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Introduction:

The Ambient Lighting/Probe pack was built from the ground up to provide designers with a cheap way to add ambient lighting/GI to environments. While it has its limitations, (which will be covered later in this document) it also overcomes some of the weaknesses that regular point lights suffer from. The GI features in this pack do not offer an automatic Global Illumination system, it provides light probes that can dynamically gather the environment and update the lighting to give more of a localized GI solution.

Media:

Ambient Lighting

Dynamic GI Video

Setup:

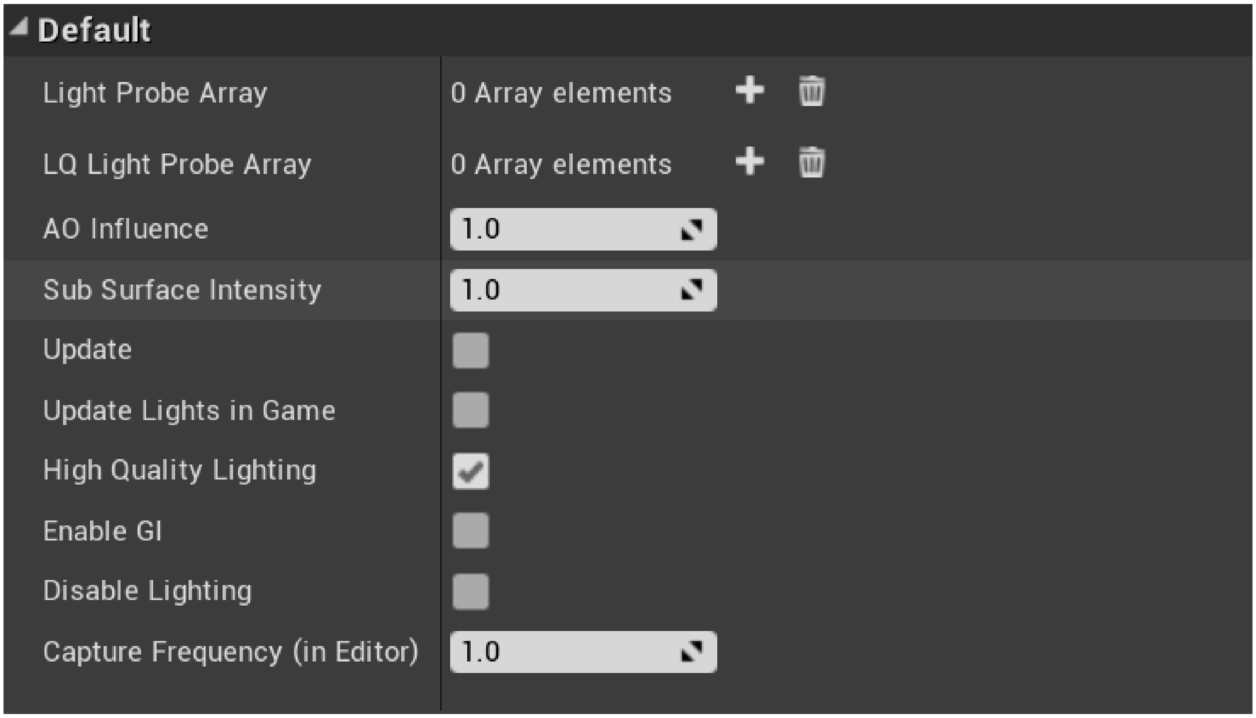
1. Place “Light_ProbeController” Actor in map
2. Place “Light_ProbeBlutility” Actor in map
3. Select the Light_Probe Blutility Actor you placed in map and under the “Light Controller Reference” setting input the Light_ProbeController actor you just placed.

4. Place “LightProbe” Actor in map
5. Each Light Probe Actor will have unique color, radius, brightness, GI, and falloff settings all of which will work exactly like a regular unshadowed point light. Each Light Probe Actor also has a “Visualize Radius” option to help you see the render distances for each light.
6. If you want to update these actors positions/colors etc during gameplay be sure to tick the “Update Lights in Game” option. This will incur a very small cpu cost because of the blueprint ticking but will not cost any extra to render.

If you have GI enabled on the light probe actor an arrow will appear, you must point this at the surface you want to the light probe to capture from!

Settings:

Light_ProbeController Settings:



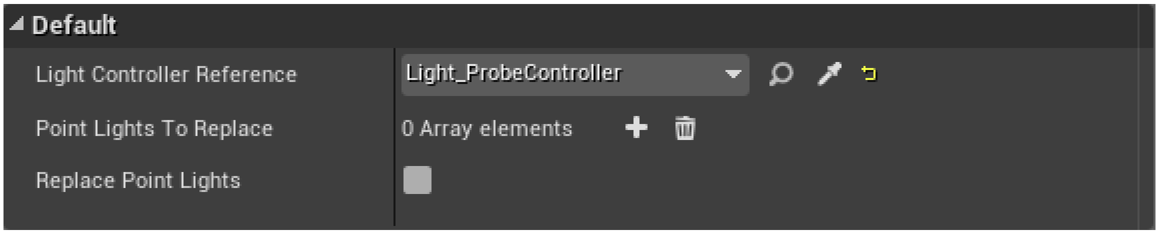
Default

Light Probe Array	0 Array elements
LQ Light Probe Array	0 Array elements
AO Influence	1.0
Sub Surface Intensity	1.0
Update	□
Update Lights in Game	□
High Quality Lighting	☑
Enable GI	□
Disable Lighting	□
Capture Frequency (in Editor)	1.0

1. Light Probe Array - No need to touch this setting, it is fully automated by the blueprint but is simply visible to the user as a way to visualize how many light probes are currently in the level. Only lights using the High Quality lighting will appear in this array. This only updates in game.
2. LQ Light Probe Array - Same as the above setting with the exception that only Low Quality Lights will appear in this array.

3. AO Influence - Increasing this value will increase the amount of influence AO has on the lights effect.
4. Sub Surface Intensity - Sets how strongly the light probes will effect surfaces that use subsurface scattering.
5. Update - Only really needed if your not using the “Light_ProbeBlutility” actor, or running 4.19 in which case Blutility does not work properly. This basically tells the blueprint to update all Light Probe info.
6. Update Lights in Game - Only use if you need to update the lights dynamically in game, color/location/intensity etc… This will only increase the cpu cost of the system by a small amount due to the ticking that has been enabled by the blueprint, but the actual rendering costs of the lights will not increase.
7. High Quality Lighting - Generally you will probably want this enabled as it will make the light probes look very much like a regular point light actor will. Disabling this option will disable SubSurface Scattering, AO Influence, and will cause the light probes to cast light on the backfaces of surrounding surfaces as it no longer takes world normals into account. Could be useful for getting really soft lighting in large outdoor environments or large open forests etc. Essentially though disabling this will cut the cost of rendering the light probes by about half.
8. Enable GI - This will globally enable/disable the built in GI system for light probes. This can still be enabled/disabled per light probe but this must be enabled for any of the light probes to use GI. Enabling this option will increase the cost of this system by a decent amount.
9. Disable Lighting - This will globally disable the rendering of all lights. This should really only be used if you want to start out the game with the lighting system disabled or just want them disabled in editor. If you want to toggle the lighting system on and off during gameplay dynamically you will want to call the “Toggle Lights” custom event on this actor through blueprint/level blueprint.
10. Capture Frequency (InEditor) - This option will only work if the above “Enable GI” option is enabled. It allows designers to set the frequency that light probes will update their captures while working in editor. Lowering this will cause the lights to capture more often but will hurt framerate. Setting this value to 0 will pause the light captures entirely while in editor.

Light_ProbeBlutility:



◢ Default

Light Controller Reference: Light_ProbeController

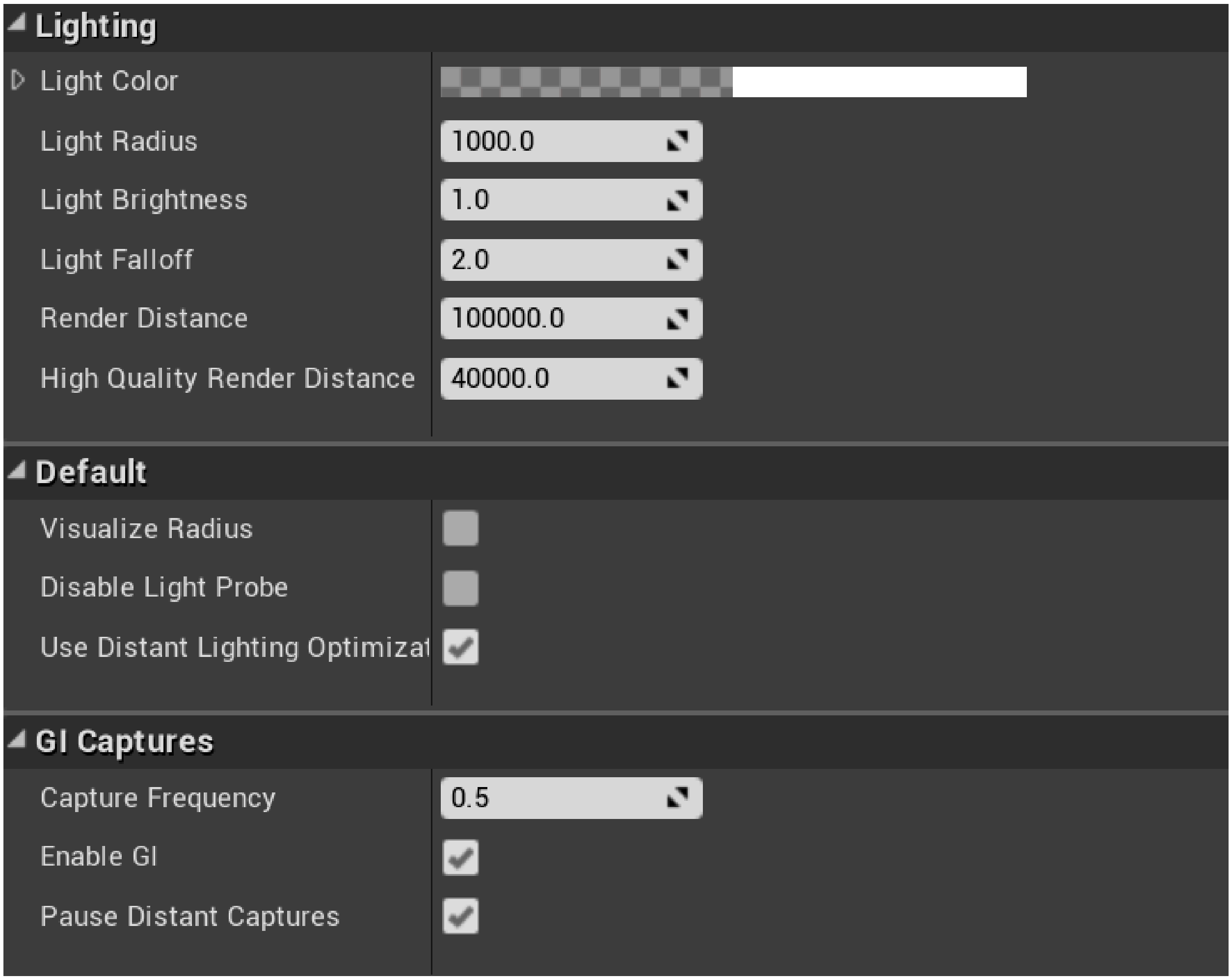
Point Lights To Replace: 0 Array elements

Replace Point Lights: □

1. **Light Controller Reference** - This must be set in order for the Light_ProbeController actor to update the light probes in real time within editor. It basically just tells the blutility which Light_ProbeController actor to update (Only one supported at this time)
2. **Point Lights To Replace** - This blueprint has built into it the ability to replace regular point lights with Light Probes. Use this option to add any point light actors you want replaced before clicking the following two options.
3. **Replace Point Lights** - Will replace any Point Light Actors you have in the “Point Lights To Replace” Array with light probe actors. This option will skip any point lights set to cast dynamic shadows, or with the “Use Inverse Squared Falloff” option as the light probes do not support either of these features.

The lightprobe blutility actor will only be used while working in editor, it simply helps designers visualize the lighting system while they work. There is a limit of 244 light probe actors that can exist in the editor at any given time, any actors added after this number is reached will simply not appear **(This is only true in editor as in game they are dynamically loaded and unloaded depending on if they are on screen or not)**. The performance you get from this system while in editor will be much lower than what you see in game as the system while in game only renders lights that are on screen, something that can’t unfortunately be done within editor so it must render all lights within the editor.

LightProbe:



Lighting

Light Color	
Light Radius	1000.0
Light Brightness	1.0
Light Falloff	2.0
Render Distance	100000.0
High Quality Render Distance	40000.0

Default

Visualize Radius	□
Disable Light Probe	□
Use Distant Lighting Optimizat	☑

GI Captures

Capture Frequency	0.5
Enable GI	☑
Pause Distant Captures	☑

1. Light Color - Adjusts the color of this light probe. If GI is enabled on this actor the light color value will effectively work as a light hue adjustment on top of any

captures. Keep this value white while using the GI feature if you want just raw values from the environment.

2. Light Radius - Adjusts the radius of this light probe
3. Light Brightness - Adjusts the brightness of this light probe
4. Light Falloff - Adjusts the falloff of this light probe
5. Render Distance - Sets the point at which this light will stop rendering. This only works while in game!
6. High Quality Render Distance - Sets the distance at which this light will toggle between a High Quality and Low Quality Light. Must have “Use Distant Lighting Optimizations” enabled or else the light will remain in High Quality mode at all distances.
7. Visualize Radius - Enables the designer to visualize the different radiuses used on this light probe. Red sphere = Light Radius, Yellow sphere = High Quality Render Distance, and Green sphere = Render Distance.
8. Disable Light Probe - Allows designers to turn off this light probe, works in editor or during gameplay.
9. Use Distant Lighting Optimizations - Toggles this lights ability to automatically switch to a low quality lighting in the distance(Only works while in game) Will only render low quality lighting when the camera is between the “Render Distance” and “High Quality Render Distance”
10. Capture Frequency - Controls how frequently the light probes update while in game. Lower values will hurt FPS more, higher values will update less often but give higher fps. Setting this value to 0 will pause updates for this specific light if you don’t need it to ever update during gameplay.
11. Enable GI - This enables the GI features on this specific light probe. “Enable GI” must be enabled on the light probe controller as well or this will have no effect.
12. Pause Distant Captures - “Use Distant Lighting Optimizations” must be enabled for this feature to work. It will basically pause the updating of the light captures once the player is far away enough away for the Low Quality light to be enabled. Captures will always pause when off screen, outside of render distance, or when being occluded. This is more an optimization for onscreen lights that are far off.

The Icon used on the Light Probe actor will show the color the light is using if GI features are turned off, if GI is enabled it will show a combination of the lighting it is capturing and the color value set by designer and should accurately depict what the light is truly giving off.

Features:

1. Automatic performance switching built into Materials/Blueprint.
2. Built in tools that allow designers to replace Point Light Actors with light probes, settings automatically carry over when replacing.
3. High/Low Quality settings, Low Quality costs about half as much.
4. Blutility system that maintains and updates all of the light probes/materials/settings automatically.
5. Light Probes work exactly like regular non-shadow casting point lights and light the environment almost exactly the same(If your used to lighting environments with point lights this will be exactly the same and look the same)
6. Ability to update lights color/position dynamically while in game, this adds only a minimum cost from the blueprint updating but will not increase the actual cost of rendering the lights at all.
7. Light Probes will only render when on screen, offscreen and occluded light probes will not render.

GI Features:

1. Dynamically capture surrounding environment and inject it into lights
2. Built in performance optimizations to allow for pausing captures, increasing/decreasing capture frequency, as well as the ability to have the light captures pause when in the distance.

Limitations/Strengths:

Limitations:

- Currently you can only see 244 light probes at a time while in editor. This restriction is not a problem in game as the number of light probes dynamically changes depending on which ones are within render distance and if they are on screen or not.
- This system does not work on mobile devices that are limited to ES2.
- The lighting system does not cast shadows

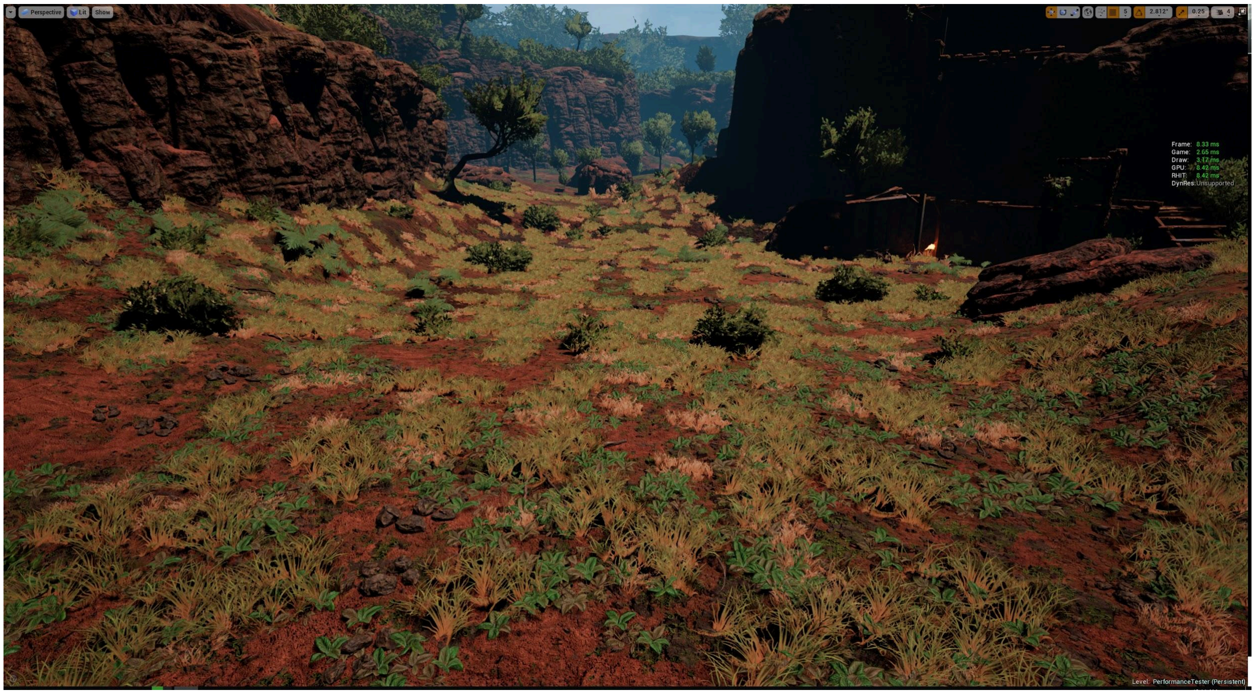
Strengths:

Ambient Lights have a flat rendering cost - Regardless of how large of a radius is used, or how many you have actually overlapping the same area the cost will remain the same.

Ambient Lights don’t show up as a bright point in reflections - Trying to use point lights to place ambient/bounce lighting can sometimes cause the point lights to awkwardly show up in reflective surfaces such as water/mirrors/glass etc…. Light probes allow designers/artists to place much softer ambient lighting.

Performance Profiling:

Empty level before point lights/light probes have been added for comparison, without any point lights or ambient lights the gpu is taking 22.20ms to render this scene on an Nvidia 980TI.



```
Frame:   8.33 ms
Game:    2.65 ms
Draw:    3.17 ms
GPU:     8.42 ms
RHIT:    8.42 ms
DynRes:Unsupported
```

Level: PerformanceTester (Persistent)

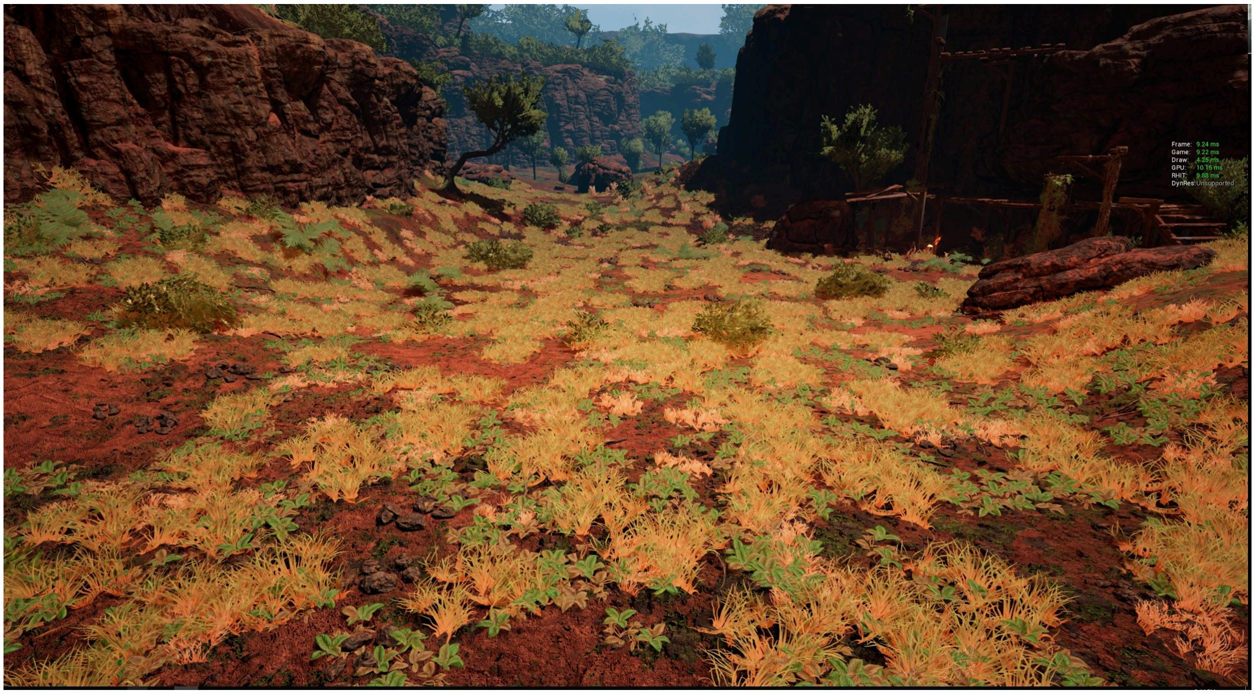
All point lights and probes are unshadowed and use 4,000 radius

Lights were not setup to look good, just thrown in for quick testing.

32 Lights:
https://imgsli.com/NDUyOA

64 Lights
https://imgsli.com/NDUyOQ

64 Lights GI Features enabled



```
Frame:   9.24 ms
Game:    9.22 ms
Draw:    4.25 ms
GPU:     10.15 ms
RHIT:    9.88 ms
DynRes:Unsupported
```

64 Lights Low Quality

```
Frame:   8.94 ms
Game:    8.94 ms
Draw:    3.30 ms
GPU:     8.94 ms
RHIT:    8.95 ms
DynRes:Unsupported
```

Help:

If you have any questions or have any issues with this pack feel free to reach out to me!
Email - evilmrfrank@yahoo.com
Twitter - https://twitter.com/evilmrfrank