

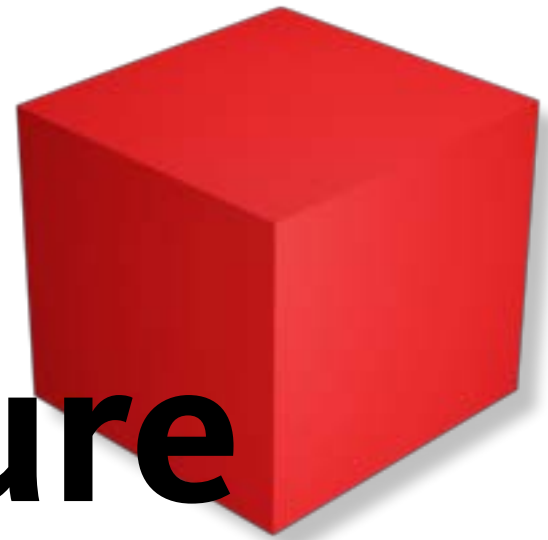
2010



3D Visualization & Animation Competition

This Workbook provided through a generous grant from **Autodesk®**


Texture



Texture



2010

 SkillsUSA[®] 3D Visualization & Animation Competition

Texture Principles

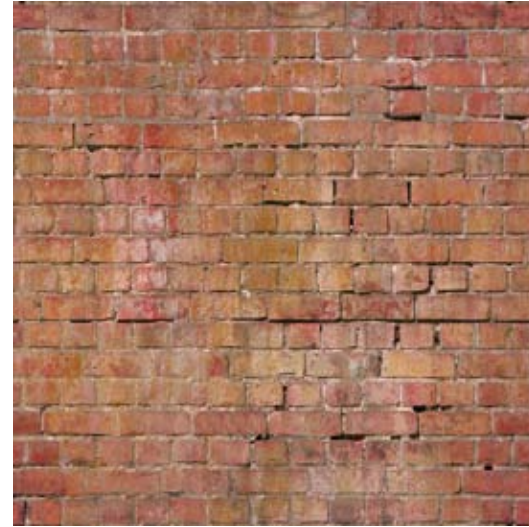
In this lesson, you learn the process of creating a texture from photographic references, and how they apply to video games and film. The texture tells the story of the untextured grey model. Textures add life to the entire environment, and give way to new ideas. Many art styles are combined when creating professional textures. Hand painted textures are created with a stylus much like a painter's brush. A great deal of time is required to get high quality results. Devising a system of texture creation can speed up production time. The process is easy to understand, but it may take some practice to get the textures just right.

Tileable and Custom

A texture map is a 32 bit RGB color file created in Adobe Photoshop or another 2D painting program. Textures are used in video games, film, TV, and advertising. Most 3D models have a texture on them, like a colored skin that shows color, specular, and fine details. Procedural textures require a mathematical algorithm to be generated. These are used mainly in film and TV production.

A tileable texture is a 2D image that is applied to a polygonal object or BSP level geometry. You create the textures from a digital photograph or a hand painted image. Tileable textures are designed to have seams in a specific area, or no seams at all. Having no seams enables a texture to be repeated over a large area. Custom textures are unique to a specific model or area. A custom texture has unique UV space and a fixed resolution. It is possible to reuse portions of a custom texture to save space and time. One way to reuse a portion of texture is to mirror from the right side of an object to the left side.

Pictured are a tiled brick texture and a custom metal prop texture.



Tileable brick texture



Custom prop texture

Texture Principles

The images display a brick texture mapped on primitive objects. The brick texture is tiled once, and can be made to tile in all directions. This is a Phong shader, and it has a diffuse, specular, and normal map.



Diffuse Map



Specular Map



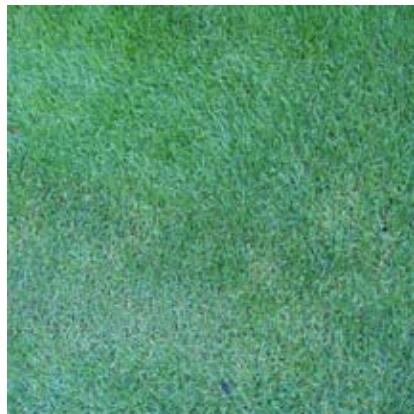
Cosine Map



Normal Map

Texture Principles

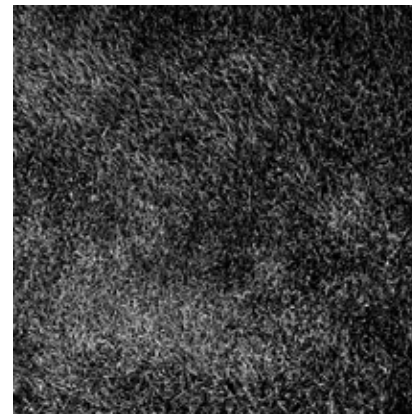
Pictured is an organic grass texture. This is a Phong shader and it has a diffuse, specular, and normal map.



Diffuse Map



Specular Map



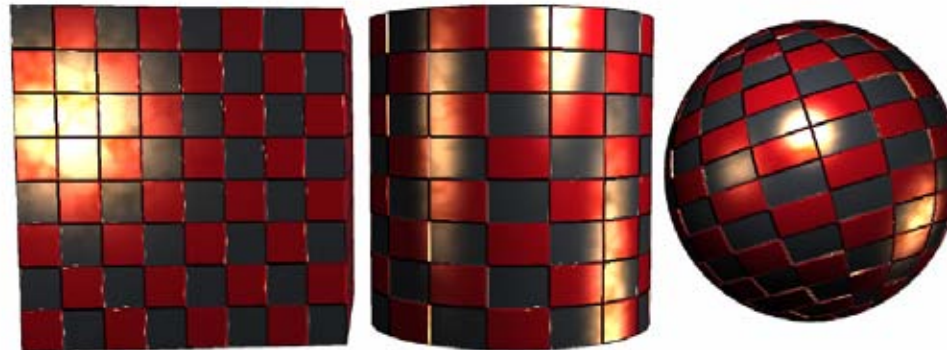
Cosine Map



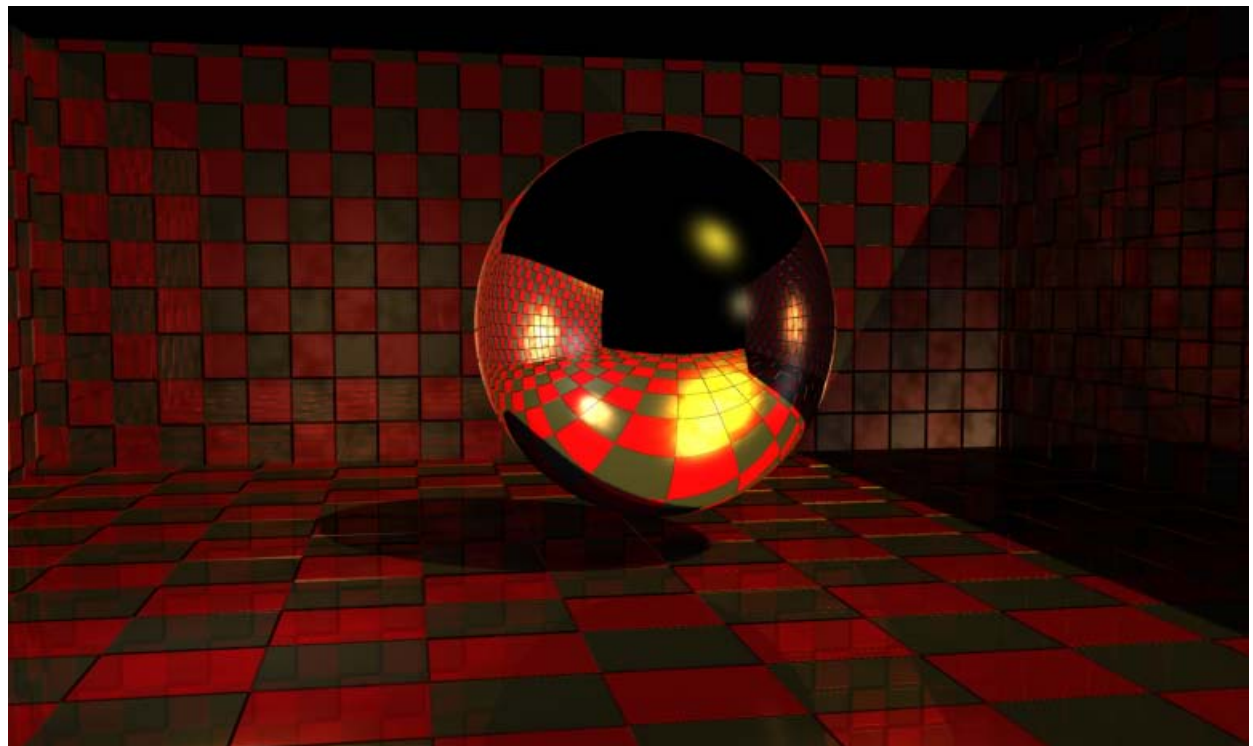
Normal Map

Texture Principles

You create procedural textures using a nod- based system in the material editor of the 3D software package or game engine. These textures are mathematically based, and can be infinitely tiled.



The image is a chrome shader on a sphere, in an environment with checkers on the walls and floor. Notice the yellow lights in the scene are reflected on the chrome ball. There is a directional light facing downward to the lower left, and two point lights.



Texture Principles

The process for creating a tiled texture that may be used vertically and horizontally is done in Photoshop. Once you have a good photograph, use the offset filter to display the seams in the middle of the texture. The goal is to paint out the hard edges. Using the Clone tool, the seams are hand painted so they are not visible. The same process is done for concrete and wood textures. It is more difficult to paint out the seams in organic textures, and may take time to perfect. Brick can be made seamless by using single or groups of bricks to cover the seams.

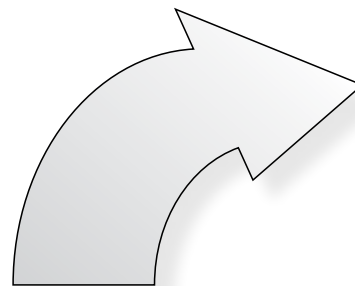
The images are of a grass texture, the offset texture, and the texture with seams painted out.



Original grass texture

Grass texture using offset filter

Grass texture with painted seams

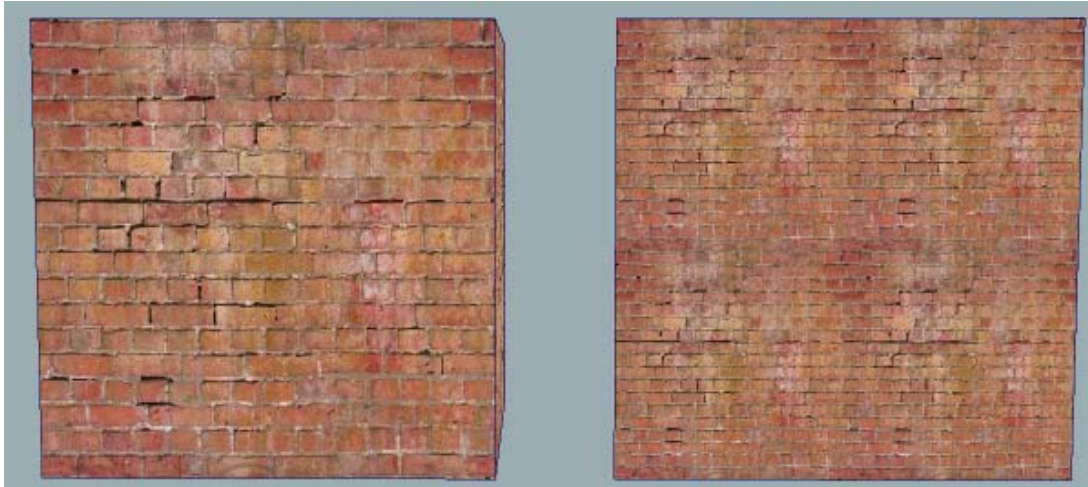


Pictured is the seamless grass texture tiled twice in both directions.



Texture Principles

The images are the brick texture on a cube, one is tiled once, and the other is tiled twice.



UV's tiled once

UV's tiled twice



When creating a texture for film or video games, use the proper pixel size. Texture sizes are often divisible by an even number such as 8. A common texture size for the Xbox 360 and PS3 is 512 by 512, up to

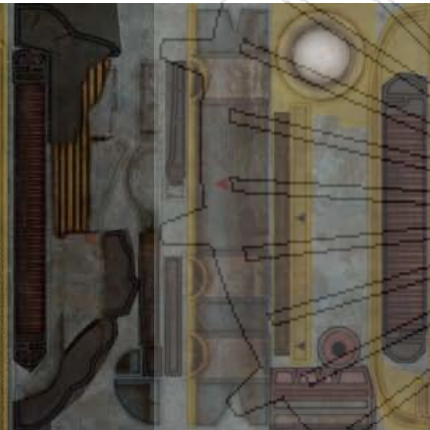
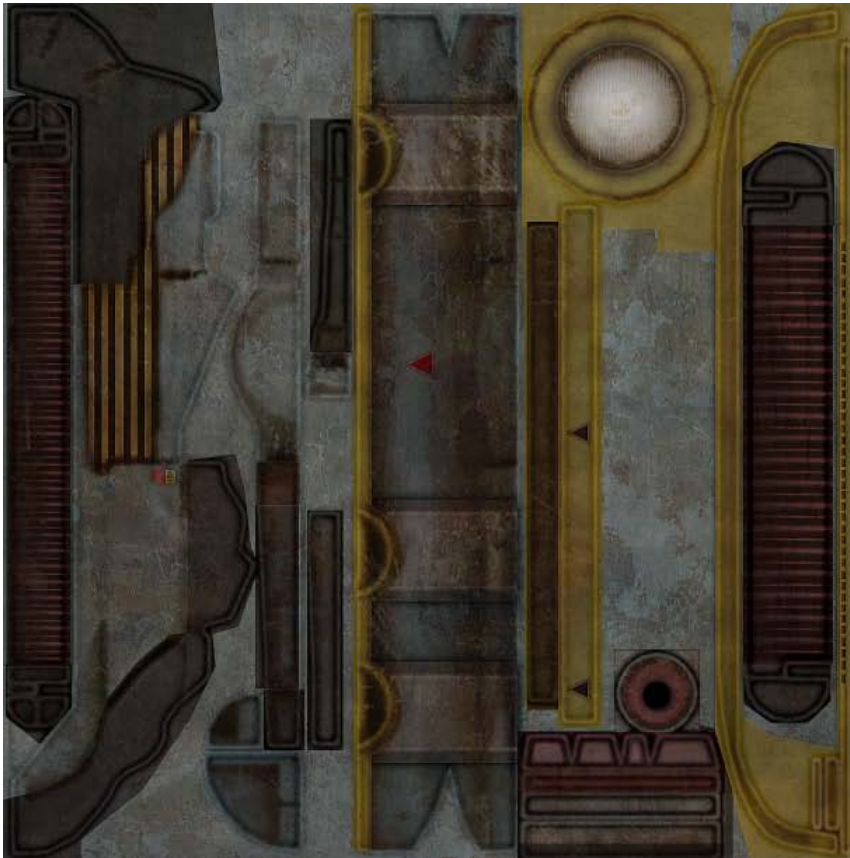
2048 by 2048 pixels. When creating textures for film or TV, the current standard is 4096 x 4096 pixels. In film, textures are all custom. This means every part has its own area of texture space, so nothing looks repeated. In video games, disk space and memory are always a concern, so mirroring of textures is common. A texture can be resized for game optimization at longer distances, which is called a mipmap. The texture size is quartered several times to create a smaller file size.

The image is mipmap for a brick texture.

Texture Principles

You create a mipmap using a plug-in for Adobe Photoshop, with the Nvidia Normal Maps and DDS filter. The Nvidia Normal Map and DDS filter create normal maps, and may also export specific settings to the DDS format. The DDS format is a compression tool for exporting smaller versions of the same texture. Creating a mipmap is usually done on the programming side, and is automatically swapped when the player gets farther away from an object. The physical resolution or polygon count is optimized in video games called a Level of Detail model. A LOD model is created at half the resolution for viewing at long distances. In film, there is no need for this since it is all rendered out for non real time viewing.

The image is mipmap for a prop texture.

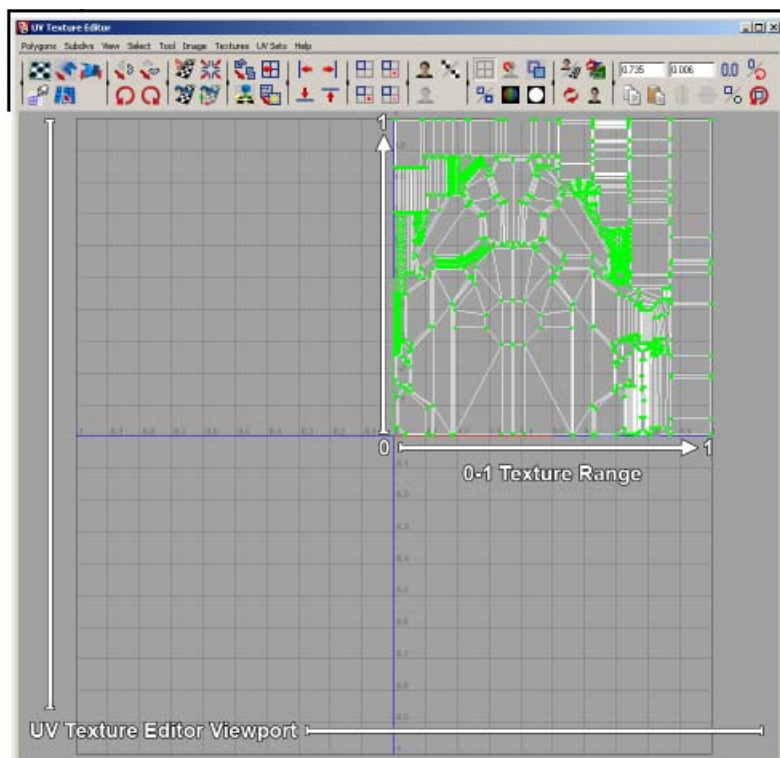


Texture Principles

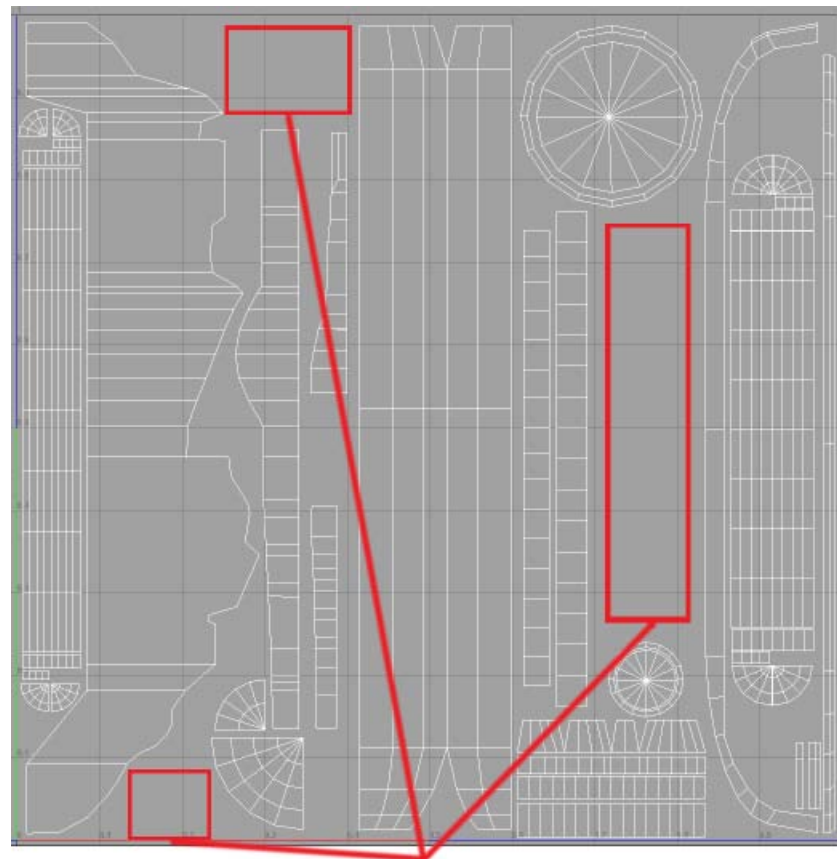
UV Placement

A model has a set of UVs on each polygon edge, similar to a vertex for texturing. A tileable texture usually starts on the 0 to 1 Texture Range, and can be scaled to the desired resolution based on the geometry size. It is okay to go outside of the 0 to 1 UV space when creating a tileable texture in a 3D package. In a human head model, the geometry is laid out so that there is no UVs overlapping. In some cases, there may be overlapped UVs when the geometry is mirrored or reused.

The image is the Autodesk Maya UV Texture Editor and 0 to 1 texture range.



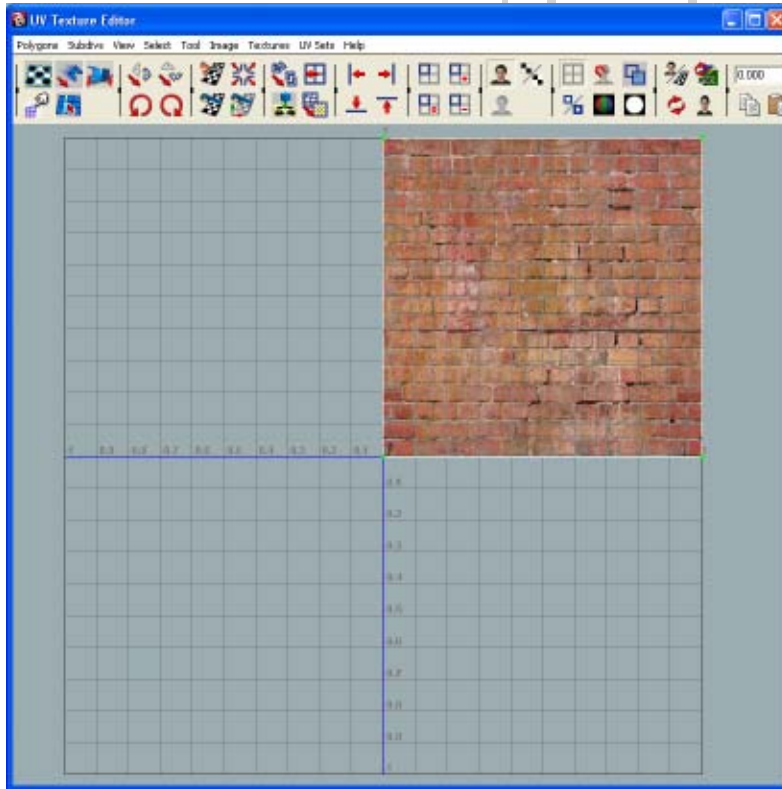
Pictured is a prop with correct UV placement, although there is some wasted UV space. Use stickers and detail variations to fill empty space.



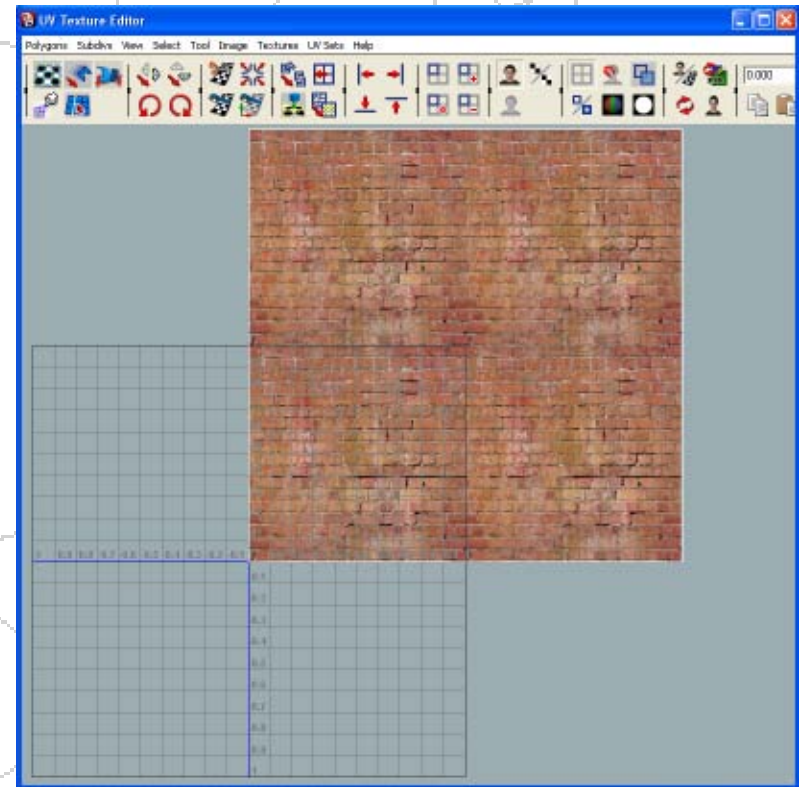
Try and fill the empty space with extra details and variations

Texture Principles

The image displays a UV Layout with UVs in the 0 to 1 space.



The image displays the UV layout with tiled UVs twice.



Texture Principles

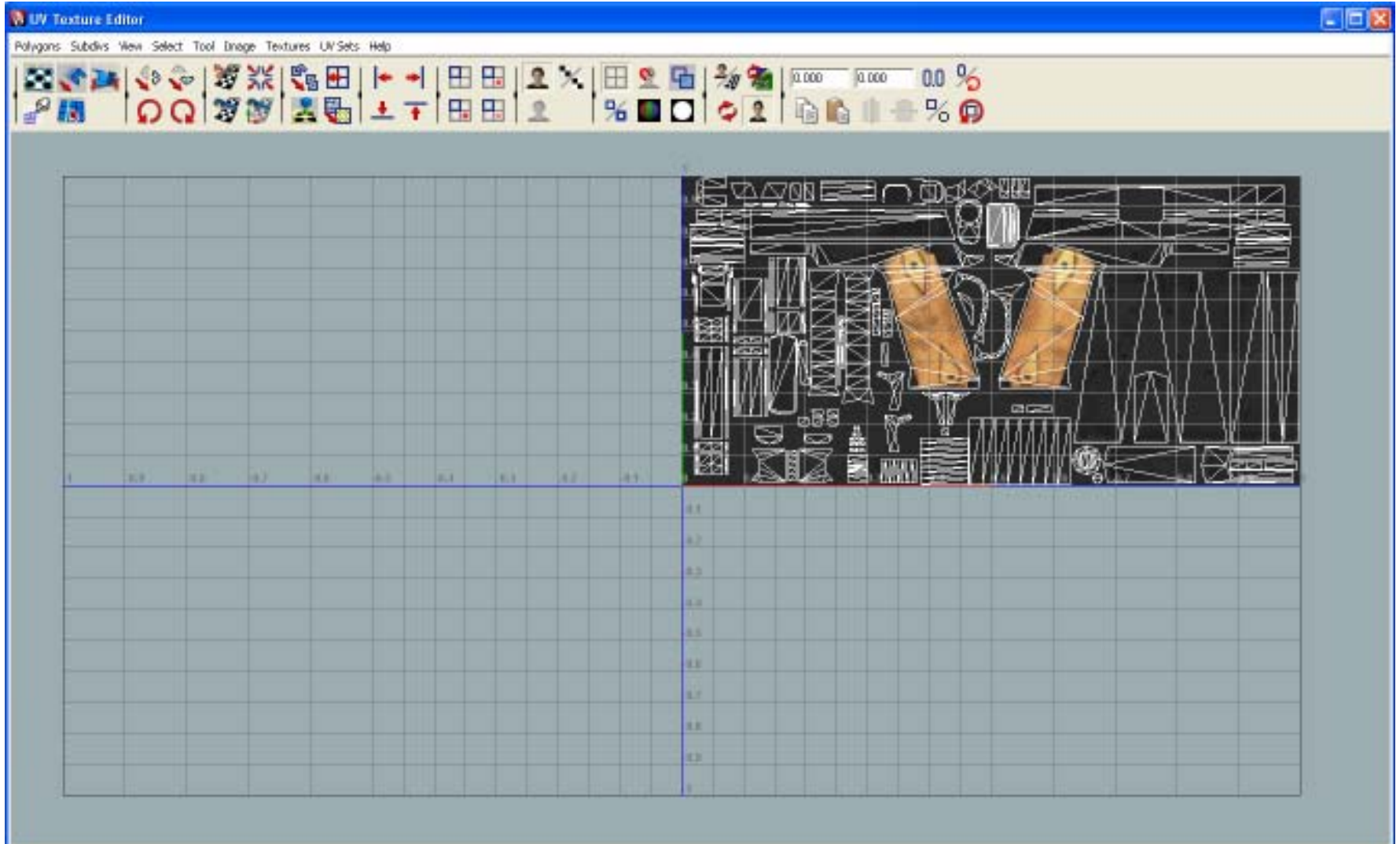
A square texture occupies the 0 to 1 UV space, such as 512 by 512. A rectangular-shaped texture, such as 1024 x 512, also occupies the 0 to 1 space. However, it must be scaled left to right to fit. When the texture is applied, it will show up in the Texture Editor and on the model as looking correct. This is a good way to save space using the 2:1 ration textures. When creating UV layouts, think about ideal placement for optimal resolution and reuse. It might seem extreme, but the tighter the UVs, the higher the quality of the textures.

The texture displayed fits in the 0 to 1 space and is 1024 x 2048 pixels.



Texture Principles

This image is the UV layout of the handgun.

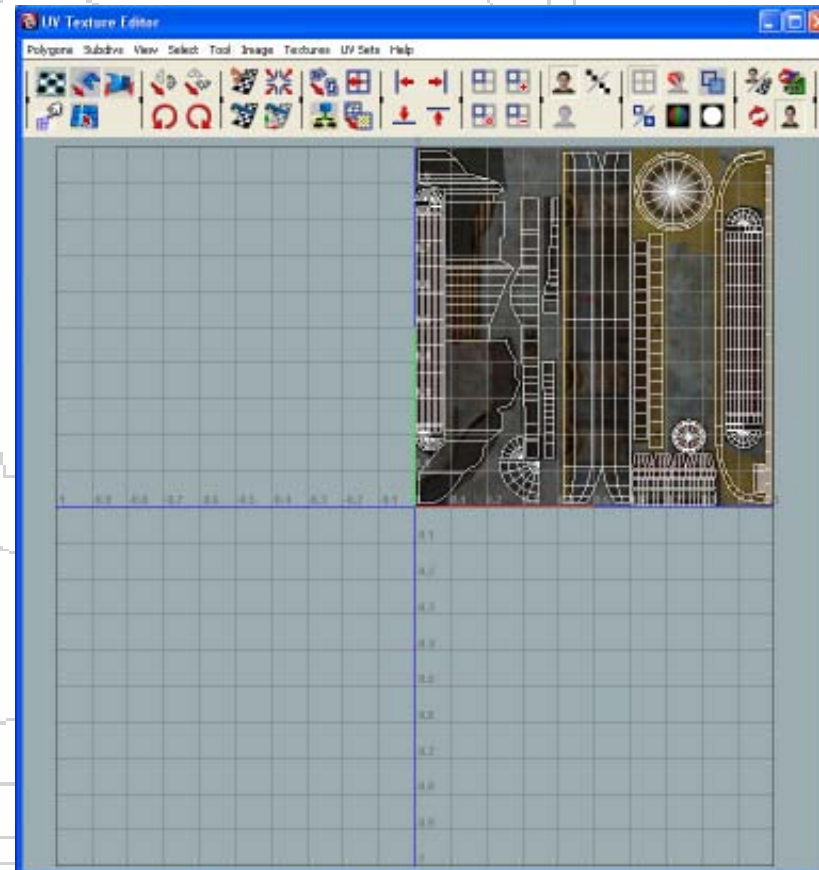


Texture Principles

The texture displayed fits in the 0 to 1 space and is 1024 x 1024 pixels.



This image is the UV layout of the prop.

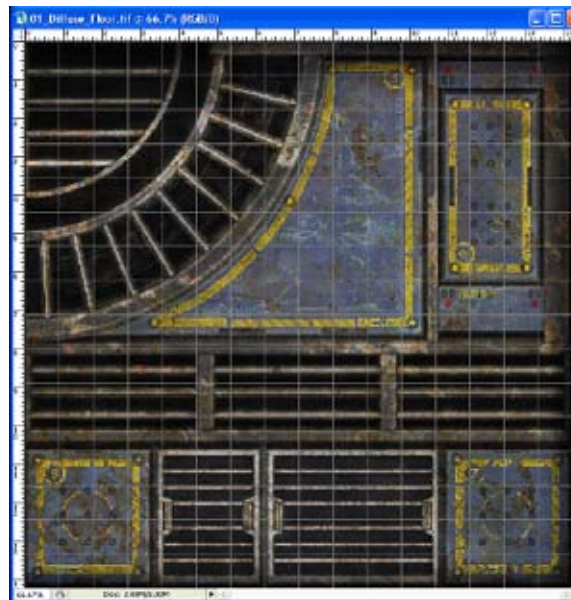


Texture Principles

The Grid

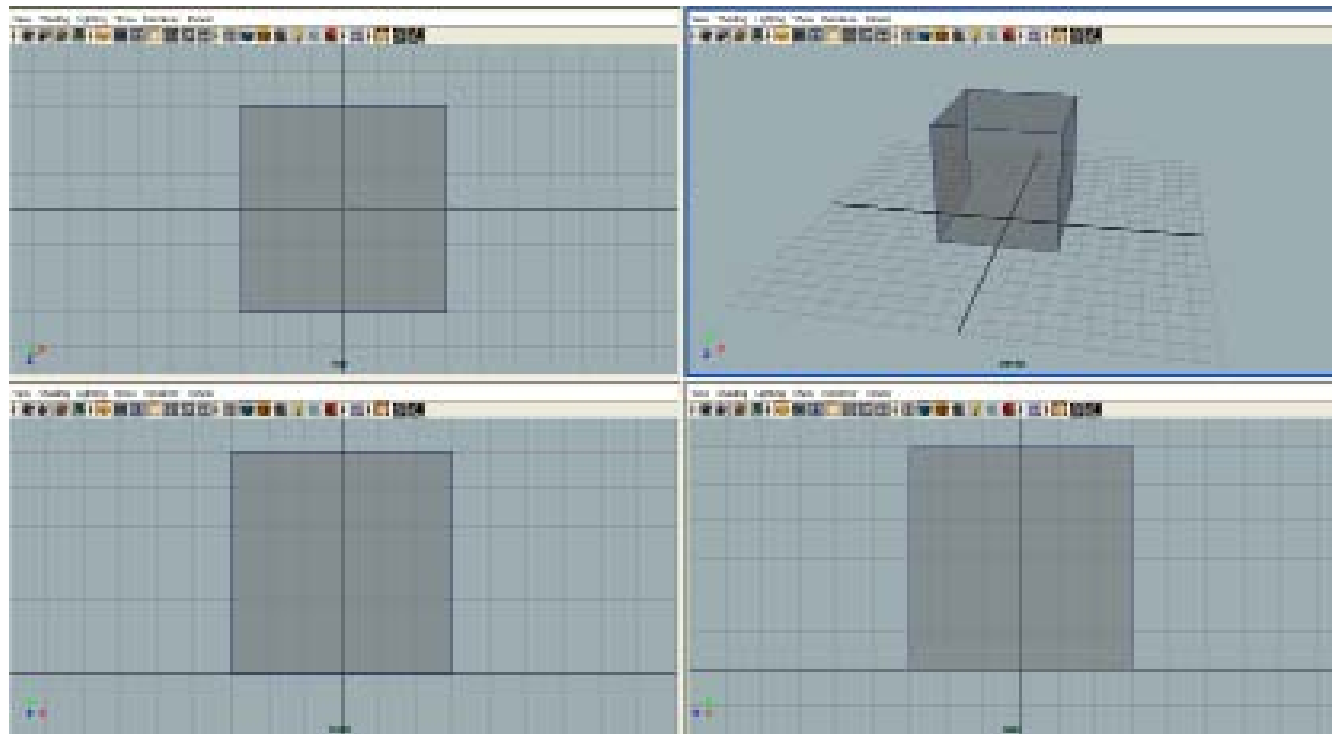
The grid refers to the coordinate system that a game engine, Photoshop, and 3D software use to align geometry and textures. The game engine is based on powers of 2. The grid is used in every 3D software package, but may have different settings. It is applicable in creating assets for film and TV. Setting up proper grid units in the 3D software and Photoshop enables you to take full advantage of reusing textures. The artist creates trim pieces that can be taken from a tileable texture and reused throughout the level. Texture sets that are the same style may be built on the grid, and will line up with the game engine or 3D geometry.

The image is a photo of a grid setup in Adobe Photoshop with a grid overlay and rulers.



In older generation video games, the textures were made to lie precisely on the grid. Today, video games have enough storage to have custom texture maps on many surfaces. When creating environment artwork, use the 3D grid. The grid enables modular pieces to be snapped to one another. Many video games also take advantage of the 3D package unit setup, which usually matches the video game engine units. You adjust the grid for the scale and dimensions of the object being created. It is important to build the geometry clean, so there are few intersecting pieces of geometry.

Pictured here is a cube snapped to the grid in Autodesk® Maya® software.



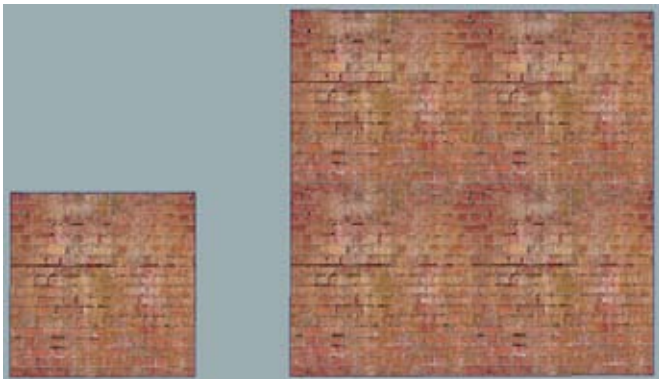
Texture Principles

Texel Density

Texel density is the pixel resolution on the relative size of the object. The pixel resolution keeps a relative balance between the textures in a scene. It is best to keep a close relationship of resolution on the environment and characters. You make adjustments if visual flaws are apparent. Some game engines automatically use a predefined texel density, such as 4 pixels per inch. The game engine automatically repeats the texture to fit the size of the level geometry. In film, the resolution is set manually by the artist in the UV editor. There are resolution standards for games and films that export directly from a 3D package.

Texel density is the amount of pixels used per inch of geometry. A 512 by 512 pixel texture covers 7 1/2 feet of space, or 90 inches. A 1024 by 1024 pixel texture covers 15 feet of space, or 180 inches. The desired texel density of 5.6 pixels per inch is calculated this way for most surfaces. When creating smaller table top sized props, use a higher texel density of 8.5 pixels per inch. This means that a 512 by 512 should cover 5 feet, or 60 inches. A vehicle or portion using a 512 by 512 texture equates to 10 feet or 120 inches, with a texel density of 4.2 pixels per inch. The wheels use the 90 inch formula of 5.6 pixels per inch.

The image is a 7 1/2 foot and 15 foot wall using a 512 by 512 texture.



Brick wall that is 7 1/2 feet tall using a 512 x 512 texture

Brick wall that is 15 feet tall using a 512 x 512 texture

In Maya, enter 90 in the Projection Height and Width. It displays the amount of UV space to use. Autodesk® 3ds Max® and XSI also have settings that enable a fixed texture resolution. If your object only takes up one quarter of the 0 to 1 space when a 90 inch projection is used, then the model will only require a 256 by 256 texture. This ratio of size to pixels may be changed when more resolution is needed. There is no exact texel resolution for film or games. It is usually set by a technical director and may vary.

The image is an 8 foot prop using a 1024 by 1024 texture.

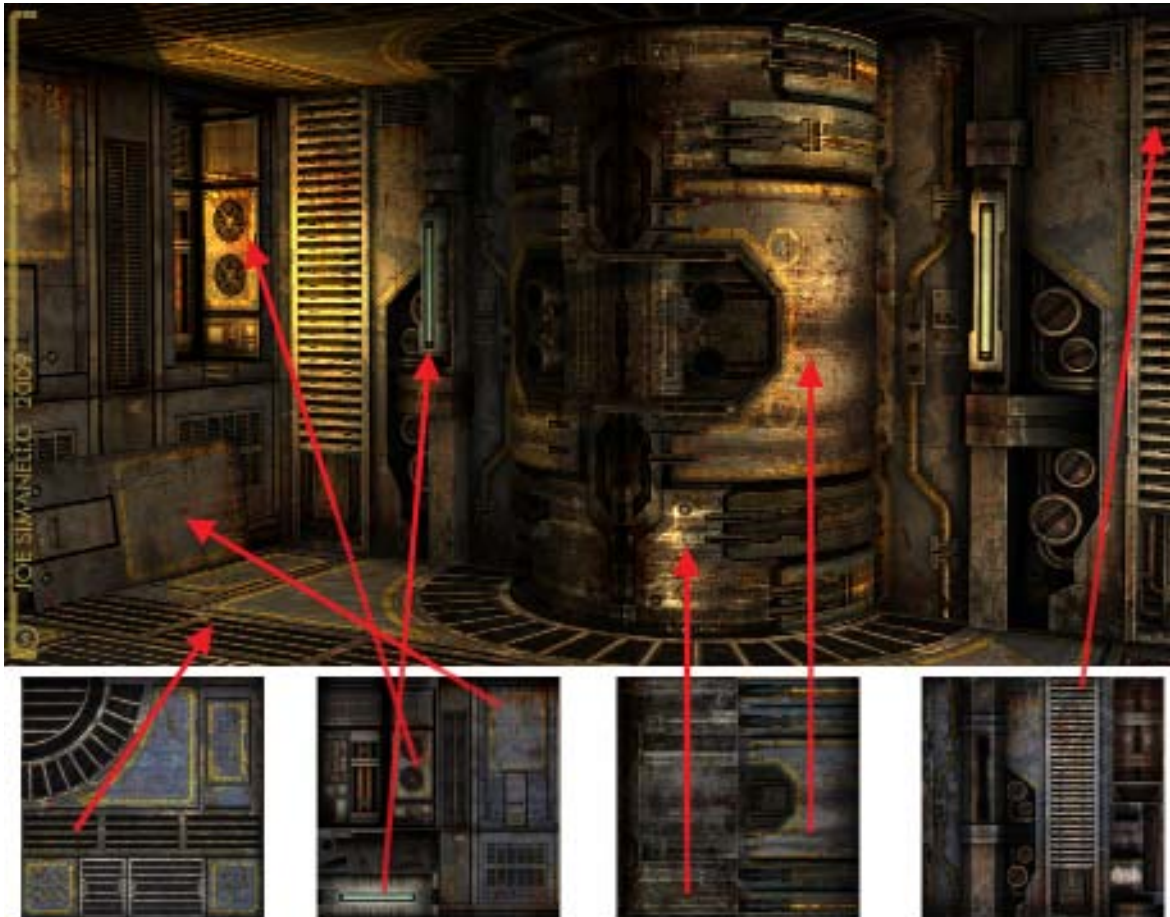


Texture Construction

Common Usages

There are many hard surface and organic types of textures with multiple uses. When creating a texture for film or games, never assume that it has one purpose. An artist applies a wall texture on the floor or ceiling. It is good to create textures for use on multiple types of architecture. You use hard surfaces such as concrete, metal, and wood on almost every type of surface.

In the image, the textures point to their location on the model.



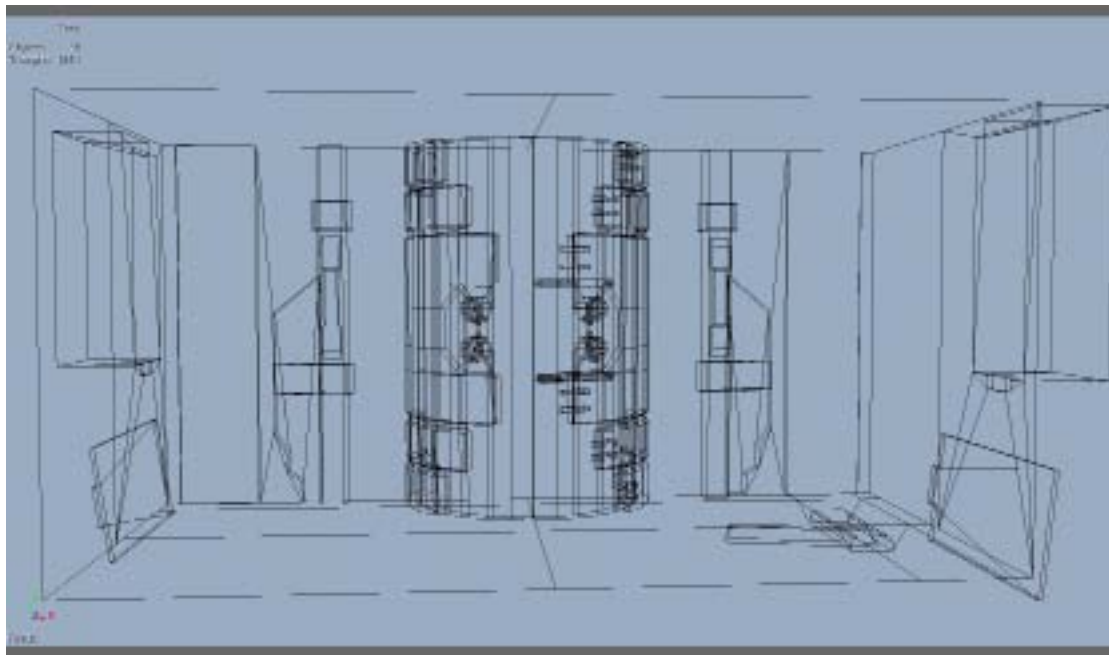
Do not build surfaces such as grass and dirt on the grid unless they have incorporated trim pieces. Organic textures are commonly used on ground surfaces. Architectural pieces such as floors, walls, ceilings, and trim are similarly made. These pieces are grouped in texture sets. Create doors, windows, and detail pieces to accent the environment.

The image is a tiled grass texture applied to a polygon plane.

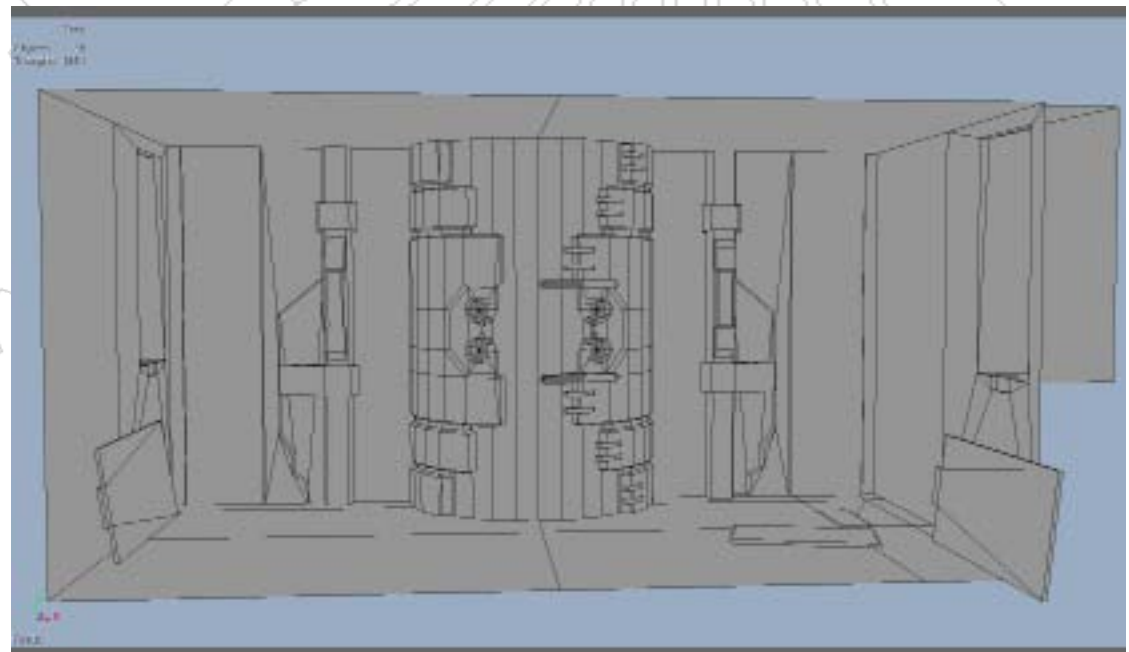
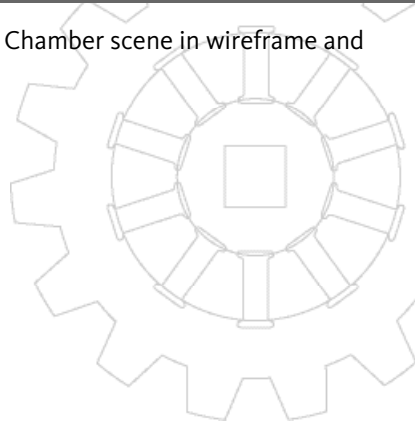


The polygons are best to texture if the geometry is flush, without overlapping areas. Without lights, the wireframe and shaded views display the geometry lines and hard edges. If the model is built in quads, the video game converts it to triangles. This is done to optimize performance of the render engine. When rendering for film, keep the geometry in quads.

Texture Construction

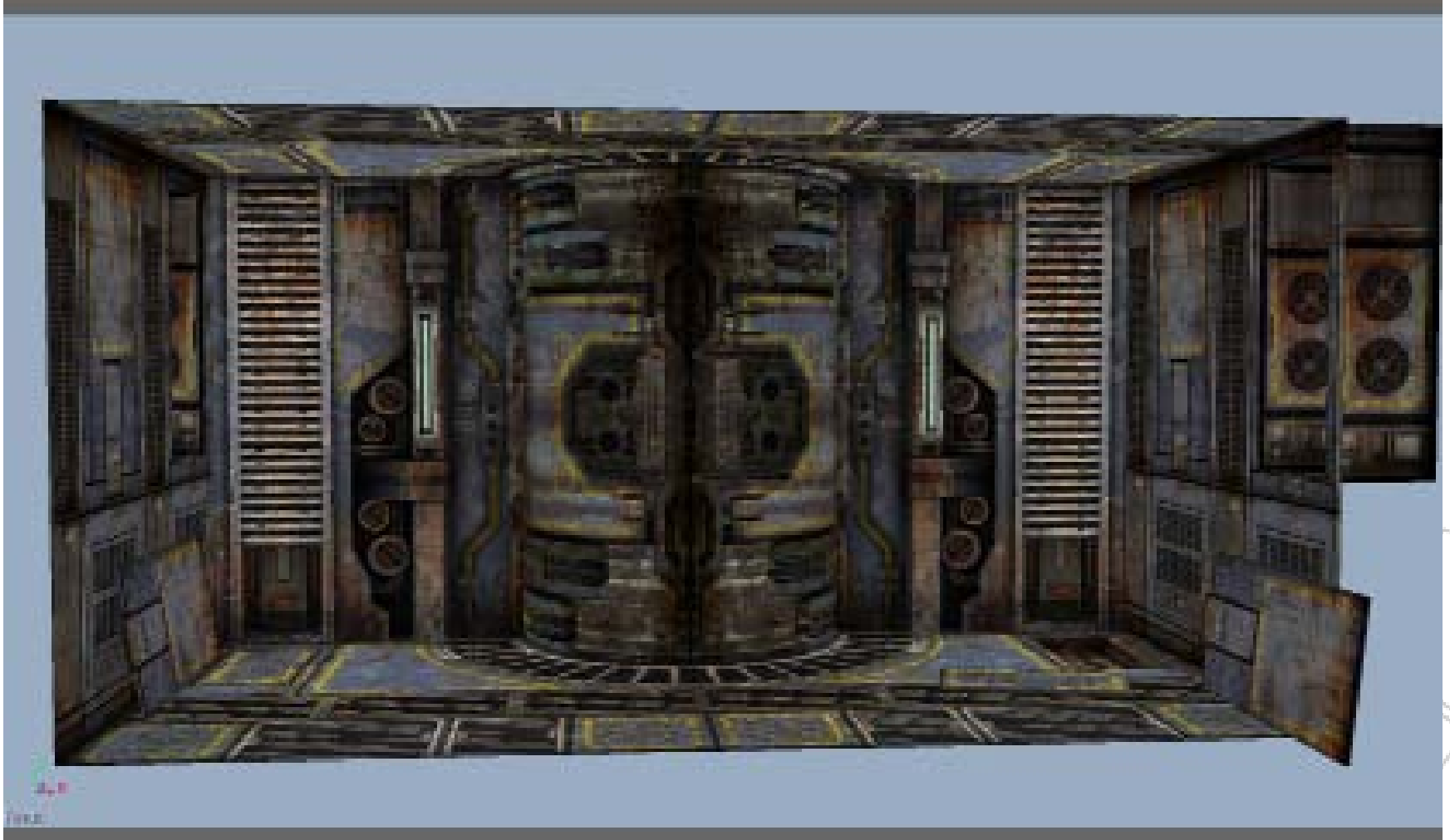


Pictured are the Bio Chamber scene in wireframe and shaded wireframe.



Texture Construction

The image is the Bio Chamber scene with textures applied.

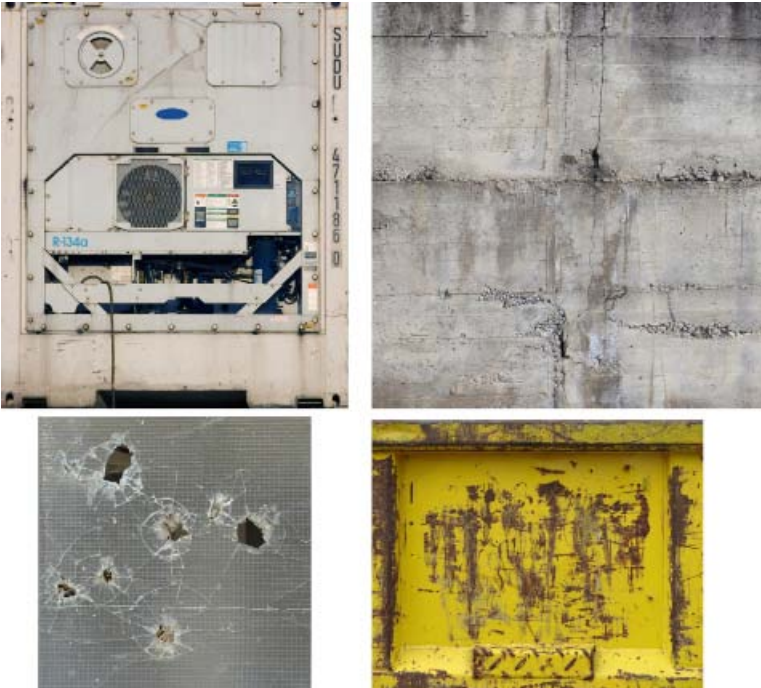


Texture Construction

Reference Images

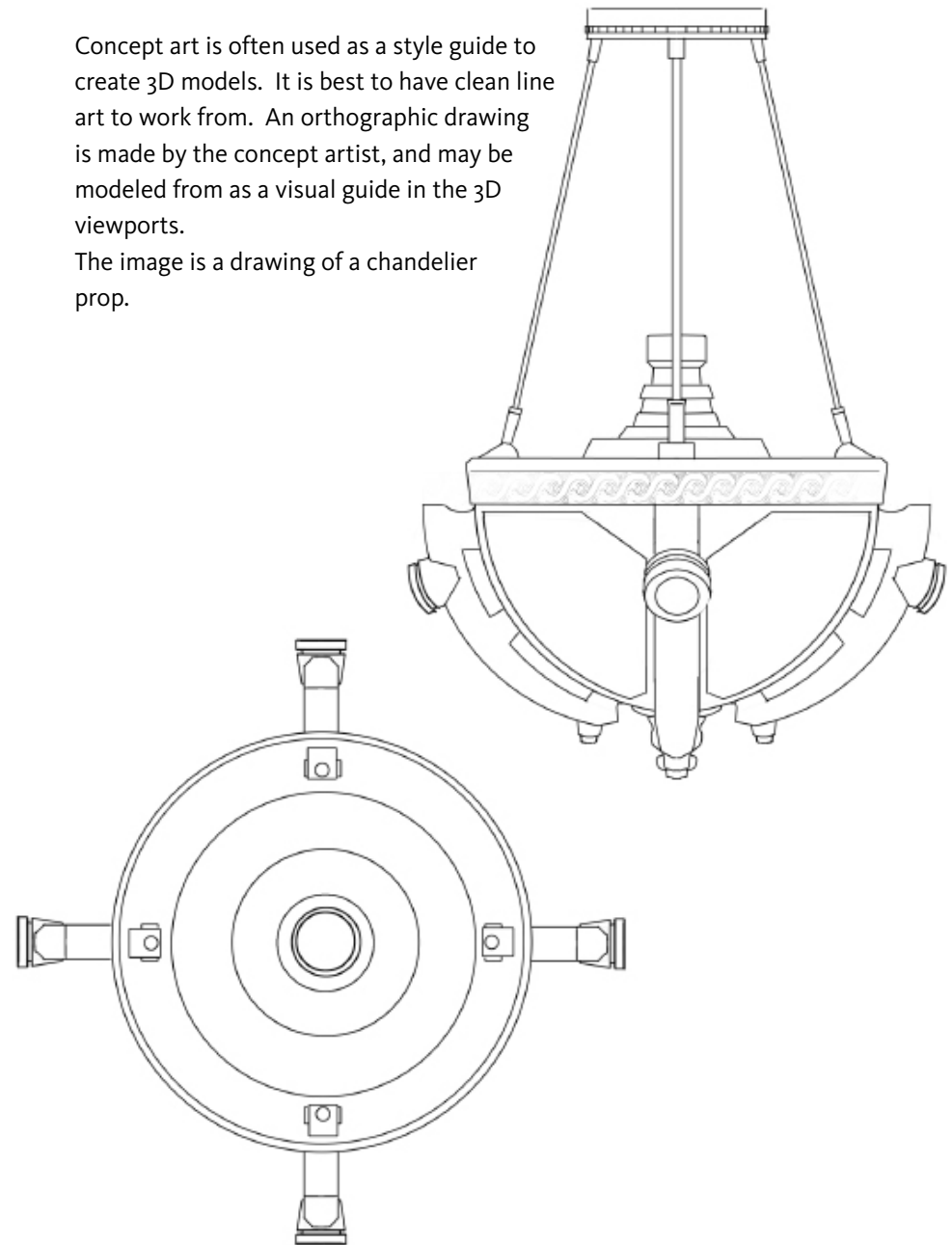
You use reference images as visual guides to create the details of the texture. It is difficult to create details from memory. When designing a texture, use photographs or references. Apply the reference photos directly on the texture and blend into the surrounding elements. Using realistic textures creates a good sense of urban reality. Many films and video games are themed to an urban style.

The images are references of a cargo container, concrete cracks, broken glass, and rust.



Concept art is often used as a style guide to create 3D models. It is best to have clean line art to work from. An orthographic drawing is made by the concept artist, and may be modeled from as a visual guide in the 3D viewports.

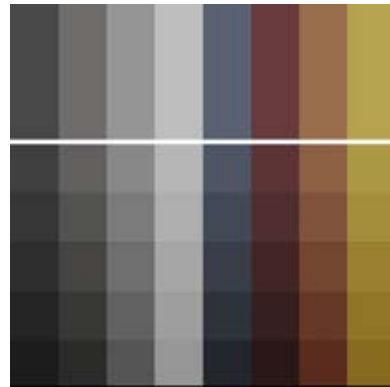
The image is a drawing of a chandelier prop.



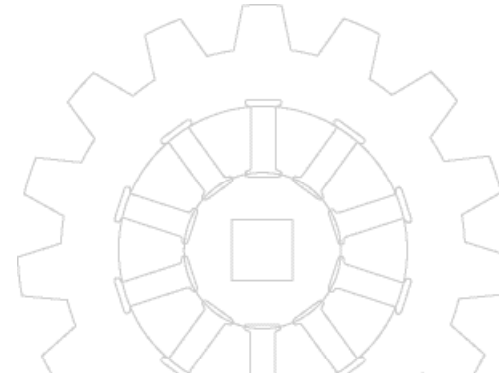
Texture Construction

It is a good idea to use a color scheme when building a texture set. Try different color schemes before settling on a specific one. Complimentary colors often work well. Use low saturation pantone colors to create a color scheme. Sometimes, one color needs the slightest adjustment, either in the hue or saturation, to make it perfect. Using a color scheme ensures that textures maintain visual consistency. The colors of a palletized color scheme were placed in vertical strips, and gradients of grey were overlaid horizontally to create different hues.

Pictured is the color scheme used for the Bio Chamber.



The image is an example of a palletized color scheme.



Base Textures and Detail Templates

It may take a production artist several hours to create a single texture. To save time, create a base set of Photoshop layers to use for a texture set. You use these layers as a starting point, and then add the details needed to build the final texture. This system enables the textures to have a uniform look.

A metal base texture is built by taking a series of metal photographs, and setting them to Overlay Layer Style. Set the Opacity 20%. Use five to ten images to create a metal base texture. Below is an image of four side by side examples of textures used for the metal base. The same process is used for concrete, organic, and custom layout textures. Similar textures are used on organic textures, not necessarily metal photos. You use this process to create a consistent look in film and games.

The following image is four metal base texture examples

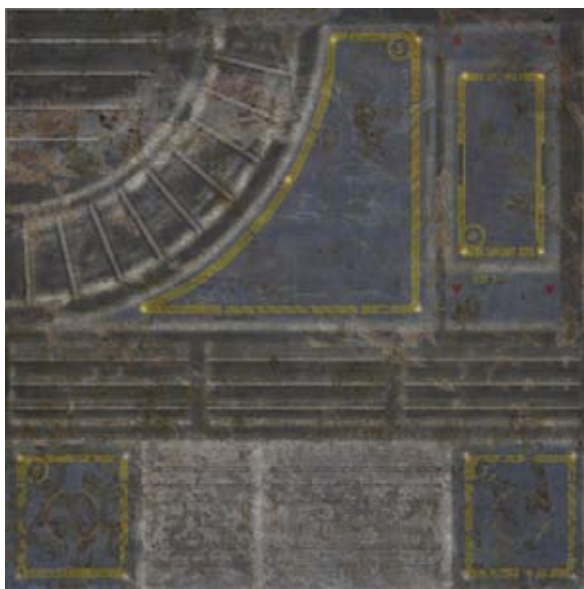
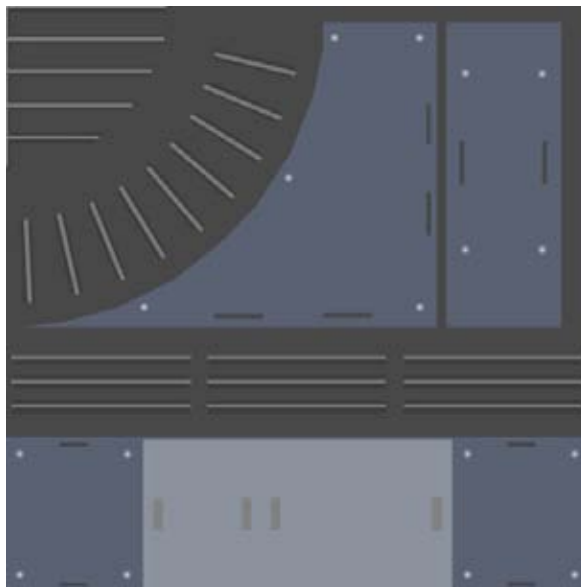


Texture Construction

Positioned under the metal base layers are localized Color Areas. This is an easy way to block in the color, and change it any time. You use the Marquee Selection tools to select areas, using the UV map as a guide. You employ the Paint Bucket tool to fill in areas with color.

The black, gray, and blue colors display areas where this process has been applied. Once the base texture is built up to a good point, it is easy to place the base metal layers into a folder and reuse to other files.

The images display the color base map and the color with metal overlays.



Pictured below is a common layer tab in Photoshop.

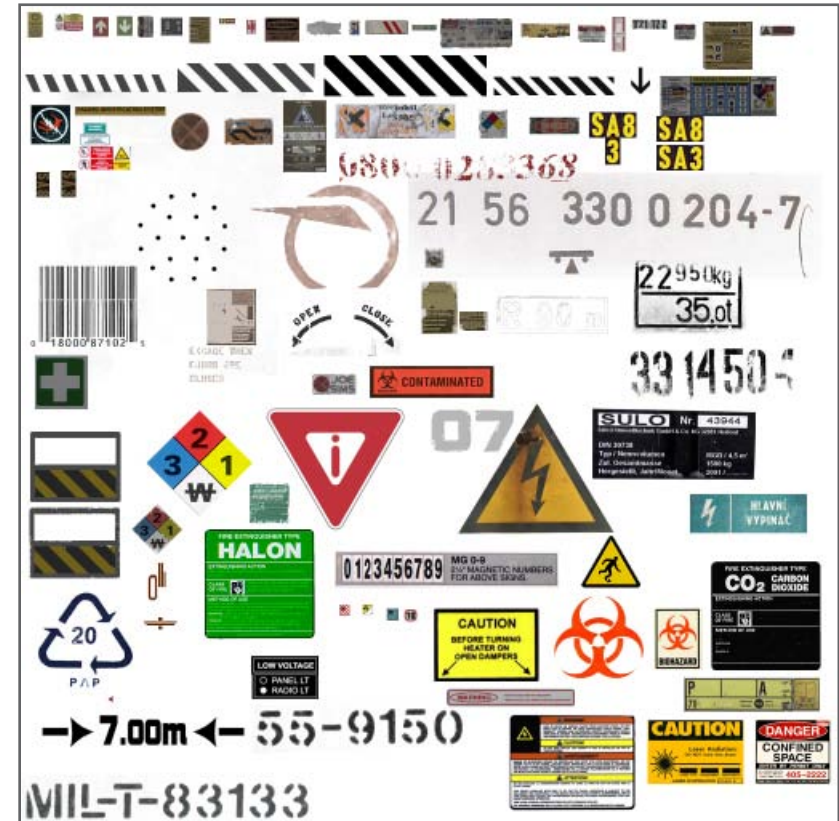


Texture Construction

Detail templates are similar to metal base layers because they are a collection of details that may be reused on many textures. For example, a rust dripping texture may take several minutes to find and extract using the Color Selection tool. You copy and paste it to the new layers, and tweak it to the desired parameters. Multiply this task by 20, and it may take several hours. The trick is to save your handpicked, cleaned up details to a new file or separate folder. When a rust texture is needed, go to the folder, pull out a layer, and flip it or erase a bit to make it look different. Create detail templates for bolts, cracks, stickers, and color variations. The image is a detail layer set of rust that may be used for overlays.



The image is a collection of stickers and logos used to detail the textures.

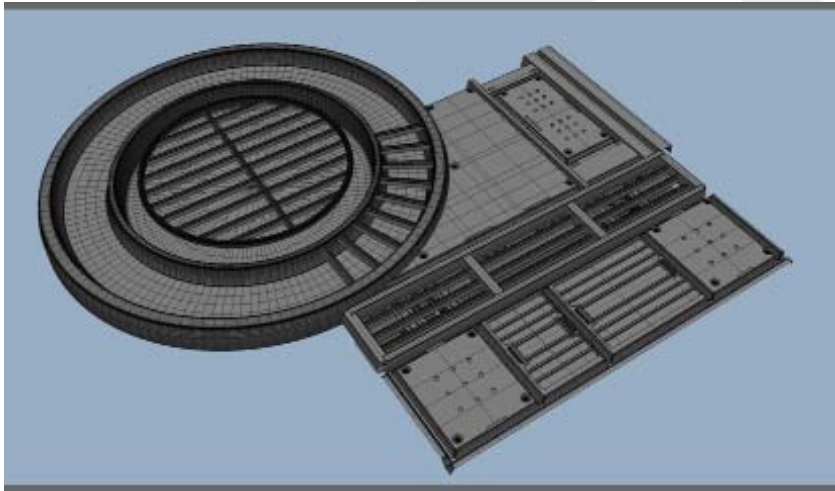


Texture Construction

High Resolution Models

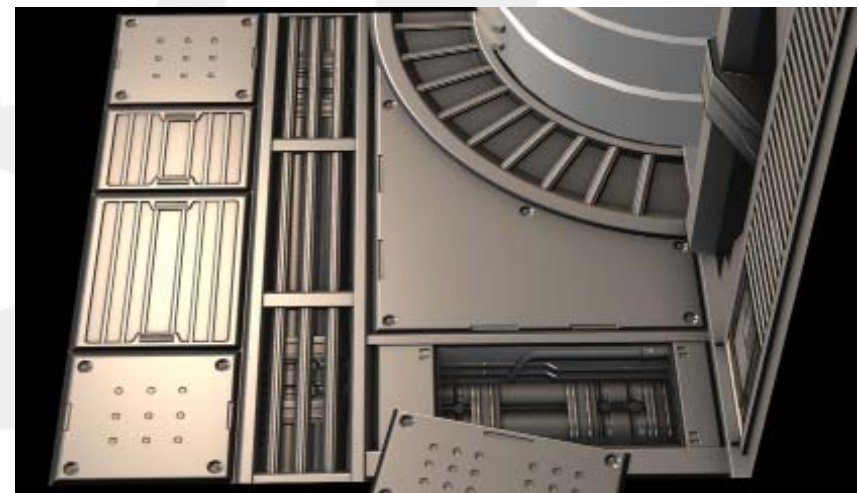
You use primitive and complex models to design a tileable or custom texture. Details do not always have to be created in 2D. You may use high resolution 3D models to design all the texture. High resolution models add great realism and depth to the texture. A 3D model enables you to bake a normal map and a matching ambient occlusion map.

The image below is a picture of a high resolution model used to create the Bio Chamber textures.



The process for constructing a normal map begins by creating a high resolution model and a low resolution model. The high resolution model is created by using polygons and a collection of detail pieces. Establishing a library of detail pieces makes it easier to design complex models. Once the high resolution model is finished, it is baked down to the low resolution model. The low resolution model may be a primitive plane or fitted to the high resolution model. Creating textures that have detail baked in will save on the polygon count and improve performance.

The image is the normal map rendered on the low resolution geometry.

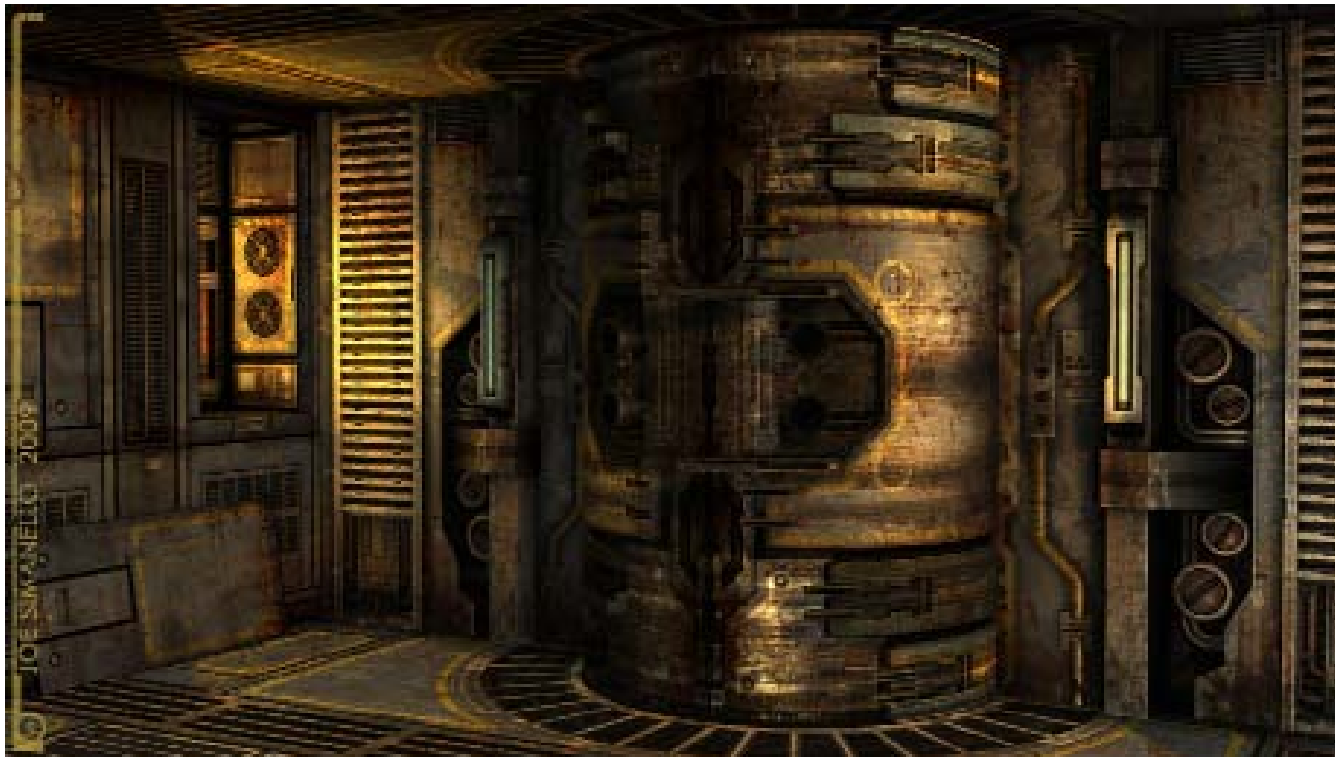
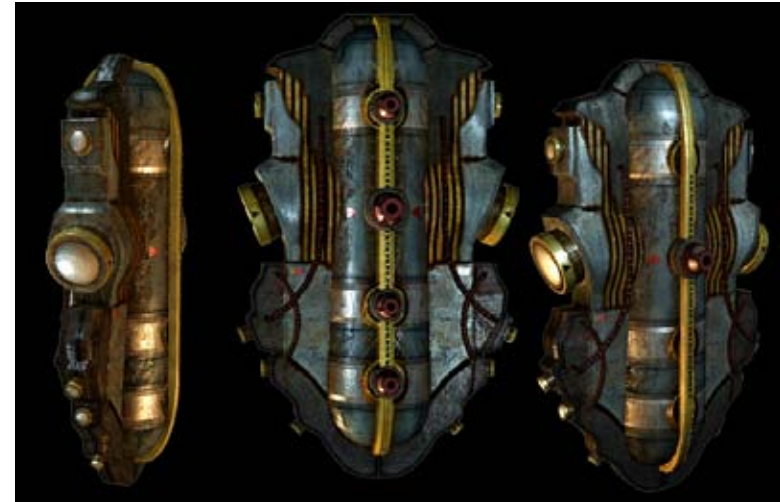


Texture Maps

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 Maya, 3ds Max, or 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.



Texture **Maps**

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



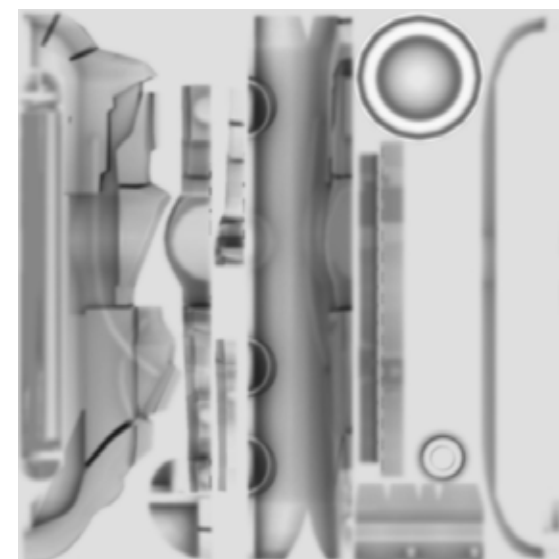
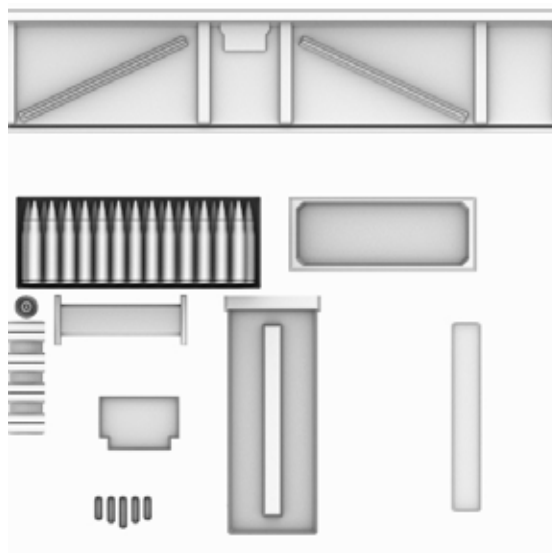
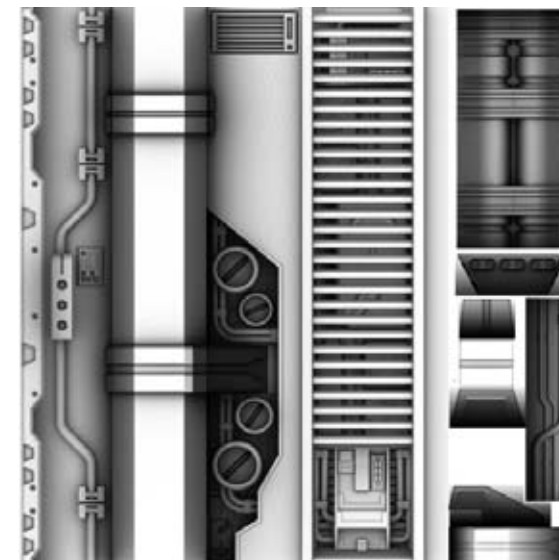
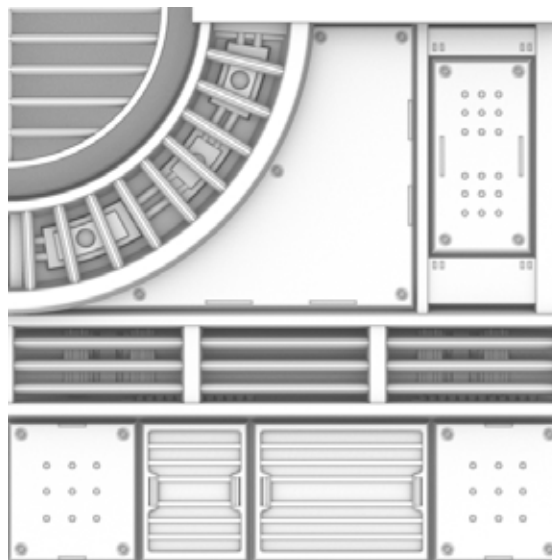
Texture Maps

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.

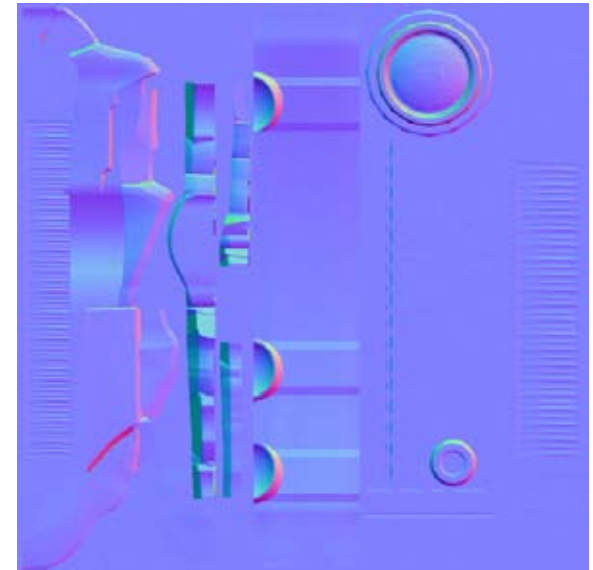
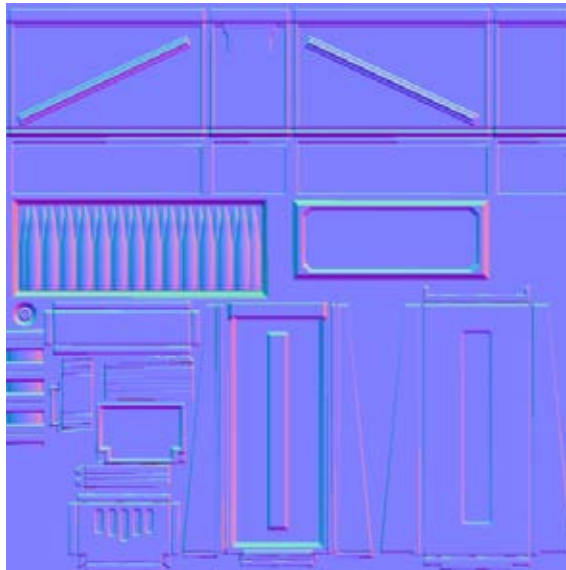
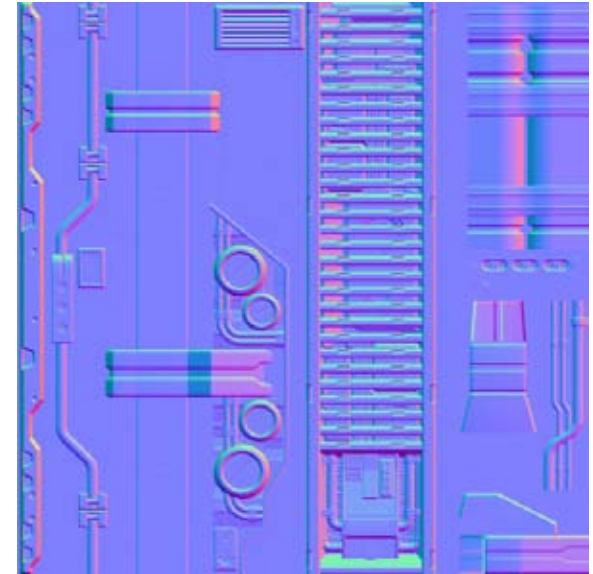
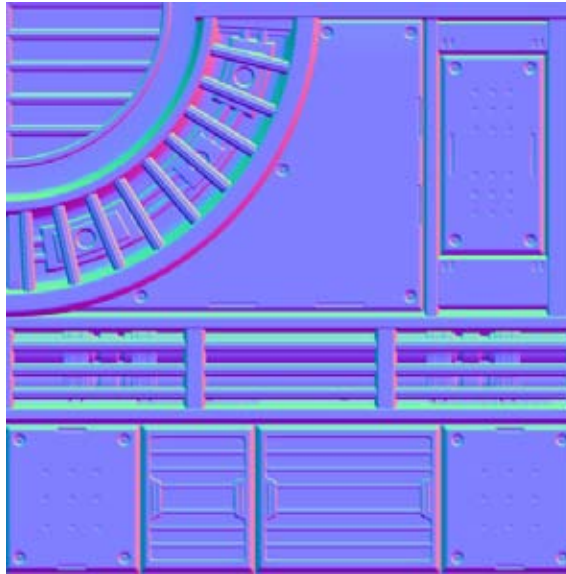


Texture Maps

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.



Texture Maps

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.

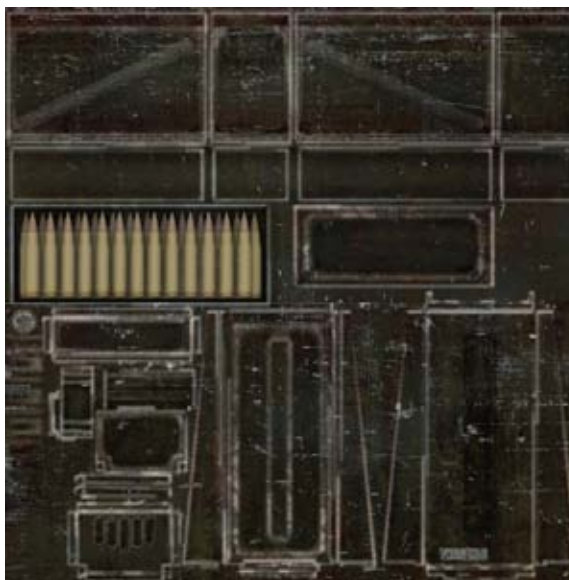
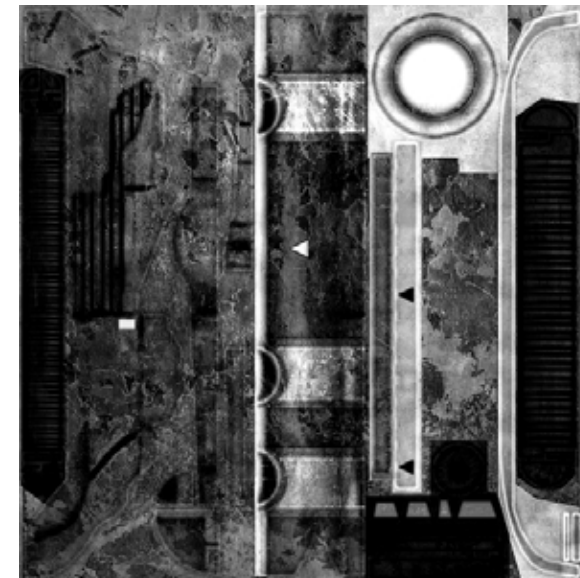
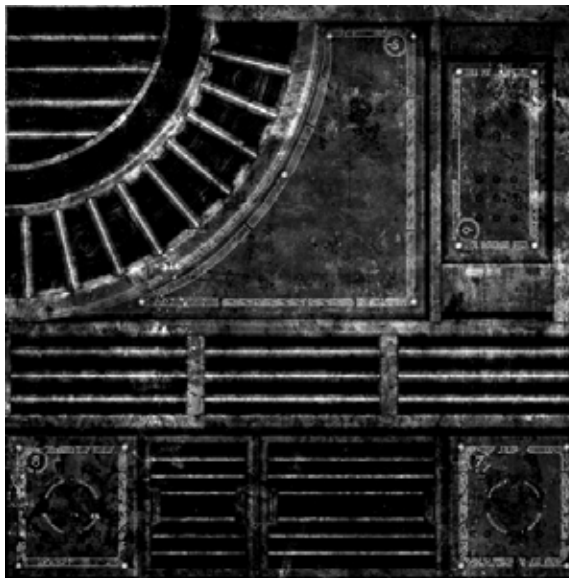


Texture **Maps**

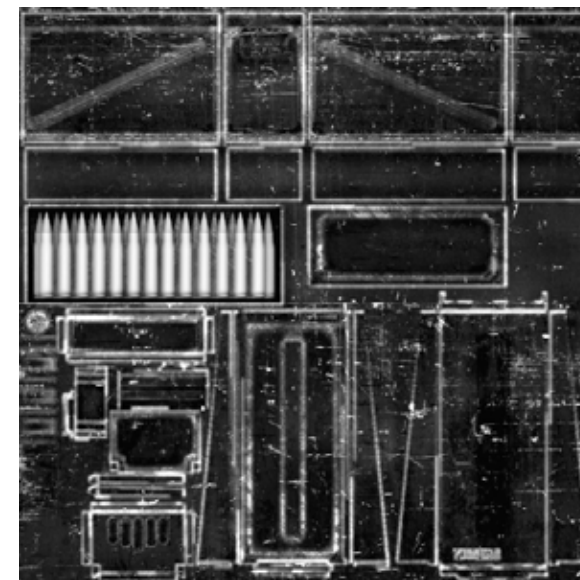
Specular Maps

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

Texture *Maps*

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.

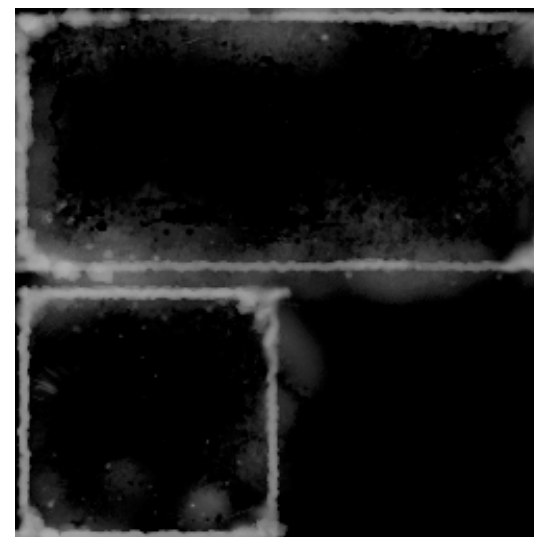
The images are an alpha map used with alpha test, and another used for glass.



Alpha Test



Glass Diffuse



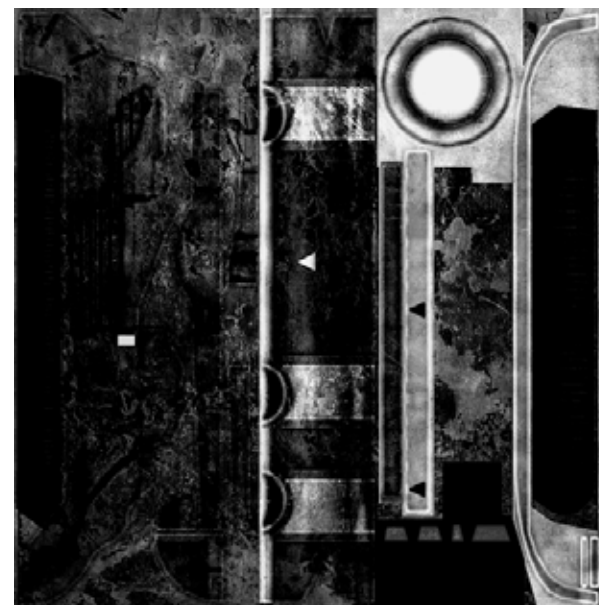
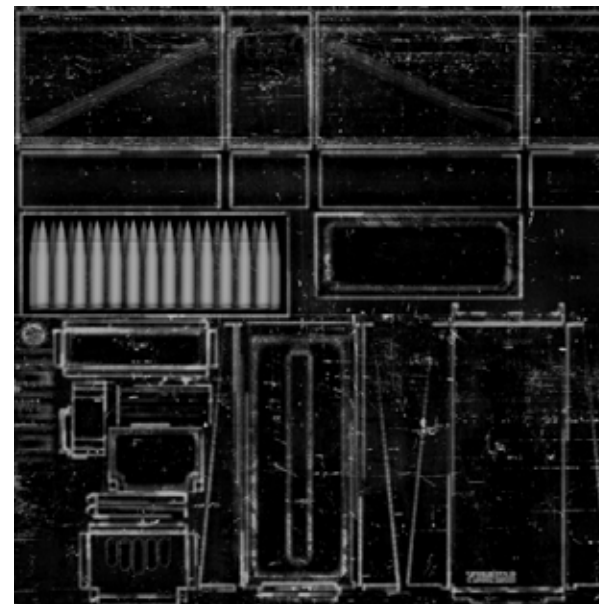
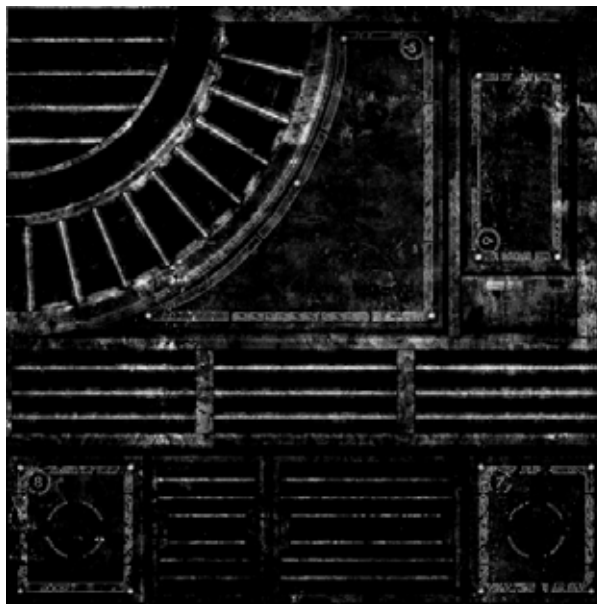
Glass Alpha

Texture Maps

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.

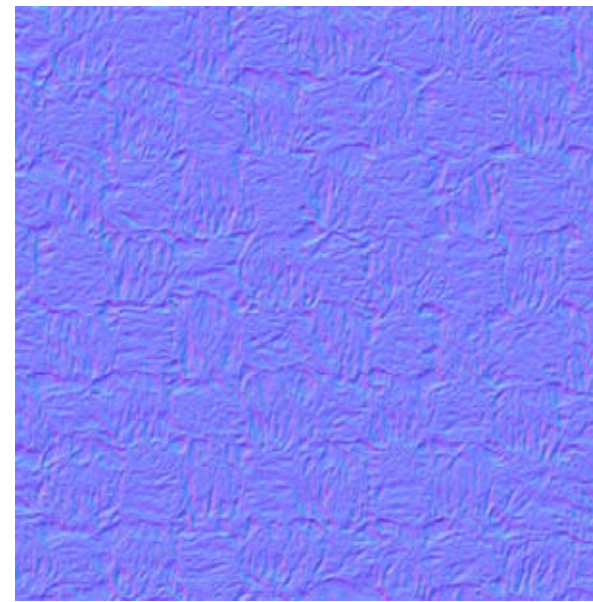
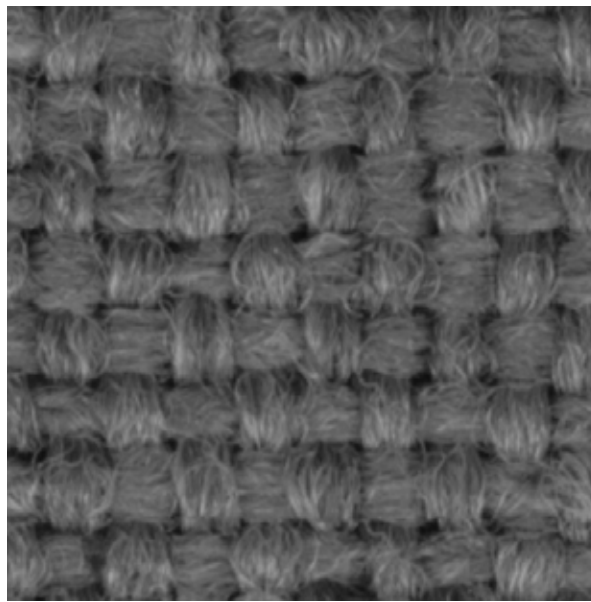


Texture Maps

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.

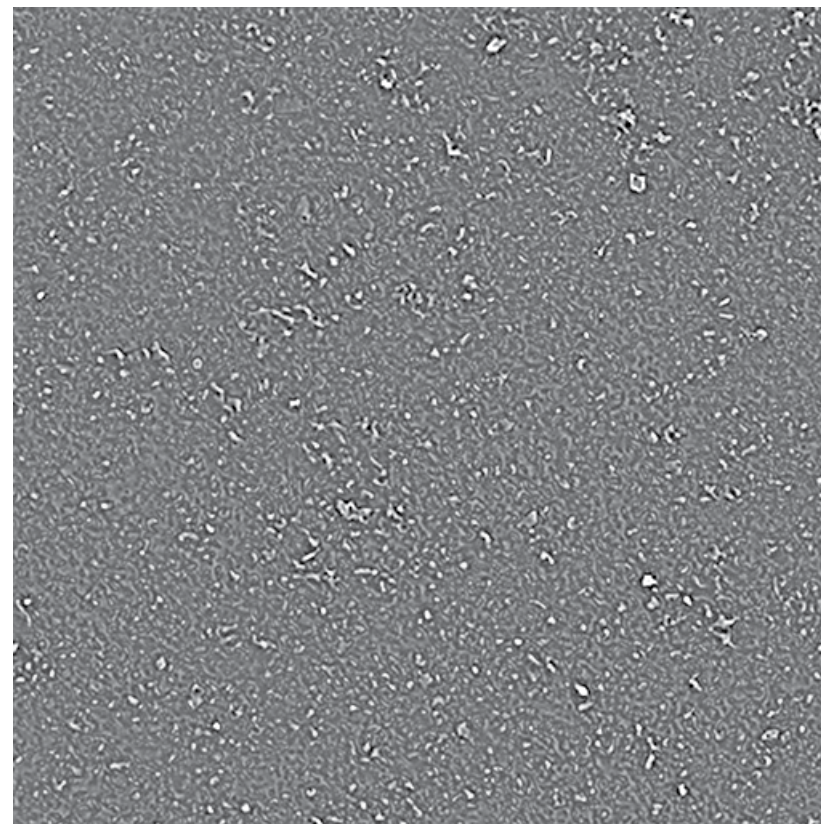


Texture **Maps**

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.



Texture Maps

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

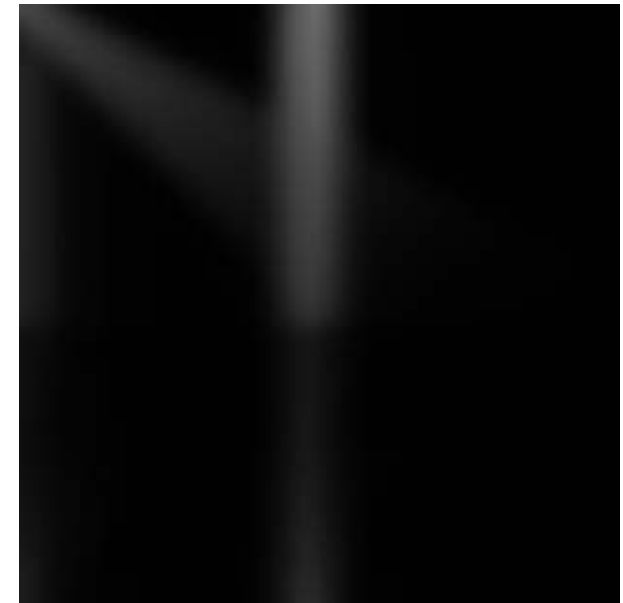


Specular BRDF

Anisotropic is a directionally dependent property that prevents the light from moving with the model when it is rotated. An anisotropic surface changes in appearance as it is rotated around its center. Cloth and velvet are examples of anisotropic materials. There are two types of BRDF maps: a diffuse and specular map. The diffuse map defines the lighting from the polygon normal of the light source. The specular map defines the lighting from polygon normal facing the camera or player. The images display diffuse and specular BRDF maps.



Glass Diffuse BRDF



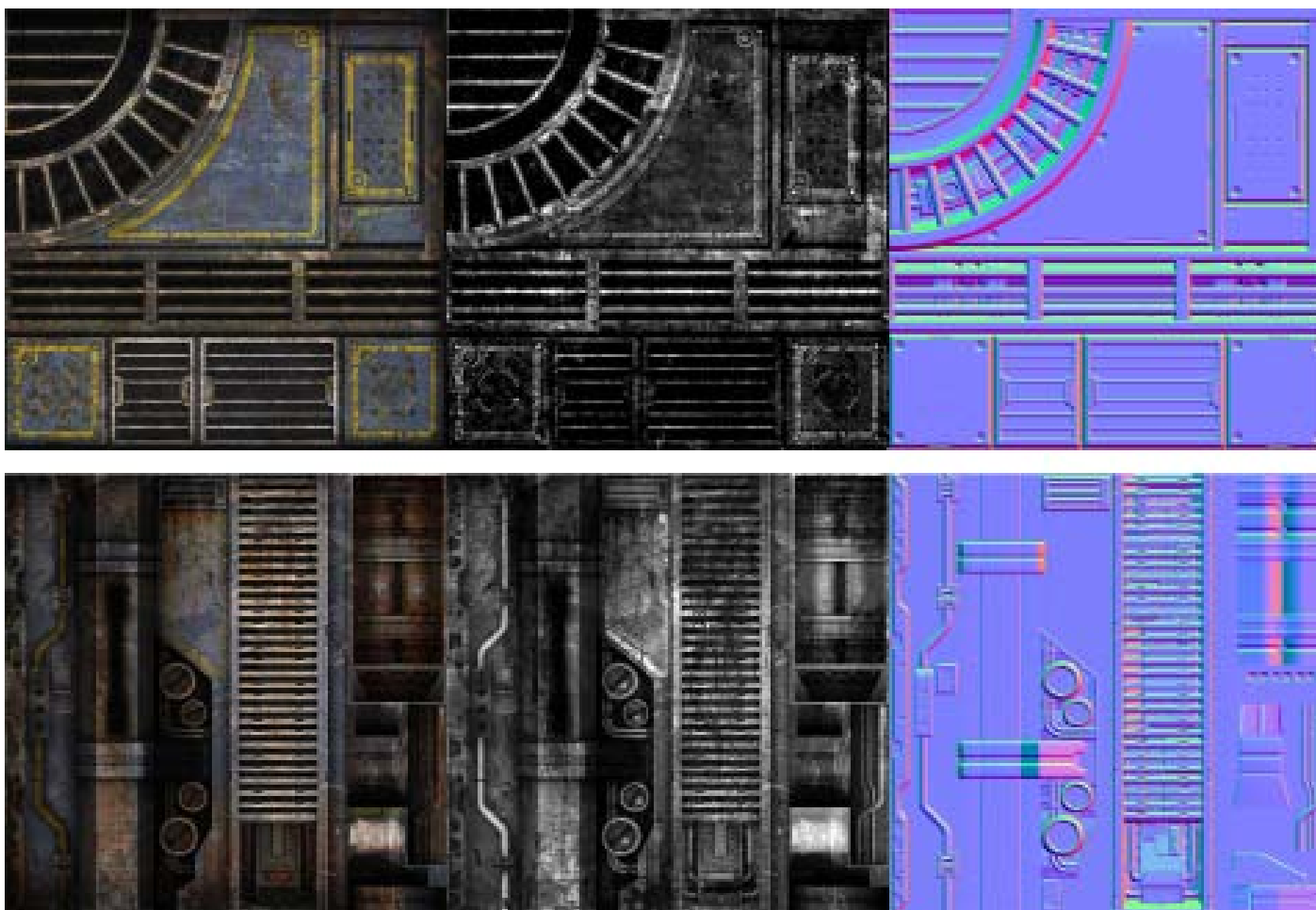
Glass Specular BRDF

Texture Maps

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.



Texture Realistic Wear & Polish

The application of realistic wear and tear, dirt, and grime is an art form in itself. Objects that interact with humans and the environment develop a wear pattern. The patterns may be oils from hands or machinery parts, and scratches from rubbing on another surface. When you study objects that receive heavy traffic such as furniture, you notice the corners are worn down to bare wood, and the large surfaces have scratches and dents. When objects are exposed to environmental elements such as sunlight and moisture, it causes paint to peel and cracks to form. Visit a large body of water and look at metal and wooden objects, noticing the water stains and rust formation. The bottom section of an object shows signs of decay and may turn white when minerals such as salt are deposited on the surface. Concrete shows a great deal of history, with

cracks and the pot holes on street asphalt. A video game environment does not look like a clean hospital ward, but has skillfully placed areas of dirt and grime. Observe the real world process of weathering to create a convincing replica texture. Use the techniques outlined in this section, and your props and environments will look more realistic.



Pictured is a wooden table that has been outside for an extended period of time.



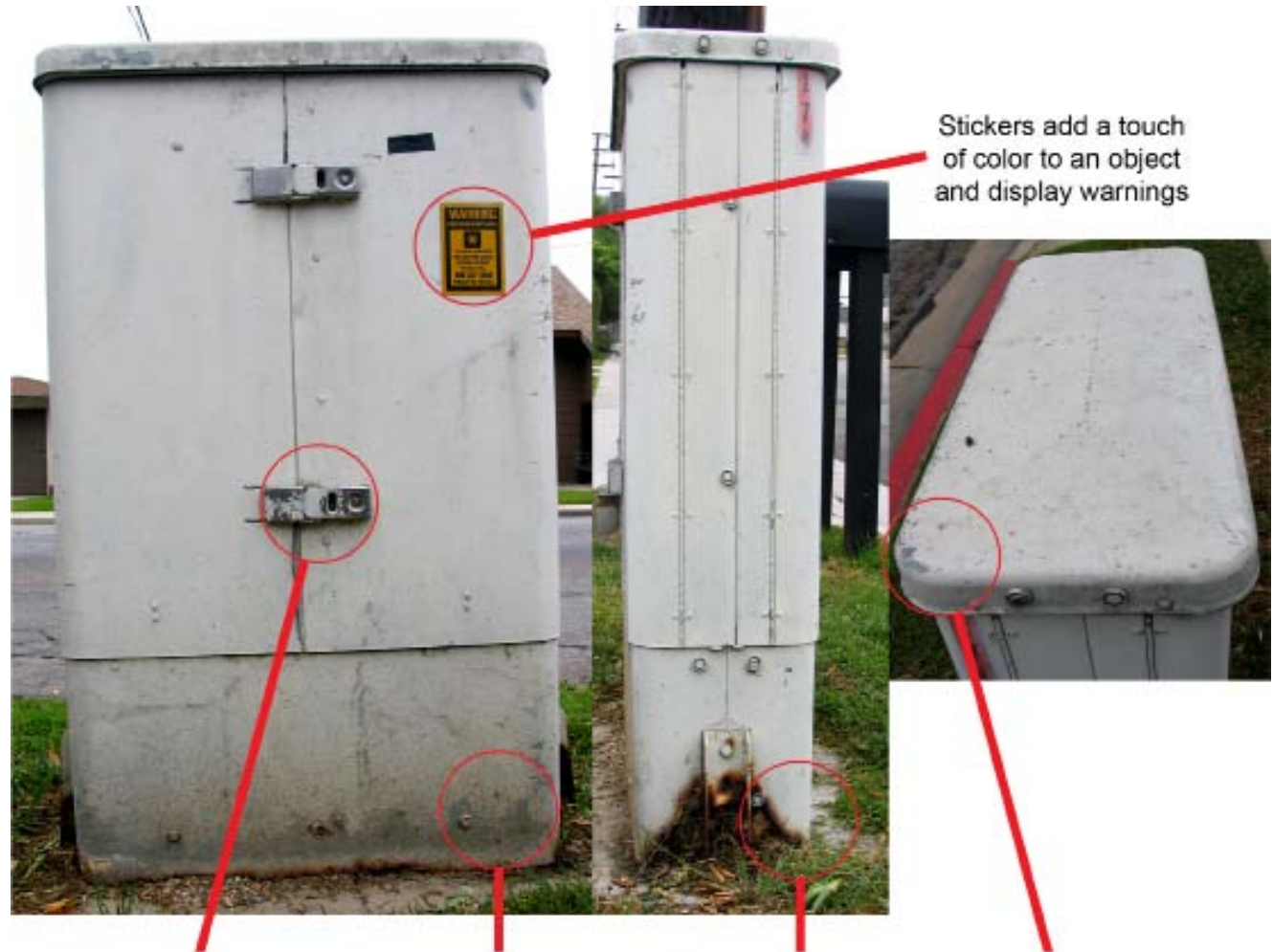
The image is the hood of a truck that has been in a hot climate near the ocean.

Texture **Realistic Wear & Polish**

Localized Wear

Localized wear and tear happens to specific areas of an object over time. Mother Nature is the most powerful source of structure decay. Water, wind, and sunlight on the coastline effect the surrounding environment causing constant erosion. The metal on a power box is a good source to study for signs of breakdown. On the handle area where there is frequent access with tools, the paint is stripped, exposing the bare metal. Aluminum does not rust very easily because it forms a layer of aluminum oxide, which protects the underlying metal. The sun causes paint to peel and fade over time, causing it to expand and contract. Be aware of the type of material an object is sitting on, such as dirt, concrete, or grass. Areas that have grass contain moisture in the topsoil, which disintegrates the metal over relatively short periods of time. Dirt often accumulates and sticks to the paint on lower sections of objects. The underside of lips and overhangs rust, causing streaks to form.

Pictured here is a diagram of a power box near the ocean.



Stickers add a touch of color to an object and display warnings

Chipped Paint exposing bare metal from frequent use

Heat has caused the paint to peel and notice the dirt gradient

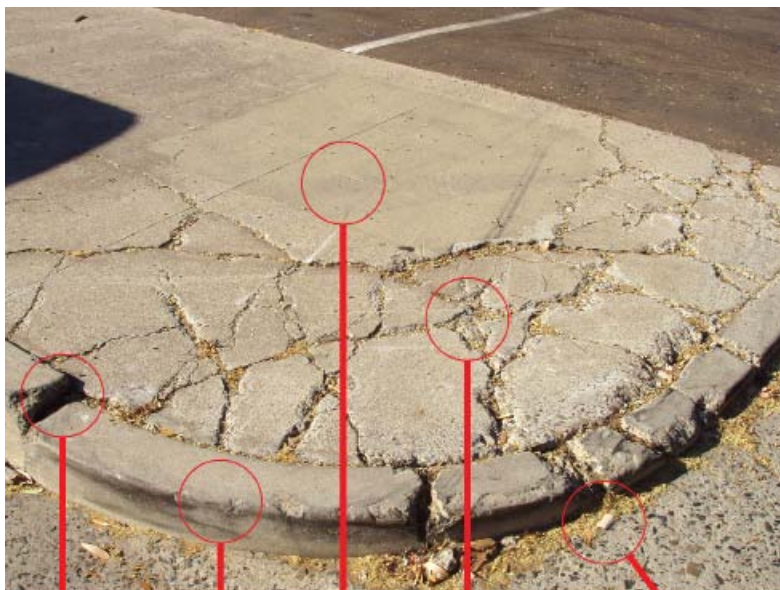
Water and salt in the air has started to disintegrate the metal

The corners are worn from rubbing and scratches are visible

Texture *Realistic Wear & Polish*

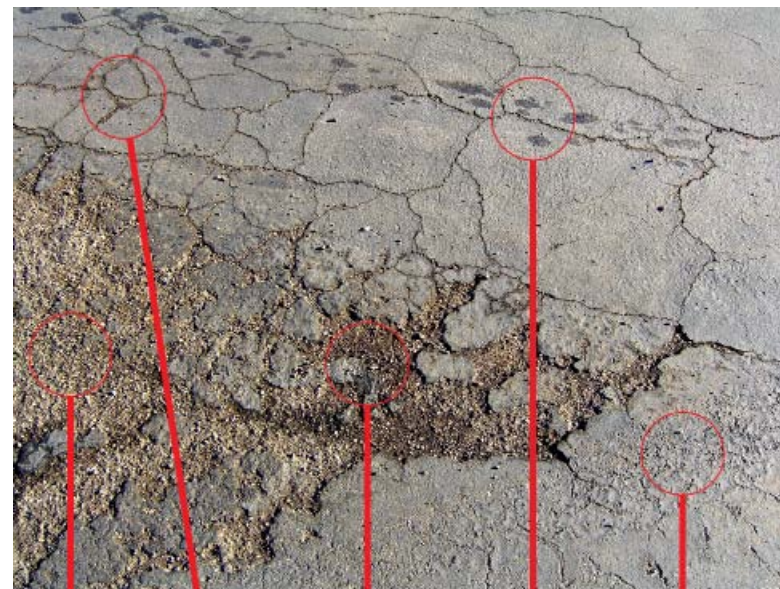
Water and the movement of the underlying ground cause cracks on a stone or concrete surface. Damage occurs when vehicles drive over the surface, and heavy objects drop on them. Water and dirt erode the surface and create deep cracks and holes. When creating a texture, find good top down reference of these details. You create variation by cutting out crack details and overlaying them on top of a similar surface. Dirt layers may be overlaid onto a clean version of concrete or asphalt. The key is to use sharp details from photos and subtle dirt layers fine tuned to the desired result. The diagrams show areas of detail that may be replicated in a real texture.

The photograph below displays distress on a concrete sidewalk.



Uneven curb and large areas of missing concrete
 Rubber tire marks
 Painted areas add variation
 Large cracks and stone worn away from rain
 Leaves and debris collect in the cracks and around the curb

The image is a photograph of distress on an asphalt lot.



Exposed asphalt before resurfacing
 Cracks in top layer of asphalt
 Dirt and water collect in the pot holes
 Oil and grease stains from vehicles
 Tar has bubbled from heat and water

Texture *Realistic Wear & Polish*

Dirt and grime effects are applied in layers over the base textures. The dirt may be applied as streaks under windows and awnings. You apply grime as a treatment for a more uniform looking texture. Game engines support a second and third UV channel, and multiply the dirt layers over the base texture. Use a multilayer shader in a 3D package for use in a film. Large surfaces tend to look very tiled, even without a seam showing. Using a grim texture breaks up the repeating pattern and adds realism. Dirt gathers in the corners and along the bottom edges of the buildings, windows, and door trim. Details that are inset, such as vents, may be caulked with materials such as sealer or concrete. Polygon geometry pipes running along a building have a grime strip texture behind them to add depth. The buildings in the diagrams have not been cleaned for a long time, and have collected dirt in the corners. When it rains, the dirt runs down along a building's natural cracks or connection points.

The image displays areas where dirt collects and is washed away during rainy days.



Dirt and water from A/C system

Layer of dirt along lower edges

Streaks from rain near windows

Painted and chipped areas

Exposed concrete areas around vents

Texture *Realistic Wear & Polish*

Surface Overlays

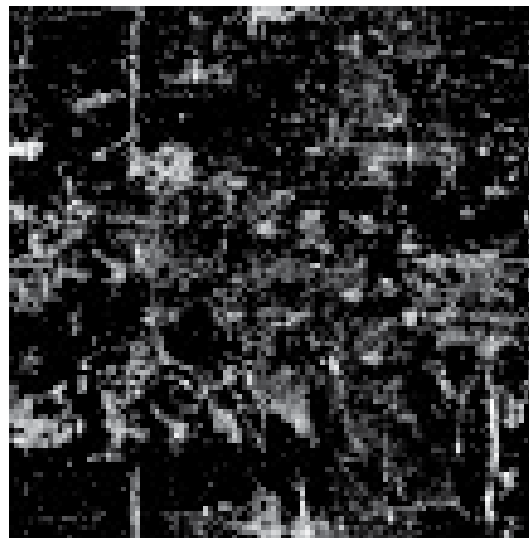
A solid library of textures enables you to build a convincing texture. There some textures essential to creating the effects described in this section. The black and white grime overlay is great for a full surface effect. In Photoshop, set this layer style to overlay, or multiply and adjust the layer's opacity. The concrete wall photograph is a real world example of the desired effect. Another way to create this effect is to use a dark grime texture, and place a black and white overlay texture in the alpha channel.



Black and white grime overlay



Concrete wall photograph



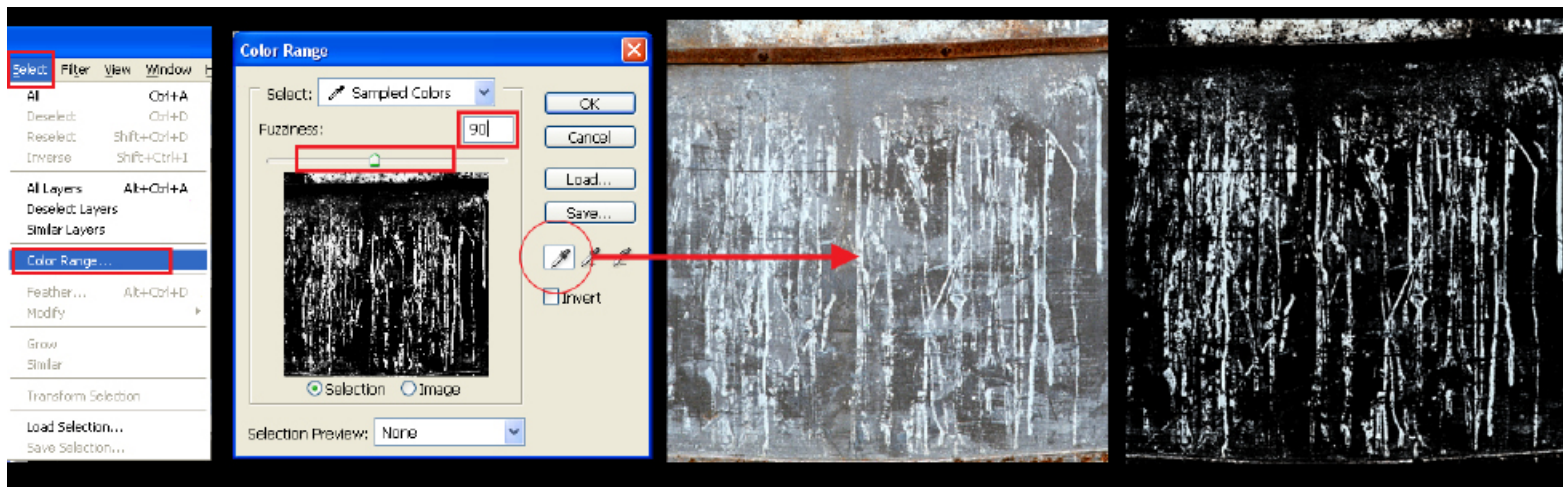
Alpha black and white grime



Dark grime texture

Texture **Realistic Wear & Polish**

Selecting a color range makes it easy to choose localized areas for overlays. Apply rust and colored streaks directly onto a texture, or use as an alpha texture sheet. Take a photograph with streaks on it, use the Color Selection tool in Photoshop to select out that color, and paste it into a new layer. The new grime layer may be set to overlay or multiply. Make adjustments to the hue and saturation to tint the color. Place this new grime layer on areas that need localized wear and tear.



Select
Color Range

Select the white
using the color picker

Photograph used
for color selection

Color selection that
is overlaid, and colored



Texture *Realistic Wear & Polish*

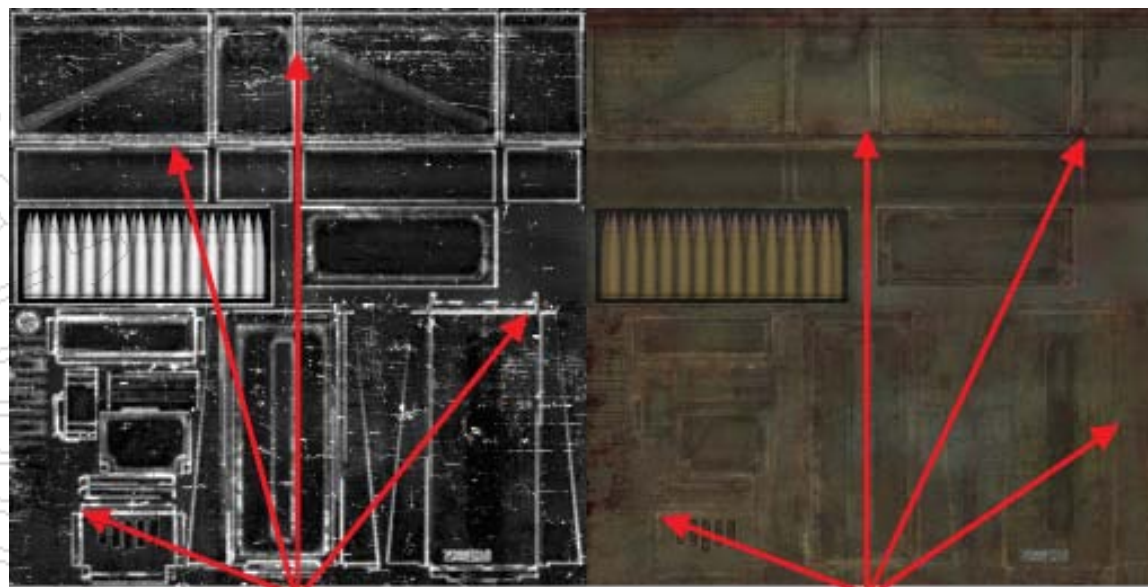
Rust is a common detail that is separated by using the color selection method. Take textures while looking at buildings and finding areas of heavy run off.

Pictured is a layer selection of rust.



Edges may look worn down on the corners of the model's textures to simulate every day use. You use the Paint Brush tool and a light color to paint in the wear and tear. Use the specular map for the majority of this high contrast detail. When the light catches the edges of the surface, they create a nice highlight. The inset areas of an object usually collect dirt as illustrated in the diffuse texture. Dirt is trapped in the tread of a tire or along the trim of an automobile. Study real world objects with heavy outdoor use, and reproduce the localized areas on a texture.

The images displayed are the edges on a specular map and dirt on a diffuse map.



Edges are painted lighter in the specular map

Dirt and scratches are painted in the corners

Texture Realistic Wear & Polish

Color Correction

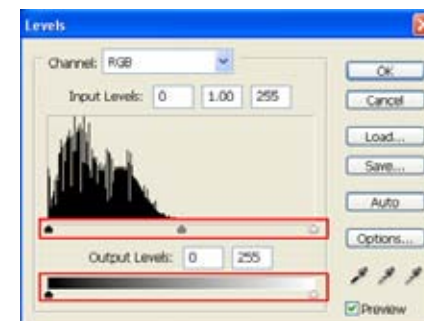
Texture polish refers to the time it takes an artist to refine a texture to match others. This can be a series of shader settings used by everyone working on a project. It takes time to become accustomed to using the Wacom tablet to draw in details. Painting by hand brings the external artist back into the more painterly and sculptural areas of art. The final texture looks like a piece of art, with clear form and resolution.

Color correction is done at the end of creating a texture or multiple textures. Adjust them all to within a value and color range, so they look similar. There are ways to adjust a texture when it is completed. You create a brightness contrast layer, or a levels adjustment layer. These filters are accessed in the Image and Adjustments list. Using the Levels windows makes it easy to adjust the minimum and maximum light values. The keyboard shortcut for adjusting the Levels is CTRL + L.

The images are an over saturated texture of the ammo case, and a color corrected one.



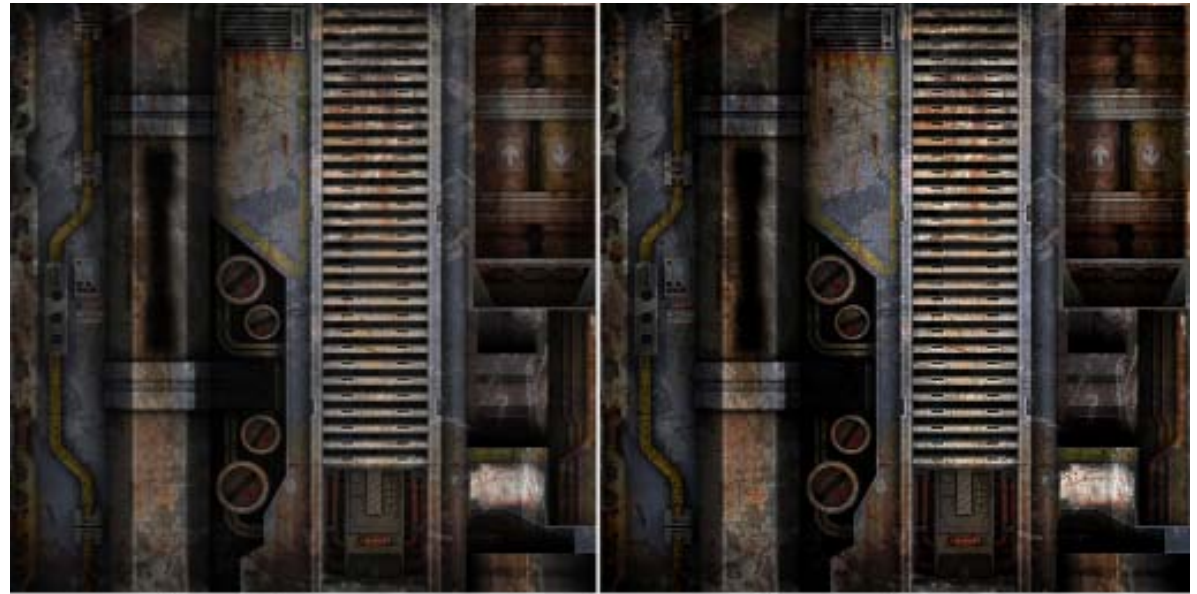
Pictured is the Levels tab. Levels are adjusting by using the sliders to clamp the color values.



Texture Realistic Wear & Polish

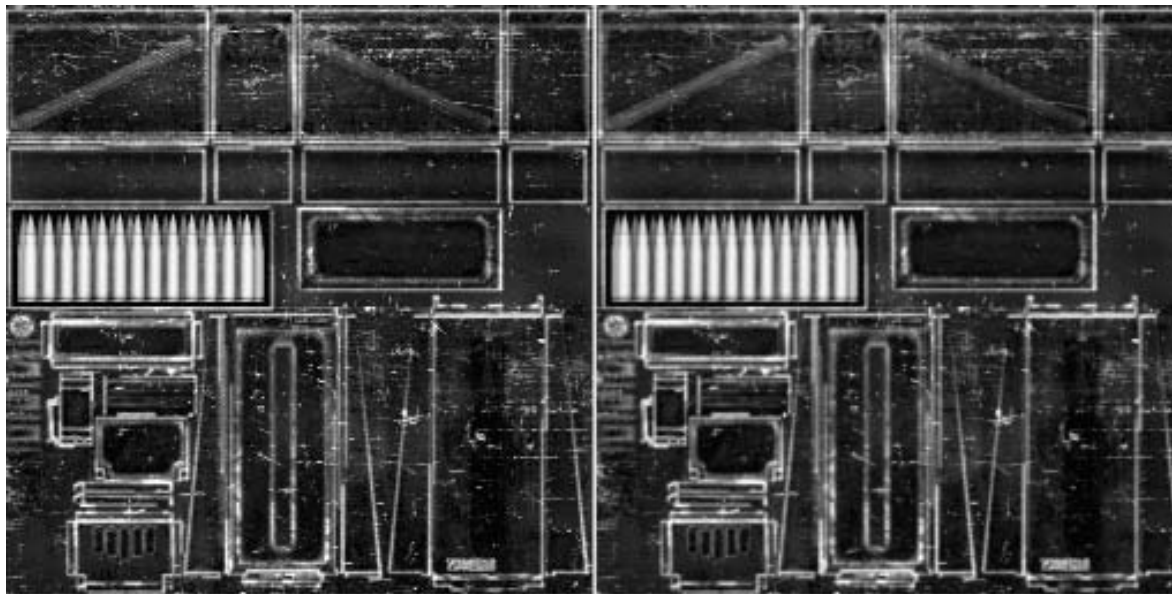
When the texture is finished, sharpen it for a grittier look. It adds bang for your buck when the texture is rendered. Use the Photoshop Sharpen filter or un-sharp mask to sharpen the texture. If the specular map is too sharp, the texture appears to flicker on the screen. To adjust the specular map use a Gaussian blur. Set the blur of a few pixels to offset it, so that the texture looks smooth.

The images display a diffuse texture that has been sharpened, and a specular texture that has been blurred.



Normal Texture

Sharpened Texture



Normal Texture

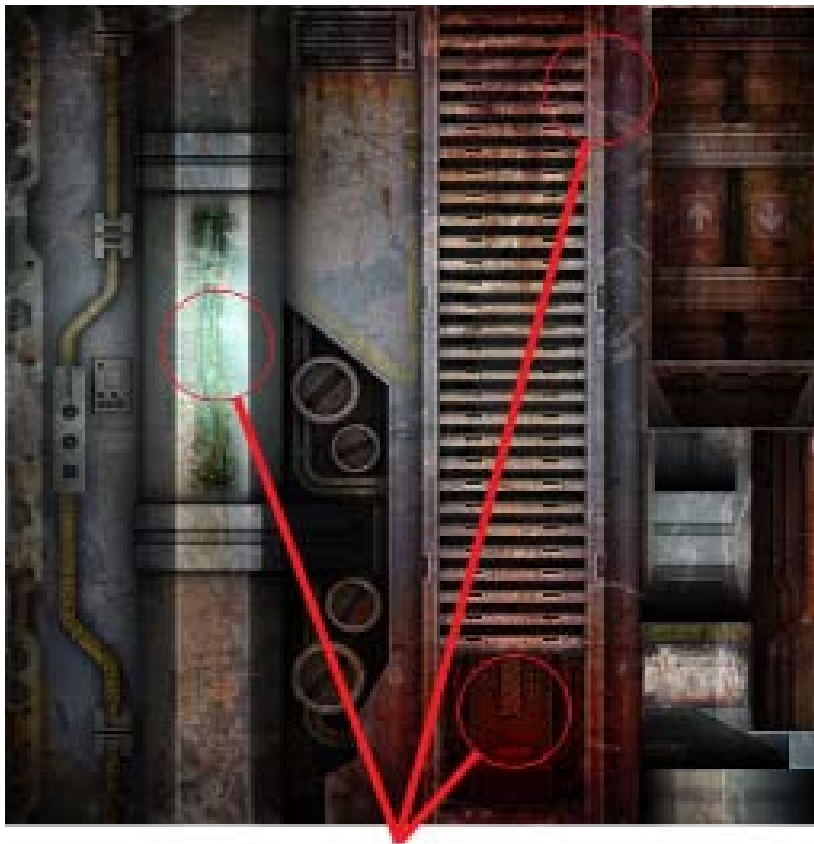
Blurred Texture

Texture *Realistic Wear & Polish*

Rendering

When a texture has a light source directly over it, a bright area is created and shadows are cast. A secondary shadow map that includes lighting and color information is added as a multiply layer during rendering. The process bakes the lighting and shadows into the texture. This saves processing power and enables the computer to run faster. A light map is similar to a secondary ambient occlusion pass, multiplied over the diffuse layer when rendered in game or for film.

The images are textures that have lights and shadows baked into them.



Blue and Red Lights
baked on the wall from
a light source



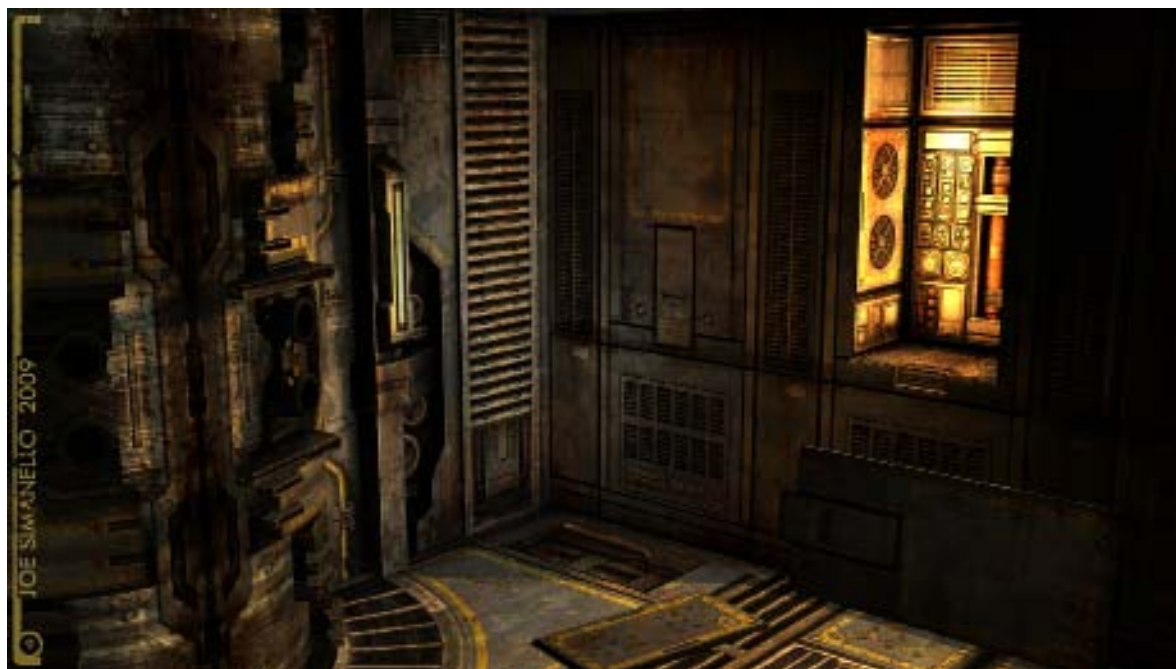
Texture with no lights baked,
only shadows

Texture Realistic Wear & Polish

Rendering for video games and films is a different process. Video games attempt to get all of the artwork rendered in real time, which means it has to render it on the fly. In film and TV, it is rendered out to a video file that is replayed. This is called pre-visualization. Mental Ray is a rendering engine used for film that takes texture sizes up to 4096 by 4096 pixels. This is the standard for film quality resolution.

A video game engine may only handle 100 megabytes of texture memory at once, and may require lower quality textures, such as 1024 by 1024 pixels. 3D software packages such as Maya, Softimage, and 3ds Max render images in mental ray. Rendering a final shot and setting up the lighting may take hours. A specialized artist may only work on rendering and lighting for a project.

Pictured are renders of the Bio Chamber in mental ray.



2010



3D Visualization & Animation Competition

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Texture

