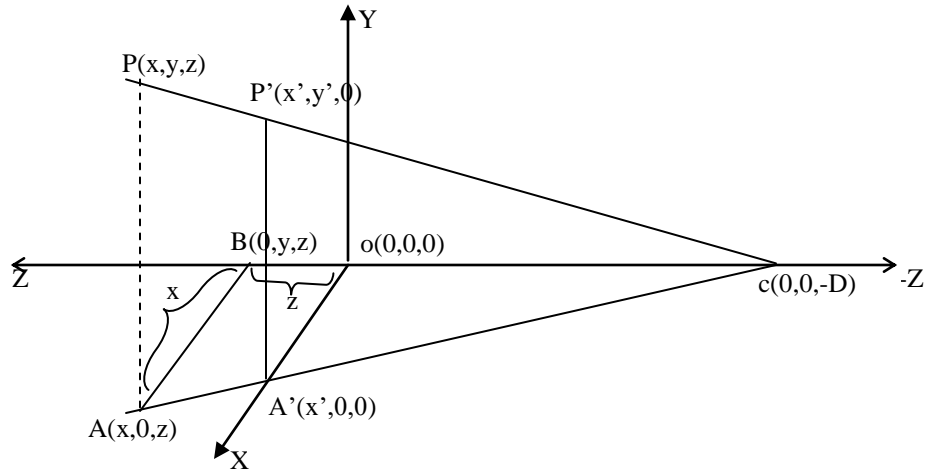


Perspective Projection (Standard)



Here center of Projection is $c(0,0,-D)$ along the direction of Z axis so the reference point is taken of world coordinate space W_c and the normal vector N is aligned with the y axis.

So now the view plane vp is the xy plane and center of projection is $c(0,0,-D)$ now from similar triangles ABC and $A'OC$

$$\frac{x}{x'} = \frac{z+D}{D} = \frac{AC}{A'C}$$

$$\text{or } \frac{x D}{z+D} = x' \quad \text{or} \quad x' = \frac{D x}{z+D}$$

similarly from triangles APC and $A'P'C$

$$\frac{y}{y'} = \frac{z+D}{D} = \frac{AC}{A'C}$$

$$\text{or } y' = \frac{y D}{z+D}$$

and $z' = 0$

now in homogenous coordinates

$$\text{Perk} = \begin{pmatrix} x' \\ y' \\ z' \\ 1 \end{pmatrix} = \frac{1}{z+D} \begin{pmatrix} D x \\ D y \\ 0 \\ z+D \end{pmatrix} = \frac{1}{z+D} \begin{pmatrix} D & 0 & 0 & 0 \\ 0 & D & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & D \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$$

A unit cube is projected into xy plane . Draw the projected image using standard perspective transformation where center of projection is (0,0,-20)

Here,

Center of projection = (0,0,-20) i.e. d = 20

$$\text{Persp} = \begin{pmatrix} 20 & 0 & 0 & 0 \\ 0 & 20 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 20 \end{pmatrix}$$

The cube represented in Homogenous coordinate is

$$V(A,B,C,D,E,F,G,H) = \begin{pmatrix} 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$\begin{aligned} V' &= \text{Persp} * V \\ &= \begin{pmatrix} 20 & 0 & 0 & 0 \\ 0 & 20 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 20 \end{pmatrix} \begin{pmatrix} 0 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix} \\ &= \frac{1}{z+D} \begin{pmatrix} 0 & 20 & 20 & 0 & 0 & 0 & 20 & 20 \\ 0 & 0 & 20 & 20 & 20 & 0 & 0 & 20 \\ 0 & 0 & 0 & 0 & 20 & 20 & 20 & 20 \\ 20 & 20 & 20 & 20 & 21 & 21 & 21 & 21 \end{pmatrix} \end{aligned}$$

Hence,

$$1/(z+D) = 1/(0+20) = 1/20$$

$$A' = (0,0,0) \quad B' = (1,0,0) \quad C' = (1,1,0) \quad D' = (0,1,0)$$

$$1/(z+D) = 1/(1+20) = 1/21$$

$$E' = (0,20/21,0) \quad F' = (0,0,0) \quad G' = (20/21,0,0) \quad H' = (20/21, 20/21,0)$$