Computer Graphics

Lecture 16
Viewing Transformations: Orthographic Perspective Projection
Announcements

• A2 is in! Artifact showcase will happen later this week.
Viewing Transformations:
Overview
A standard sequence of transforms to go from object (model) space to screen (image) space
Wireframe Rendering
Model Matrix

Input: Scene in model coordinates
Parameters: Pose, scale, etc of model in scene
Output: Scene in world coordinates
Overview

• https://www.cs.cornell.edu/courses/cs4620/2019fa/demos/view_explore/view_explore.html
Camera Matrix

**Input:** Scene in world coordinates

**Parameters:** Camera frame \((u, v, w, e)\)

**Output:** Scene in camera coordinates
Projection Matrix - Orthographic

**Input:** Scene in (canonically-posed) camera coordinates

**Parameters:** Orthographic viewport dimensions

**Output:** Normalized device coordinates
Viewport Matrix

**Input:** Scene in the canonical view volume

**Parameters:** $W, H$ (image dimensions in pixels)

**Output:** $(x, y)$ in pixel coordinates; $z$ unchanged
Let's build it
Viewport Matrix

**Input:** Scene in the canonical view volume

**Parameters:** $W, H$ (image dimensions in pixels)

**Output:** $(x, y)$ in pixel coordinates; $z$ unchanged
Projection Matrix - Orthographic

**Input:** Scene in (canonically-posed) camera coordinates

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Camera Matrix

Input: Scene in world coordinates
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What about perspective cameras?

Perspective Projection

Exercise:
Find $y_s$, the y coordinate of the point where $(x, y, z)$ projects onto the viewport.