

From Real World to Synthetic World

CMSC 161: Interactive Computer Graphics

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Institute of Computer Science

University of the Philippines – Los Baños

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The world of three dimensional objects

OBJECTS AND VIEWERS

Objects

Objects in the real world exist **independent**
of any image-formation process/viewer

Objects

Objects in the synthetic world is similar

*Objects are form by specifying locations of various **geometric primitives** (vertices/points)*

Shot Angles



Low



Eye-level



High



Worm's eye



Canted



Bird's eye

Viewer

It is the one that forms the images from our
objects

For conventional cameras, the image is formed in the film

Viewer

**It is the one that forms the images from our
objects**

For digital cameras, the image from the real world is converted to electrical signals by a semiconductor (CCD or CMOS)

Viewer

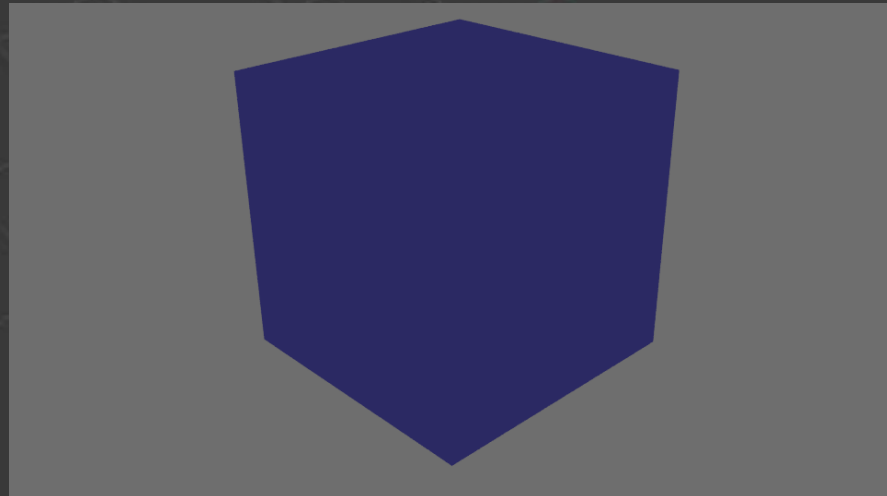
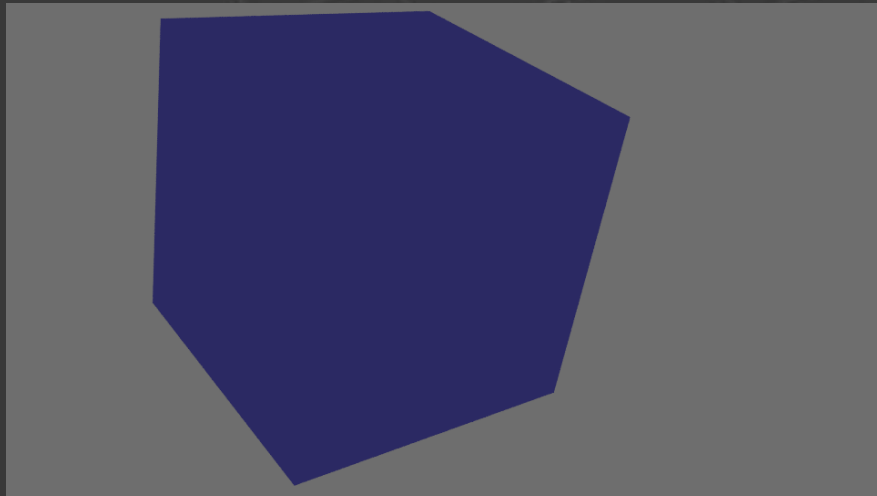
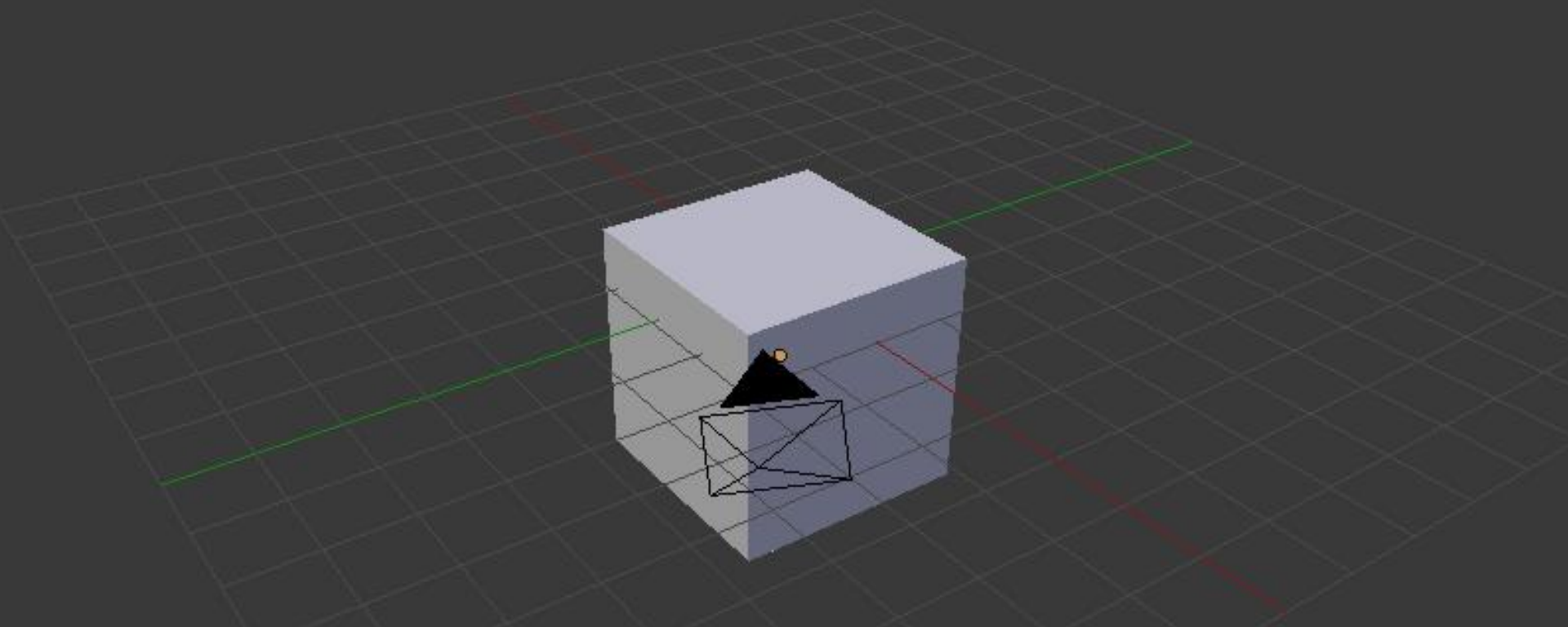
It is the one that forms the images from our
objects

For humans, the image is formed at the back of the eye

Viewer

In computer graphics, viewer is responsible
for **viewing transformations**

From 3D Geometry to 2D Images



What is visible and what is not

LIGHT, IMAGES AND IMAGING SYSTEMS

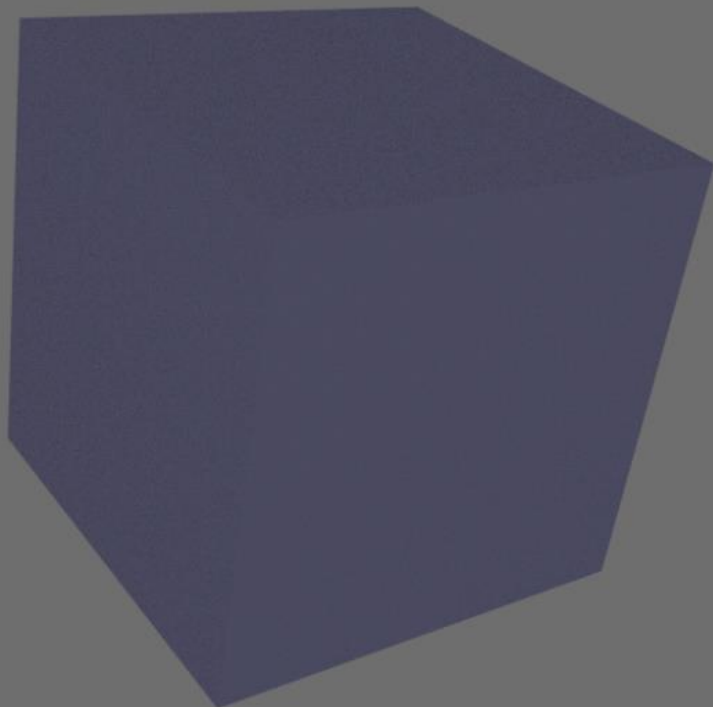
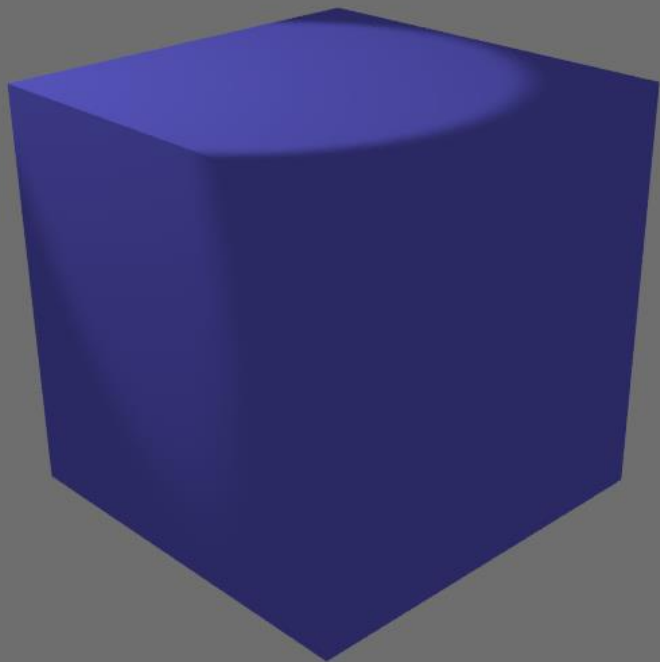
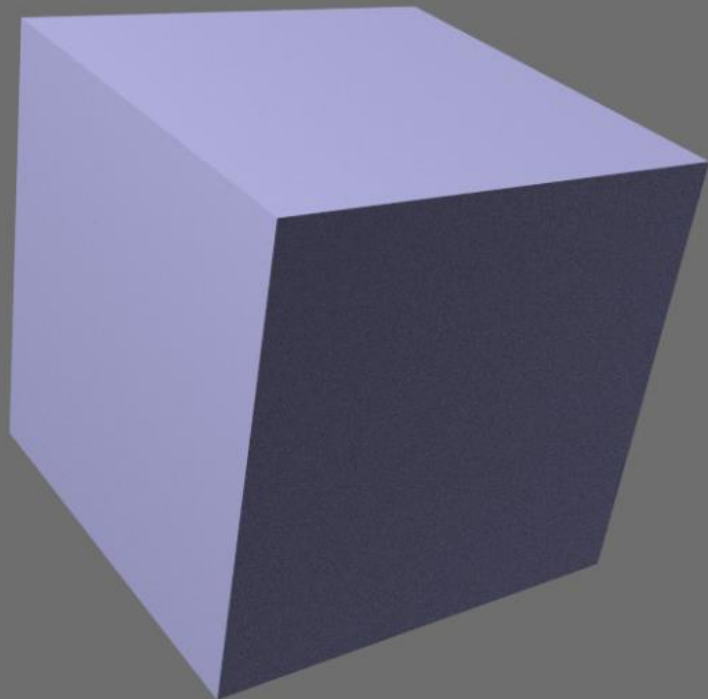
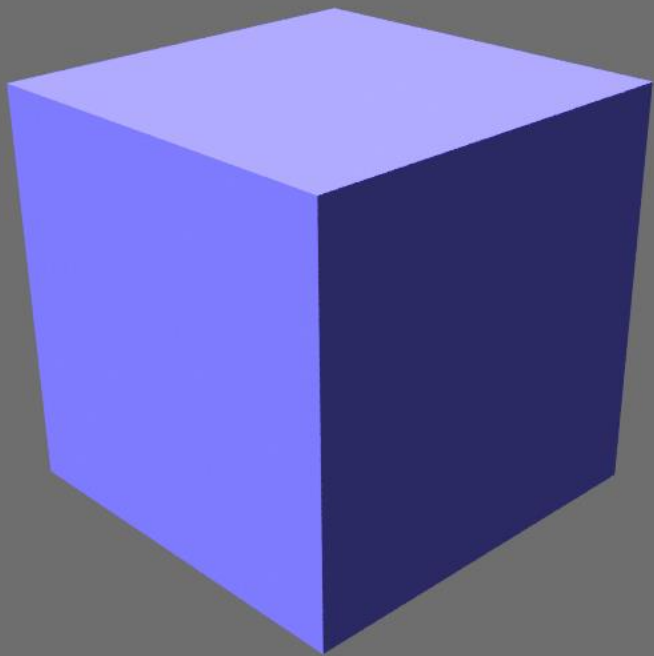
Light

Light can dictate
what we see and what we cant see

Light

There are different types of
light sources and lighting

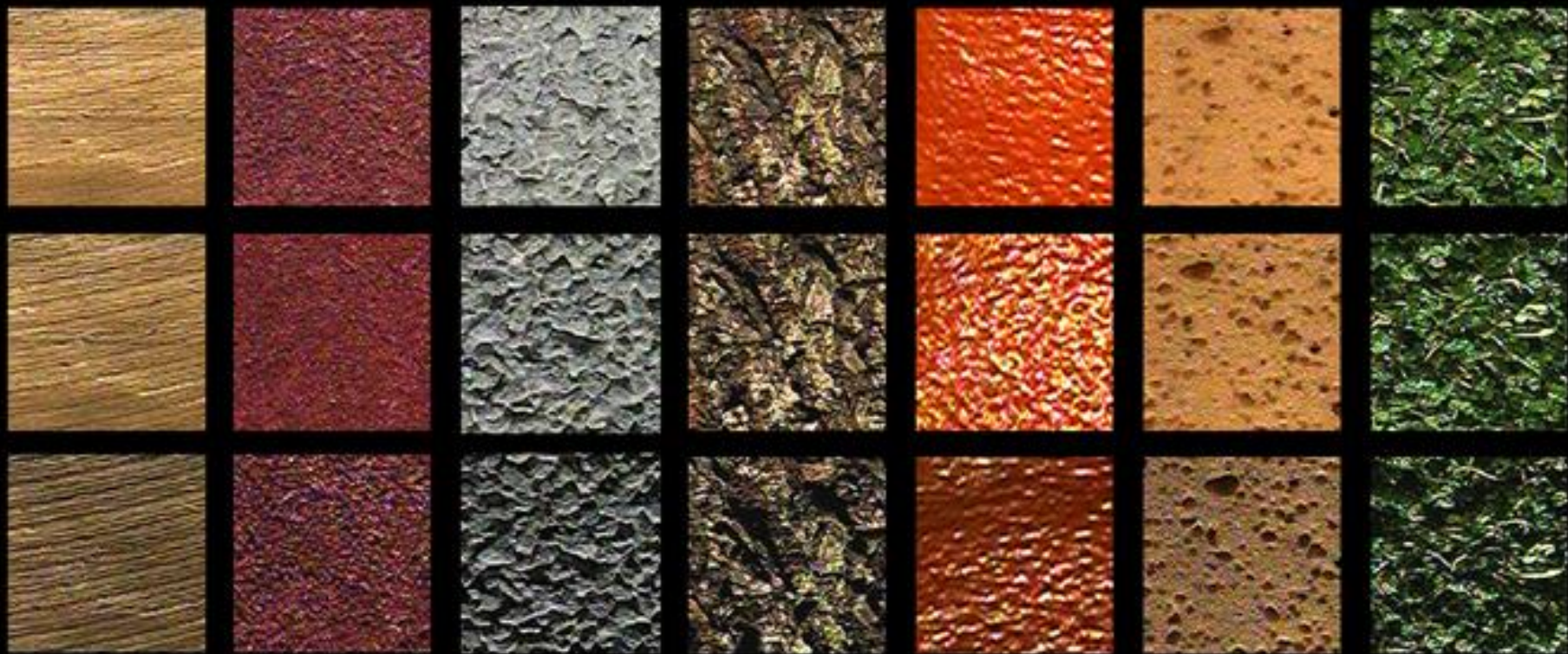
Sun and Flashlight



Light

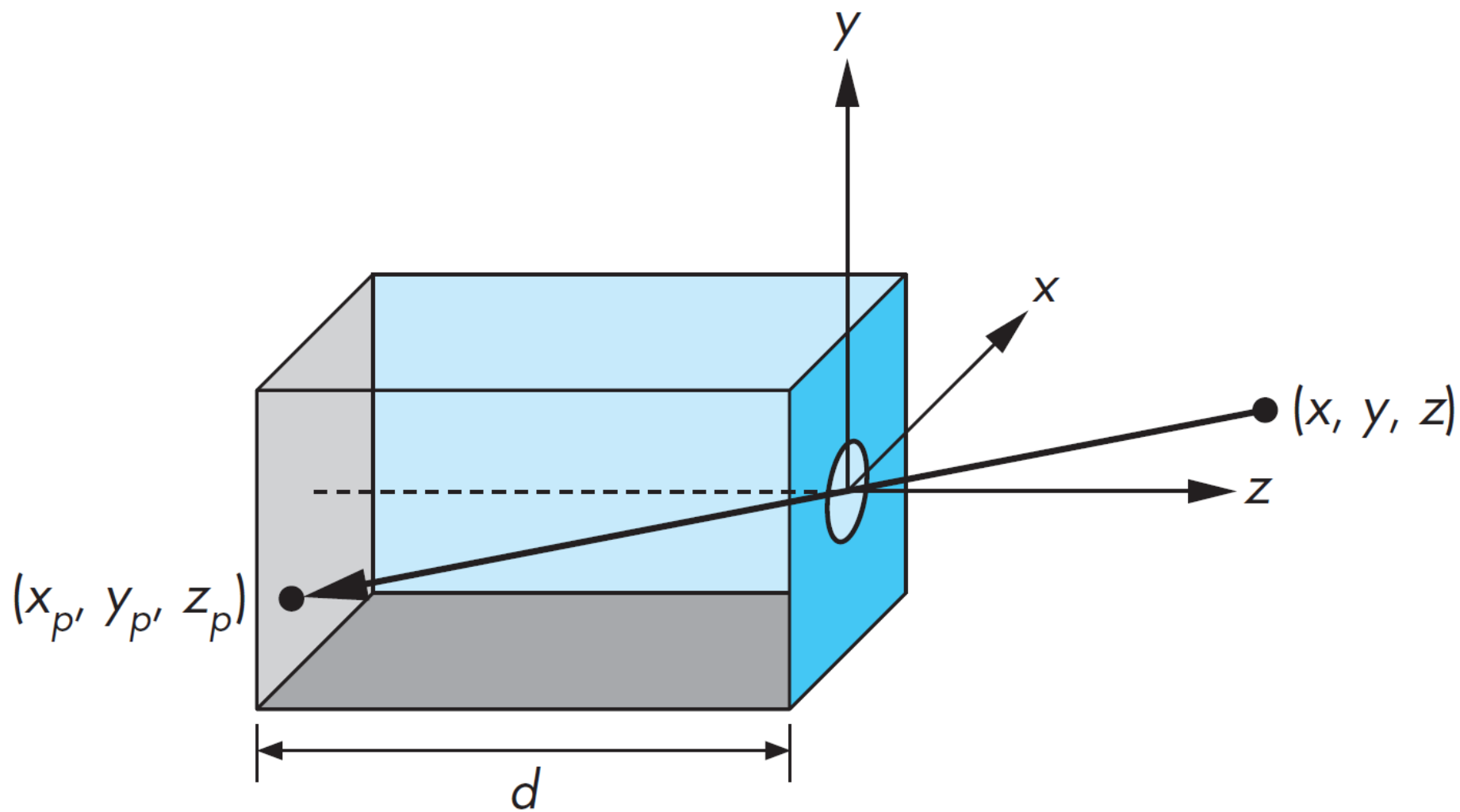
There are different interactions of light and materials

Mirror and Wood



The Pinhole Camera

A box with a small hole in the center of one
side of the box, film placed inside the box
opposite of the hole

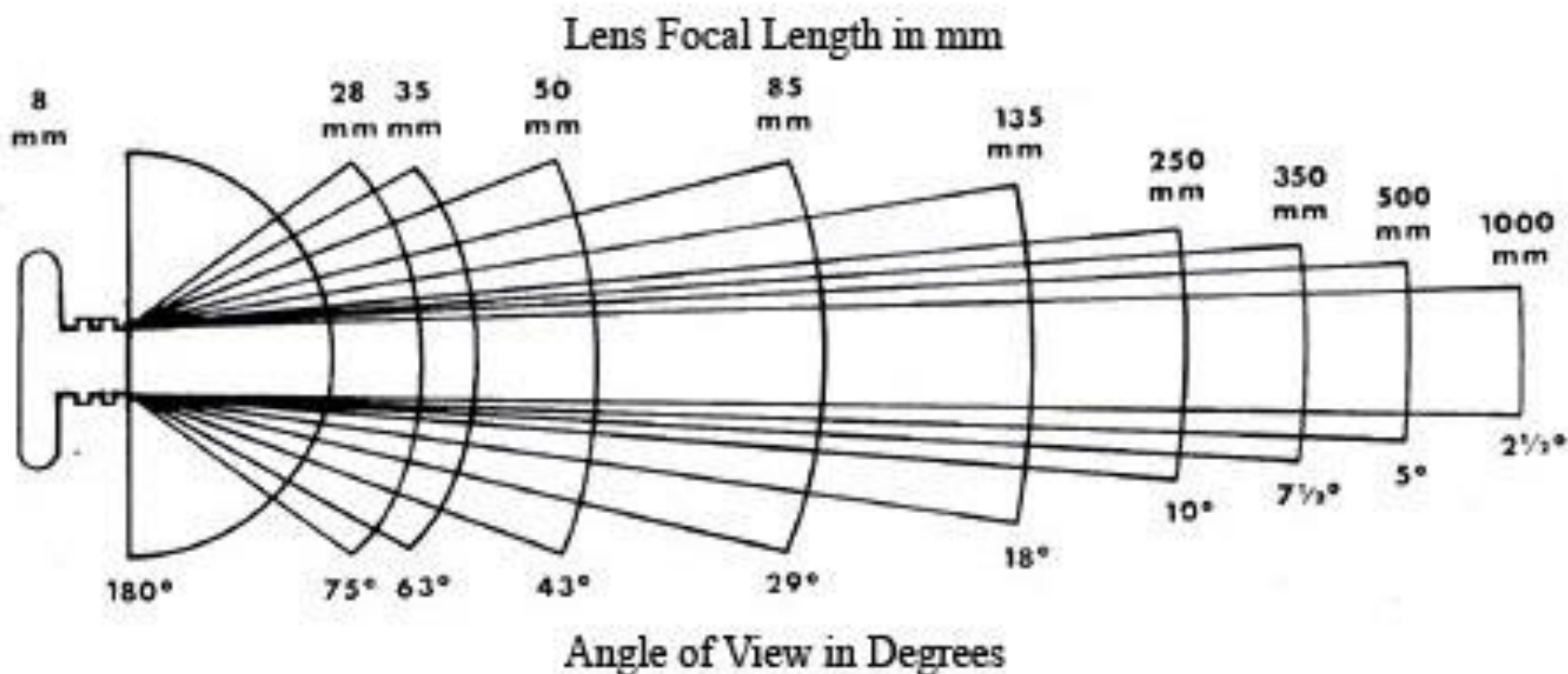


The Pinhole Camera

Projection: (x, y, z) to (x_p, y_p, z_p)

Angle of view: angle of what the camera can image on its film

Depth of field: the nearest and the farthest objects the camera can image



Angle of Coverage: The angle of coverage of a lens depends upon its focal length - the longer the focal length, the smaller the angle of coverage. For example, a 28mm lens has a 75 degree angle of coverage . . . a 500 mm lens has a 5 degree angle of coverage.



f/40

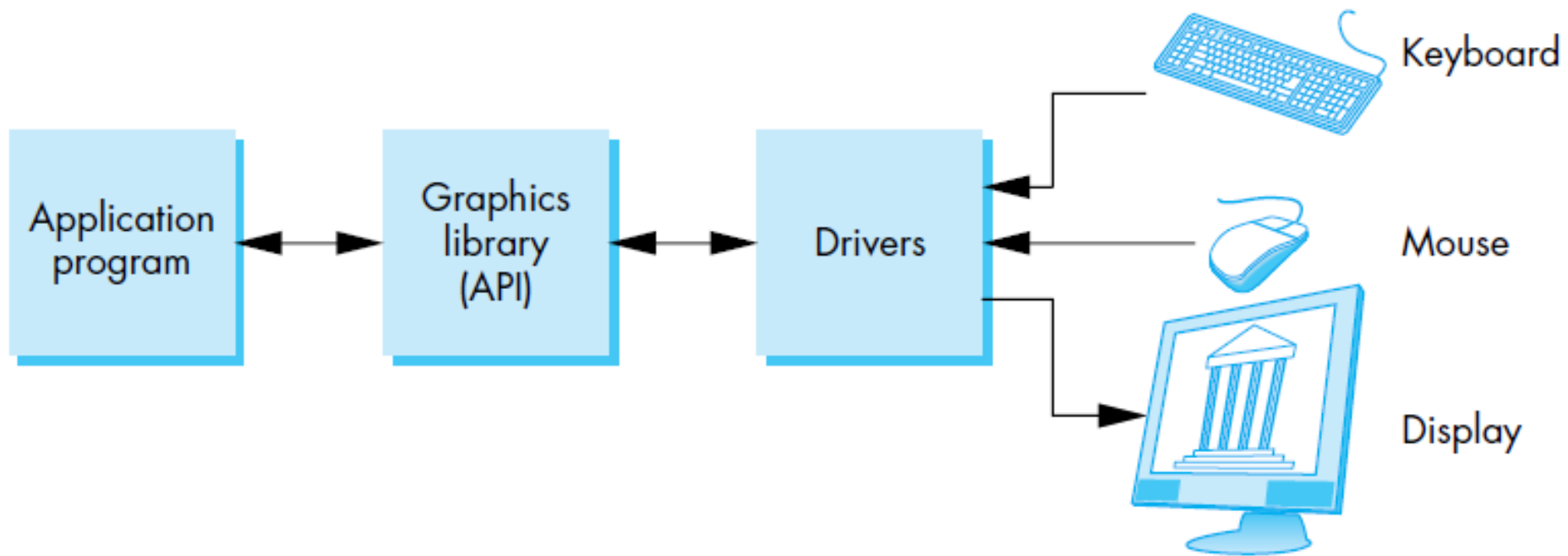


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The Programmer's Interface

GRAPHICS PROGRAMMER



Programmer's View of Graphics System

Application Programming Interface (API)

Contains specified functions to create/manipulate computer
graphics

Programmer's View of Graphics System

Drivers

Responsible for converting API calls to hardware language

Three-Dimensional APIs

Provides functions to specify/emulate the real world

Objects (using vertices/primitives)

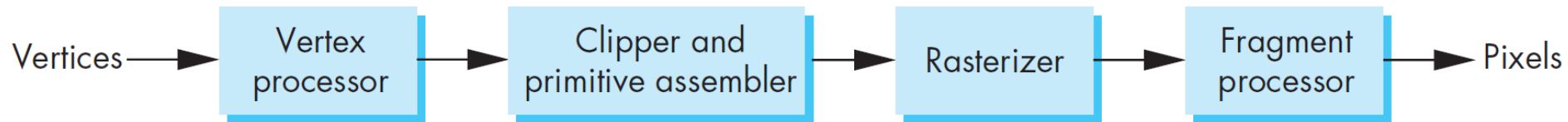
Viewers

Light Sources

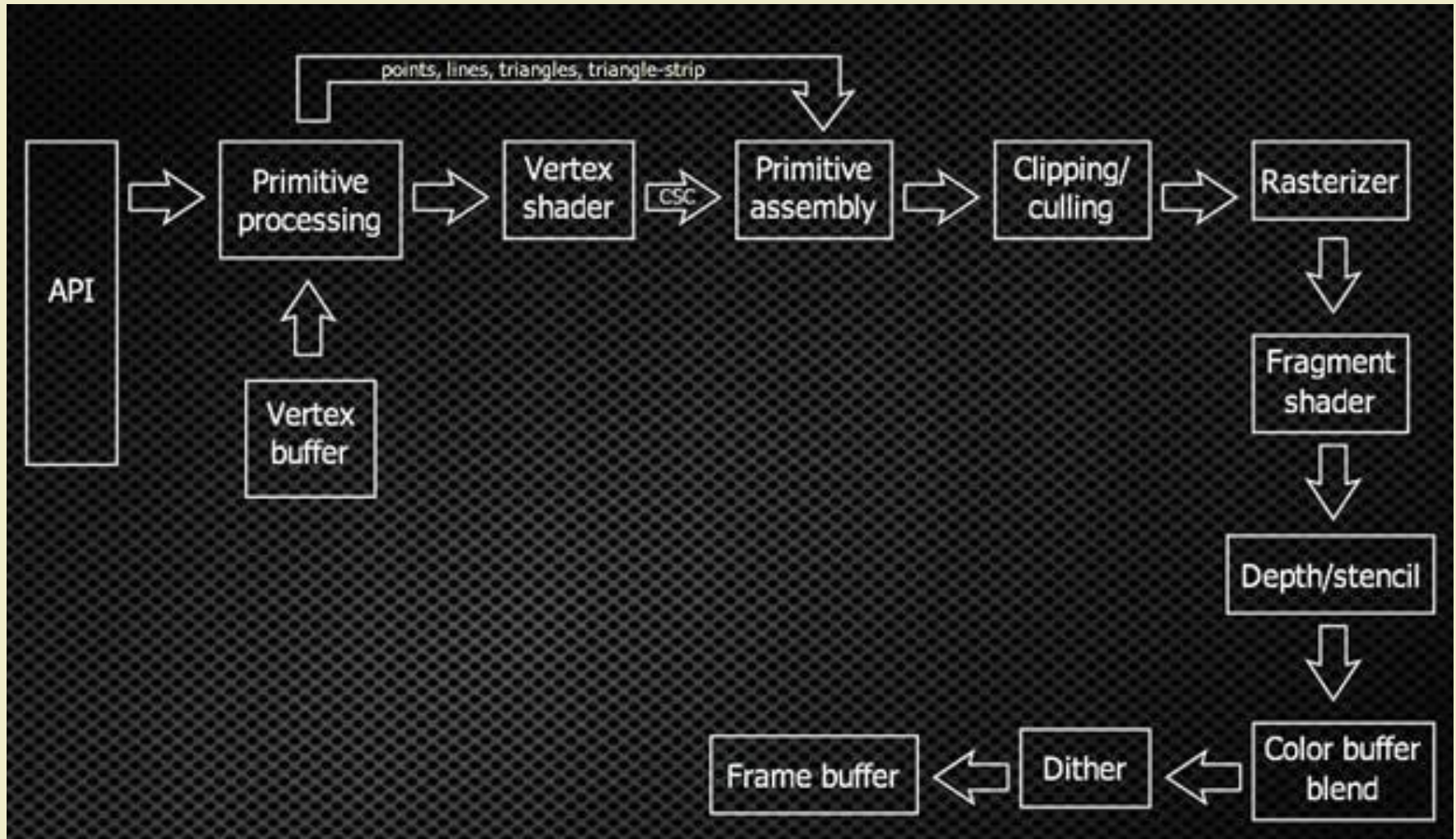
Material Properties

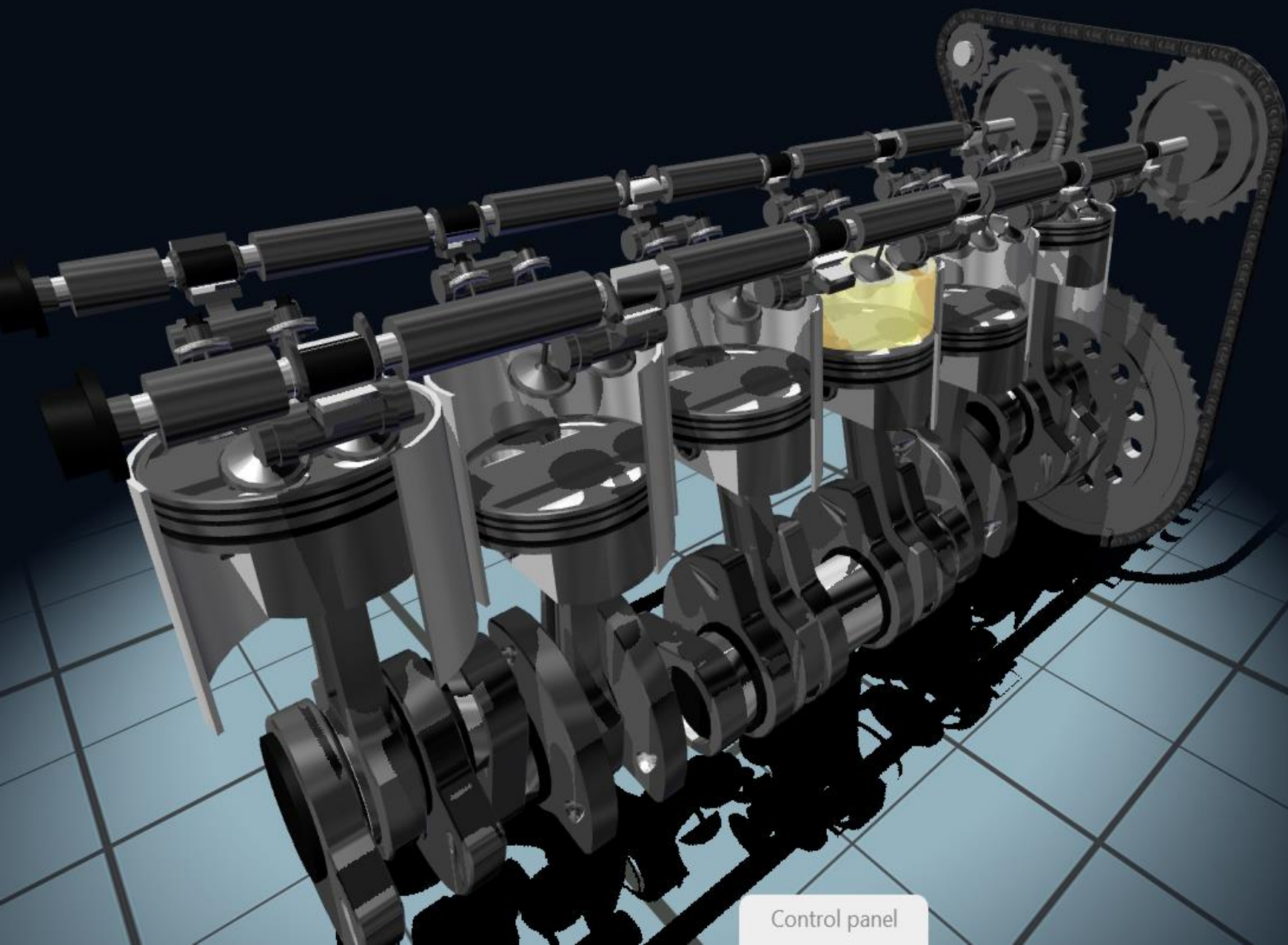
WebGL, OpenGL, Direct3D

General Computer Graphics Pipeline



WebGL Programmable Pipeline





Control panel

References

Books

- ANGEL, E. AND SHREINER, D. 2012. Interactive computer graphics : a top-down approach with shader-based OpenGL. Addison-Wesley. 6.ed. Boston, MA.
- SALOMON, D. 2011. The Computer Graphics Manual. Vol. 1. Springer. Northridge, CA.
- SHIRLEY, P. AND MARSCHNER, S. 2009. Fundamentals of Computer Graphics. 3.ed.

Images

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- <http://visual-memory.co.uk/daniel/Documents/short/Images/angles.jpg>
- http://www1.cs.columbia.edu/CAVE/projects/btf/images/main_image.jpg
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- <http://www.elementsofcinema.com/images/aperture%20and%20DOF.jpg>