

3-D Graphics

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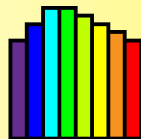
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What Will We Learn?

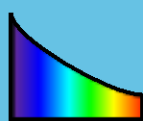
- Why is the sky blue?
- Why is the sun yellow?
- Why is the grass green?
- How does 3-D graphics work?

Sun

"White"
Solar
Radiation



23%
Sky
Rayleigh scattering
by wavelength

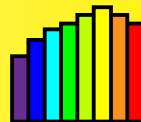


Chlorophyll

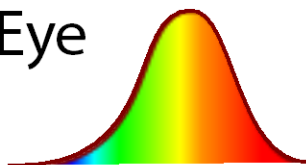


Absorption by
wavelength

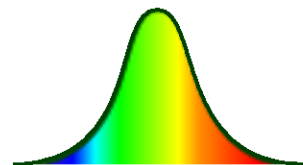
Yellow
"Sunlight"



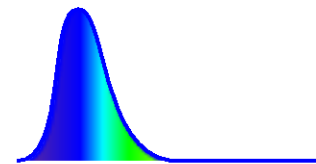
Eye



Red Cone Response

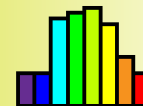


Green Cone Response

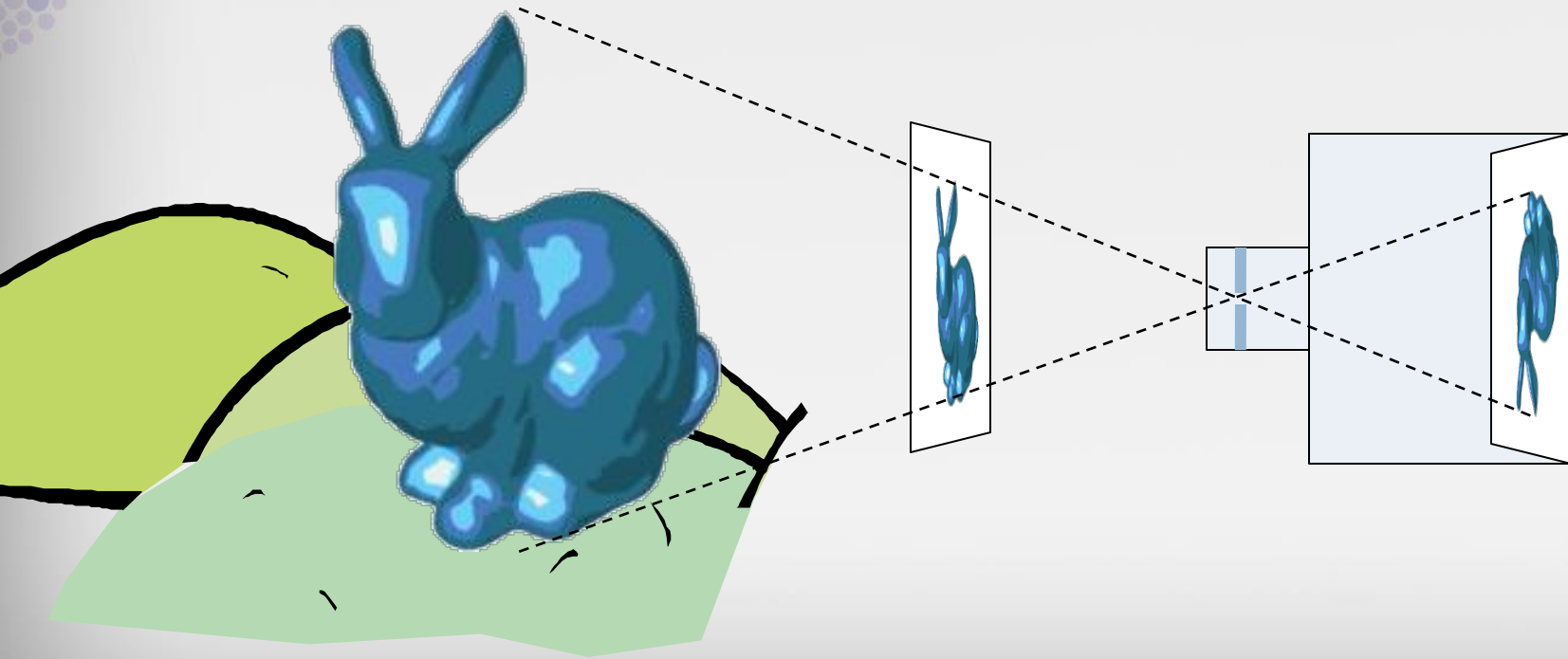


Blue Cone Response

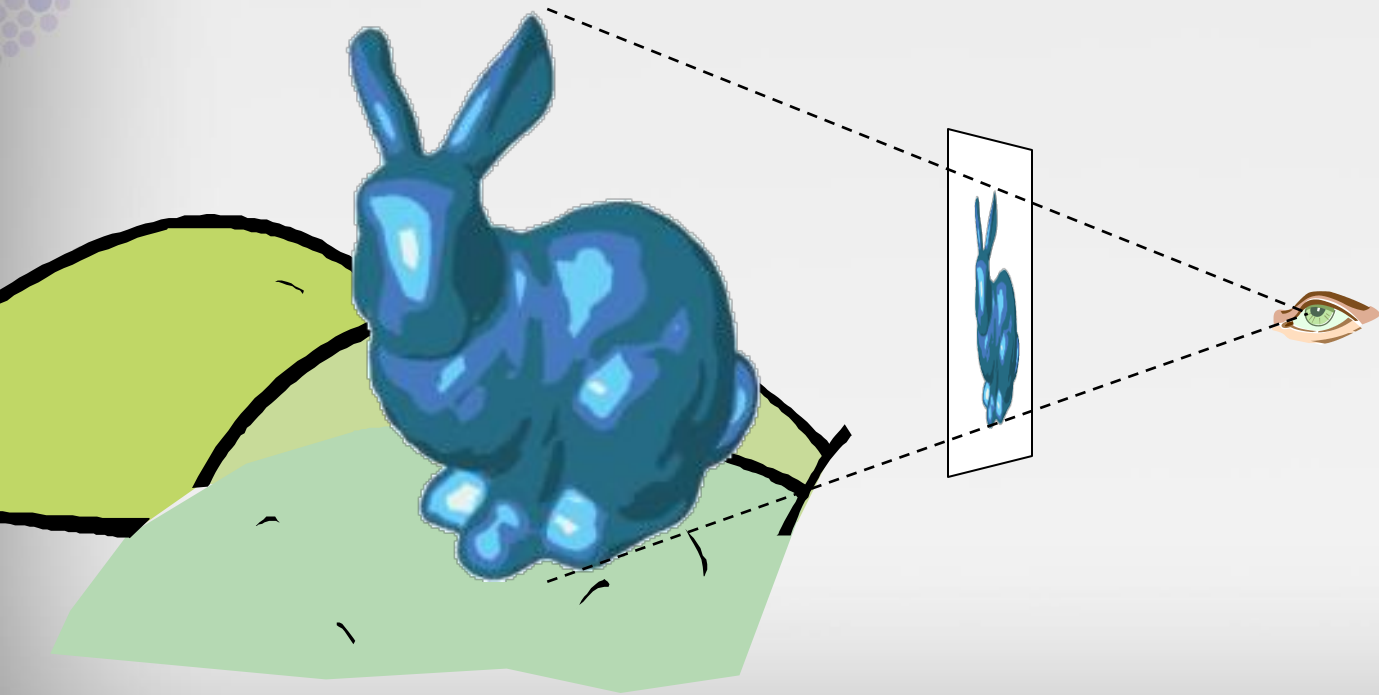
Green
Foliage



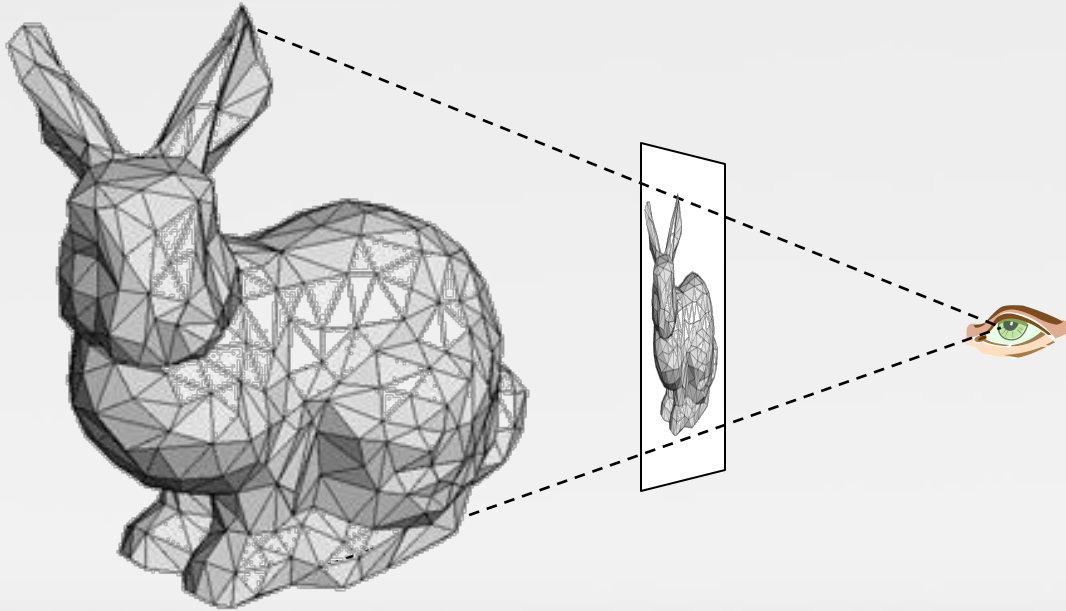
The Camera



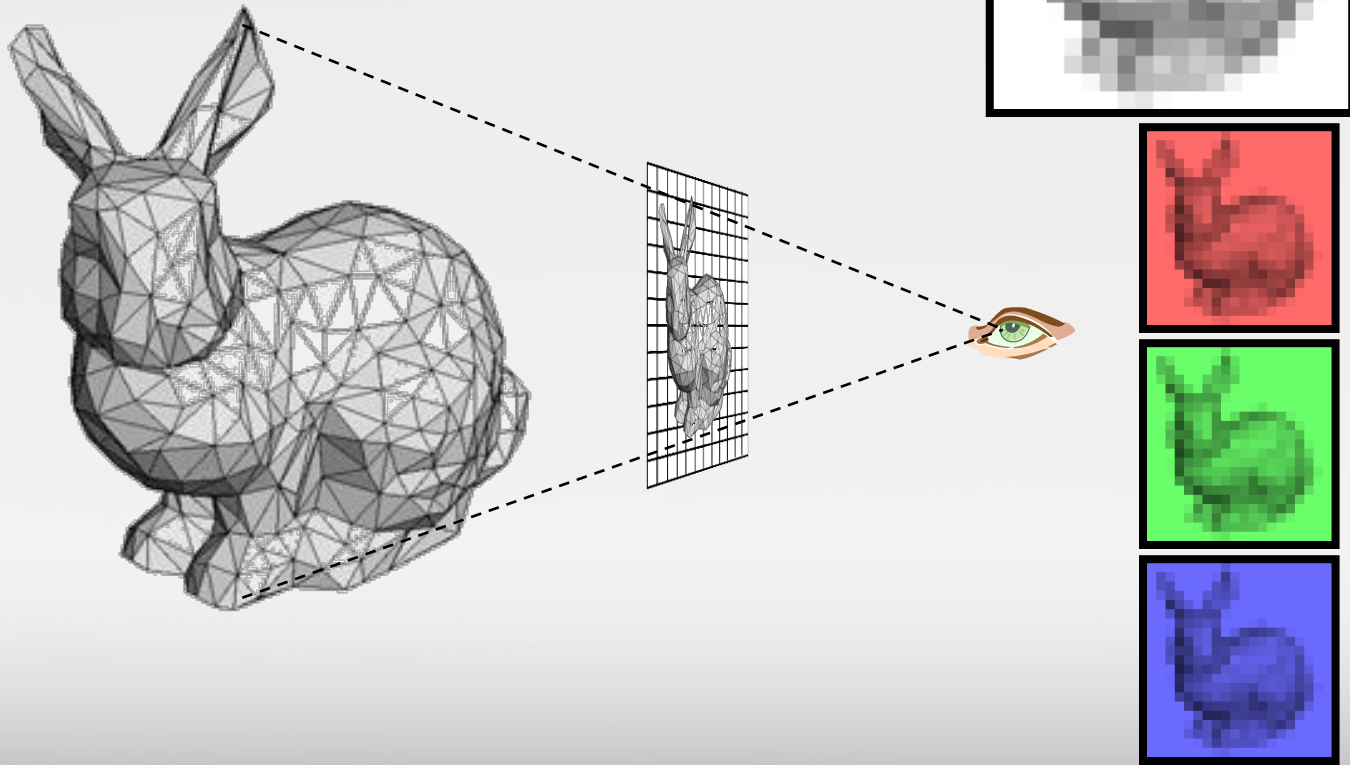
The Image Plane



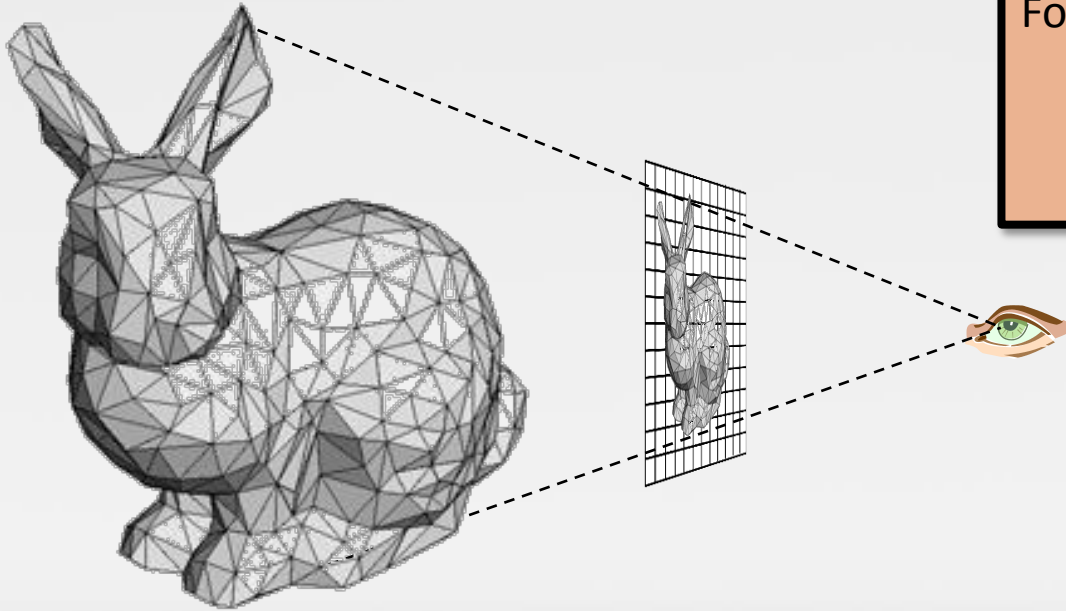
Polygonal Models



Pixel Discretization



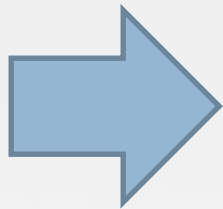
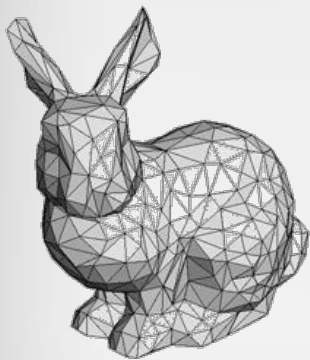
Raster Rendering



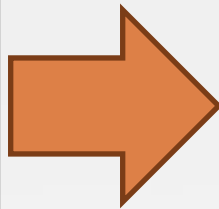
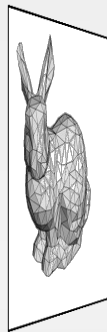
For each primitive:
Compute illumination
Project to image plane
Fill in pixels

3-D Graphics Pipeline

Vertex
Processing



Rasterization

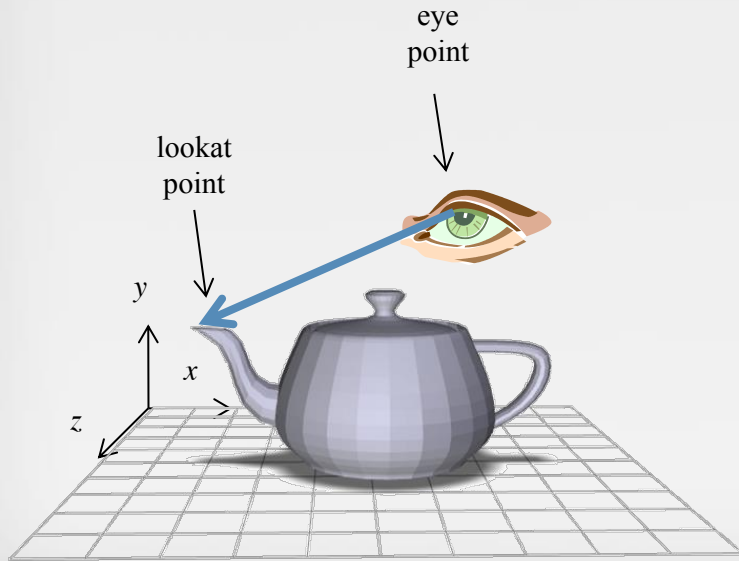


Pixel
Processing



Viewing a 3-D Scene

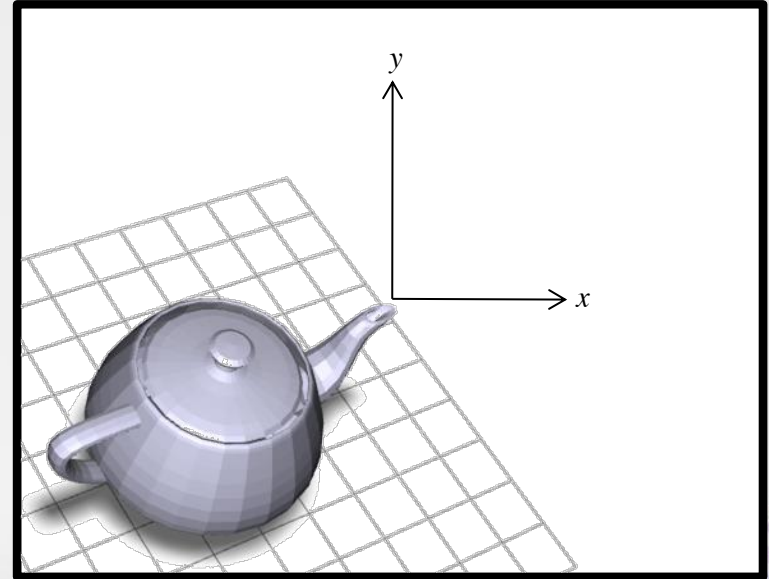
World Coordinates



Canvas Coordinates

$(-1,1)$

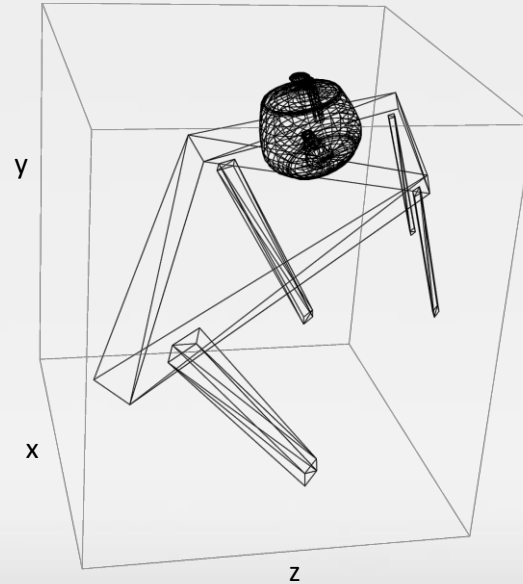
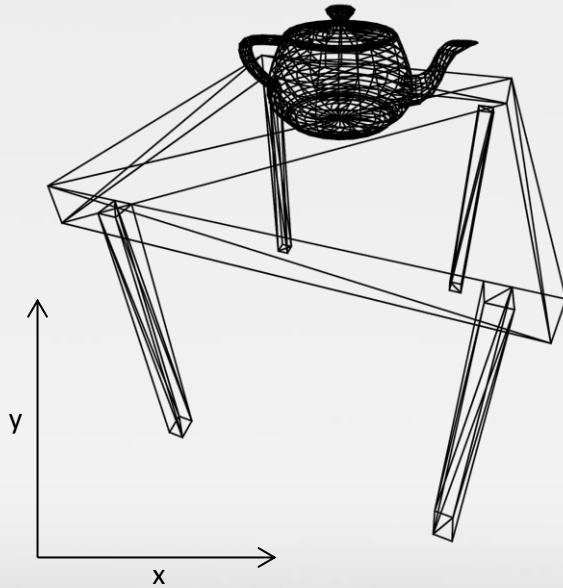
$(1,1)$



$(-1,-1)$

$(1,-1)$

Perspective Distortion



Looking good when projected on the 2-D plane

What Have We Learned?

- 3-D graphics scenes consist mostly of triangle meshes
- We specify a view with an eye point, a lookat point and an up direction
- In graphics, perspective really does change object sizes
- Vertex processing projects triangles onto image plane
- Rasterization converts shapes into pixels
- Pixel processing determines colors (e.g. shading) of pixels