CSC418 Computer Graphics

- Cameras and Projections

Follow lecture notes on 3D Projection and Clipping:
www.dgp.toronto.edu/~karan/courses/csc418/fall_2002/notes/lectures.html

Camera model
Viewing Transform

\[ k = \frac{(P_{\text{eye}} - P_{\text{ref}})}{||P_{\text{eye}} - P_{\text{ref}}||} \]
Viewing Transform

\[ i = (V_{up} \times k) / \| V_{up} \times k \| \]

Viewing Transform

\[ j = k \times i \]
Change-of-basis Matrix

![Diagram of change-of-basis matrix with vectors and coordinates.]

Camera model

![Diagram of camera model with a perspective view.]
Camera model

What is the difference between these images?

Orthographic

Perspective

Perspective projection
Perspective projection

Simple Perspective
Simple Perspective

\[ y' = \frac{yd}{z} \]
\[ x' = \frac{xd}{z} \]
\[ z' = d \]

\[
\begin{bmatrix}
    x' \\
    y' \\
    z' \\
    w'
\end{bmatrix} =
\begin{bmatrix}
    1 & 0 & 0 & 0 \\
    0 & 1 & 0 & 0 \\
    0 & 0 & 1 & 0 \\
    0 & 0 & 1/d & 0
\end{bmatrix}
\begin{bmatrix}
    x \\
    y \\
    z \\
    1
\end{bmatrix}
\]

\[ w' = \frac{z}{d} \]
Viewing volumes

Projected image

Viewing volumes

Projected image
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Next Lecture

- Canonical space
- 3D Clipping
- Visibility culling