

IA369P – Tópicos em Engenharia de Computação VI

Visualização de Informação: Algoritmos

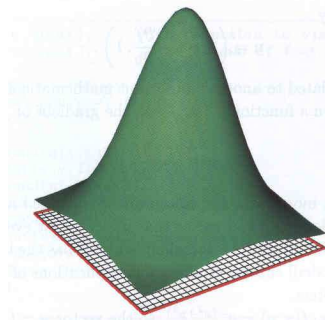
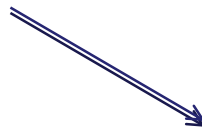
Fluxo de Síntese de Imagens

Capítulo 2 do livro-texto Telea

Visualização de Dados

Conjunto de técnicas que transformam um conjunto
de dados em imagens

$$(x, y, f(x, y) = e^{-(x^2+y^2)}), x, y \in [-1, 1]$$



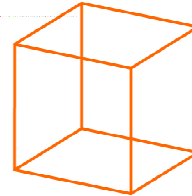
Síntese de Imagens

Conjunto de técnicas que transformam modelos matemáticos em imagens

```
// top face
p0 = {x:-50, y:-50, z:-50};
p1 = {x:50, y:-50, z:-50};
p2 = {x:50, y:-50, z:50};
p3 = {x:-50, y:-50, z:50};
// botton face
p4 = {x:-50, y:50, z:-50};
p5 = {x:50, y:50, z:-50};
p6 = {x:50, y:50, z:50};
p7 = {x:-50, y:50, z:50};
pointArray = [p0, p1, p2, p3, p4, p5, p6, p7];

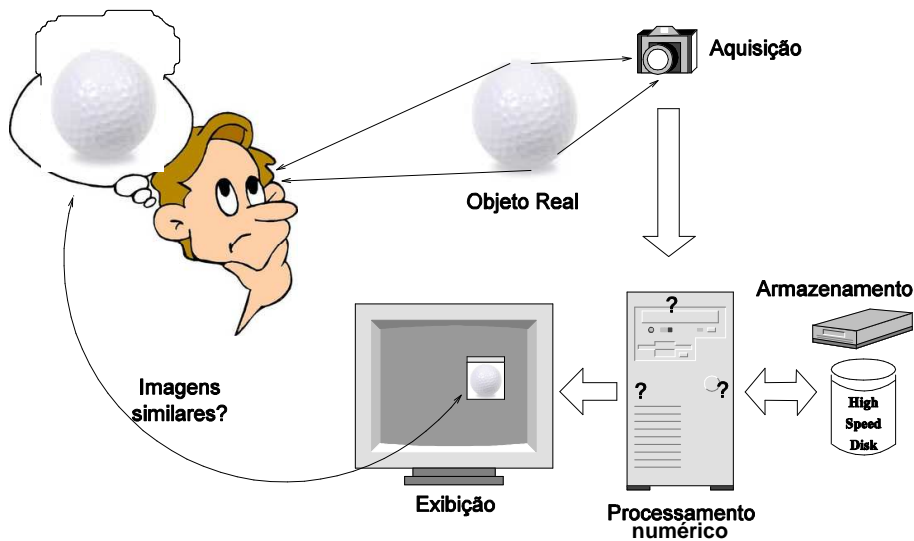
// p0 to p8 , the 3d points of a cube;
```

Síntese de Imagens

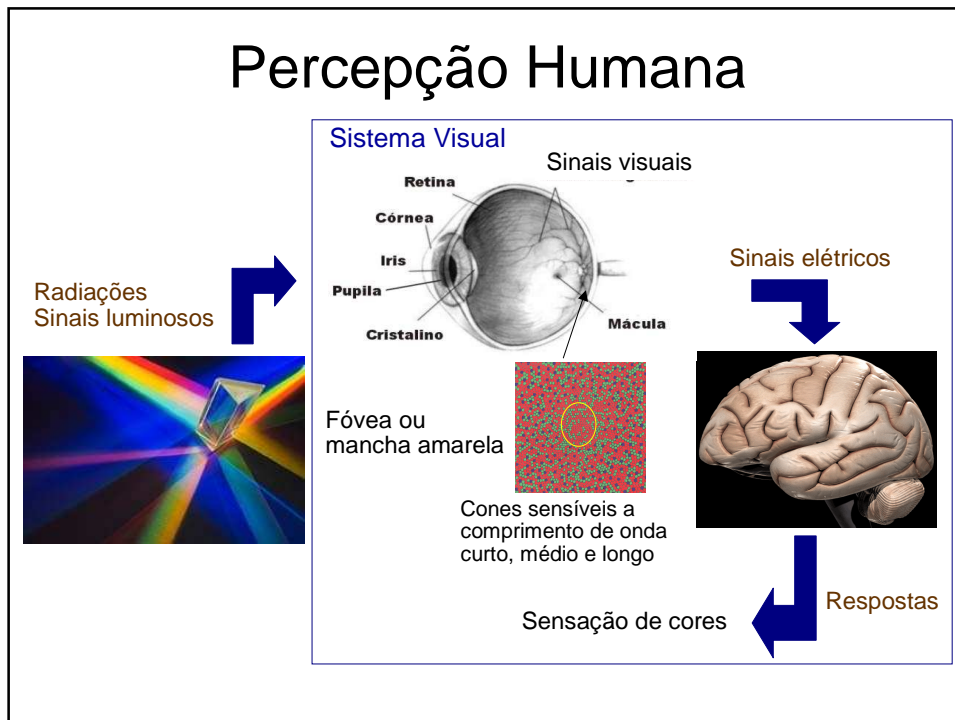


... de preferência, próxima à nossa percepção!

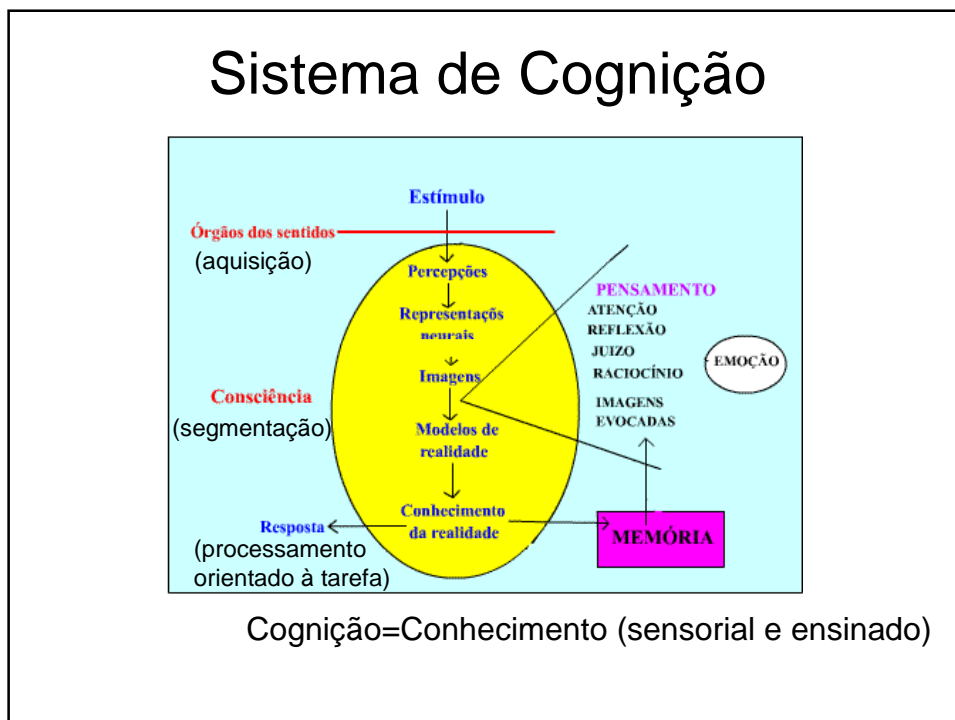
Síntese de Imagens



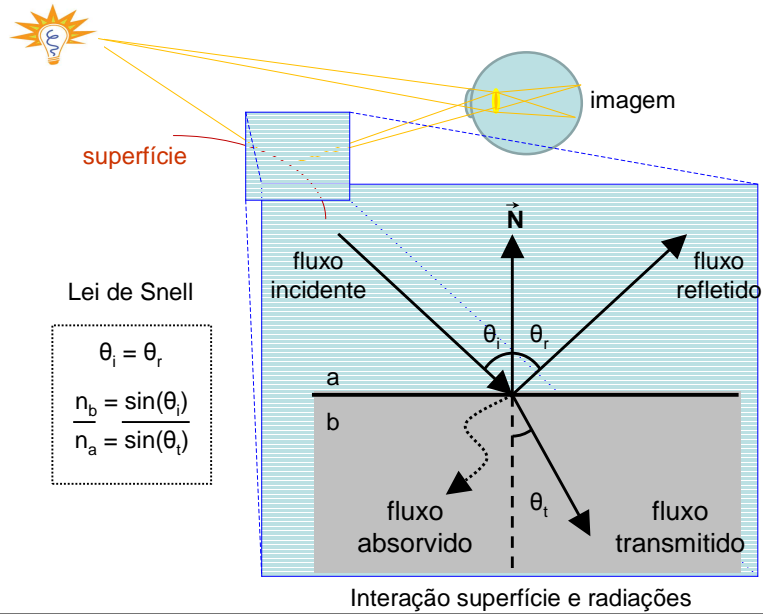
Percepção Humana



Sistema de Cognição

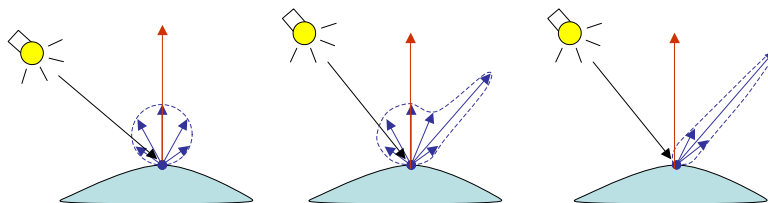


Princípio



Modelo de Phong

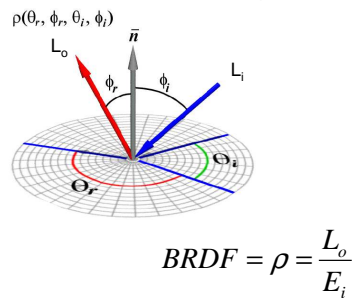
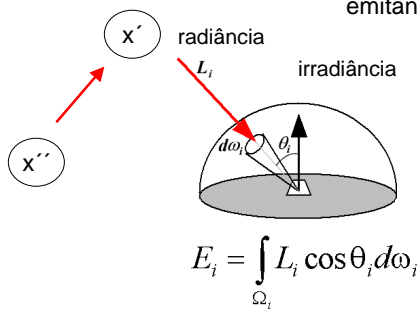
$$I_p = \underbrace{k_a I_a}_{\text{Ambiente}} + \underbrace{k_d I_d \cos\theta}_{\text{Difusa}} + \underbrace{k_s I_s (\cos\phi)^{\alpha'}}_{\text{Especular}}$$



Modelo de Iluminação Global

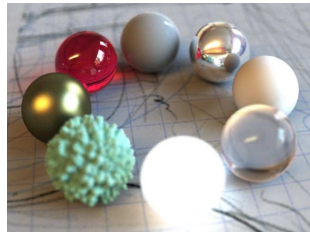
- Equação de *Rendering* (Kajiya, 1986)

$$I(x, x') = g(x, x') \left[\underset{\substack{\uparrow \\ \text{emitância}}}{\mathcal{E}(x, x')} + \int_S \underset{\substack{\uparrow \\ \text{irradiância}}}{\rho(x, x', x'')} I(x', x'') dx'' \right]$$



Modelo Global

Traçado de Raios



- Trajetória de um raio entre observador (E) e fonte luminosa (L):
 - Difusa (D) para difusa
 - Difusa para especular
 - Especular (S) para difusa
 - Especular para especular

Especular = reflexão+refração

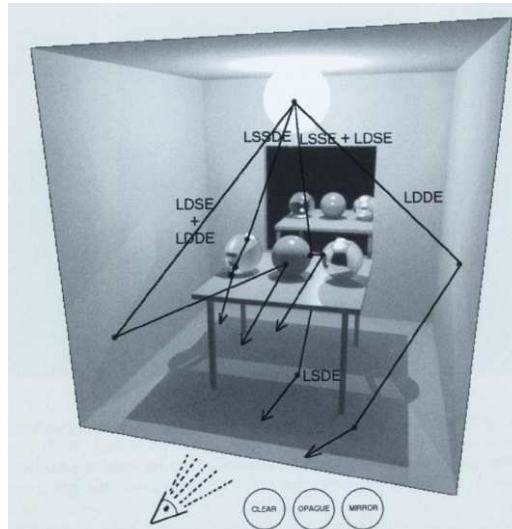
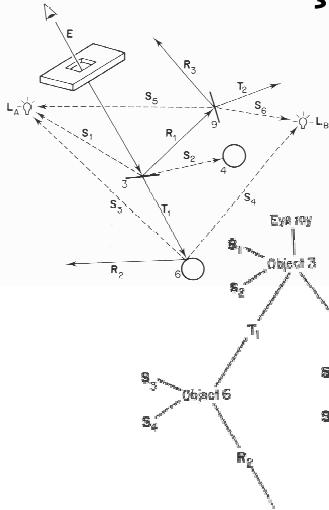


Figure 10.4 (b)
A selection of global illuminations paths in (a).

Traçado de Raios

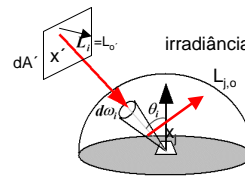


<http://www.mentalimages.com>

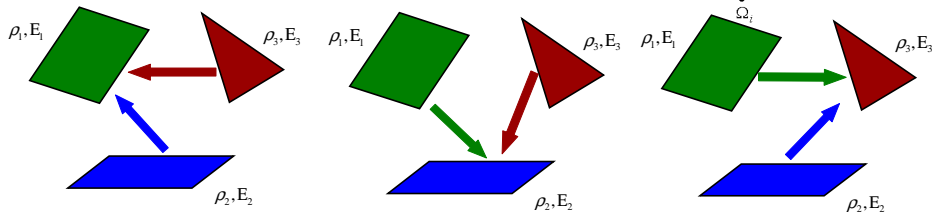
Fig. 12. The ray tree in schematic form.

Modelo Global Radiosidade

- Intensidade luminosa é derivada do fluxo luminoso que resulta das trocas entre as superfícies de uma cena.



$$E_i = \int_{\Omega_i} L_i \cos \theta_i d\omega_i$$



$$B_1 = E_1 + \rho_1 B_1 F_{11} + \rho_2 B_2 F_{12} + \rho_3 B_3 F_{13}$$

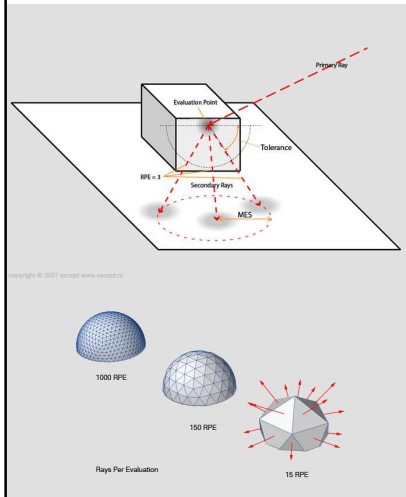
$$B_2 = E_2 + \rho_1 B_1 F_{21} + \rho_2 B_2 F_{22} + \rho_3 B_3 F_{23}$$

$$B_3 = E_3 + \rho_1 B_1 F_{31} + \rho_2 B_2 F_{32} + \rho_3 B_3 F_{33}$$

$$B_2 = E_2 + \rho_1 B_1 F_{21} + \rho_2 B_2 F_{22} + \rho_3 B_3 F_{23}$$

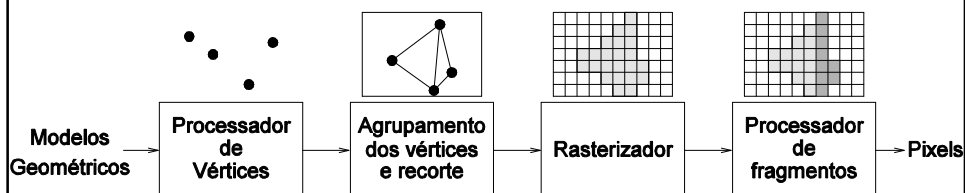
$$B_3 = E_3 + \rho_1 B_1 F_{31} + \rho_2 B_2 F_{32} + \rho_3 B_3 F_{33}$$

Radiosidade

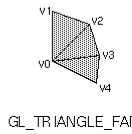
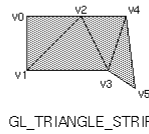
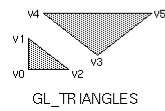
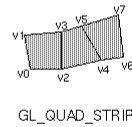
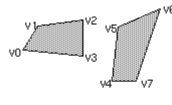
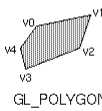
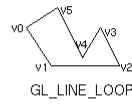
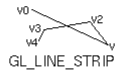
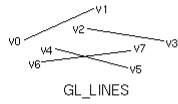
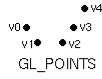


http://www.9icq.com/tutorials/jason_jacobs/radiosity_01.jpg

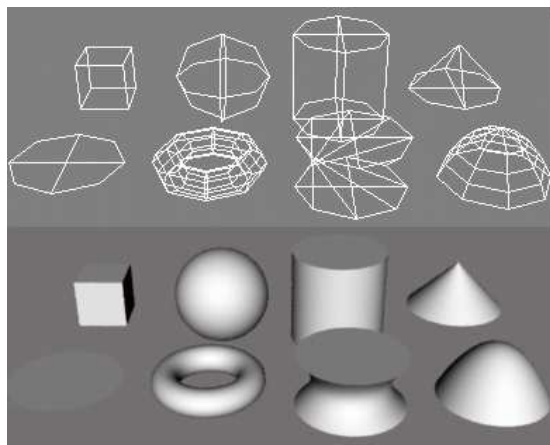
Fluxo de Síntese com Iluminação Local



Primitivas Gráficas



Modelos Geométricos

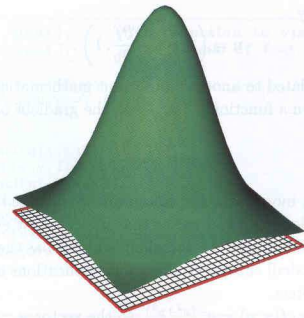


Visualização de Dados

$$(x, y, f(x, y) = e^{-(x^2+y^2)}), x, y \in [-1, 1]$$

Primitivas Gráficas

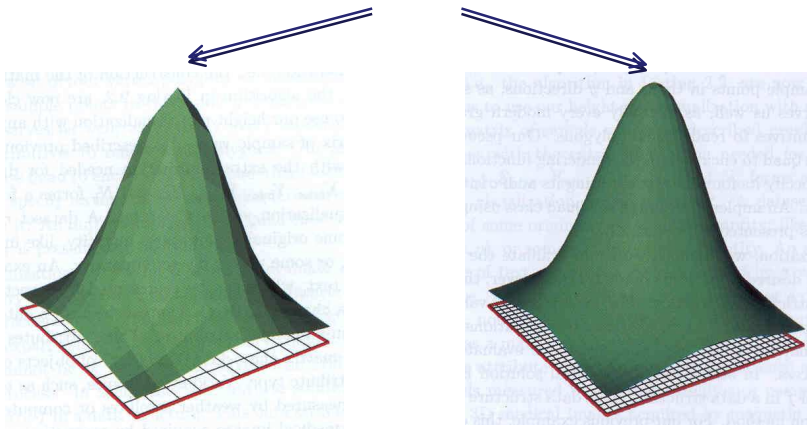
Síntese de Imagens



Visualização de Dados

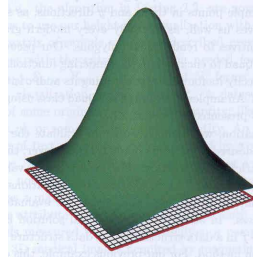
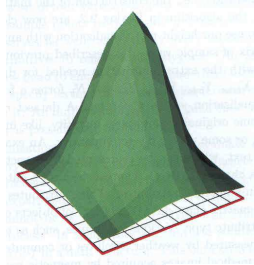
Amostragem

$$(x, y, f(x, y) = e^{-(x^2+y^2)}), x, y \in [-1, 1]$$

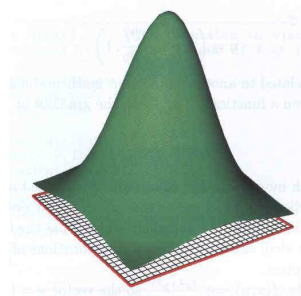


Visualização de Dados

Fluxo de Síntese de Imagens



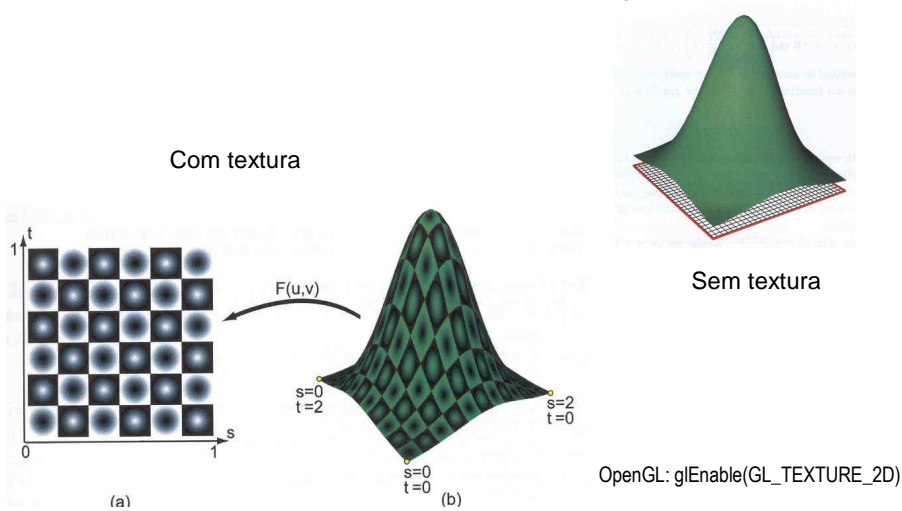
Flat Shading:
Sem interpolação de cores
OpenGL: `glShadingMode(GL_FLAT)`



Gouraud Shading:
Interpolação de cores
OpenGL: `glShadingMode(GL_SMOOTH)`

Visualização de Dados

Fluxo de Síntese de Imagens



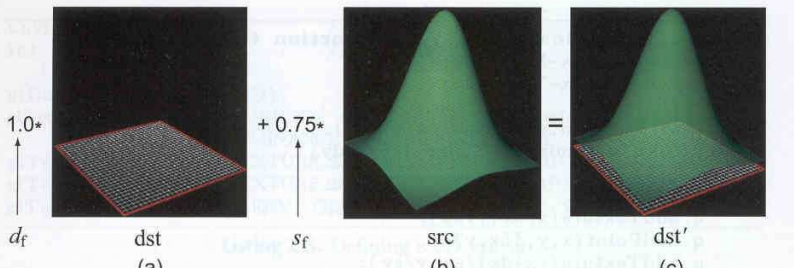
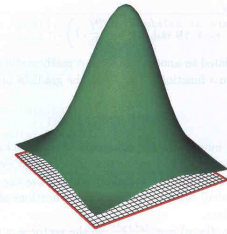
OpenGL: `glEnable(GL_TEXTURE_2D)`

Visualização de Dados

Fluxo de Síntese de Imagens

OpenGL: glEnable(GL_BLEND)

Sem transparência



Com transparência

Visualização de Dados

$$(x, y, f(x, y) = e^{-(x^2+y^2)}), x, y \in [-1, 1]$$

Discretização:

Transformar dados contínuos em discretos

Amostras

Mapeamento:

Transformar amostras em dados geométricos e seus valores em propriedades ópticas/cores.

Primitivas Gráficas

Síntese de Imagens:

Transformar dados geométricos (posição e vetores normais), propriedades ópticas destes dados e radiações luminosas incidentes sobre estes dados em cores.

