

Screen space ambient occlusion (SSAO)

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Introduction

SSAO is a pixel shader, used to make the image more realistic by adding shadows. It calculates how dark a pixel could be on surfaces that are close to each other.

Reformulation

Sampling the points

- sample points in the word space

G-buffer – first pipeline

We store information about:

- the fragment positions in the view space
- the normals in the view space
- the color of the fragments

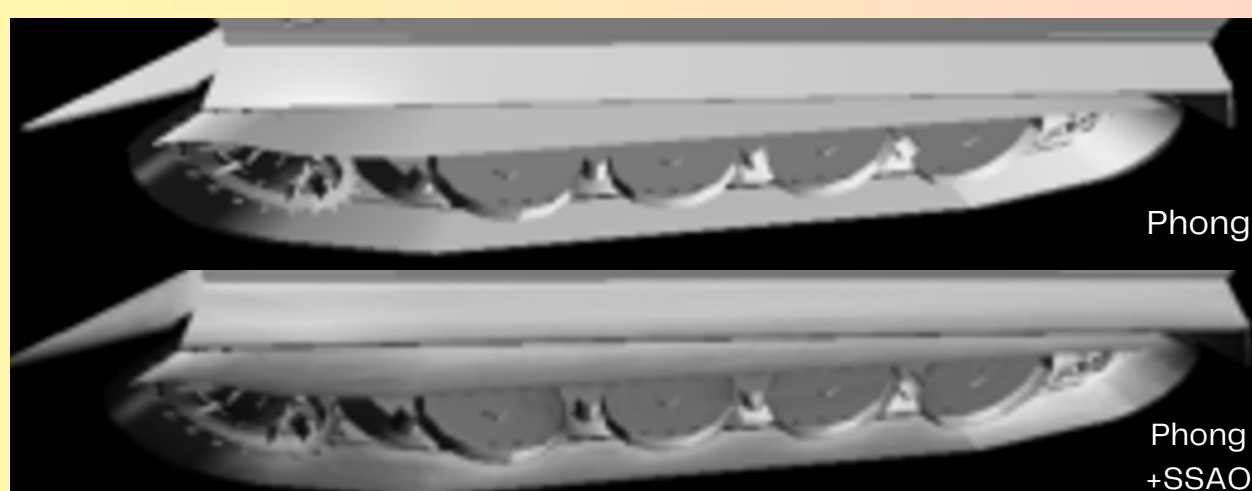
SSAO calculation – second pipeline

- the G-buffer is used
- calculation of the samples in the view space

Results

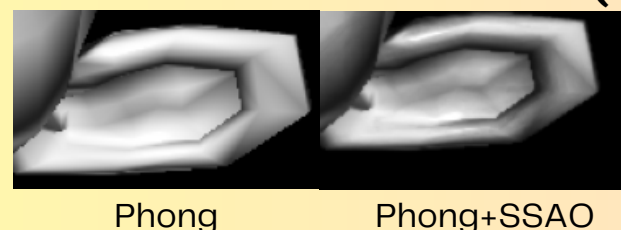
Here, we provide several models in two variants: one with phong and another with phong+ssao, to show the difference before and after applying SSAO.

Partial view of :Tank



More shadow details on the tyre of tank with SSAO

Partial view of : Suzanne(ear)

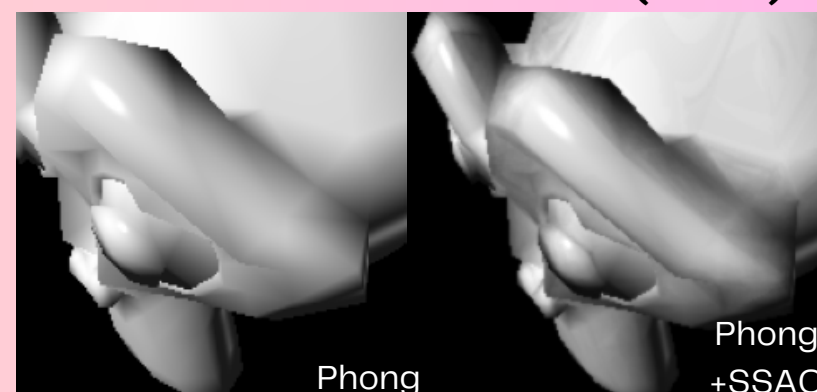


More shadow details on the inner edges of ear

Lucy



Partial view of : Suzanne(head)



More shadow details on the nose and forehead with SSAO

Motivation

- More realistic images
- Easier computation
- Independent from scene complexity
- No data pre-processing needed, no loading time and no memory allocations in system memory
- Works with dynamic scenes
- Works in the same consistent way for every pixel on the screen
- No CPU usage – it can be executed completely on the GPU
- May be easily integrated into any modern graphics pipeline

Limitation

- Time-consuming rendering
- Produces artifacts in some cases
- Careful and selective parameters need to be chosen (radius, number of samples)
- Locality and Blurriness

References

- <https://john-chapman-graphics.blogspot.com/2013/01/ssao-tutorial.html>
- <https://learnopengl.com/Advanced-Lighting/SSAO>
- <https://www.youtube.com/watch?v=7hxrPKoELpo&t=248s>

Improved versions

- GTAO – temporal stability, realism
- VXAO – voxel-based techniques
- HBAO+ – accuracy, visual quality, performance, adaptability, and integration