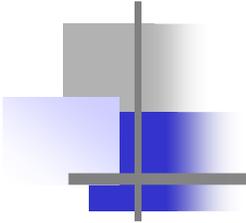


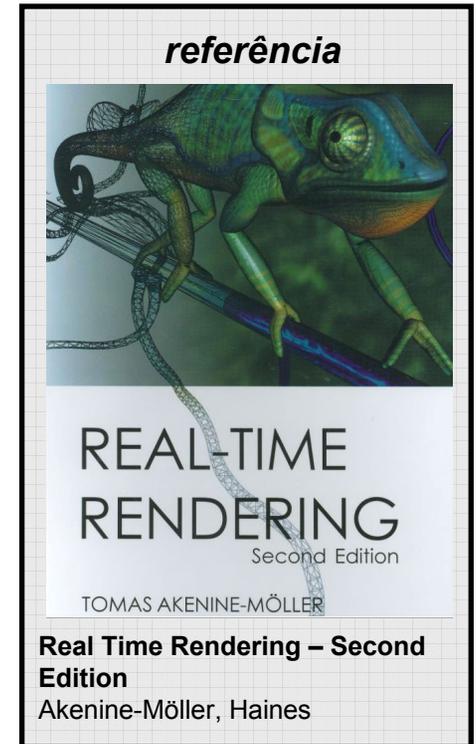
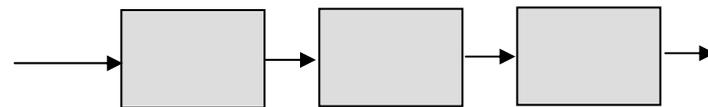
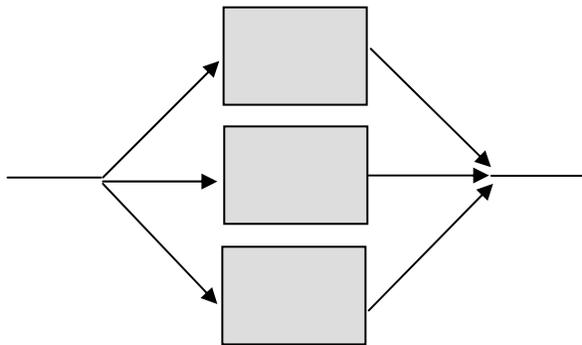
Parte 1 – Conceitos de Real Time Rendering



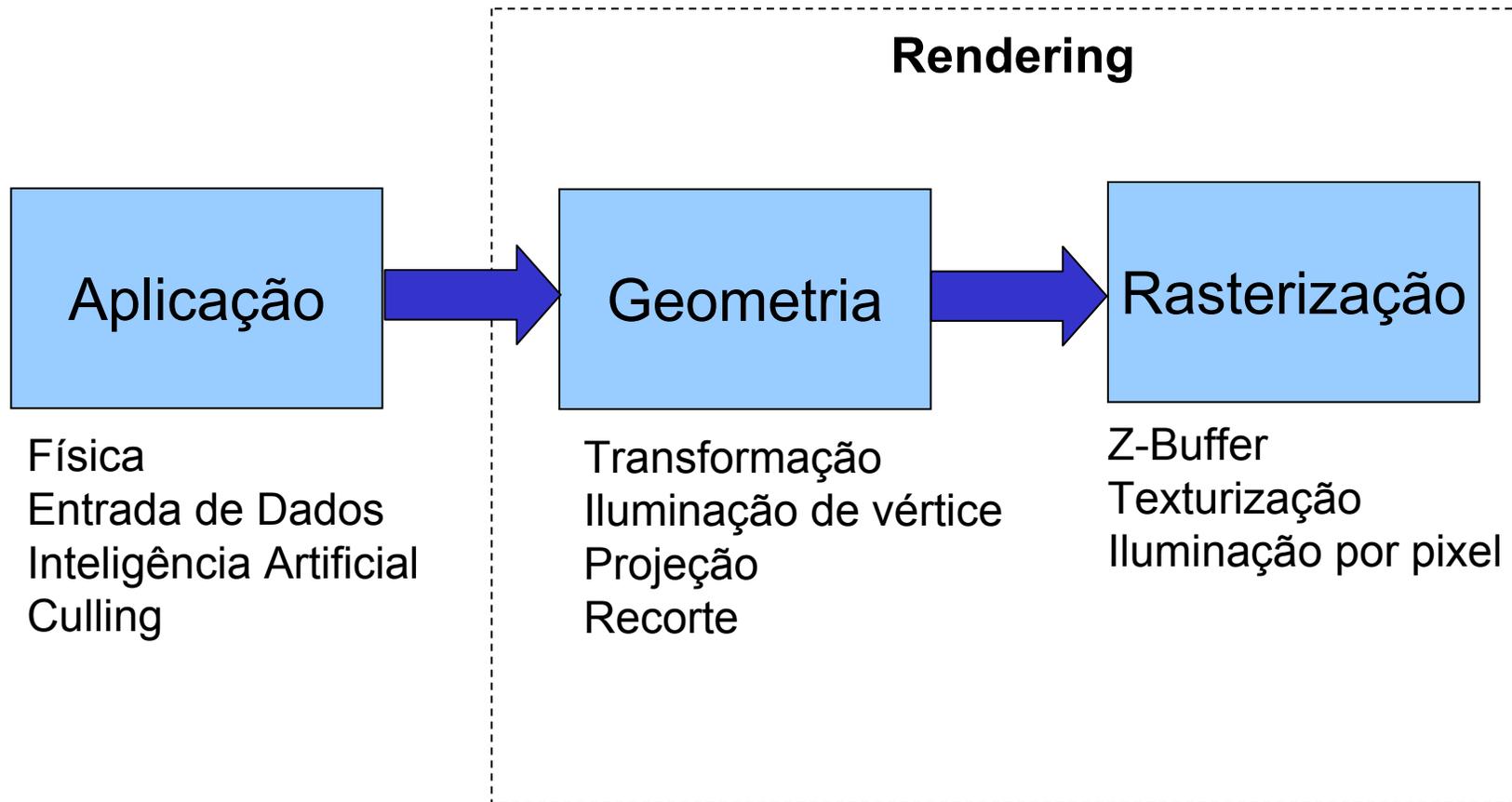
a. Pipeline Gráfico

Pipeline Gráfico

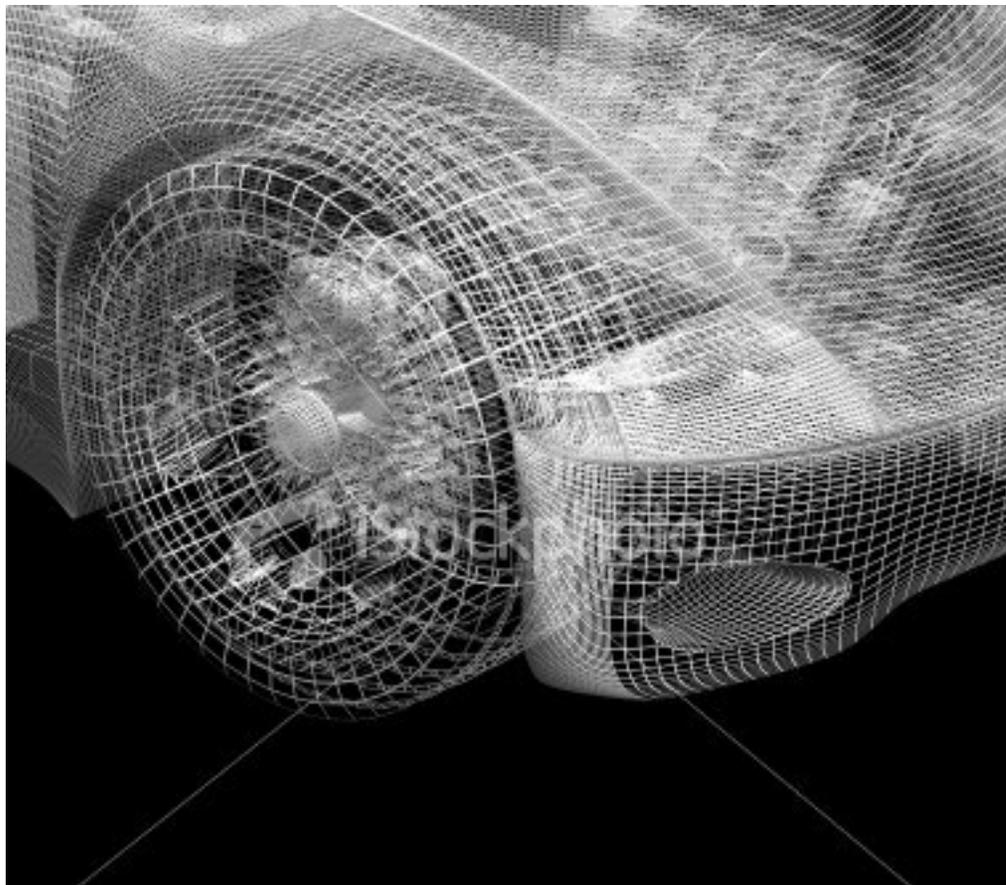
- Pipeline / Estágios
- Gargalo
- Otimização
- Tipos de Processamento Paralelo



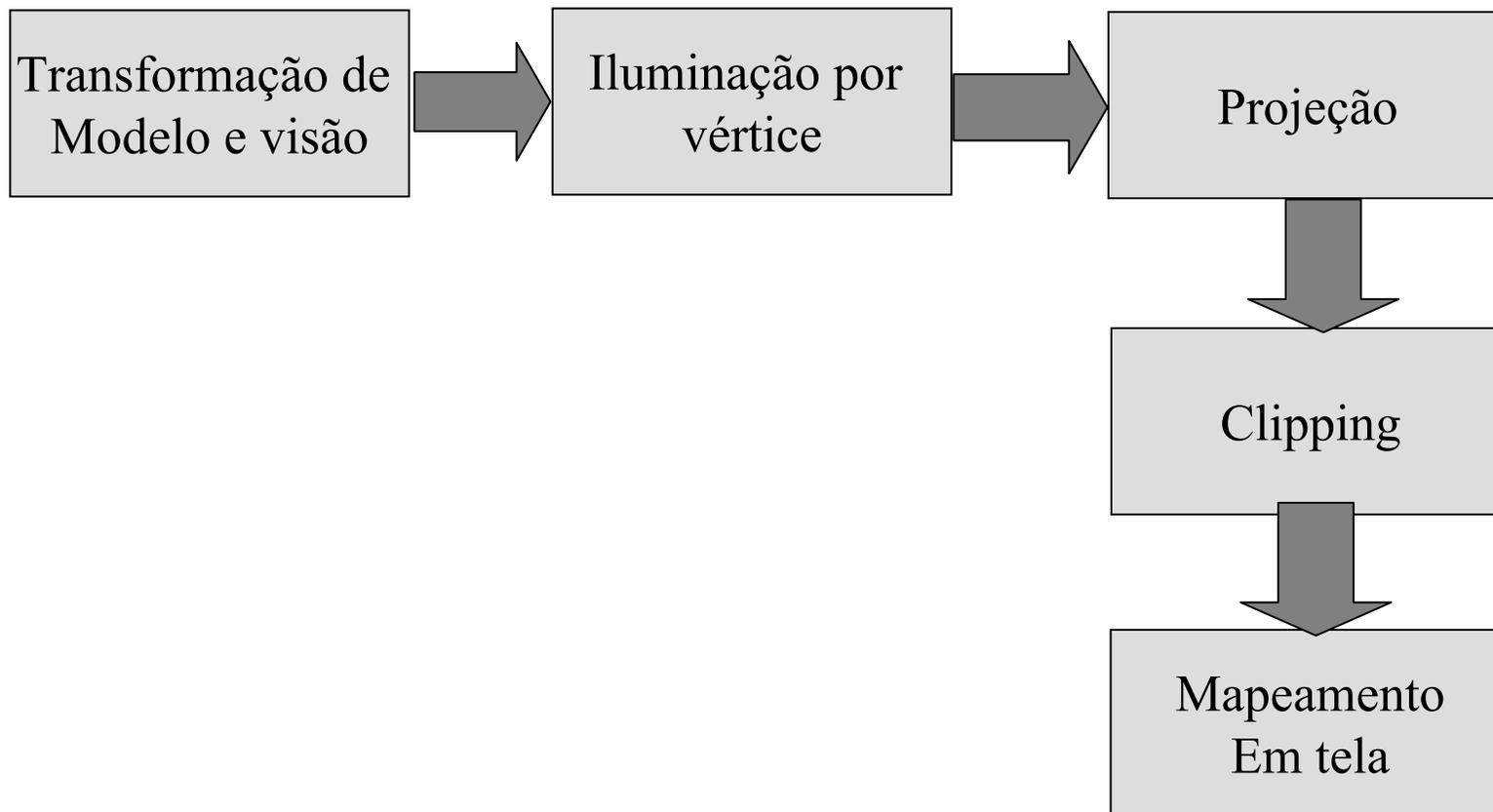
Pipeline Gráfico



Representação de modelos geométricos

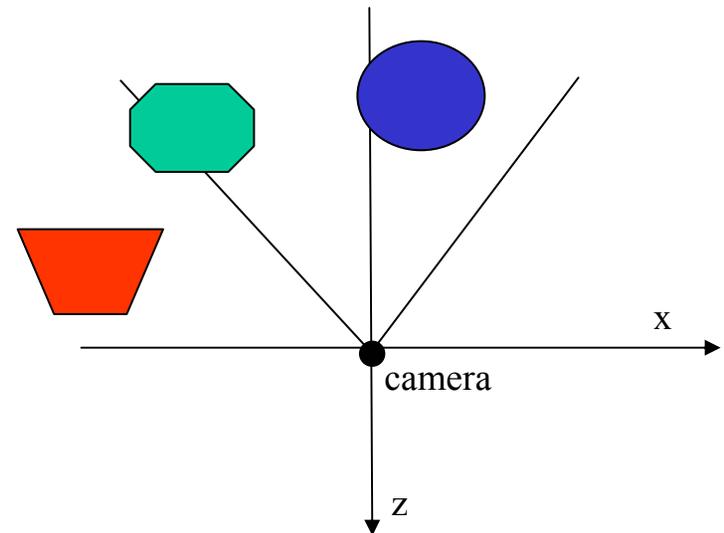
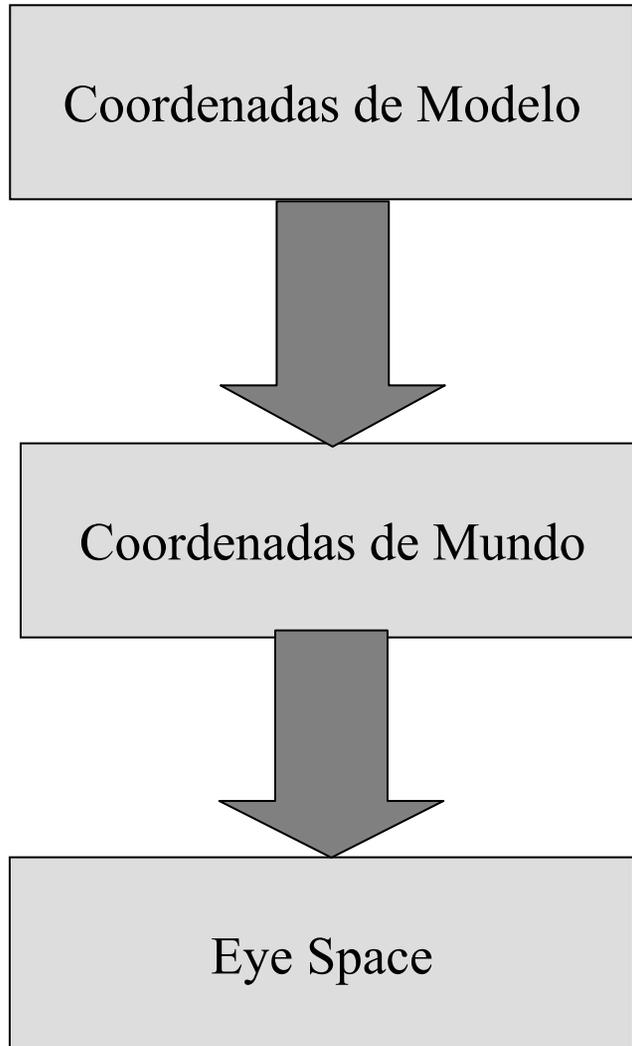


Estágio de Aplicação



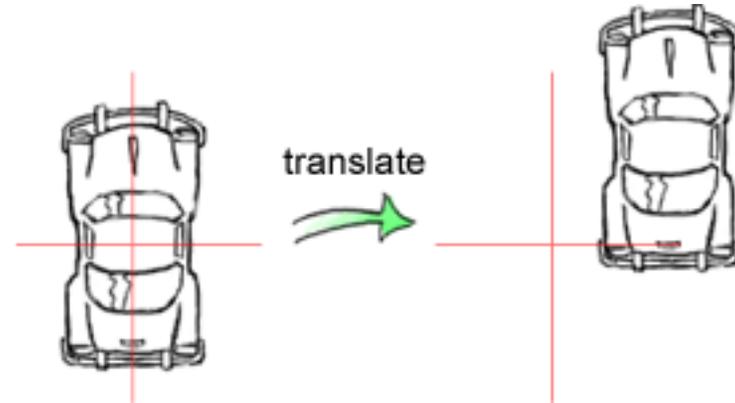
Aproximadamente 100 operações de ponto flutuante para esta aplicação

Transformação de Modelo e Visão



Transformação

$$T_{\mathbf{v}} = \begin{bmatrix} 1 & 0 & 0 & v_x \\ 0 & 1 & 0 & v_y \\ 0 & 0 & 1 & v_z \\ 0 & 0 & 0 & 1 \end{bmatrix}.$$



$$T_{\mathbf{v}}\mathbf{p} = \begin{bmatrix} 1 & 0 & 0 & v_x \\ 0 & 1 & 0 & v_y \\ 0 & 0 & 1 & v_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} p_x \\ p_y \\ p_z \\ 1 \end{bmatrix} = \begin{bmatrix} p_x + v_x \\ p_y + v_y \\ p_z + v_z \\ 1 \end{bmatrix} = \mathbf{p} + \mathbf{v}.$$

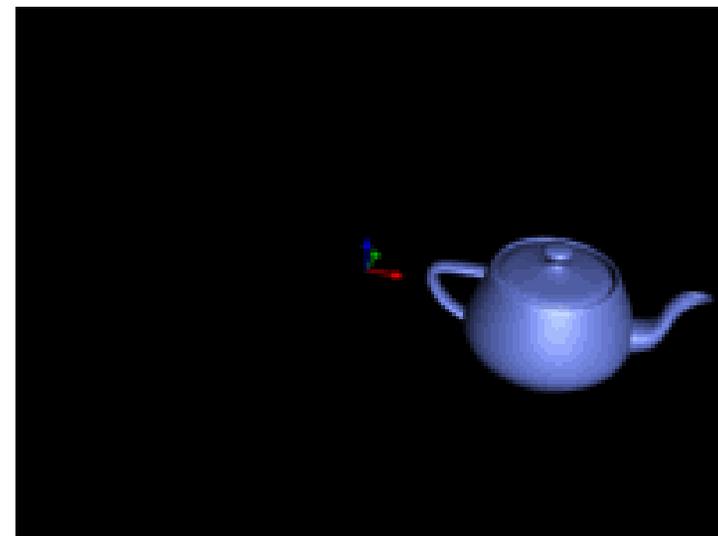
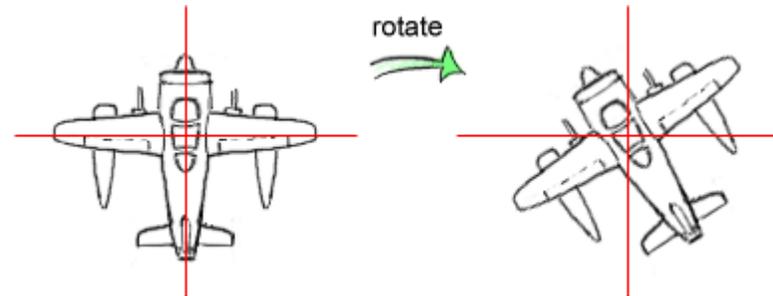
T(v)

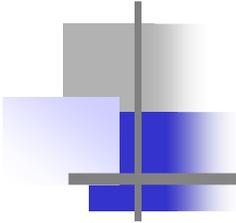
Rotação

$$R_x(\alpha) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos \alpha & -\sin \alpha & 0 \\ 0 & \sin \alpha & \cos \alpha & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$R_y(\beta) = \begin{bmatrix} \cos \beta & 0 & \sin \beta & 0 \\ 0 & 1 & 0 & 0 \\ -\sin \beta & 0 & \cos \beta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

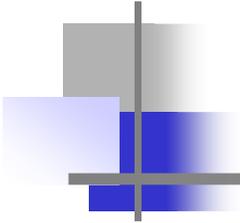
$$R_z(\gamma) = \begin{bmatrix} \cos \gamma & -\sin \gamma & 0 & 0 \\ \sin \gamma & \cos \gamma & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$





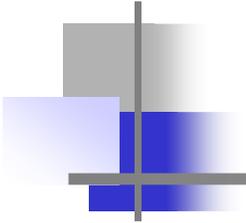
Rotação

$$R_x R_y R_z = \begin{bmatrix} \cos \alpha \cos \beta & -\cos \gamma \sin \alpha + \cos \alpha \sin \beta \sin \gamma & \cos \alpha \cos \gamma \sin \beta + \sin \alpha \sin \gamma & 0 \\ \cos \beta \sin \alpha & \cos \alpha \cos \gamma + \sin \alpha \sin \beta \sin \gamma & \cos \gamma \sin \alpha \sin \beta - \cos \alpha \sin \gamma & 0 \\ -\sin \beta & \cos \beta \sin \gamma & \cos \beta \cos \gamma & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$



Escala

$$\begin{bmatrix} s_x & 0 & 0 & 0 \\ 0 & s_y & 0 & 0 \\ 0 & 0 & s_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$



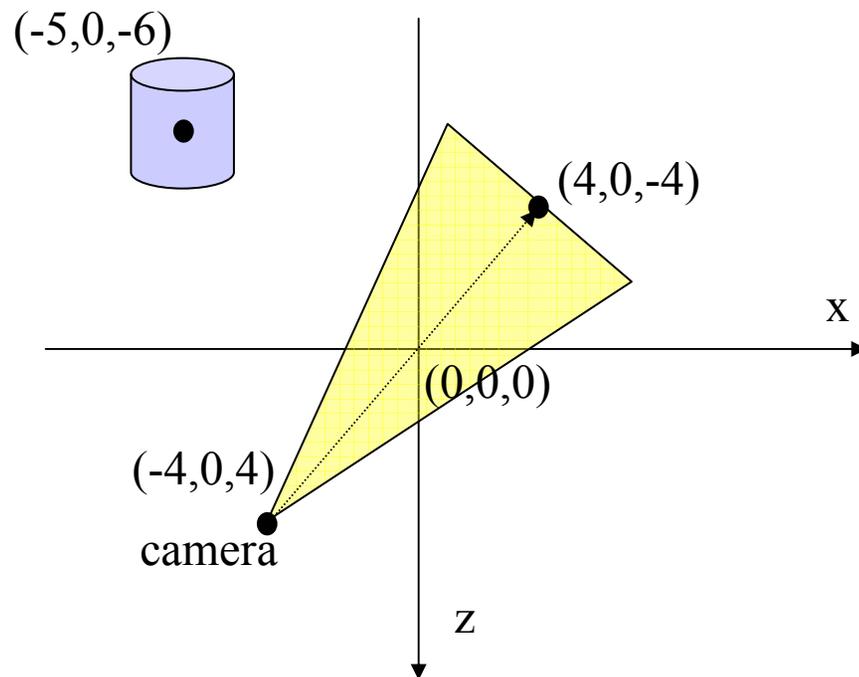
Composição de Transformações

Como rotacionar um objeto ao redor de um ponto p ?

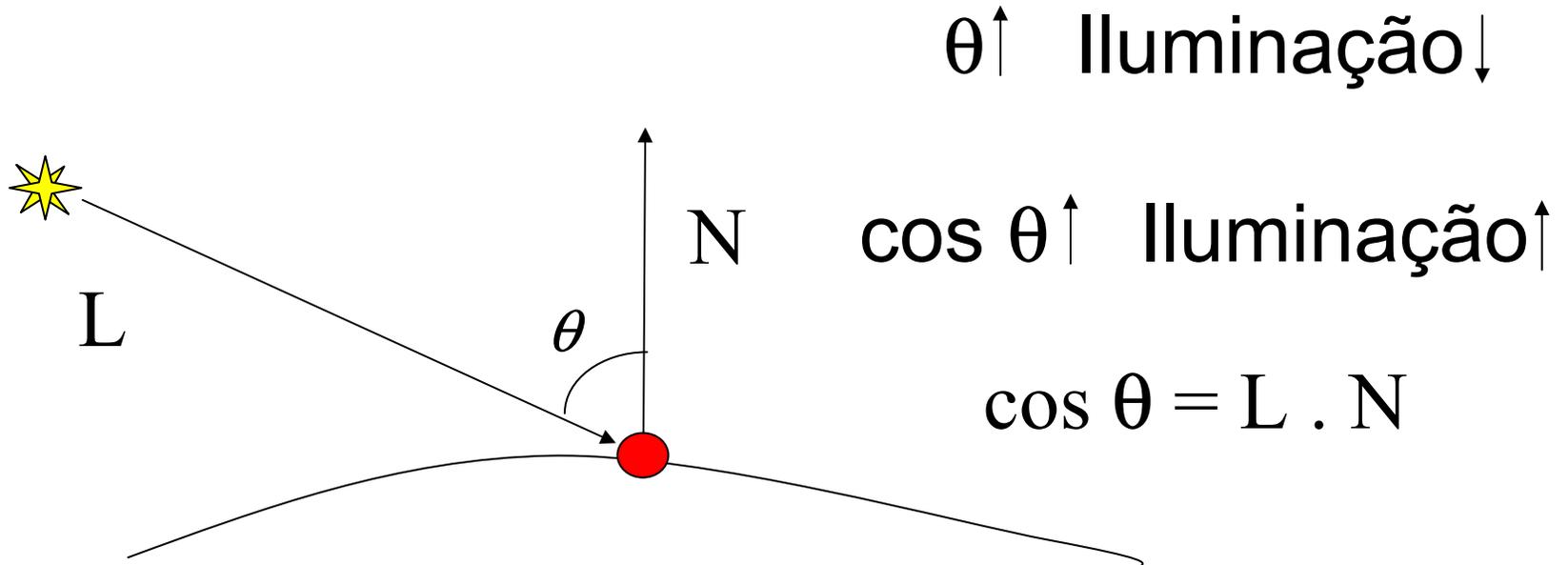
$$T(p).R_z(\alpha).T(-p)$$

Exercício

Crie uma matriz de transformação para eye space para a cena descrita abaixo:



Iluminação por vértice



$$I_{total} = I_{ambiente} + I_{difusa} + I_{especular}$$

$$I_{total} = I_a K_a C_d + f_{at} I_{luz} [K_d C_d (\mathbf{N} \cdot \mathbf{L}) + C_s K_s (\mathbf{R} \cdot \mathbf{V})^{n_s}]$$

Iluminação por vértice

