

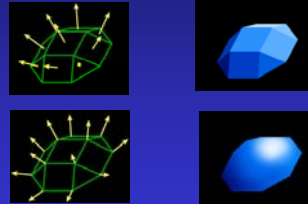
Smooth Shading

Gouraud

Phong

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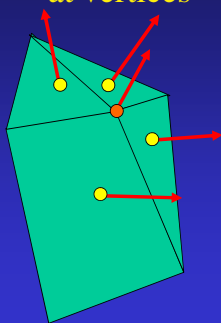
Interpolate value(s) for point in face from values at vertices



<http://www.blancmange.info/notes/maths/vectors/primitives/>

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Interpolate normals at vertices

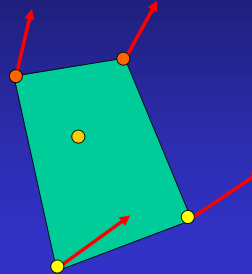


For each vertex, v
 $N_v = \langle 0, 0, 0 \rangle$
 For each face of vertex
 Compute face normal
 $N_v +=$ face normal
 Normalize N_v

For each vertex, v
 $N_v = \langle 0, 0, 0 \rangle$
 For each face
 Compute face normal
 For each vertex of face
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 For each vertex, v
 Normalize N_v

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Interpolate value(s) for point in face from values at vertices



Gouraud smooth shading:
 Compute normals at vertices
 Compute color at vertices
 Interpolate interior color

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Mach Band Effect

Smoothly shaded objects

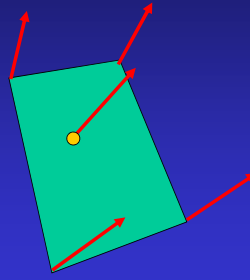
Colors are continuous, but not derivatives

Eye picks up on this and accentuates discontinuity



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Interpolate value(s) for point in face from values at vertices



Phong smooth shading:

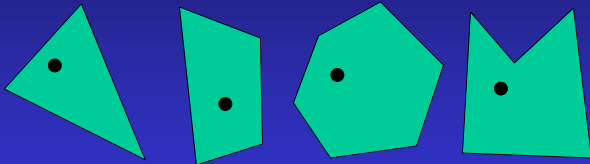
Compute normals at vertices

Interpolate interior normal

Compute color at point

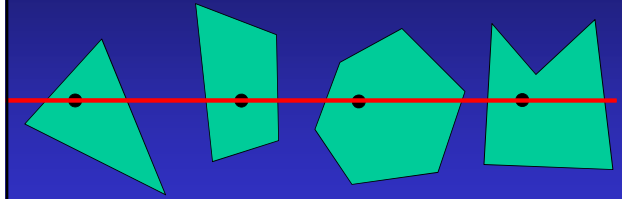
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Interpolate value(s) for point in face from values at vertices



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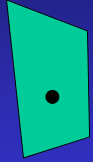
Interpolate value(s) scanline algorithms



Interpolate down edges, across scanline

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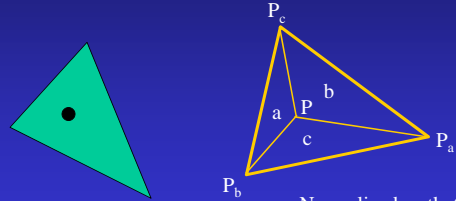
Point sample Quadrilateral inverse binlinear map then use u, v values to interpolate



$$\begin{aligned}
 P_{u0} &= (1-u)P_{00} + uP_{10} \\
 P_{u1} &= (1-u)P_{01} + uP_{11} \\
 P_{uv} &= (1-v)P_{u0} + vP_{u1} \\
 P_{uv} &= (1-v)((1-u)P_{00} + uP_{10}) + v((1-u)P_{01} + uP_{11}) \\
 P_{uv} &= vu(P_{11} - P_{01} - P_{10} + P_{00}) + v(P_{01} - P_{00}) + u(P_{10} - P_{00}) + P_{00} \\
 u &= \frac{P_{uv} - P_{00} - v(P_{01} - P_{00}) - P_{00}}{v(P_{11} - P_{01} - P_{10} + P_{00}) + (P_{10} - P_{00})}
 \end{aligned}$$

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Point sample Triangle compute barycentric coordinates then use to interpolate

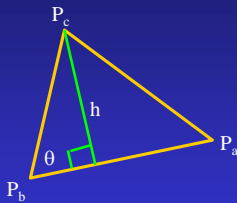


Normalized so that $a+b+c=1$

$$P = aP_a + bP_b + cP_c$$

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Area of a triangle - using vector algebra



$$\text{Area} = (1/2)h|V_{ab}|$$

$$h = |V_{bc}| \sin(\theta)$$

$$\text{Area} = (1/2) |V_{ab}| |V_{bc}| \sin(\theta)$$

$$|V_{ab} \times V_{bc}| = |V_{ab}| |V_{bc}| \sin(\theta)$$

$$\text{Area} = (1/2) |V_{ab} \times V_{bc}|$$

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Examples of smooth shading

See links off of course web site

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