Some Real Time Rendering

Depth Buffer

Quick recap:
- Contains our -1/z (depth) in range 0..1s
- Painter’s algorithm
- Depth test & ordering

But:
- Z-fighting
- Lots of resolution wasted
- Improvements: negate, minimize f/n, logarithmic..
- And…. Transparent objects?
Normalized to $Z_{far} = 1$
Let’s start easy.

Fog

What:
- Simple, but very useful
- Increases with distance
- Approximation: final_color = lerp(pixel_color, fog_color, f)

Some examples for f:
- Linear
- Exponential (sq)
- Range check
- Tendency towards more physical oriented systems
Exponential fog

Exponential Fog squared
Silhouettes and edges

Let’s try:
- Just with geometry.. Render backfaces (Many other ways too)
- Just having the normal.. Surface angle
- Can also use the depth buffer.. Depth discontinuities
- Otherwise we go in the realm of image processing

But afterall:
- Mostly used for artistic purposes in NPR
- Usually combined with other techniques to achieve desired style

https://youtu.be/N4mkgbwLg7U?t=2645
Surface angle

Interactive Technical Illustration '98
Ambient Occlusion

Let’s start from..
- Ambient lighting
- No directional variance
- What about (local) shadowing?

Some ways
- Raycasting
- Baking
- Screen Space

http://www.cse.chalmers.se/edu/course/TDA361/
What it should look like

![Image of a cube and two spheres.](image1)

What it should look like

![Image of a street scene.](image2)

Solid Angle Arnold Renderer
Screen Space Ambient Occlusion

Local approximation

Use depth buffer

Generate random samples

Test depths

Sum positive contributions

http://frederikaalund.com/a-comparative-study-of

https://www.shadertoy.com/view/Ms33WB
http://alteredqualia.com/three/examples/webgl_postprocessing_ssao.html
Global Illumination

- Photorealism is the goal (might not be yours)
- Approximating the rendering equation
- Offline: Raycasting
- Offline: Pathtracing
- Environment mapping
- More..
Global Illumination

From a real time perspective:
- Approximated combining multiple techniques for the different components
- Direct Illumination
- Indirect Illumination (recursive here)
- Shadows
- Ambient Occlusion
- Reflections, refractions...
Current Solutions

VXGI
https://developer.nvidia.com/vxgi

http://simonstechblog.blogspot.ca/2014/10/

http://polycount.com/discussion/135481/radiosity-in-video-games