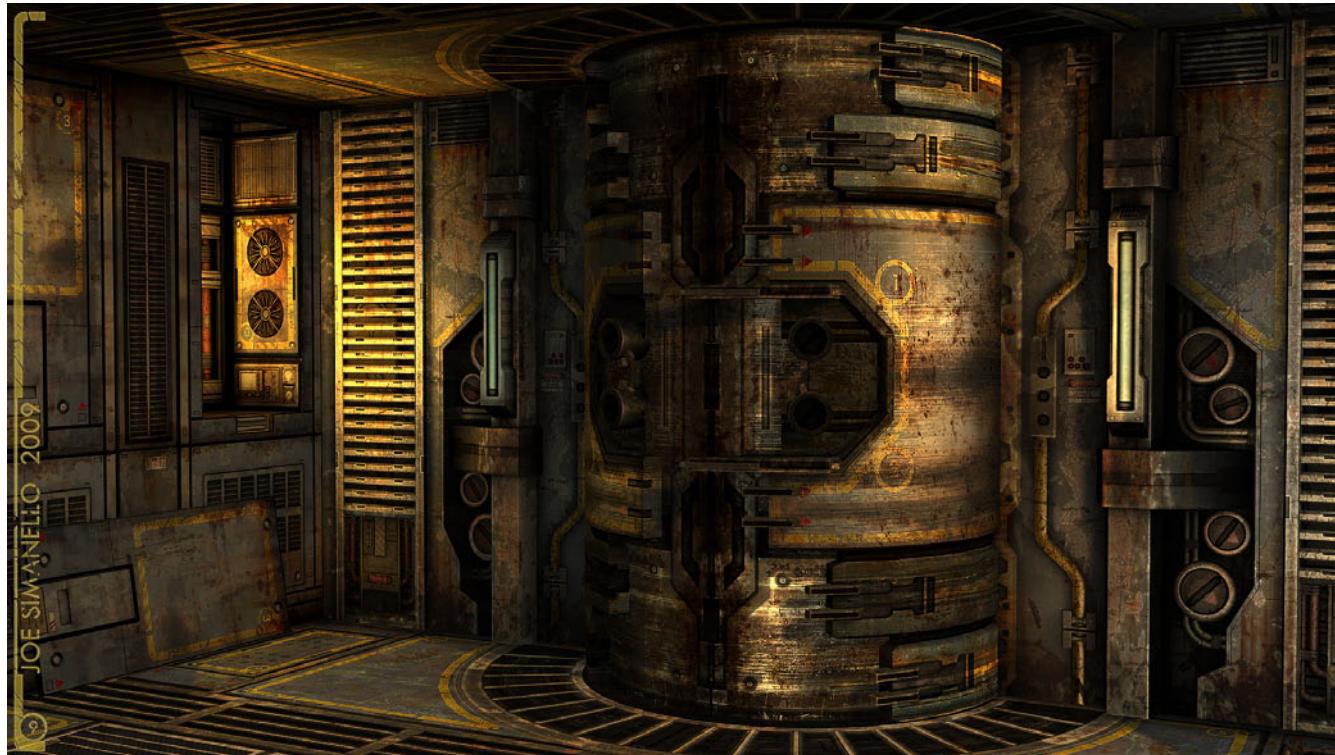
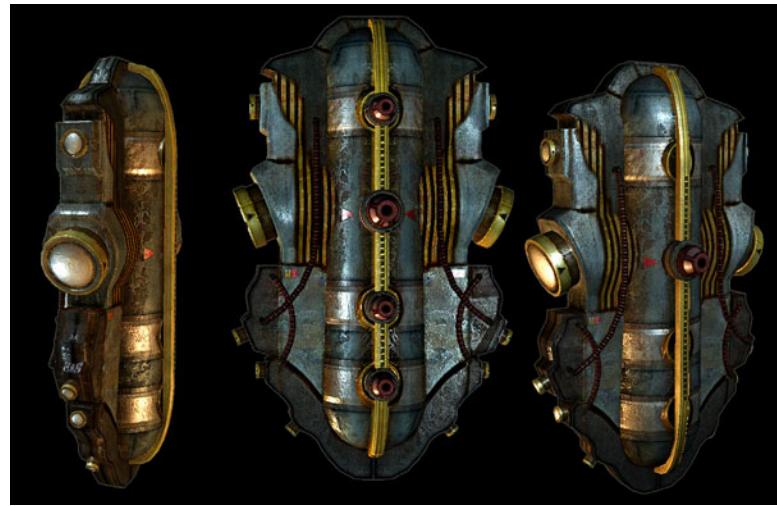


Textures add more realism to an environment and characters. There are many 2D painting programs that can be used to create textures, such as Adobe Photoshop and Corel Painter. Many artists use photographs and add hand-painted details to create textures. Every artist paints a different way, with a certain style or look. Sometimes you adapt to a predefined art style, so that the textures look similar. The textures in this lesson are from different models, but were all painted by the same artist. The first textures shown are from a science fiction-themed scene. The textures depicted later in this lesson are from an ammo case prop and a fantasy prop. These scenes and props were rendered using mental ray® Standalone in 3D software such as Autodesk® Maya®, Autodesk® 3ds Max®, or Autodesk® Softimage® (formerly Softimage|XSI).

The image displays a render of the Bio Chamber created in XSI

Pictured are renders of the Hydrant Prop created in Maya.



The images are renders of the Ammo Case created in Maya.

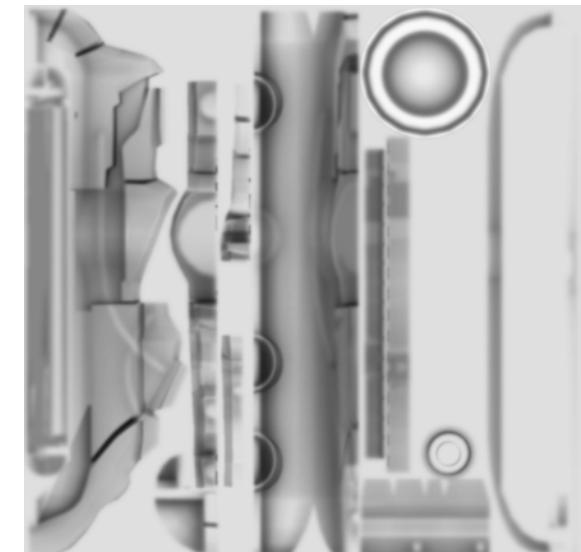
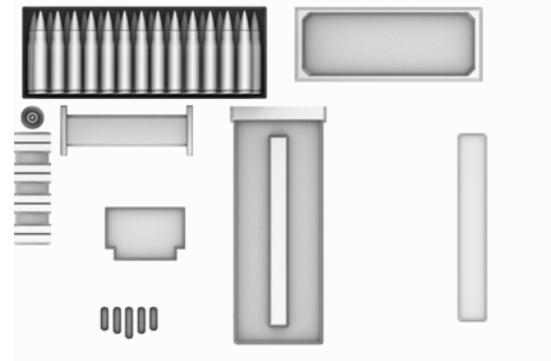
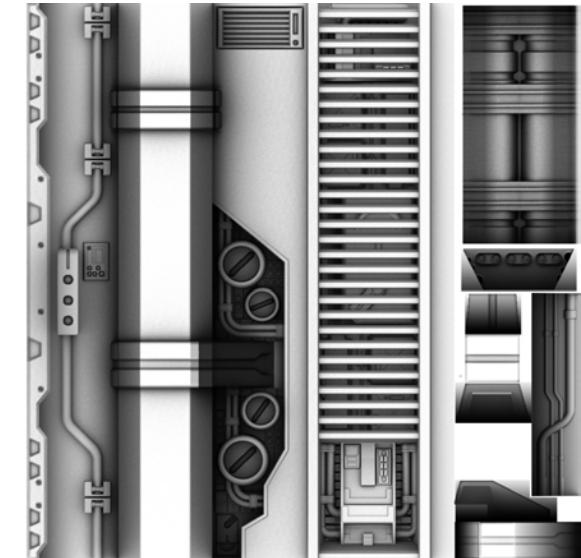
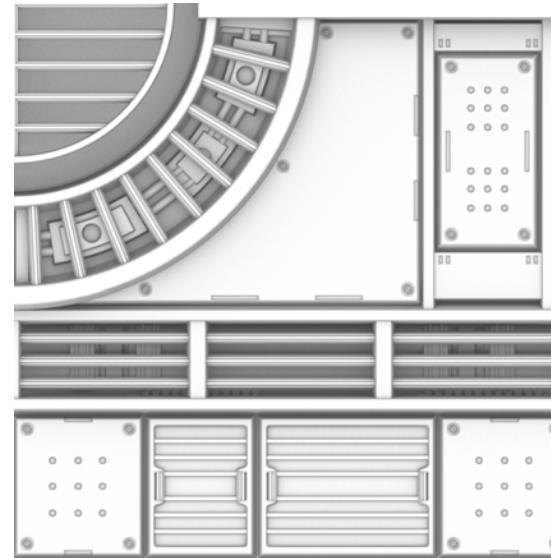


Standard Texture Maps

AO Maps

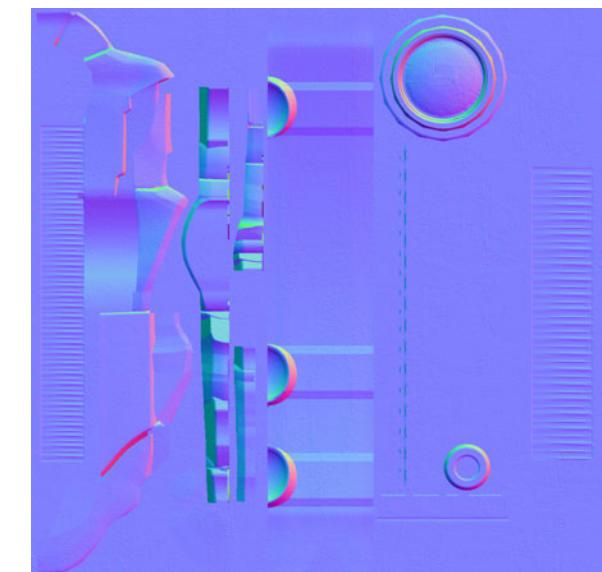
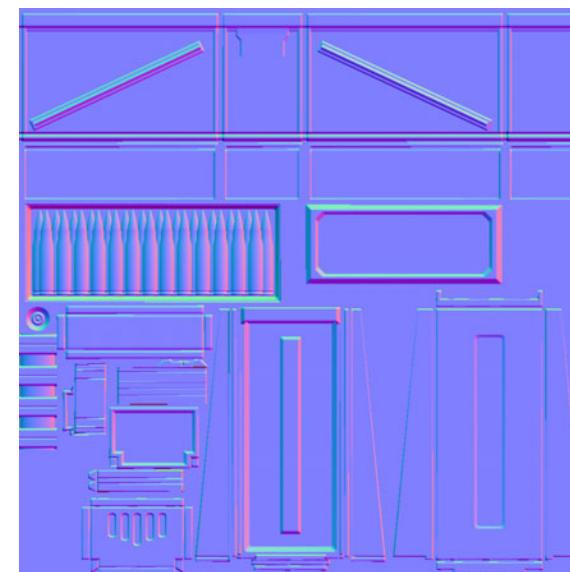
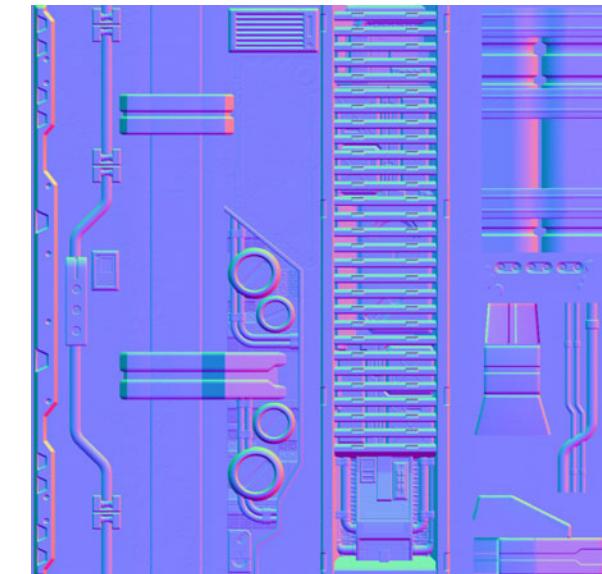
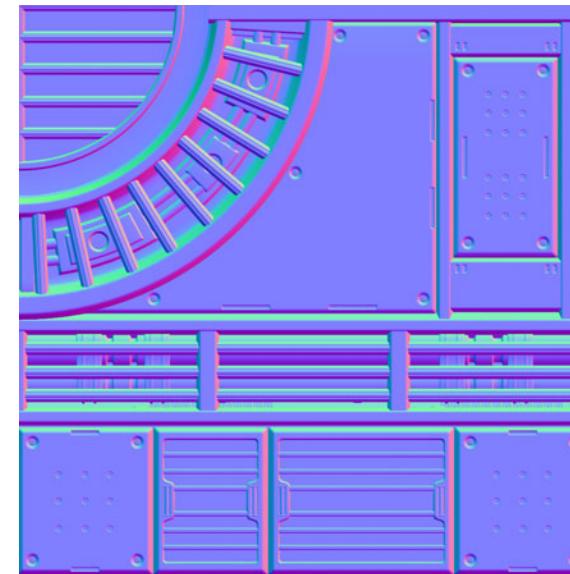
Ambient Occlusion is a shading model that adds realistic shadows to a 3D model or scene. AO maps add shadows to cracks and the underside of objects. AO maps have a soft look, and are used as an overlay on the diffuse texture. This is accomplished by setting the AO map Layer Style to Multiply in Photoshop. This is a simple way to fake global illumination, which is a method to calculate realistic lighting. It saves rendering time because the shadows are overlaid onto the diffuse texture. AO maps are created from a high resolution model and can take a long time to calculate.

The images below are ambient occlusion maps.



Normal Maps

A normal map is an RGB colored texture that acts as a 3D bump map. A normal map uses X, Y, Z coordinates to add detail to the surface normal of the polygon face. The normal map adds fine detail on a relatively flat surface. The normal map is seen when a light hits the polygon, shading the concave areas with shadows and the edges with highlights. A normal map bumps in any direction, but tends to degrade the effect when viewed at less than a 45 degree angle. You create normal maps in Photoshop using a grayscale image. You use the Nvidia map filter to convert a grayscale image into a RGB normal map. The common colors of a normal map are shades of blue, pink, purple, orange, and green.

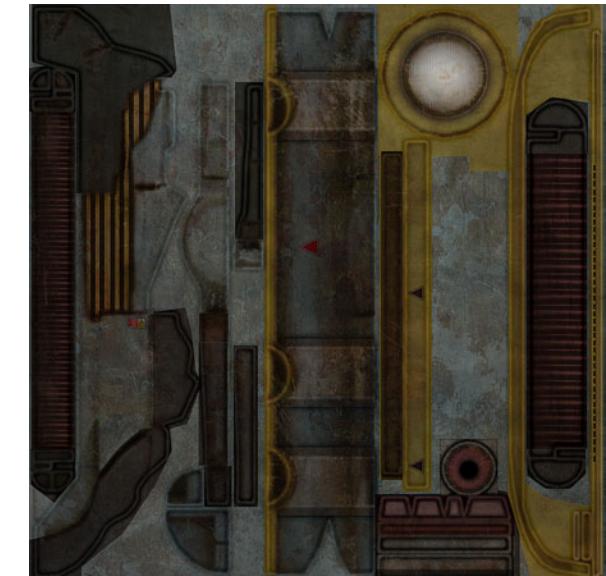
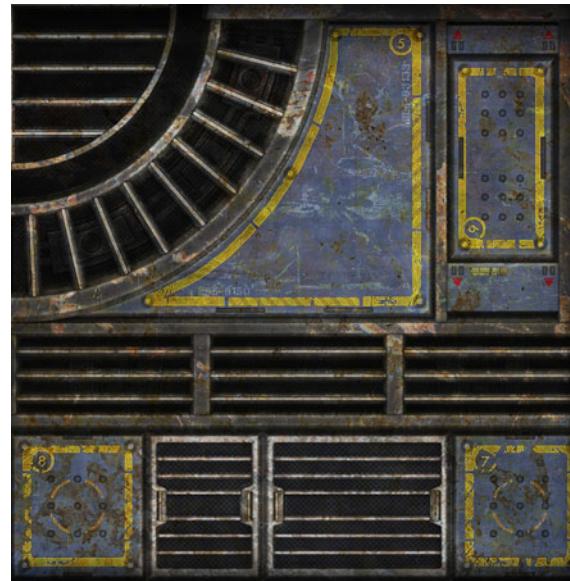


Pictured are normal maps used on a floor and props.

Diffuse Maps

The diffuse map is an RGB color texture. This texture holds the majority of the detail and color information seen on the 3D model. In production settings, the normal map and ambient occlusion maps are created before the diffuse map. The textures should have details that line up on top of one another. It is common to go back to the normal and AO maps to add details while creating the diffuse map. When viewing a diffuse texture in a video game engine, it sometimes over saturates colors, blows out the color white, and darkens black colors. Lower the saturation, and never use pure white or black.

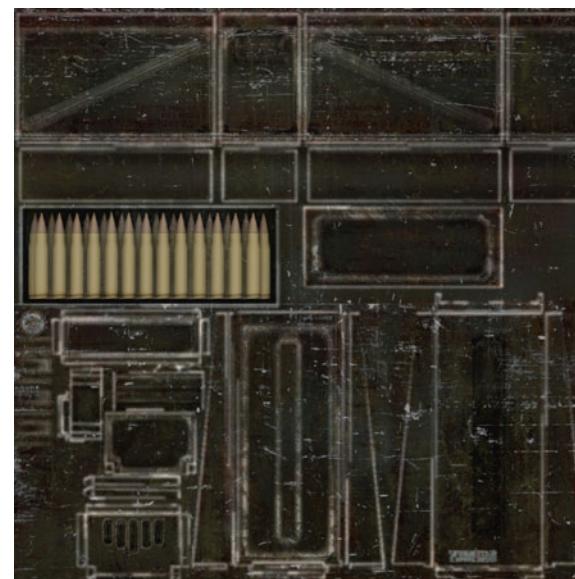
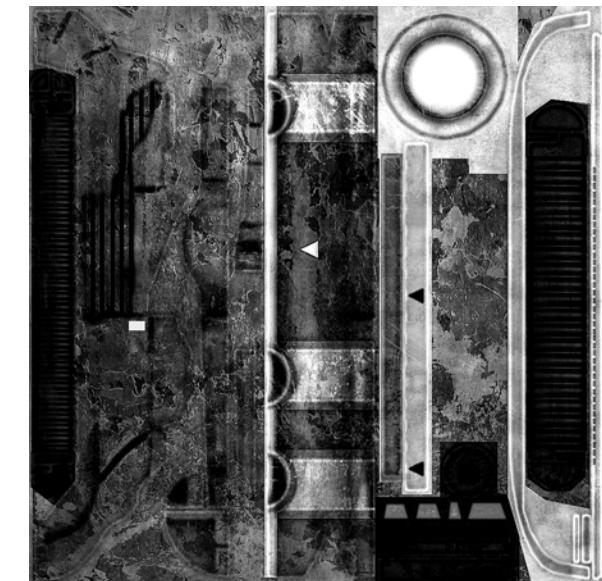
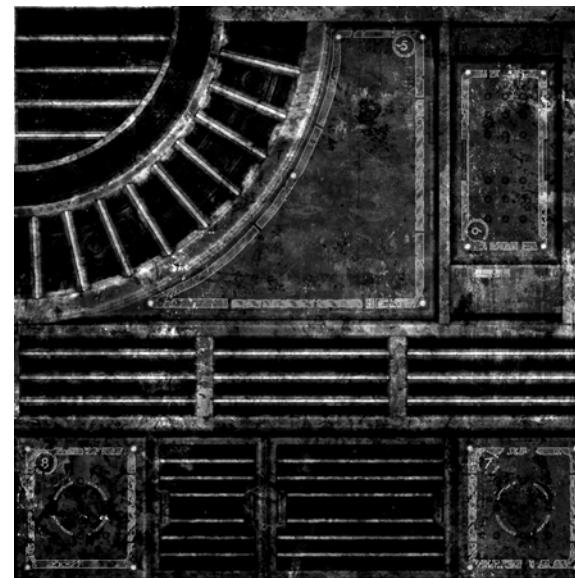
The images are diffuse color maps.



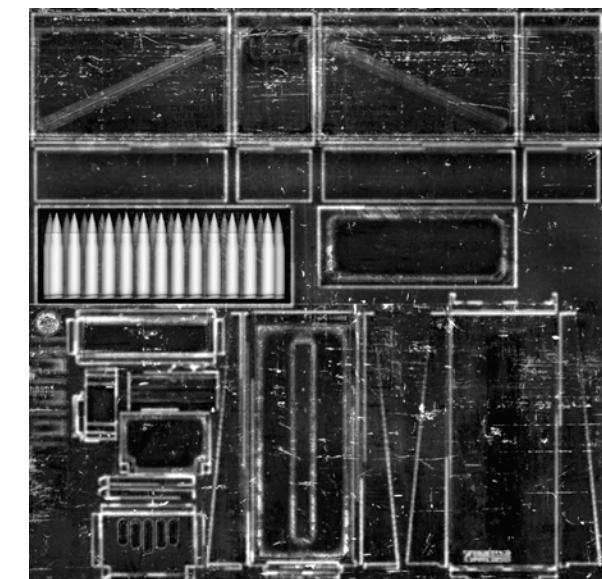
Specular Maps

Specular textures come in two styles: grayscale maps and color maps. A grayscale specular map accents areas of the texture that are shiny and matte. White and gray areas are shinier when hit by a light. The black and dark gray areas do not reflect much light, and have a low specular value. You use color specular maps to add color when viewed at a glancing angle. To create a chrome material, add some of the same color to the specular map. The specular map adds refined detail in a texture. The final specular map is sharpened or blurred to get a worn or soft feel.

The images below are specular maps.



Color Specular Map



Grayscale Specular Map

Special Texture Maps

Alpha Maps

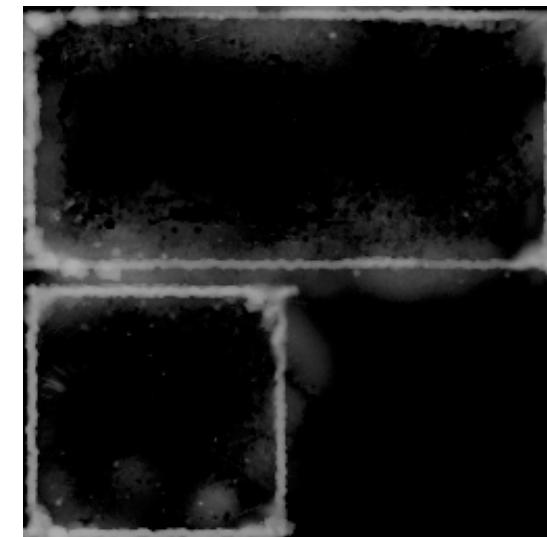
You use alpha maps for glass, decals, and even hair textures. An alpha map is a grayscale texture usually placed in the alpha channel in Photoshop. The texture is saved out as a 32 bit Targa file. There are special alpha map settings for use in a game engine. Alpha test is a setting that uses almost completely white and black values. This is less expensive because the alpha is transparent and opaque, with no blending. Alpha channels applied to windows use the full grayscale spectrum to achieve the desired transparency value. These settings are slightly more expensive in video games, when there are transparent objects rendering in front of another. In pre-render, this is not as much of a performance concern. The images are an alpha map used with alpha test, and another used for glass.



Alpha Test



Glass Diffuse

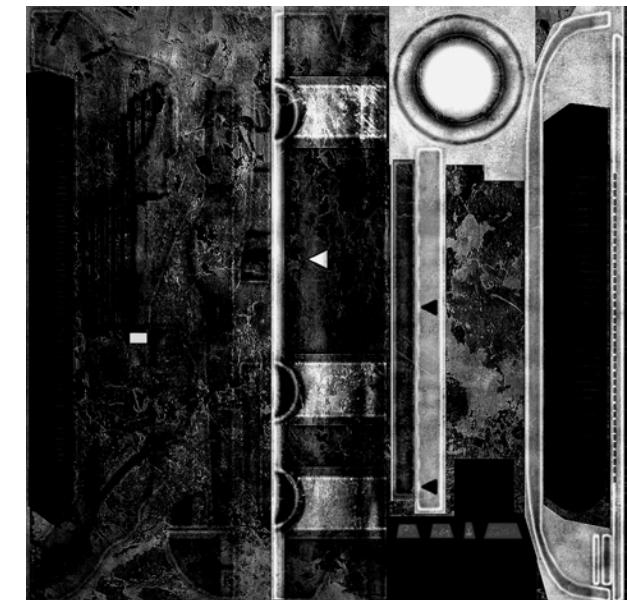
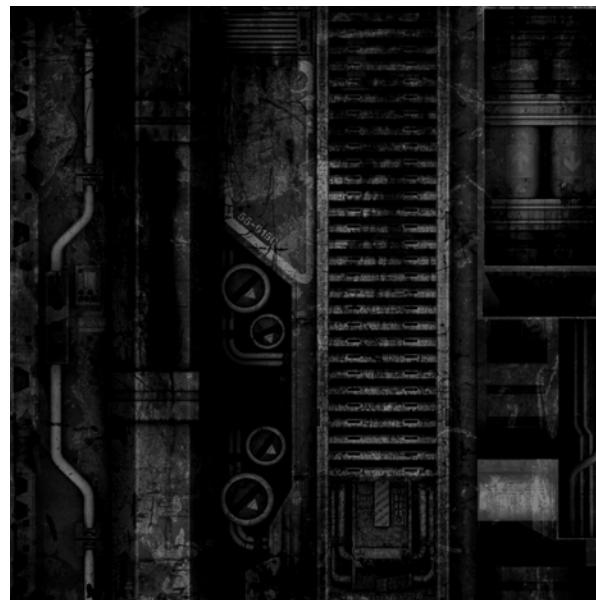
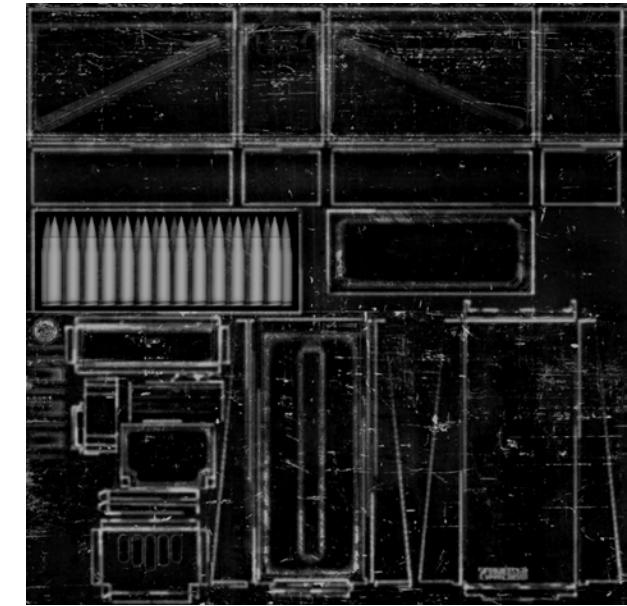
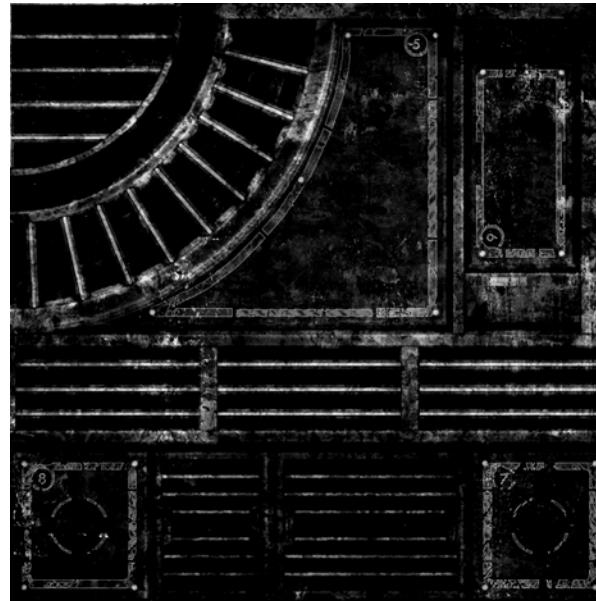


Glass Alpha

Cosine Maps

Cosine maps define the glossiness of a surface. A cosine map is a grayscale map, and may be used in combination with a color specular map. In some game engines, the glossiness level uses a reflection cube map. White areas in the cosine map pick up the reflection of the world through the cube map. When trying to get a highly reflective surface, the diffuse texture must be a darker color. Cosine maps look similar to a grayscale specular map.

The images are examples of cosine maps.



Secondary Texture Maps

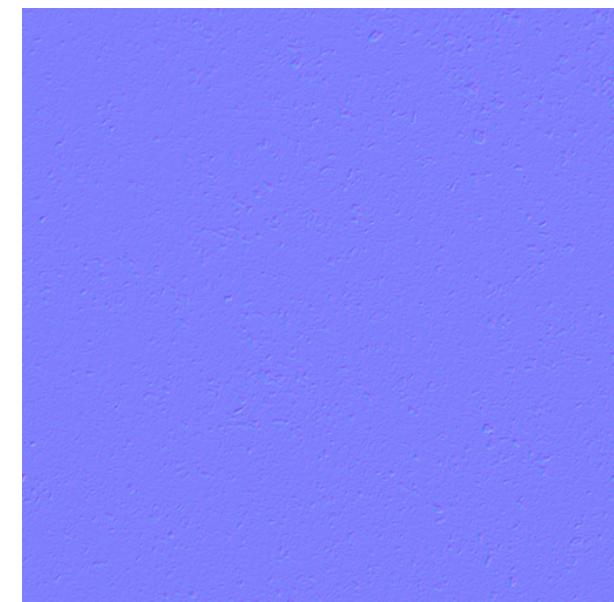
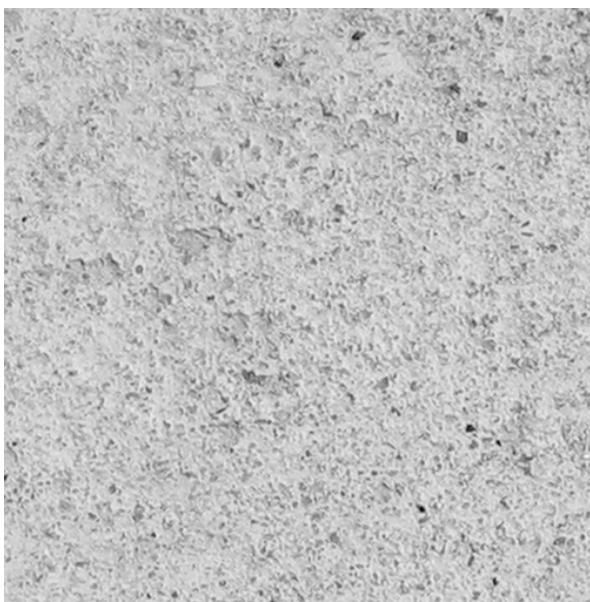
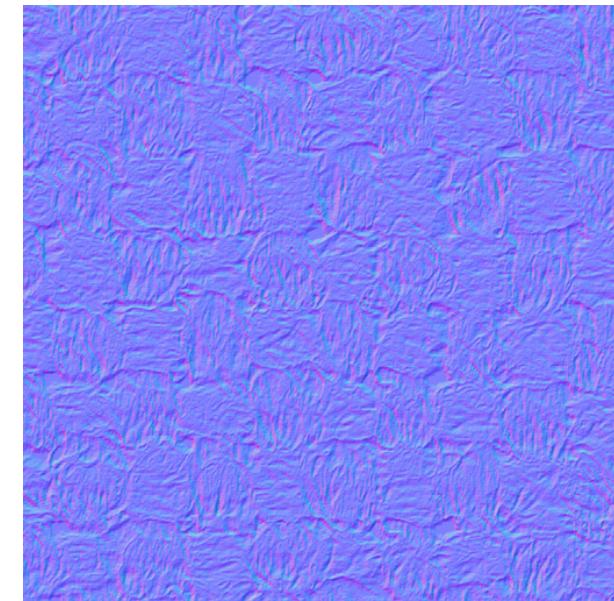
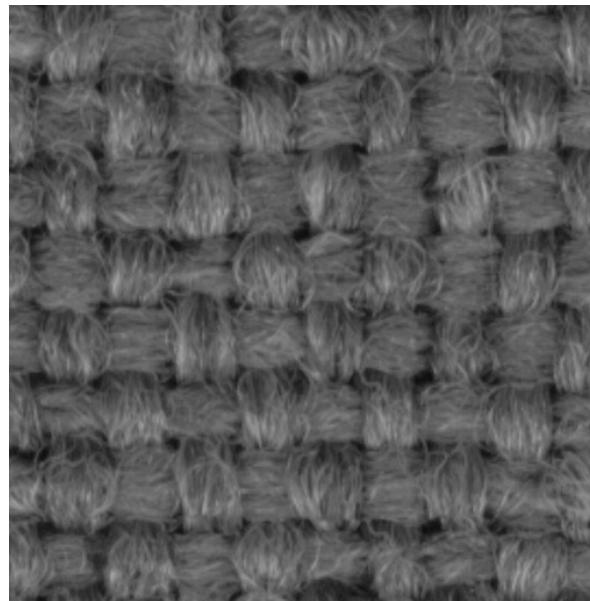
Detail Normal Maps

Detail normal maps create macro details surfaces such as fabric, or large subtle variations in stone.

You create a second set of UVs for adjusting the scaling and detail.

Detail normal maps are usually small, about 128 by 128 pixels or less. A dual layer shader is needed with two normal map channels. The detail normal map is created from a grayscale map, using the Crazy Bump or the Nvidia normal map filter.

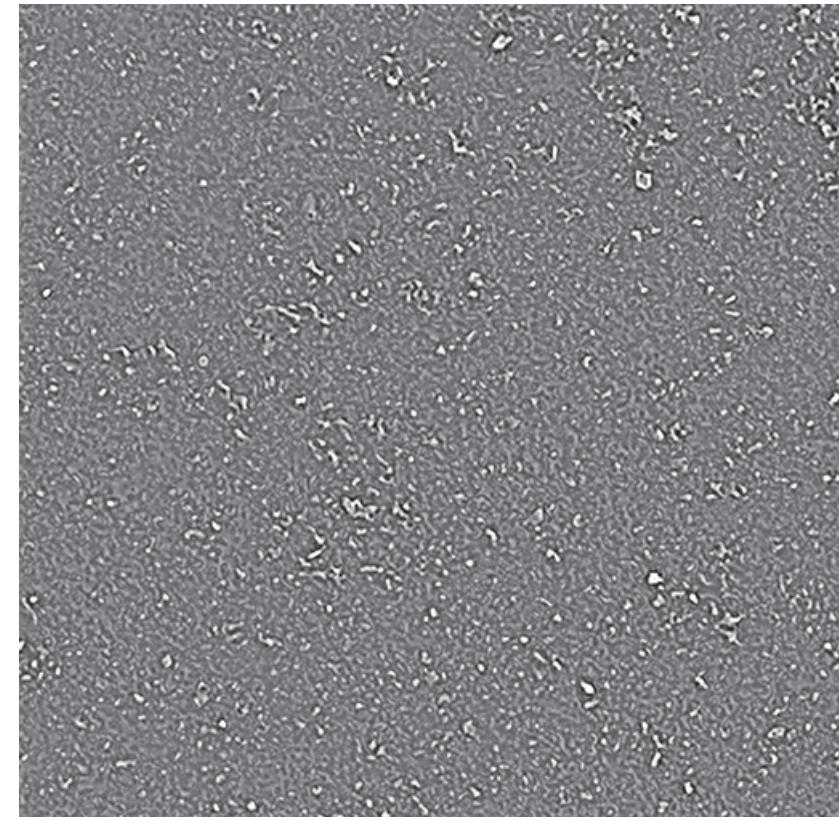
These images are detail normal maps in grayscale and normal map.



Parallax Maps

Parallax maps are a form of visual displacement map. This map makes the environments surface look like it has more depth. Parallax textures are grayscale textures and are similar to normal maps in that they add depth in all directions. The more extreme the view angle, the more depth is created. Organic textures are ideal for parallax maps because they have a nonuniform layout. Custom normal mapped textures are sometimes problematic if they have very detailed edges and corners. Some 3D packages such as Softimage create a depth map, which may be used as a parallax map. There are also file converters that create a displacement or parallax map from a normal map.

The images are parallax maps for fabric and stone.



BRDF Maps

The bidirectional reflectance distribution function is a four dimensional equation that defines how light is reflected on a 3D object. In video games, a 128 by 128 pixel color texture that simulates a light source is used to create lighting effects. A BRDF map is created on a solid black background, using gradients and hand painted details. Depending on the placement of the painted details, it controls the reflection properties on the model. One effect is rim lighting, which is a highlight around the edge of the model.



Diffuse BRDF



Specular BRDF



Glass Diffuse BRDF



Glass Specular BRDF

Final Textures

Most traditional game engines render a diffuse, normal, and specular map. The advanced game engines such as Unreal 3, Cry Engine 2, and Hammer support the maps covered above and many more. 3D software rendering supports many of these, but may have to be created and applied in different ways.

Below are final texture maps created at 1024 by 1024 pixel resolution. From left to right, they are diffuse, specular, and normal map.

