Introduction to 3D Graphics
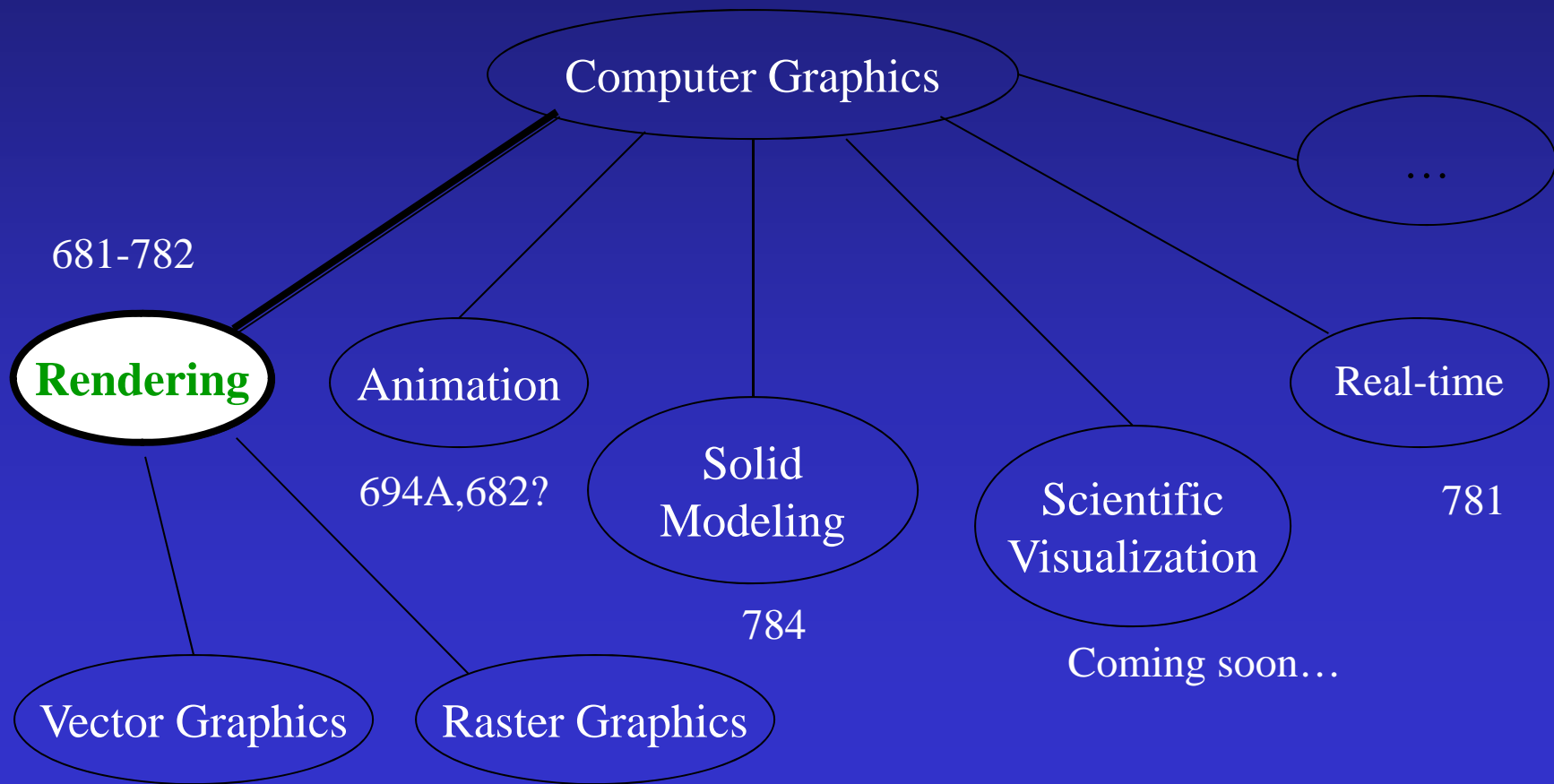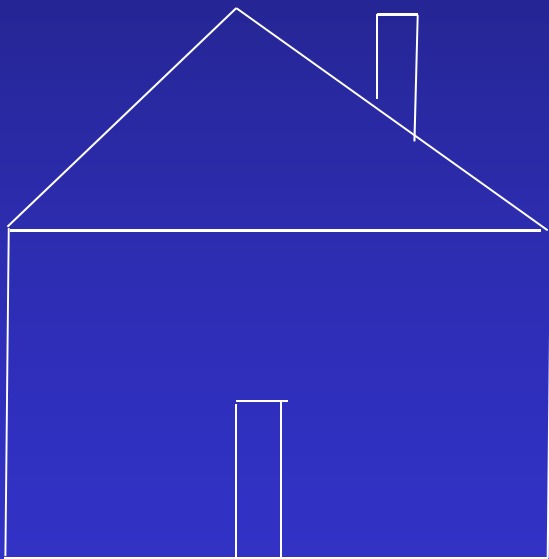
Computer graphics is "the creation and manipulation of graphics images by means of computer." (Marc Berger, 1986.)

Computer Graphics

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681-782

Rendering

Animation

Real-time

694A,682?

Solid
Modeling

Scientific
Visualization

781

784

Coming soon…

Vector Graphics

Raster Graphics

CSE 681

Vector Graphics

Draw a picture line by line.

Advantages:

- Straight lines.
- Hardward supports high resolution

Drawbacks:

- Not solid imagery (wireframe).
- Vector hardware continually redraws all objects.
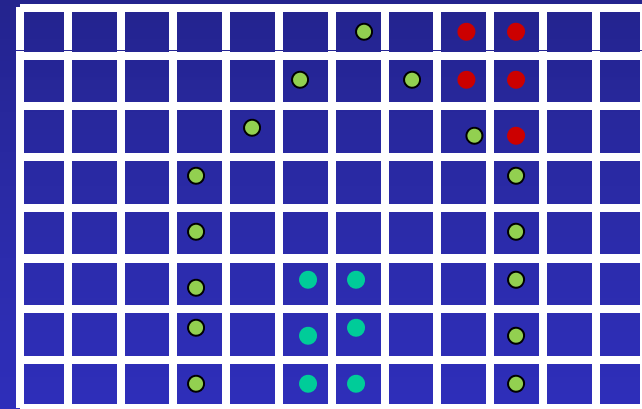
Raster Graphics

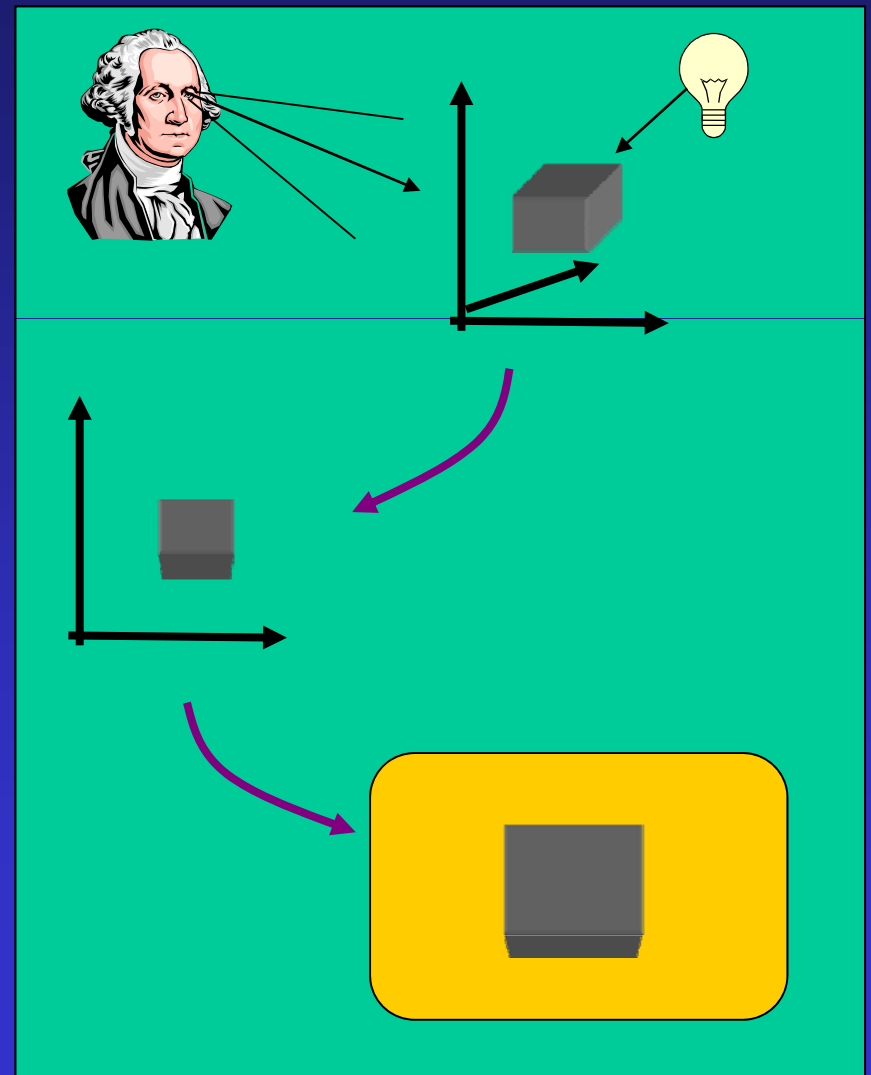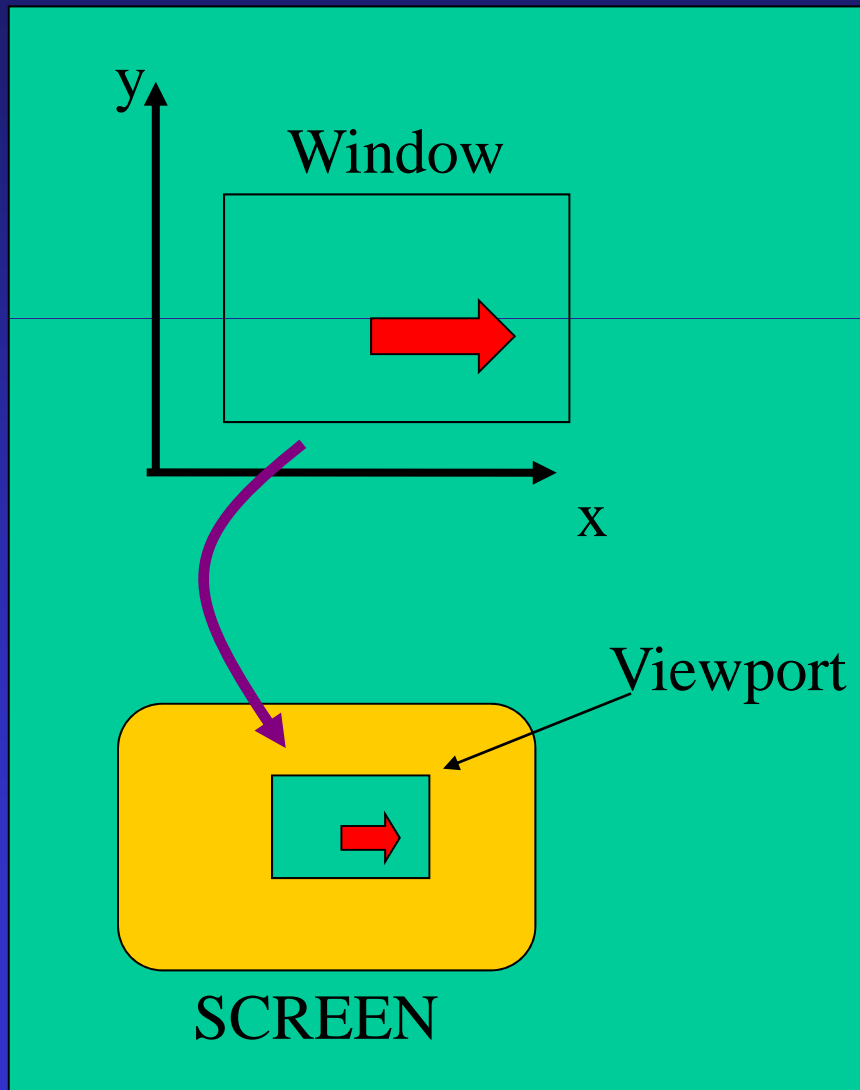## n x m grid of pixels

Advantages:

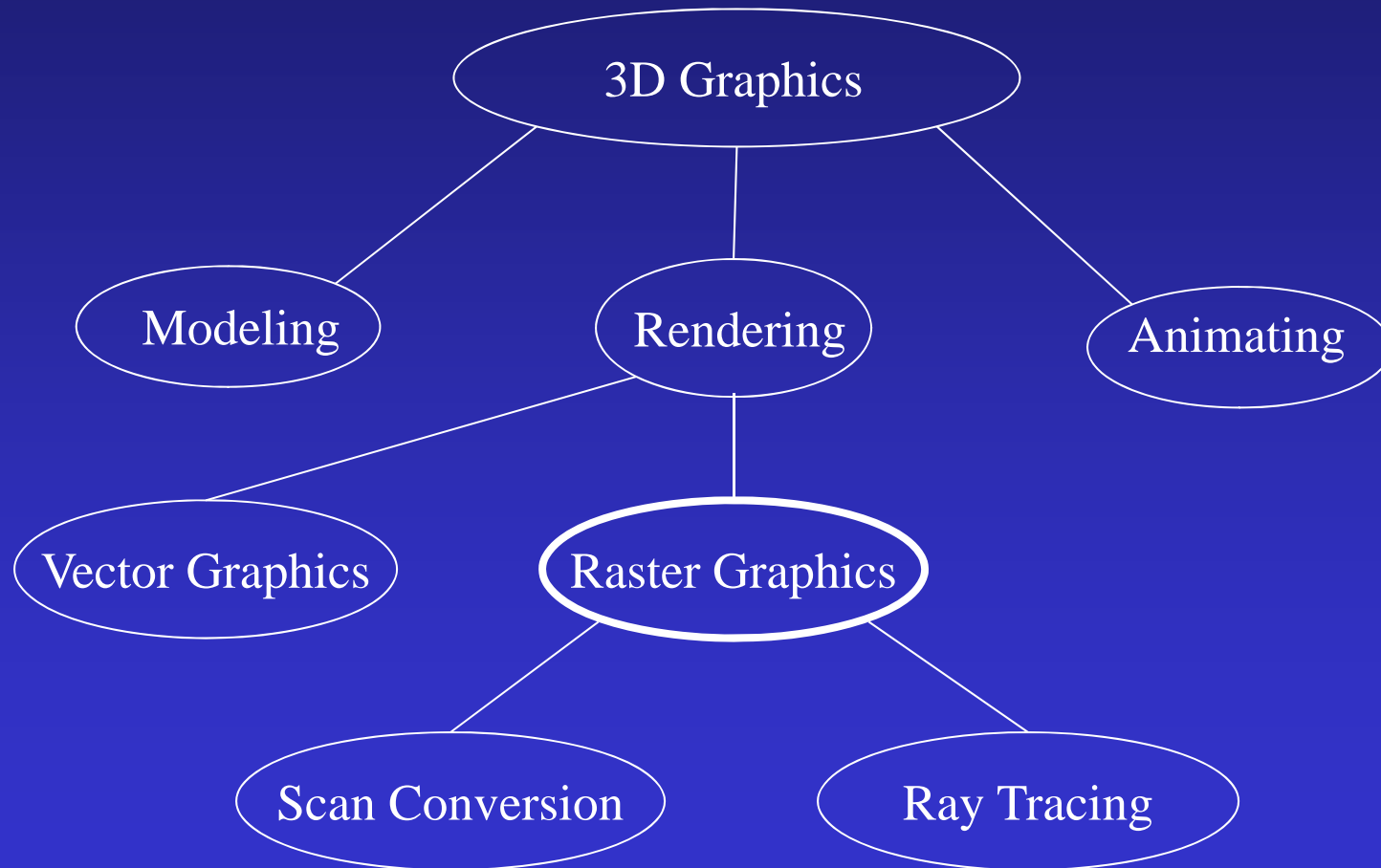- Based on TV technology

- Lends itself to shaded imagery

Problems:

- Needs a frame buffer

- Convert objects to pixels

- Aliasing: Screen resolution may be much less than object resolution.
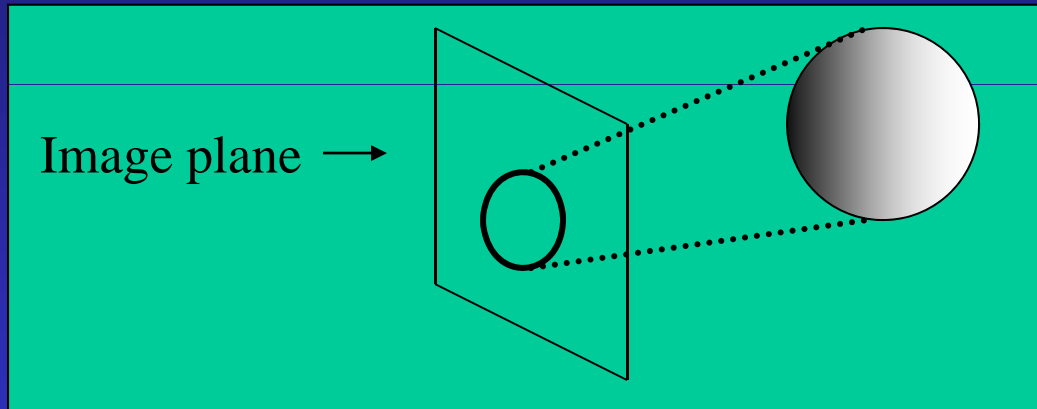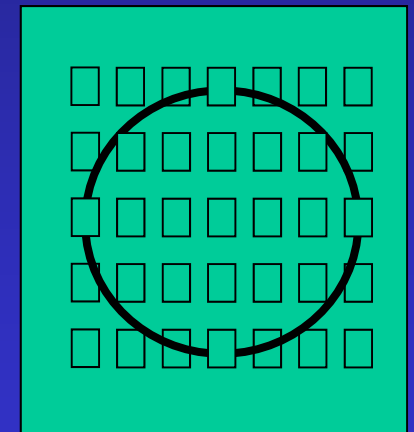
2D v. 3D

y

Window

x

Viewport

SCREEN

3D Graphics

3D Graphics

Modeling   Rendering   Animating

Vector Graphics   Raster Graphics

Scan Conversion   Ray Tracing

Scan Conversion

- Transform 3d object into 2d object (object-based)
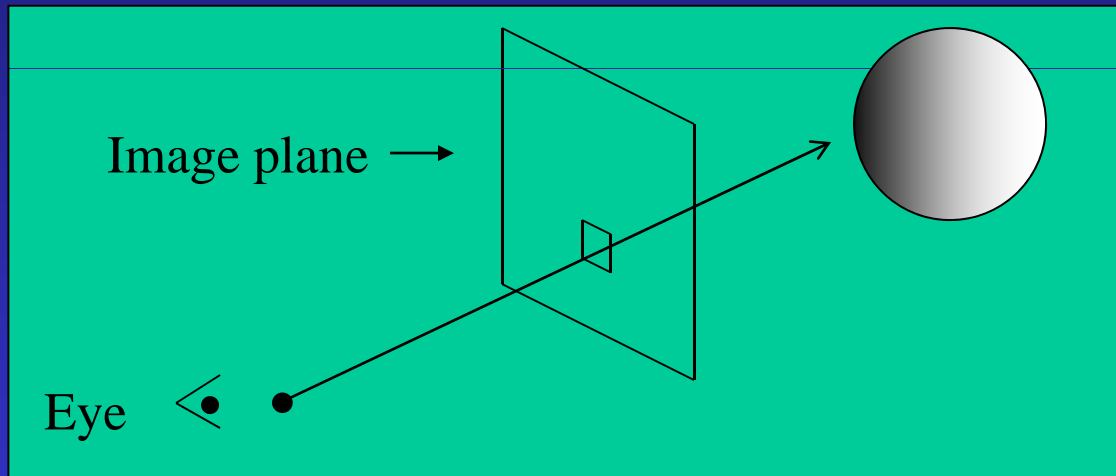- "Scan" 3d object, converting it into pixels.

Image plane →

- Fast;
- Commonly used;
- Industry standard – OpenGL;
- Hardware support (OpenGL).

Ray Tracing

- Shoot a ray through each pixel (pixel-based)
- Find first object intersected by ray.

Image plane →

Eye

- Slow;
- Not commonly used;
- No hardware support.

Scan Conversion v. Ray Tracing
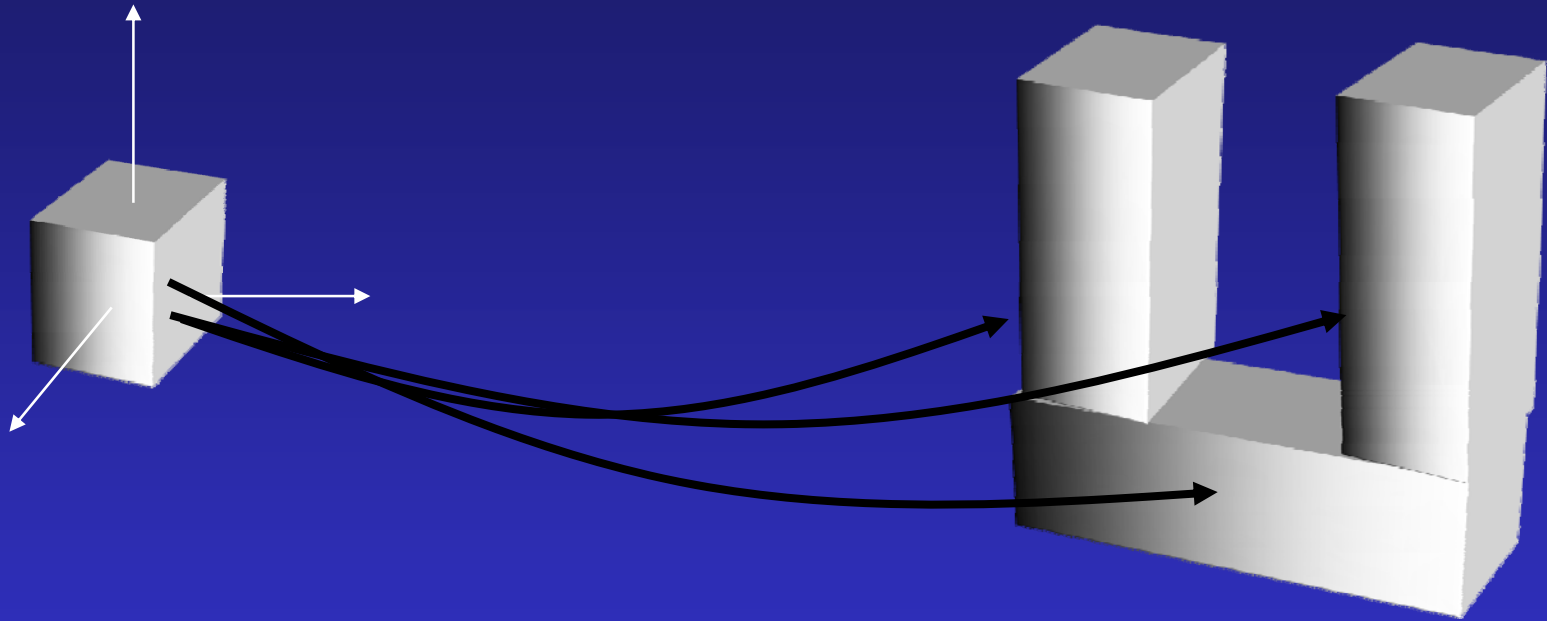
Scan Conversion
(CSE 581, 781, …)

- Fast;
- Commonly used;
- Industry standard (OpenGL);
- Hardware support.

Ray Tracing
(CSE 681)

- Models optics (better);
- Photorealistic rendering;
- Special effects;
- Better for understanding rendering/lighting.

Creating a Scene

- Translate & rotate objects.
- Linear algebra. (Prerequisite: Math 568 or 571.)