HORIZON BASED
AMBIENT OCCLUSION

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USER GUIDE

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1. Introduction

Horizon Based Ambient Occlusion (HBAO) is a post processing image effect to use in order to add realism to your scenes. It helps accentuating small surface details and reproduce light attenuation due to occlusion.

HBAO delivers **more accurate** AO compared to the other SSAO solutions available on the asset store, and this without any compromise on performances. This algorithm is **highly optimized** to use minimal GPU time and offers the best quality to performance ratio.

HBAO is compatible with both forward and deferred rendering, and artifact free with forward rendered SpeedTrees and foliage. Source code included in the package.

The effect is scalable in order to achieve the proper performances.
With Color Bleeding feature. HBAO is Gaia extension ready.

2. Requirements

HBAO is fully compatible with Unity 5 and newer versions.

Shader Model 3.0 compatible hardware is required (All Nvidia cards since GeForce 6 series, all AMD cards since R500/X1xxx Series and Intel since GMA 3150).

3. Usage

This image effect now comes with 2 variants: HBAO and HBAO_Integrated. HBAO is the normal post FX way, HBAO_Integrated as its name implies is integrated into the rendering pipeline with command buffers. Integrated mode should be less prone to problems with forward rendered shaders and allows PBR lit AO with "Before Reflections" integration stage.

In order to use this image effect, just add one of the 2 script variant to your main camera.
For this you can drag the HBAO.cs (or HBAO_Integrated) script on your camera or select it from the Add Component menu (Image Effects/HBAO).

Important notice: the placement of the HBAO component in your post FX stack is really important! It should theoretically be the first effect in the chain meaning it should be placed on top.
The above is no longer applicable to HBAO_Integrated.

In most scenarios, using **medium quality** with a **medium blur** and a radius near to 1 will yield very good results, this is what the normal preset uses.

You can use the presets as a starting point for your tweaks, but depending if you are targetting high performances vs beautiful AO you can use the following custom settings:
- high performances: low quality with wide blur, small radius,
- normal: medium quality with medium blur, medium radius,
- fine ao: high quality with narrow blur, large radius.

For even more performances you can use half or quarter resolution AO, but it generally introduces some objectionable flickering when the camera is in movement (and especially with fine geometry like foliage) so I recommend to turn it on only for specific use case.

Using color bleeding is heavier on performances as it requires an additional color sampling. The normal color bleeding saturation to use is 1.

4. Presets

The presets are here to help you as a guide on how to reach a specific level of quality or performance but once it is applied you can fine tune the settings as you please.

To apply a preset, first select it then click the Apply Preset button.

5. General settings

Integration Stage: this setting is only available in HBAO_Integrated, it is really important one. Depending on the rendering path used (Forward or Deferred) you have the choice between "Before Image Effect Opaque", "After Lighting" or "Before Reflections" (Unity 5.2+ required for "Before Reflections").
In forward rendering, you have no other choice than "Before Image Effect Opaque", this is expected as the 2 other stages are for the deferred rendering pipeline. In Deferred you can choose any stage, but the better is "After Lighting" or "Before Reflections". With "Before Reflections" you'll get fully PBR lit AO which is great for realism whereas with "After Lighting" the AO won't be lit.
Reference: http://docs.unity3d.com/Manual/GraphicsCommandBuffers.html

Quality (Lowest/Low/Medium/High/Highest): the quality used for the AO calculation. Higher the quality is, more sampling it requires and higher is the impact on perfomances.

Deinterleaving (Disabled/2x/4x): new technology introduced in update 1.5. To get a real benefit from this setting, you need to use quite high resolutions. Deinterleaving is better used with resolutions ranging from HD to UltraHD.

Note: 2x deinterleaving can introduce some banding due to its limited dither pattern, this can be hidden with higher quality and wider blur.

Resolution (Full/Half/Quarter): the resolution at which AO calculation should be performed. Not available when deinterleaving is enabled.

Note: can introduce some objectionable flickering when the camera is in movement (and especially with fine geometry like foliage) so I recommend to turn it on only for specific use case.

Noise Type (Dither/Random): the type of noise to use to reduce banding. Dither pattern is tiled uniformly across the screen so it have the benefit to stabilize the occlusion while in movement, which Random pattern can't do. Not available when deinterleaving is enabled (Deinterleaving uses dither pattern).

Display Mode: the way the AO is displayed on screen. You have the choice between normal and a few debug views.

6. AO settings

Radius: the AO calculation radius in world units.

Max Radius Pixels: the maximum AO radius in pixels, this can be used to limit how much the radius can grow for close objects.

Note: this can help to reduce the performance drop from close up views but keep in minds that it's a nonsense to get very low max radius pixels with large radiuses.

Bias: low tessellation geometry tends to make occlusion variations appear at creases and ridges, which betray the underlying tessellation. To remove these artifacts, the algorithm uses an angle bias which restricts the hemisphere.

Intensity: this value allow you to control how much the AO intensity is.

Luminance Influence: how much of the target pixel luminance is retained before to apply AO. This can help to make brightly lit areas to receive less occlusion. This setting is only available in the legacy HBAO version.

Max Distance: the max distance in world units at which AO can be drawn. You can use it to avoid occlusion at far distances and you should be careful to set this value lower to your camera far clipping plane to not waste performances.

Distance Falloff: the falloff distance of occlusion in world units. This prevents AO to appear cut in the max distance.

Per Pixel Normals (GBuffer/Camera/Reconstruct): generally GBuffer normals are preferable over Camera normals as it gives more precision, and hence less wobbles in movement. Reconstruct mode is the heavier on performance since it is calculated from depth, however you may find it's preferable to take this perf hit instead of the overhead of the scene being redrawn in Forward rendering.

Note: GBuffer mode is only available for Deferred shading.

Base Color: allow you to tint the AO, the alpha channel being unused.

7. Color bleeding settings

Enabled: should color bleeding be used. Please remember that using color bleeding is heavier on performances as it requires an additional color sampling.

Saturation: controls the saturation of the color bleeding. The normal saturation to use is 1.

Albedo multiplier: this value scales the albedo contribution of the color bleeding samples.

8. Blur settings

Amount (None/Narrow/Medium/Wide/Extra Wide): this lets you control how much to blur the occlusion.

Sharpness: sharpens AO around depth discontinuities. This is preferable to use the maximum value to get a clean sharpened blur.

Downsample: downsample the blur passes.

9. Support

In case you need help, you can use the foum thread:
http://forum.unity3d.com/threads/horizon-based-ambient-occlusion-hbao-image-effect.387374/

For any support request, please drop me an email at jimmikaelkael@gmail.com