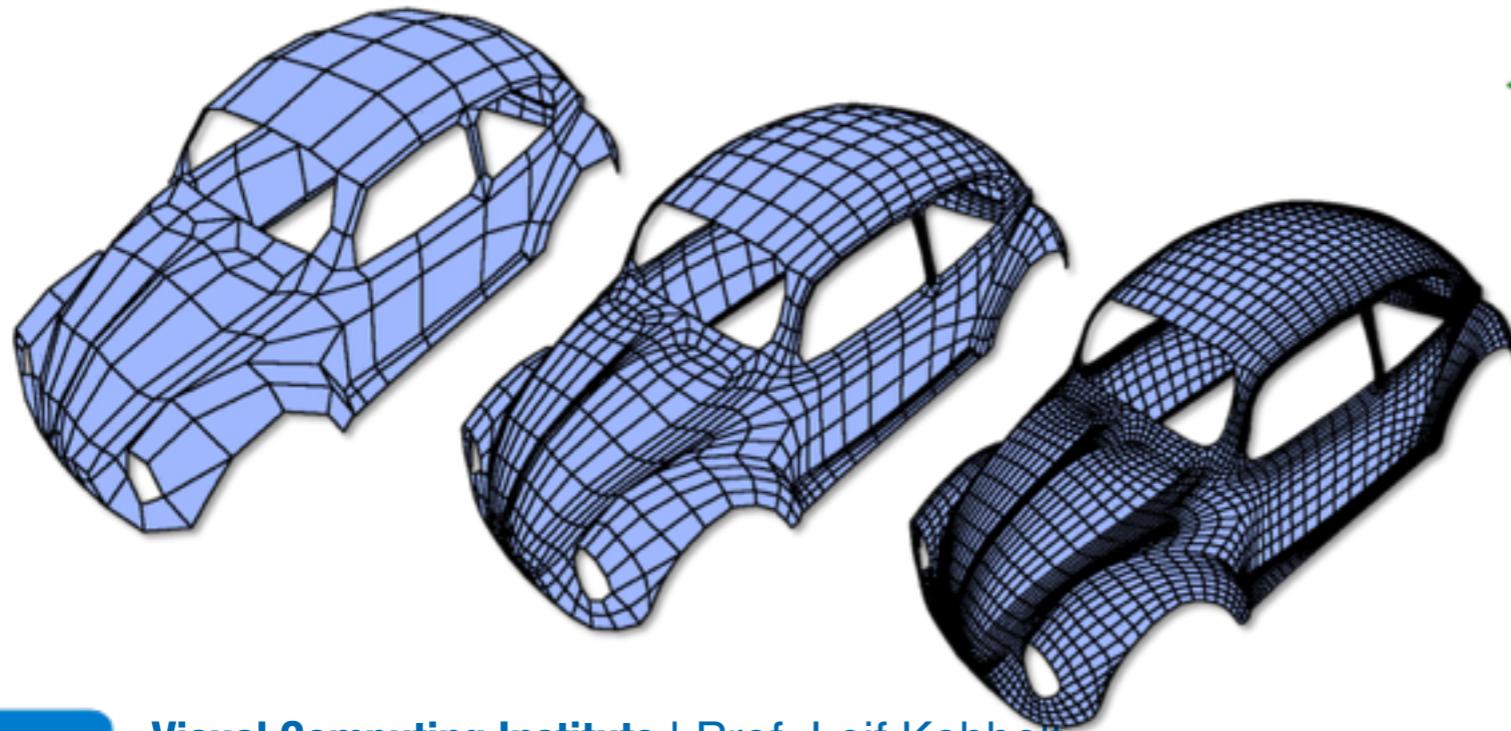
- 2D Tesselation
- Voronoi Algorithms
- Triangle Quality



Structure of this Lecture

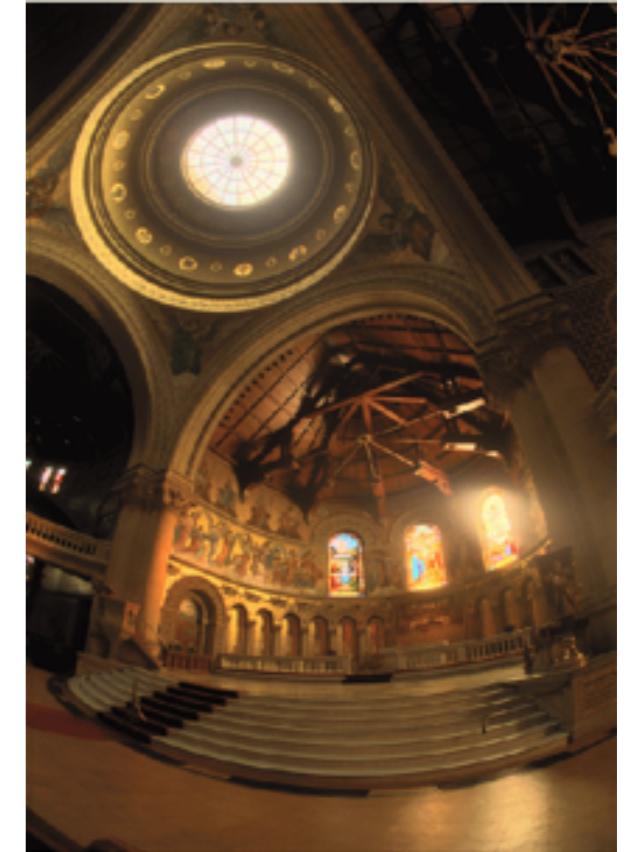
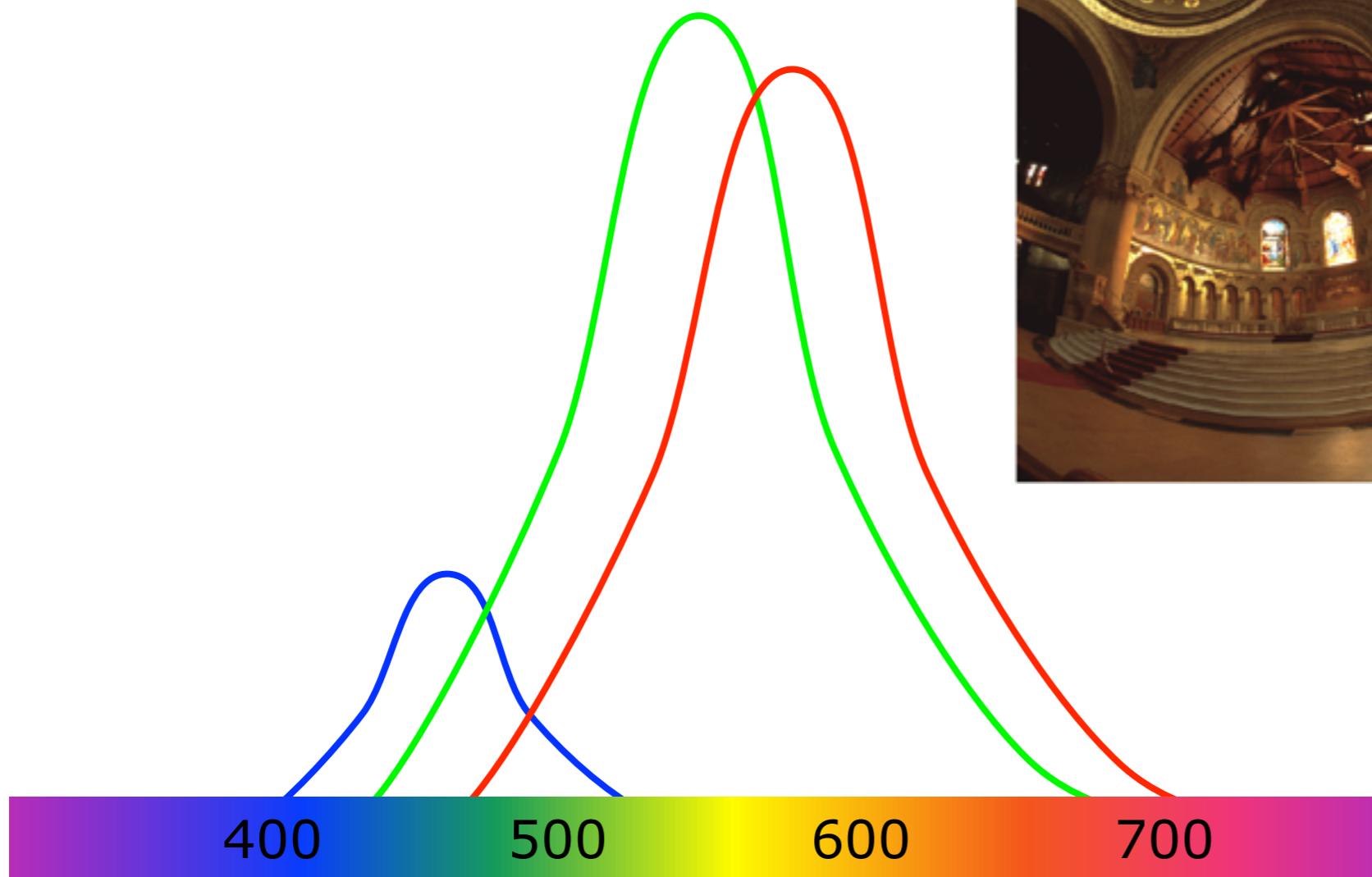
10. Curves and Surfaces

- Bezier Curves / Splines
- Surface Subdivision



Structure of this Lecture

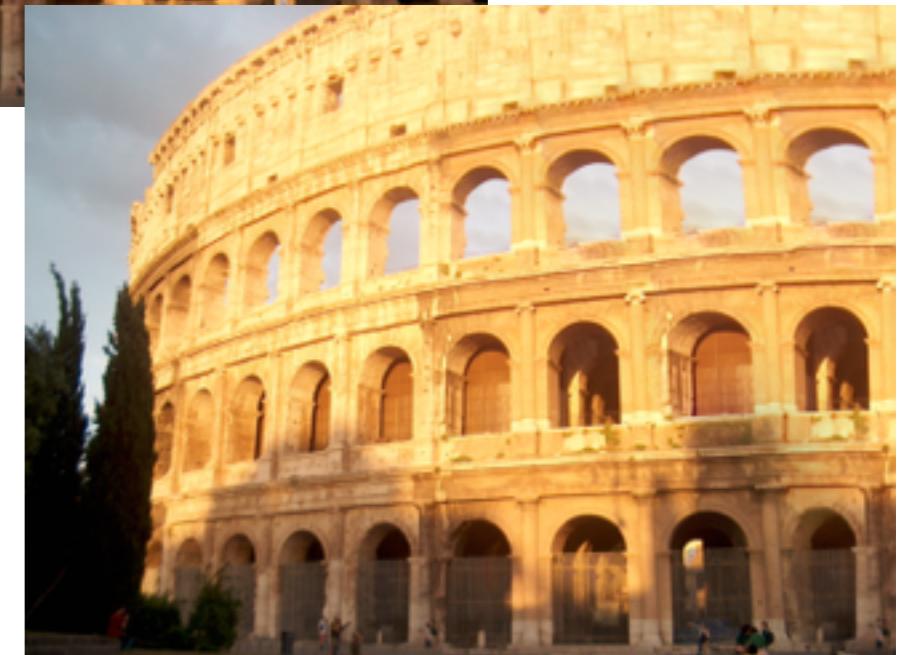
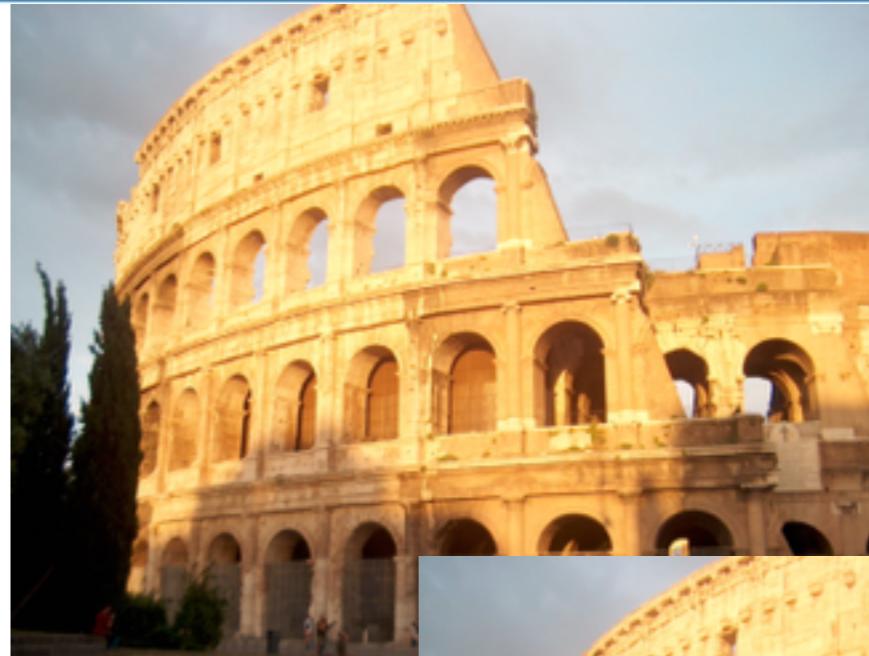
11. Colors



Structure of this Lecture

12. Image Based Rendering

- Retargeting
- Image Completion



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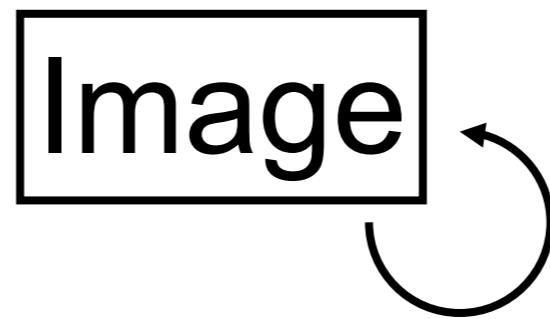
Computer Graphics is Computer Science

- **Mathematical modeling**
 - physics of light transport
 - deformable objects
- **Solving computationally hard problems**
 - efficient algorithms and data structures
 - software design and development
- **Managing large datasets**
 - storing, searching, accessing, exploring
 - transmitting

Computer Graphics Landscape

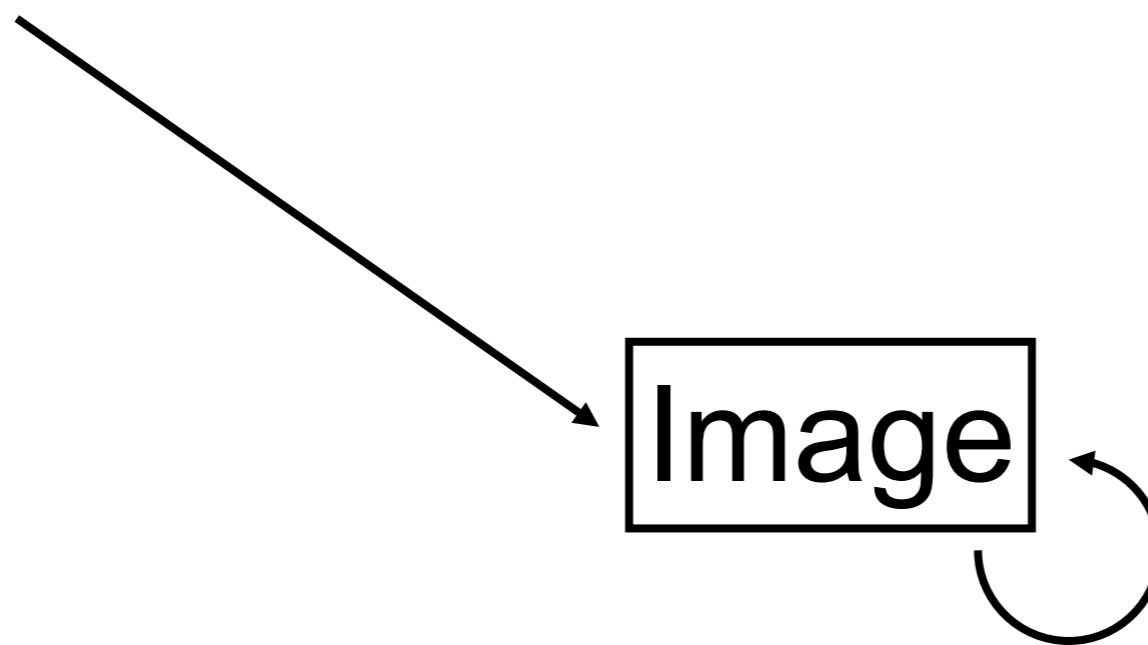
Image

Computer Graphics Landscape

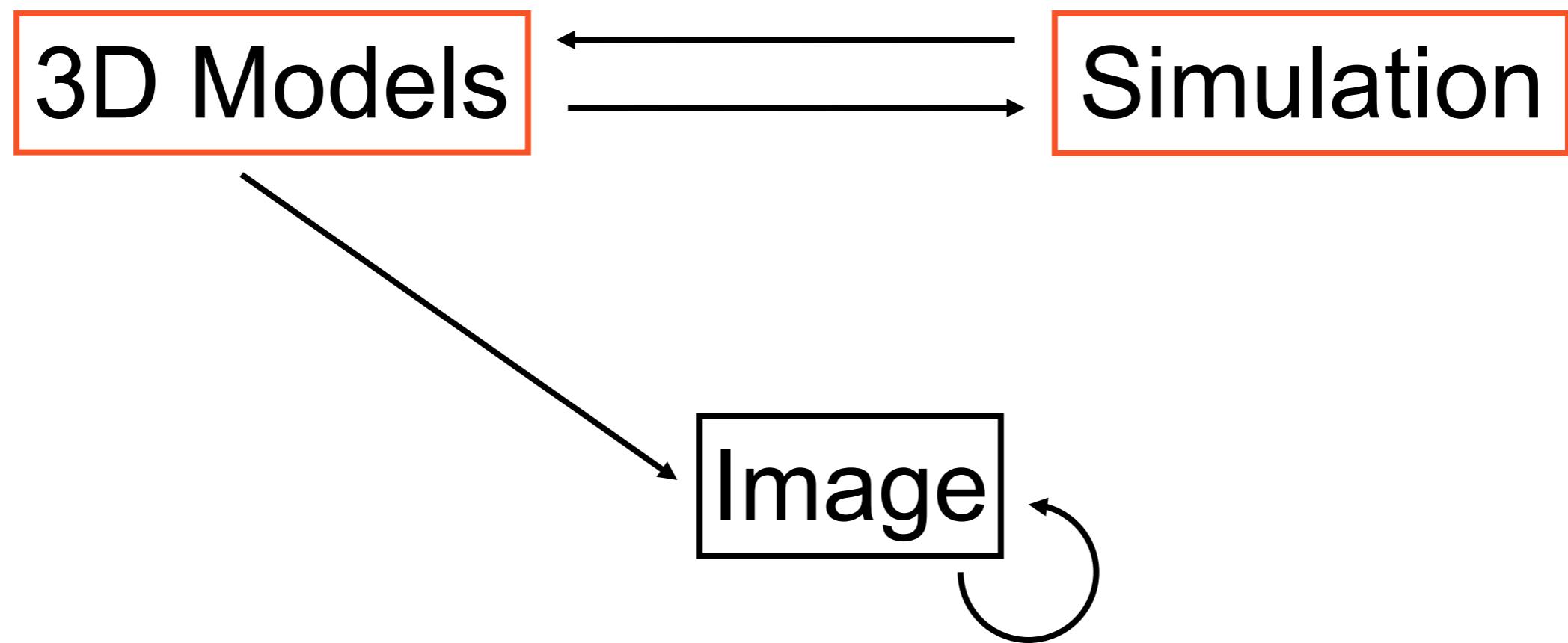


Computer Graphics Landscape

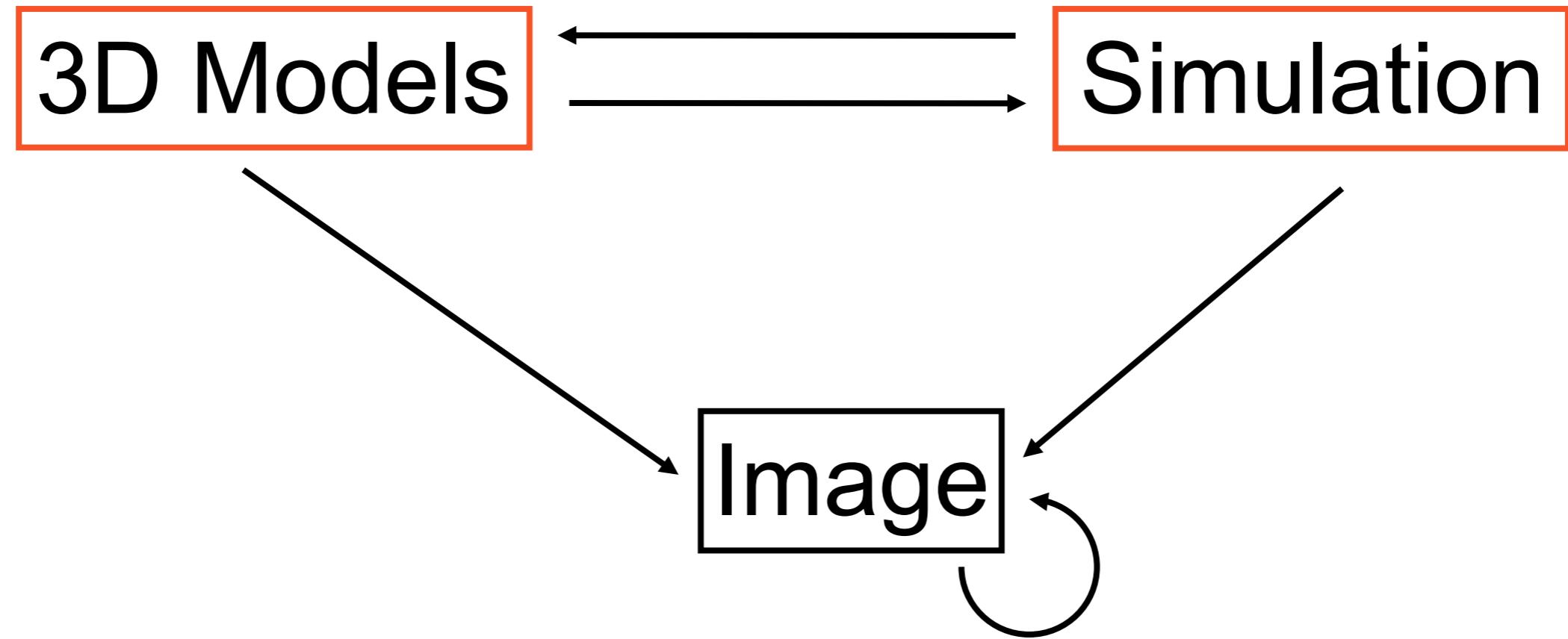
3D Models



Computer Graphics Landscape

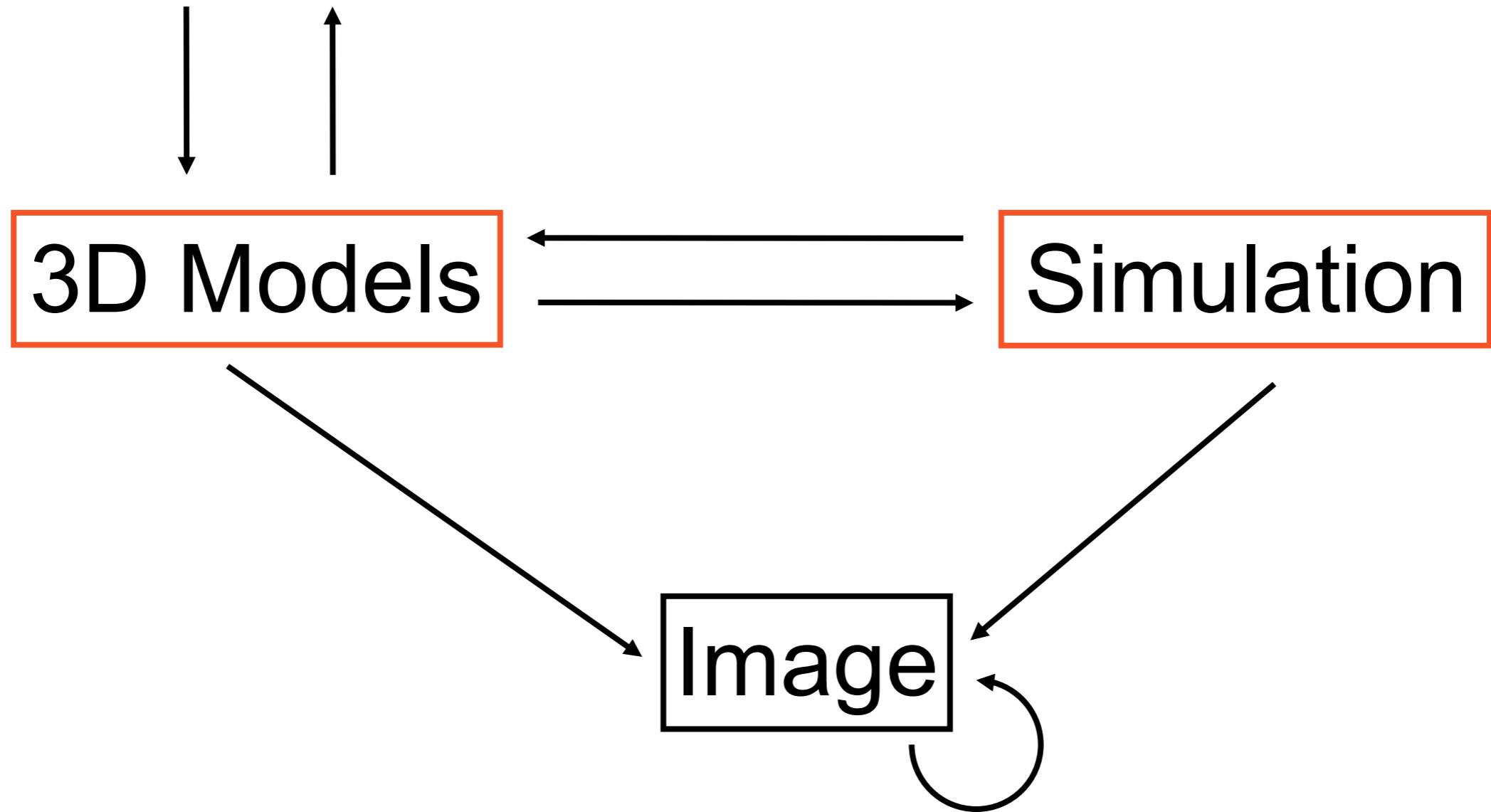


Computer Graphics Landscape

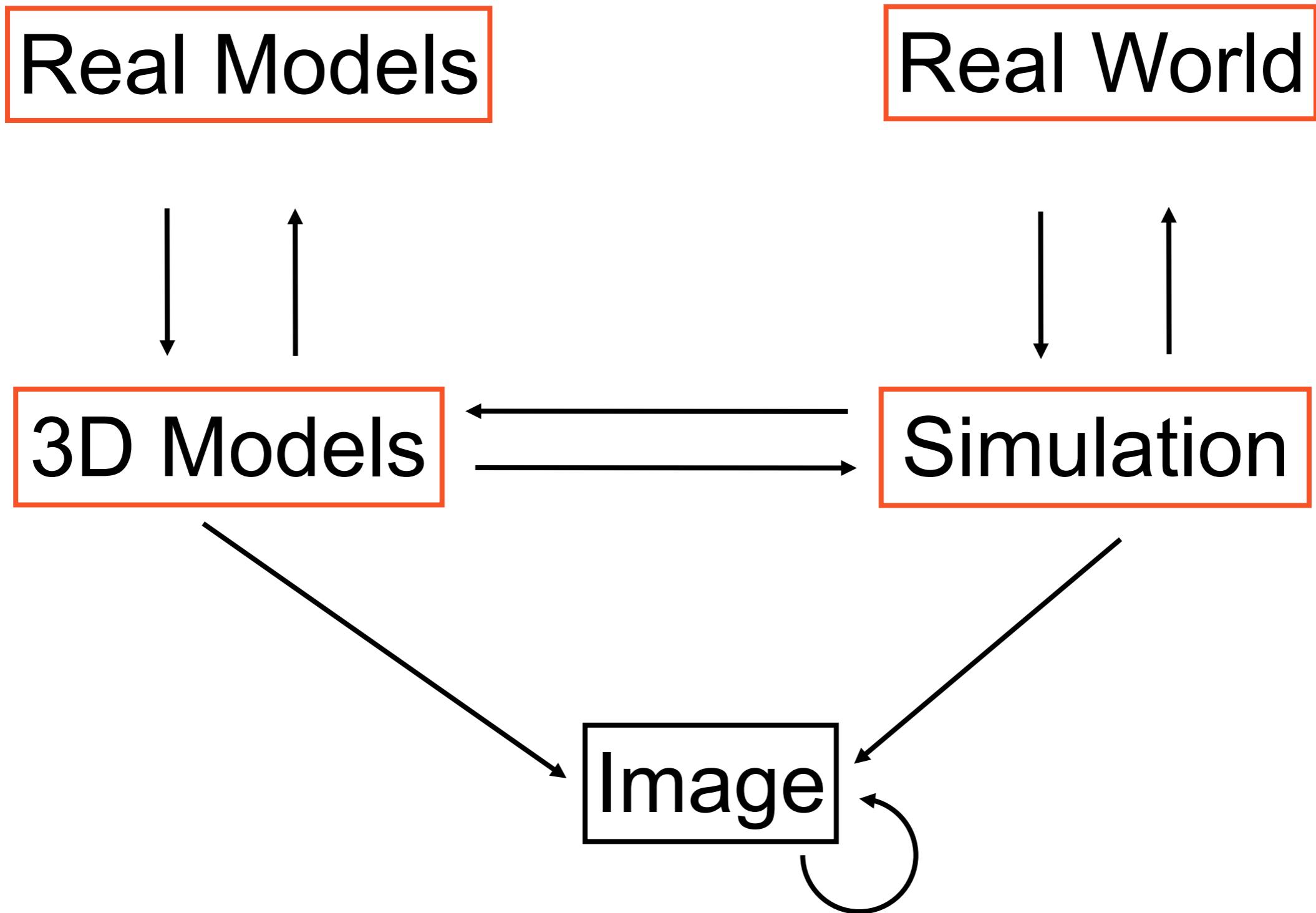


Computer Graphics Landscape

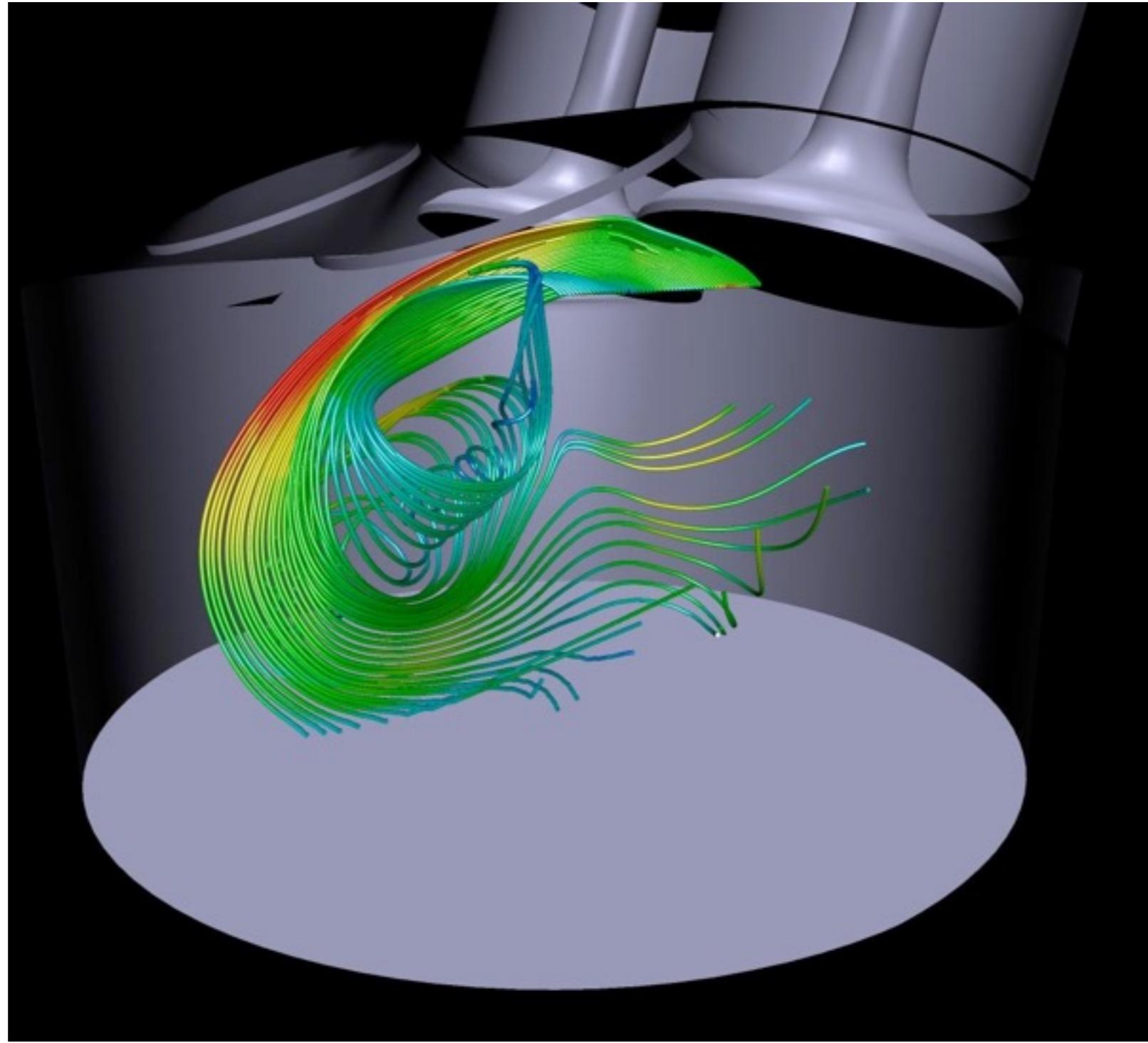
Real Models



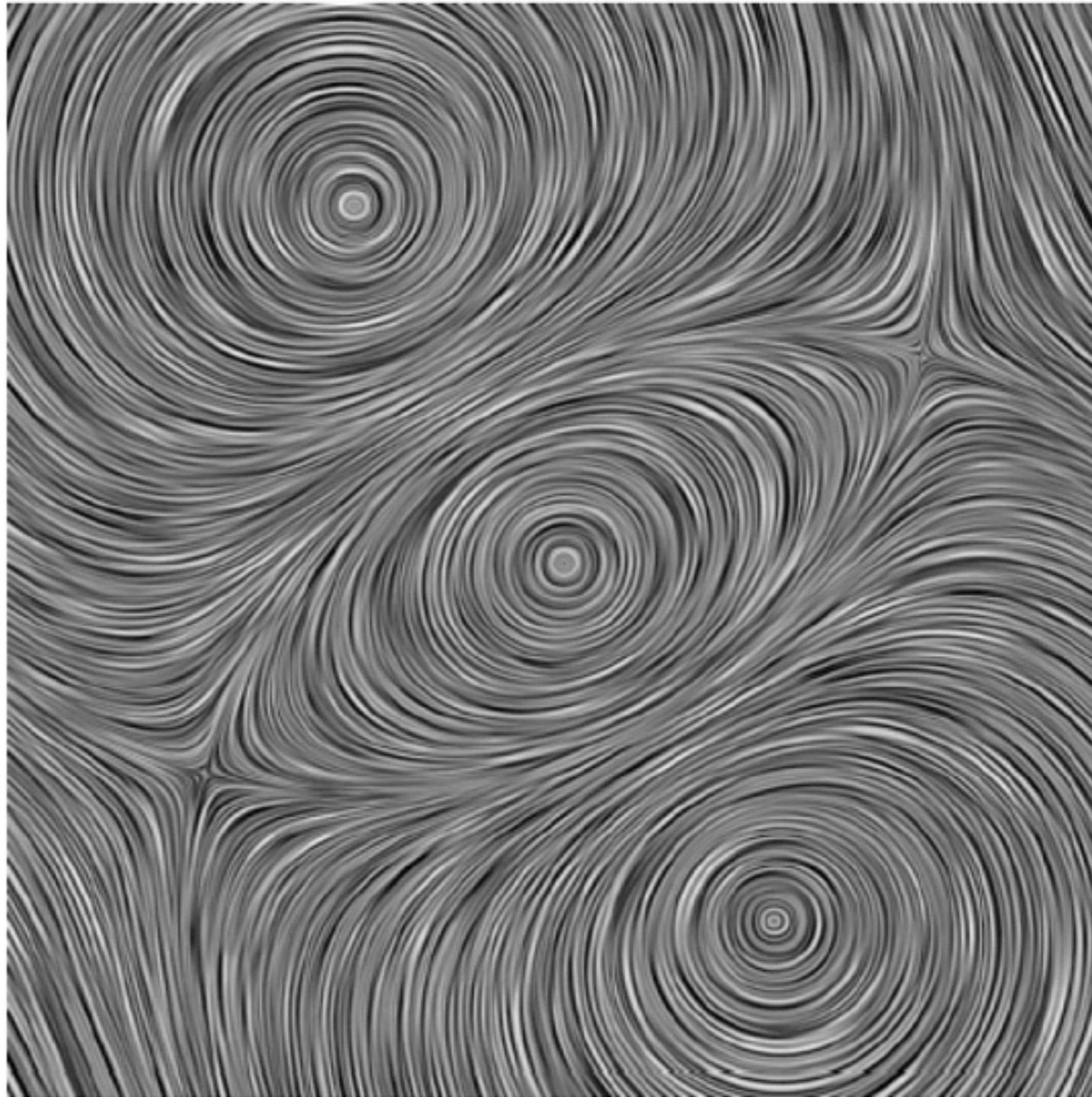
Computer Graphics Landscape



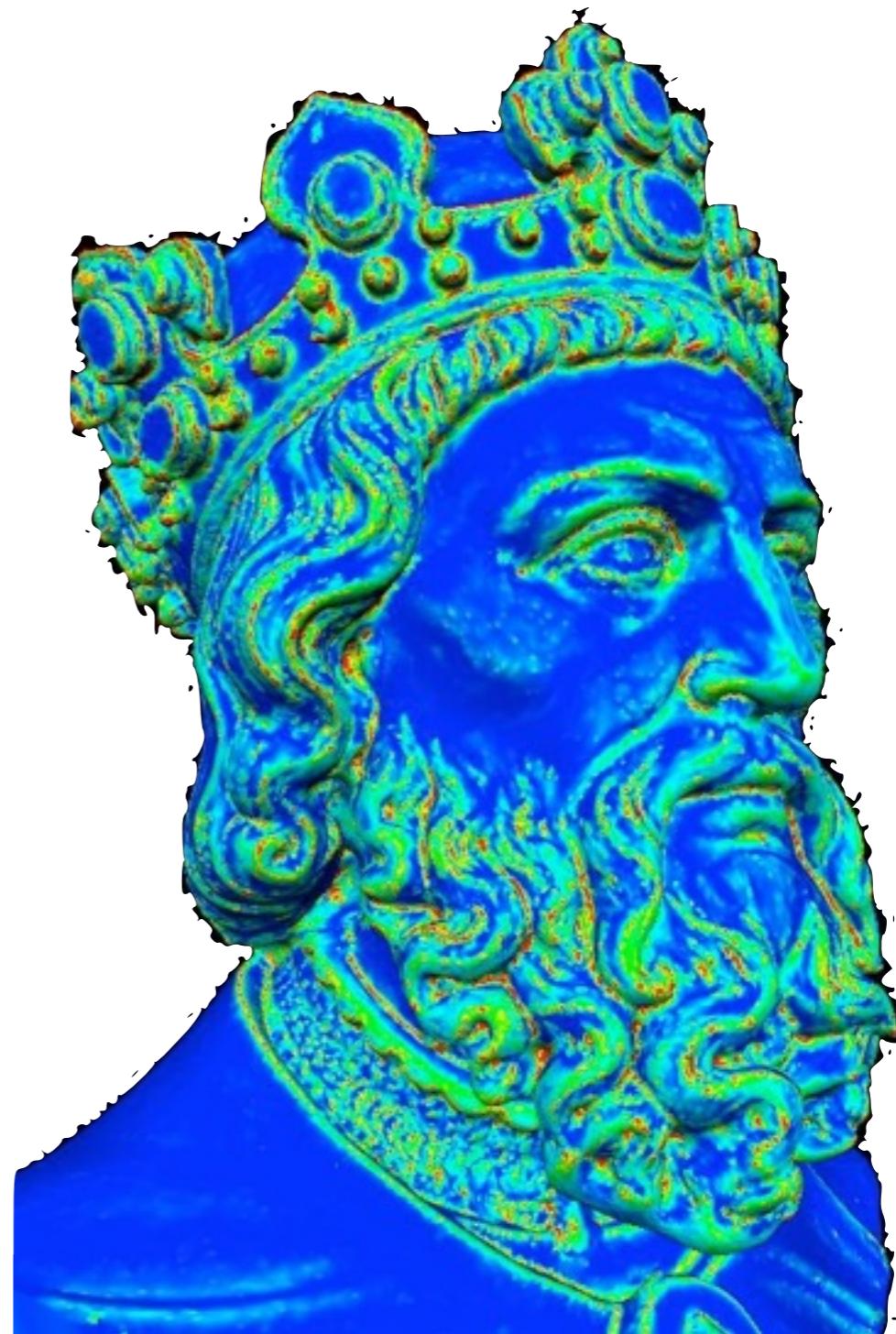
Examples



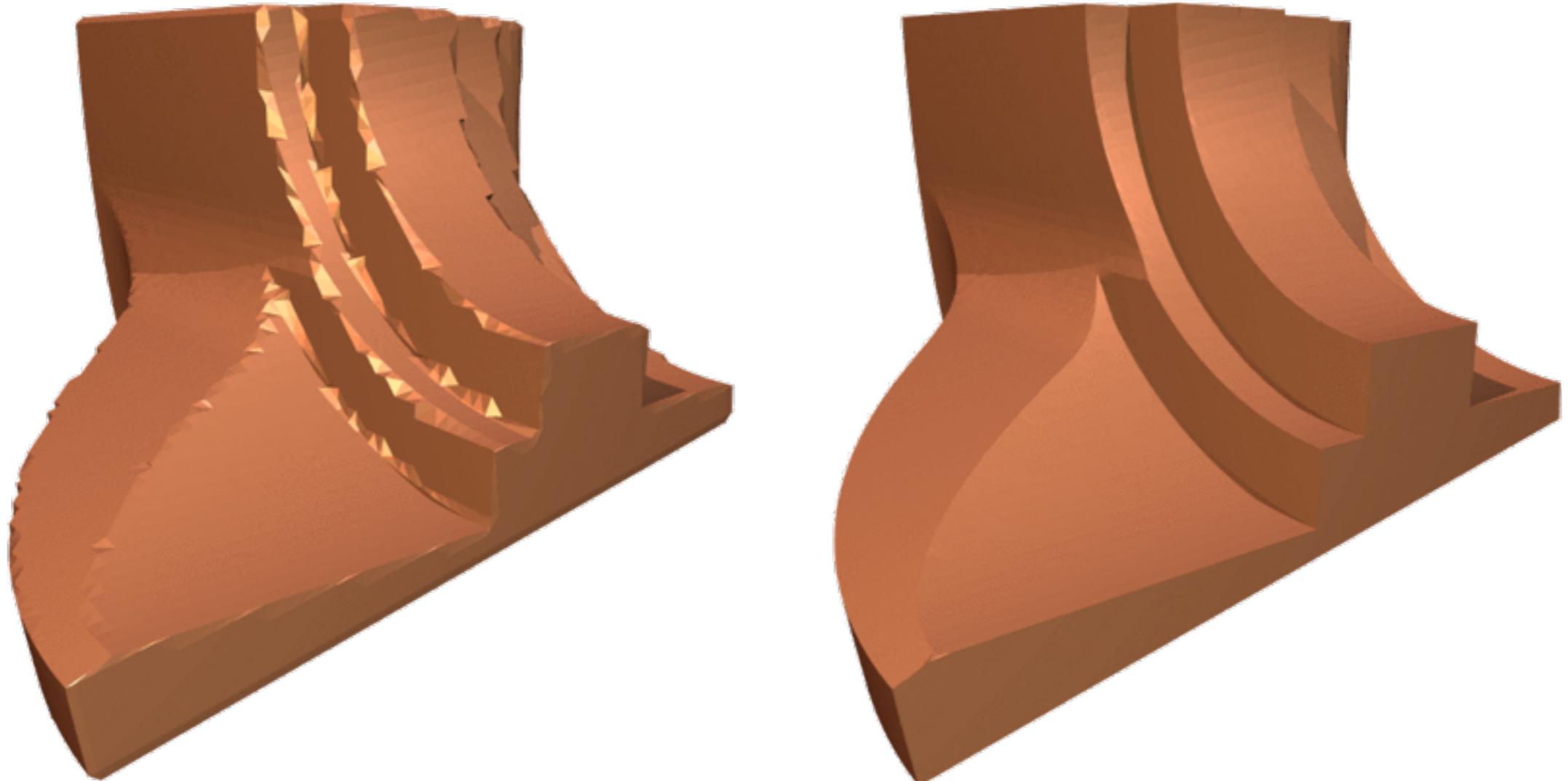
Examples



Examples



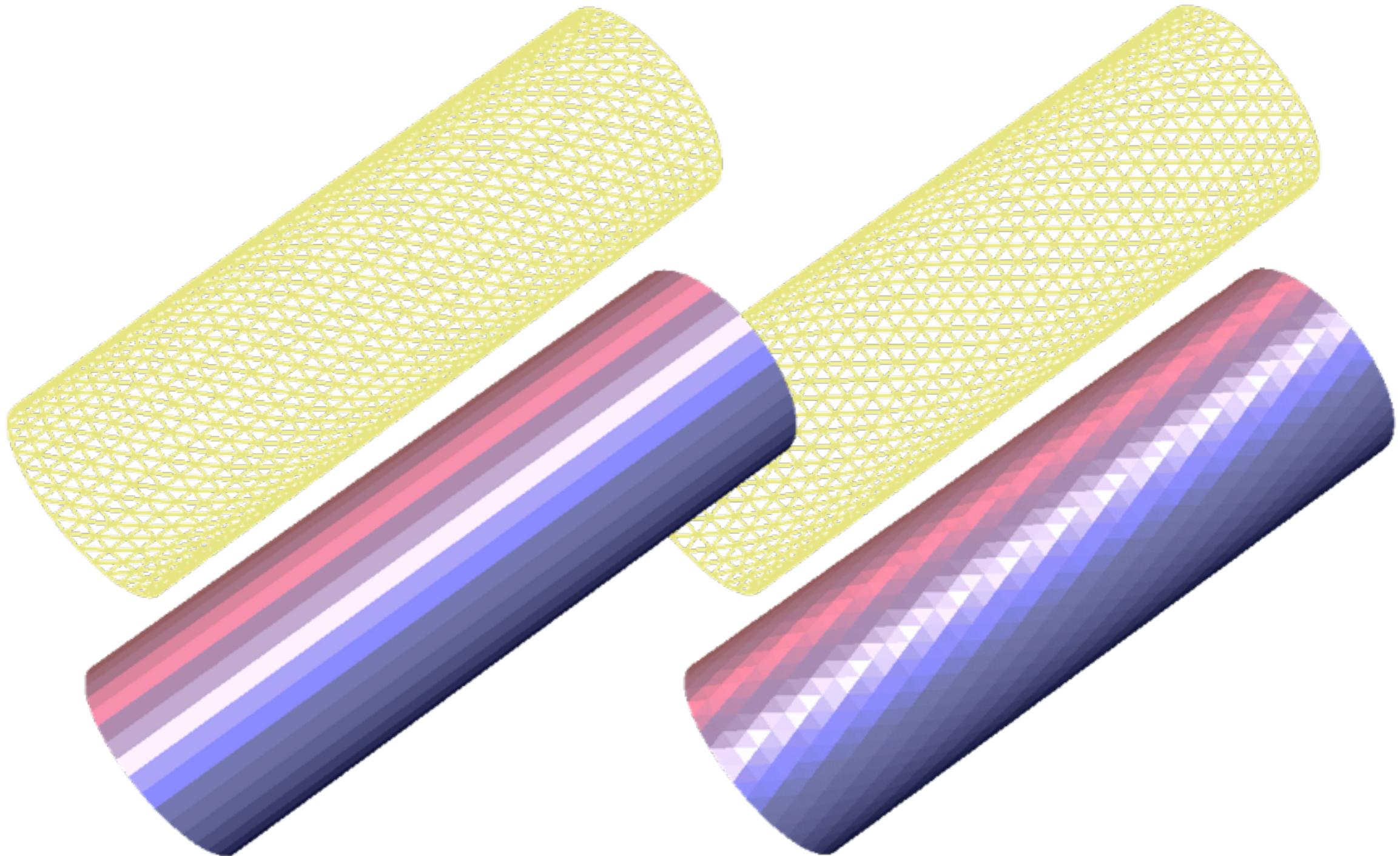
Examples



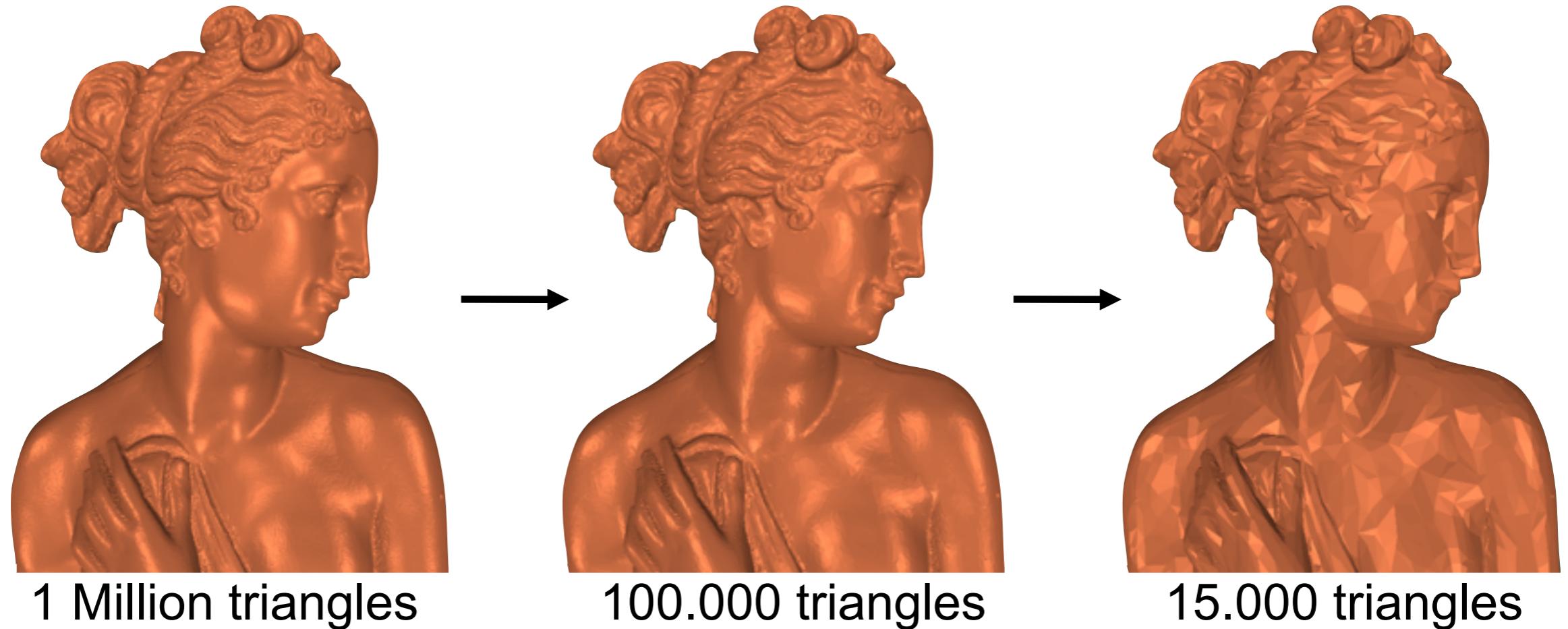
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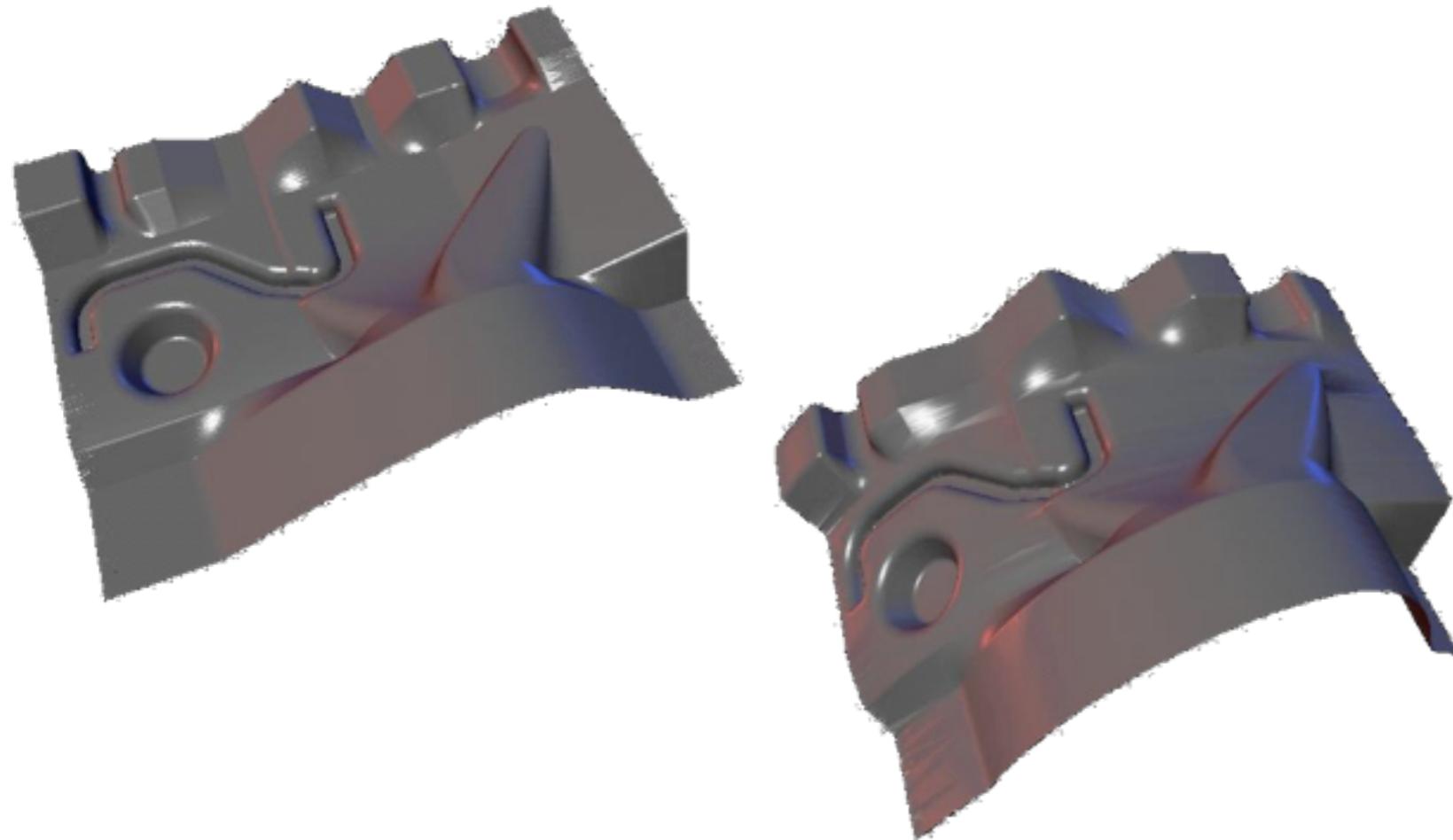
Examples



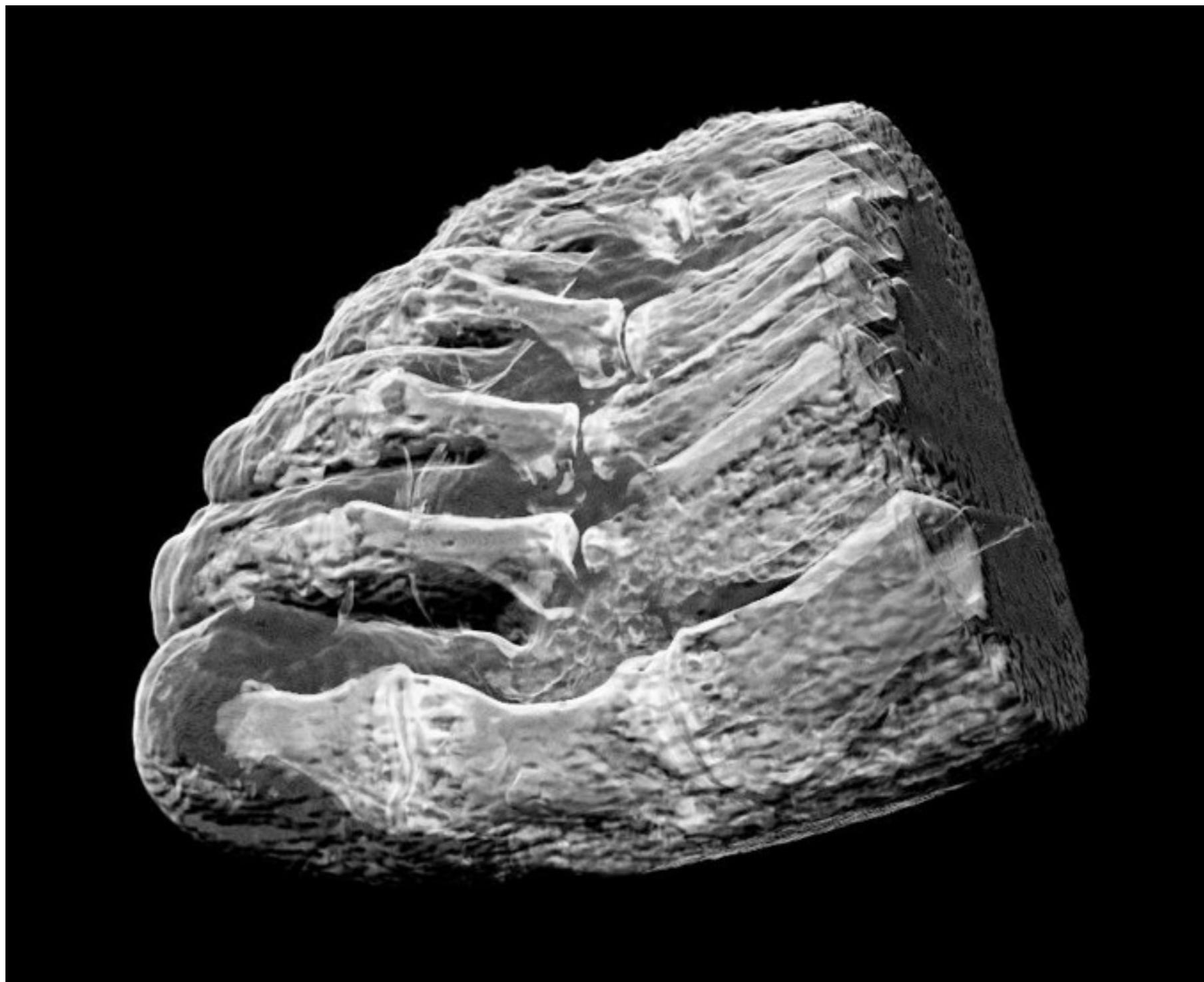
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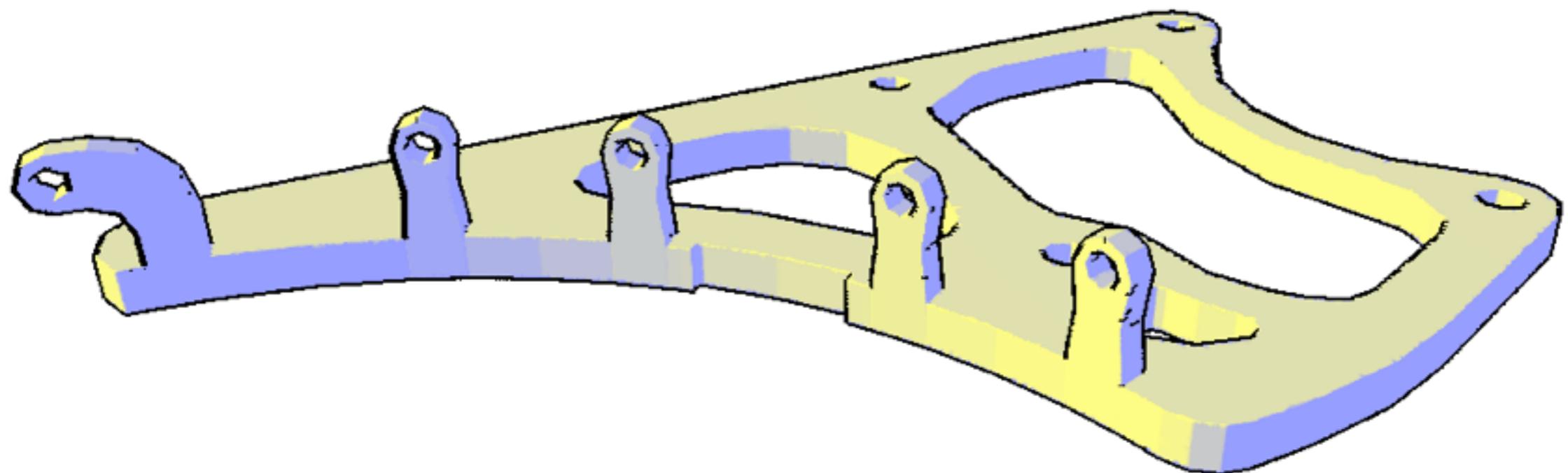
Examples



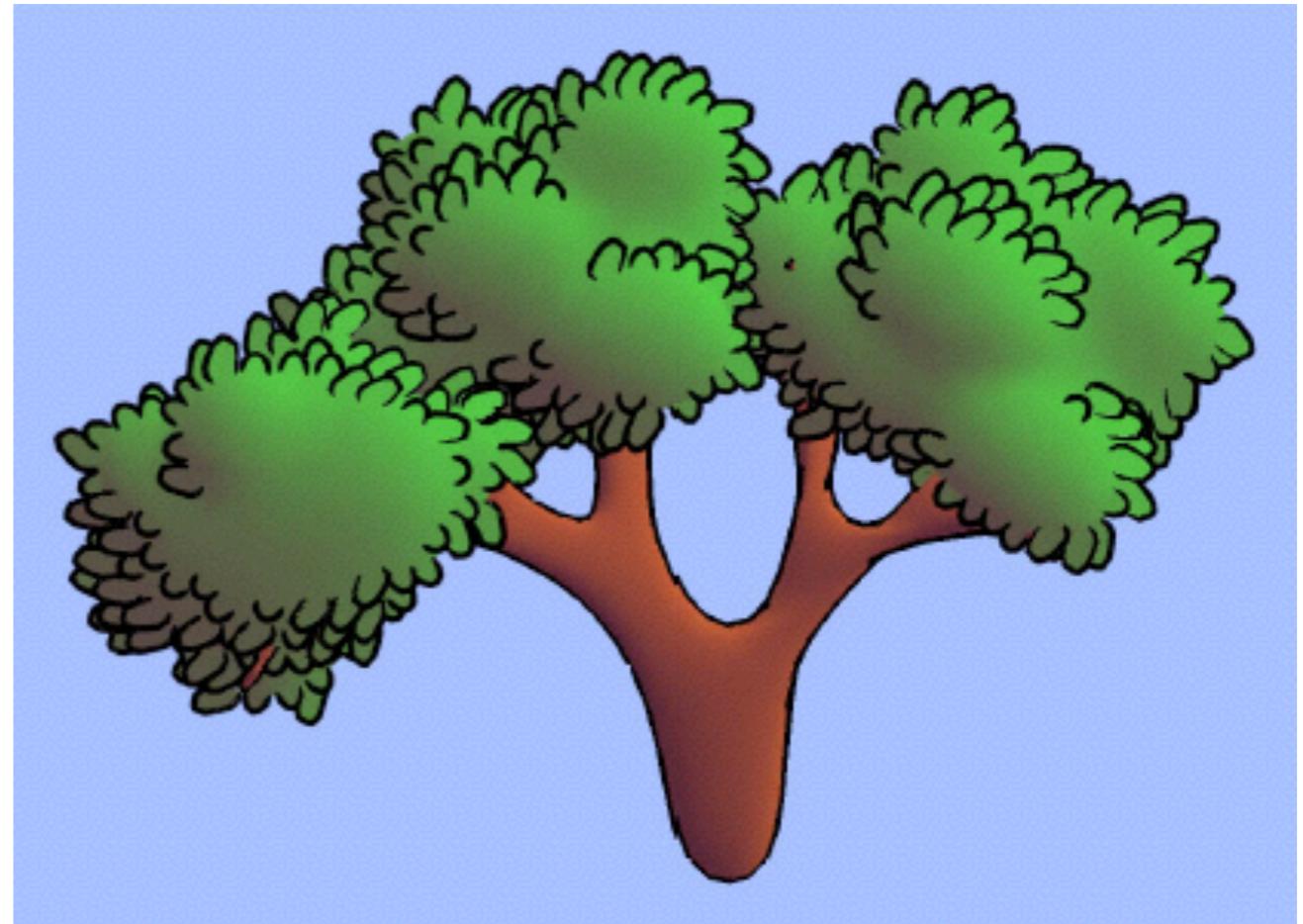
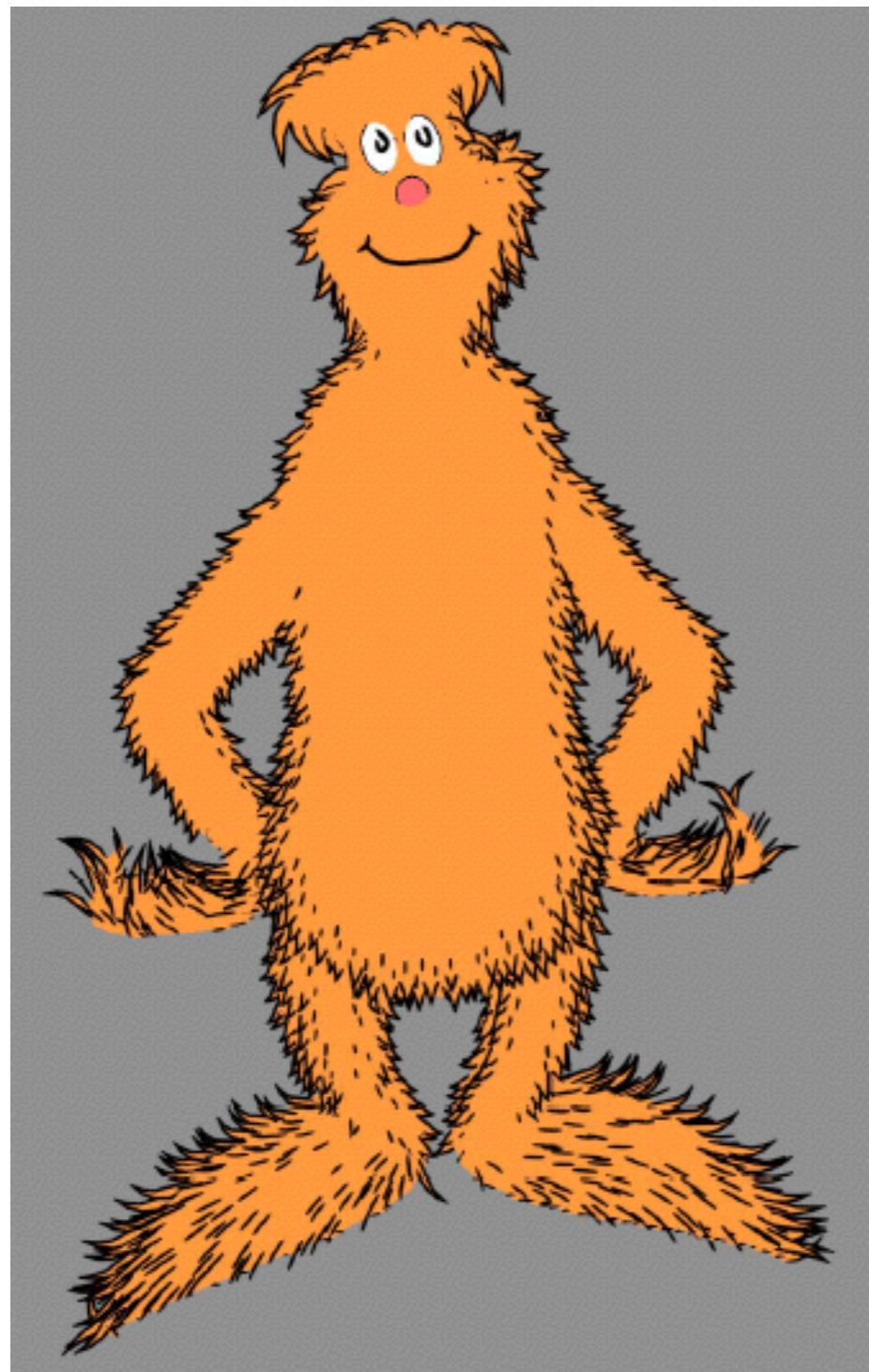
Examples



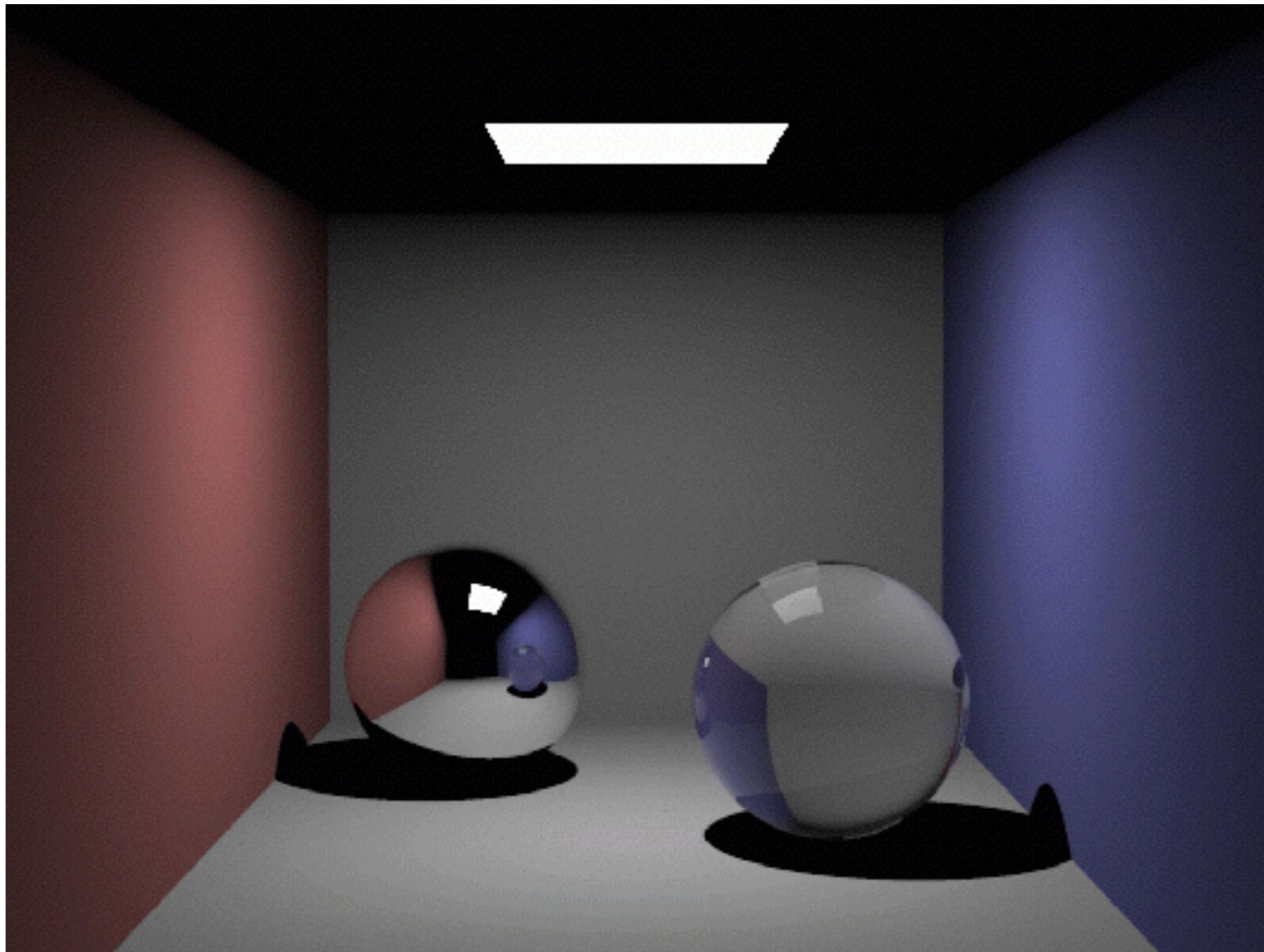
Examples



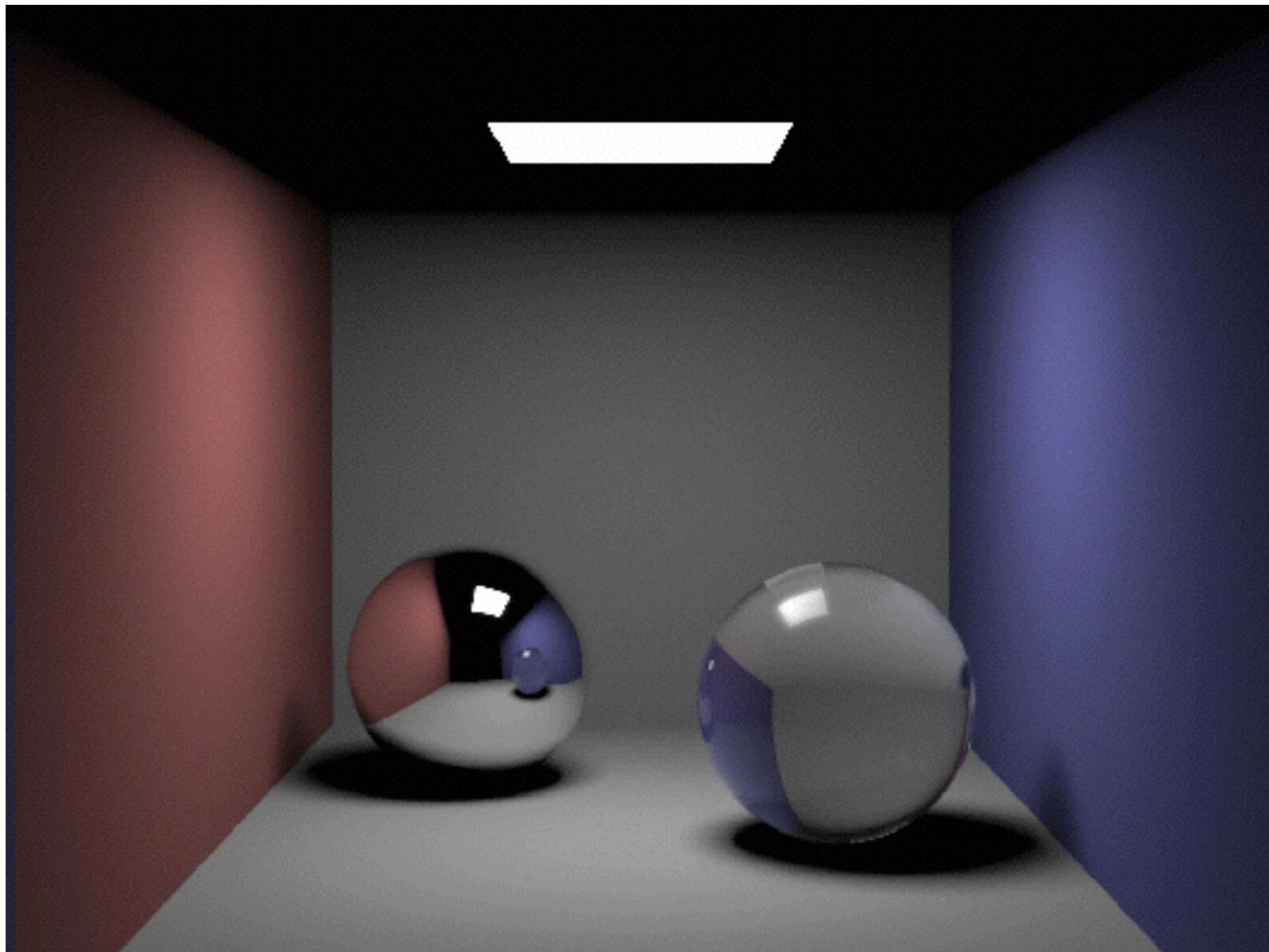
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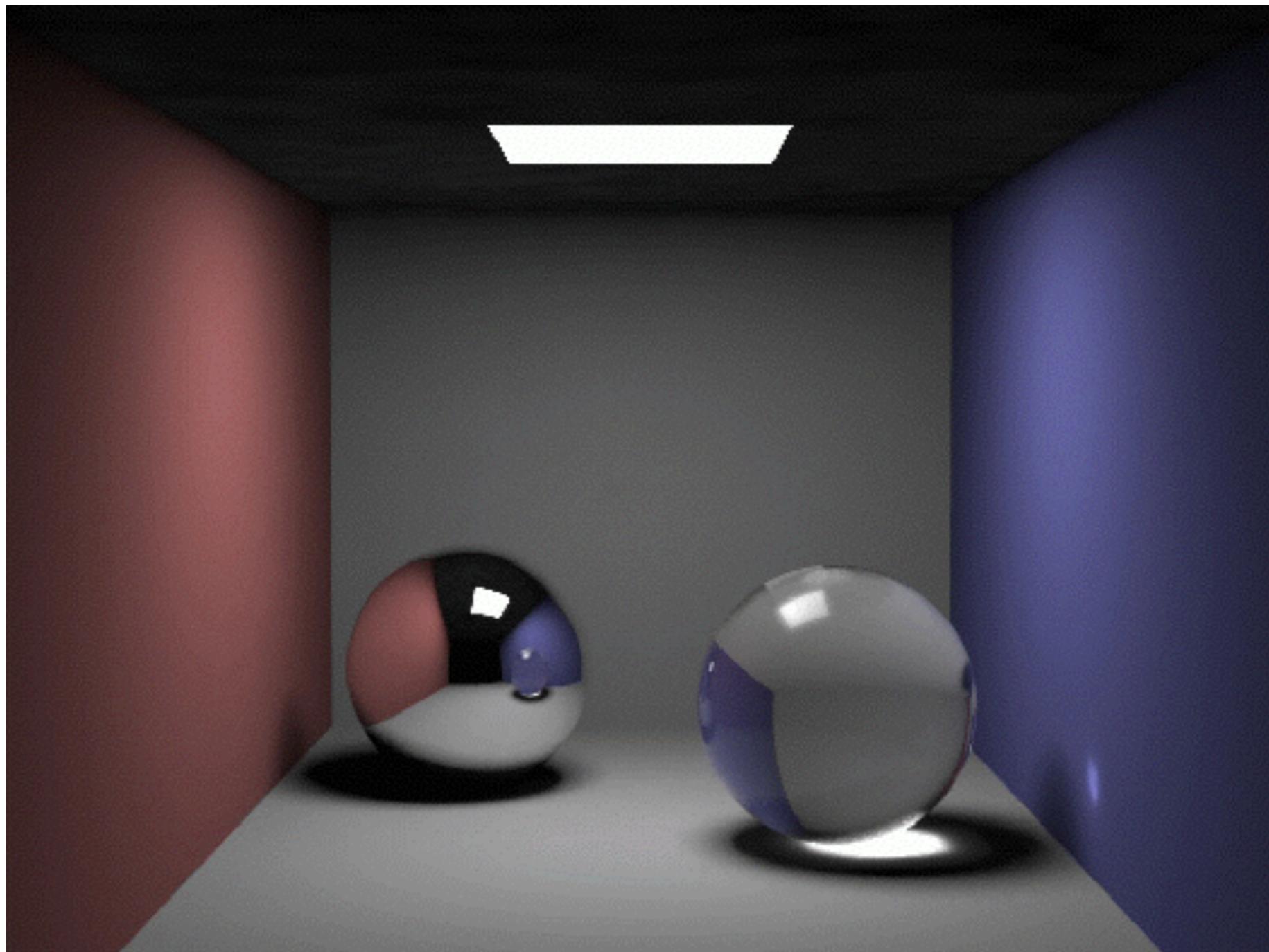
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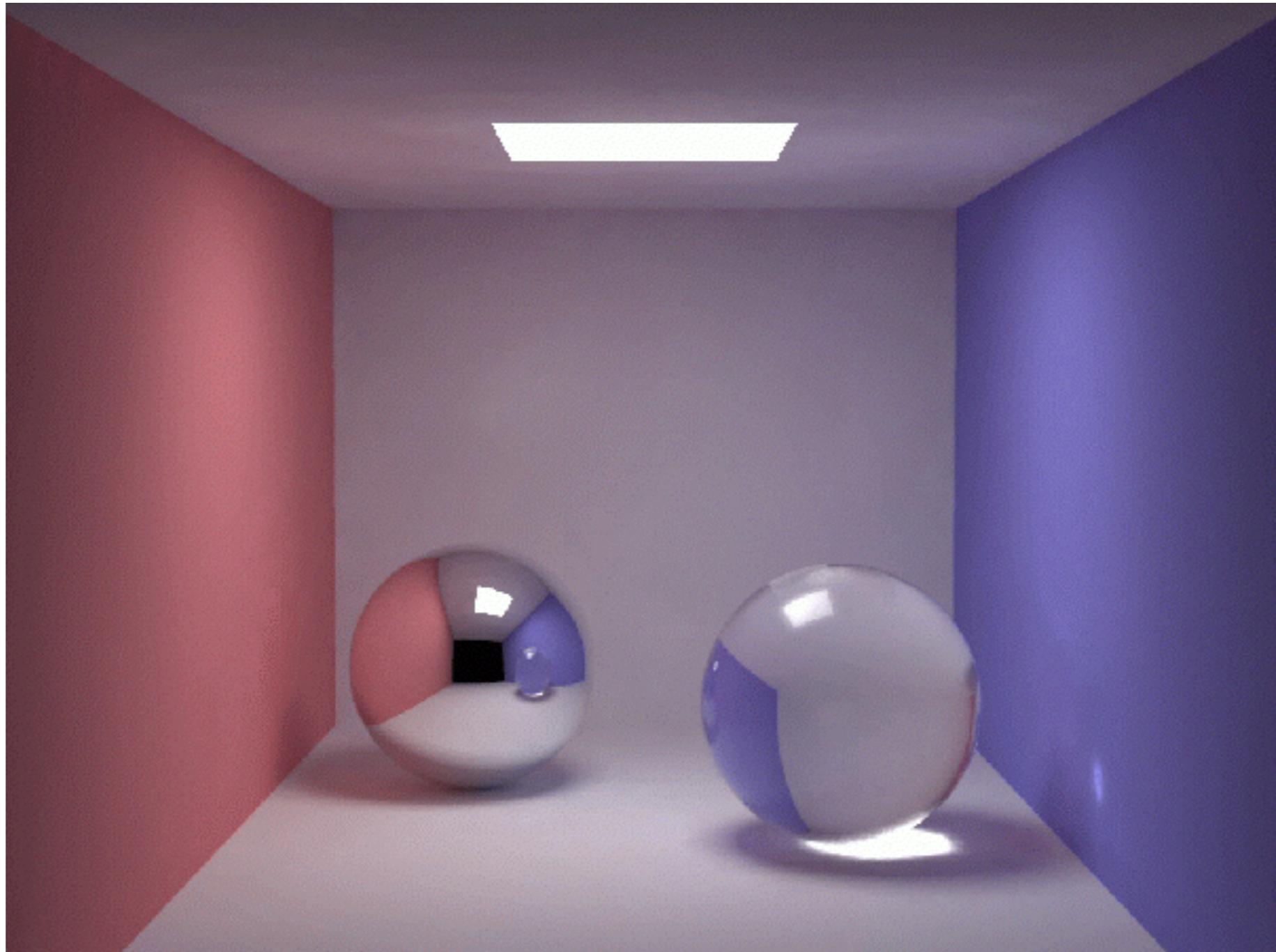
Examples



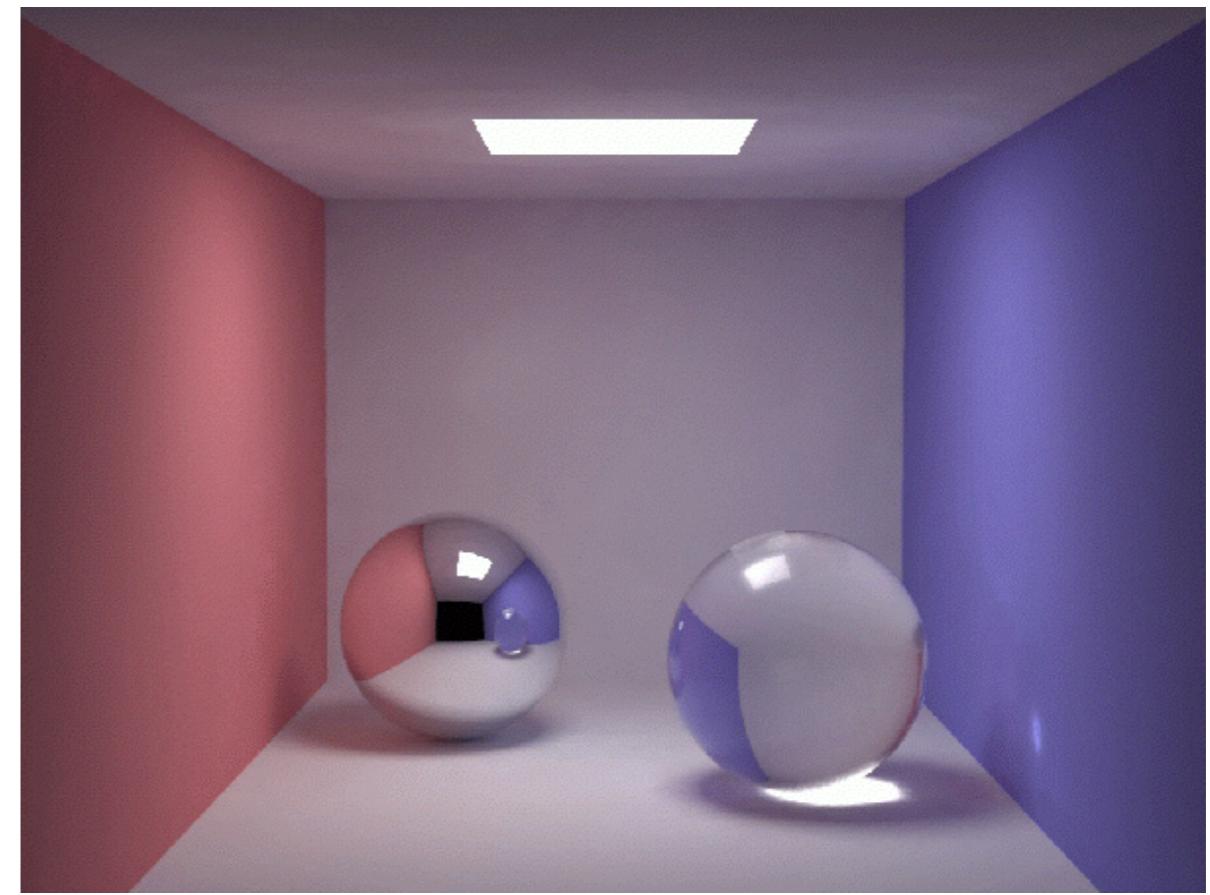
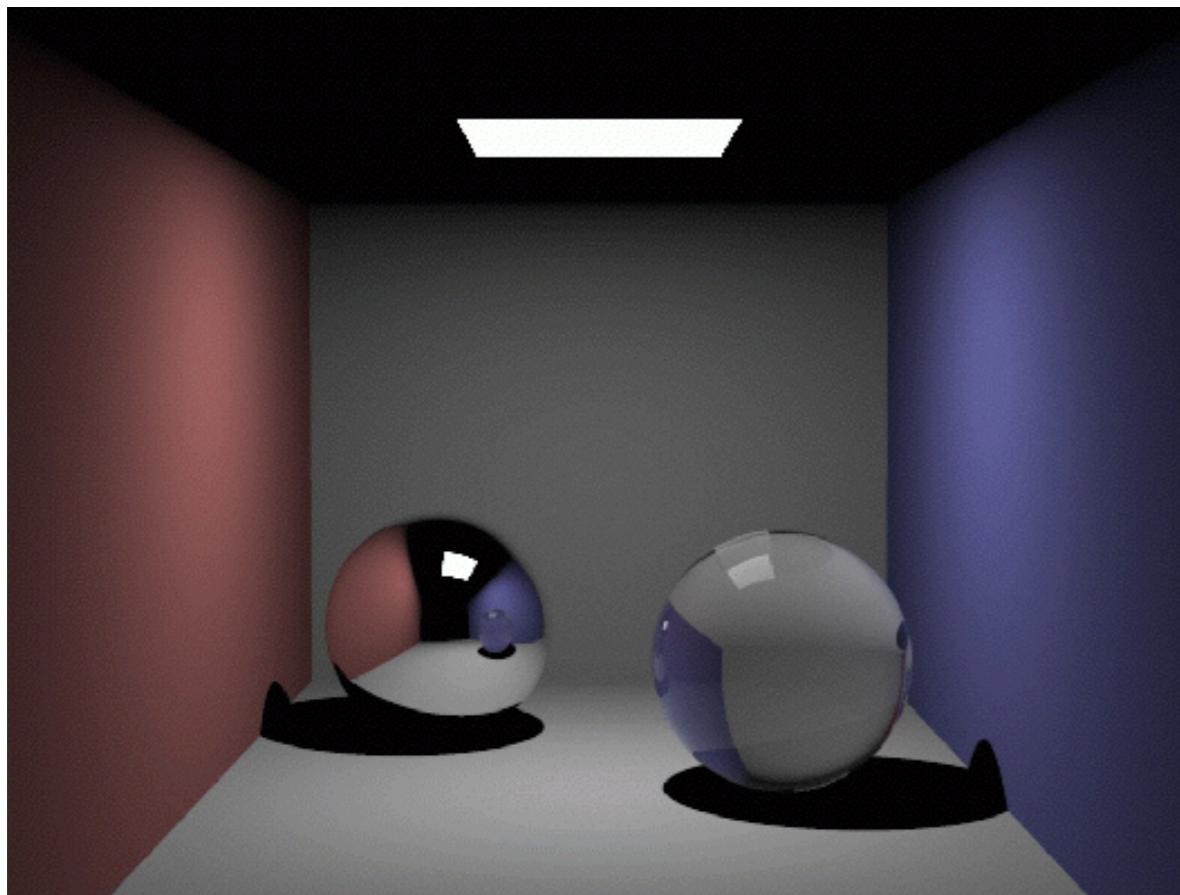
Examples



Examples



Examples



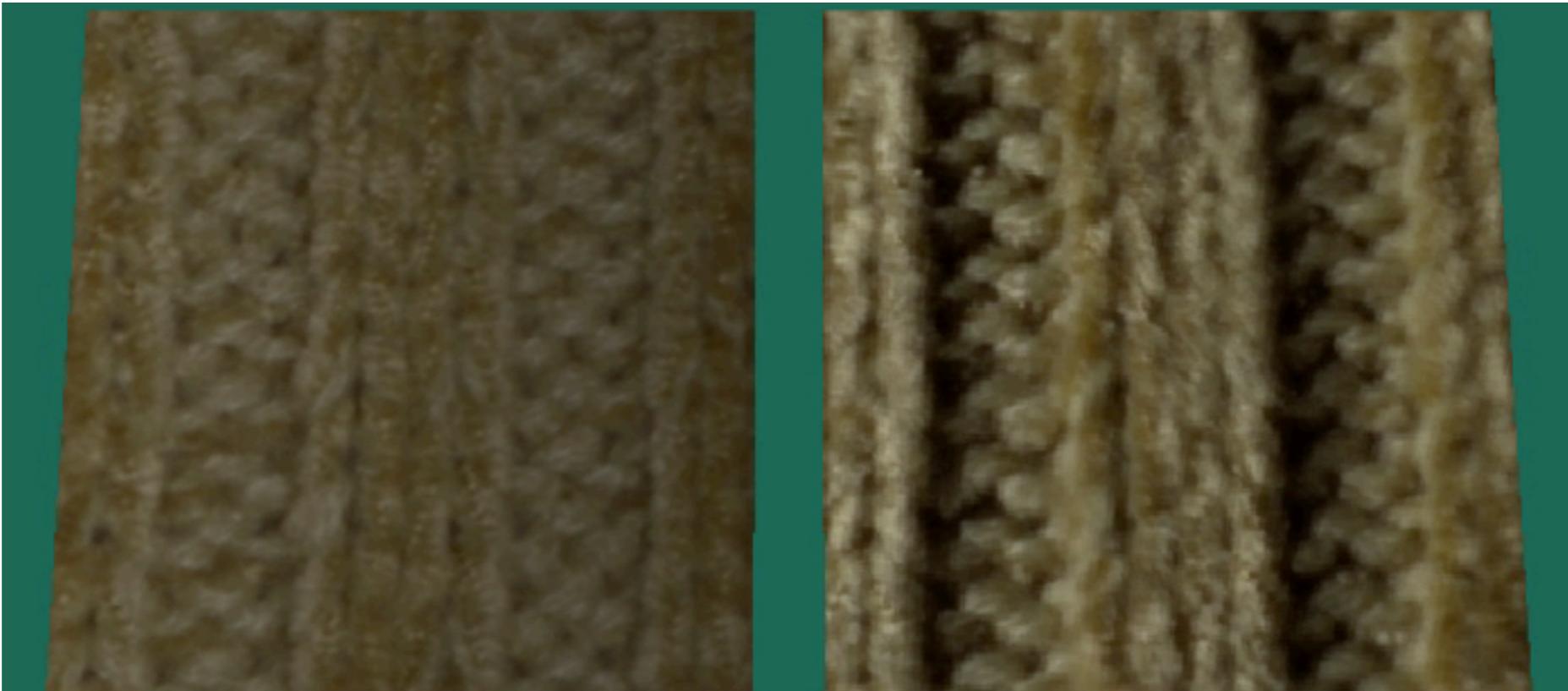
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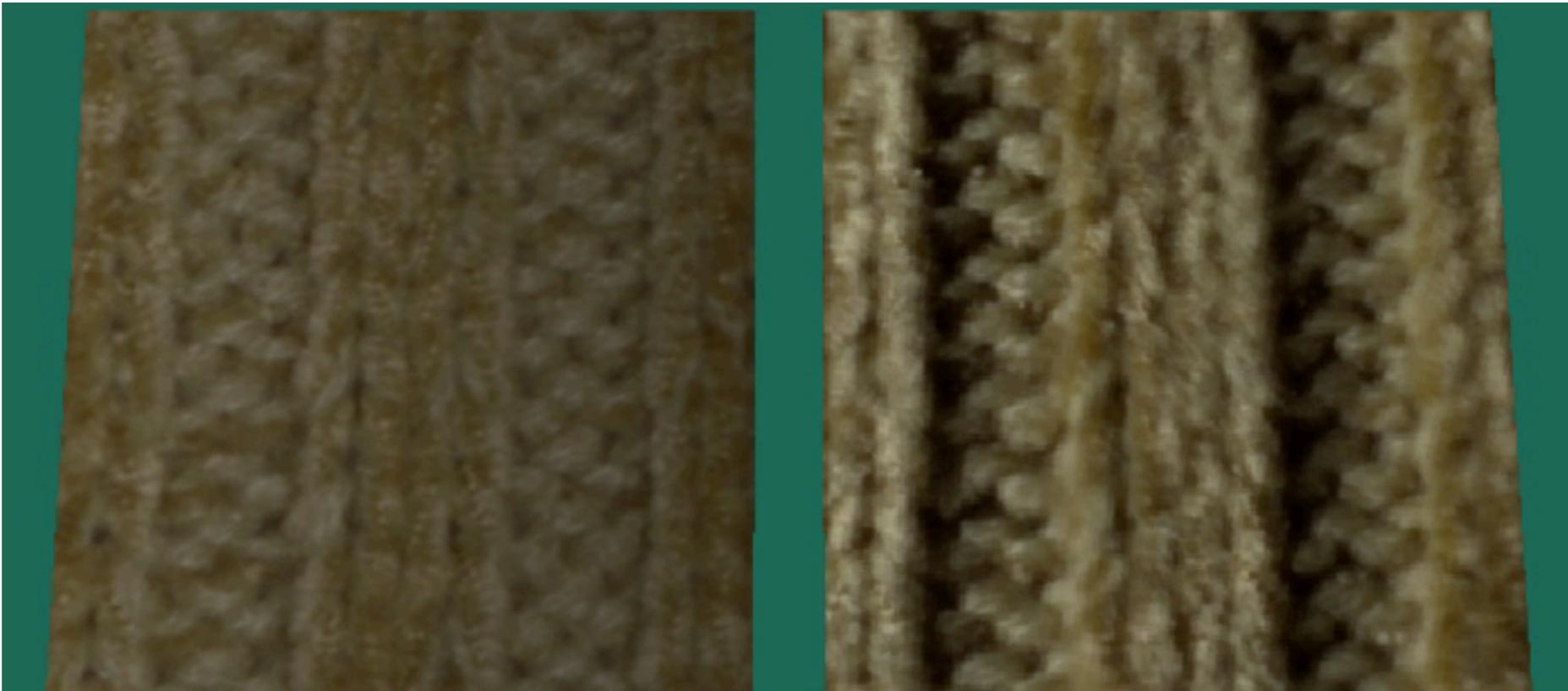
Examples



Examples



Examples



Examples



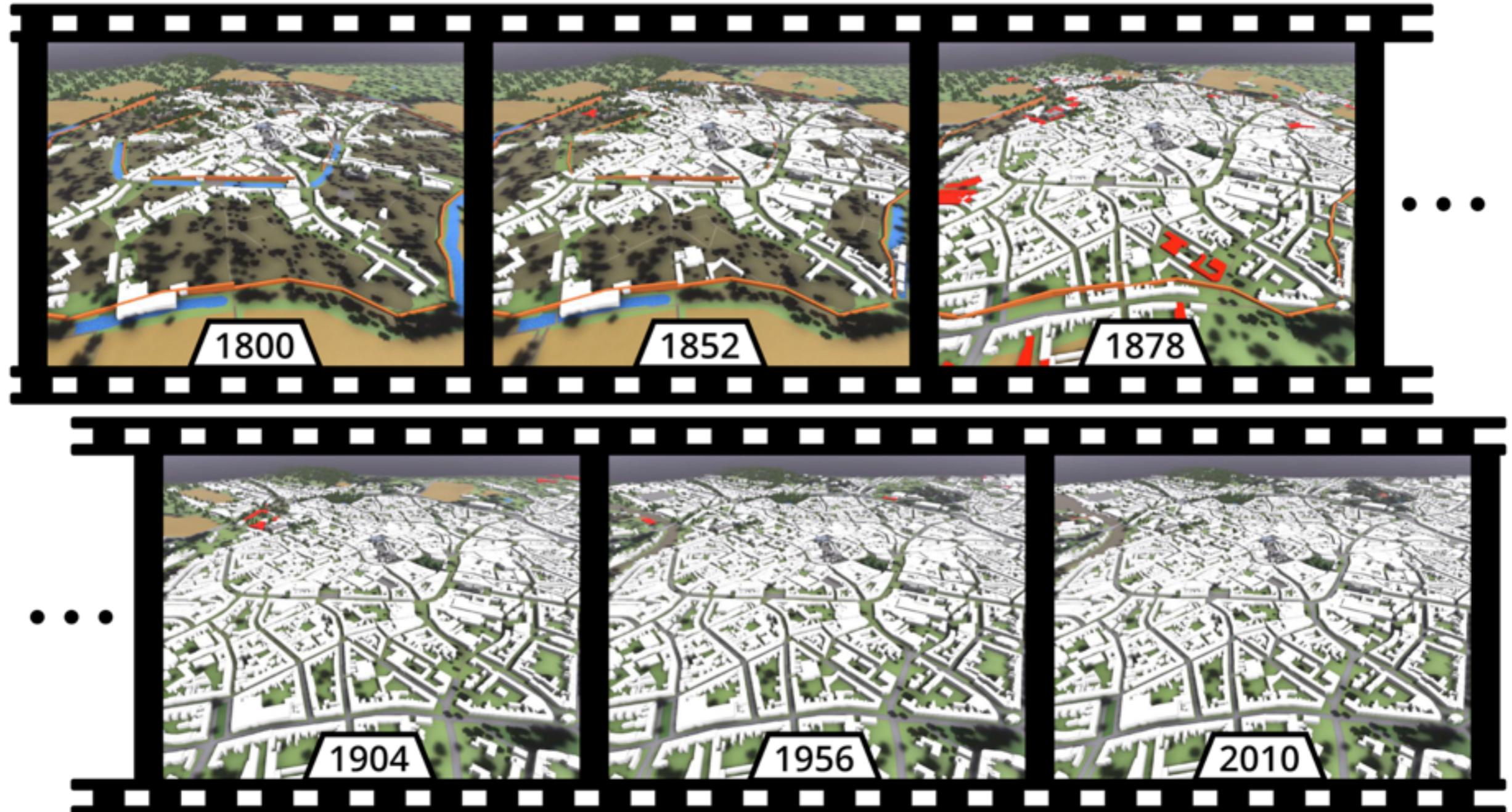
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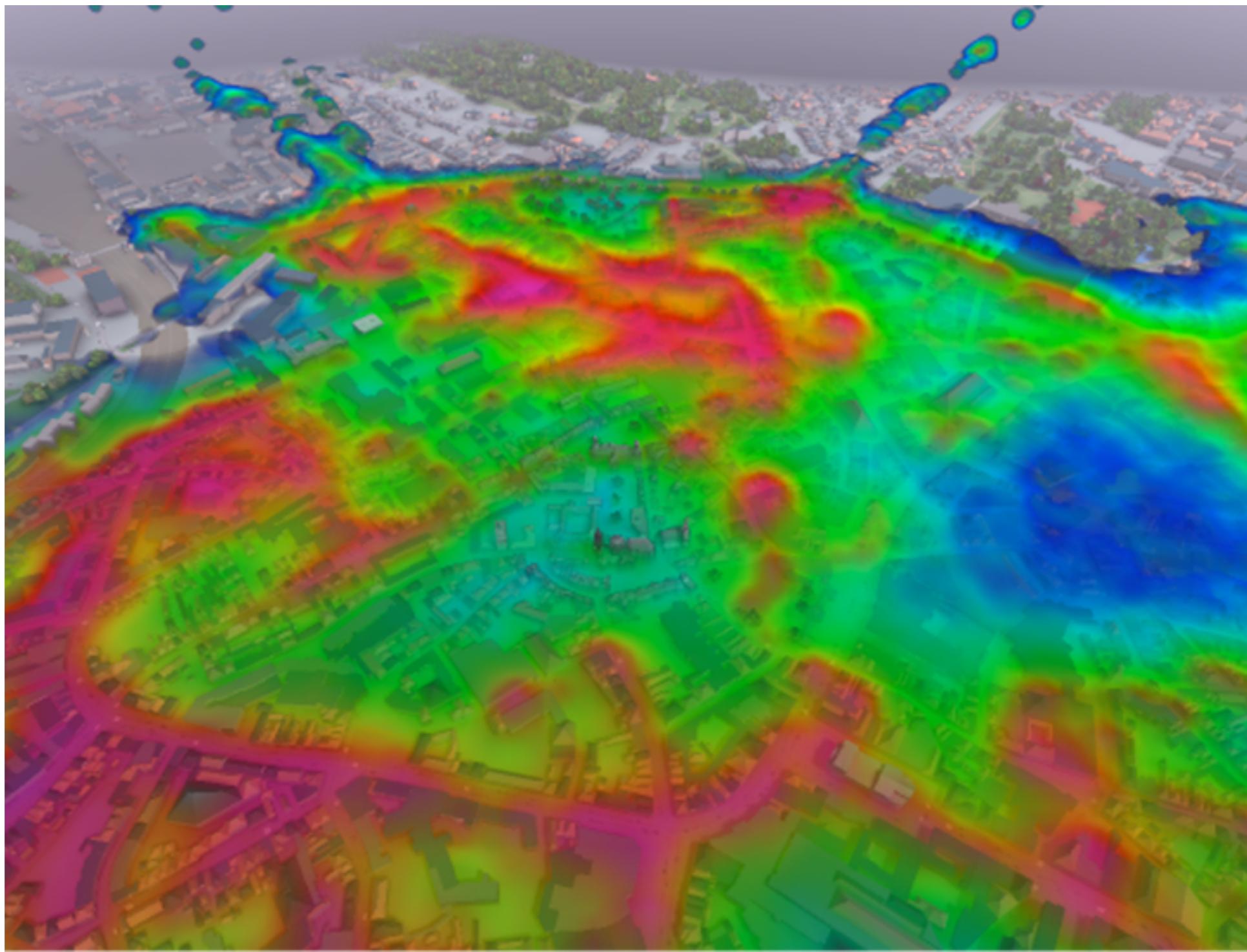
Examples



Examples



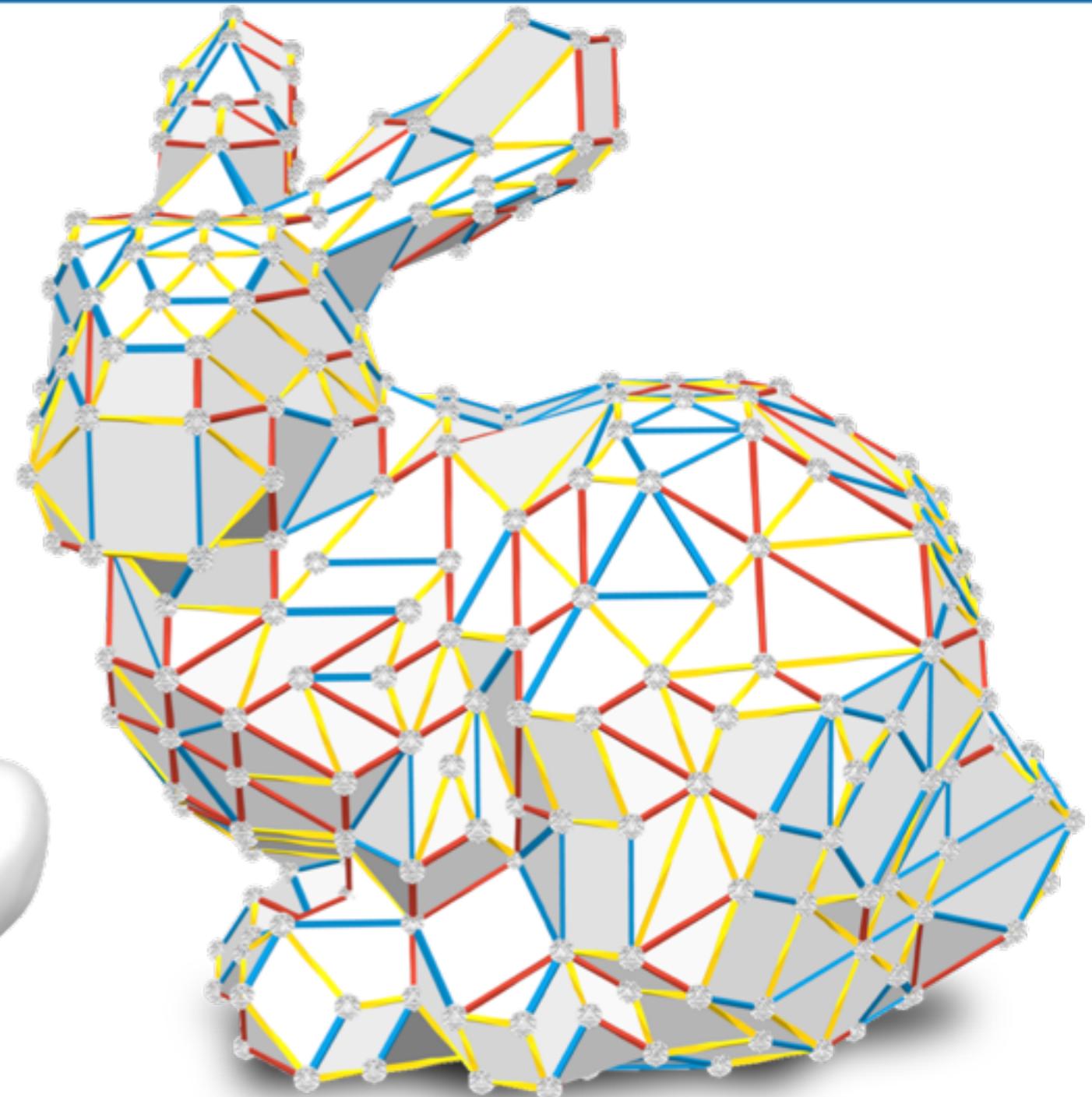
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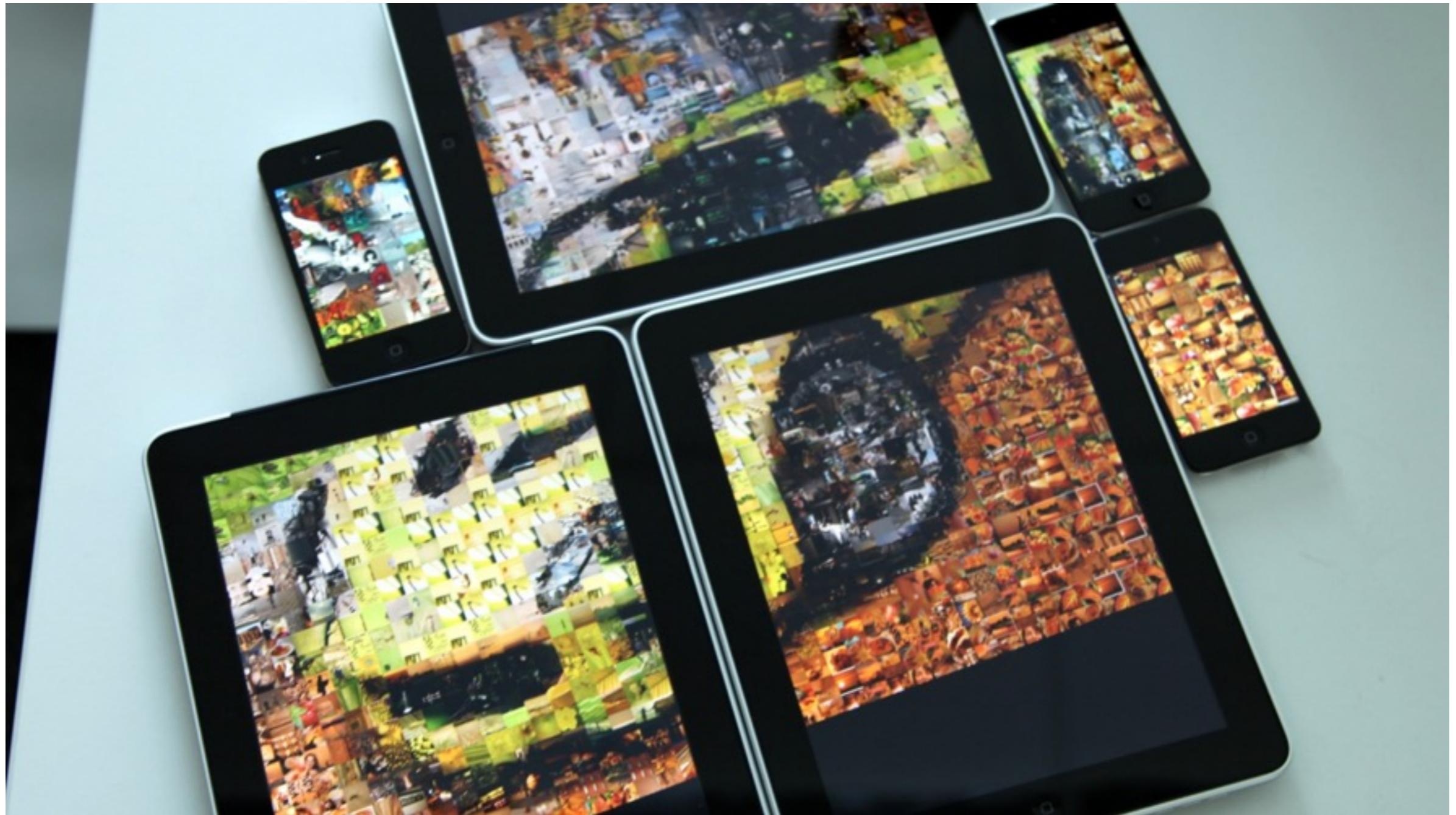
Examples



Examples



Examples



Examples

