

Ambient Occlusion

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Ambient Occlusion

- Ambient Occlusion (AO)
 - "shadowing of ambient light"
 - "darkening of the ambient shading contribution"

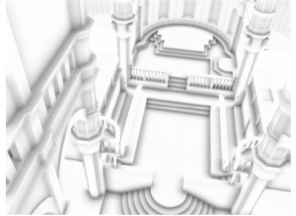


Image from Bavol and Sainz. <http://developer.download.nvidia.com/SDK/10.5/direct3d/Source/ScreenSpaceAO/doc/ScreenSpaceAO.pdf>

Ambient Occlusion

- Ambient Occlusion
 - "the crevices of the model are realistically darkened, and the exposed parts of the model realistically receive more light and are thus brighter"
 - "the soft shadow generated by a sphere light of uniform intensity surrounding the scene"

Ambient Occlusion

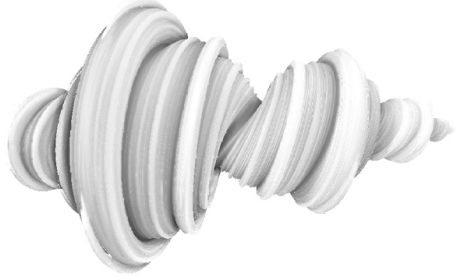


Image from Iñigo Quilez. <http://iquilezles.org/www/articles/ssao/ssao.htm>

Ambient Occlusion



Evenly lit from all directions

Ambient Occlusion

Global Illumination

Images courtesy of A K Peters, Ltd. <http://www.realtimerendering.com/>

Ambient Occlusion

- "the integral of the occlusion contributed from inside a hemisphere of a given radius R , centered at the current surface point P and oriented towards the normal n at P "

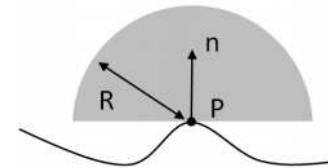


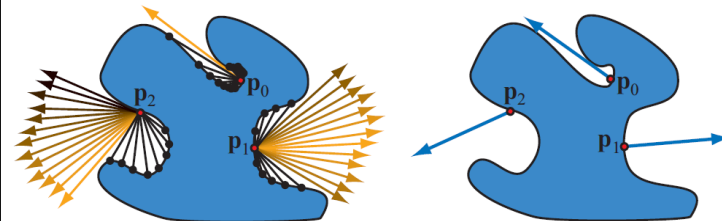
Figure 2. Hemisphere Ω around a surface point P .

Image from Bavoi and Sainz. <http://developer.download.nvidia.com/SDK/10.5/direct3d/Source/ScreenSpaceAO/doc/ScreenSpaceAO.pdf>

Object Space Ambient Occlusion

- AO does not depend on light direction
- Precompute AO for static objects using *ray casting*
 - How many rays?
 - How far do they go?
 - Local objects? Or all objects?

Object Space Ambient Occlusion



- Cosine weight rays
 - or use *importance sampling*: cosine distribute number of rays

Image courtesy of A K Peters, Ltd. <http://www.realtimerendering.com/>

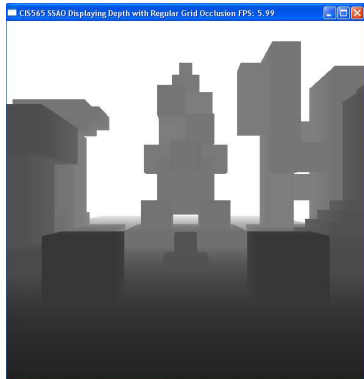
Object Space Ambient Occlusion

- Depends on scene complexity
- Stored in textures or vertices
- How can we
 - Support dynamic scenes
 - Be independent of scene complexity

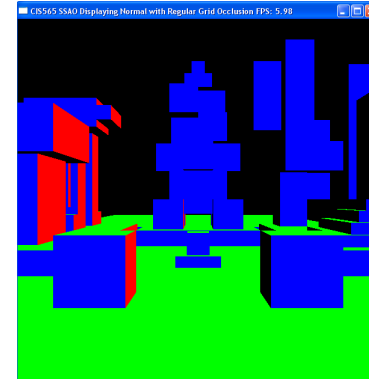
Screen Space Ambient Occlusion

- Apply AO as a post processing effect using a combination of *depth*, *normal*, and *position* buffers
- Not physically correct but plausible
- Visual quality depends on
 - Screen resolution
 - Number of buffers
 - Number of samples

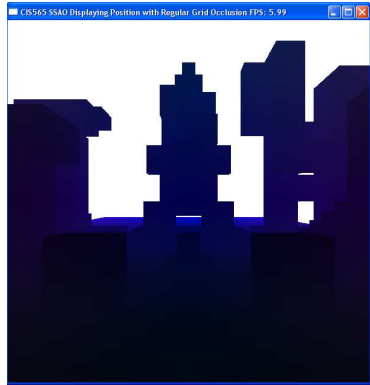
Depth Buffer



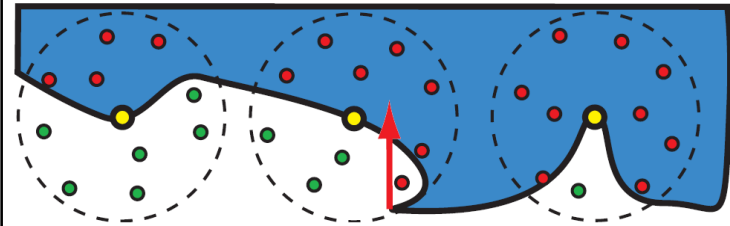
Normal Buffer



View Space Eye Position Buffer



Screen Space Ambient Occlusion



Images courtesy of A K Peters, Ltd. <http://www.realtimerendering.com/>

Screen Space Ambient Occlusion



Figure 15. Screen-Space Ambient Occlusion in a complete ambient lighting situation (note how occluded areas darken at any distance)

Image from Martin Mittring. http://developer.amd.com/documentation/presentations/legacy/Chapter8-Mittring-Finding_NextGen_CryEngine2.pdf

Screen Space Ambient Occlusion

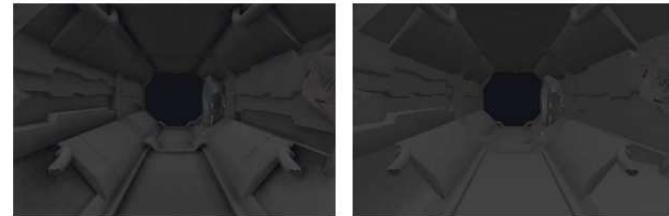
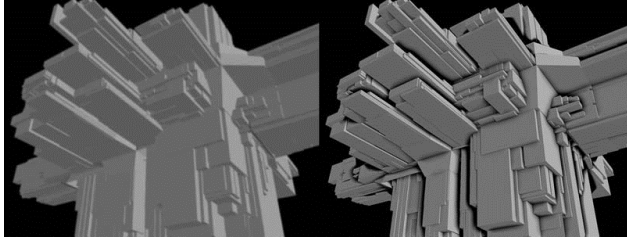


Figure 17. Sample scene B with special material setup to visualize SSAO (left: with SSAO, right: without SSAO)

Image from Martin Mittring. http://developer.amd.com/documentation/presentations/legacy/Chapter8-Mittring-Finding_NextGen_CryEngine2.pdf

Screen Space Ambient Occlusion



- Blur depth buffer
- Subtract it from original depth buffer
- Scale and clamp image, then subtract from original
- Superficially resembles AO but fast

Image from Mike Pan. <http://mikepan.com>