$target = T \cdot \underset{}{\overset{\text{lengths}}{\overbrace{D}}}$ $\quad$ $start = S$ $\quad$ (INPUTS)

$right = R \cdot W$ $\quad$ $end = E$

$up = \underbrace{U}_{\text{unit vectors}} \cdot H$

$$n = S \cdot \frac{T}{\|T\|} \quad (\text{zNear}) \qquad (SVN)$$

$$f = E \cdot \frac{T}{\|T\|} \quad (\text{zFar})$$

$$q = \frac{n+f}{f} \quad (\text{zScale})$$

initial matrix * point P yields:

$$x = \frac{D}{2W} R \cdot P$$

$$y = -\frac{D}{2H} U \cdot P$$

$$z = (T \cdot P - n) q$$

$$w = T \cdot P \longleftarrow \text{(divisor for } x, y\text{)}$$

then adjust x, y:

$$x \mathrel{+}= \alpha w \qquad \alpha \text{ (ofs0)}$$

$$y \mathrel{+}= \beta w \qquad \beta \text{ (ofs1)}$$

such that:

$$target \longrightarrow (\underset{x}{\underset{\parallel}{\tfrac{1}{2}}}, \underset{y}{\underset{\parallel}{\tfrac{1}{2}}}, ?)$$

full transform in 3 steps:

$$\begin{pmatrix} x\\ y\\ w \end{pmatrix} = \begin{bmatrix}1&0&\alpha\\0&1&\beta\\0&0&1\end{bmatrix}\begin{bmatrix}\frac{D}{2W}&0&0&0\\0&-\frac{D}{2H}&0&0\\0&0&1&0\end{bmatrix}\begin{bmatrix}R&0\\U&0\\T&0\\0\;0\;0&1\end{bmatrix}\begin{pmatrix}x_0\\y_0\\z_0\\1\end{pmatrix}$$

divisor

result — shift III — projection II — rotation I — input point

$$\frac{z}{n+f} = (T\cdot P - n)\frac{q}{n+f} = \frac{T\cdot P - n}{f} = \frac{T\cdot(P-S)}{T\cdot E}$$

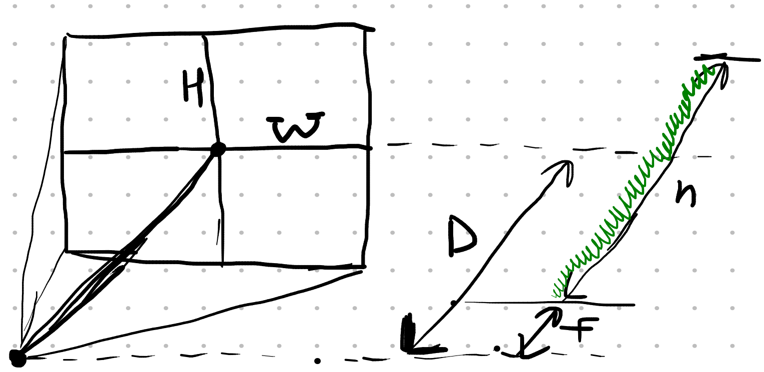
scale

not divided by w!

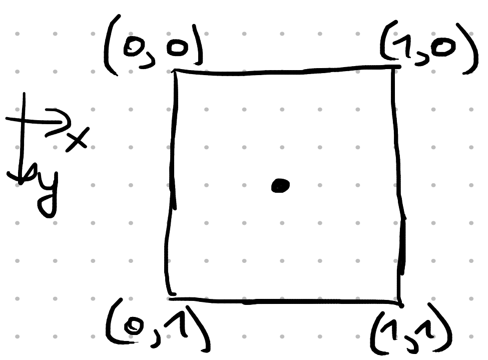
$\frac{z}{n+f} = 0$ at $P=S$

$\frac{z}{n+f} = 1$ at $P=S+E$

linear



(after I)



(after I, II, III)

along z: