

EDV & Multimedia

Game Development

Shading

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Shader

Ein (Pixel-) Shader ist ein kleines Programm, das auf der Grafikkarte ausgeführt wird und für jeden Bildschirmpunkt (Pixel) die auszugebende Farbe bestimmt.

Workflow

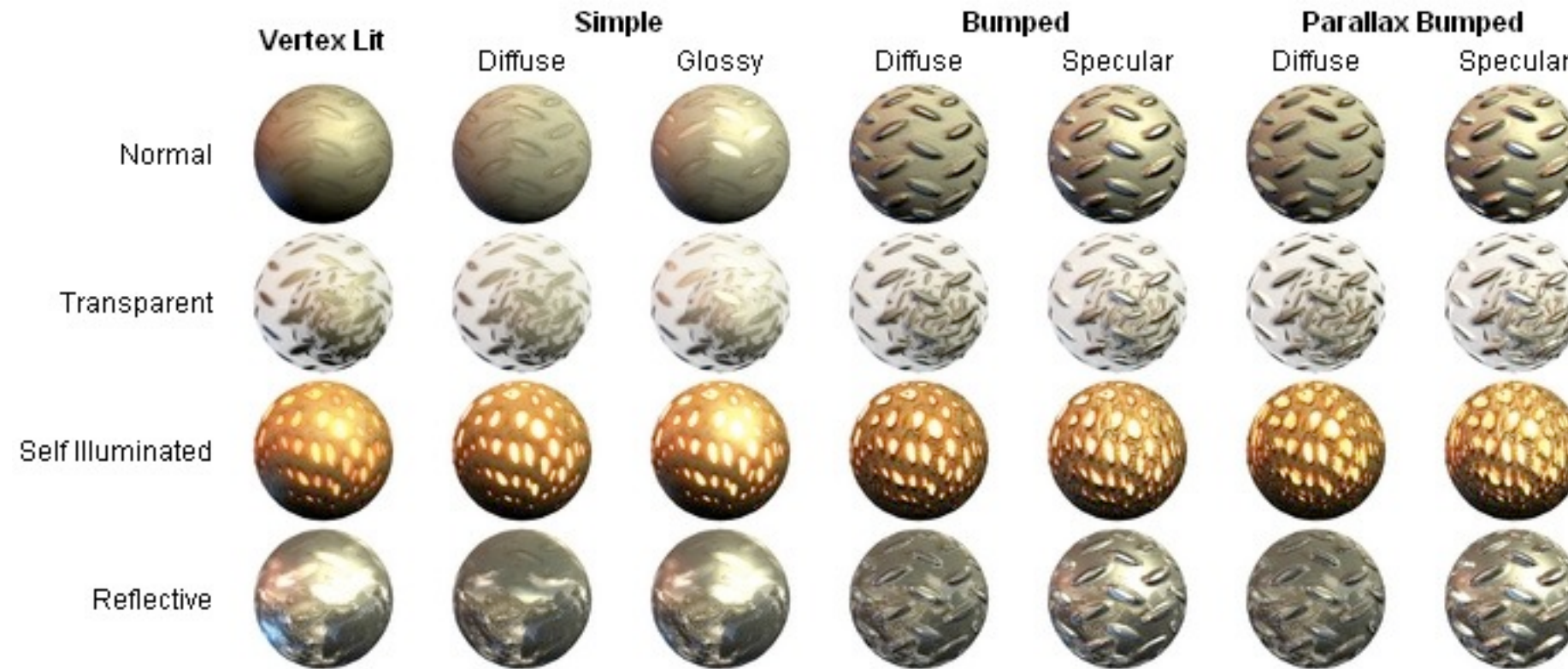
Da Shading die meiste Rechenzeit beansprucht, wird es erst am Ende der Produktion eingesetzt.



<http://www.youtube.com/watch?v=Wj0XXYJ3gCY>

Die Qualität der Pre-Shading Footage von *Final Fantasy: The Spirits Within* (2001) entspricht ungefähr den Previsualisierungen heutiger Produktionen

Unity built-in Shader

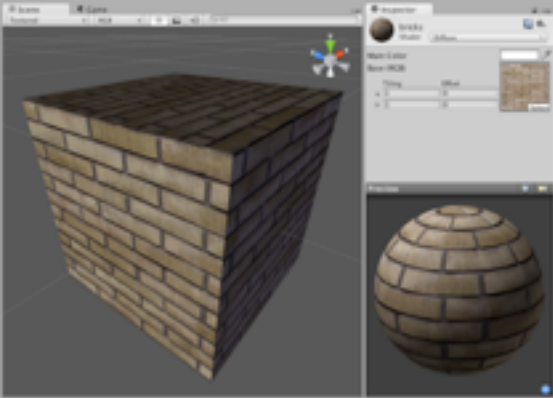


<http://unity3d.com/support/documentation/Manual/Materials.html>

<http://unity3d.com/support/documentation/Components/Built-in%20Shader%20Guide.html>

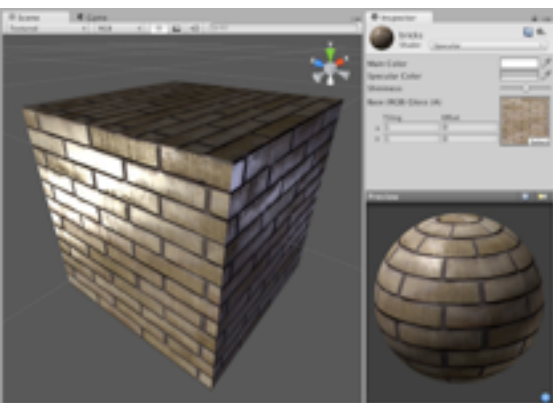
Shader Models

1



All rendering in Unity is done with *Shaders* - small scripts that let you configure the how the graphics hardware is set up for rendering.

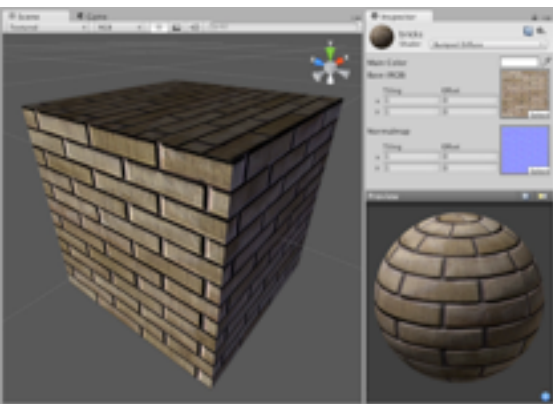
2



1. Diffuse computes a simple (Lambertian) lighting model. The lighting on the surface decreases as the angle between it and the light decreases. The lighting depends only on the this angle, and does not change as the camera moves or rotates around.

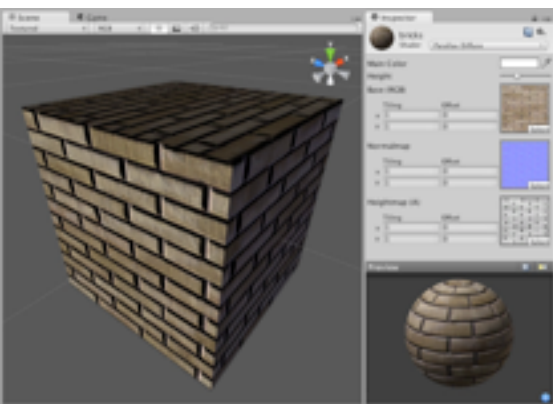
2. Specular computes the same simple (Lambertian) lighting as Diffuse, plus a viewer dependent specular highlight. This is called the Blinn-Phong lighting model. It has a specular highlight that is dependent on surface angle, light angle, and viewing angle. The highlight is actually just a realtime-suitable way to simulate blurred reflection of the light source. The level of blur for the highlight is controlled with the Shininess slider in the Inspector.

3



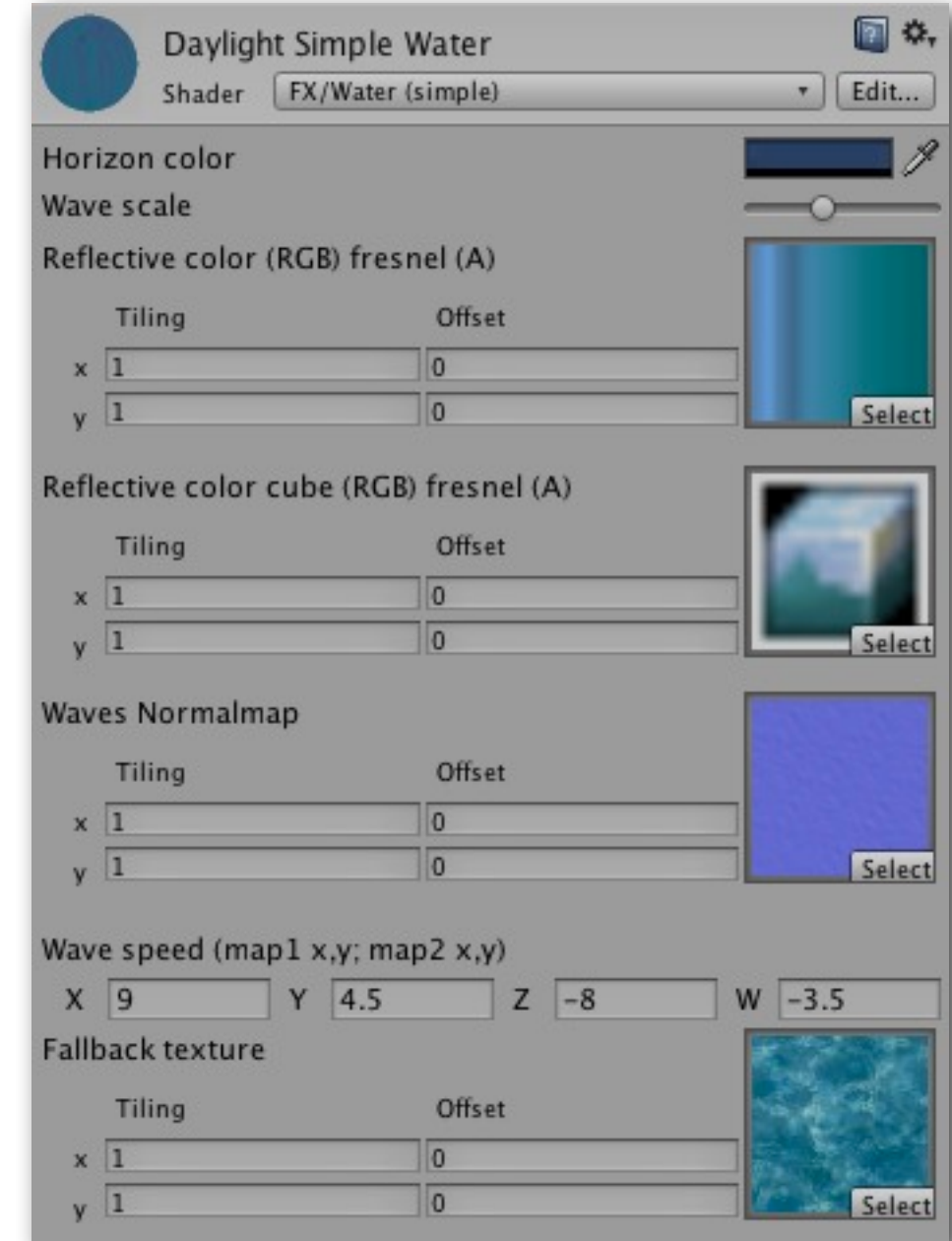
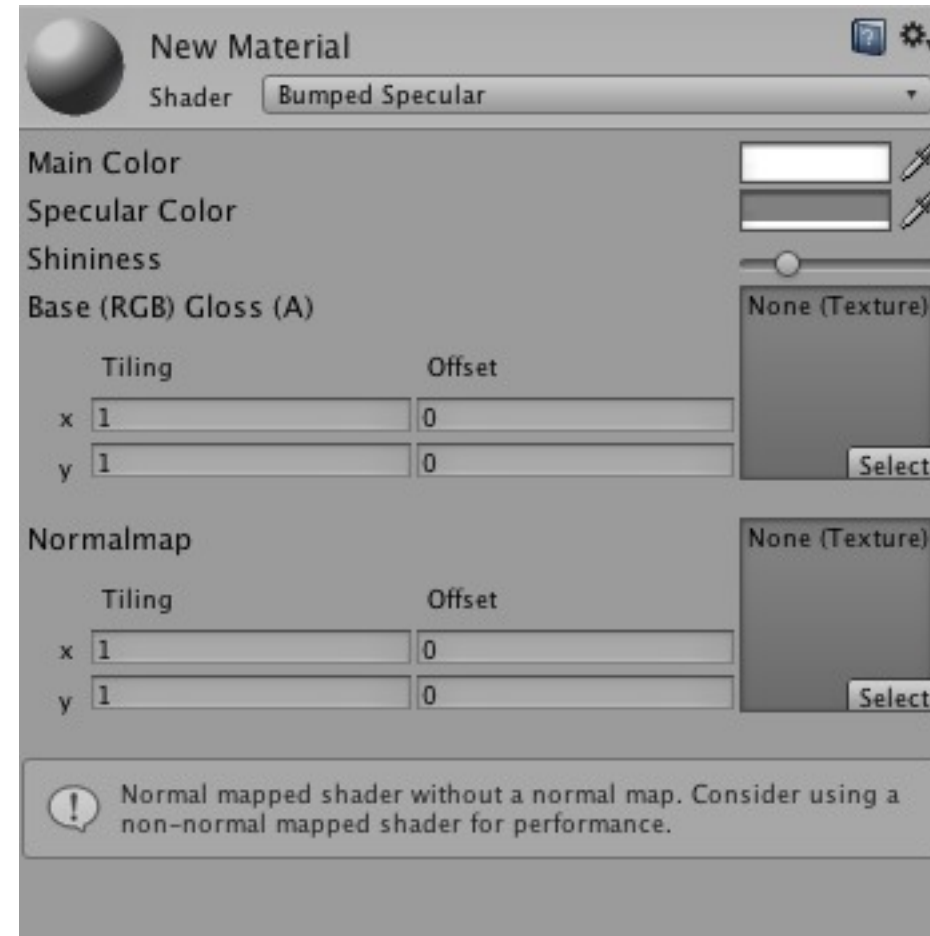
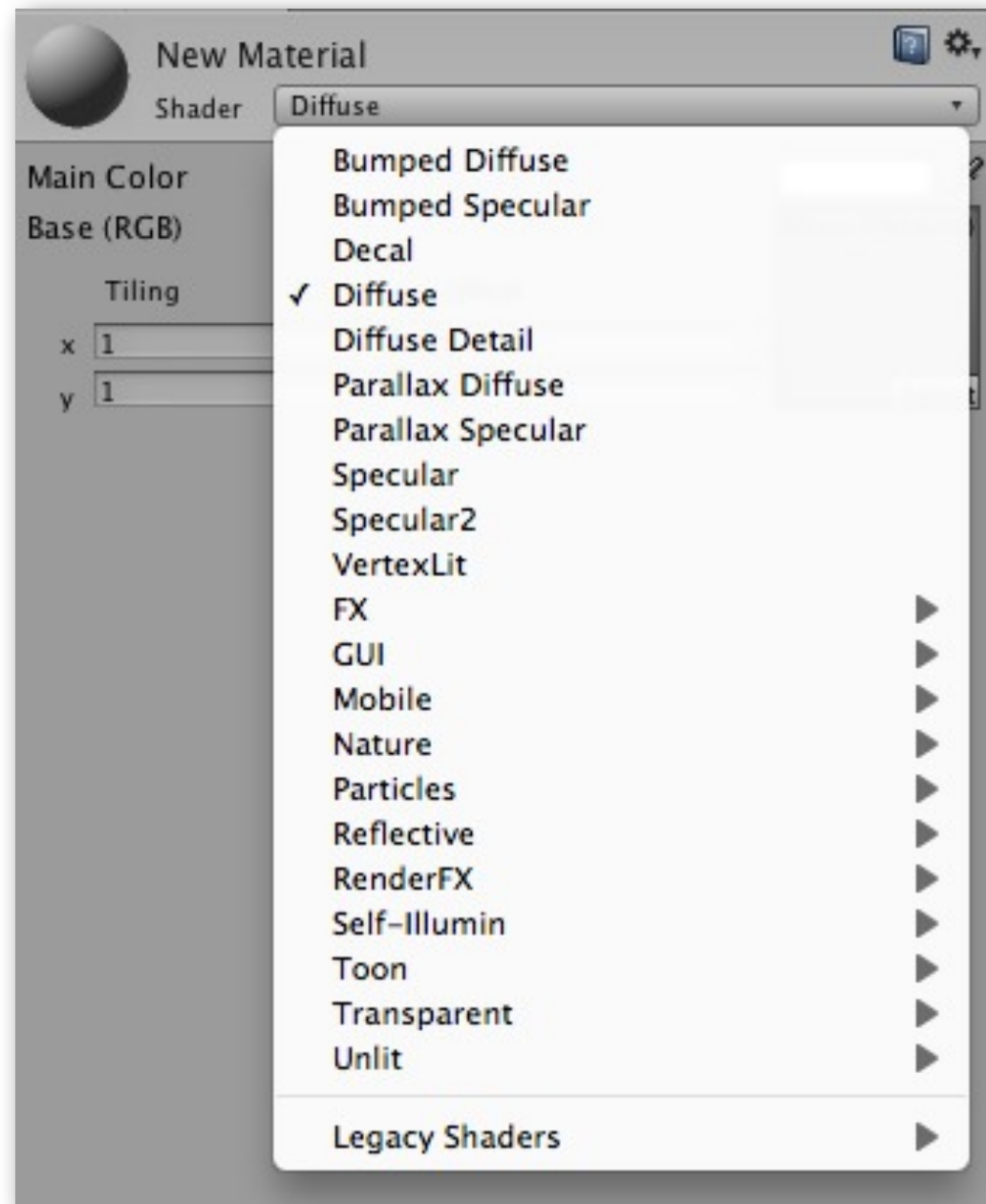
3. Normal mapping simulates small surface details using a texture, instead of spending more polygons to actually carve out details. It does not actually change the shape of the object, but uses a special texture called a **Normal Map** to achieve this effect. In the normal map, each pixel's color value represents the angle of the surface normal. Then by using this value instead of the one from geometry, lighting is computed. The normal map effectively overrides the mesh's geometry when calculating lighting of the object.

4

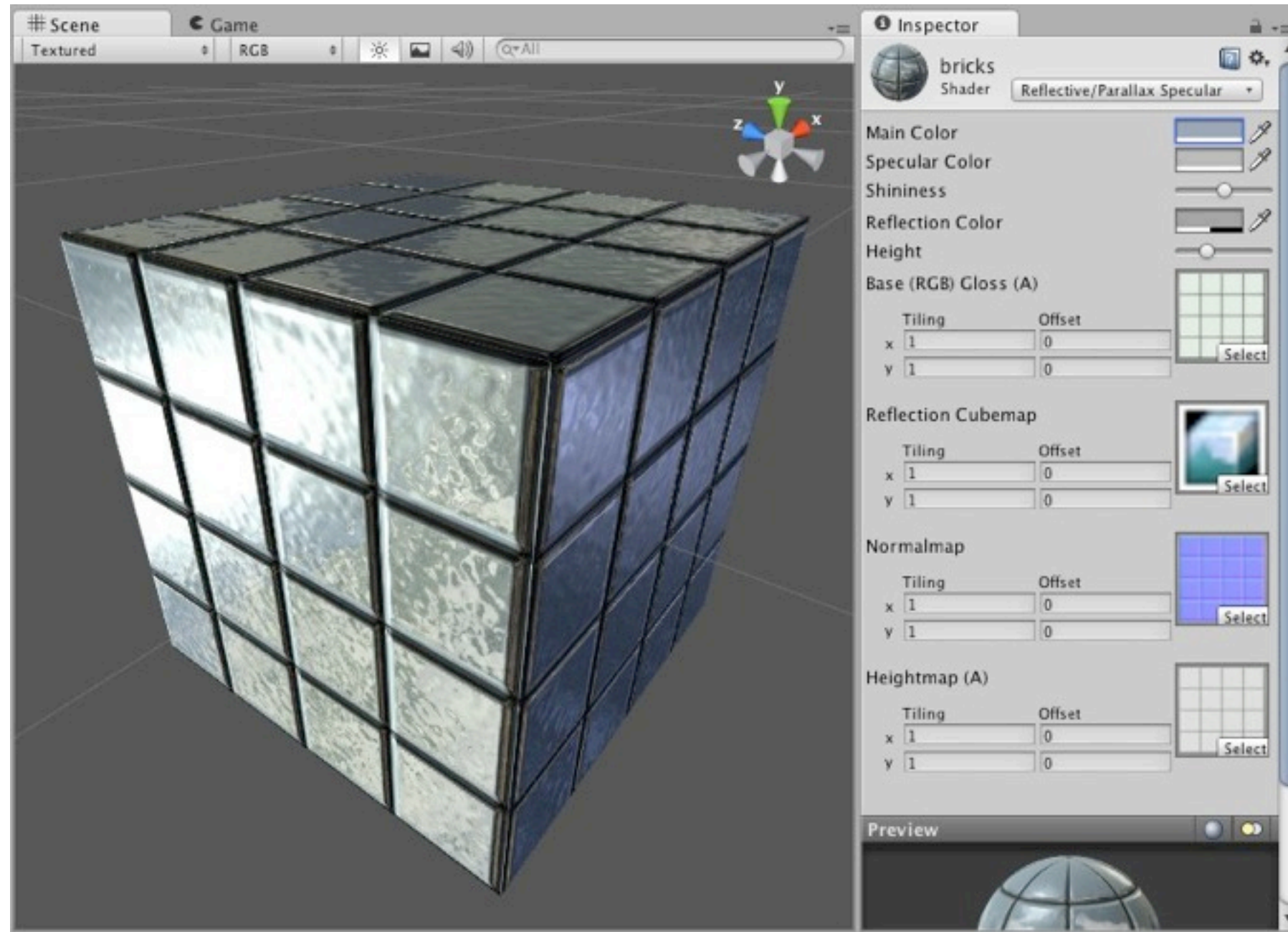


4. The Parallax mapping technique is pretty simple, so it can have artifacts and unusual effects. Specifically, very steep height transitions in the Height Map should be avoided. Adjusting the Height value in the Inspector can also cause the object to become distorted in an odd, unrealistic way. For this reason, it is recommended that you use gradual Height Map transitions or keep the Height slider toward the shallow end.

Material = Shader + Farben + Texturen

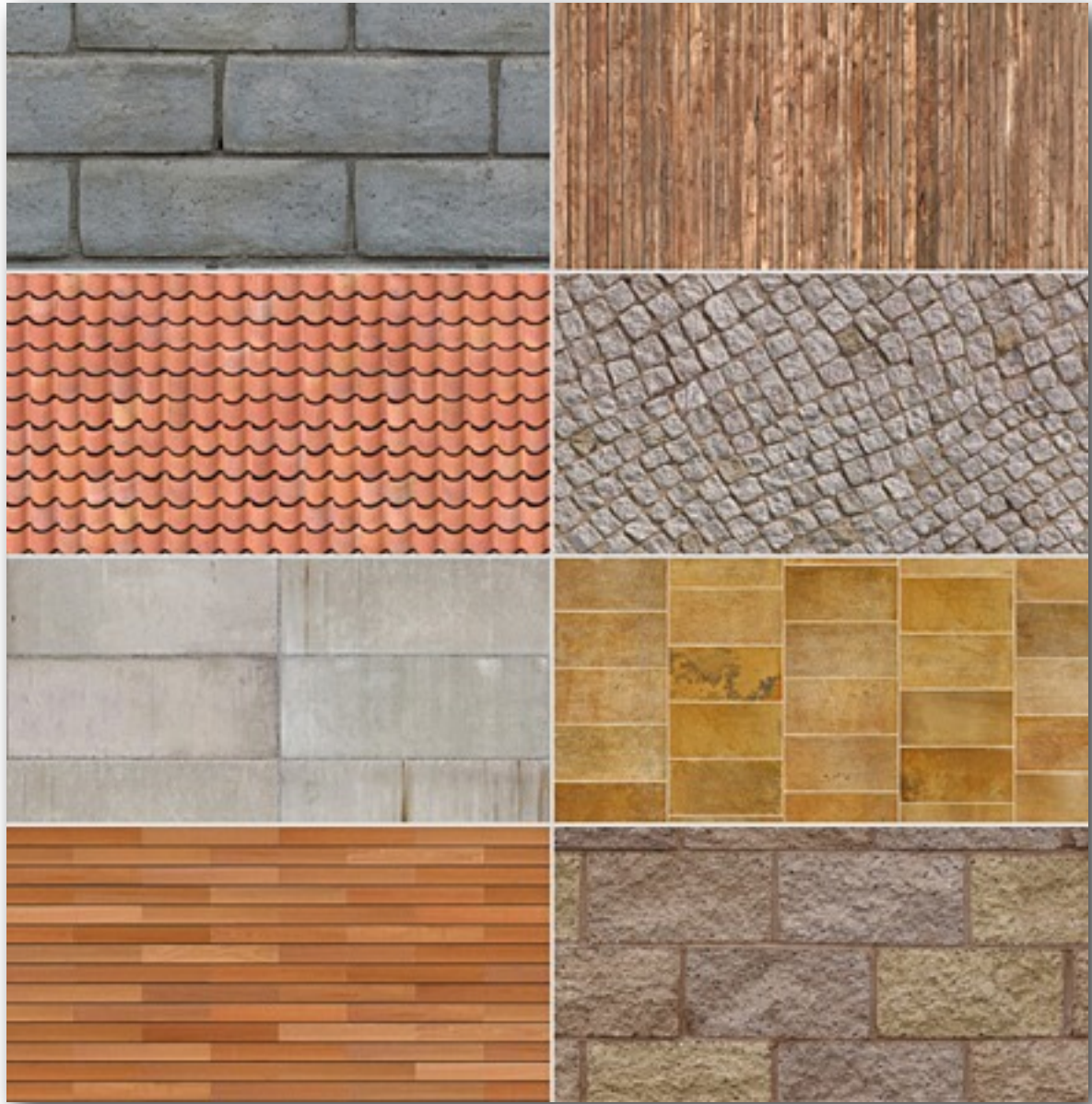


Beispiel: Reflective Parallax Specular

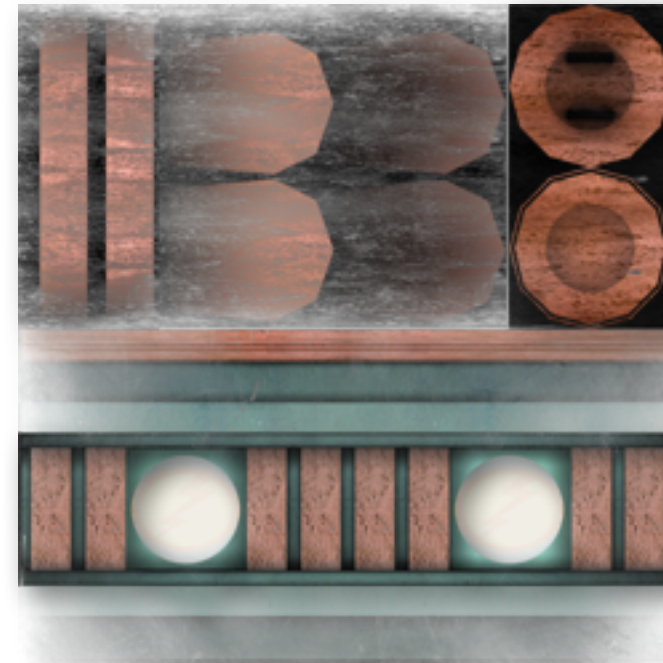


<http://unity3d.com/support/documentation/Components/shader-ReflectiveParallaxSpecular.html>

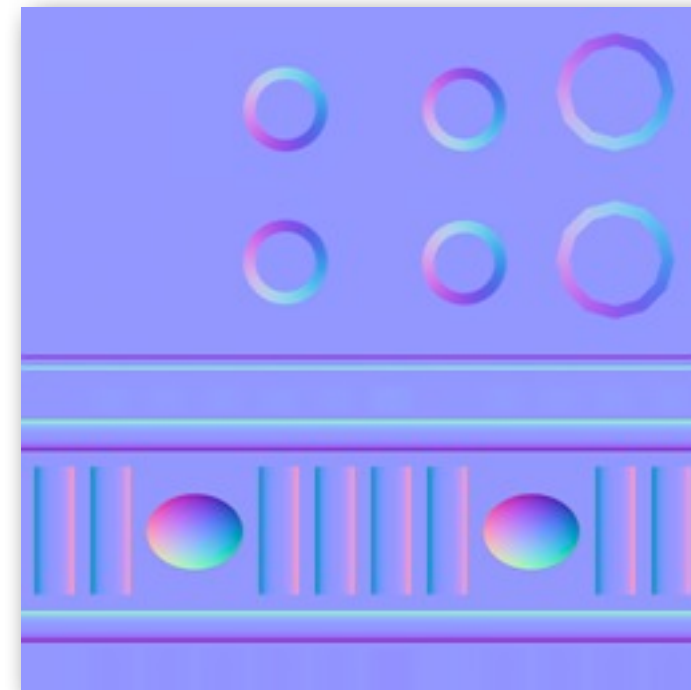
Textur



<http://www.cgtextures.com/>



Base-Textur (Albedo)



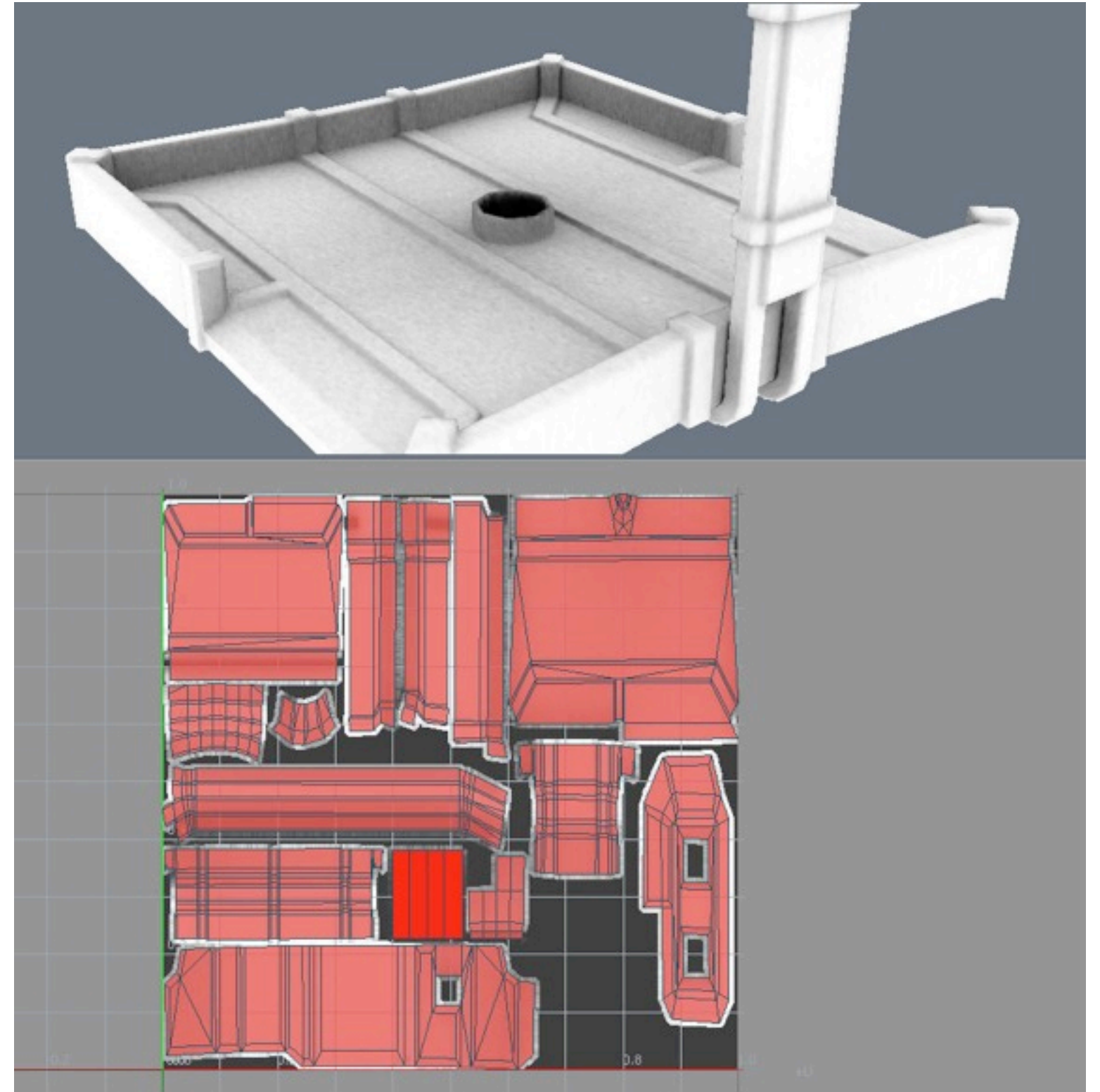
Normal-Bump Map

UV-Textur



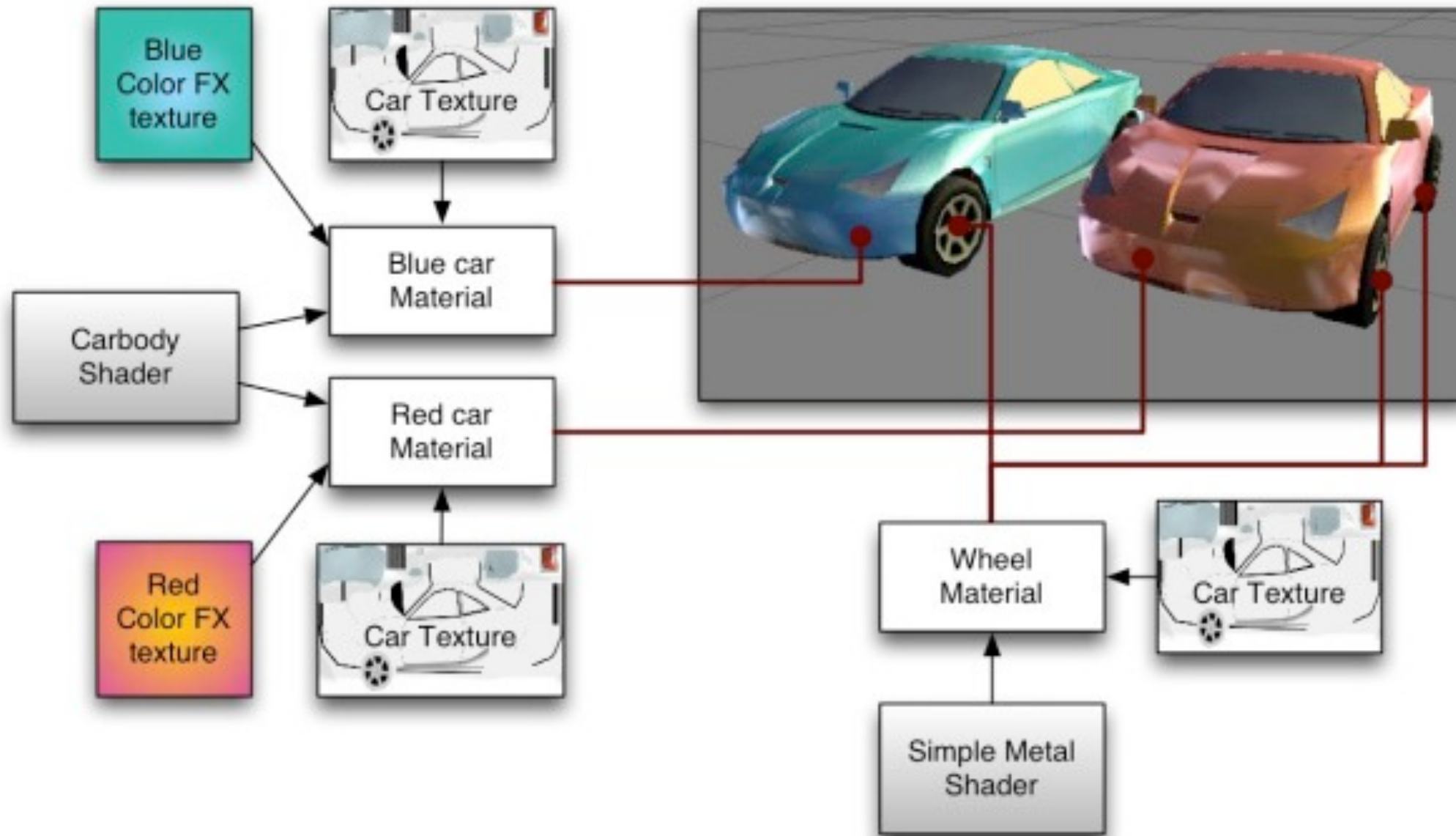
Unity, 3rd Person Controller

UV-Texturing



Modell Entfalten und bemalen

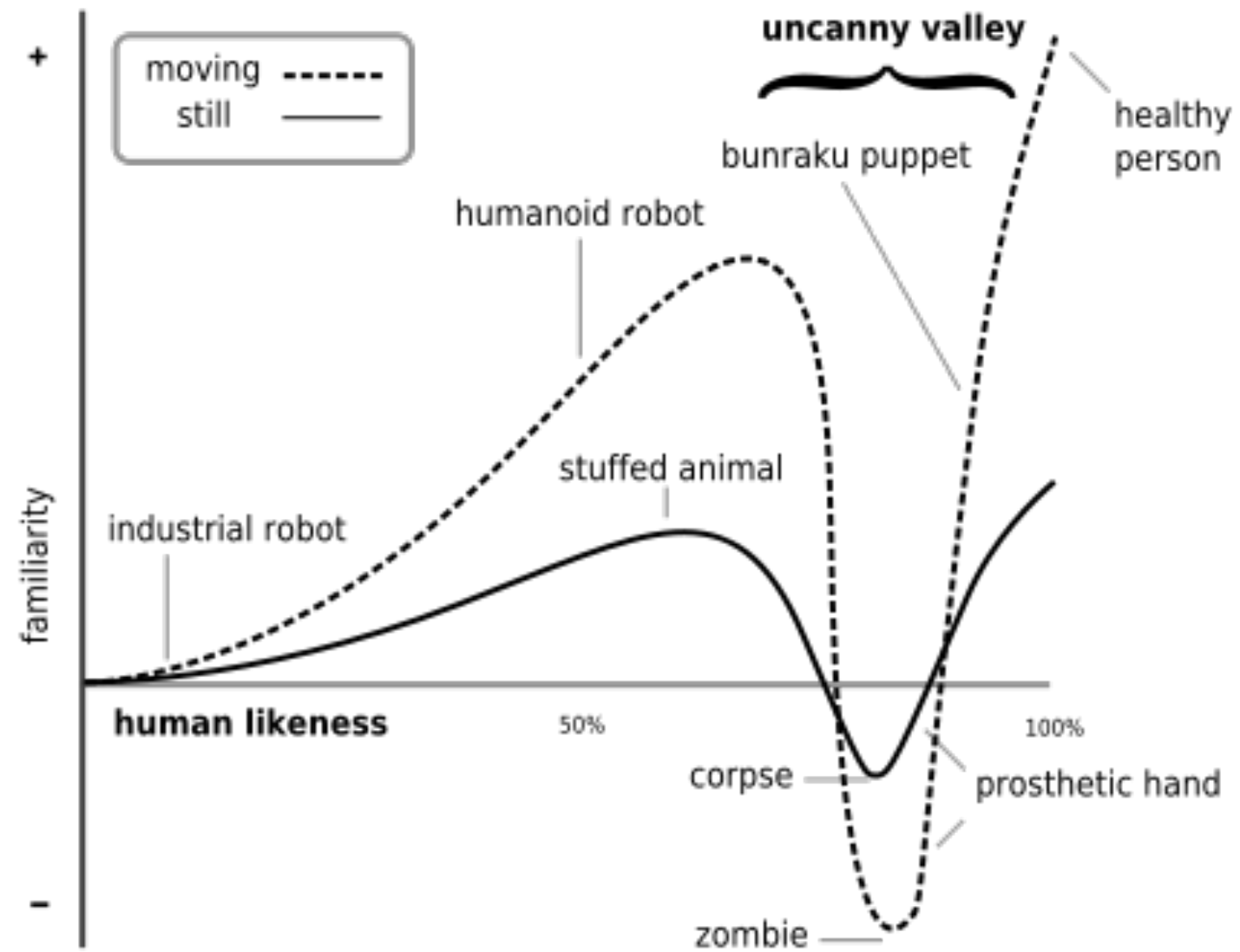
Shading



Rendern



Uncanny Valley



<http://www.cubo.cc/creepygirl/>
<http://www.youtube.com/watch?v=PF1NQGmOoAE>



Beowulf

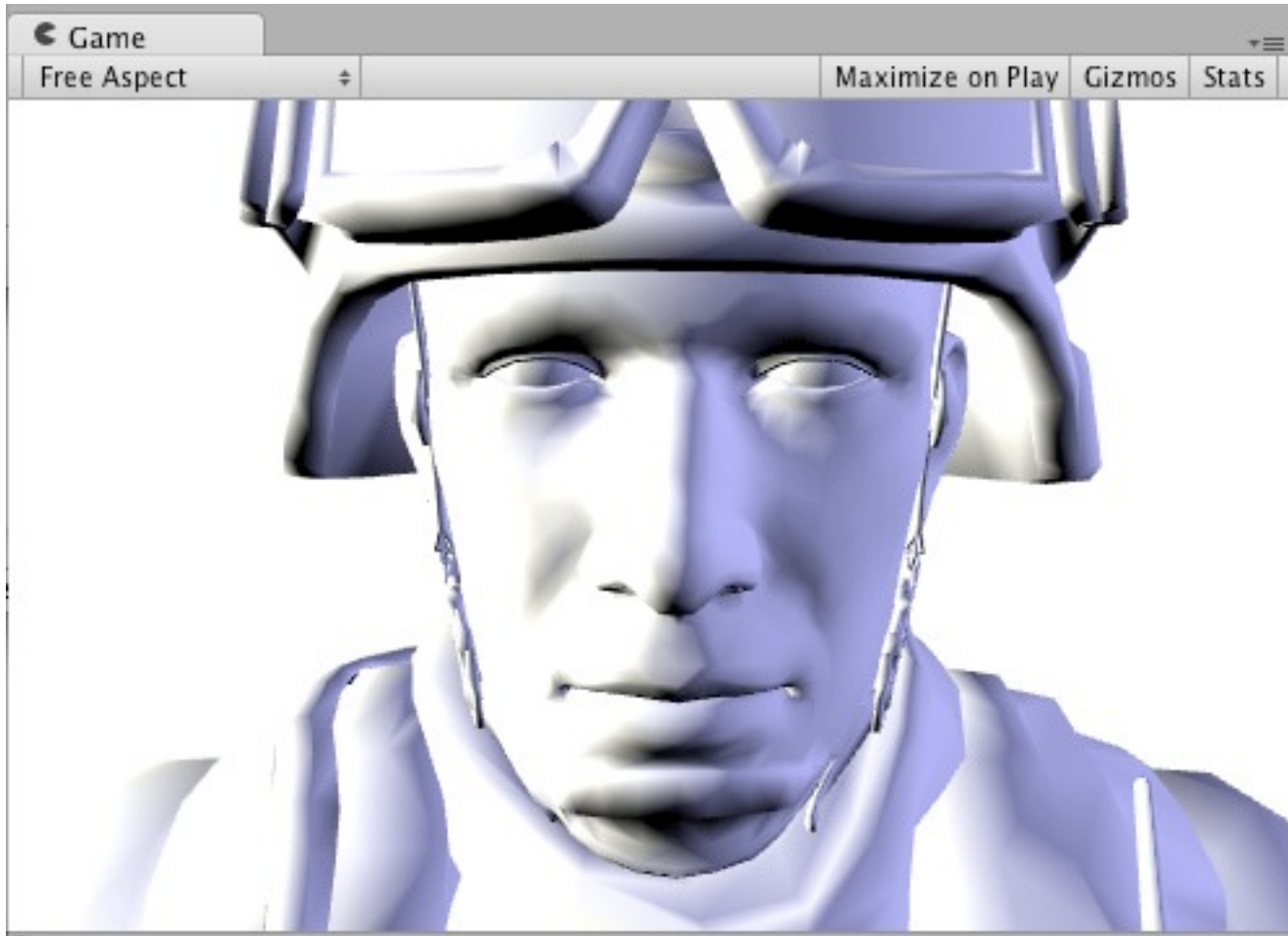
Surface Shader

The input structure Input generally has any texture coordinates needed by the shader. Texture coordinates must be named "uv" followed by texture name (or start it with "uv2" to use second texture coordinate set).

Standard output structure of surface shaders is this:

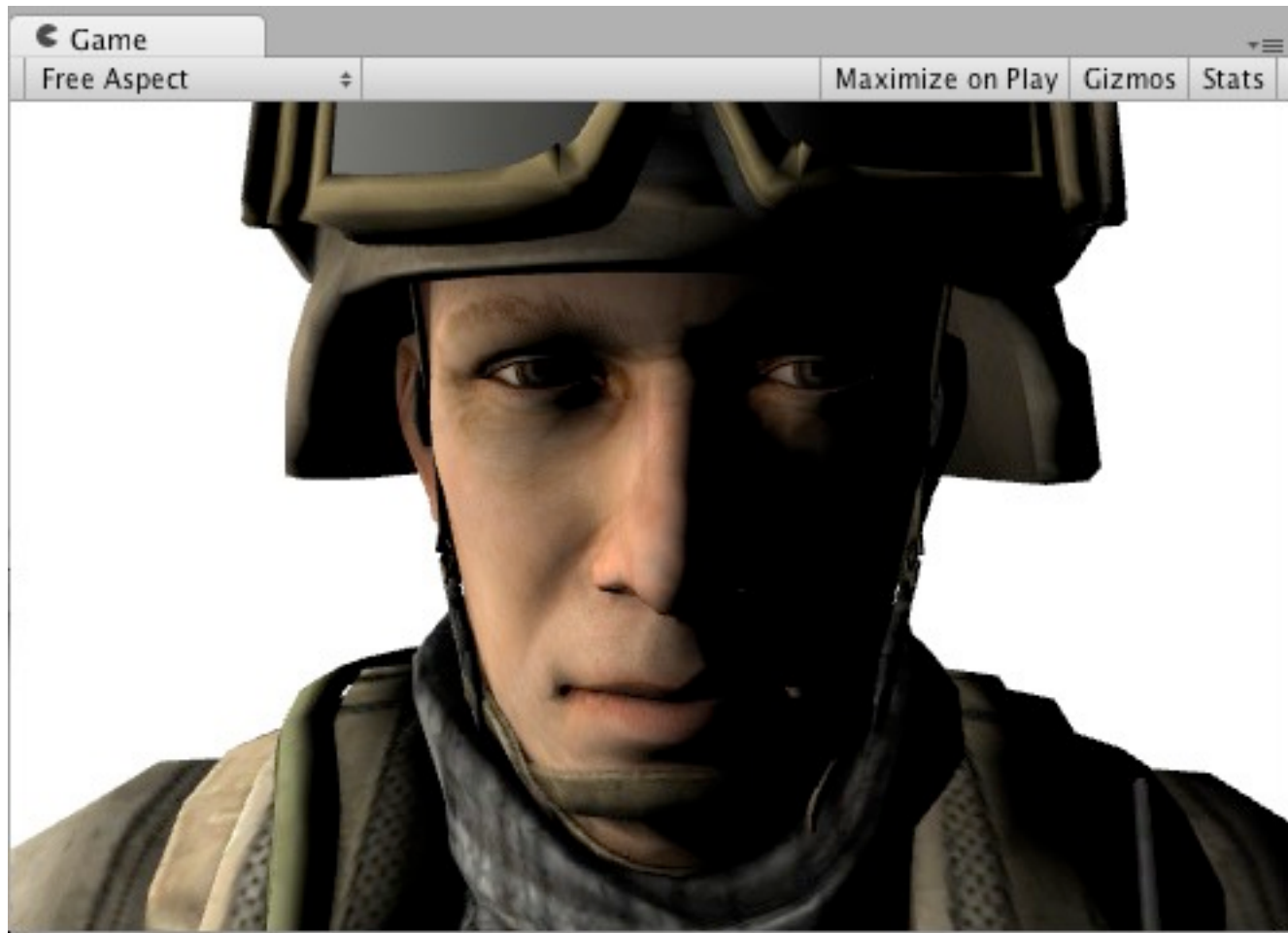
```
struct SurfaceOutput {  
    half3 Albedo; //Lichtreflektion und Farbe  
    half3 Normal; //Reflektionswinkel  
    half3 Emission; //Leuchten  
    half Specular; //Gerichtete Reflektion  
    half Gloss; //Glanz  
    half Alpha; //Durchlässigkeit  
};
```


Surface Shader



<http://unity3d.com/support/documentation/Components/SL-SurfaceShaderExamples.html>

Surface Shader Lighting



Beispiel: Double Side Shader

Die Unity-Shader rendern von einer Fläche (Terrain, Plane, Cloth) nur eine Seite und schneiden die andere ab (Occlusion Culling). Wir benötigen daher einen Shader ohne Occlusion Culling

1. Download Build-In-Shader

<http://unity3d.com/support/resources/assets/built-in-shaders>

2. Shader in Projekt kopieren, z.B. Normal-Diffus.shader

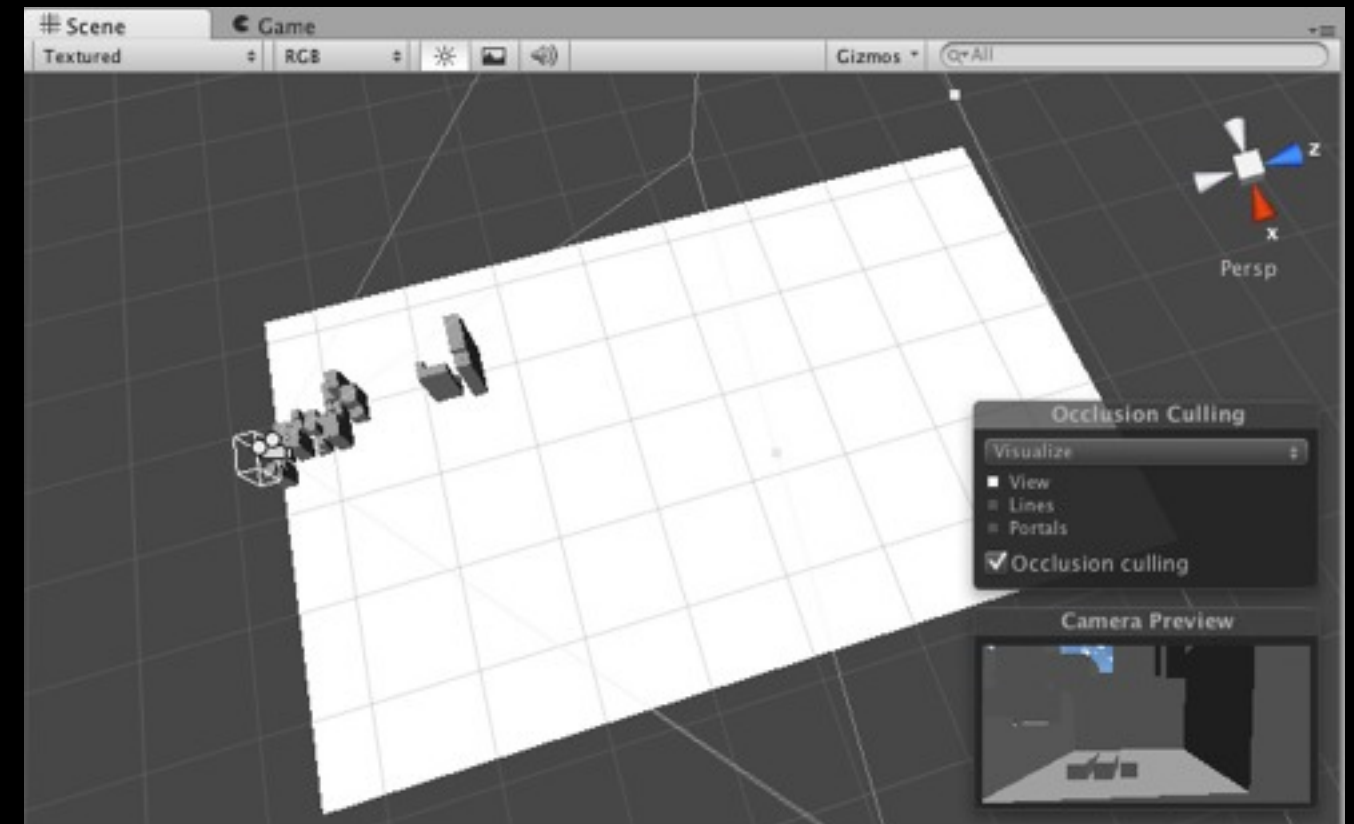
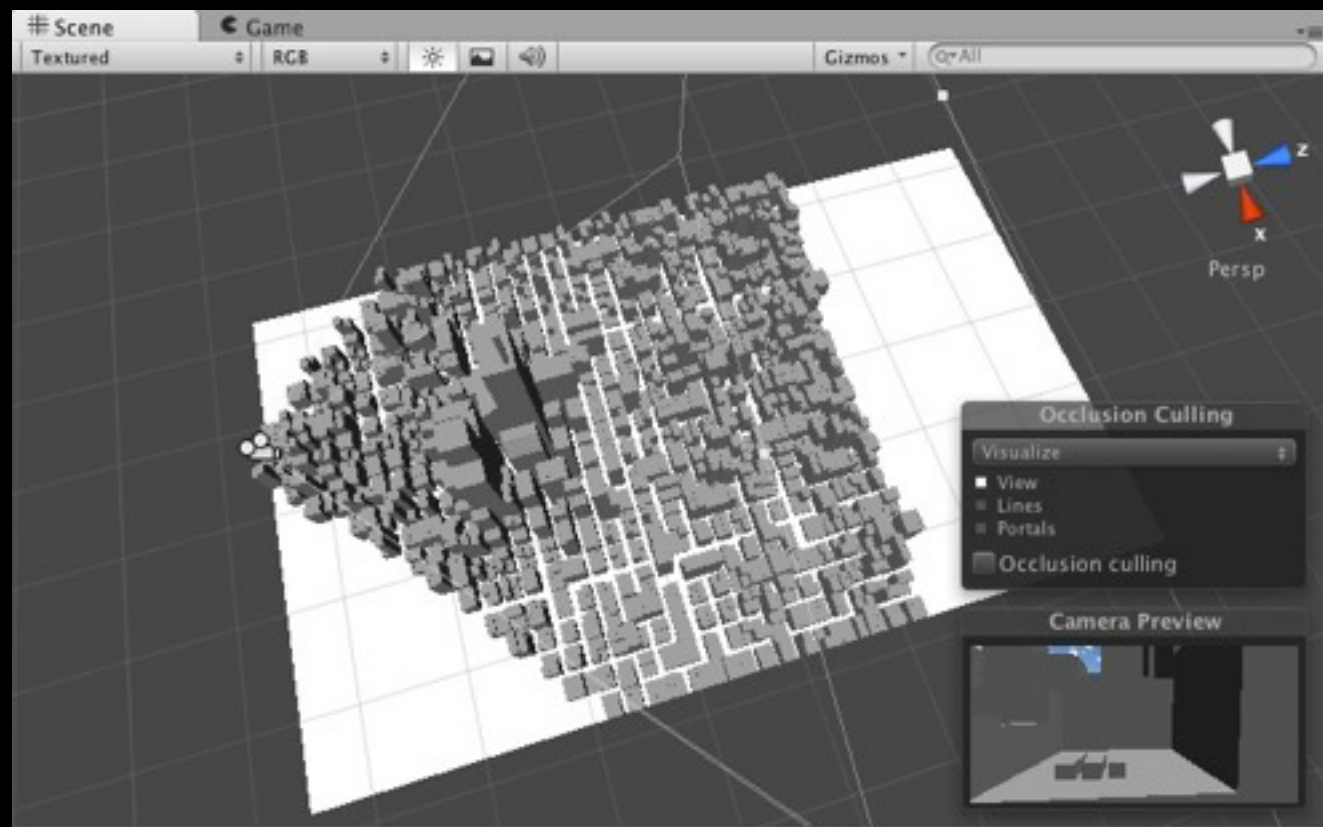
Namen im Editor ändern (1. Zeile): `Shader "Diffuse2" {`

Culling deaktivieren:

```
SubShader {  
    Tags { "RenderType"="Opaque" }  
    LOD 200  
    CULL OFF
```

3. Neues Material erzeugen und neuen Shader auswählen. Anwenden. Fertig.

Occlusion Culling (Pro only)

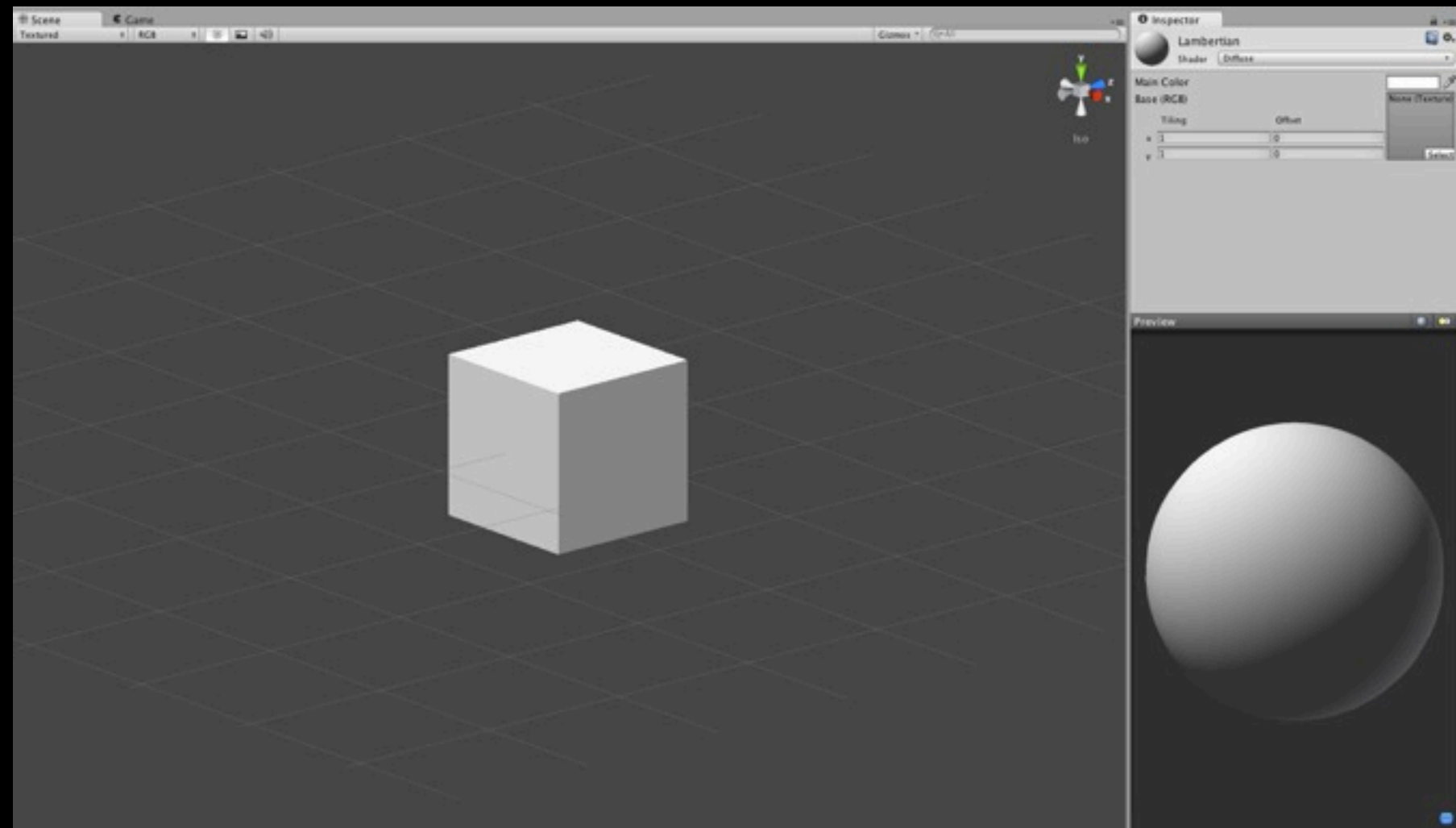


Filled Polygons

Flat Shading / Lambertian Shading



Atari: I, Robot, 1983



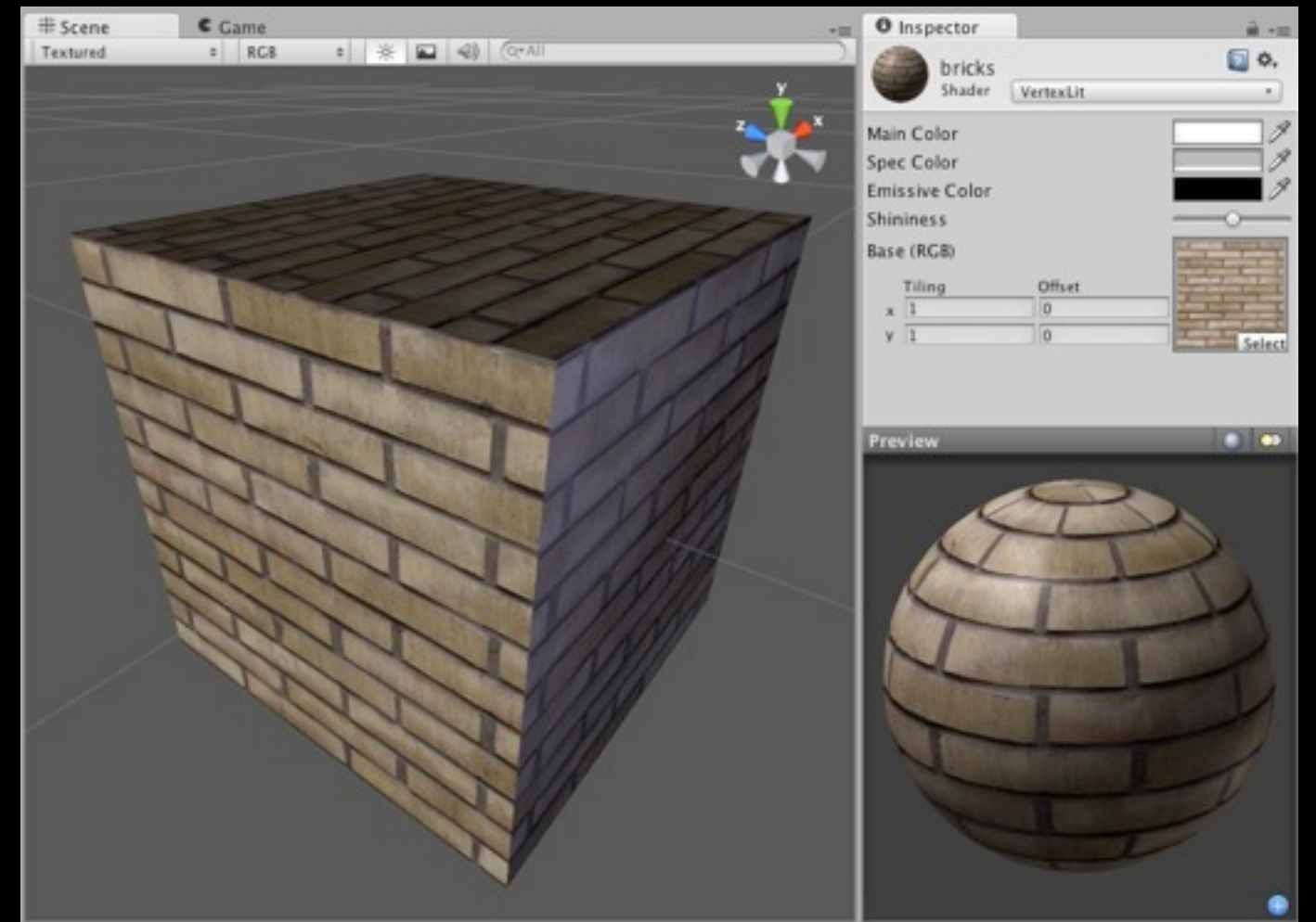
Diffuse Shader

Gouraud Shading

Vertex Lighting



LucasArts: TIE Fighter, 1994

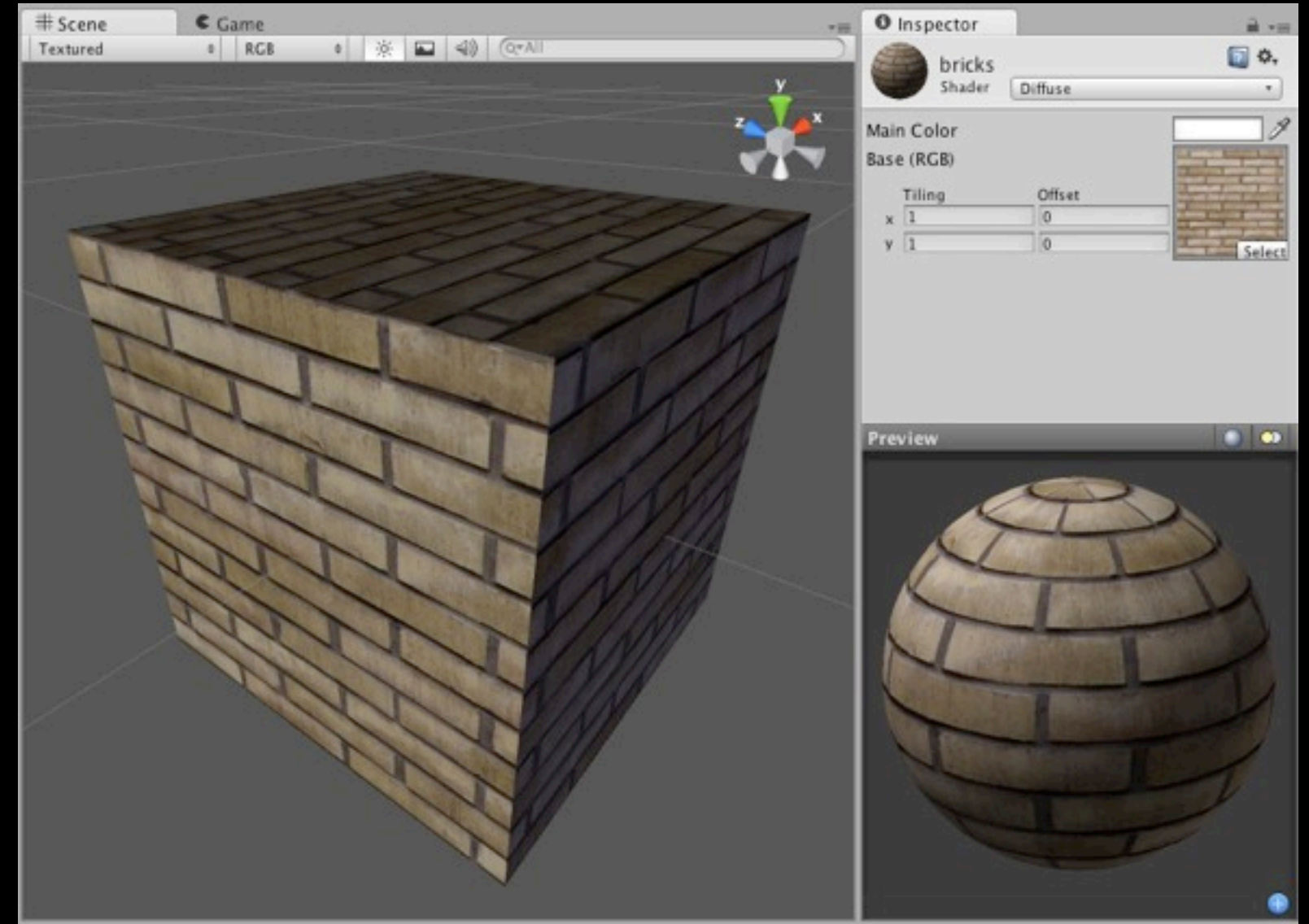


Vertex Lit

Texture Mapping

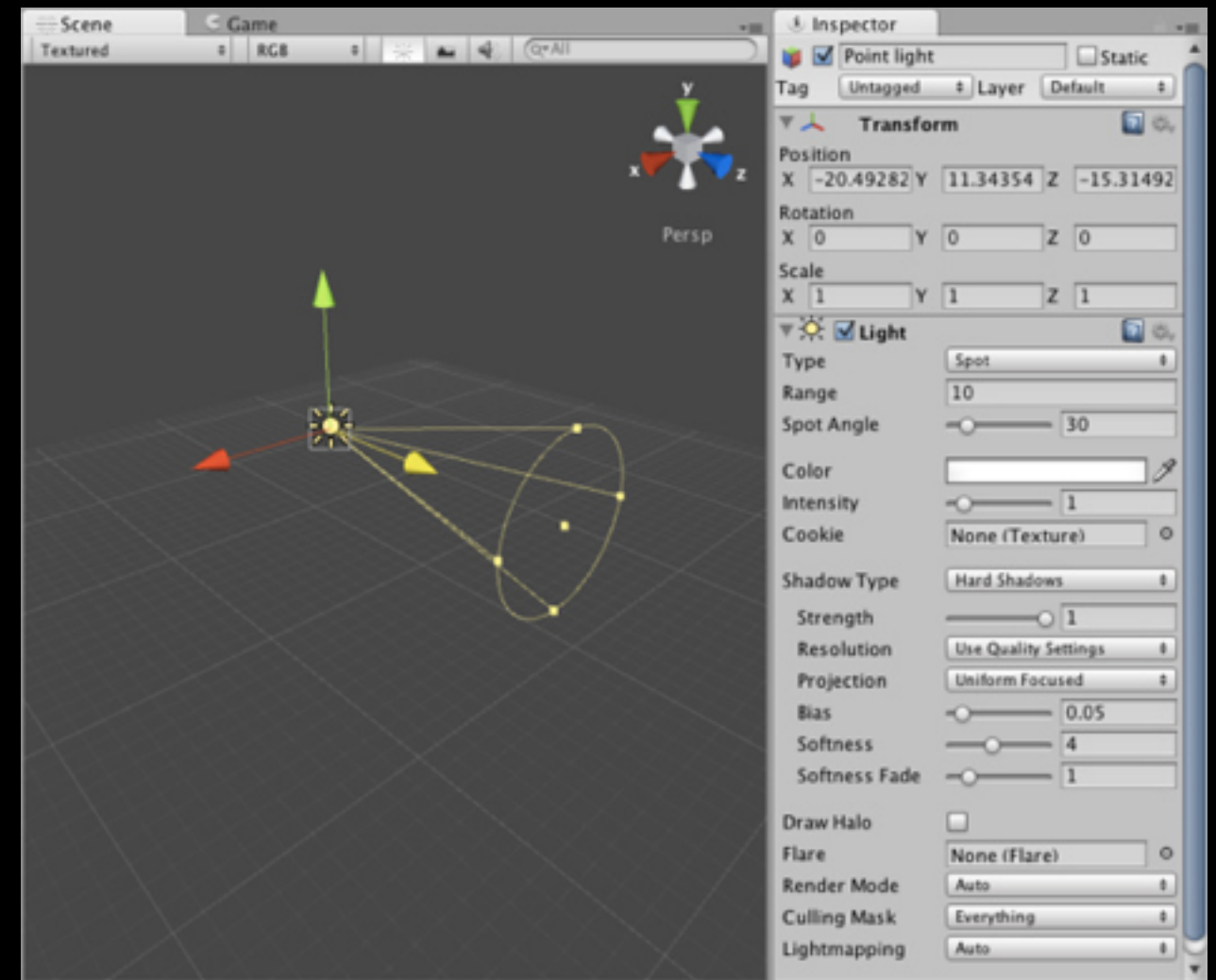


Parallax: Descent, 1995



Base (RGB)

Realtime Lighting



Id: Quake, 1996

Pre-Computed Lighting Lightmap



Id: Quake II, 1997



Lightmap

<http://docs.unity3d.com/Documentation/Manual/Lightmapping.html>

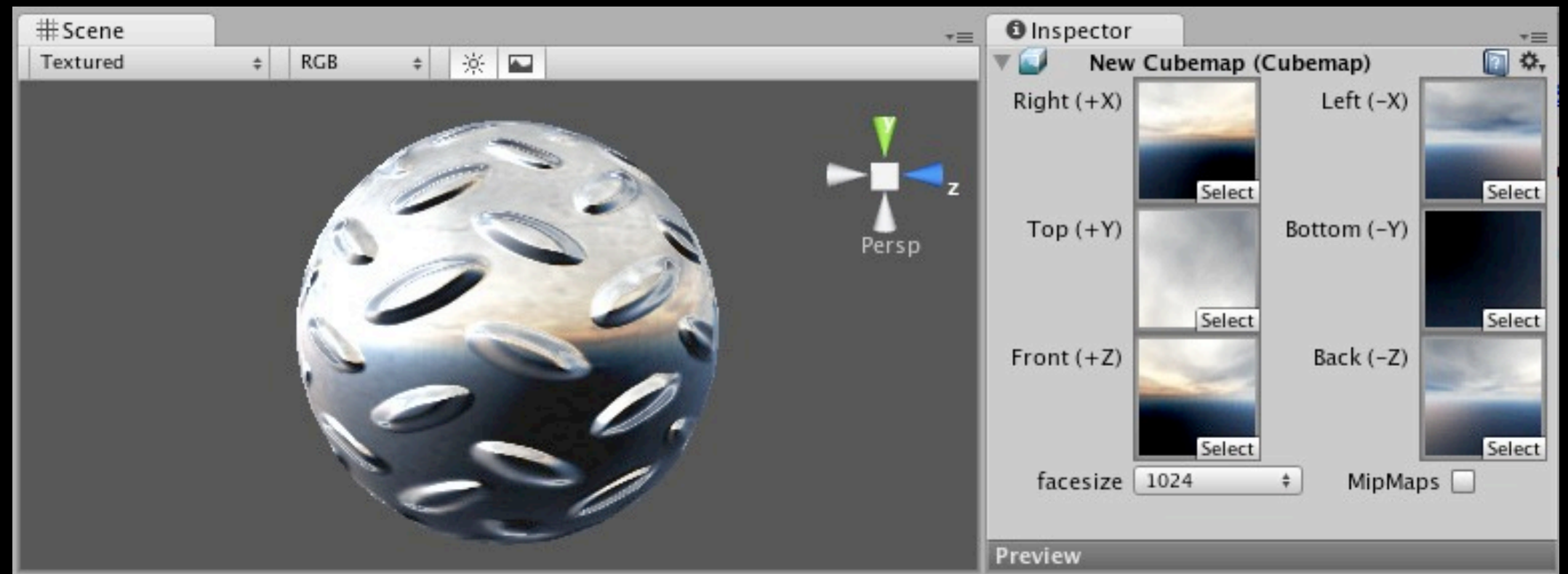
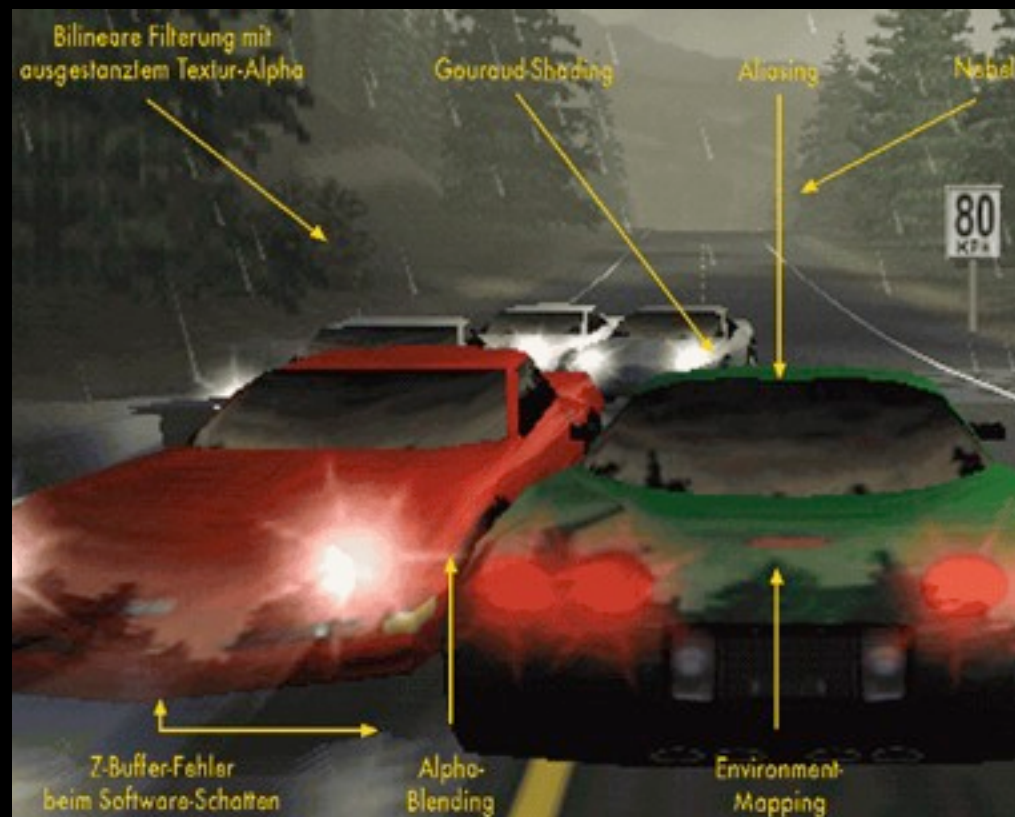
MIP Mapping



<http://aras-p.info/blog/2011/05/03/a-way-to-visualize-mip-levels/>

<http://unity3d.com/support/documentation/Manual/Textures.html#mipmaps>

Environment Mapping



Cube Map

<http://unity3d.com/support/documentation/Components/class-Cubemap.html>

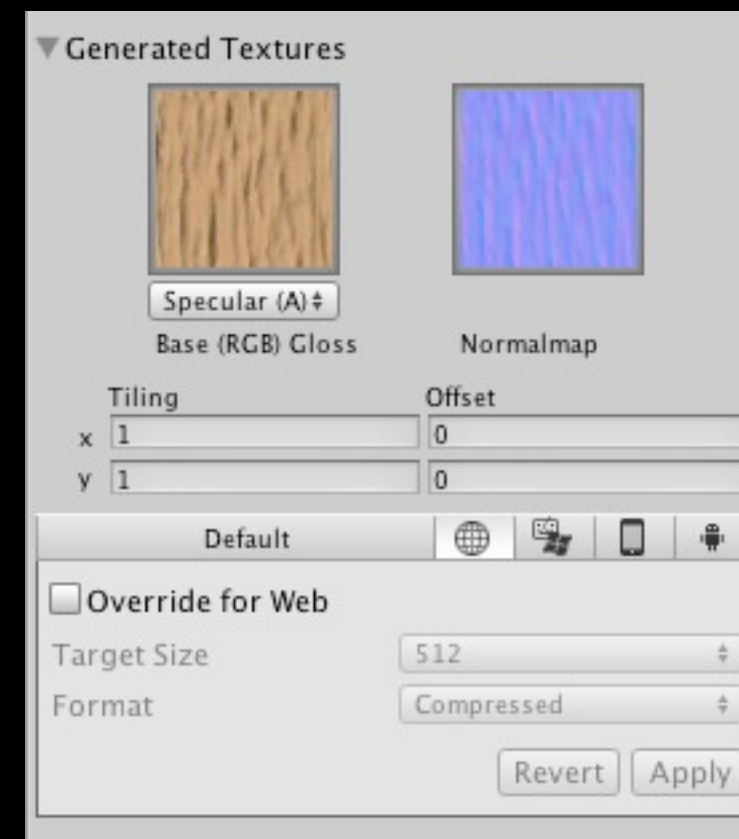
Parametric Surface

Procedural Material



id: Quake III, 1999

<https://www.assetstore.unity3d.com/#/content/1352>



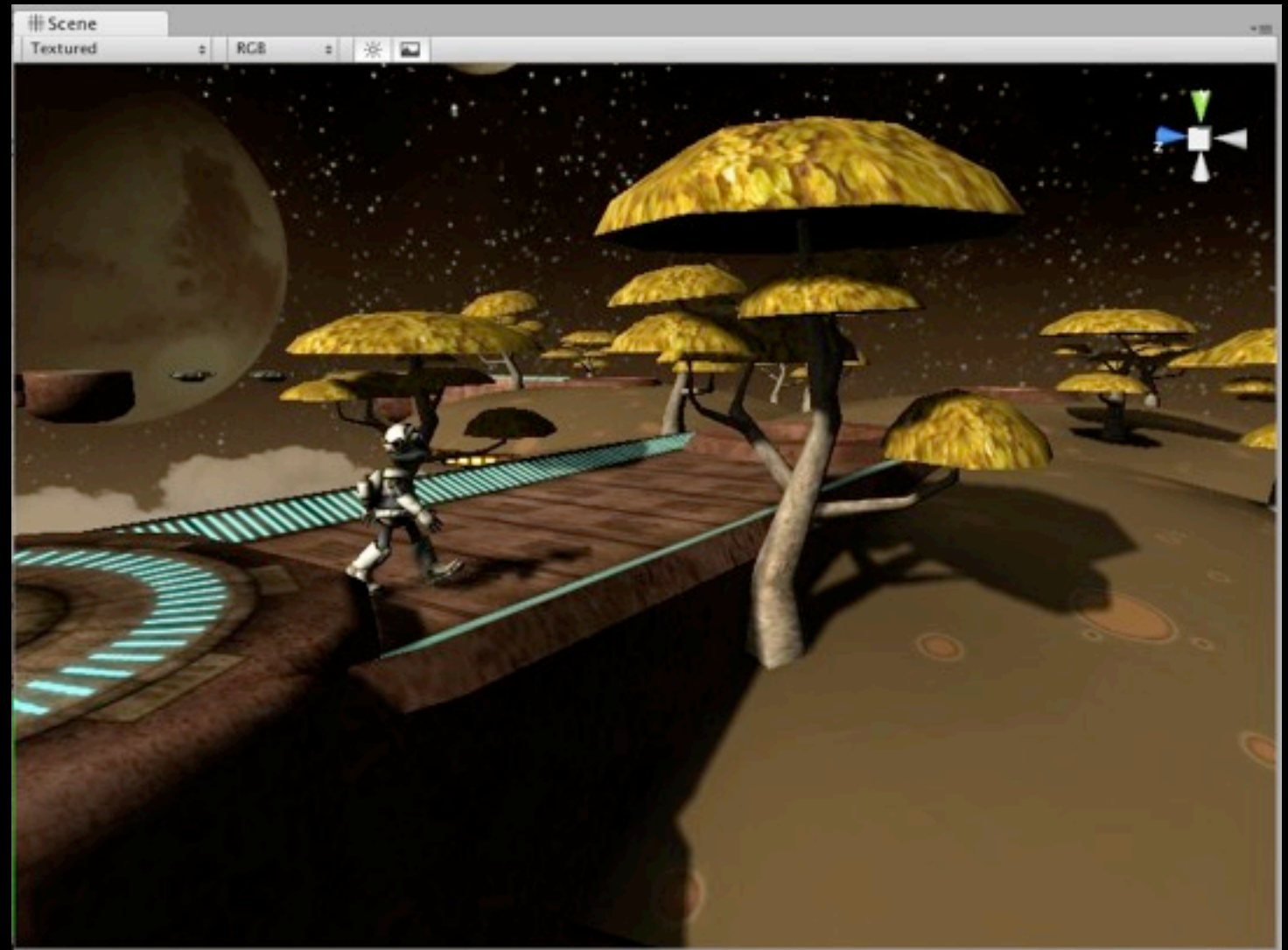
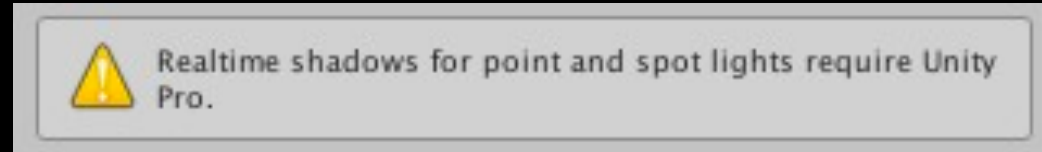
<http://docs.unity3d.com/Documentation/Manual/ProceduralMaterials.html>

<http://unity3d.com/support/documentation/Components/class-ProceduralMaterial.html>

Shadow Mapping Realtime Shadows



Ubisoft: Splinter Cell, 2002



<http://unity3d.com/support/documentation/Manual/DirectionalShadowDetails.html>

<http://unity3d.com/support/documentation/Manual/Shadows.html>

Post Processing

They are only available with Unity Pro



Killzone 2



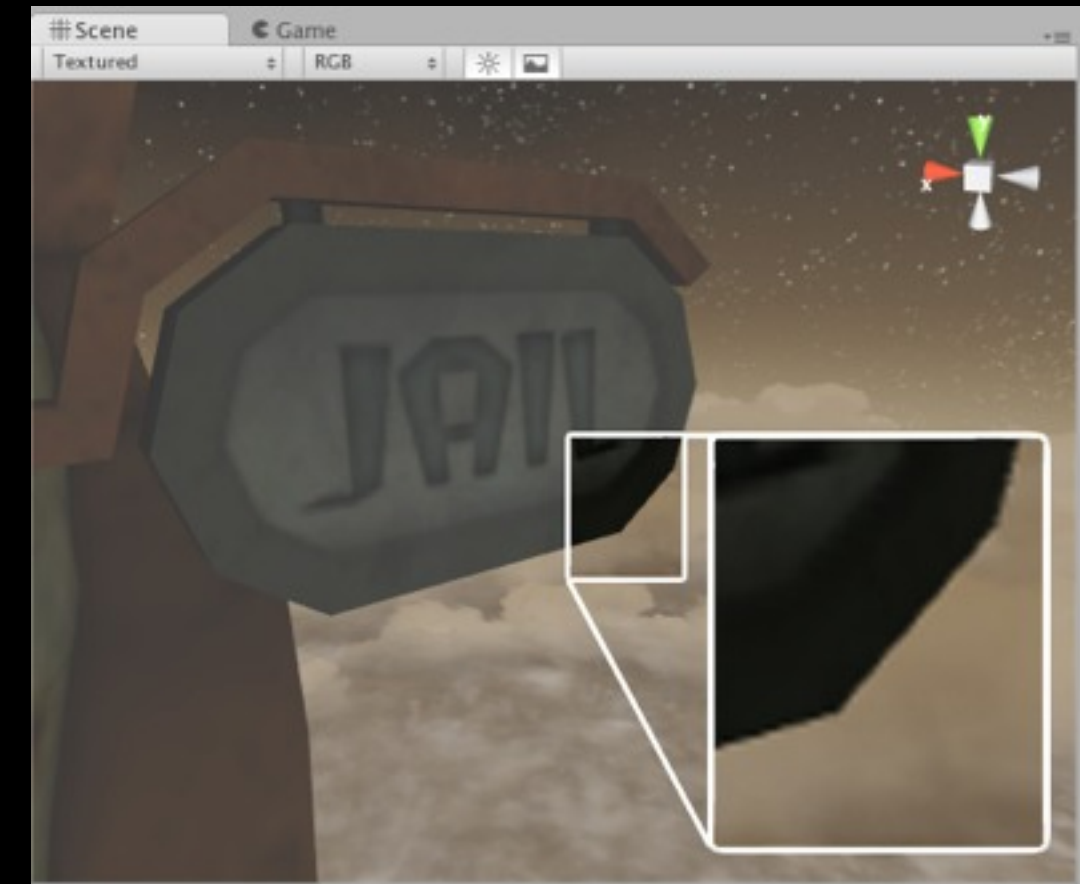
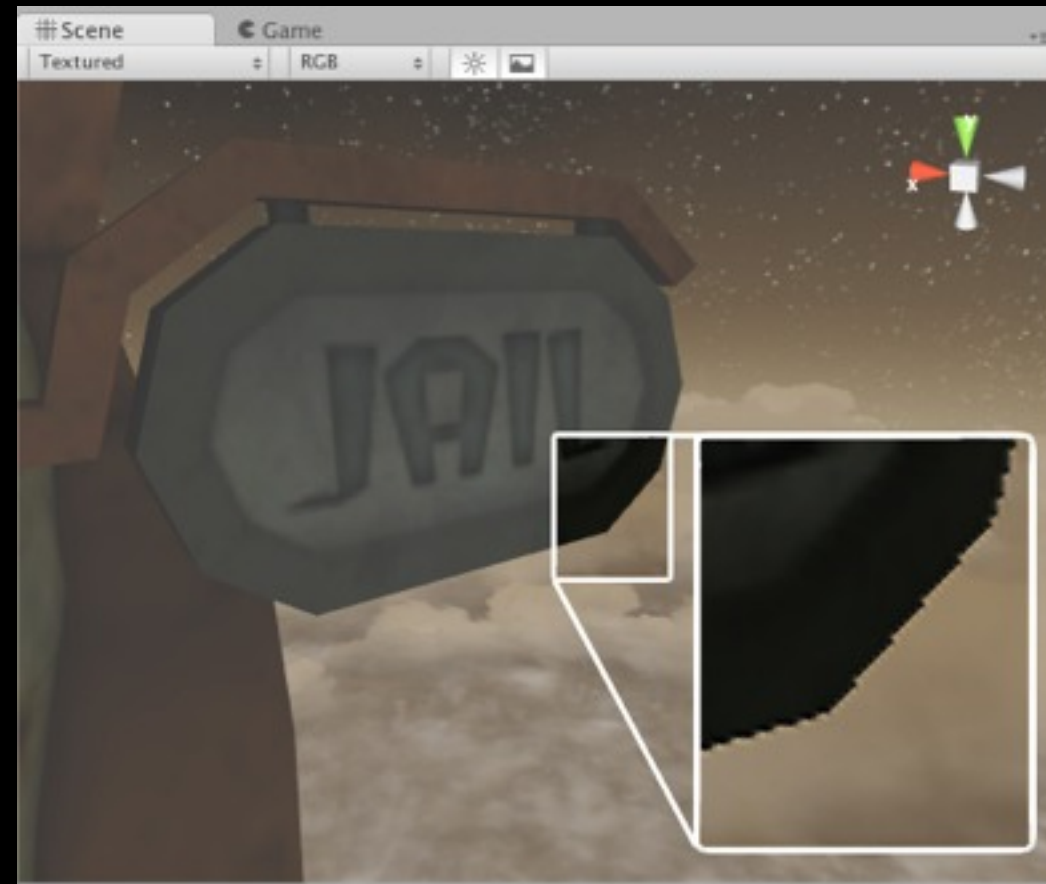
<http://unity3d.com/support/documentation/Components/comp-ImageEffects.html>

Anti Aliasing

Pro Only



Tomb Raider ohne und mit 3DFX



<http://unity3d.com/support/documentation/Components/script-AntialiasingAsPostEffect.html>

<http://unity3d.com/support/documentation/Components/class-QualitySettings.html>

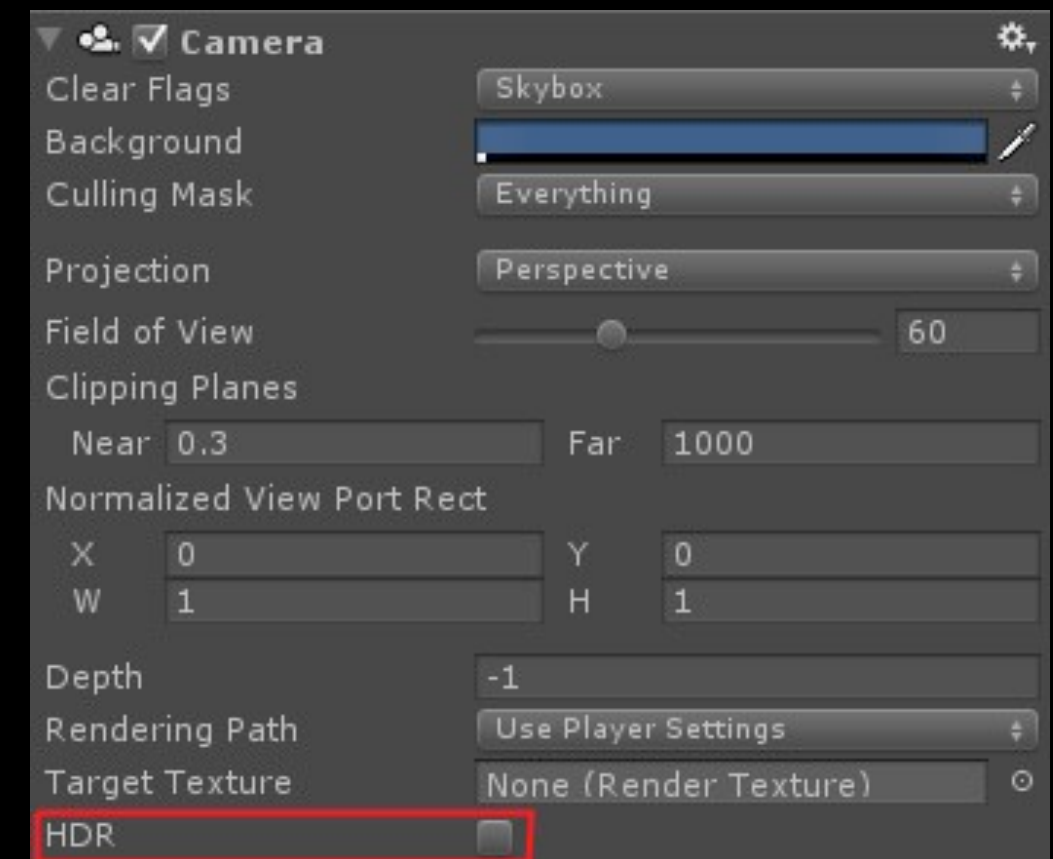
HDR Rendering Pro Only

<http://unity3d.com/support/documentation/Manual/HDR.html>

With HDR Rendering



Without HDR Rendering



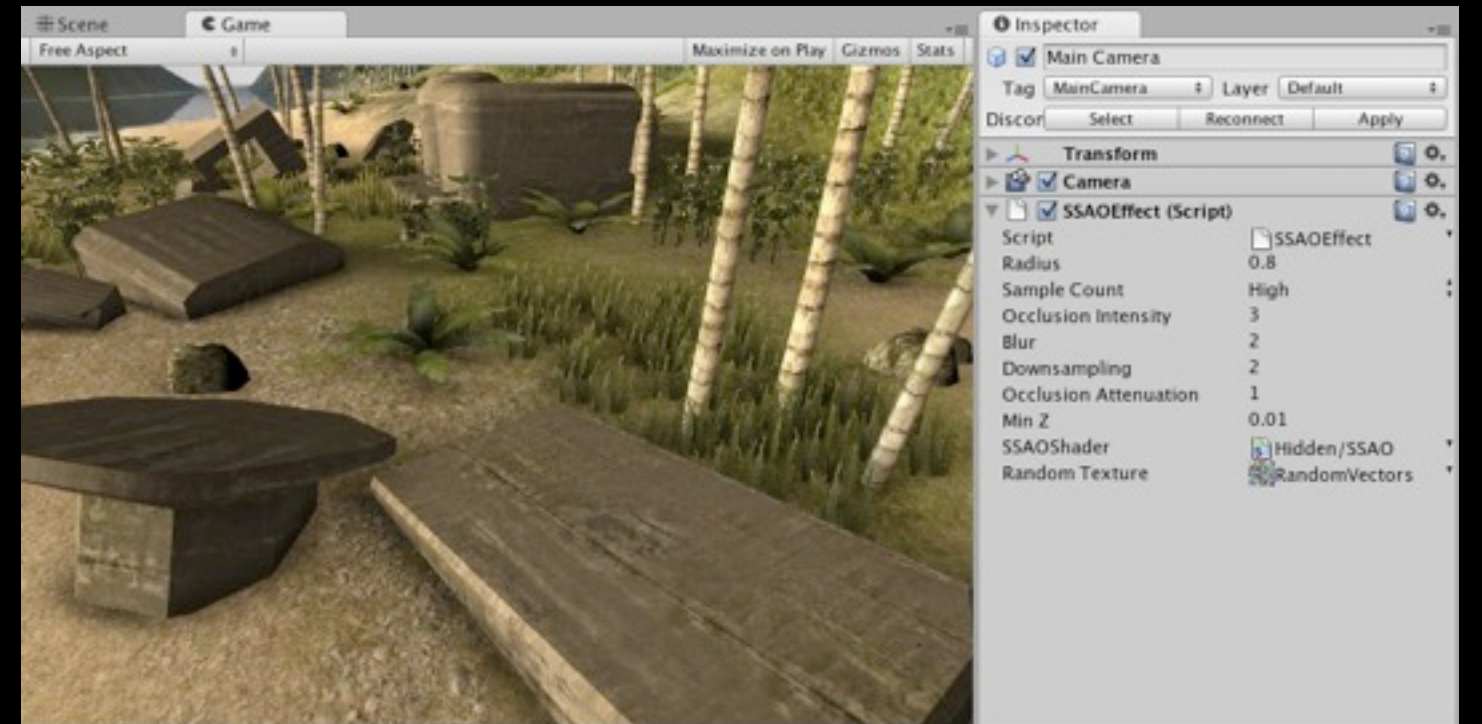
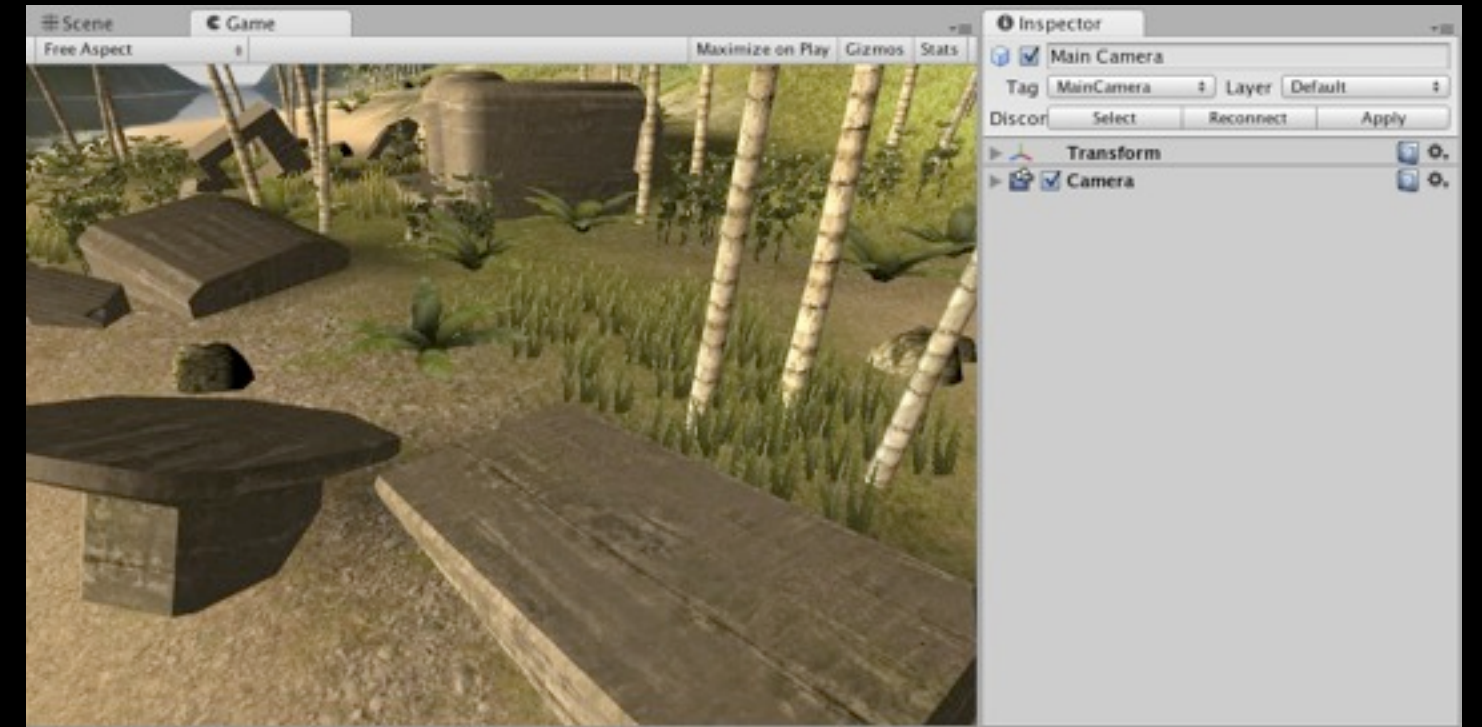
Crytek: Far Cry, 2001

Ambient Occlusion

Pro Only

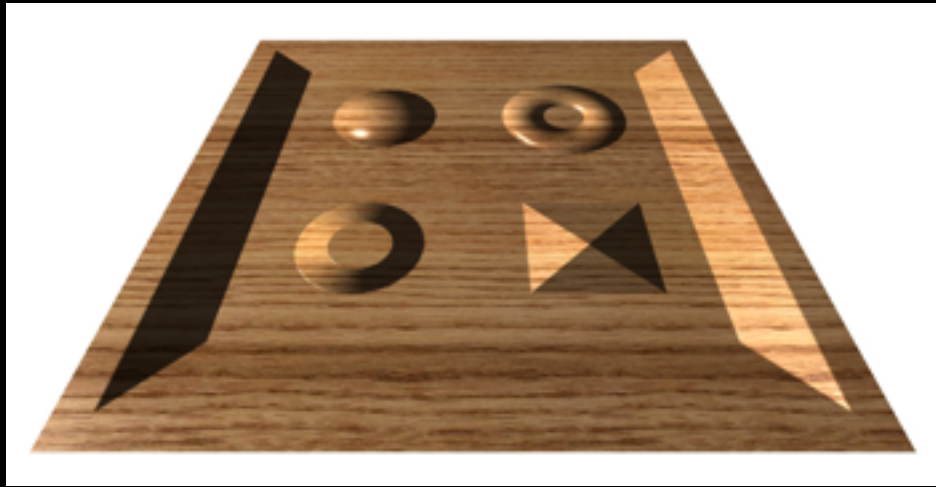


Vavle: Half Life 2, 2004

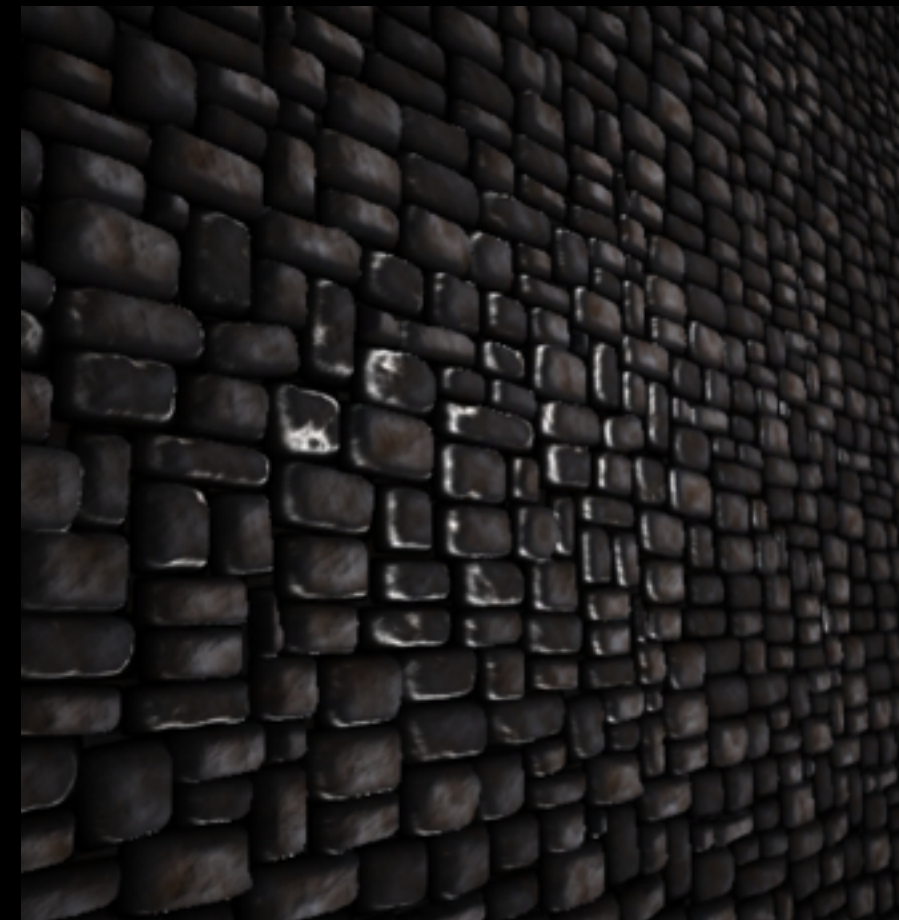


<http://unity3d.com/support/documentation/Components/script-SSAOEffect.html>

Relief Mapping



id: Doom 3



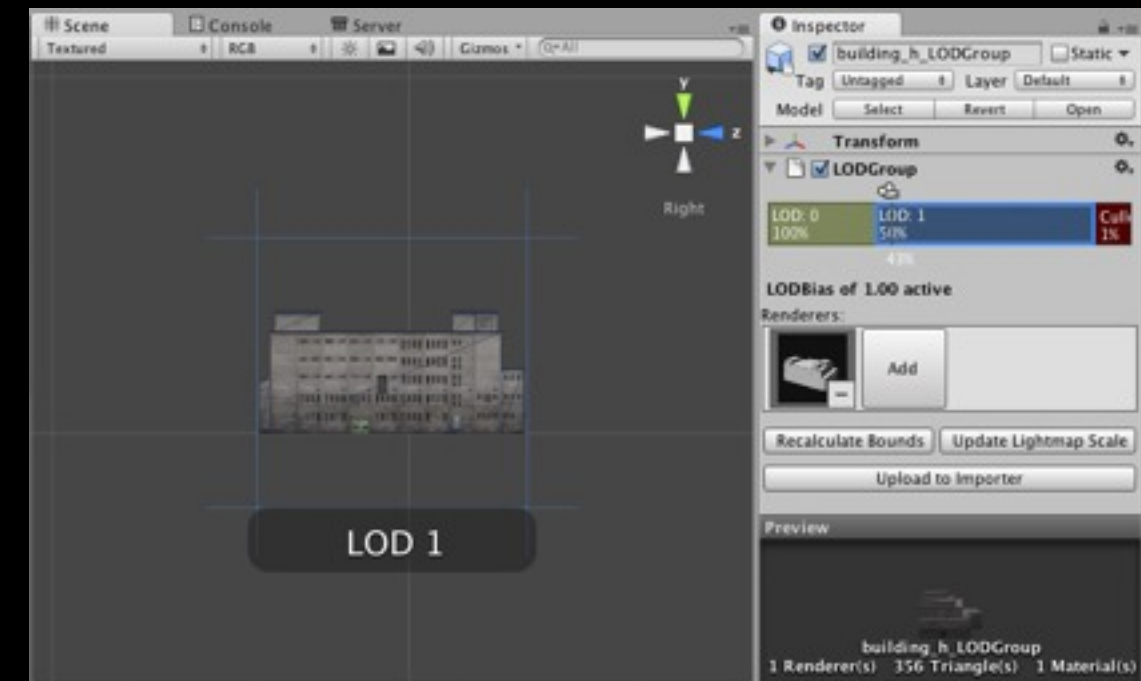
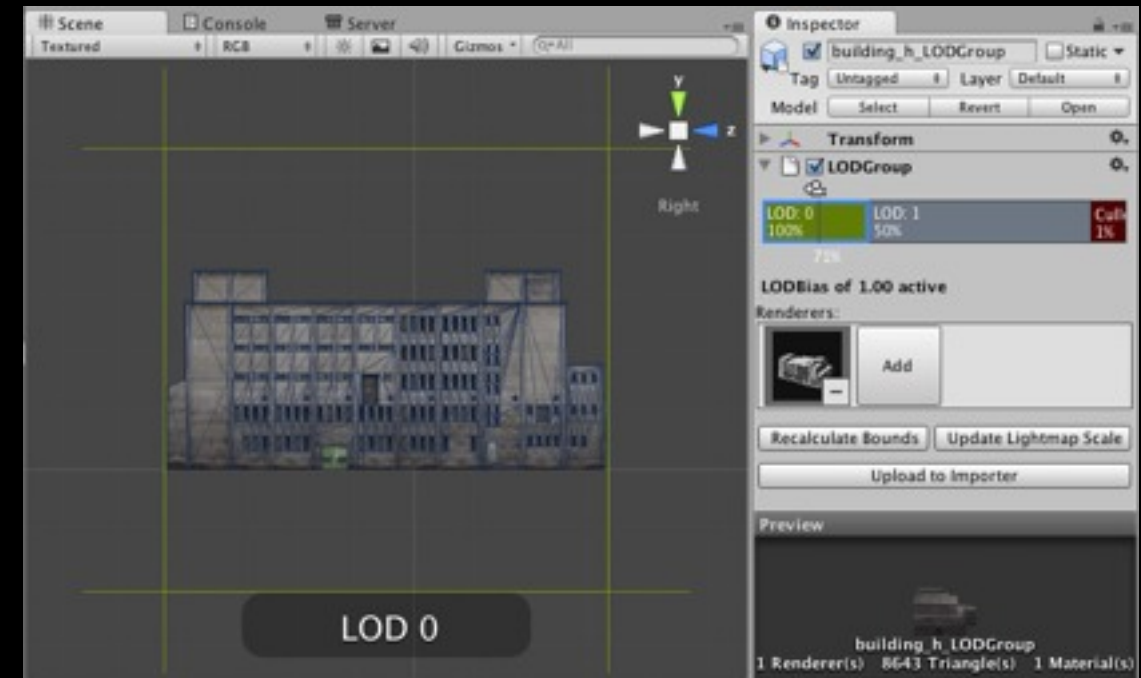
<http://unifycommunity.com/wiki/index.php?title=ReliefSpecular>

Level of Detail

Pro Only



Level of Details: Far Cry, 2004



<http://unity3d.com/support/documentation/Manual/Level%20Of%20Detail.html>

Global Illumination Pro Only

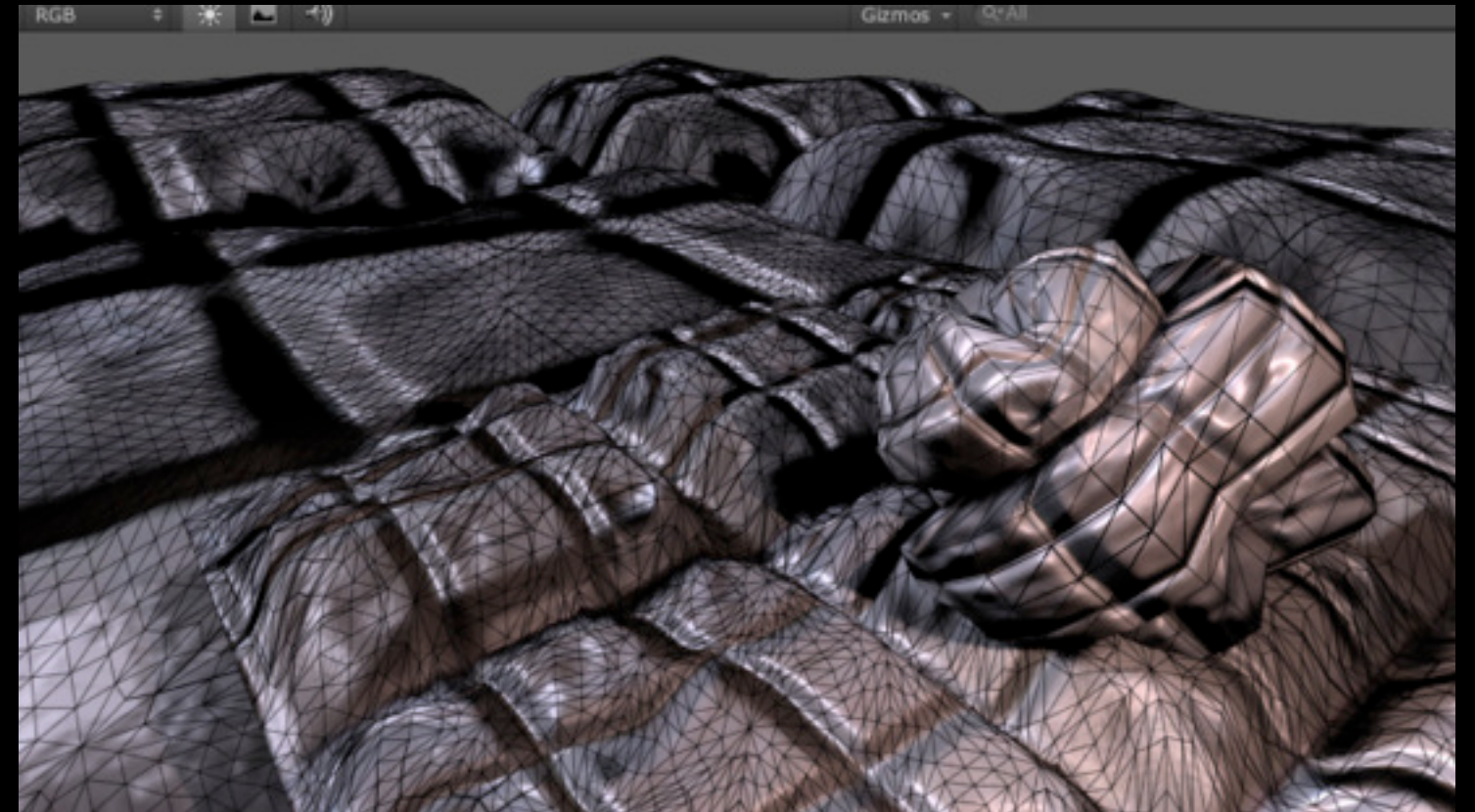
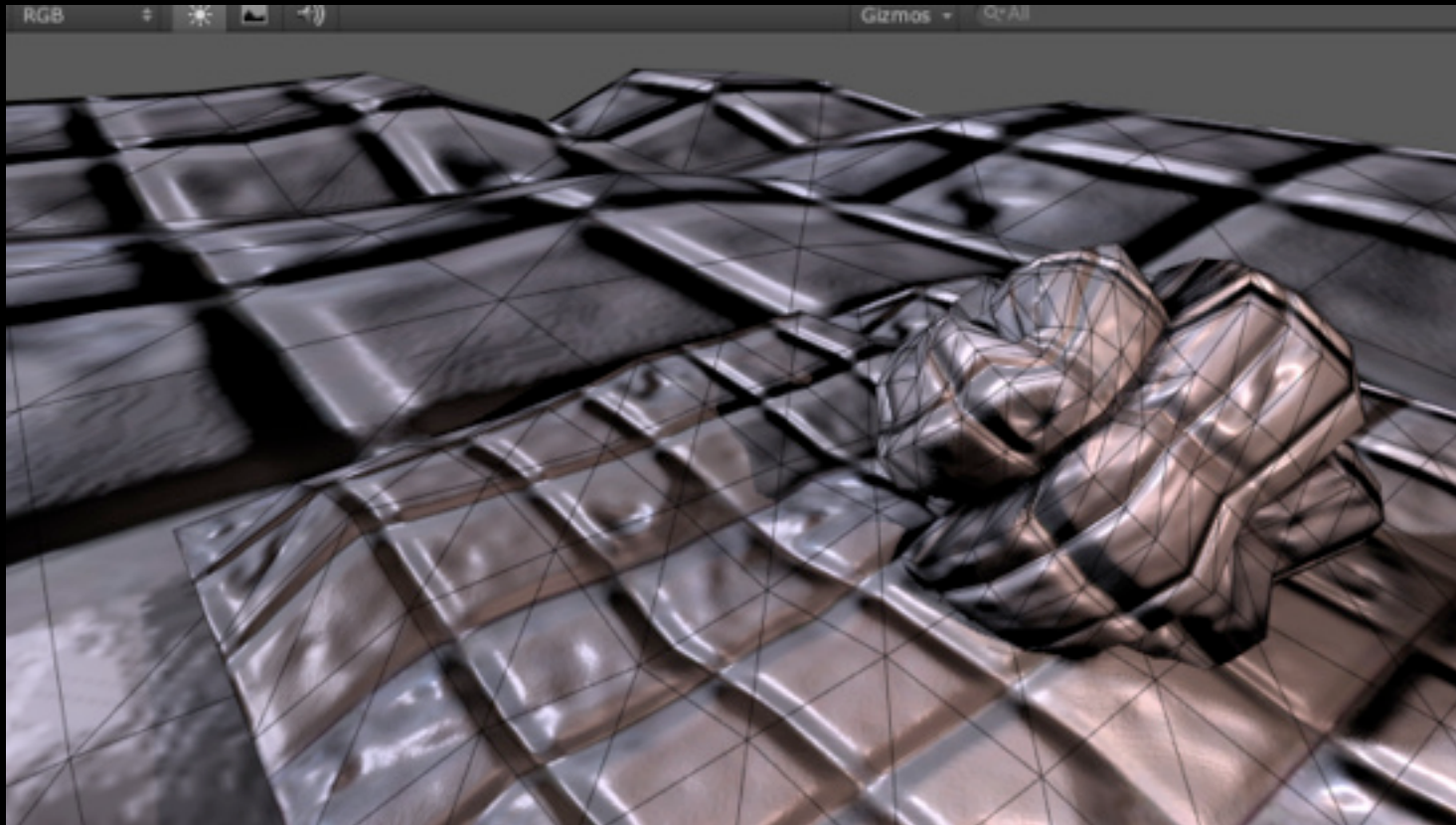
<http://docs.unity3d.com/Documentation/Manual/LightmappingInDepth.html>

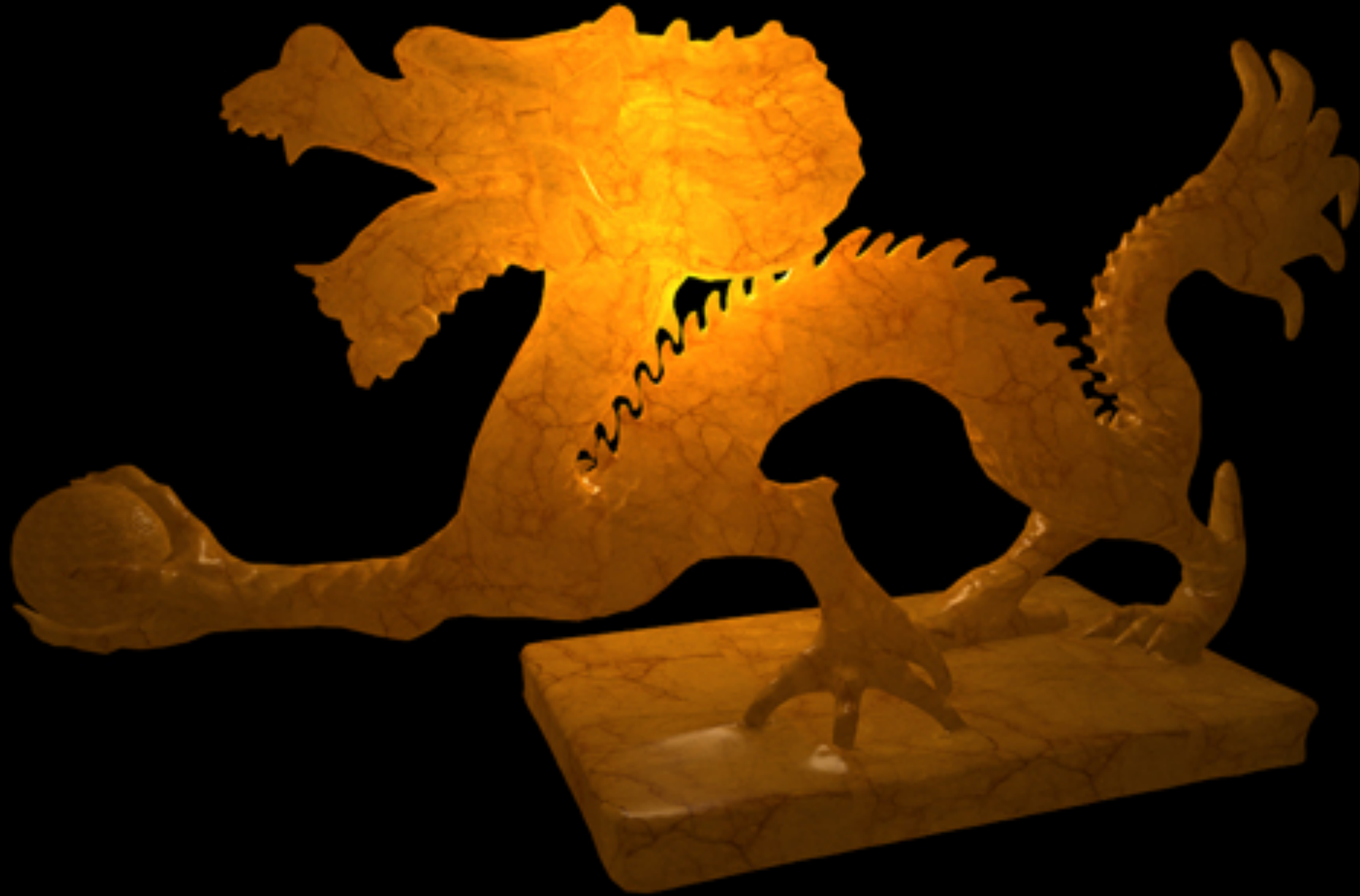


Global Illumination: Halo III, 2007

Tessellation

<http://docs.unity3d.com/Documentation/Components/SL-SurfaceShaderTessellation.html>





Sub Surface Scattering

<http://www.youtube.com/watch?v=Akv34Ct0IT4>

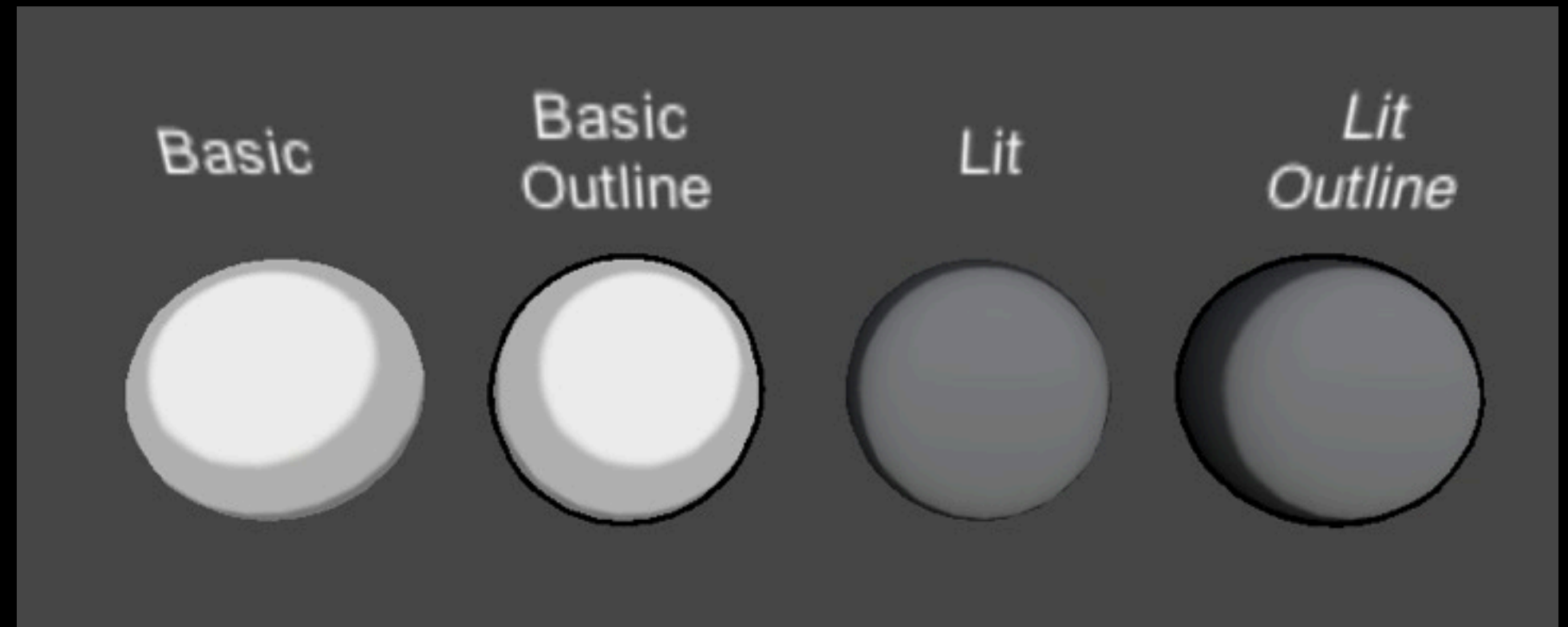
http://dl.dropboxusercontent.com/u/49615231/SSS_webPlayer/SSS%20webPlayer.html

Non Photorealistic Rendering

<http://www.unifycommunity.com/wiki/index.php?title=Shaders>



Okami, 2006



Assets > Import Package > toon shading

<http://www.youtube.com/watch?v=BiFvCeXmr4M>