Viewing Transformations
Projection: map 3D scene to 2D image
Orthographic projection
Perspective projection
two-point perspective  three-point perspective
Viewing transformations

- Map objects from their 3D locations to their positions in a 2D view
Decomposition of viewing transforms

- **Camera transform**
  - rigid body transformation
  - place camera at origin

- **Projection transform**
  - $x, y, z$ in $[-1, 1]$
  - depends on type of projection

- **Viewport transform**
  - map to pixel coordinates

Viewing transforms depend on: camera position and orientation, type of projection, field of view, image resolution
Viewport transform

$$\begin{align*}
(x, y, z) & \rightarrow (x', y', z') \\
(x, y, z) & \in [-1, 1]^3 \\
x' & \in [-0.5, n_x - 0.5] \\
y' & \in [-0.5, n_y - 0.5]
\end{align*}$$
Viewport transform

Camera transform → Projection transform → Viewport transform

$M_{vp}$

<whiteboard>
Orthographic Projection Transform

Camera transform → Projection transform → Viewport transform

$M_{orth}$

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