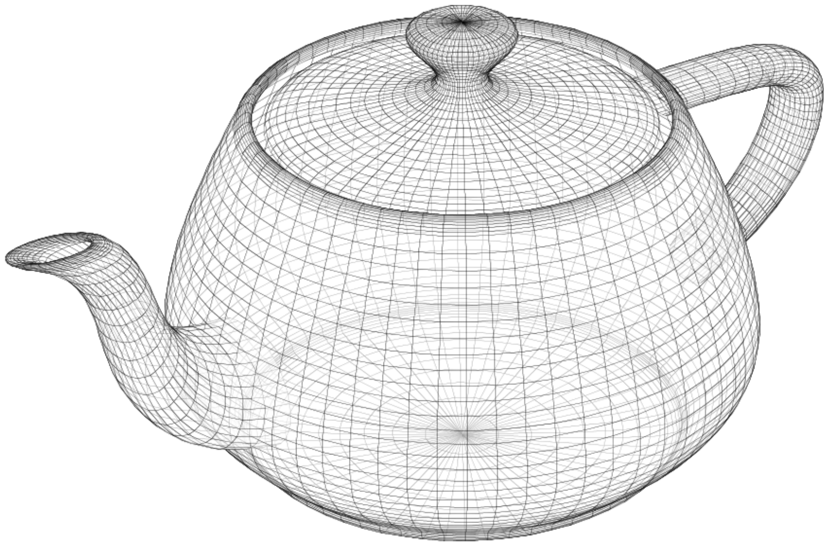


3D Computer Graphics for People in a Hurry

Rendering

CS 418: Interactive Computer Graphics

Professor Eric Shaffer

ILLINOIS

Rendering

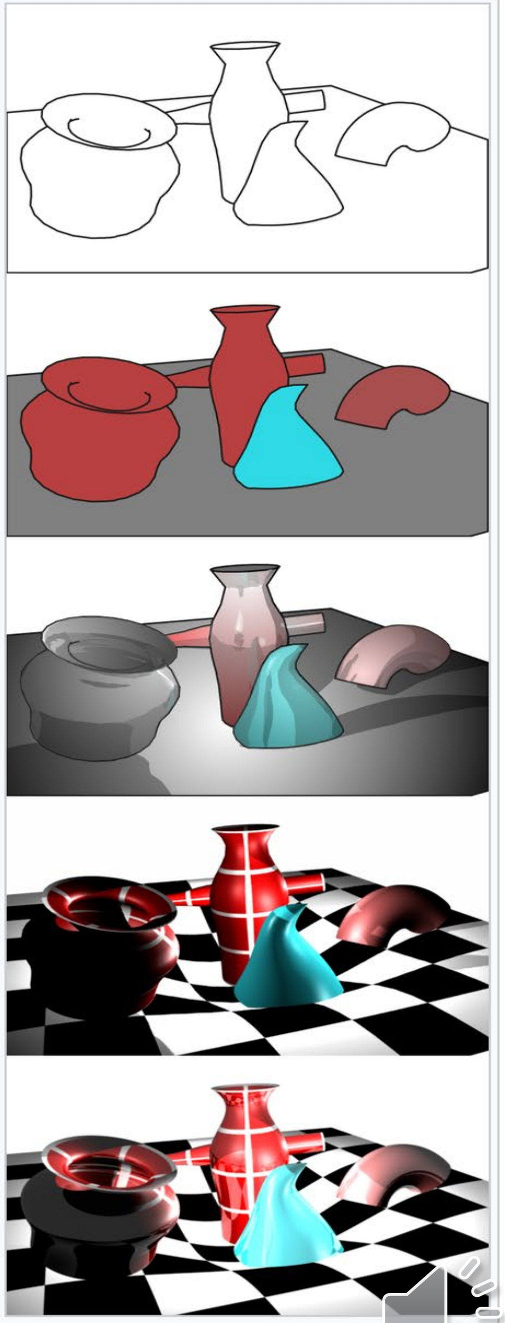
Rendering or **image synthesis** is the automatic process of generating a photorealistic or non-photorealistic image from a 2D or 3D model (or models in what collectively could be called a scene file) by means of computer programs.

Wikipedia

What is the same about each image at the right?

What is different?

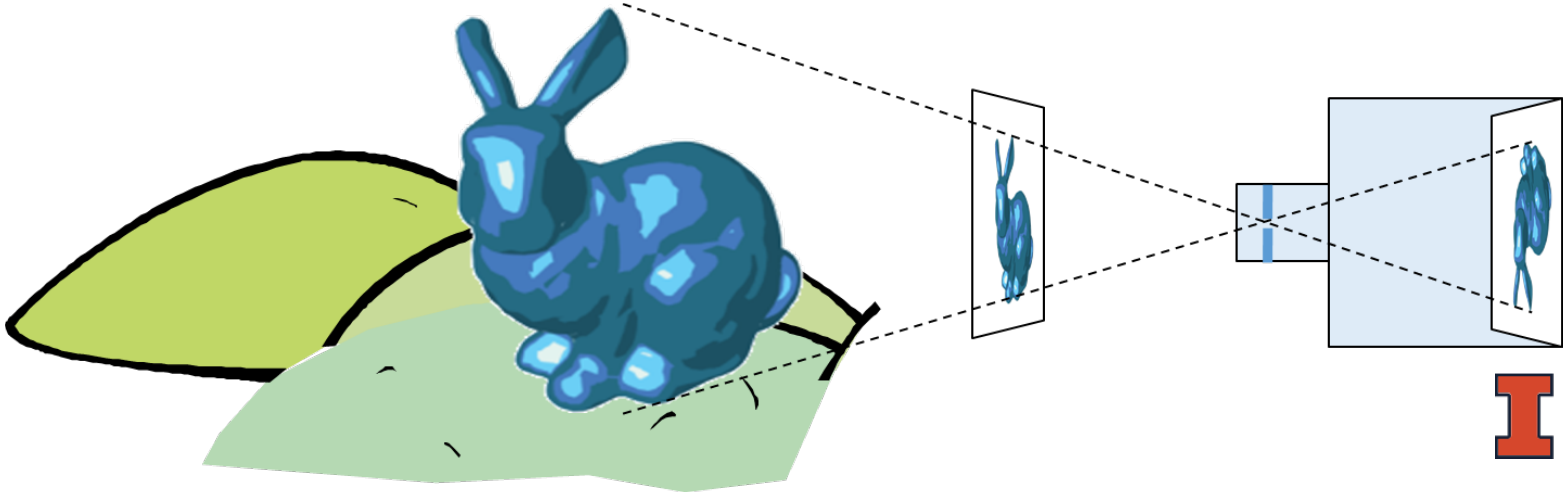
What technology enables this change in modern real-time graphics?



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

3D Graphics: Image Formation

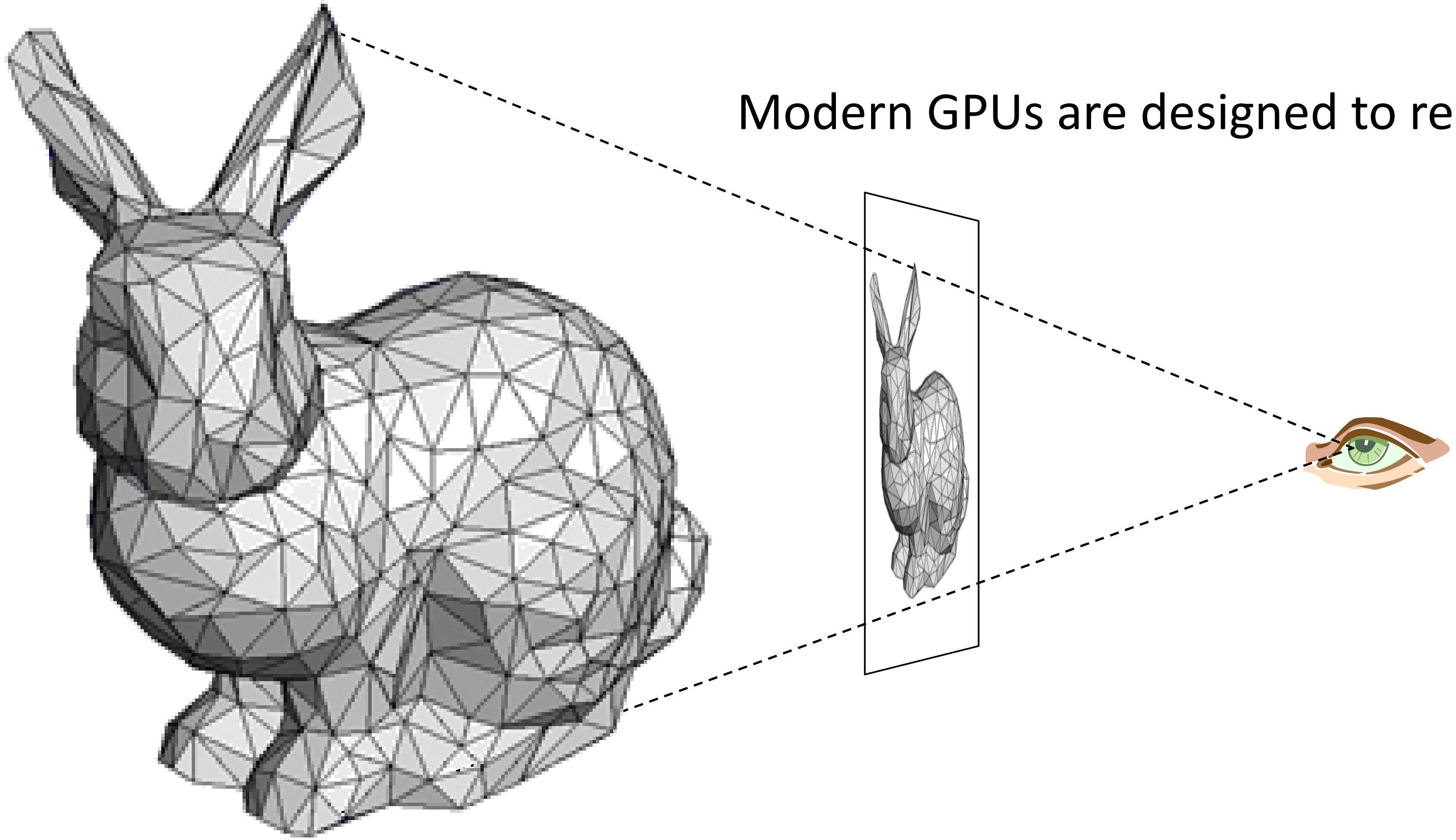
- Goal in CG (usually)is to generate a 2D image of a 3D scene…
  - The input data is a scene description
  - Output is an image
- To achieve this we computationally mimic a camera or human eye
- In the scene…there are objects…lights…and a viewer



Polygonal Models

Surfaces are most often modeled using triangles

Modern GPUs are designed to render triangles



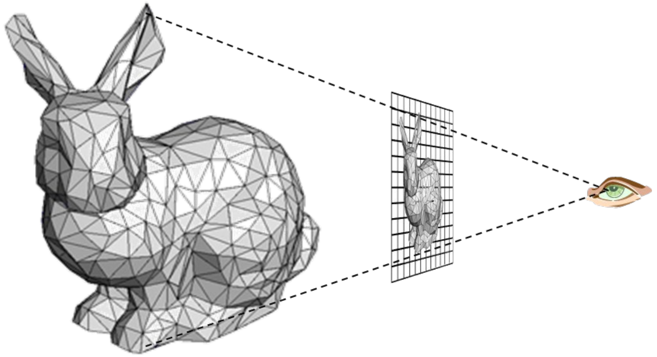
By Gilles Tran - http://www.oyonale.com/modeles.php?lan

Rendering generally uses one of two approaches

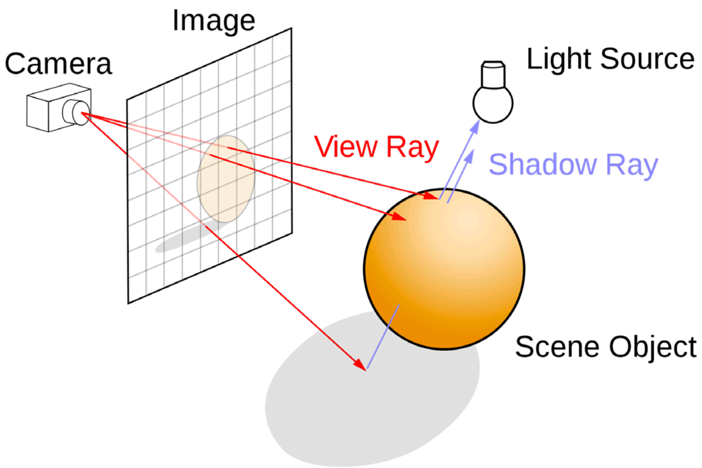
- Rasterization
- Ray tracing
- Sometimes both….
- …and the are other methods like radiosity

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.



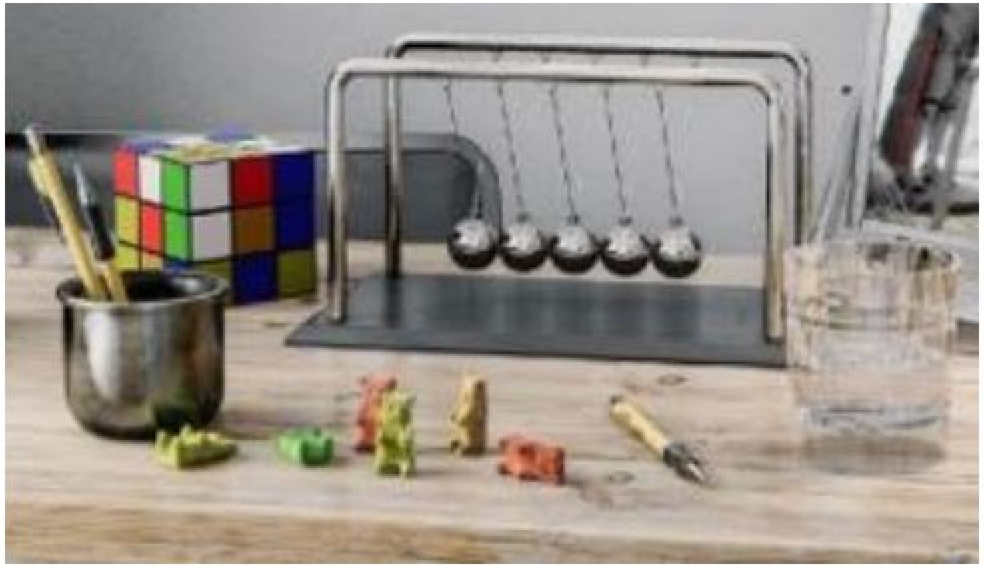
- In ray-tracing, we model the physical transport of light by shooting a sampling ray though each pixel in an image plane and seeing what the ray hits in the scene

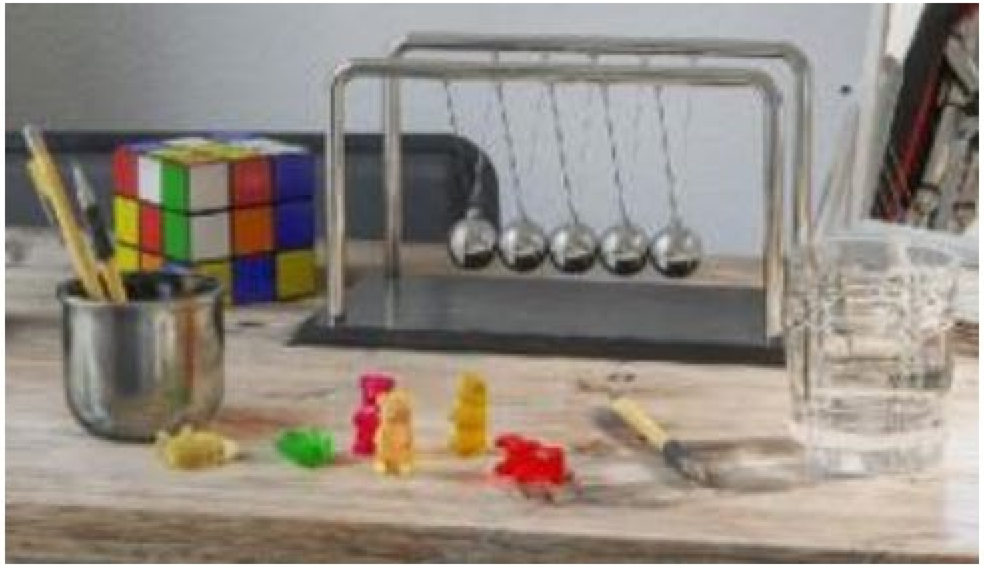


Rasterization versus Ray Tracing

```
Rasterization loop:
    For each object
        For each pixel—closer?
```

```
Ray tracing loop:
    For each pixel
        For each object—closest?
```





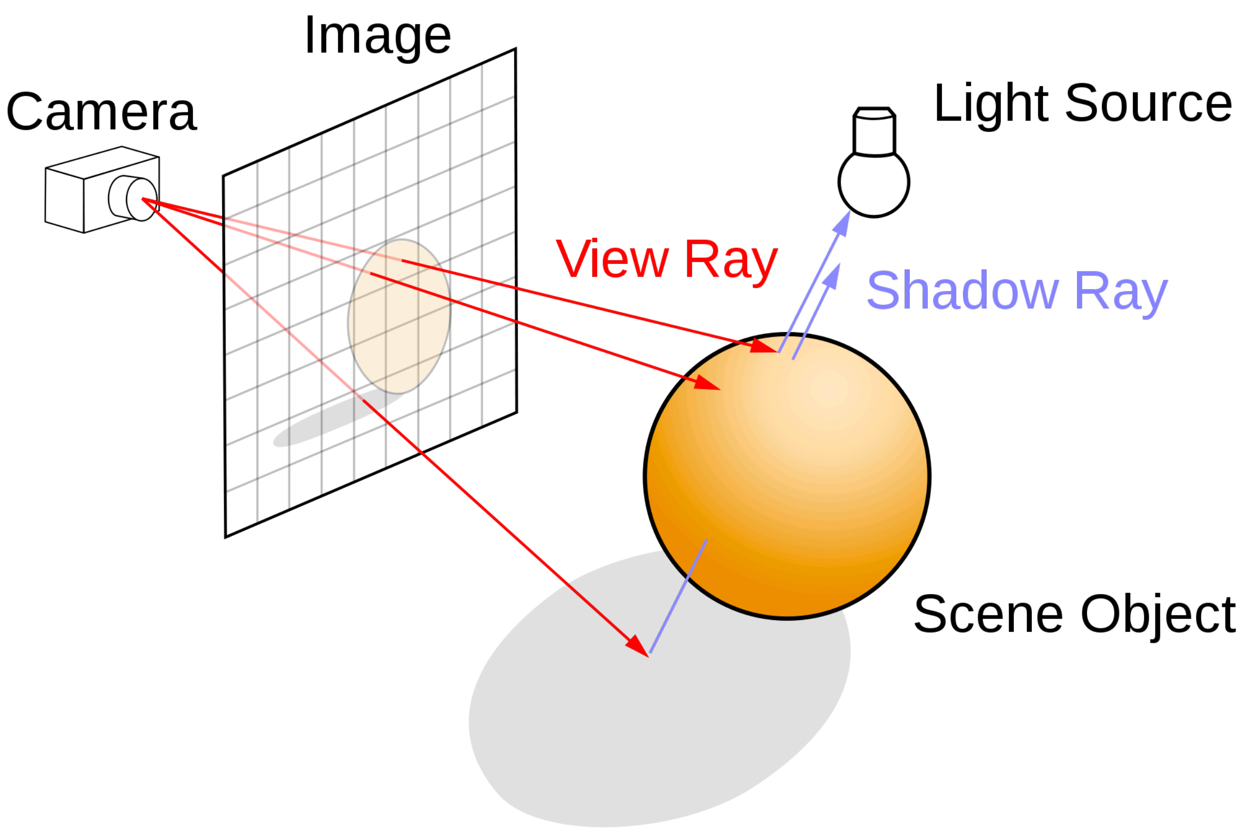
Ray Tracing

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?

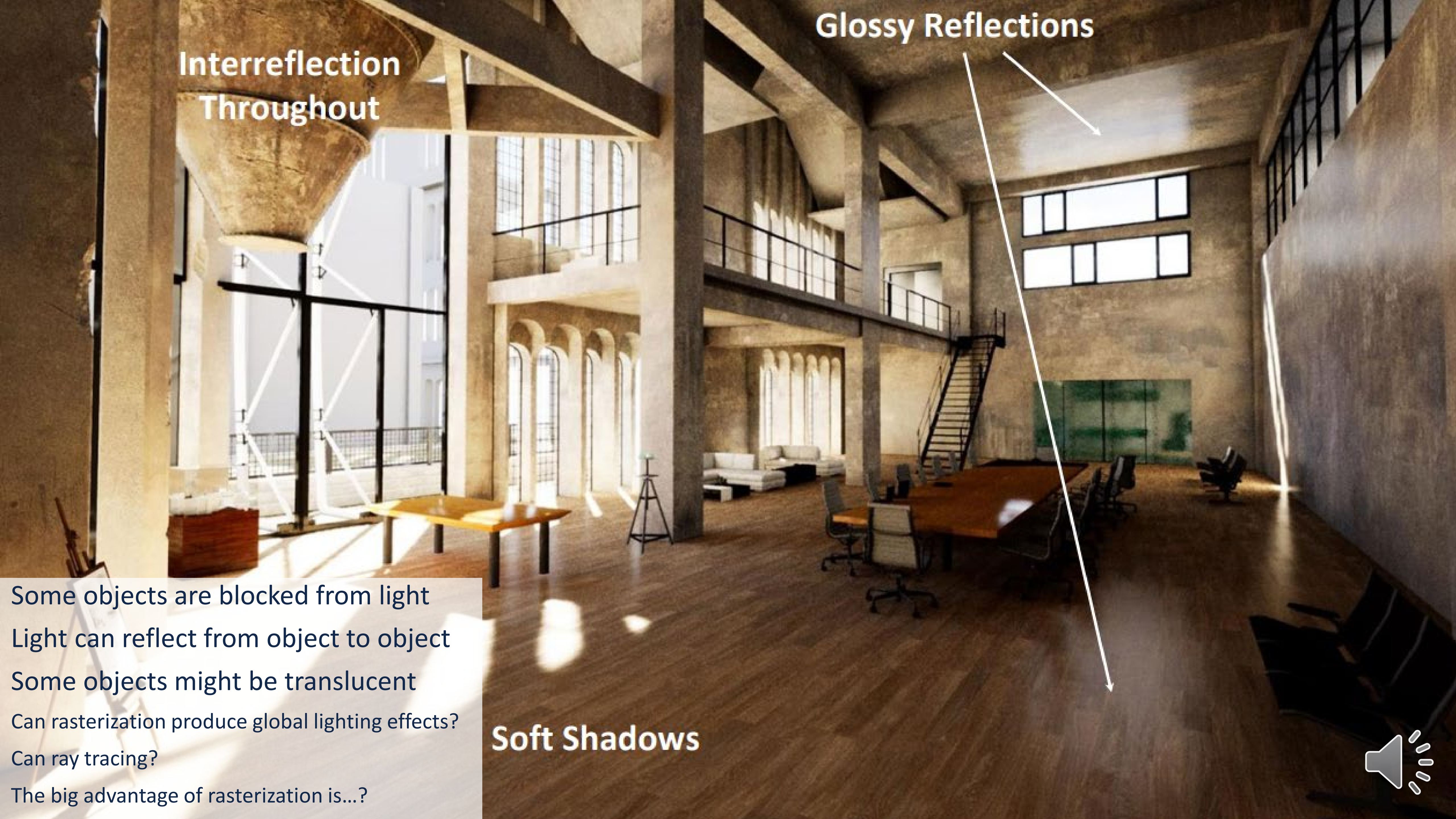


Global versus Local Illumination

For true photo-realism:

We cannot compute color or shade of each object independently

Why?



Some objects are blocked from light

Light can reflect from object to object

Some objects might be translucent

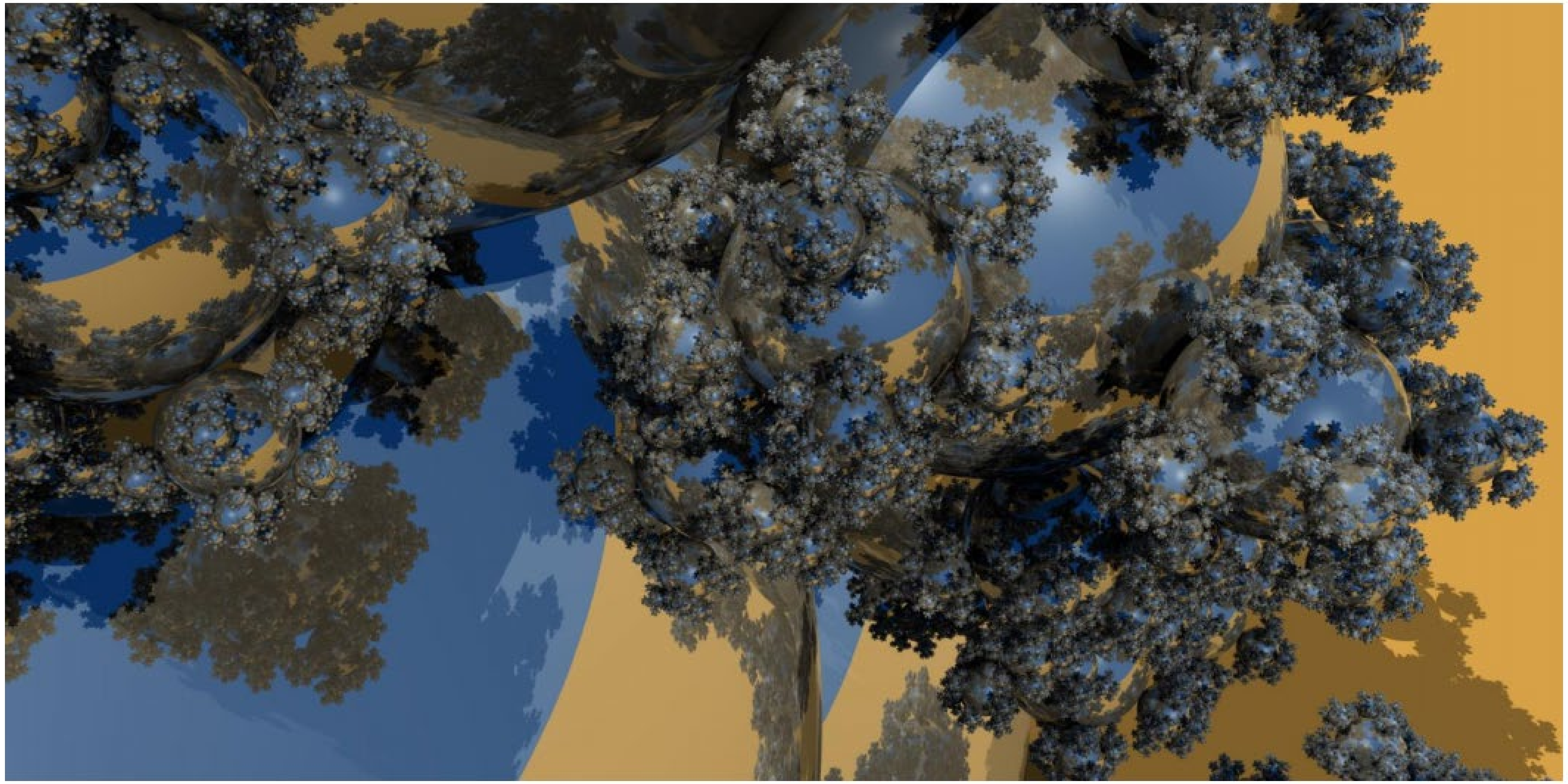
Can rasterization produce global lighting effects?

Can ray tracing?

The big advantage of rasterization is…?

Real-Time Ray Tracing

2019: RTX



Sphereflake: 48,427,561 spheres rendering in real time