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1. What is VertexDirt?

VertexDirt is a Unity plugin for baking ambient occlusion to vertex colors. It not uses lightmaps, no need of unwrapped uv coordinates. Good for mobile game development. VertexDirt is an offline technique, which means it is not updating the results realtime, you have to ‘bake’ it instead in the Unity Editor. The way of baking is similar to the Unity Lihtmapping baking.

What is ambient occlusion?

Ambient occlusion is a general term referring to a method to approximate how much indirect lighting a part of a surface recieves. Ambient Occlusion is a non realistic technique, but adds realism to your scenes. This is a commonly used technique in games. The idea behind ambient occlusion is that in nature, bouncing light reaches occluded areas (e.g. the ground under a car) less often compared to open areas, which lead to dark shadows under the car even in overcast day.

What are vertex colors?

Vertex colors are part of the data structure of a mesh, just like the vertex positions or the vertex normals. This array of colors are contains only white colors by default. It can be used for different purposes. VertexDirt uses vertex colors to store the baked AO. Storing and using colors this way is fast and have a small memory and storage footprint.

Shader requirements

In Unity, vertex colors are only visible if you using shaders which supports them. Although the Default and Standard shaders doesn’t supports vertex colors, it is really simple to add this feature to them. You can find vertex color shader in the Unity Forums ans Asset Store too. VertexDirt package also bundled with some sample shaders to start with.

2. Usage quickstart

VertexDirt is a very simple, easy-to-use plugin. No need of colliders or special setup. To bake with VertexDirt, just follow these steps:

1. Select objects you want to bake.
2. Open Tools/Zololgo/VertexDirt/Bake Ambient Occlusion window
3. Set the parameters as you wish.
4. Hit the bake button and wait.
5. If you are not satisfied with the results, just tweak the settings and repeat baking.

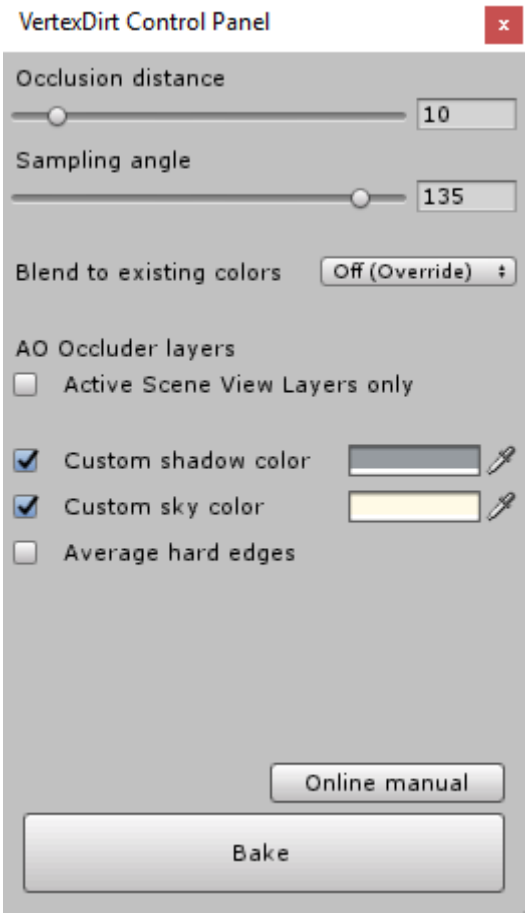
Sample scenes

You can find several sample scenes bundled with VertexDirt in the \Plugins\VertexDirt\Samples' folder. These scenes helps you to learn using VertexDirt.

Scriptable rendering pipeline

You can bake AO with VertexDirt even if you are using Universal RP, HDRP or other Scriptable Render pipeline. You can find the URP test scene in the Samples scenes.

3. VertexDirt settings explained



Occlusion distance
The distance in units after the geometry clipped.
Sampling angle
Narrow angles gives strong contrast and sharp gradients, wider angles gives smoother, faded results.

Blend to existing colors
If the meshes already have vertex colors, you can multiply them with the baked colors.

AO Occluder Layers - Active Scene View Layers only
If enabled, then only the renderers in Scene View layers act as occluder (otherwise every active renderer).

Custom shadow color
The color of the completely occluded areas. Uncheck this property if you want default black shadow color.
Custom Sky color
The color of the unoccluded areas. Uncheck this property if you want default white sky color.
Average hard edges
Averages the normals of vertices in the same position, giving smoother results.

4. Modeling guidelines

This guide specify some modeling tricks to achive better results when using per-vertex ambient occlusion. Altough this chapter has written for the Unity VertexDirt plugin, these tips could useful for any other application where you can bake indriect lighting to vertex colors (e.g. 3D Studio Max).

Ambient Occlusion is a popular way to bring indirectional lighting and shadowing effects into your realtime 3D scenes. There are basicly two different approaches, you can pre-generate the AO and store it somehow for use it in your geometry, or you can calculate the AO in realtime through a post image effect (e.g SSAO).

The per-vertex ambient occlusion stores the genereated AO data in vertex colors. This is a mobile friendly approach as not require additonal images, specific unwrapping or heavy calculations. Although it requires good topology and more detailed geometry as usual.

Some examples when per-vertex ambient occlusion is a GOOD idea:

- generally for mobile applications / games, where small file size and low system requirements is important.
- for organic models, beacuse these models usually already have good topology and curvy surfaces.
- for detailed / subdivided models as they usually have enough vertices for good results.
- models textured with texture atlases or any other examples when uv overlapping happens.

And some cases when per-vertex ambient occlusion is a BAD idea:

- for extremely low poly models
- when the models are completely unwrapped and / or lack of UV overlapping (in that case, you can simply use regular lightmapping)
- when vertex-colors are not supported or already taken into account (for texture blending for example).

So it needs more vertex than usual, why this is a good idea on mobile?

- VertexDirt bakes to the vertex colors. reading them is possible in the shaders's vertex program, so you can have lighter fragment/surface program.

Differences between Beast Lightmapping and VertexDirt

- VertexDirt only bakes AO, can not calculate direct lighting, or bouncing like Beast do, just approximates the indirect lighting.
- VertexDirt writes to the vertex colors. this requires a new mesh instance in Unity right now, but not require textures.
- VertexDirt can bake objects one by one, in any time without ruining the previous bakes.
- Vertexdirt's quality depends on the mesh's topology. Sometimes it needs more attention to get good results.

5. Save baked meshes

You may want to save the baked meshes for using them elsewhere. One way to do that is to prefabing the baked gameObjects. Other way is to use the VertexDirt Save meshes tool. It is also useful when you want to make your baked models independent from VertexDirt (normally, VertexDirt adds a ColorHandler component to the baked GameObjects).
To use the Save meshes tool, follow these steps:

1. Select one parent GameObject which contains the baked meshes.
2. Open Tools/Zololgo/VertexDirt save meshes
3. Set the path for the new mesh assets.
4. Hit the Save meshes button.