

# Shaders and Visual Realism

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"Toy Story" - Pixar, 1995 - Using RenderMan

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"Bioshock"

rpgsite.net

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"Alan Wake"

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"Unreal Tournament 2007"

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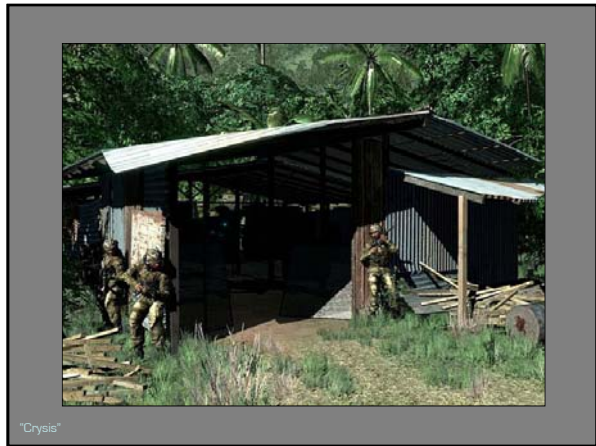
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"Crysis"

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"Test Drive Unlimited"

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"Test Drive Unlimited"

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Most of the following images were taken from  
"Shaders for Game Programmers and Artists" by Sebastien St-Laurent.  
Copyright: 2004 by Course Technology

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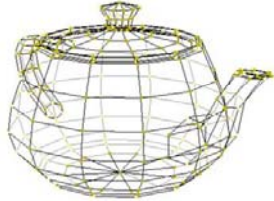
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Vertices



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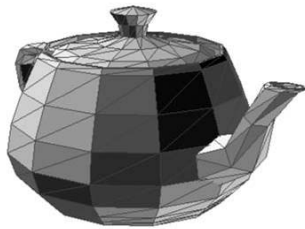
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Polygons (Triangles)



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Pixels



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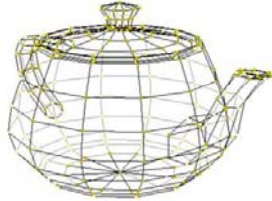
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## Vertex Transformation (positioning in the world)




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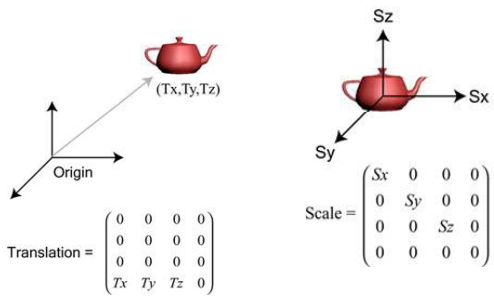
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## Translating and Scaling




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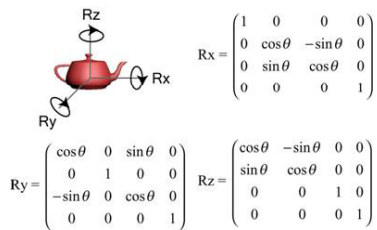
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## Rotating




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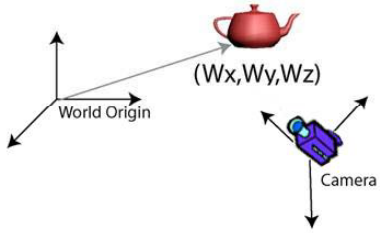
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### World Coordinates



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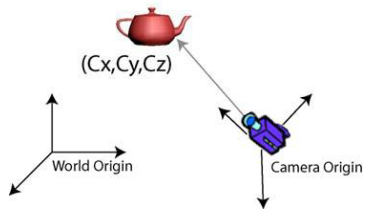
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### Camera Coordinates



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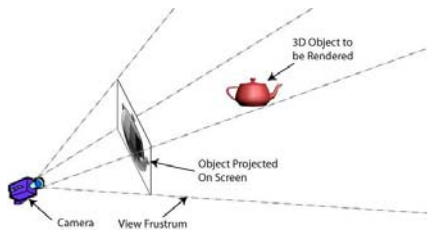
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### View Projection



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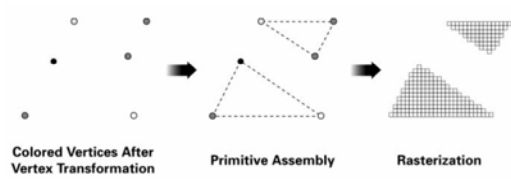
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# Rasterization



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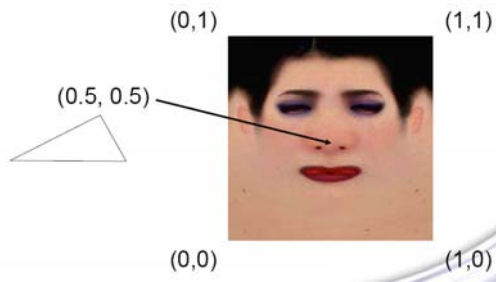
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# Texture Mapping



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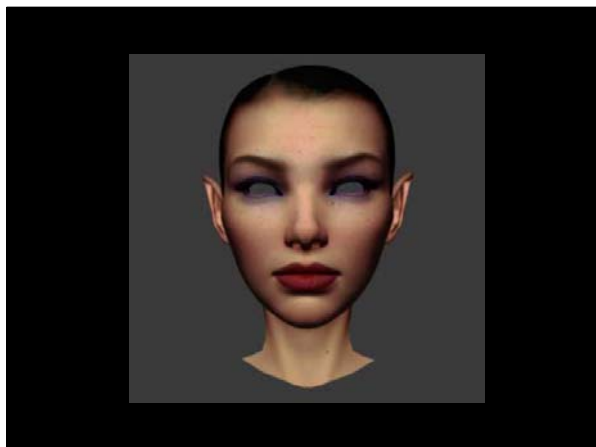
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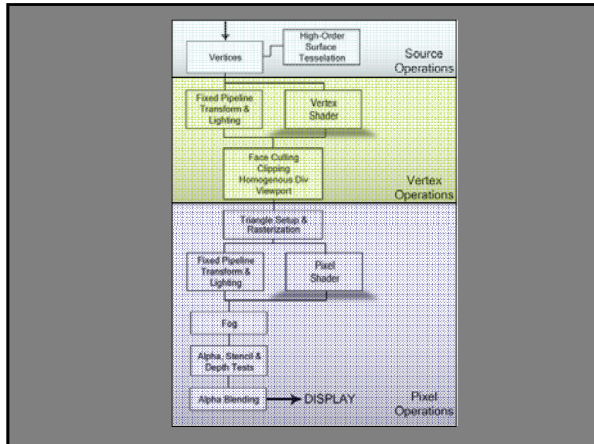
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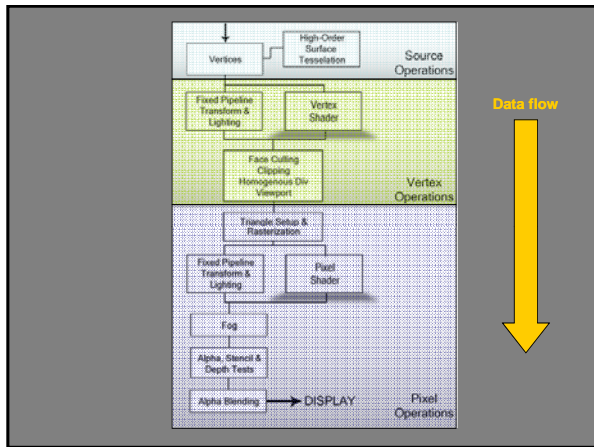
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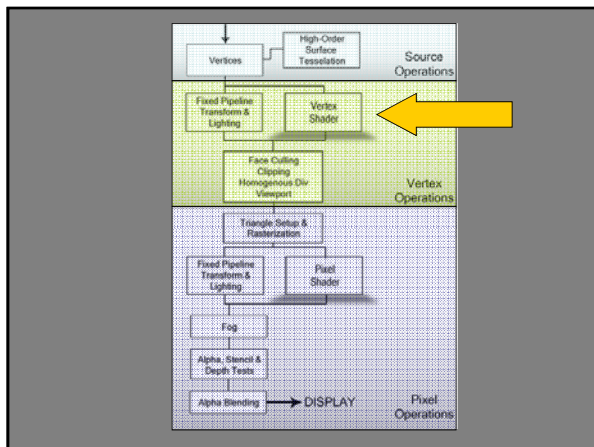
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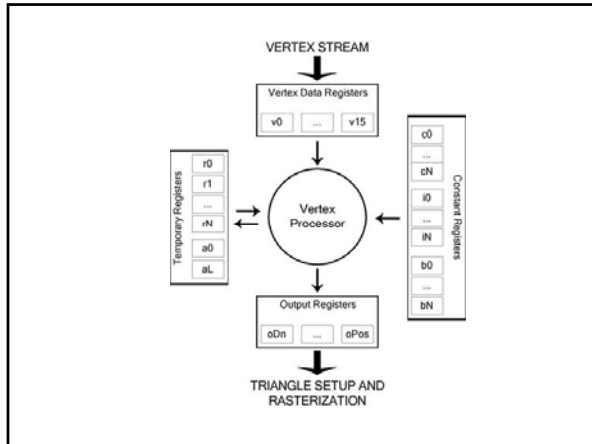
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### Vertex Shader

```

// Simplest Vertex Shader
// input vertex
struct VertIn {
    float4 pos : POSITION;
    float4 color : COLOR0;
};
// output vertex
struct VertOut {
    float4 pos : POSITION;
    float4 color : COLOR0;
};
// vertex shader main entry
VertOut main(VertIn IN, uniform float4x4 modelViewProj) {
    VertOut OUT;
    OUT.pos = mul(modelViewProj, IN.pos); // calculate output coords
    OUT.color = IN.color; // copy input color to output
    return OUT;
}

```

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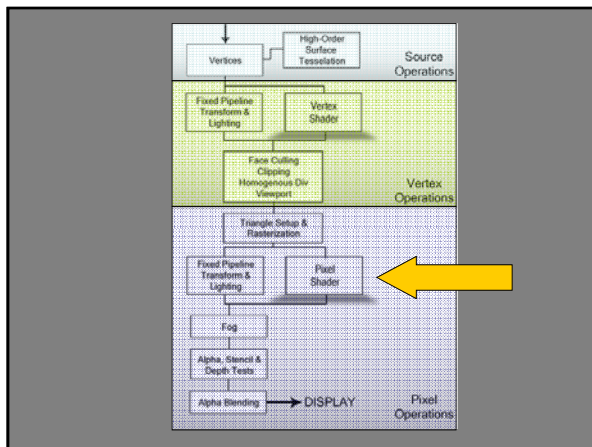
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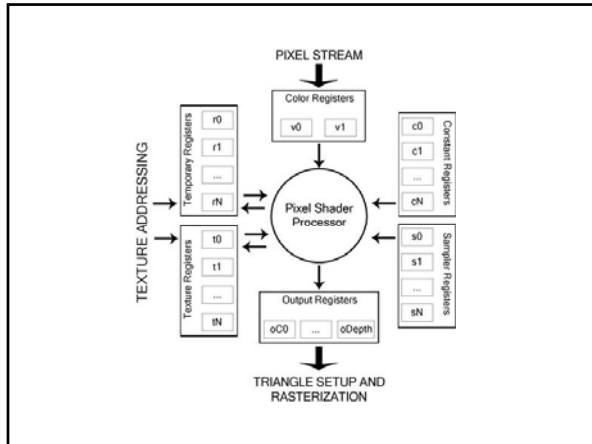
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### Pixel Shader

```

// Small Pixel Shader (Grayscale Converter)
// input pixel
struct PixIn {
    float3 color    : COLOR0;
    float3 texcoord : TEXCOORD0;
};
// output pixel
struct PixOut {
    float3 color : COLOR0;
};
// vertex shader main entry
PixOut main(PixIn IN, uniform sampler2D texture : TEXUNIT0) {
    PixOut OUT;
    float3 color = tex2D(texture, IN.texcoord).rgb;
    OUT.color = dot(color, float3(0.299, 0.587, 0.184)).xxx;
    return OUT;
}

```

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### Screen Effects

- Pixel shader renders to a temporary texture that it then processes with filters before returning the color values.

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Scene Effects: **Glow**



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Scene Effects: **Depth of Field**



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Scene Effects: **Distortion**



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Scene Effects: High Dynamic Range



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Lighting Models

- Shaders calculate new color values by applying various lighting models, involving parameters such as surface normals, light angle and view angle.

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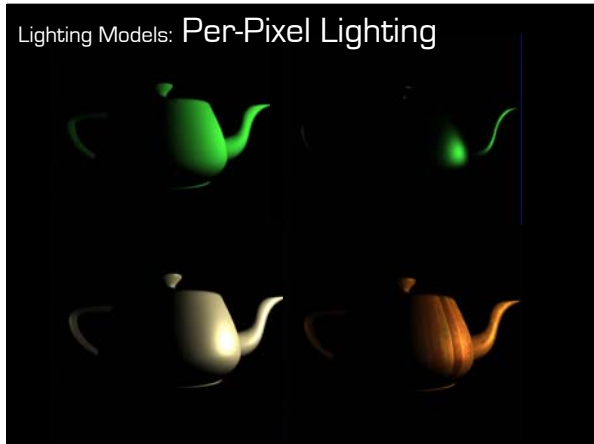
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Lighting Models: Per-Pixel Lighting



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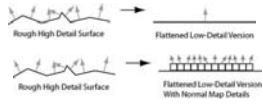
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### Lighting Models: Normal Mapping



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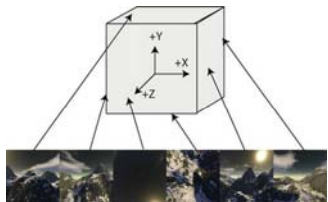
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### Lighting Models: Environment Reflection



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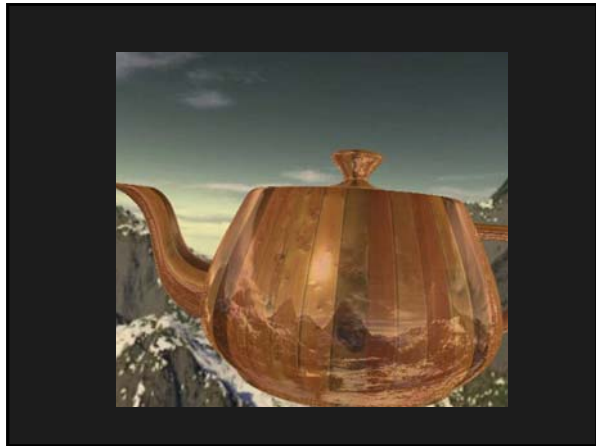
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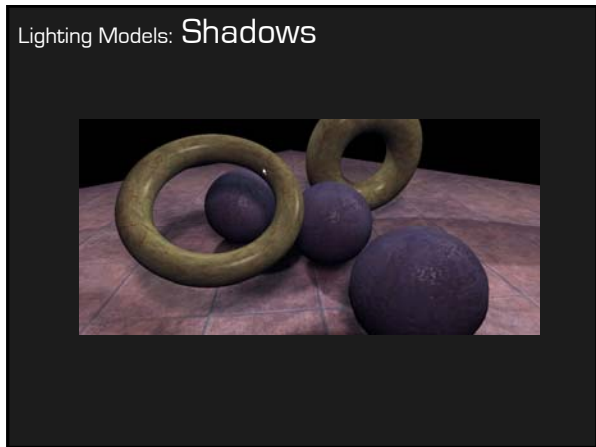
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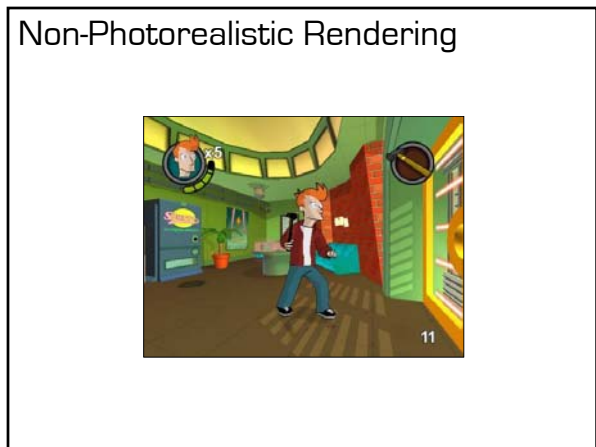
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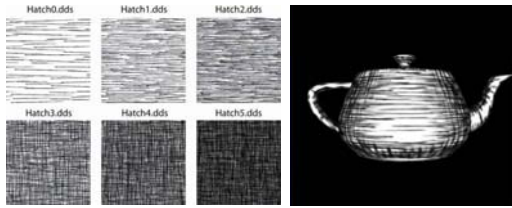
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# Non-Photorealistic Rendering



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