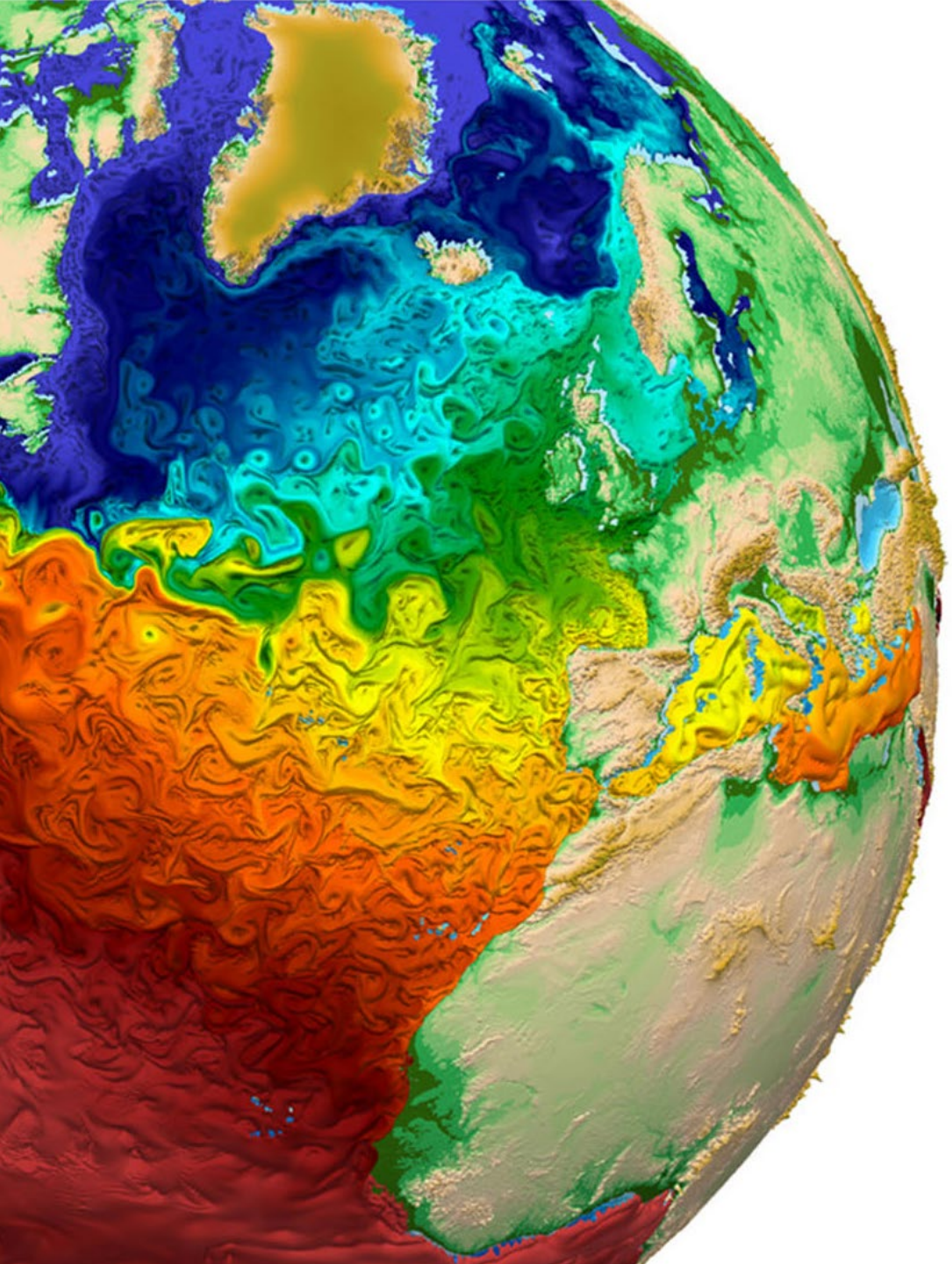


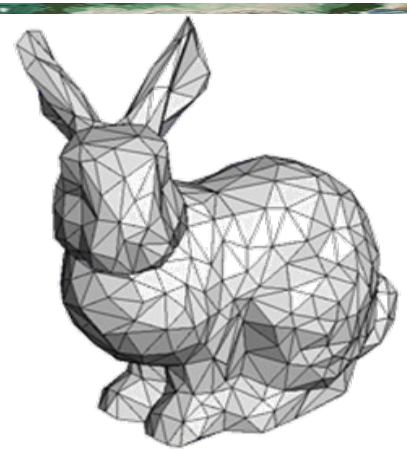
3D Computer Graphics for People in a Hurry

Rendering

Scientific Visualization

Professor Eric Shaffer

Visualization and Computer Graphics



Visualization and Computer Graphics are not the same thing

- Visualization uses computer graphics technology as a tool
- You can create great visualizations without a deep knowledge of CG

Need understand what elements of CG that impact visualization

- What impacts application performance?
  - Important for interactivity
- What impacts the visual quality of the rendered image?
  - Avoid distorting the image in misleading ways

3D CG is important for sci vis because we often want to see 3D physical domains

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Rendering

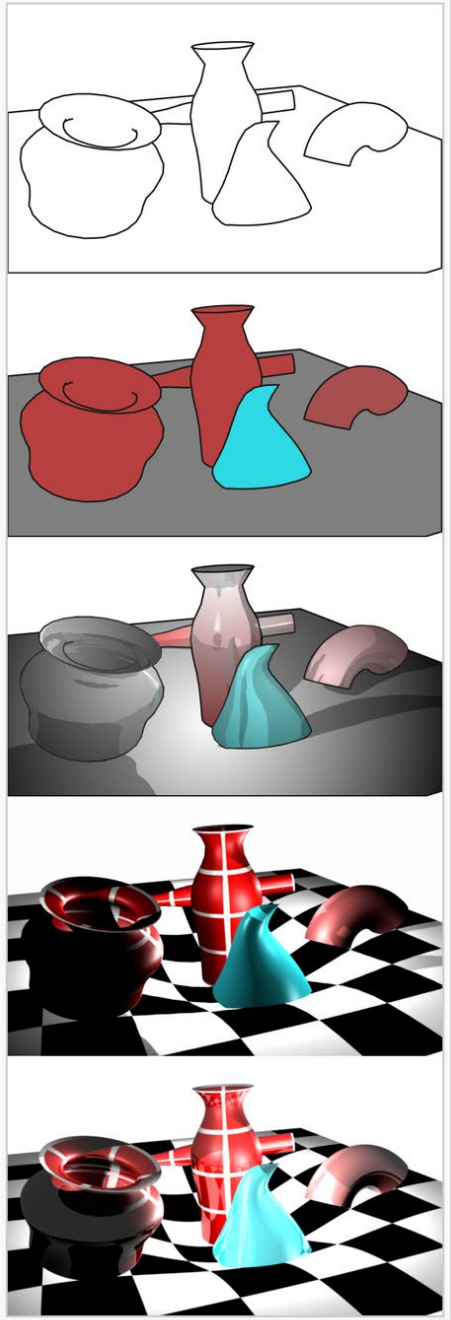
Rendering or **image synthesis** is the automatic process of generating a photorealistic or non-photorealistic image from a 2D or 3D model (or models in what collectively could be called a scene file) by means of computer programs.

Wikipedia

What is the same about each image at the right?

What is different?

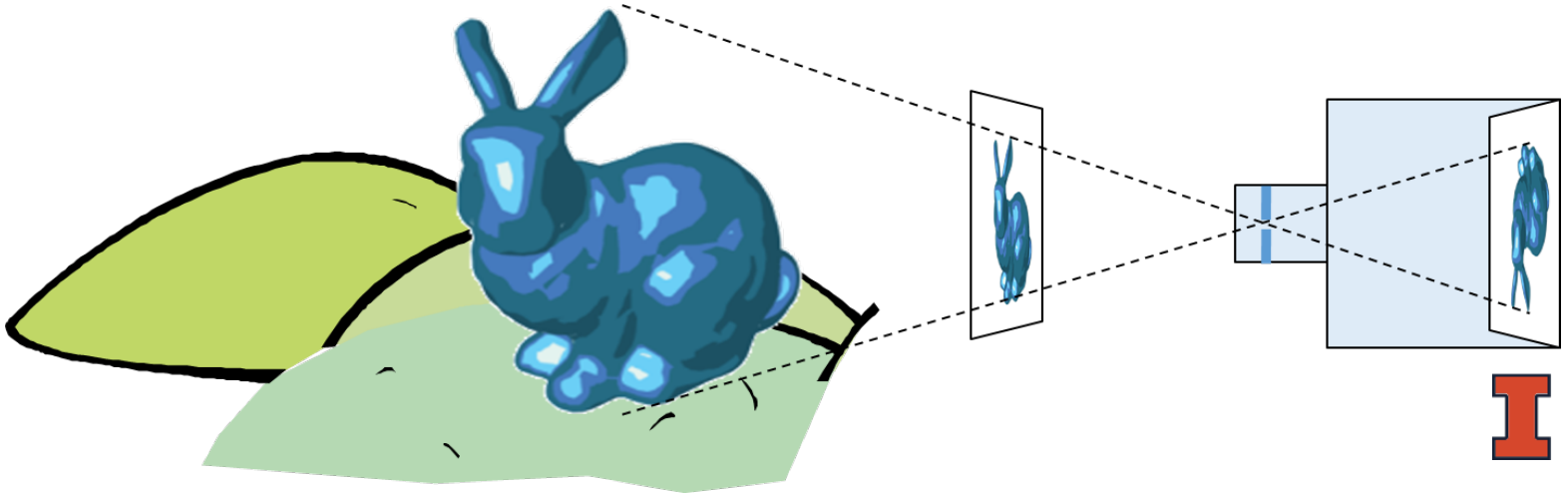
What technology enables this change in modern real-time graphics?



A variety of rendering techniques applied to a single 3D scene

3D Graphics: Image Formation

- Goal in CG (usually)is to generate a 2D image of a 3D scene…
  - The input data is a scene description
  - Output is an image
- To achieve this we computationally mimic a camera or human eye
- In the scene…there are objects…lights…and a viewer



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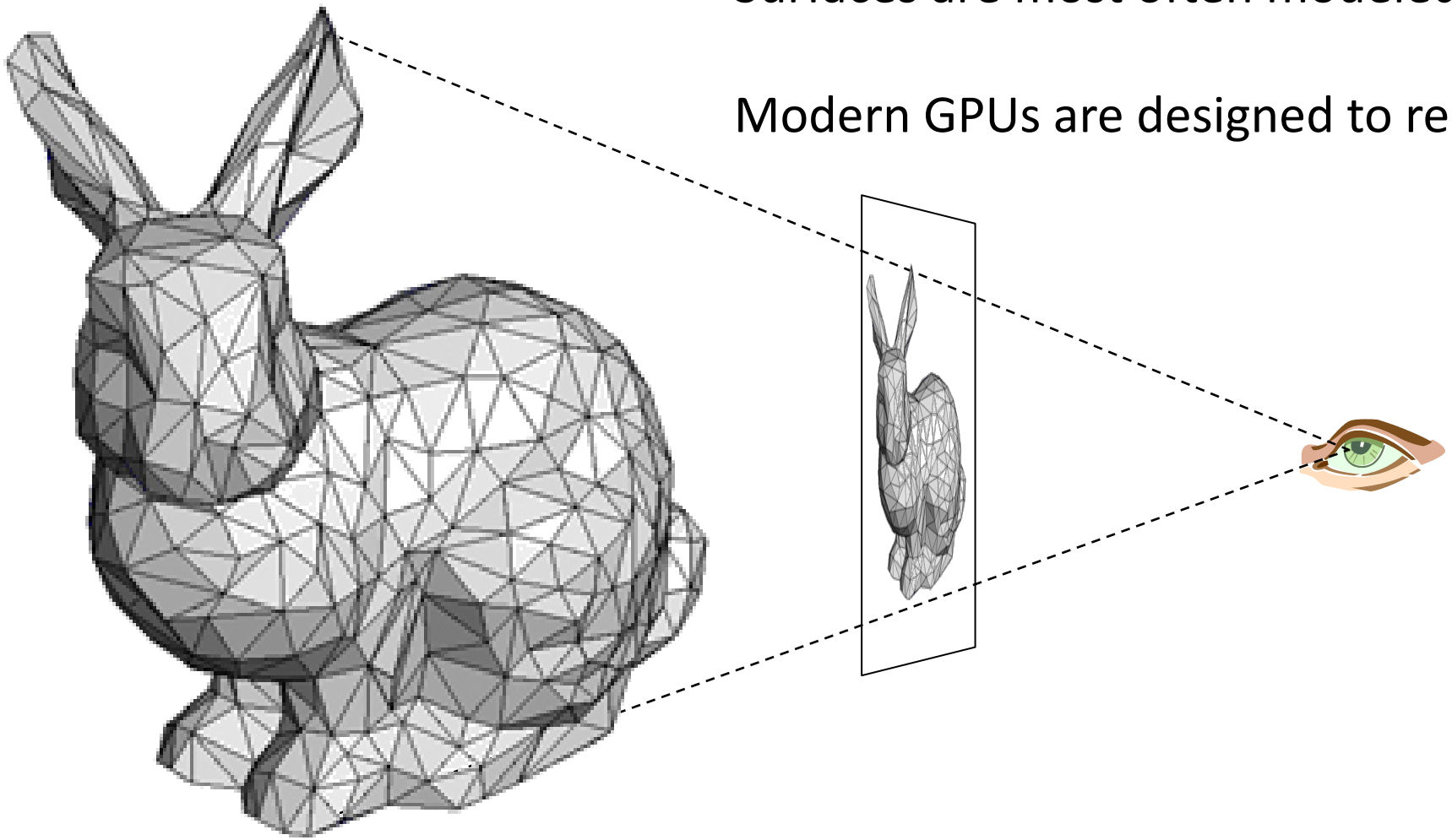
Polygonal Models

Surfaces are most often modeled using triangles

Modern GPUs are designed to render triangles



By Gilles Tran - http://www.oyonale.com/modeles.php?lan

Rendering generally uses one of two approaches

- Rasterization
- Ray tracing
- Sometimes both….
- …and the are other methods like radiosity

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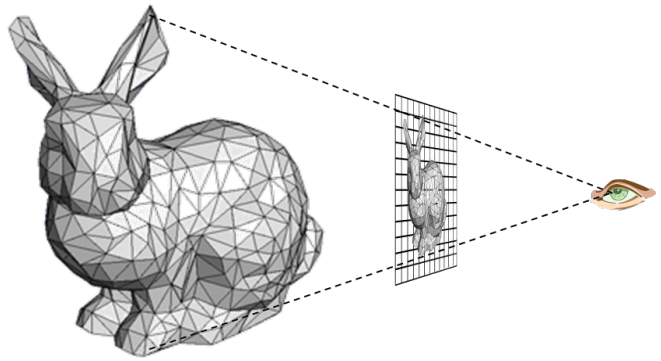
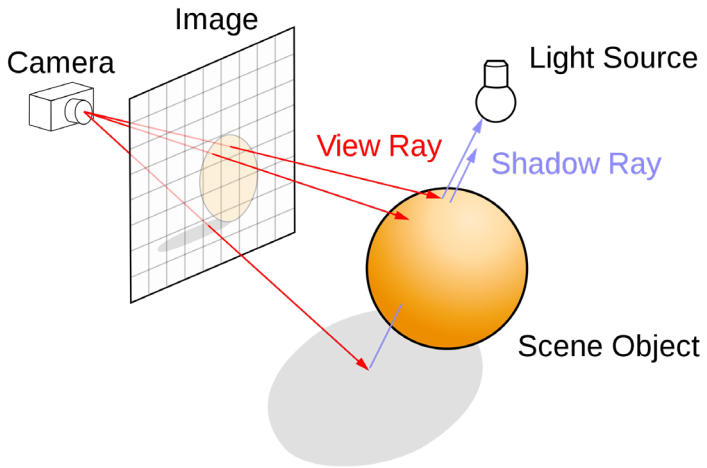
Rasterization versus Ray Tracing

- To oversimplify….
- In rasterization, geometric primitives are projected onto an image plane and the rasterizer figures out which pixels get filled.



- In ray-tracing, we model the physical transport of light by shooting a sampling ray though each pixel in an image plane and seeing what the ray hits in the scene



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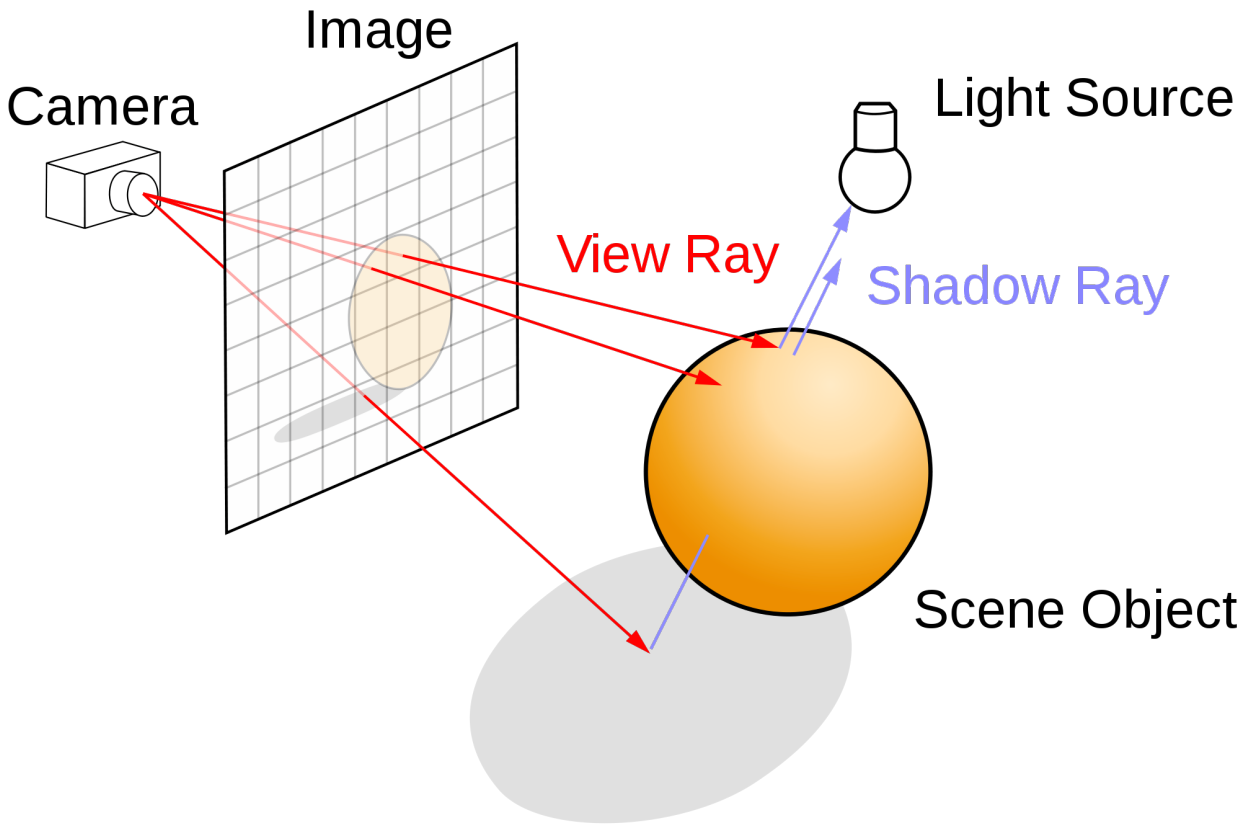
Ray Tracing

Follow ray of light….

Can trace from an eyepoint through a pixel

See what object the ray hits…

How would you check to see if the object is lit or in shadow?



Ray Tracing in Visualization

Ray Tracing is used in visualization to generate semi-transparent views of volumes

- Rays can sample volumes

Rasterization has difficulty doing this

- Designed for surface rendering