Vector de la cámara

$$e := \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$ Posición del observador

$$u := \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$ Vector up

$$a := \begin{bmatrix} 0 \\ 0 \\ -1 \end{bmatrix}$$ Vector at

$$f := \frac{a-e}{\|a-e\|} = \begin{bmatrix} 0 \\ 0 \\ -1 \end{bmatrix}$$ Forward vector

$$s := f \times u = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$ Vector sideways

$$up := s \times f = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$ Vector up ortogonal

$$V := \begin{bmatrix} s_0 & up_0 & f_0 & -e_0 \\ s_1 & up_1 & f_1 & -e_1 \\ s_2 & up_2 & f_2 & -e_2 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Matrices de transformación

$$M_{ortho}(r,l,b,t,n,f) := \begin{bmatrix} \frac{2}{r-l} & 0 & 0 & -\frac{r+l}{r-l} \\ 0 & \frac{2}{t-b} & 0 & -\frac{t+b}{t-b} \\ 0 & 0 & \frac{-2}{f-n} & -\frac{f+n}{f-n} \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$zevf(a) := \begin{array}{l} \text{if } a \le 10^{-10} \\ \quad \text{return } 0 \\ \text{return } a \end{array}$$

$$R_z(a) := \begin{bmatrix} zevf(\cos(a)) & -zevf(\sin(a)) & 0 \\ zevf(\sin(a)) & zevf(\cos(a)) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$T(p,ta,tb,tc) := p + \begin{bmatrix} ta \\ tb \\ tc \end{bmatrix}$$

$n := -5$ $\qquad$ $f := -10$

$$M := M_{ortho}(10,-10,-10,10,n,f) = \begin{bmatrix} 0.1 & 0 & 0 & 0 \\ 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0.4 & -3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$M(p) := \begin{array}{l} a \leftarrow M \cdot V \cdot \begin{bmatrix} p_0 \\ p_1 \\ p_2 \\ 1 \end{bmatrix} \\ \text{return } a \end{array}$$

$$R := R_z(90°) = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$P_1 := \begin{bmatrix} 0 \\ 10 \\ -7 \end{bmatrix}$ $\quad T_1 := T(P_1,-5,0,-0.5) = \begin{bmatrix} -5 \\ 10 \\ -7.5 \end{bmatrix}$ $\quad R_1T_1 := R \cdot T_1 = \begin{bmatrix} -10 \\ -5 \\ -7.5 \end{bmatrix}$ $\quad M_1T_1R_1 := M(R_1T_1) = \begin{bmatrix} -1 \\ -0.5 \\ 0 \\ 1 \end{bmatrix}$

$P_2 := \begin{bmatrix} -10 \\ 0 \\ -7 \end{bmatrix}$ $\quad T_2 := T(P_2,-5,0,-0.5) = \begin{bmatrix} -15 \\ 0 \\ -7.5 \end{bmatrix}$ $\quad R_2T_2 := R \cdot T_2 = \begin{bmatrix} 0 \\ -15 \\ -7.5 \end{bmatrix}$ $\quad M_2T_2R_2 := M(R_2T_2) = \begin{bmatrix} 0 \\ -1.5 \\ 0 \\ 1 \end{bmatrix}$

$P_3 := \begin{bmatrix} 0 \\ 0 \\ -7 \end{bmatrix}$ $\quad T_3 := T(P_3,-5,0,-0.5) = \begin{bmatrix} -5 \\ 0 \\ -7.5 \end{bmatrix}$ $\quad R_3T_3 := R \cdot T_3 = \begin{bmatrix} 0 \\ -5 \\ -7.5 \end{bmatrix}$ $\quad M_3T_3R_3 := M(R_3T_3) = \begin{bmatrix} 0 \\ -0.5 \\ 0 \\ 1 \end{bmatrix}$