

World Optimization Ver.2  
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I've noticed with the large number of new people coming into vrchat there have also been people wanting to create their own worlds. But are having performance problems. This document is to help do some of the basics of world optimization. To get the best results is to learn hopefully this document will help you look in the right areas for that.

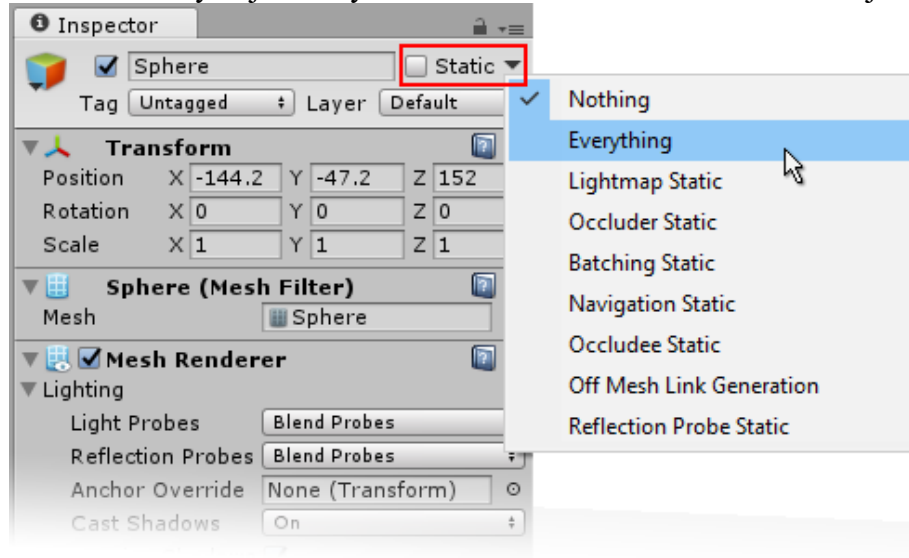
The main concept for optimizing a world is to reduce realtime calculations. So reducing draw calls or precalculating objects will reduce what needs to be calculated in game. The performance profiler in unity will let you analyze the performance of your scene.

- Static objects
- Baked lighting
- Occlusion culling
- Lod
- Instancing/Prefab
- Texture size/Polycount
- Physics
- Shaders
- Audio
- Vrchat

## Static Objects

source: <https://docs.unity3d.com/Manual/StaticObjects.html>

one of the basics is to make any objects in your world that don't move to a static object.

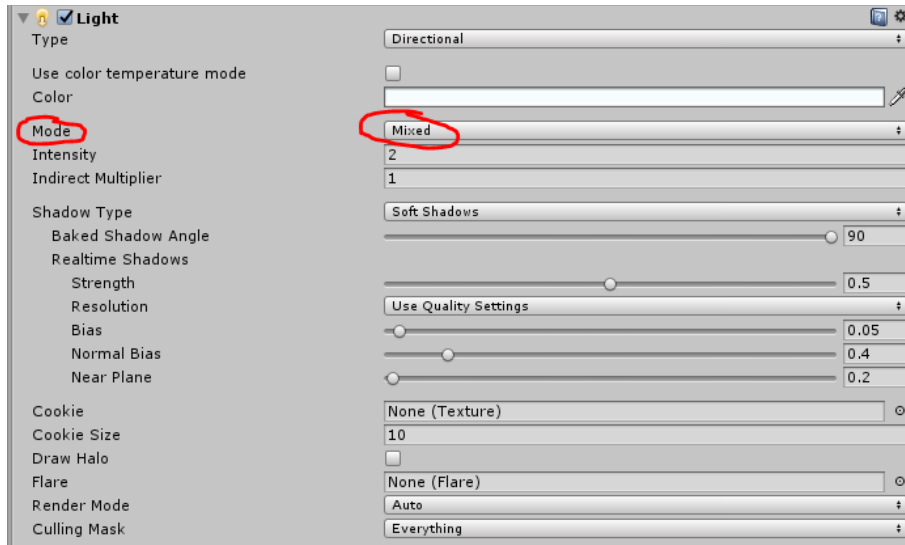


If this is not checked the object is classified as dynamic making the game recalculate it every frame.

## Baked Lighting

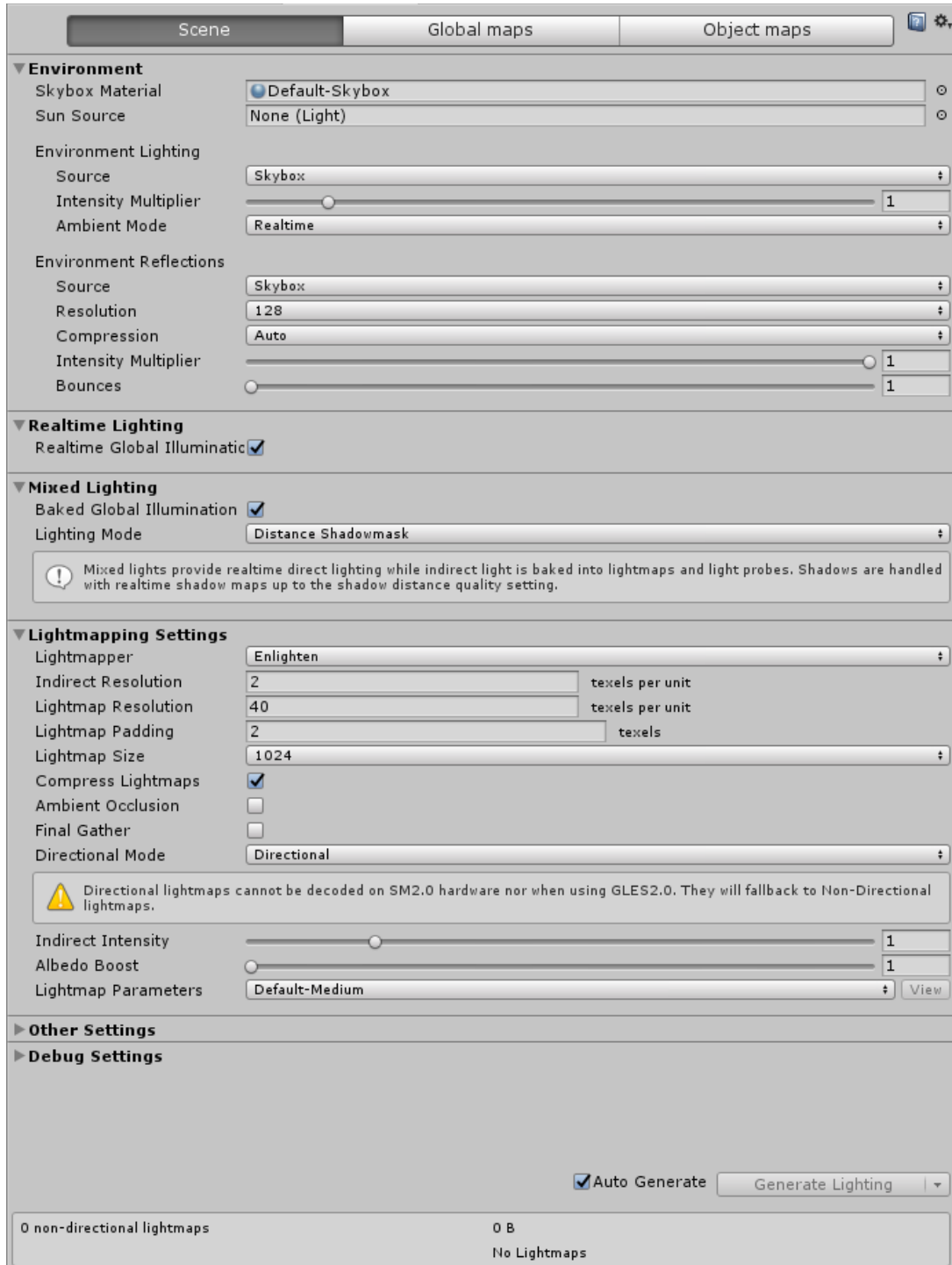
source: <https://docs.unity3d.com/Manual/LightMode-Baked.html>  
<https://docs.unity3d.com/Manual/LightProbes.html>

This can only be taken advantage of if the object is static. If the object is dynamic the object lighting will not be baked. The lights in unity usually have 3 modes real-time, mixed, and baked. The real-time lighting should only be used if the light source itself is moving around. Other than that it should be mixed or baked. Mixed lighting it bakes static objects but also lights dynamic objects. Where baked lights will only light static objects not lighting dynamic objects. But you can set up Lightprobes with baked lights which will light dynamic objects and avatars. The most important part about baking lights is to actually bake the lights in the light settings.



Source: <https://docs.unity3d.com/Manual/GlobalIllumination.html>

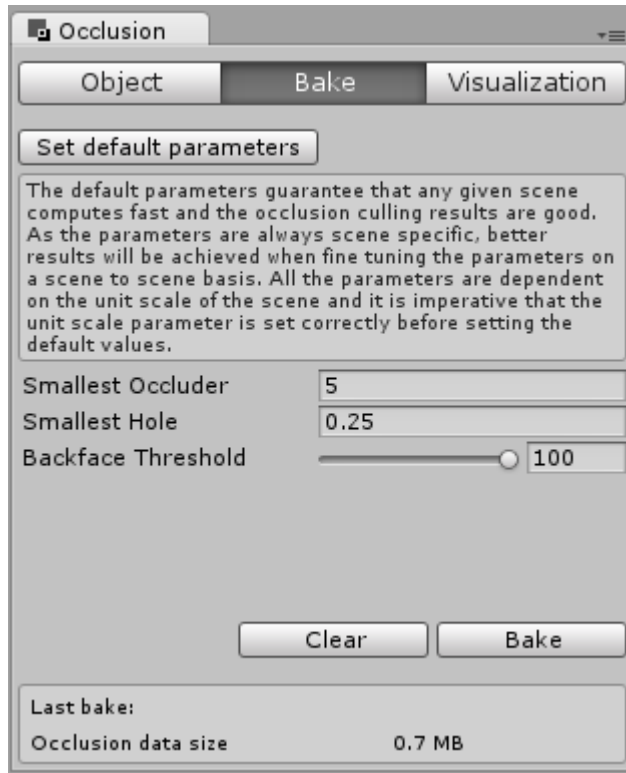
To have more control over the lighting there is a light settings window which you can open by going to Windows>lighting>settings. I would suggest reading up what all the settings do but some of the basics is to have realtime global illumination off. also changing the resolution of your baked light mapping in the lightmapping settings area. The default is 40 texels but 20 or 10 is ok. Also making the lightmap size to 2048 will help with draw calls.



## Occlusion culling

Source: <https://docs.unity3d.com/Manual/OcclusionCulling.html>

This can help in a big map or a map with a lot of objects. Occlusion culling makes it so objects not seen by the camera will not be rendered. So all your GPU power is being used on what actually being seen. This can be accessed by going to Windows>Occlusion culling. Usually, the default settings will be fine so just click bake. A warning this does cause more processing for the cpu so smaller maps will most likely not need this.



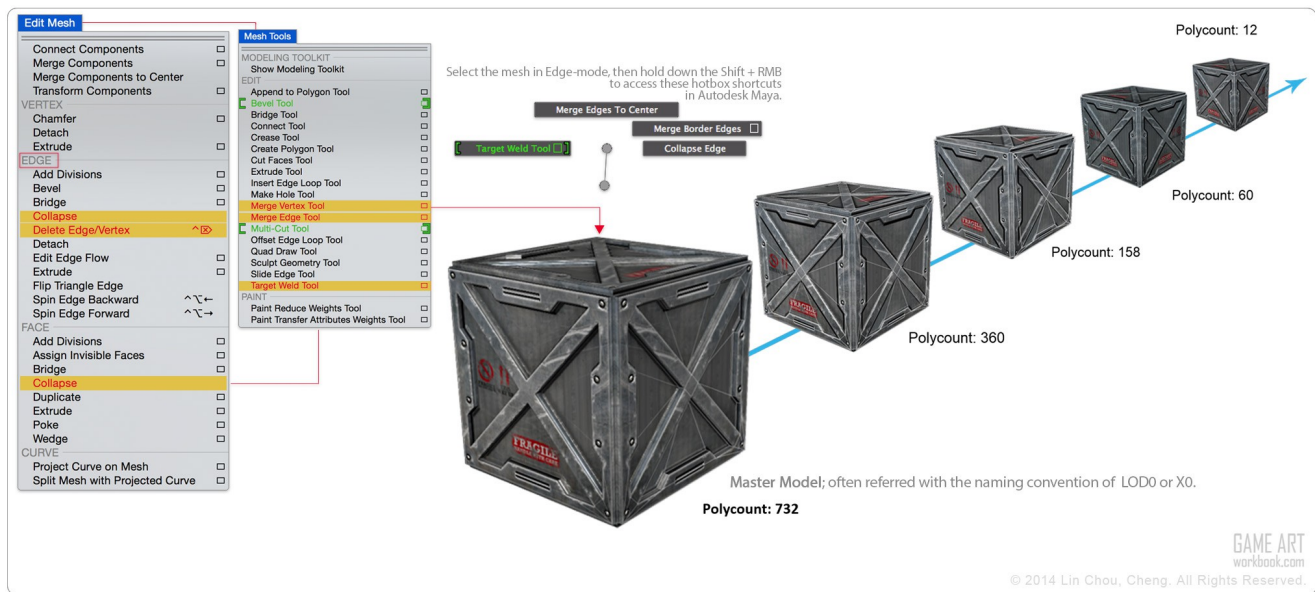
## Lod (level of detail)

source: <https://docs.unity3d.com/Manual/LevelOfDetail.html>

This is used in almost every modern game. This is a component in unity letting different objects to be loaded in depending on your distance to the object. Cause if you're viewing a high-quality model from far away you can barely see the details but the computer still has to render all the details. So by replacing that high-quality model with a low quality one far away, you wouldn't be able to tell the difference.

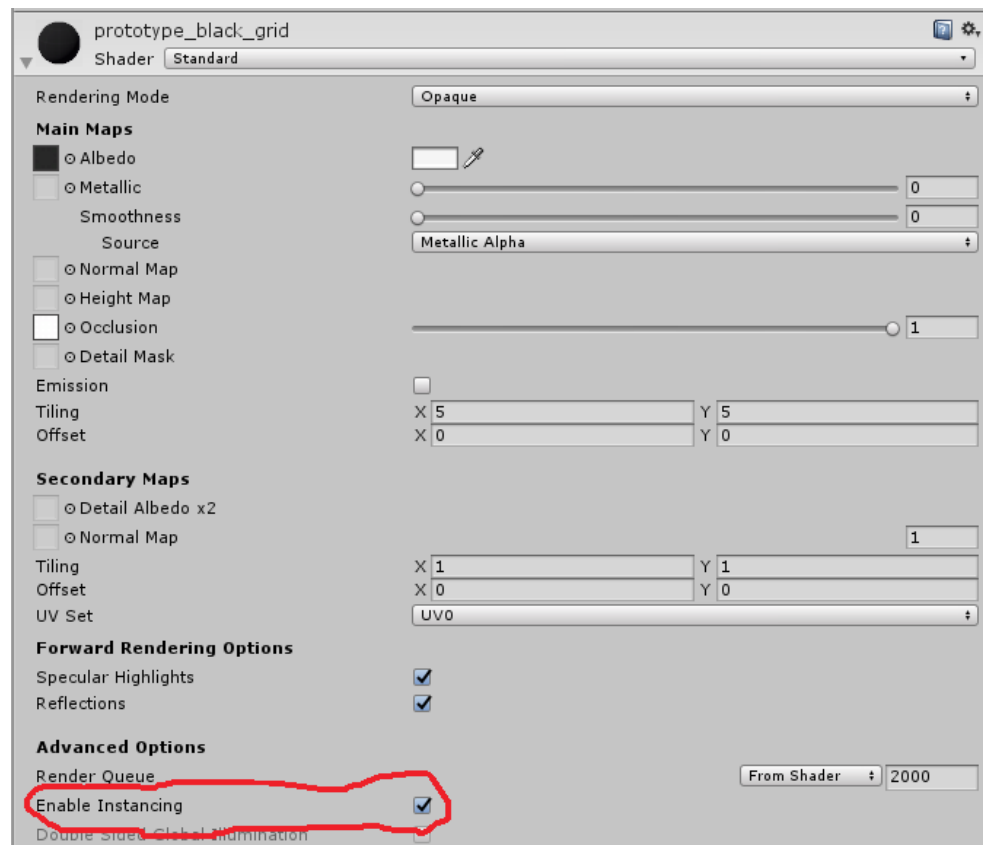
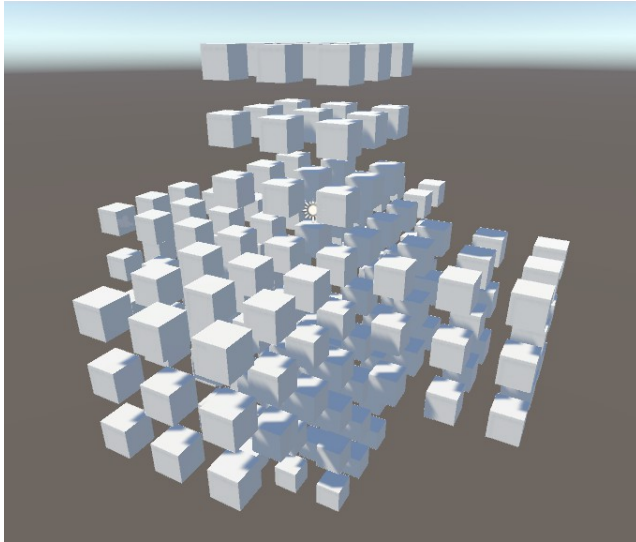
This can also be used with small objects in your world so you don't render them until you get close to them.

This talks about lod a bit more: <http://www.indiegamedeveloper.tv/about-level-of-detail-lod-in-game>



## Instancing/Prefabs

most people do this without realizing it. Instancing lets the computer know it just has to copy and past a calculation. In the photo, you see a lot of cubes if instancing didn't exist the computer would have to calculate every object as different pieces losing performance. But with instancing it knows that each cube is the same so it just has to calculate the one cube then past it multiple times. You can create your own instances with prefabs so if you have an object or objects that are repeated save it as a prefab. Most materials/shaders also have a option for render instance at the bottom.



### Texture size/polycount

This is a basic one but the main point don't have any unnecessary detail. If the detail can be made on a texture don't use the extra polygons for that detail. If you only see that texture from far away or not up close don't use a 4k texture. Keep polycount low especially if the object doesn't need to be very detailed.

Another helpful tip is reduce and reuse textures. If you have a lot of small textures combine them in a texture atlas so instead of loading in 10 textures you just have load in 1.

### Physics

if graphics is not a problem physics could be one. Make sure the number of objects with physics are limited. Mesh colliders are also a big cost in performance a mesh collider uses all the polygons in a model for detecting collisions. So a model with 1000 polygons is going to cost more compared to a model with 12. if possible use the basic colliders that unity gives you like the box collider or the sphere collider.

### Shaders

this is one I have a lack of knowledge about but I do know this can be a source of problems. Were some shaders can be simple and don't take up processing while others can. Ive been told to watch out for image effect shaders too many can cost performance. Mobile friendly shaders have very low cost.

### Audio

this might seem like a small thing but it can impact performance. Simply if you have a long audio file you want to play make sure its compressed. If its short while compressing wont be as noticeable you can still do it.

### Vrchat

there are a few tools in the vrchat that can cause bad performance the big one are mirrors. Make a button that enables and disables the mirror locally so unless someone wants to look at it it's disabled. While not as bad video panels have also been known to decrease performance. Also having a lot of avatar pedestals can make your world load in slow.

One setting ive not personally messed with since ive not made rooms for a lot of people. In the world scene descriptor at the bottom is the update time in ms. Increasing the time will make the update time for everyone slower and should lower cpu usage created by avatars.

Helpful links:

[https://wiki.unity3d.com/index.php?title=General\\_Performance\\_Tips](https://wiki.unity3d.com/index.php?title=General_Performance_Tips)

<https://docs.unity3d.com/Manual/OptimizingGraphicsPerformance.html>