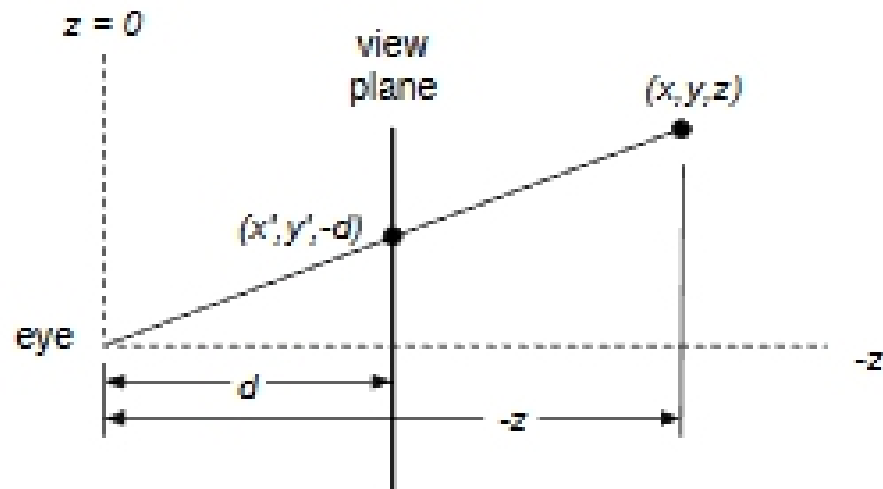


Perspective Projections

CS 442/452

September 30, 2014

Perspective Projection onto View Plane



Via similar triangles (note $z < 0$):

$$\frac{x'}{d} = \frac{x}{-z}$$

$$\frac{y'}{d} = \frac{y}{-z}$$

$$z' = -d$$

$$(x', y', z') = \left(\frac{xd}{-z}, \frac{yd}{-z}, -d \right).$$

Perspective Transformation

- Our perspective transformation is not linear (we can not describe it with a (simple) matrix).
- We exploit the use of homogeneous coordinates

$$(x, y, z, w) \equiv (x/w, y/w, z/w, 1) \quad (w \neq 0).$$

- We then create the following perspective matrix

$$\begin{bmatrix} xd \\ yd \\ zd \\ -z \end{bmatrix} = \begin{bmatrix} d & 0 & 0 & 0 \\ 0 & d & 0 & 0 \\ 0 & 0 & d & 0 \\ 0 & 0 & -1 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

After transforming our point, we perform a homogeneous **perspective division**:

$$(xd, yd, zd, -z) \mapsto \left(\frac{-xd}{z}, \frac{-yd}{z}, -d, 1 \right)$$