Recap / Prospective

Last Week:
- Monday = Viewing
- Wednesday = Lighting
- Friday = Forensics

This Week:
- Monday = Viewing (and pipeline / visibility)
- Wednesday = Lighting / Shading (and meshes)
- Friday = Hopefully curves

Last Monday Recap
Local Coords
Object Coords
World Coords
Camera Coords
Device Coords (NOC, Viewport)

Camera Transform
Camera as physical object in world
Rigid = rotation + translation
Field of View (part of projection)
Film maker's frame

Rotation + Translation Specification
Look from / Look At / Vup (orientation)
\texttt{gluLookAt}
Book E (eye point) G (gaze direction) T (up vector)
Viewing Transform / Projection

Camera Coords \Rightarrow \textit{Screen/Film Plane Coords}

Orthographic:
- Scale World to fit in box
- Push everything to "front"
- Scale objects to fit in "box behind screen"
- Scale "box behind screen" to cover world

2 parts:
- Project onto screen
- Keep z - so know what's farther away
  doesn't change where, just what is in front

Perspective:
- Eye point
- Film maker's frame
- Field of view (angle)
- Focal length $\equiv$ relative to image size

Viewing area is frustum - no 2nd R!

Simple perspective:
- Film plane is flat, \perp to line of sight, centered
Frustum -
near and far edges

Position/Shape in 
Wor<0 = Pointing a camera

Frustum \Rightarrow NDC

1. put points \( x, y \) on near plane
2. Projection
3. give a reasonable \( z \) (preserves order)

Projection

\[
\frac{y}{z} = \frac{y'}{d} \quad y' = \frac{d y}{z}
\]

Let \( d=1 \), look at positive \( z \) (easy for board)

\[
y' = \frac{y}{Z} \quad x' = \frac{x}{Z}
\]

← how do we do this with a matrix?
Remember \( w ? \)

\[
\begin{align*}
\text{if } \quad w &= \overline{w} \\
\text{then} \quad X' &= \frac{X}{w} = \frac{X}{\overline{w}} \\
\end{align*}
\]

\[
\begin{bmatrix}
1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 \\
\end{bmatrix}
\]

\[
X' = x \\
y' = y \\
z' = ? \\
w' = z
\]

Problem: What to do about \( z \)

\[Z' = z \quad ? \quad \leftarrow \text{can't do} \quad \text{need} \quad \frac{z^2}{w} = z\]

can't do \( z^2 \)

\[
\text{trick } \overline{z} = 1 - \frac{1}{z}
\]

preserves ordering

work w/ transform

\[
\frac{z'}{w'} = \frac{z - 1}{z} = Z_{cc} = 1 - \frac{1}{z}
\]

More Complex

Scale so \( n \) maps to front \((+1 \text{ in OpenGL})\)

\( f \) maps to back \((-1 \text{ in OpenGL})\)

etc

see the book!