Ambient Occlusion Volumes
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Ambient occlusion occurs when nearby objects block indirect (“ambient”) light. This yields important visual cues, such as contact shadows and corner darkening. Previous AO estimation algorithms tend to be either fast or accurate. Our new Ambient Occlusion Volume (AOV) algorithm combines the quality of ray tracing with the performance of screen space methods [1,2,7].

The algorithm extrudes each scene polygon (fig. 1) into the ambient equivalent of a shadow volume [3]. It then rasterizes these volumes over depth and normal buffers. At each point within the volume, it decreases the indirect illumination at the corresponding pixel by the analytic form factor [4,5,6] weighted by the falloff function and surface opacity (fig. 2).

AOV results (fig. 2) exhibit comparable performance and substantially higher quality than previous real-time methods. Render time is largely independent of geometric complexity. It is dominated by fill time, so an optional bilateral upsampling post process enables even higher performance with graceful quality degradation.

Fig 1. A triangle and its ambient occlusion volume.

Fig 2. Urban street scene. The fence model has an α-matte.

![AOV results](image)

Fig 3. Quality comparison at 1280x720 for a 1.4 Mtri scene (courtesy of Vicarious Visions)

a) Ambient Occlusion Volumes (analytic): 31 ms
b, inset) AOV wireframe
c) Szirmay-Kalos et al., 256 samples/pix: 16 ms
d) Ray traced reference, 5000 samples/pix: 556228 ms

c) Szirmay-Kalos et al., 64 samples/pix: 61 ms

[4] Baum, Rushmeier, Winget, Improving Radiosity Solutions through the use of Analytically Determined Form-factors, SIGGRAPH 89