CMSC427
L08P6: Shading Strategies

Credit: slides from Dr. Zwicker

Today

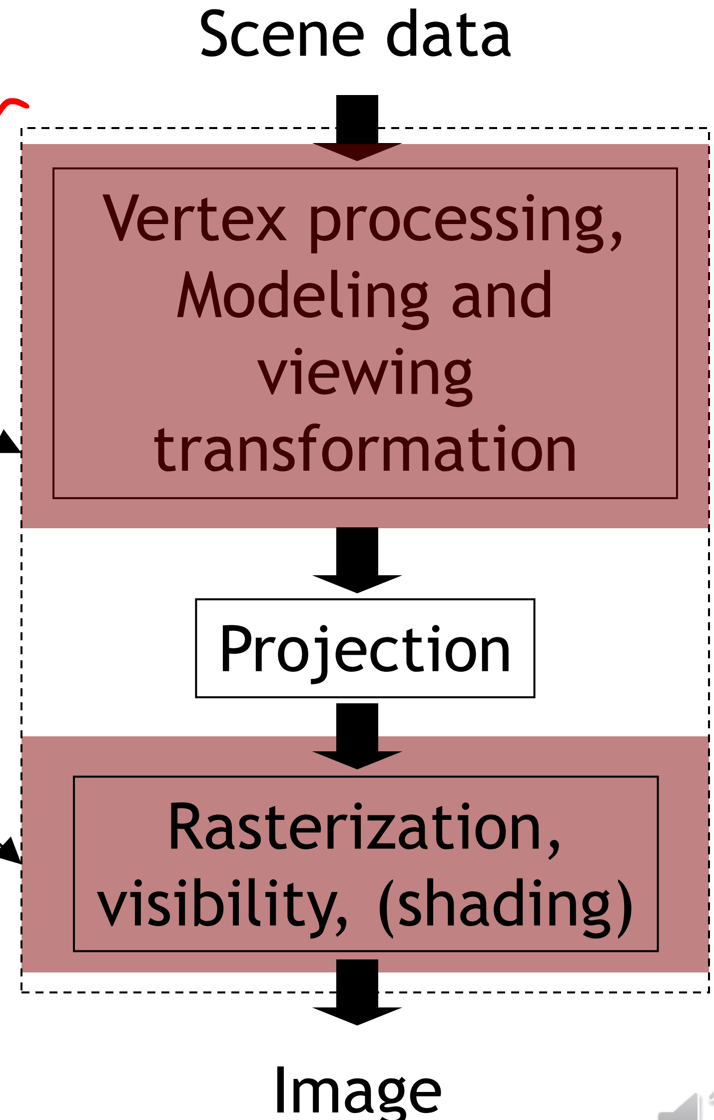
Shading

- Introduction
- Radiometry & BRDFs
- Local shading models
- Light sources
- Shading strategies

Per-triangle, -vertex, -pixel shading

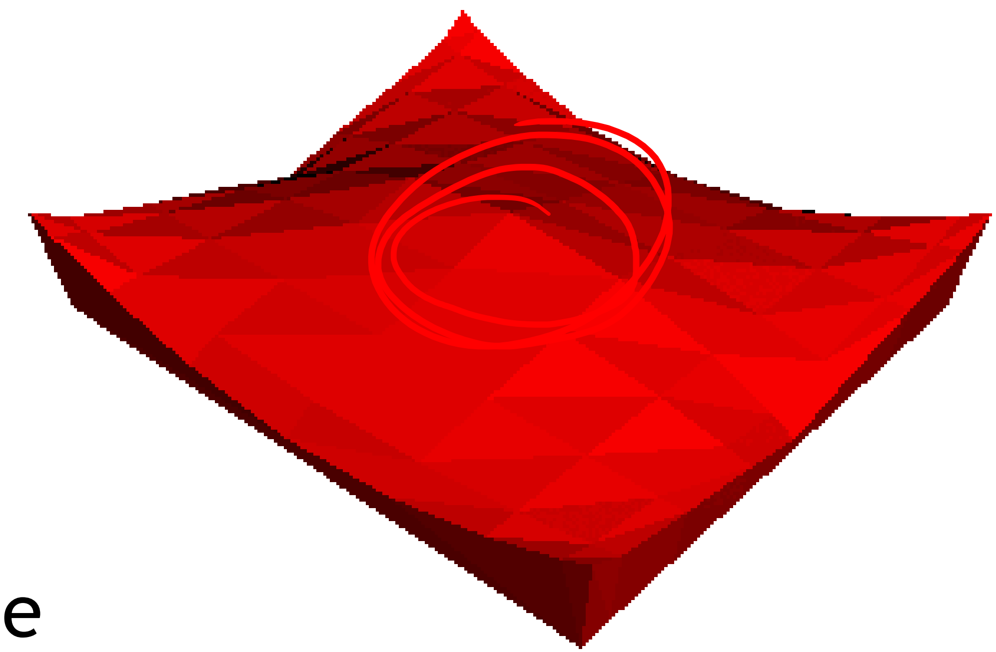
- May compute shading operations
  vertex shader
  3D → 2D
  - Once per triangle
  - Once per vertex
  - Once per pixel

fragment shader



Per-triangle shading

- Known as flat shading
- Evaluate shading once per triangle using per-triangle normal
- Advantages
  - Fast
- Disadvantages
  - Faceted appearance



Per-vertex shading

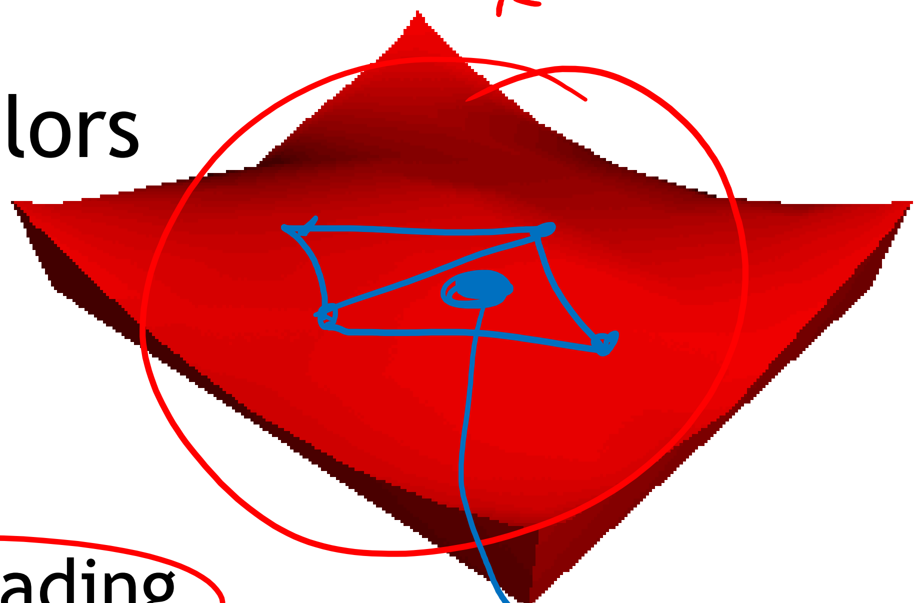
- Known as Gouraud shading (Henri Gouraud 1971)

vertex normals

B

R G

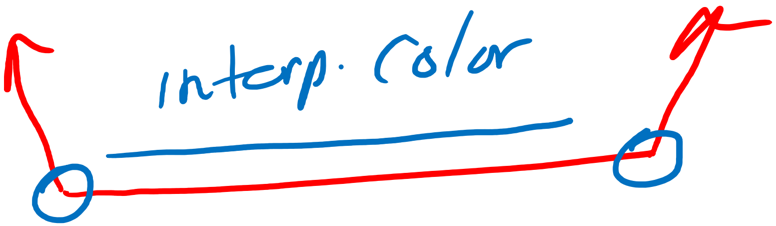
- Per-vertex normals
- Interpolate vertex colors across triangles
- Advantages
  - Fast
  - Smoother than flat shading
- Disadvantages
  - Problems with small highlights



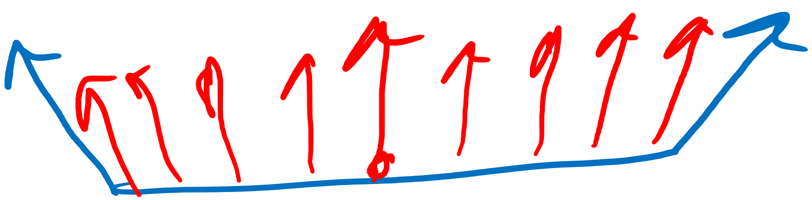
miss spec. highlight

Per-pixel shading

phong interpolation



Gouraud



Phong

- compute interp. normal @ each pixel
- compute shading equation at each

Per-pixel shading

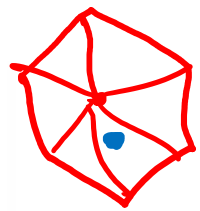
- Also known as Phong interpolation (not to be confused with Phong illumination model)
  - Rasterizer interpolates normals across triangles
  - Illumination model evaluated at each pixel
  - Implemented using programmable shaders (next week)
- Advantages
  - Higher quality than Gouraud shading
- Disadvantages
  - Much slower, but no problem for today's GPUs

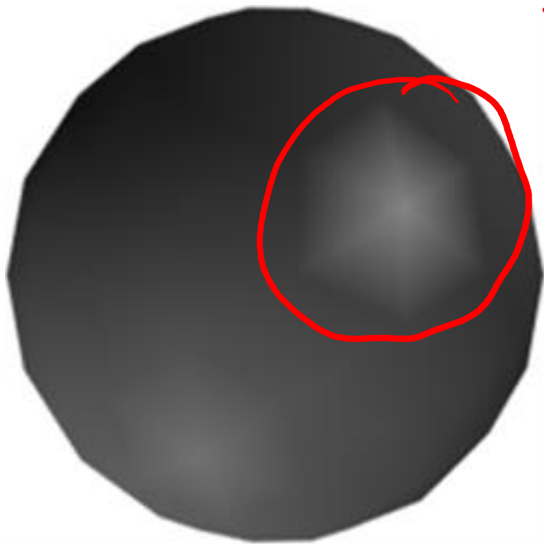
fragment shaders

Gouraud vs. per-pixel shading

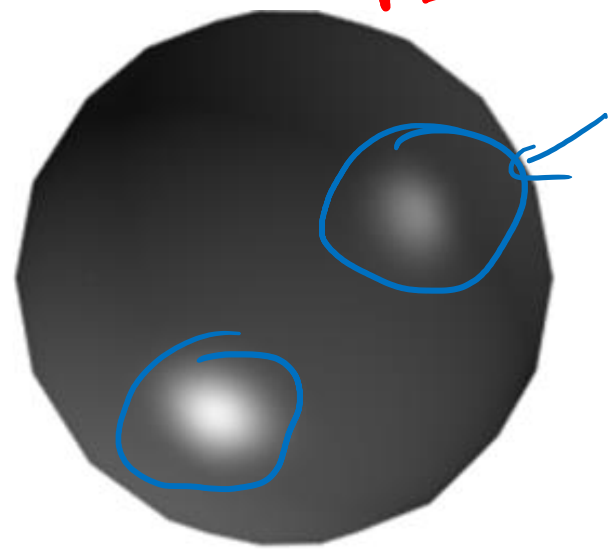
- Gouraud has problems with highlights
- Could use more triangles…

phong





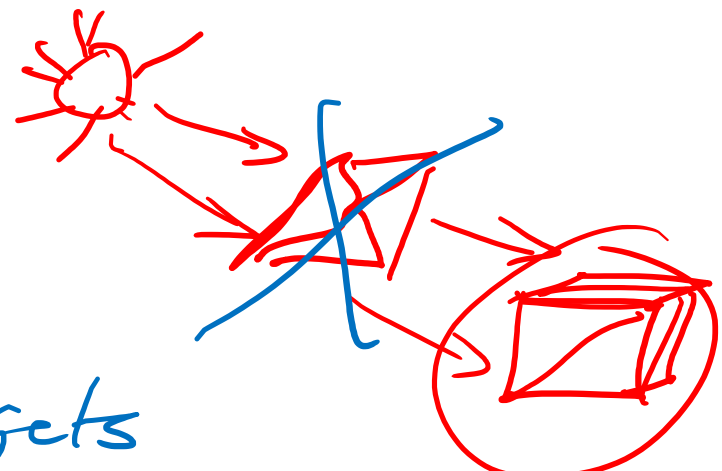
Gouraud



Per-pixel,
same triangles

What about shadows?

- Standard shading assumes light sources are visible everywhere
  - Does not determine if light is blocked
  - No shadows!
- Shadows require additional work
- Later in the course



local shading
each tri. gets
shading on its own

What about textures?

- How to combine „colors“ stored in textures and lighting computations?
- Interpret textures as shading coefficients
- Usually, texture used as ambient and diffuse reflectance coefficient k_d, k_a
- Textures provide spatially varying BRDFs
  - Each point on surface has different BRDF parameters, different appearance

Summary

- Local illumination (single bounce) is computed using BRDF
- BRDF captures appearance of a material
  - Amount of reflected light for each pair of light/viewing directions
- Simplified model for BRDF consists of diffuse + Phong/Blinn + ambient
  - Lambert's law for diffuse surfaces
  - Microfacet model for specular part
  - Ambient to approximate multiple bounces
- Light source models
  - Directional
  - Point, spot, inverse square fall-off
- Different shading strategies
  - Per triangle, Gouraud, per pixel