Tutorials: Materials & Mapping

Autodesk® 3ds Max®

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Materials and Mapping Tutorials

6

Materials are like paint. With materials, you make apples red and oranges orange. You put the shine in chrome and the polish on glass. By applying maps, you can add images, patterns, and even surface texture to objects. Materials are what make your scenes look real.

Mapping is a method of projecting pictorial information (materials) onto surfaces. It is a lot like wrapping a present with wrapping paper, except the pattern is projected mathematically, with modifiers, rather than being taped to the surface.

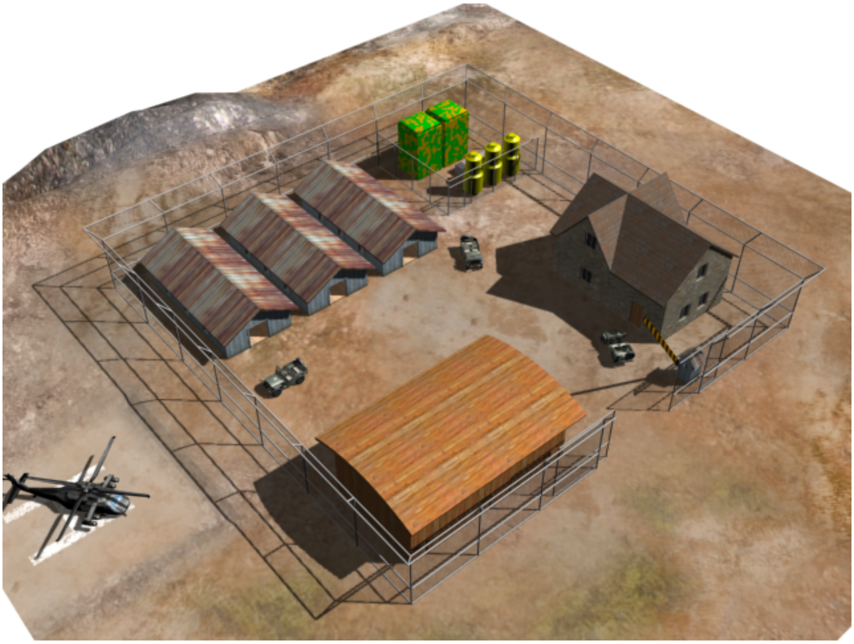
This tutorial introduces the Material Editor, the master design studio for materials and maps. In the following tutorials, you will learn how to assign materials to objects, how to create basic materials, and how to apply textures.

Features Covered in This Section

- Using the 3ds Max Material Editor to create, edit and apply materials.
- How mapping coordinates work, and how to manipulate them using 3ds Max modifiers.
- How to layer multiple texture maps onto a surface to create a composite image.
- How to map textures onto curved surfaces.
- How to apply multiple sub-maps similar objects to give each their own unique identity.

Introduction to Materials and Mapping

To introduce materials, you will work with a scene that shows an army compound: a field headquarters that has been built around a farmhouse.



A rendering of the field headquarters after you have completed the tutorial

In this tutorial, you will learn how to:

- Create basic materials.
- Assign materials to objects in the scene.
- Create and adjust mapping coordinates.
- Use texture, opacity, and bump mapping.
- Use 3D procedural materials.

Skill level: Basic to Intermediate

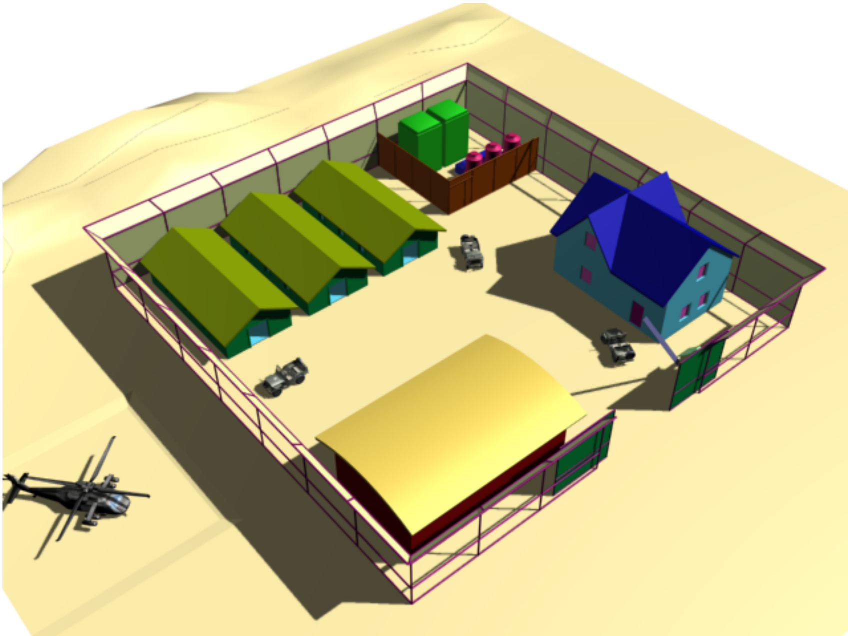
Time to complete: 1.5 hours

Applying Materials and Textures

You begin with a scene that has only a few materials in it.

Set up the lesson:

-  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\intro_to_materials* and open the scene file *army_compound.max*.
  Except for the vehicles, the jeeps and helicopter, this scene contains no materials. The buildings and terrain have a featureless, plastic look to them that is typical of newly created geometry in 3ds Max.

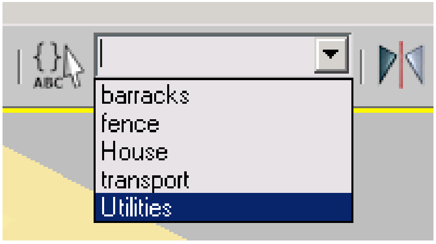


The field headquarters before you apply materials

You'll begin by adding textures to the utility containers in the fenced area at the rear of the compound.

Isolate the utility containers:

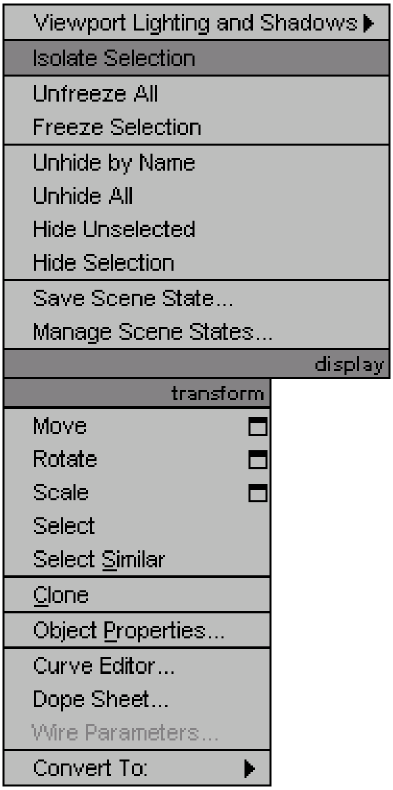
1 On the main toolbar, open the Named Selection Sets drop-down list, and choose the *Utilities* selection set.



3ds Max selects the various containers.

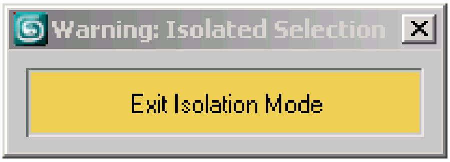
2 Right-click the viewport to display the quad menu, and choose Isolate Selection.

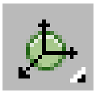
This command is in the upper-right, Display quadrant.

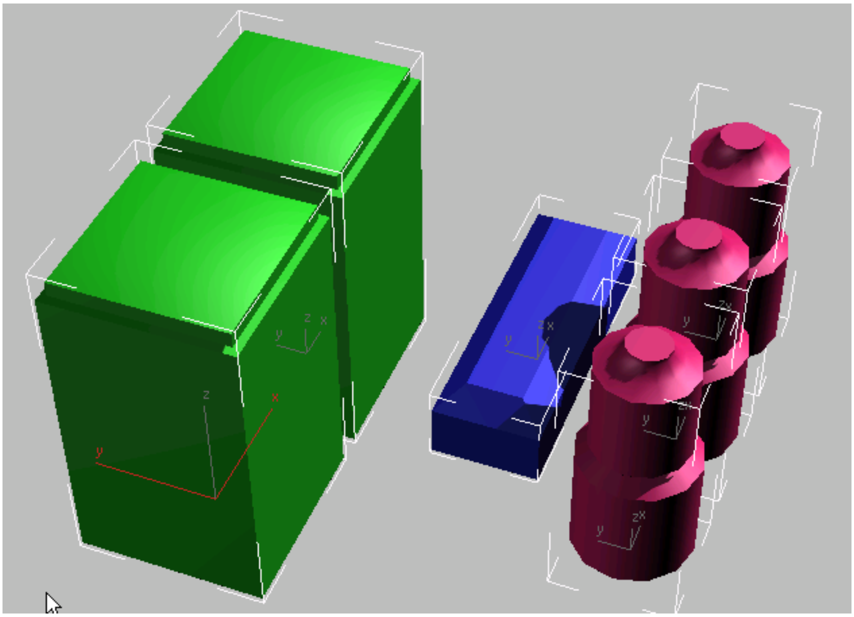


3ds Max displays the utility containers in the center of the viewport, and hides the other scene geometry.

TIP You might have to move the Warning: Isolated Selection dialog to see the geometry clearly.



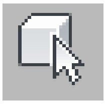
3  Use Orbit to adjust the view so you can see all five containers clearly.



The isolated set of containers

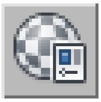
Now you're ready to begin creating materials for these objects.

Apply a basic material to the oil tanks:

1  Turn on Select Object.

2 Click an empty area of the viewport to deselect the *Utilities* set, and then click *OilTank01* (the front cylindrical object on the right) to select it.

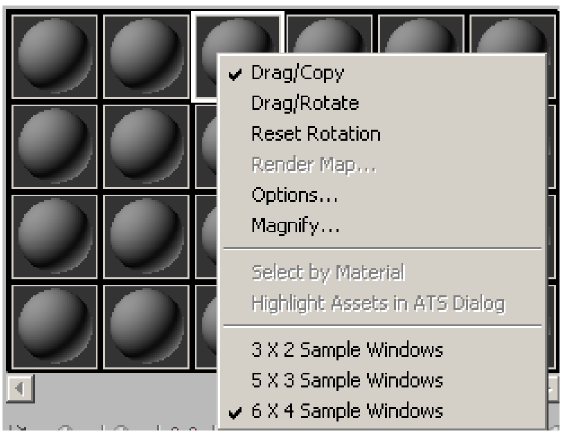
3 Ctrl+click *OilTank02* and *OilTank03* to select them as well.

4  On the main toolbar, click Material Editor to display the Material Editor.

The Material Editor is a sort of workbench for creating materials, adjusting them, managing them, and applying them to objects. The most obvious part of the Material Editor interface is an array of small windows with spheres in them. These are known as the *sample slots.*

Sample slots in the Material Editor

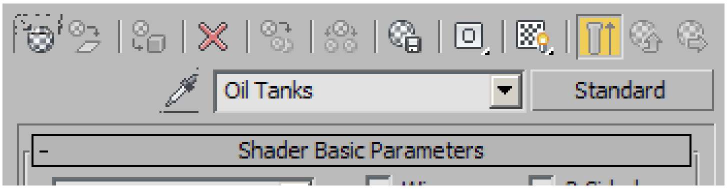
NOTE When you start the Material Editor, you might see a different number of sample slots. This isn't important. You can change the number of visible slots by right-clicking a slot and choosing how many "sample windows" to display from the pop-up menu.



Below and to the right of the sample slots are buttons for various controls, and below this area are rollouts with detailed controls for specific materials. We will describe controls when you need to use them, without going into detail at this point.

5 The active sample slot has a white border. If the upper-left slot is not already active, click it to make it active.

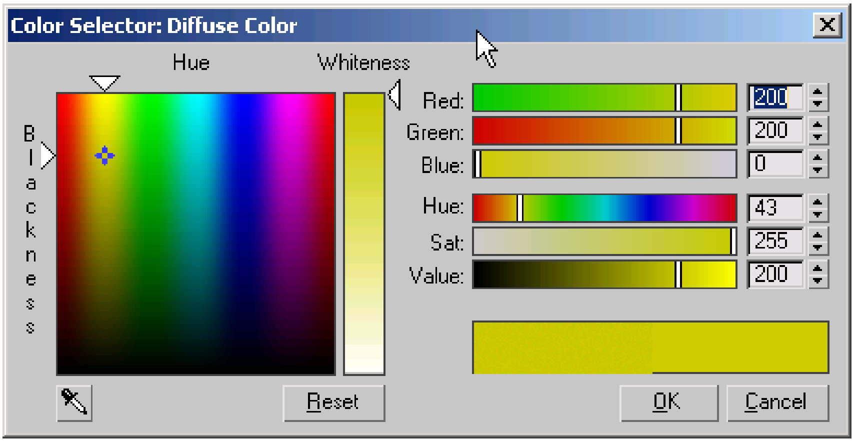
6 In the material Name field, just below the sample slot array, enter **Oil Tanks** as the material name.



It is good to get in the habit of naming a material as soon as you create it. In a complex scene, intelligible material names are useful.

7 On the Blinn Basic Parameters rollout, below the sample slots, click the color swatch that is labeled Diffuse.

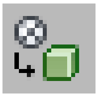
3ds Max displays a Color Selector dialog.



Use the Red/Green/Blue controls on the Color Selector to choose a yellow color. Set Red = **200**, Blue = **200**, and Green = **0**.

The *diffuse* color of a material is the color that appears under diffuse, or scattered, light. It is what we usually think of as "the" color of a material, and what you will set first, when you create a basic material such as this one.

8 Click OK to close the Color Selector.

9  Among the buttons below the sample slots, locate the button called Assign Material To Selection, and click it.

In the viewport, the oil canisters turn yellow.

Look at the sample slot: it now has angled corners. Angled corners on a sample slot mean that the material has been applied to at least one object in the scene. When the angled corners are solid white, as they are in this case, the material is said to be *hot*. When you make changes to a hot material, the scene changes immediately, and usually the viewport display shows the material changes you have made.

You will take advantage of adjusting a “hot” material in the next set of steps.

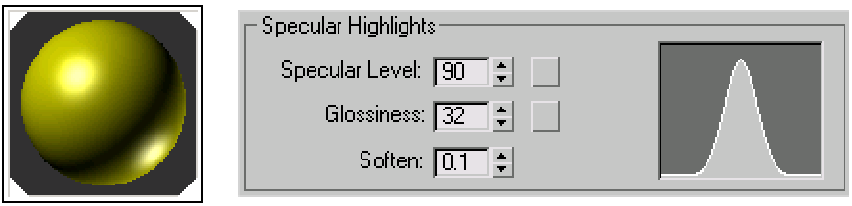
Make the oil tanks shiny:

Make sure that the three oil tanks are still selected, and that the Oil Tanks material sample slot is still active.

1 On the Blinn Basic Parameters rollout, in the Specular Highlights group, change the value of Specular Level to **90**.

Bright highlights appear on both the sphere in the sample slot, and the oil tanks in the viewport.

2 Also in the Specular Highlights group, change the Glossiness value to **32**.

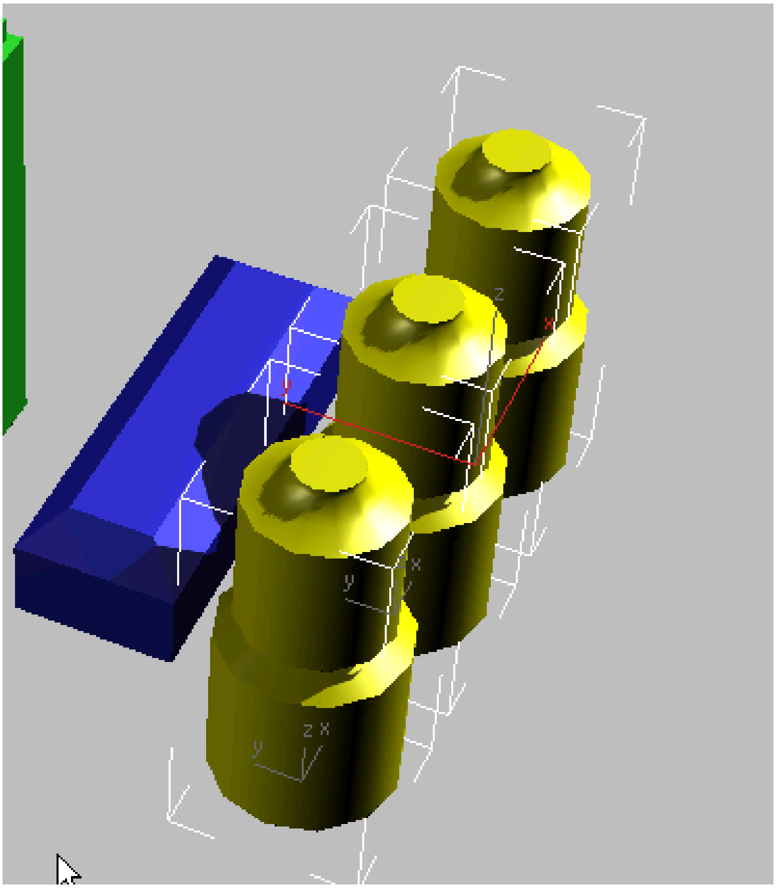


Left: Sample slot with the oil tank material

Right: Specular highlight controls with Glossiness = 32

As you can see the sample slot and in the graph to the right of the Specular Highlight and Glossiness controls, the highlight is now narrower. Specular Level controls how bright highlights are, while Glossiness controls highlight width. In general, shinier materials have smaller highlights.

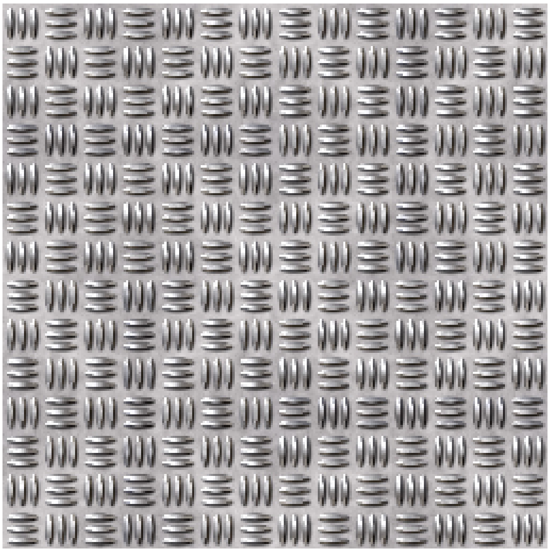
You have used basic material controls, Diffuse color, Specular Level, and Glossiness, to create a simple material that has the appearance of a moderately shiny paint. This completes the material for the oil tanks.



The oil tanks with their material

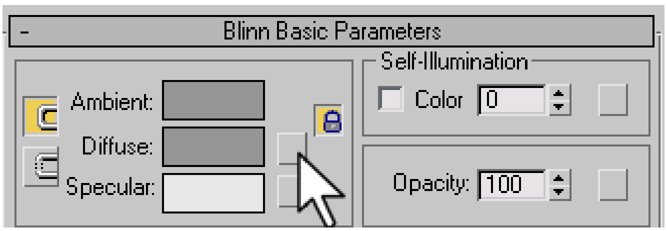
Apply a texture map to the ammunition canister:

For the ammunition canister, you will use a bitmap. Bitmaps are a versatile way to add visual detail to scenes, and we use them extensively in this scene. When a bitmap is used to provide an object's color, it is also known as a *texture map*. The texture map you apply to the canister shows a section of metal plating with a "checkered" pattern.



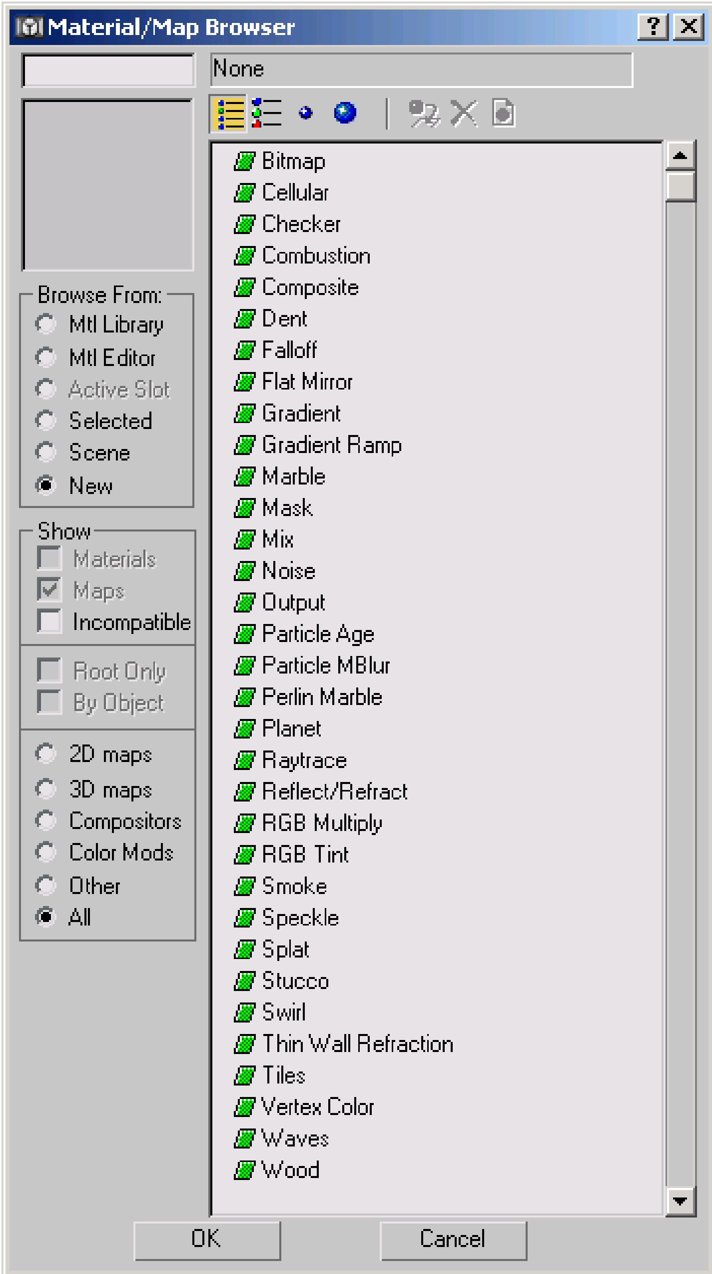
Texture map for the ammunition canister

1. In the Material Editor, click the second sample slot to activate it.
2. In the Name field, change the name of the material to **Canister**.
3. In the Blinn Basic Parameters rollout, click the gray button immediately to the right of the Diffuse color swatch.

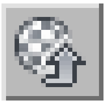
   This button assigns a map, rather than a plain color, to the Diffuse component of the material.

   3ds Max displays the Material/Map Browser.


Material/Map Browser
None
Browse From:
Mtl Library
Mtl Editor
Active Slot
Selected
Scene
New
Show
Materials
Maps
Incompatible
Root Only
By Object
2D maps
3D maps
Compositors
Color Mods
Other
All
Bitmap
Cellular
Checker
Combustion
Composite
Dent
Falloff
Flat Mirror
Gradient
Gradient Ramp
Marble
Mask
Mix
Noise
Output
Particle Age
Particle MBlur
Perlin Marble
Planet
Raytrace
Reflect/Refract
RGB Multiply
RGB Tint
Smoke
Speckle
Splat
Stucco
Swirl
Thin Wall Refraction
Tiles
Vertex Color
Waves
Wood
OK
Cancel

4 In the Material/Map Browser list of map types, click Bitmap to highlight it, and then click OK.

5 3ds Max displays a file dialog. Click to highlight the file *metals.checker.plate.jpg* (it's *\sceneassets\images*, like all the maps for the tutorials), and then click Open.

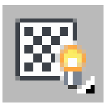
6  In the Material Editor, click Go To Parent.

This button is toward the right of the row of tool buttons below the sample slots.

Now you are at the top-level Canister material once again. Materials with maps are organized in a tree-like hierarchy. Controls in the rollouts portion of the Material Editor depend on which level you are at: after you adjust a map, you can click Go To Parent to get back to the topmost, main material level.

7 Make sure that none of the utility objects is selected, then drag the sample slot from the Material Editor to the viewport, and release the mouse over the blue canister in the middle of the group.

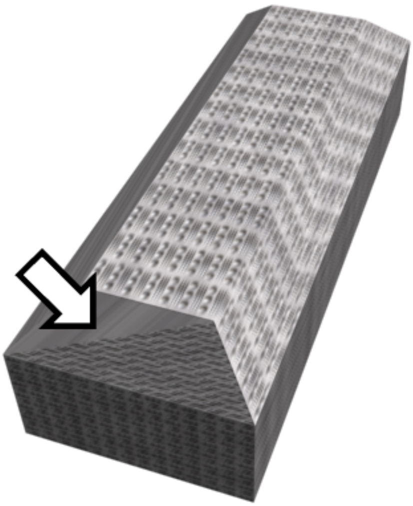
The canister turns gray.

8  In the Material Editor, click to turn on Show Standard Map In Viewport.

Now you can see the material's texture in the viewport.

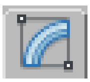
Adjust the metal plate mapping:

If you zoom in, you can see that the mapping is not as good as it could be. The top and sides of the canister look all right, but there is streaking where the top of the canister has beveled faces.



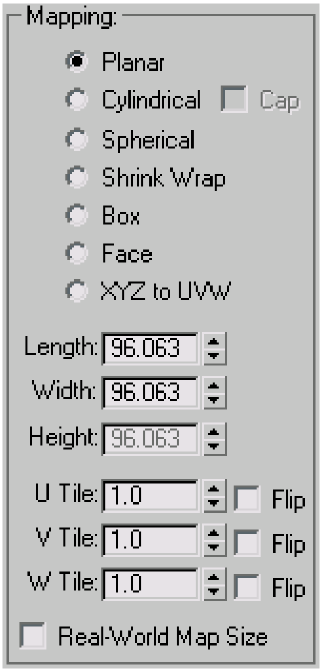
Streaks in the texture when using the default mapping

To fix this, you use a modifier called UVW Map.

1  Select the canister object, which is named *Ammo,* and go to the Modify panel.

2 Open the drop-down Modifier list, and choose UVW Map from the list.

TIP Once you open the list, you can press U a couple times until the list highlights UVW Map, and then press Enter.

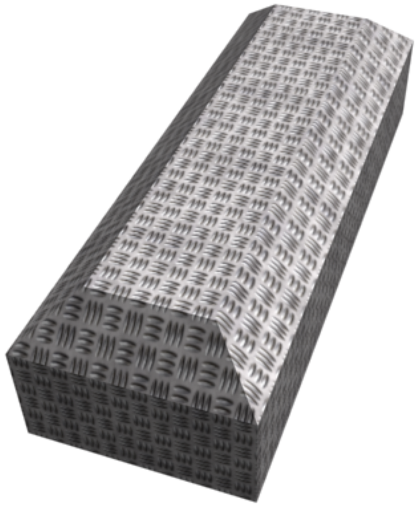


3 In the Parameters rollout > Mapping group, choose Box.

The radio buttons at the top of the Mapping group (Planar, Cylindrical, Spherical, and so on) tell the UVW Map modifier how to project the map onto the object. Box mapping projects the map from all six sides, so the texture display is more uniform.

4 Also in the Mapping group, set Length = Width = Height = **2.0m**.

Now the mapping is uniform and looks good from any angle.



The texture corrected using UVW Map

Apply a 3D material to the generators:

Finally, for the generators, you will use a 3D procedural map. A bitmap is simply a digital image such as a scan or a photograph. A 3D map, on the other hand, is generated by 3ds Max.

1 Select *Generator01* and *Generator02,* the large boxy objects to the left.

2 In the Material Editor, click the next unused sample slot to make it active, then name the material **Camouflage**.

3 In the Blinn Basic Parameters rollout, click the small Diffuse map button.

   3ds Max displays the Material/Map Browser.

4 In the list of map types, highlight Noise, and then click OK.

   TIP In the Browser, you can also double-click the Noise map to assign it without having to click OK.

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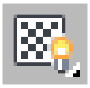
5 In the Noise Parameters rollout, click the color swatch labeled Color #1.

3ds Max displays a Color Selector.

6 Change Color #1 to a dark green: Red = **0**, Green = **175**, Blue = **0**.

7 Click the color swatch labeled Color #2. In the Color Selector, change Color #2 to a tan: Red = **200**, Green = **155**, Blue = **0**, and then click OK.

8 Click OK to close the Color Selector.

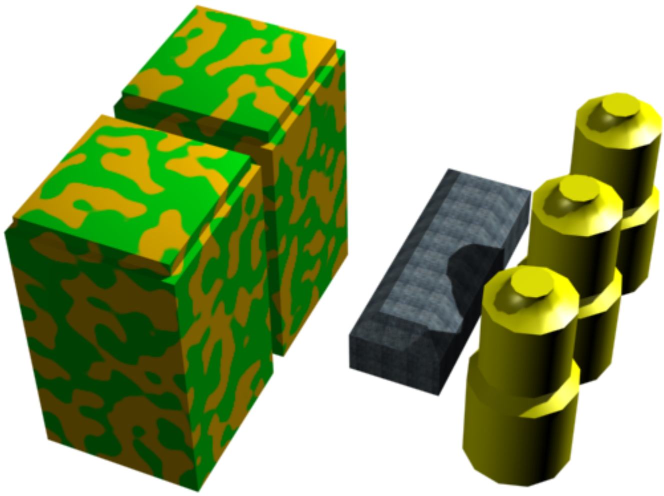
9   Click Assign Material To Selection, and then click Show Standard Map In Viewport to turn it on.

The map appears in the viewport, but the camouflage pattern isn't very apparent.

10 In the Noise Parameters rollout, change the Noise Threshold values. Set High = **0.51** and Low = **0.49**. In addition, change the Size value to **18.0**.

Now the generator casings have a recognizable camouflage pattern. A bonus of the procedurally generated 3D Noise texture, is that the pattern is not quite the same on either generator. (This effect is apparent only when you render the scene: in viewports, both generators look the same.)

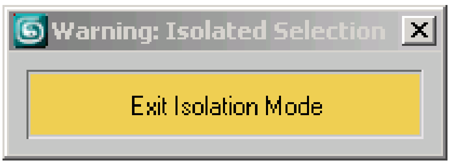
You now have a reasonably realistic texture for all of the containers in the utilities area of the compound.



Utility containers with their textures

View the entire scene again:

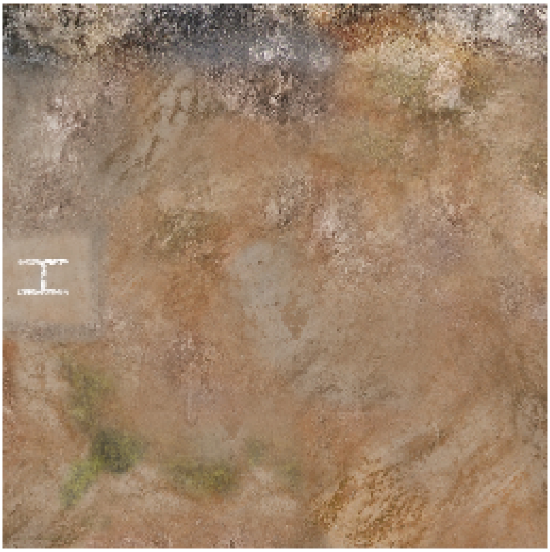
- In the Warning: Isolated Selection dialog, click Exit Isolation Mode.



The viewport shows the entire scene once again.

Apply a texture map to the terrain:

For the last step in this lesson, you will apply a texture to the terrain beneath and surrounding the compound.



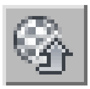
Terrain texture for the army compound

1 In the Material Editor, click the next unused sample slot to make it active, and name the new material **Terrain**.

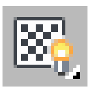
2 In the Blinn Basic Parameters rollout, click the Diffuse map button. In the Material/Map Browser, double-click Bitmap.

3 In the file dialog, choose *terrain.jpg,* and then click Open.

   The Terrain texture now has an image of the ground.

4  Click Go To Parent, and then drag the sample slot to the *Ground* object in the viewport. This is the large, flat, tan object that underlies all the other geometry.

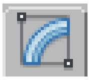
   The *Ground* object turns gray.

5  Click Show Standard Map In Viewport to turn it on.

   The *Ground* object turns brown, but it doesn't show the texture map. This is a sign that the object doesn't have mapping coordinates.

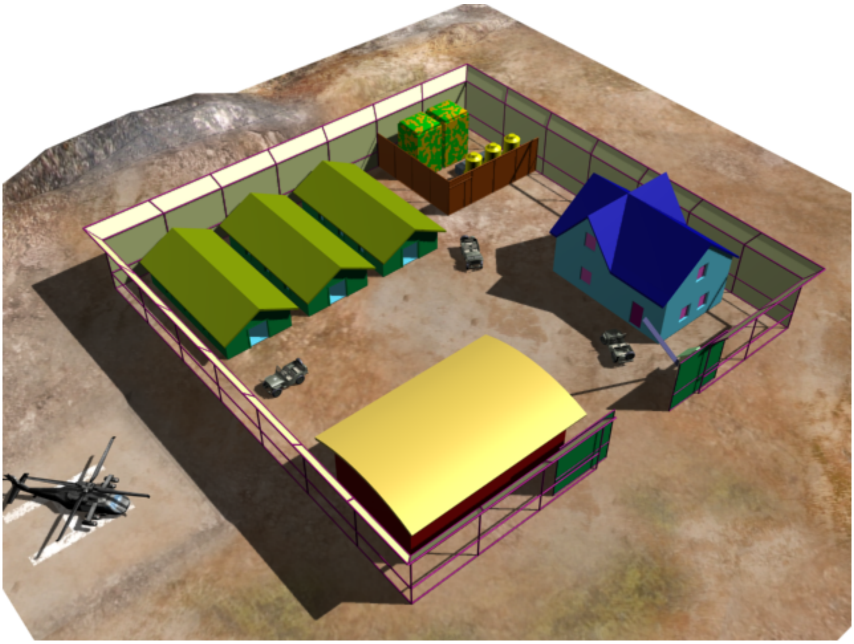
   Primitive objects such as boxes and spheres have default mapping coordinates, but editable geometry such as *Ground,* which is an Editable

Poly, does not. You have to assign mapping coordinates by applying UVW Map.

6  Select the *Ground* object, and go to the Modify panel.

7 Use the Modifier List to apply a UVW Map modifier.

For the terrain, the default Planar projection works fine, and the map *terrain.jpg* is already the right size for the scene, so your work in this lesson is now complete.



Army compound with textured utility containers and terrain

Save your work:

- Save the scene as **my_fieldhq_containers_and_terrain.max**.

Add Detail to Some Outbuildings

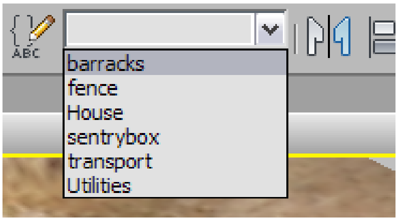
Next, you will add materials to the barracks. Materials for the barracks use texture maps, as the ammunition canister does, but they also use *bump mapping* to create a more three-dimensional appearance.

Set up the lesson:

■ Continue from the previous lesson, or open *army_compound01.max*.

Isolate the barracks:

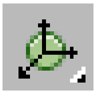
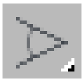
1 On the main toolbar, open the Named Selection Sets drop-down list, and choose the *barracks* selection set.



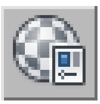
3ds Max selects the barracks buildings.

2 Right-click the viewport to display the quad menu, and choose Isolate Selection.

3ds Max displays the barracks in the center of the viewport, and hides the other scene geometry.

3   Use Orbit and Field-Of-View to adjust the view so you can clearly see the barrack walls.

Texture the barrack walls:

1  If it is not already visible, display the Material Editor.

TIP Besides the toolbar button, another way to display the Material Editor is simply to press M.

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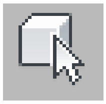
2  Turn on Select Object, then click an empty area of the viewport to deselect the *barracks* set.

3 In the Material Editor, choose Options > Propagate Materials To Instances from the menu bar, in order to turn it on. (When this option is turned on, a check mark appears before its name.)

   Like the oil tanks and generators, the barracks objects, roof, walls, and floors, are instances of each other. By turning on this option, you can apply a material to all the objects of one type by dragging and dropping to only one object.

4 In the Material Editor, click the next unused sample slot to make it active, and name the new material **BarracksWalls**.

5 In the Blinn Basic Parameters rollout, click the Diffuse map button. In the Material/Map Browser, double-click Bitmap.

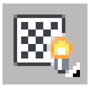
6 In the file dialog, choose *planks.jpg,* and then click Open.

   The BarracksWalls texture now has an image of the planking.

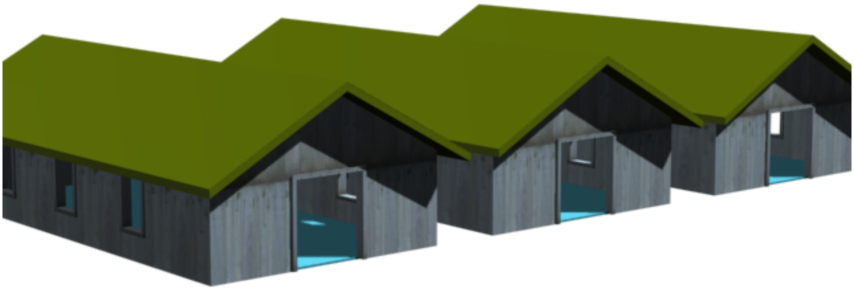
Planks texture for barracks walls

7 Drag the sample slot to the leftmost barrack walls.

All three barracks turn gray, to show the material has been applied.

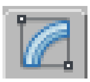
8  Click Show Standard Map In Viewport to turn it on.

The planks texture shows dirt at the bottom of the wall, but with default mapping coordinates, the dirt appears just above each doorway, instead.



Planks texture appears on the walls, but is not aligned correctly.

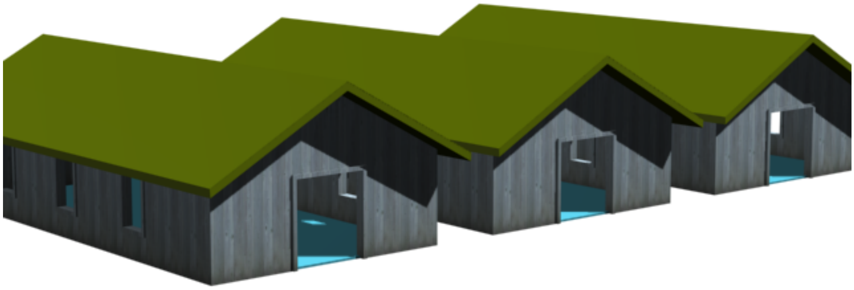
Use UVW Map to adjust the planks:

1  Select *Barracks01-Walls,* and then go to the Modify panel.

2 Use the Modifier List to apply a UVW Map modifier.

3 In the Parameters rollout > Mapping group, change the projection type to Box. Also set Length = Width = Height = **4.0m**.

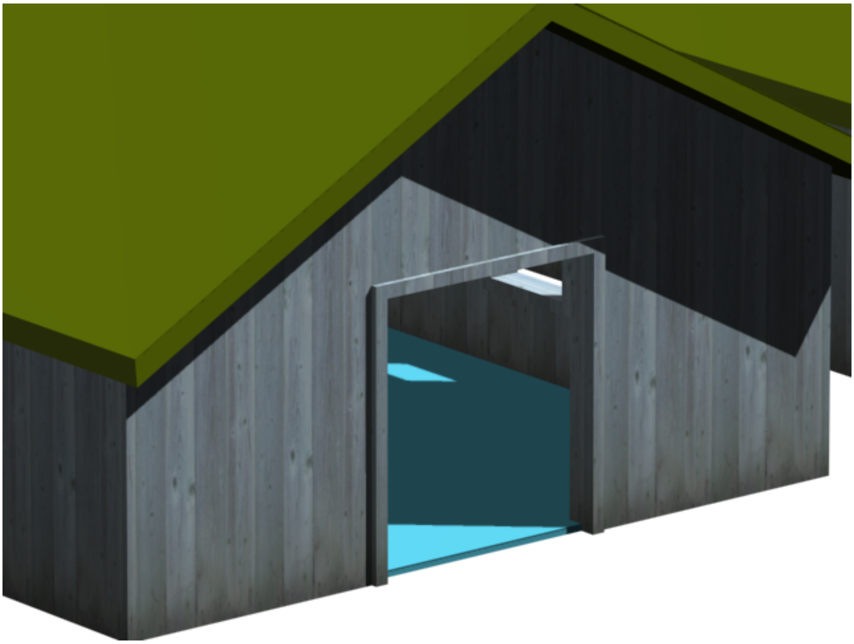
Now the planking texture is correctly aligned with the walls.



After applying UVW Map, the planks on the walls are aligned correctly.

Add a bump map to the planks material to improve realism:

If you take a closer look at the barracks, you can see that the texture looks good, but it also has a flat appearance, smoother than aged wood typically appears.



Barrack walls with a texture alone, and no bump mapping

You can improve the appearance of the plank walls by using *bump mapping*. Bump mapping makes an object appear to have a bumpy or irregular surface.

1 In the Material Editor, make sure the sample slot for the BarracksWalls material is active.

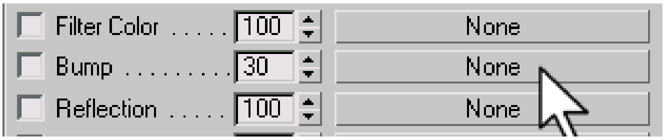
If it isn't, click it to make it active.

2  If the rollouts area of the Material Editor displays map controls, click Go To Parent to go to the main material level.

3 In the rollouts area of the Material Editor, open the Maps rollout.

You might have to scroll down a bit to see the title bar of this rollout.

4 In the Maps rollout, click the map button that on the left has the label "Bump" (at this point, the button itself is labeled "None").



Bump map controls

Left: On/off toggle

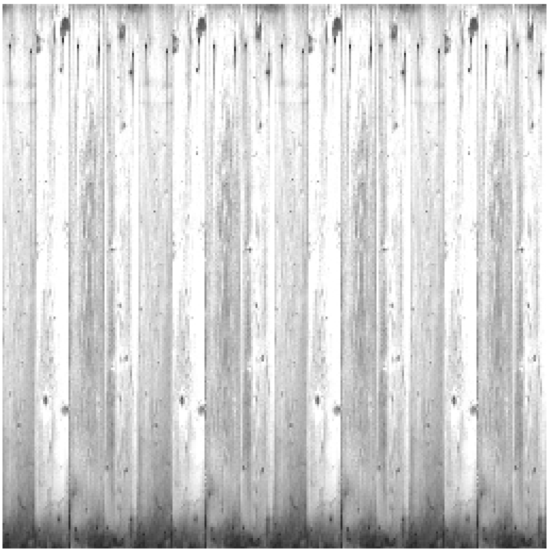
Middle: Amount spinner

Right: Map button, which opens the Material/Map Browser

3ds Max displays the Material/Map Browser.

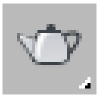
5 In the Browser's list of map types, double-click Bitmap. In the file dialog, choose *planks.bump.jpg,*, and then click Open.

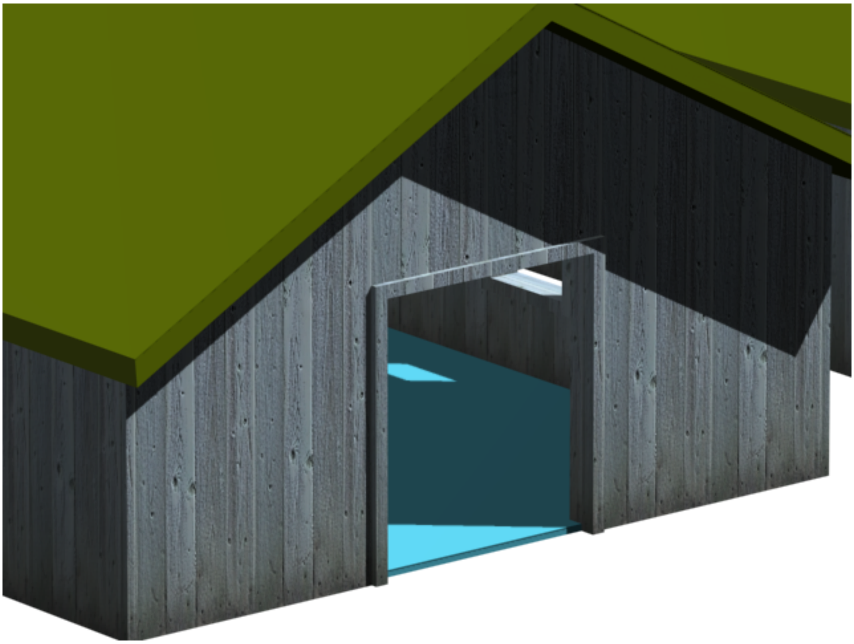
This map is simply a black-and-white version of the *planks.bmp* map itself.



Black-and-white planks texture for bump mapping

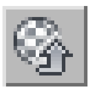
Bump mapping uses intensities in the map to affect the surface of the material when you render it: white areas appear higher, and black areas appear lower. This is why the bitmap you use for bump mapping is often a black-and-white version of the map you use for texture.

6  Bump mapping isn't displayed in the viewports, so click Render Production to see the effect of the new map.



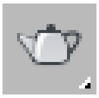
The barrack walls with bump mapping

To get an even more weathered look, you can increase the bump mapping Amount.

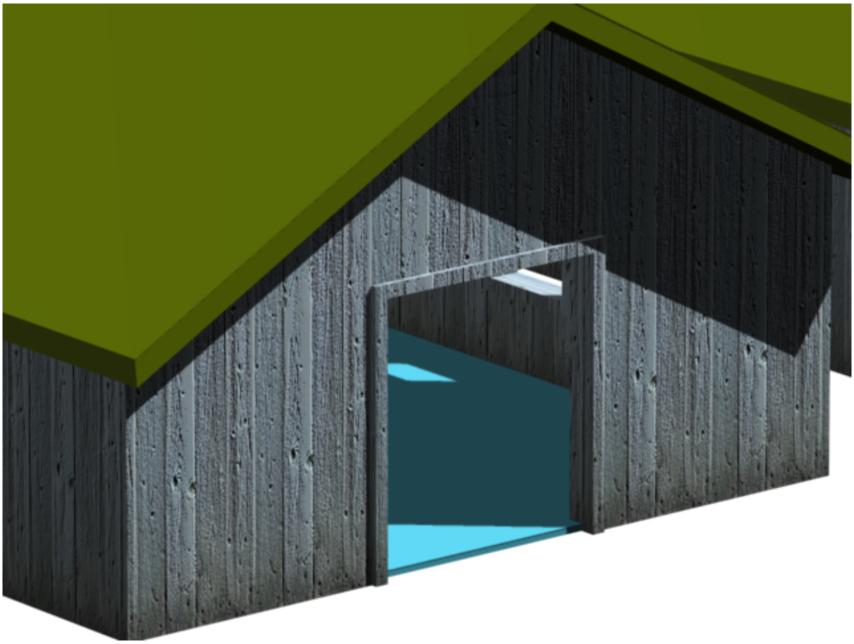
7  Click Go To Parent to go to the main material level, and then on the Maps rollout, increase the Bump Amount to **75**.

NOTE You might notice a couple of user-interface changes that happened when you assigned the map for bump mapping: a check box indicates that bump mapping is turned on, and the Bump button now shows the name of the map: *planks.bump.jpg*.

---

8  Click Render Production again.

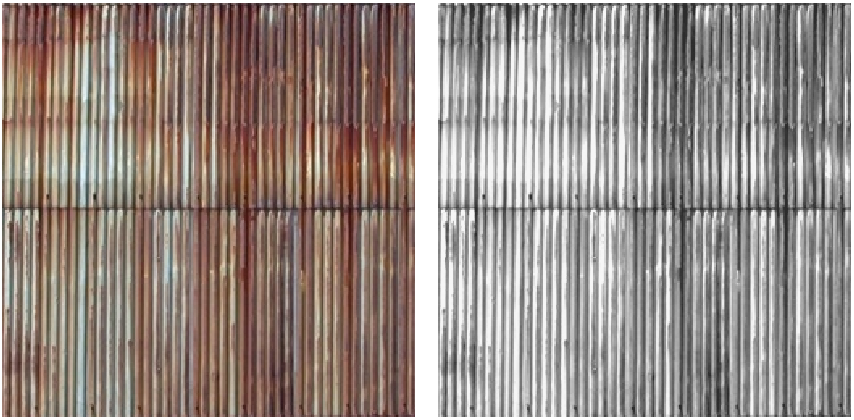
Now the plans appear extremely weathered.



The barrack walls with increased bump mapping

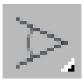
Texture the barrack roofs:

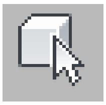
You will use a similar method for the roofs and floors of the barracks.



Left: Texture map for the barrack roofs

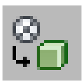
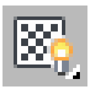
Right: Bump map for the barrack roofs

1  Increase the Field-Of-View so you have a good view of the barrack roofs.

2  Select *Barracks01-Roof*.

3 Click the next unused sample slot to make it active, and name the material **BarracksRoof**.

4 In the Blinn Basic Parameters rollout, click the Diffuse map button. In the Browser, double-click Bitmap, and then choose *metal_plate.jpg* as the texture map.

5   Click Assign Material To Selection, and then click Show Standard Map In Viewport to turn it on.

In the viewport, the map appears on the barrack roofs. However, it is oriented the wrong way: the corrugated plates should lie along the slope of each roof instead of lengthwise.

TIP The map should be applied to all three roofs. If it isn't, Propagate Materials To Instances was not on. Choose Options > Propagate Materials To Instances to turn this option back on, and try applying the map again.

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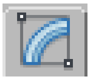
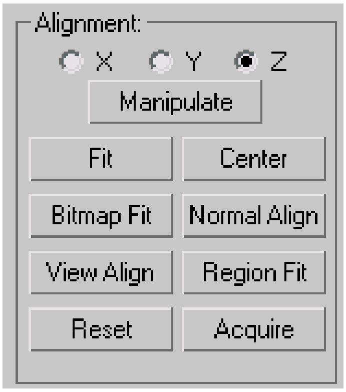
6 In the Material Editor > Coordinates rollout, change the W Angle to **90.0** degrees.

7  Go to the Modify panel, and use the Modifier List to apply a UVW Map modifier.

At first this appears to lose the W-Angle correction you just made, but changing the modifier alignment will fix that.

8 In the Parameters rollout > Alignment group, choose Y as the alignment axis.



Now the metal plates are oriented correctly again.

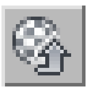
9 Also on the Alignment rollout, click Fit.

This sets the Width to its correct value of 7.04 meters.

10 In the Parameters rollout > Mapping group, change Length to also equal **7.04m**.

(Make sure you leave the UVW Map projection set to Planar, the default.)

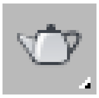
The roof texture now has the correct size and orientation.

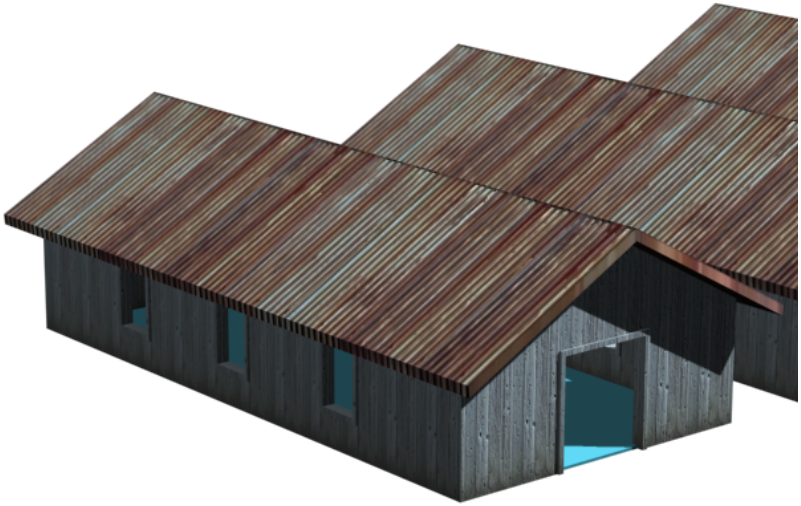
11  In the Material Editor, click Go To Parent, and then open the Maps rollout.

12 Assign *metal_plate.bump.jpg* as the Bump map.

13 In the Coordinates rollout, change the W Angle to **90.0** to match the texture.

14  Click Go To Parent again, and on the Maps rollout, increase the Bump Amount to **90**.

15  Click Render Production to see the effect.

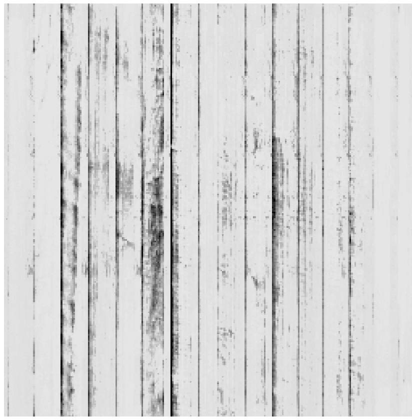


The barrack roofs with bump mapping

At the eaves of the roofs, the texture “slops over” a bit. In this scene, it isn’t a problem because usually you will render the barracks from a distance. Of course, the bump mapping isn’t too apparent at a distance, either. Whenever you texture a scene, bear in mind how much detail you want to use to make the scene believable.

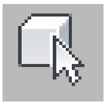
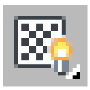
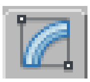
Texture the barrack floors:

Texturing the barrack floors should now be a familiar process

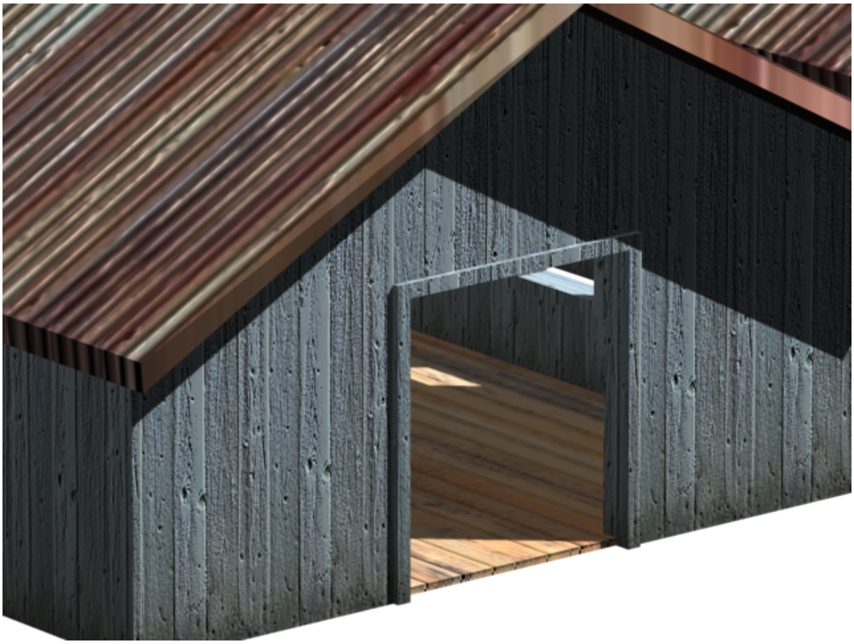
Left: Texture map for the barrack floors

Right: Bump map for the barrack floors

1.  Select *Barracks01-Floor*.
2. Click the next unused sample slot to make it active, and name the material **BarrackFloors**.
3. Assign *wood_batten.jpg* as the texture (Diffuse) map.
4.   Click Assign Material To Selection, and then turn on Show Standard Map In Viewport.
5.  Apply a UVW Map modifier. Leave the projection set to Planar. Set Length = Width = **4.0m**.

   You don't need to adjust the orientation of the floorboards.
6. Assign *wood_batten_bump.jpg* as the Bump map, and increase its Amount to **90**.

Now the barracks are completely textured.



Close-up of one barrack with textures for roof, walls, and floor

Use the Barrack Materials for the Sentry Box

Now that you have textured the barracks, you can use the same materials for the sentry box. The trick is to use the same materials *and* the same UVW Map settings.

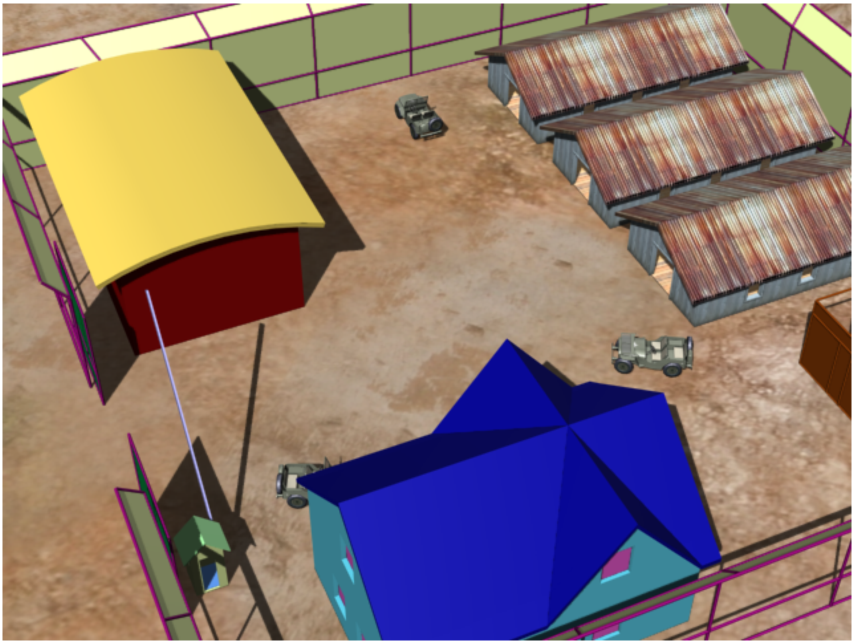
Change the view:

1. In the Warning: Isolated Selection dialog, click Exit Isolation Mode to return to a general view of the scene.
2. Click the Point Of View (POV) viewport label, and choose Cameras > Camera02.

   This gives you a view of the completed barracks, and the unfinished sentry box.

   TIP You might have to move the Material Editor to see the viewport label, or some of the geometry in the steps that follow.

The new view lets you see the roofs, walls, and floors of the completed barracks, and also the roof, walls, and floor of the sentry box, which doesn't yet have materials applied.

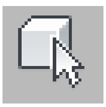


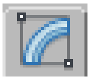
Camera02 view with finished barracks to the right, unfinished sentry box to the left.

3 Click the Point Of View (POV) viewport label, and choose Perspective.

Changing to a perspective view doesn't change what appears in the viewport, but in the perspective view, you can navigate without changing the camera settings.

Copy the barracks floor material:

1  Click one of the *Barracks0X-Floor* objects to select it.

2  Ctrl+drag the UVW Mapping entry in the floor object's modifier stack, and drop this modifier instance over the floor of the sentry box. (Before it has a material, the floor appears blue.)

   The sentry box floor now has the correct mapping, but it still needs its material.

3 Drag the BarrackFloors material from the Material Editor to the sentry box floor.

   Now the floor has both the material and the correct mapping.

Copy the roof and wall materials:

- For the roof and walls of the sentry box, follow the same steps you did for the sentry box floor: first select a barracks roof or wall, Ctrl+drag UVW Mapping from the modifier to the corresponding sentry box object, then drag the appropriate material from the Material Editor and drop it on the roof or walls.

The sentry box with the same materials as the barracks

NOTE The order in which you apply the material and the mapping doesn't matter. The important thing is to assign the material *and* the UVW Mapping, so that the materials render correctly.

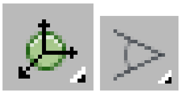
Create a new, 3D material for the sentry bar:

For the sentry bar, which blocks or permits vehicle access to the compound, you can use a simple material with a procedural map named Gradient Ramp.

1 On the main toolbar, open the Named Selection Sets drop-down list, and choose the *sentrybox* selection set.

   3ds Max selects the sentry box.

2 Right-click the viewport, and choose Isolate Selection from the quad menu.

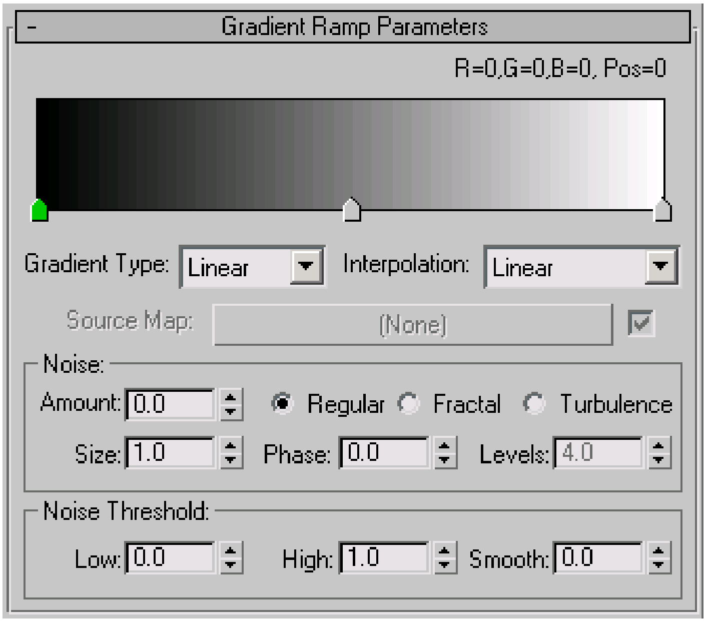
3  Use Orbit and Field-Of-View to adjust the view so the sentry bar is clearly visible.

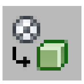
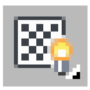
Isolated sentry box with a view of the bar

4 In the Material Editor, click the next unused sample slot to make it active, and name the new material **SentryBar**.

5 In the Material Editor > Blinn Basic Parameters rollout, click the Diffuse map button, then in the Material/Map Browser, double-click Gradient Ramp.

3ds Max assigns a Gradient Ramp as the map type. Gradient Ramp is a 3D procedural material like the Noise material you used for the generator casings.

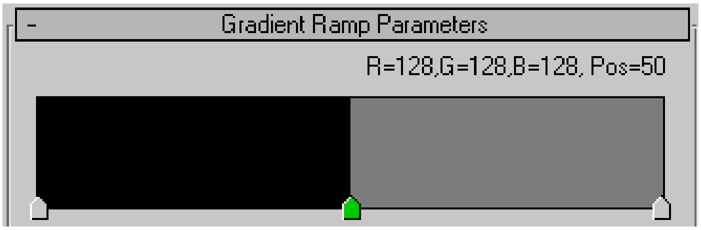


6   Click Assign Material To Selection, and then turn on Show Standard Map In Viewport.

7 In the Gradient Ramp Parameters rollout, change the Interpolation type to Solid.

The gradient display changes to two solid colors, one of them black.

8 Double-click the arrow-shaped slider at the middle of the gradient display. This slider controls the color to its right (you could use the first slider on the left to adjust the black color.)



Gradient Ramp with solid colors

Double-click the middle slider (shown in green) to change the color to the right of the slider.

3ds Max displays a Color Selector.

9 In the Color Slider, change the second gradient color to orange: Red = **255**, Blue = **150**, Green = **0**.

10 Click OK to close the Color Selector.

11 In the Coordinates rollout, change the U Tiling value to **10.0**.

The material changes from two color areas to multiple stripes.

12 Also in the Coordinates rollout, change the W Angle value to **–2.5**.

Now the stripes have an angle to them.

Isolated sentry box with the completed sentry bar

View the entire scene again:

1 In the Warning: Isolated Selection dialog, click Exit Isolation Mode.

2 Click the viewport label and choose Cameras > Camera02.

3 Click the viewport label again and choose Perspective.

Save Your Work

- Save the scene as **my_fieldhq_barracks.max**.

Using Opacity Mapping for the Fences

The fences are a bit of a special case, because the chain-link parts of them should be partially transparent. You accomplish this the way you did bump mapping: by the use of bitmaps.

Set up the lesson:

- Continue from the previous lesson, or open *army_compound02.max*.

Select the fences:

➤ On the main toolbar, open the Named Selection Sets drop-down list, and choose the *fence* selection set.

This step is mainly to show you what and where the fences are. There is the main fence around the compound and the smaller fence that encloses the utility containers.

NOTE Incidentally, the main fence includes two gates, left and right. Each gate can move along its own local X axis to open or close the compound.

Use a basic material for the fence supports:

Each fence component, including the gates, actually includes two objects: a "structure" component for the fence's supportive piping, and a "wire" component for the actual chain link.

1 In the Material Editor, click the next unused sample slot to make it active, and name the material, **FenceSupport**.

2 In the Blinn Basic Parameters rollout, click the Diffuse color swatch to display the Color Selector, and then assign the material a light gray color: Red = Blue = Green = **188**.

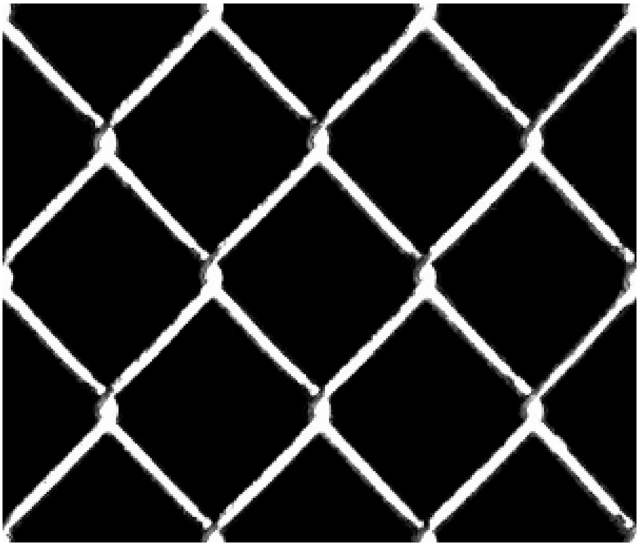
3 Click OK to close the Color Selector.

4 Press H to display the Select From Scene dialog. Highlight the structure objects for all the fences: *Fence-Structure, Gate-left-structure, Gate-right-structure,* and *Fence-sml-Structure*. Click OK to select these four objects.

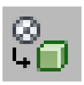
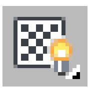
5  Click Assign Material To Selection.

Use a texture map for the chain link:

The chain link itself uses a bitmap with a chain-link pattern.



Chain-link texture for the fence

1. In the Material Editor, click the next unused sample slot to make it active, and name the new material **FenceChainLink**.
2. In the Shader Basic Parameters rollout, turn on 2-Sided.
3. In the Blinn Basic Parameters rollout, click the Diffuse map button. In the Browser, double-click Bitmap, and then in the file dialog, assign the bitmap *sitework.chainlink.jpg* as the diffuse map.
4. Press H to display the Select From Scene dialog. Highlight the wire objects for all the fences: *Fence-Wire, Gate-left-wire, Gate-right-wire,* and *Fence-sml-Wire*. Click OK to select these four objects.
5.   Click Assign Material To Selection and then turn on Show Standard Map In Viewport.

   The fence texture appears in viewports as a gray pattern on a black background. It isn't yet to scale, so you need to adjust it with UVW Map.

NOTE Because the mapping isn't yet right, some fence surfaces might appear gray even if you turned on 2-Sided. The UVW Map adjustments will fix this.

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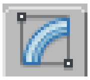
6  With all four objects still selected, go to the Modify panel and apply a UVW Map modifier.

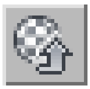
7 Change the mapping projection type to Box, and then set Length = Width = Height = **0.5m**.

   Now the mapping and the scale of the chain link are correct; but of course, the fences still appear to be solid objects.

Use the chain-link texture to create transparency and opacity:

Just as in bump mapping, where black areas of a map appear recessed and white areas appear prominent (with gray values having an intermediate effect), in opacity mapping, black areas appear transparent and white areas appear opaque (while gray values create some degree of translucency).

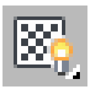
Because the chain-link map is already black-and-white, it should work effectively both as a texture and as an opacity map.

1  In the Material Editor, click Go To Parent if you are not already at the top material level, and then open the Maps rollout.

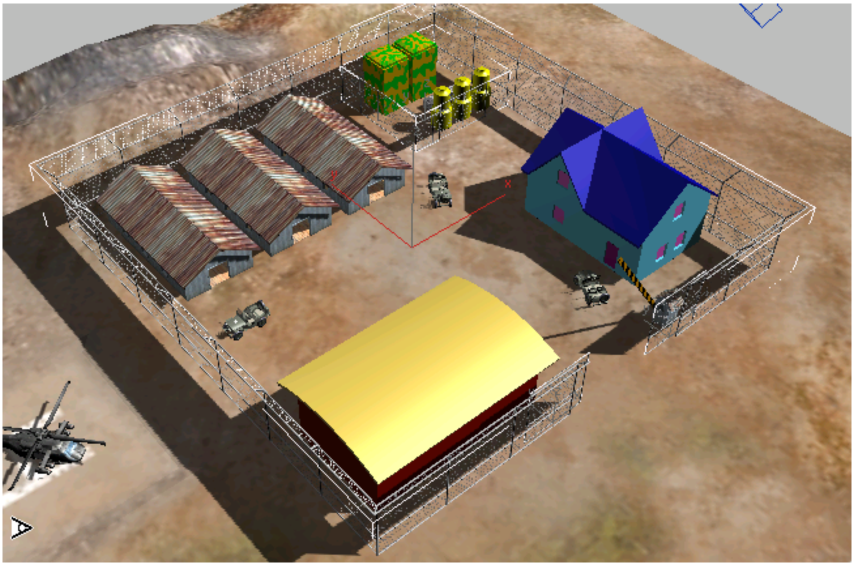
2 In the Maps rollout, drag the Diffuse Color map button to the Opacity map button, and then release the mouse.

3 3ds Max displays a Copy (Instance) Map dialog. Make sure you choose Instance, and then click OK.

   (Also, leave the Opacity Value set to 100 percent.)

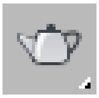
4  Click to turn on Show Standard Map In Viewport at the main material level.

   Now, in the viewport, the chain-link portions of the fence appear partially transparent.

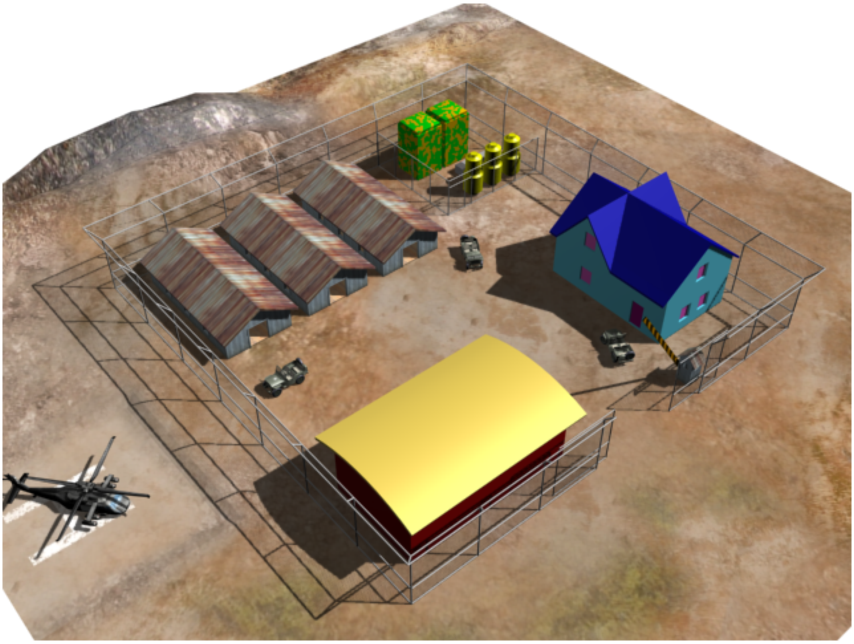


Viewport display of fence with opacity mapping

The one thing missing from this view is transparency in the fence shadows. Depending on your graphics card, viewports might not display opacity mapping just as they don't display bump mapping. If this is the case, you must render to see the effect of opacity mapping on shadows.

5  Click Render Production.

In the rendering, the shadows convincingly match the transparency of the fence.



Rendering of opacity-mapped fence

Save your work:

- Save the scene as **my_fieldhq_fencing.max**.

Texturing the House: More Mapping Techniques

The house is of stone, not of wood, but for the most part, the mapping techniques you use should be familiar from previous lessons. This lesson introduces a couple new techniques that can be useful.

Set up the lesson:

- Continue from the previous lesson, or open *army_compound03.max*.

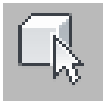
Texture the walls of the house:

The walls of the house present familiar techniques.

1. On the main toolbar, open the Named Selection Sets drop-down list, and choose the *house* selection set.

   3ds Max selects the farm house.

2. Right-click and choose Isolate Selection from the quad menu.

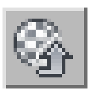
3.  Click an empty area of the viewport to clear the selection, and then click the *House* object to select the walls.

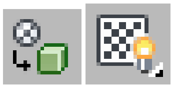
4. In the Material Editor, click the next unused sample slot, and name the new material **Masonry**.

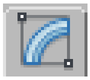
5. In the Blinn Basic parameters rollout, click the Diffuse map button. Assign *masonry.fieldstone.jpg* as the texture map.

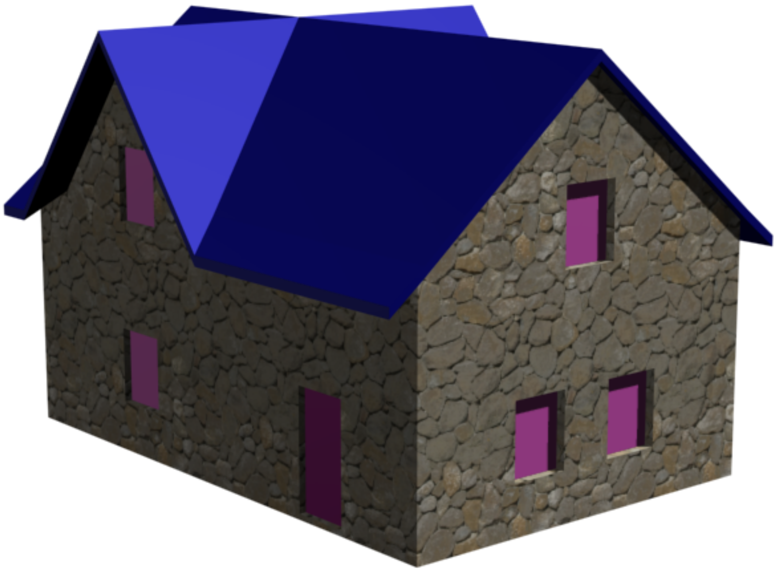
   

   Texture for the house walls

6.  Click Go To Parent.

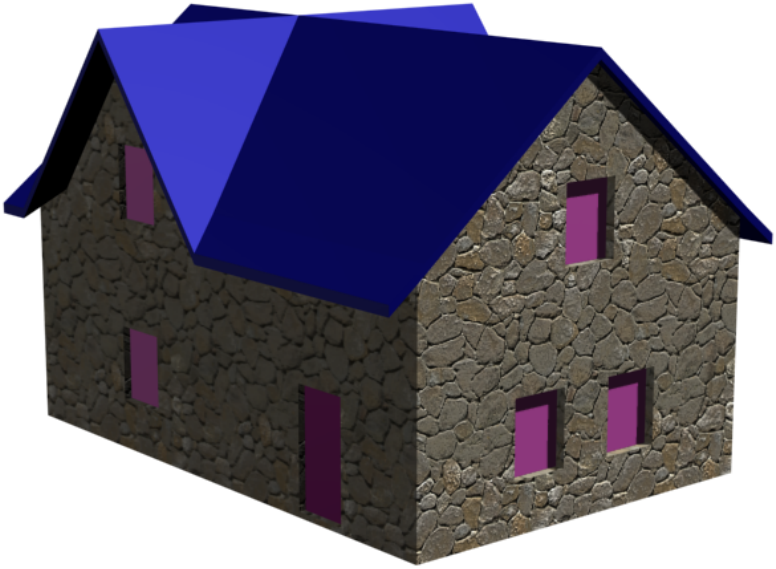
7  Click Assign Material To Selection, and then turn on Show Standard Map In Viewport.

8  Apply a UVW Map modifier to the house walls. Change the map projection to Box, and set Length = Width = Height = **5.0m**.



House walls with a masonry texture

9 The *masonry.fieldstone.jpg* bitmap is not strictly black-and-white, but it has enough of a black-and-white range to work well as its own bump map. In the Material Editor, open the Maps rollout. Drag the Diffuse Map button and drop it on the Bump Map button. Make sure you choose Instance, then increase the Bump Amount to **90**.



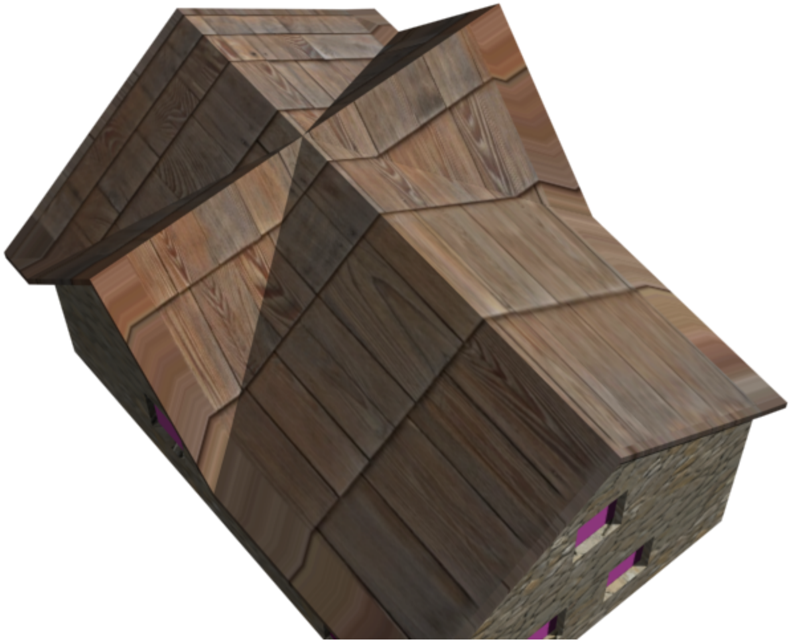
House walls with both texture and bump mapping

Use a Mapscaler to texture the roof:

The roof, on the other hand, presents a problem. With its two gables, there is no straightforward way to map the pattern using UVW Map.

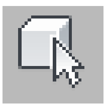
Shingle texture for roof of house

With default mapping (you don't need to go through these steps, yourself), the texture doesn't look right. Even if you were to adjust the scale or change the projection type, the shingles wouldn't conform to the direction of the gables.



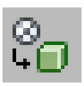
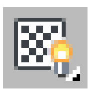
Default texture mapping for the roof

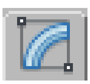
The solution is to use a different modifier, Mapscaler, to handle the texture mapping.

1  Select the *House-Roof* object.

2 In the Material Editor, click the next unused sample slot to make it active, and name the new material **HouseRoof**.

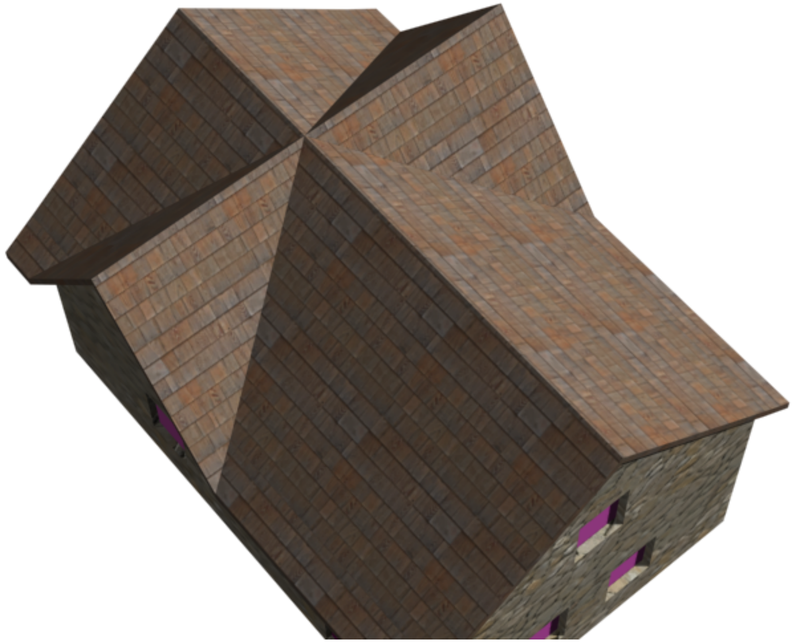
3 In the Blinn Basic Parameters rollout, click the Diffuse map button. Assign *shakes.weathered.jpg* as the texture map.

4   Click Assign Material To Selection, and then turn on Show Standard Map In Viewport.

5  Go to the Modify panel. From the Modifier List, choose MapScaler.

NOTE Be sure to choose "MapScaler" from the list, and not "MapScaler (WSM)". The world-space (WSM) version of MapScaler has a similar effect, but is not quite the same.

The MapScaler modifier maintains the map scale relative to the object (in this case, the roof), and by default it wraps the texture so the shingles follow the angles of the roof.



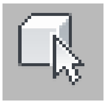
Shingle texture mapped using MapScaler

TIP Not all game engines recognize the MapScaler modifier, but if you apply MapScaler and then collapse the object to an Editable Mesh or Editable Poly, the texture mapping will be "baked in" to the model, and game engines will recognize the mapping.

Texture the windows:

The windows use another small feature to ensure correct mapping.

1 In the Warning: Isolated Selection dialog, click Exit Isolation Mode.

2  Click one of the purple windows to select it. The windows are a single grouped object named *Windows*.

3 Right-click the viewport, and choose Isolate Selection from the quad menu.

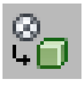
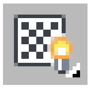
4 In the Material Editor, click the next unused sample slot to make it active, and name the new material **HouseWindows**.

5 In the Shader Basic Parameters rollout, click to turn on Face Map.

When Face Map is on, a texture map is applied to each face of an object individually.

6 In the Blinn Basic Parameters rollout, click the Diffuse map button. Assign *window.jpg* as the texture map.

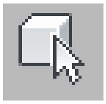
Bitmap for the window texture

7   Click Assign Material To Selection, and then turn on Show Standard Map In Viewport.

8 In the Warning: Isolated Selection dialog, click Exit Isolation Mode.

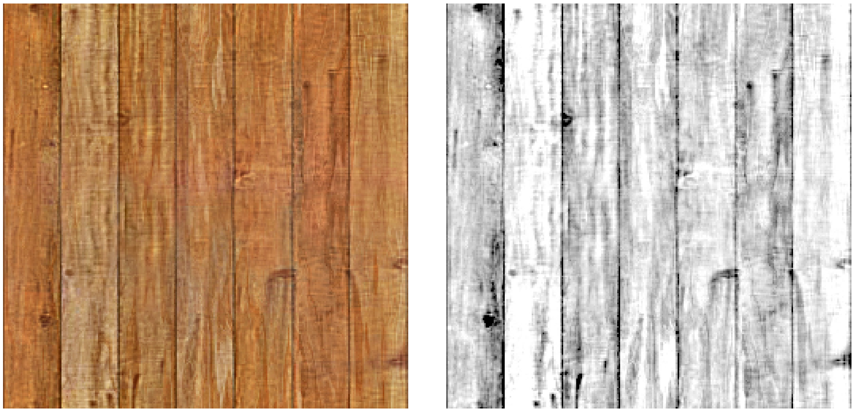
Texture the front door:

Like the walls, the front door of the house is a straightforward texture mapping.

1  Click to select the *Door* object.

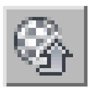
2 In the Material Editor, click the next unused sample slot, and name the new material **WoodBoards** (you will use it elsewhere in the scene).

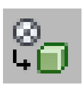
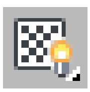
3 In the Blinn Basic parameters rollout, click the Diffuse map button. Assign *wood.boards.jpg* as the texture map.

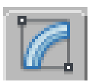


Left: Texture for the wood boards that make the house door

Right: Bump map for the wood boards

4  Click Go To Parent.

5   Click Assign Material To Selection, and then turn on Show Standard Map In Viewport.

6  Apply a UVW Map modifier to the door. Change the map projection to Box, and set Length = Width = Height = **4.0m**.

7  In the Material Editor, open the Maps rollout. Click the Bump Map button and assign *wood.boards.bump* as the bump map. Click Go To Parent, then increase the Bump Amount to **70**.

This completes your texturing of the house.

The house with all its textures

Save your work:

- Save the scene as **my_fieldhq_farmhouse.max**.

Mapping the Barn

The army compound scene is nearly complete. The walls and doors of the barn use the same material you just created for the door, while the floor of the barn is the same as the barracks floors. The only difference is the roof of the barn: this also uses the WoodBoards material, but with a slightly different mapping.

Set up the lesson:

- Continue from the previous lesson, or open *army_compound04.max*.

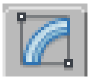
Use the front-door texture for the walls and doors of the barn:

1 Click the Perspective viewport label, and choose Cameras > Camera03.

Camera03 shows a view of the barn.

2 Click the viewport label again, and choose Perspective, so any navigation you do won't change the camera position or settings.

3 From the Material Editor, drag the WoodBoards material onto the barn walls and barn doors: the objects *Barn, Barn-Door-right,* and *Barn-Door-left*.

4  Press H to display the Select From Scene dialog. Select the *Door* object, then Ctrl+drag its UVW Mapping from the modifier stack to the barn walls and doors.

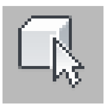
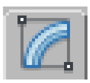
Use the barracks floor material for the floor of the barn:

1 From the Material Editor, drag the BarrackFloors material onto the barn floor.

2 Press H to display the Select From Scene dialog. Select one of the barracks floor objects, then Ctrl+drag its UVW Mapping from the modifier stack to the barn floor.

Texture the roof of the barn:

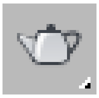
1 From the Material Editor, drag the WoodBoards material onto the barn roof.

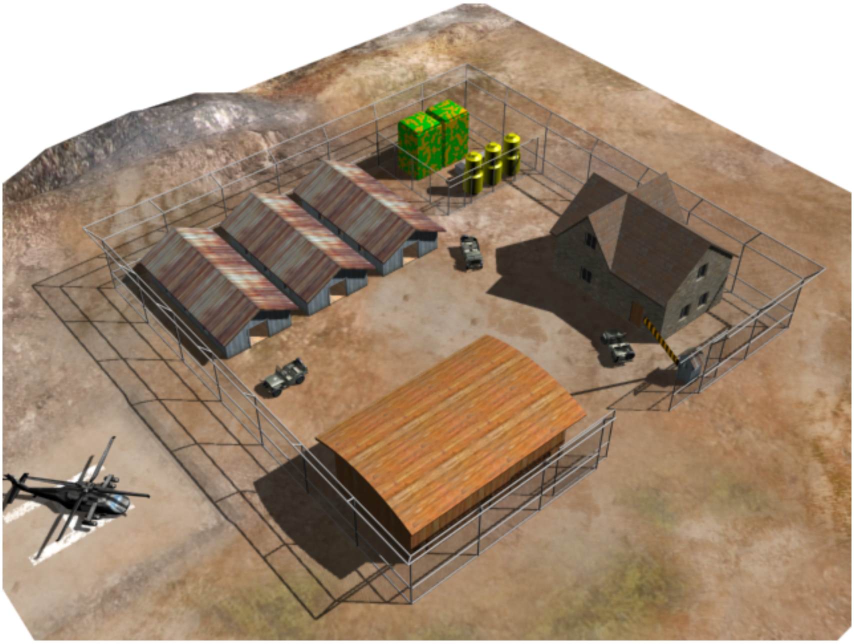
2   Select the barn roof and apply a UVW Map modifier to the it. Leave the map projection set to Planar. In the Alignment group, change the alignment axis to Y. In the Mapping group, change Length = Width = **4.0m**.

Now the army compound scene is completely textured.

Render the completed scene:

1 Right-click the viewport label and choose Cameras > Camera01.

2  Click Render Production to view the final results.



The fully textured field headquarters

Save your work:

- Save the scene as **my_fieldhq_finished.max**.
  You can see a version of the finished scene in *army_compound_completed.max*.

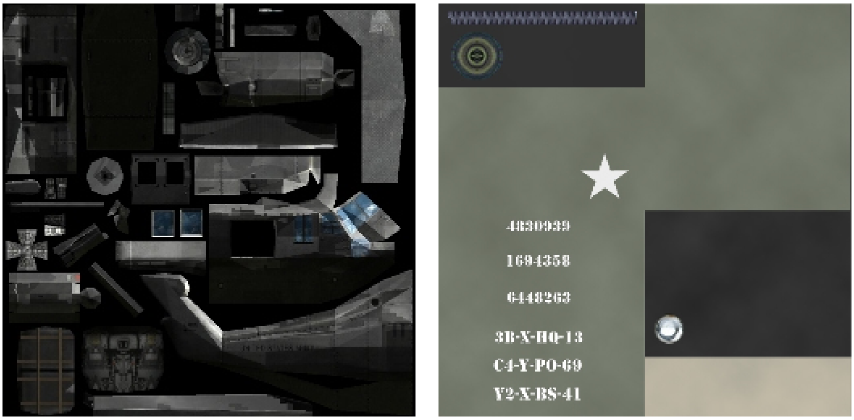
Summary

This tutorial has introduced a variety of methods for applying materials to objects. Among the methods shown were:

- Applying a basic material to change an object's color or shininess (the oil tanks and the fence piping)
- Applying a 3D procedural map to create a patterned material (the generators and the sentry bar)
- Applying a Diffuse or "texture" map to give an object a photorealistic pattern (the ammunition canister, the terrain, and almost all of the building surfaces)
- Using the UVW Map modifier to control the projection, orientation, and scale of texture mapping
  We also showed how to copy UVW Map from one object to another when the objects share the same material
- Using bump mapping to give a 3D appearance to a textured material (most of the materials on the buildings)
- Using opacity mapping to make a material partially transparent (the chain-link fence)
- Using the object-space Mapscaler modifier to project a map onto a complicated shape (the roof of the house)

What About the Vehicle Textures?

The jeeps and helicopter were already textured when you began working on the army compound scene. If you look at their texture maps, they appear to be a patchwork of different elements.



Left: Texture map for the helicopter

Right: Texture map for the jeeps

A single bitmap can provide the texture for a complicated object, provided you control its texture coordinates with a modifier called Unwrap UVW. This is the subject of the next tutorial, Managing Texture Coordinates on page 1112.

Managing Texture Coordinates

This tutorial looks at some of the 3ds Max features related to materials, texturing, and rendering. The first lesson covers functionality in the Unwrap UVW modifier. You'll then go on to learn more about the UVW's Flatten mapping command for automatic mapping.

Another useful tool presented in this tutorial is the Relax tool, which algorithmically spreads out texture coordinates, to give more even coverage of the underlying texture. This makes it easier to assign specific texture coordinates to the desired area of the texture.

Finally, you will work with the Channel Info utility to minimize memory usage and manage other channel mapping tasks.

In this tutorial, you will learn how to:

- Use the Unwrap UVW modifier.
- Use Render To Texture to “bake” lighting, shadows, and other scene features into a bitmap texture for use in games and other real-time applications.
- Use Ink 'n Paint to render comic-style images.
- Use the Translucent shader to simulate translucent materials.
- Use the Relax tool to affect texture coordinates.
- Use the Channel Info utility to manage channel mapping tasks.

Skill level: Intermediate

Time to complete each lesson: 30 to 90 minutes

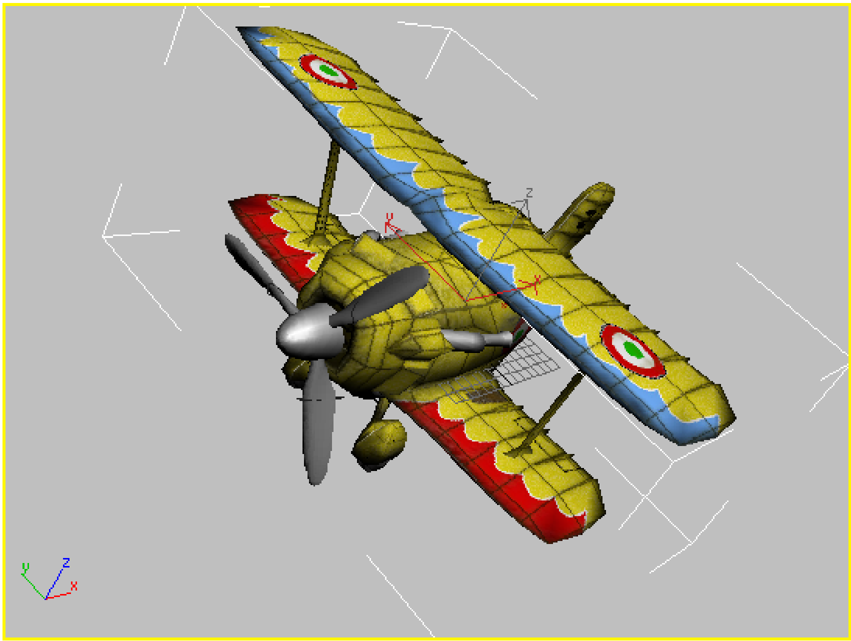
Using Unwrap UVW, Part 1

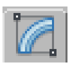
In this three-part lesson, you'll get an introduction to the Unwrap UVW modifier, and use several of its features.

Examine the final mapping:

You'll start by looking at the final version of a fairly detailed object mapped with the Unwrap UVW modifier.

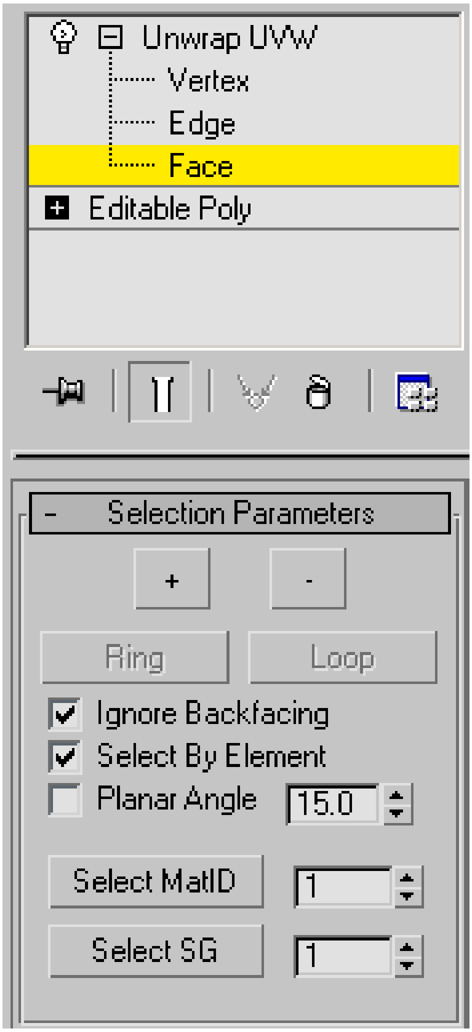
1  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\unwrap_uvw* and open the scene file *tut_unwrap_start.max*.



2  Go to the Modify panel and select the Fuselage object; just click a wing.

You can now see the object's modifier stack, with the Unwrap UVW modifier applied to the Editable Poly object.

3 In the modifier stack display, click Face to access this sub-object level. Also, on the Selection Parameters rollout, make sure Select By Element is on.

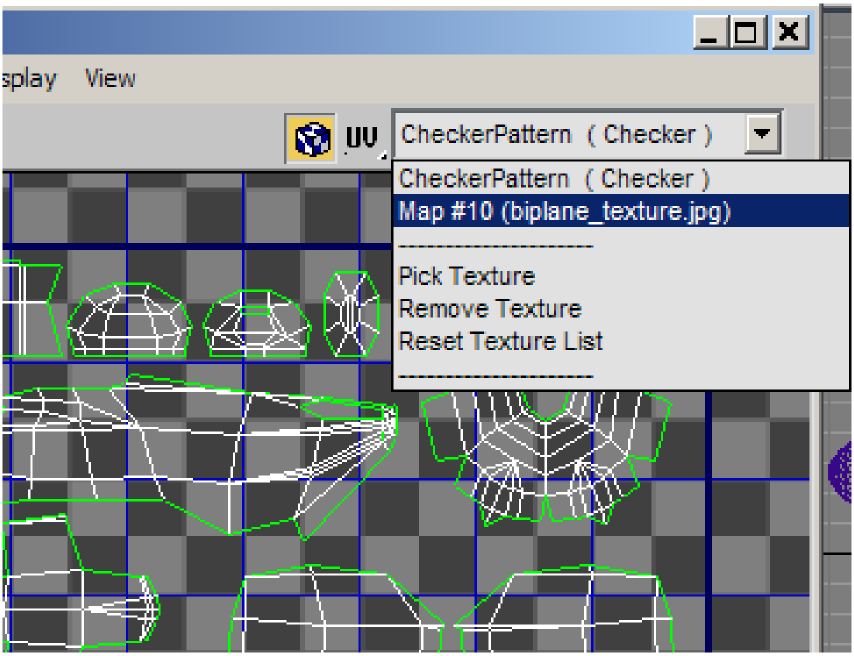


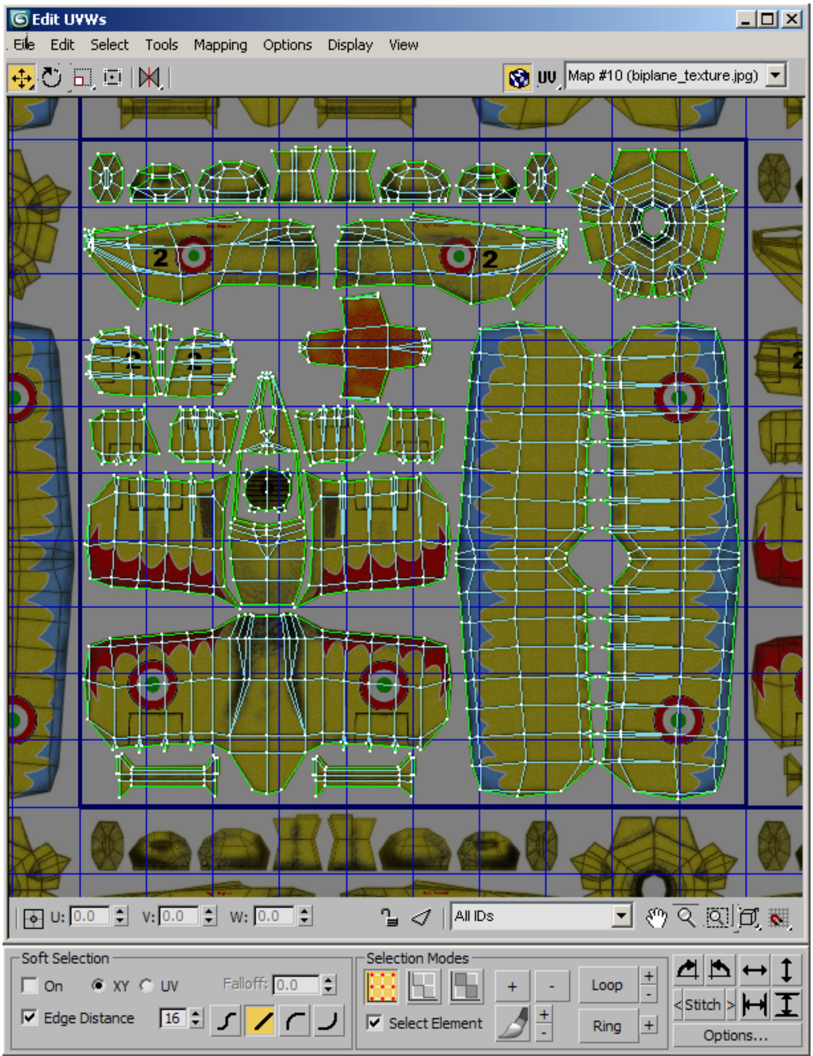
This will let you select large sections of the Fuselage object, rather than single faces.

4 On the Parameters rollout, click Edit.

This opens the Edit UVWs dialog, also known as the UVW editor.

5 From the drop-down menu at the top right of the window, choose *Map #10 (biplane_texture.jpg)*.


splay
View
UV
CheckerPattern (Checker)
CheckerPattern (Checker)
Map #10 (biplane_texture.jpg)
Pick Texture
Remove Texture
Reset Texture List



You can now see the UVW clusters laid out against the texture map in the background. Each cluster represents a section of the Fuselage geometry that is planar-mapped with the underlying area of the bitmap texture.

6 In the Perspective viewport, click the upper wing.

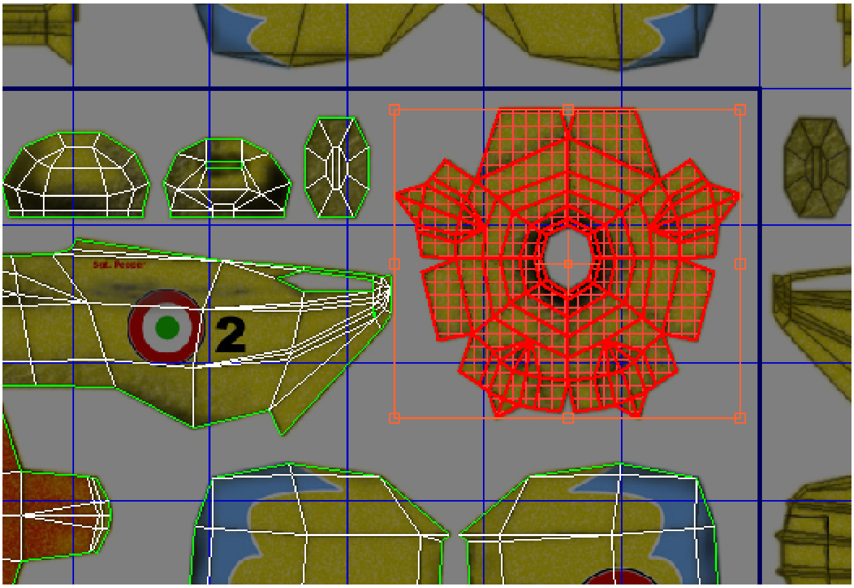
The entire wing is selected, and in the editor window, the UVW clusters assigned to it become highlighted.

7 Still in the viewport, click different parts of the Fuselage to see which UVW clusters correspond to them.

Highlighting a cluster makes it easier to see how well its outline matches the shape of the underlying section of the texture map. To change the wireframe color used by the clusters, you can also use the Options button near the bottom-right corner of the Edit UVWs dialog. Also, it often helps to lower the bitmap brightness as well.

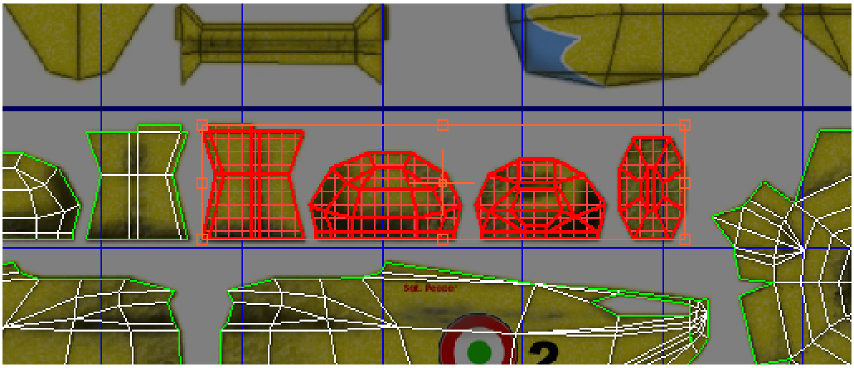
Most of the Fuselage parts are combined into a single element, which uses the clusters on the left side of the editor window.

8 In the viewport, select the nose cone (it's right behind the propeller), and note the cluster that highlights in the editor.



The nose cone is mapped as a single piece, which is convenient to texture with a single area of the bitmap. It's not really flat, but the planar mapping works with it because of the UVW editor's ability to closely match the geometry with the bitmap on a per-vertex basis.

9 Next, click one of the landing gear housings, and note how it's mapped with four different clusters.



10 Click an empty area of the editor window to deselect the UVW clusters.

11 In the editor, turn on Selection Modes group > Select Element, if necessary, and click each of the previously highlighted clusters in turn to see which part of the housing it maps. You might need to rotate the viewport to see the highlighted polygons. If you still can't see the selection, press F2 and/or F4 to enable Shade Selected and Edged Faces, respectively. Also, the outermost cluster corresponds to the inside of the wheel housing, so it might be a bit difficult to spot at first.

   Because the housing structure is more complex than that of the nose cone, it makes sense to map it with four clusters instead of one.

   Ultimately, it's up to you how you map your geometry; the UVW editor gives you the power and flexibility to use the method that works best for you.

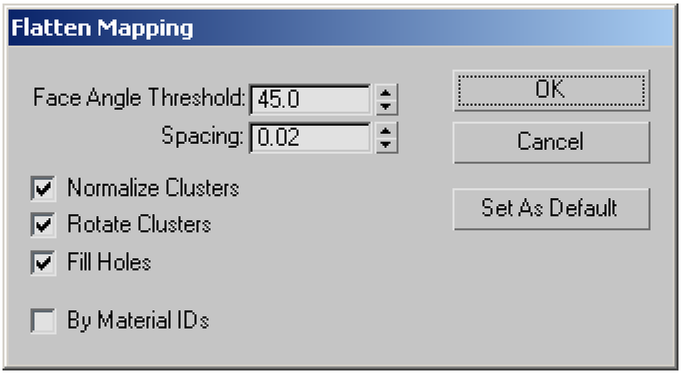
Using Unwrap UVW, Part 2

In this lesson, you'll examine Unwrap UVW's Flatten Mapping command for automatic mapping.

Use Flatten Mapping:

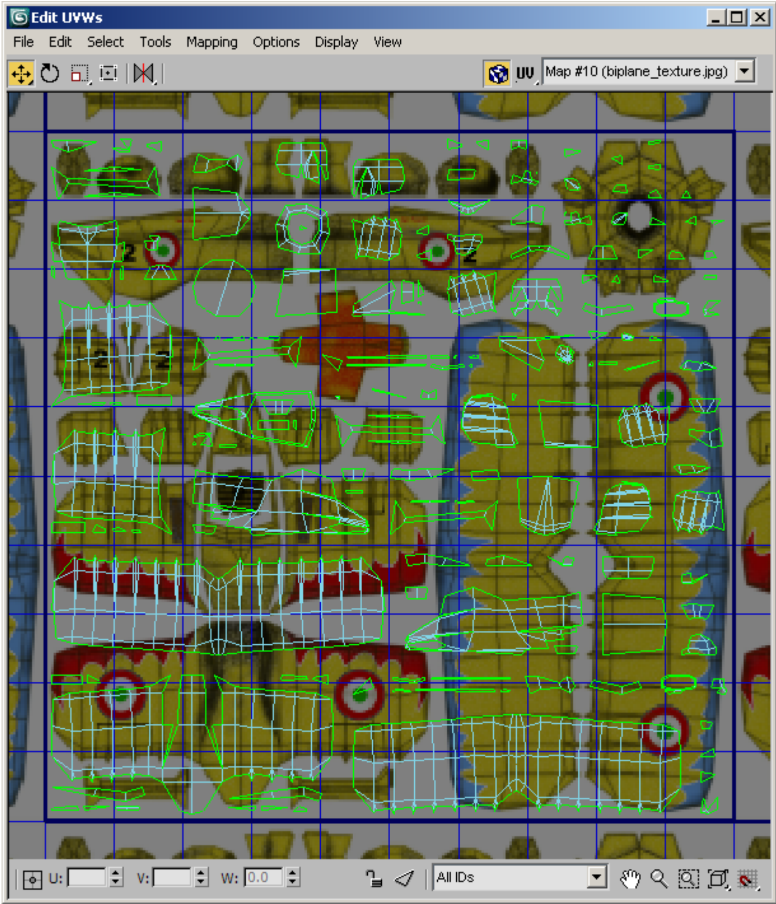
1 In the Edit UVWs dialog > Selection Modes group, activate polygon selection mode, then press Ctrl+A.

2 From the Editor mapping menu, choose Flatten Mapping.



The Flatten Mapping dialog opens.

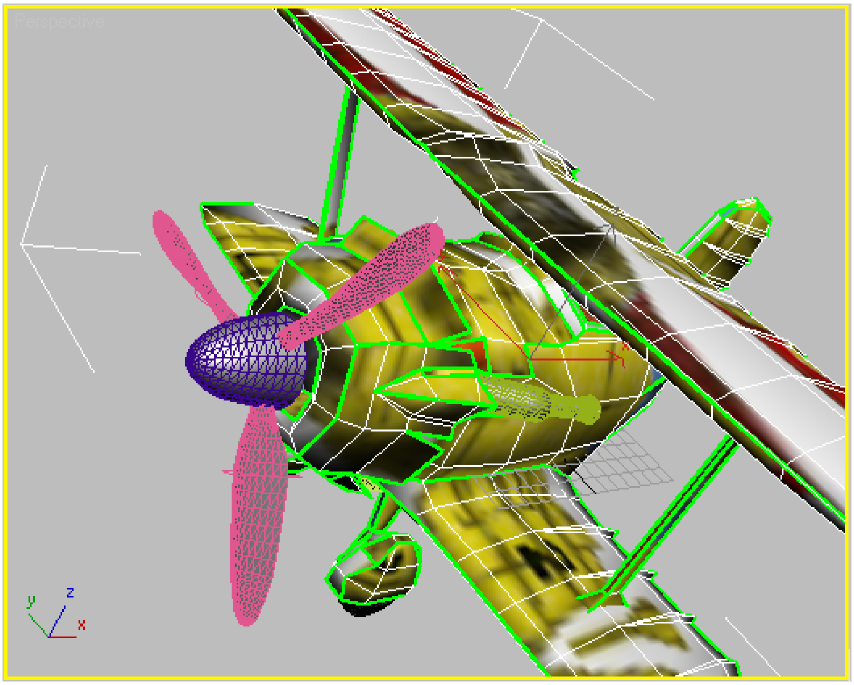
3 Click OK to accept the default settings and remap the Fuselage using this automatic mapping function.



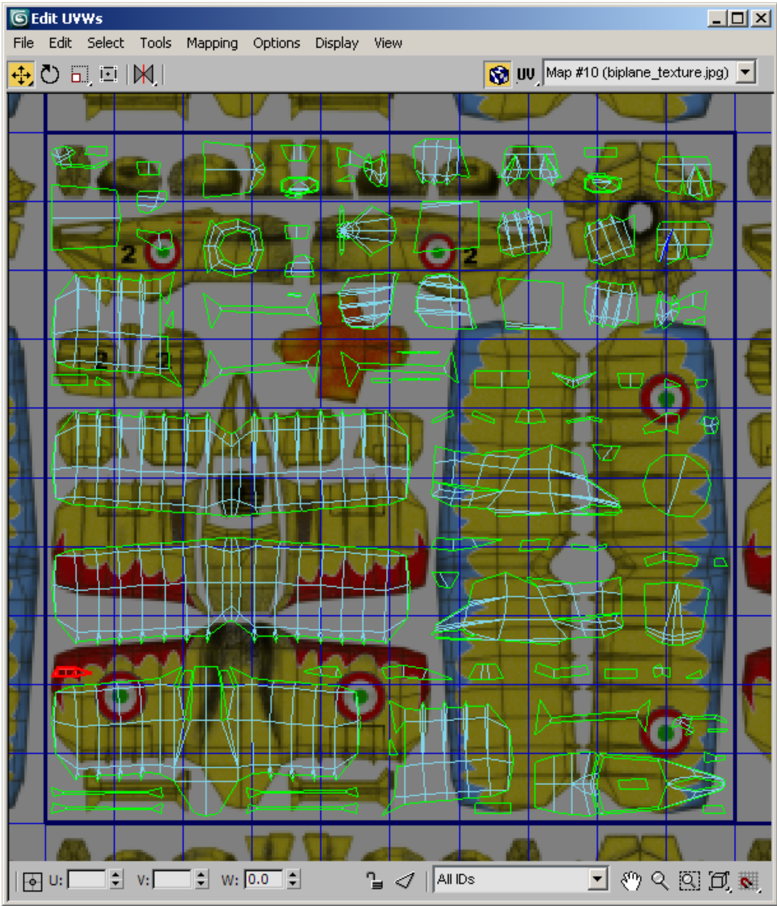
The software applies planar mapping to each section of the mesh based on the Flatten Mapping dialog settings. The editor now displays a very different set of UVW clusters. Each cluster consists of a set of contiguous faces in which the angle between neighboring faces is less than or equal to the Face Angle Threshold setting in the Flatten Mapping dialog.

The main difference is that there are many more clusters, and most of them are smaller than in the final. The wings are relatively flat, so their clusters are easy to identify, but most of the rest are not. You can remedy this somewhat by increasing the angle threshold.

Of course, the underlying texture map remains the same when you change the mapping. If you look at the Perspective viewport, you can see that the mapping is now much different than before.



4 Again choose Mapping menu > Flatten Mapping, and for Face Angle Threshold, type **61** (this is the angle used by the artist as a first step in creating the final mapping). Click OK to perform the remapping.

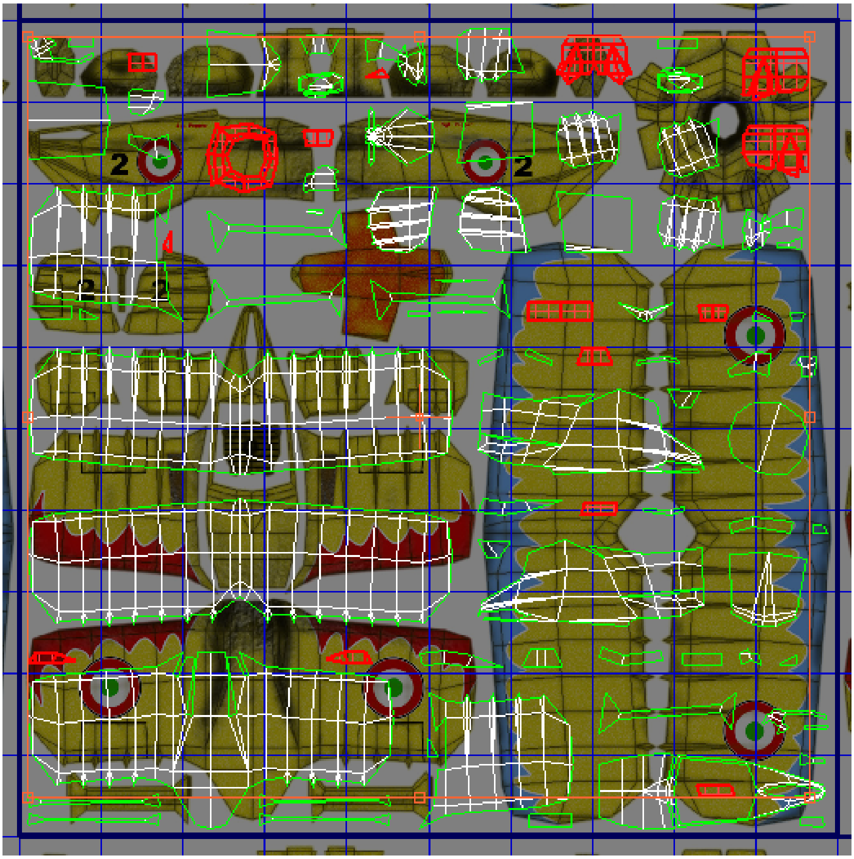


The result is fewer clusters than before, but still many more than in the final. In the next procedure, you'll look at a couple of ways of combining these clusters.

Combine the UVW clusters:

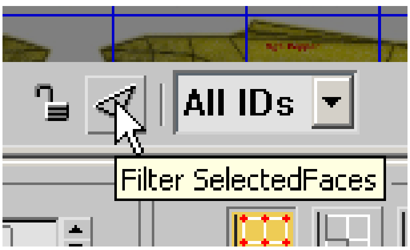
You can use the editor's Stitch function to combine clusters one at a time, and the modifier's Planar Map command lets you combine several clusters simultaneously.

1 In the viewport, select the nose-cone element.



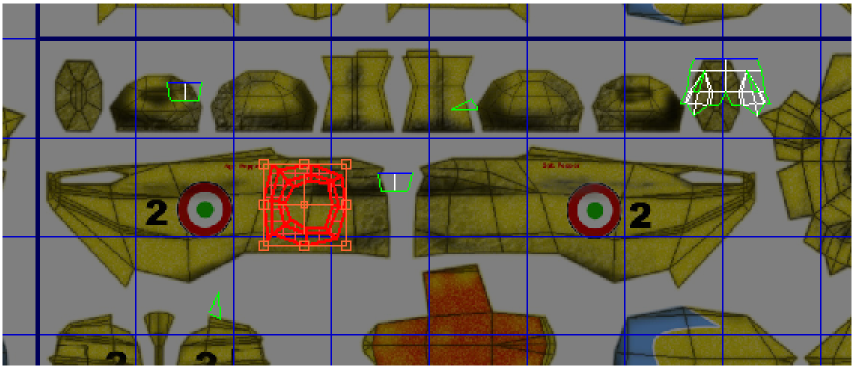
This causes all of the UVW clusters used by the nose-cone geometry to highlight in the editor.

2 On the editor's lower toolbar, click the Filter Selected Faces button to turn it on.



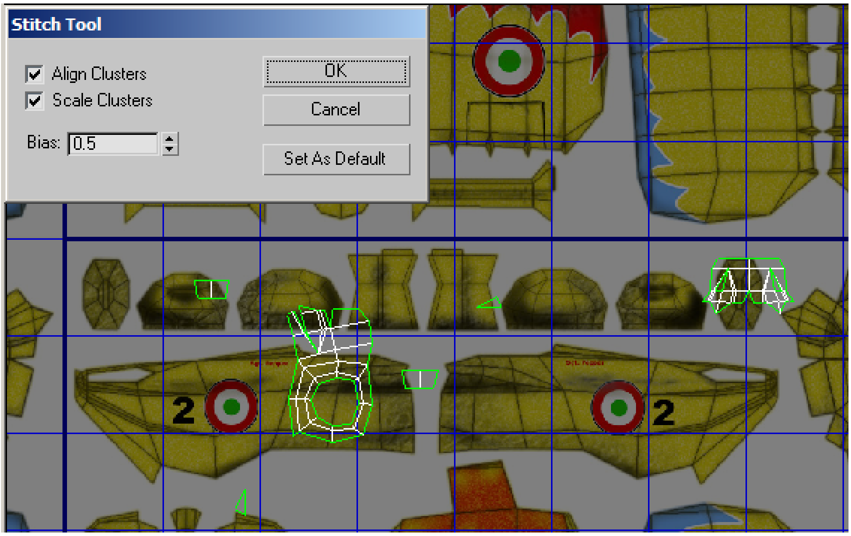
Now only the highlighted clusters appear.

3 Click outside the bounding box to deselect everything, then click a vertex on one of the smaller clusters to select the cluster.



Highlighted edges and vertices appear on one or more other clusters to show the sub-objects shared with the selected cluster.

4 In the Tools menu, choose Stitch Selected.



The Stitch Tool dialog appears, and one of the other clusters moves next to the selected clusters, with the shared sub-objects "stitched" together. The software automatically stitches the cluster with the most shared sub-objects; if two or more share the same number of sub-objects, it picks the one with the lowest vertex ID numbers. In this case, it picked the rightmost cluster near the top of the editor window.

5 In the dialog, click the Align Clusters check box to turn it off, note what happens, then click it again to turn it back on.

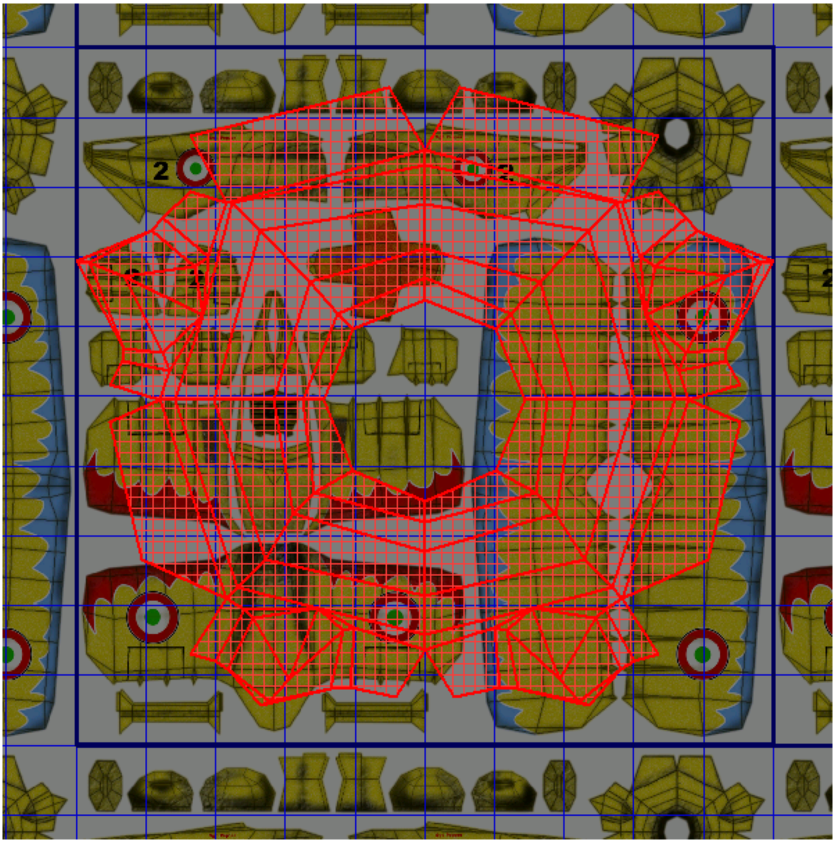
   When you turn off Align Clusters, the attached cluster moves back to its original position. Use this when the automatic alignment positions the attached cluster in an undesirable way, such as overlapping the first cluster.

6 Click OK to close the dialog.

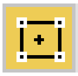
   Next, you'll use Quick Planar Map to combine all of the nose cone clusters at once.

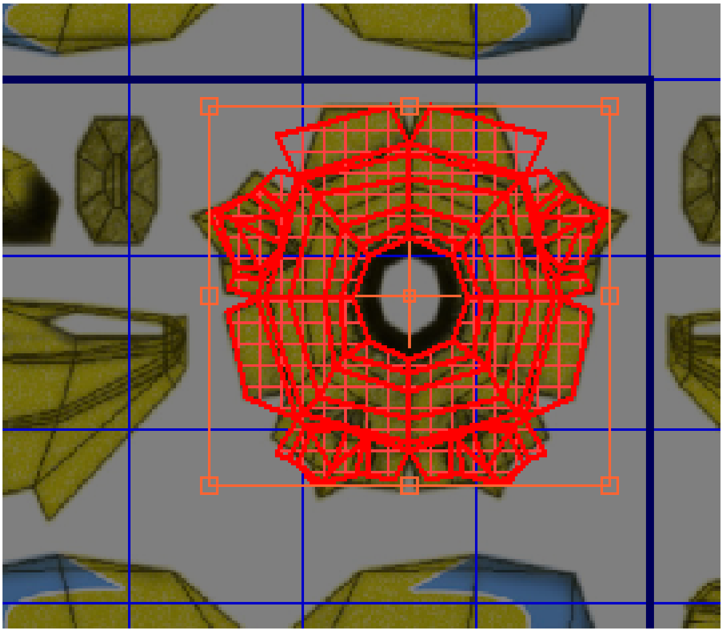
7 In the viewport, select the nose cone element.

8 On the Map Parameters rollout, choose the X axis under Preview Quick Map Gizmo. This reorients the mapping gizmo so that it is perpendicular to the nose cone element.



9 On the Map Parameters rollout, click Quick Planar Map.

10  Use the Freeform Mode transform tools to fit the cluster to the nose-cone texture. Drag the corners of the bounding box to scale the cluster, and drag within the bounding box to move it. Check your work in the viewport, and render if you like.



To get an exact match, you'd have to move the vertices as well.

TIP You can use the Edit UVWs dialog to make a template for creating your own texture maps. Once you've got the clusters set up the way you want them, go to the Tools menu and choose Render UVW Template, then use the Render UV Template button to generate a flattened 2D image of the mapping coordinates. You can then save and open the bitmap image into your Paint application (such as Adobe Photoshop). Use the cluster outlines as a guide for painting the texture map.

Summary

The Unwrap UVW modifier is a powerful tool for applying complex mapping to your objects. This tutorial covered a variety of methods for using the modifier, including how to coordinate selection of UVW coordinates and parts of the object, usage of the automatic mapping tools such as Flatten Mapping, combining mapping clusters, and sketching vertices.

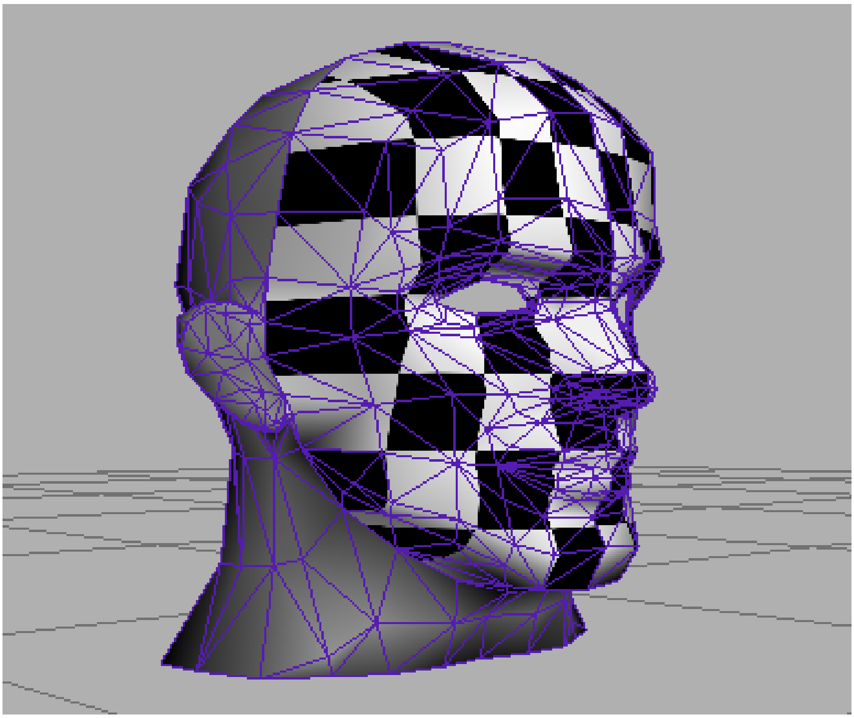
Using the Relax Tool on Texture Coordinates

An important tool in the *Unwrap UVW modifier* editor is Relax, which algorithmically spreads out texture coordinates to give more even coverage of the underlying texture. This makes it easier to assign specific texture coordinates to the desired areas of the texture.

The Relax tool in Unwrap UVW can save you time and effort by automatically spreading out mapping vertices. In some cases, you'll need to follow up by moving vertices to the desired final locations.

Set up the lesson:

- From the *\materials_and_mapping\unwrap_uvw* directory, load the scene file *clown_head.max*.



The scene contains a model of a head, with a UVW Map modifier set to Planar applied to the face. Also applied to the face is a material with a Checker map. The map helps show where the texture vertices might need to be adjusted.

Apply the Unwrap UVW modifier:

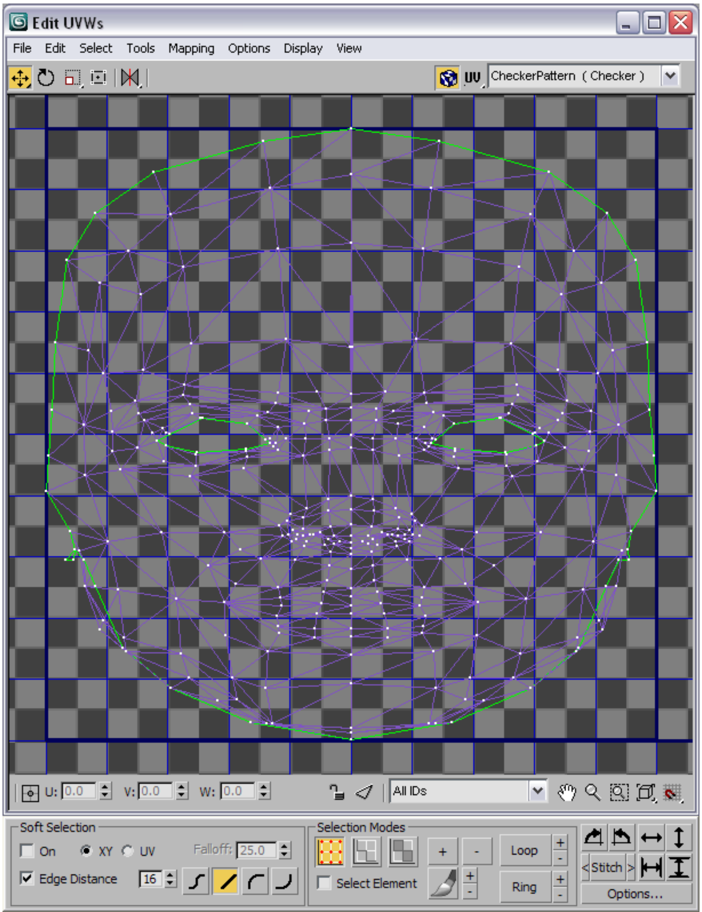
1. Select the head object and go to the Modify panel.
2. Apply an Unwrap UVW modifier.

   The Unwrap UVW modifier appears at the top of the stack, but doesn't provide a sub-object mode because you're applying it to an existing sub-object selection.

Edit the UVW mapping:

1. On the Parameters rollout, click the Edit button.

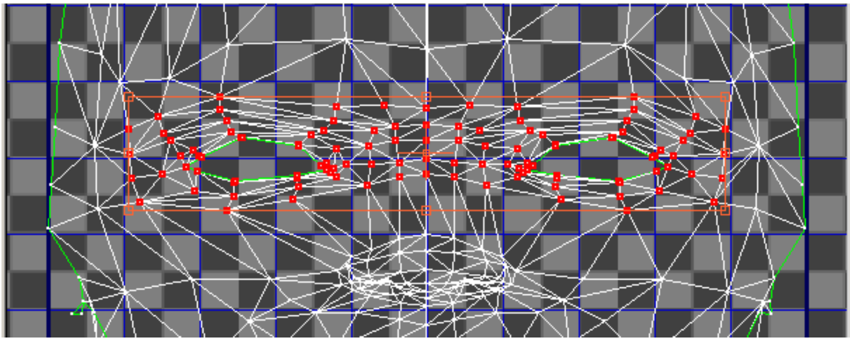
   The Edit UVWs dialog opens.



Only the selected parts of the mesh appear, and all texture vertices are selected.

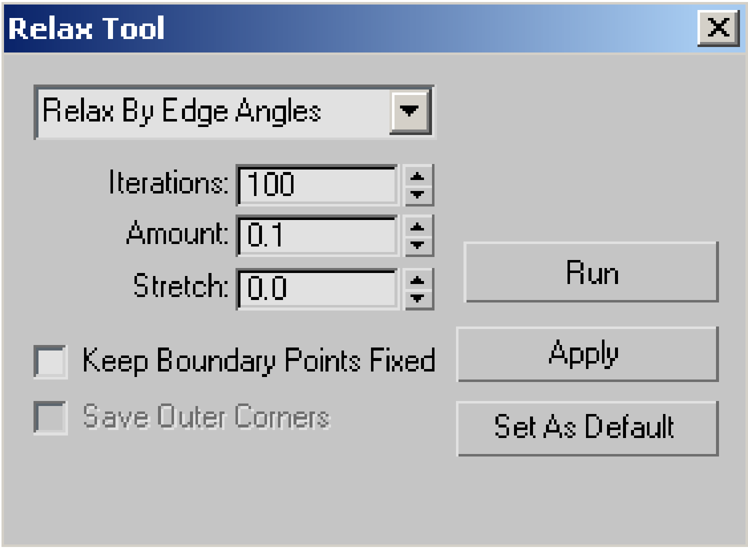
Note that the texture vertices are most dense around the detailed parts of the face: the eyes, nose, and mouth. This is where you can use Relax to spread out the vertices for easier manual editing.

2 Drag a selection region around the eyes.



3 From the Edit UVWs dialog menu bar, choose Tools > Relax.

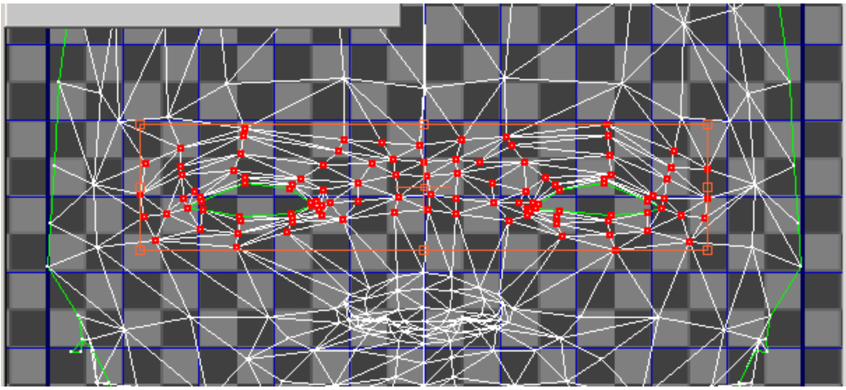
The Relax Tool dialog displays.



The Relax Tool dialog is modeless. It offers different algorithms to relax the mapping. The default mode, Relax By Edge Angles is often recommended as it minimizes the overlapping of edges.

4 Click the Apply button twice.

The selected vertices move apart slightly.



5 Similarly, use Relax on the vertices around the nose and mouth.

Next

Using the Channel Info Utility on page 1132

Using the Channel Info Utility

This lesson shows a number of different methods for using the *Channel Info utility*.

Reduce a mesh object's memory footprint:

When working as a 3D artist on a game-development project, you might receive models to work on that have already been mapped, but it's difficult to tell what the mapping is. In addition, the mapping might have been applied inefficiently, so that it takes up more memory than necessary in the model's data structure. This lesson shows you how to use Channel Info to adjust a model's mapping, thus recovering the unused memory, which can then be used by other game assets.

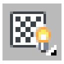
1  On the Quick Access toolbar click New, browse to the folder *\materials_and_mapping\map_channel_info*, and open the scene *ostrich.max*.

2 Apply a *UVW Map modifier* to the ostrich model. In the Parameters rollout > Channel group, set Map Channel to **4**.

3 Right-click UVW Mapping in the modifier stack display and choose Collapse All to *collapse* the ostrich object's stack; this results in an Editable Mesh object.

This simulates a situation you might encounter as a 3D artist working for a commercial game developer: You receive a mesh object to work on that already has mapping applied, but you don't have direct access to the tool (modifier) originally used for applying mapping, and you need to minimize the object's memory footprint for embedding into the game.

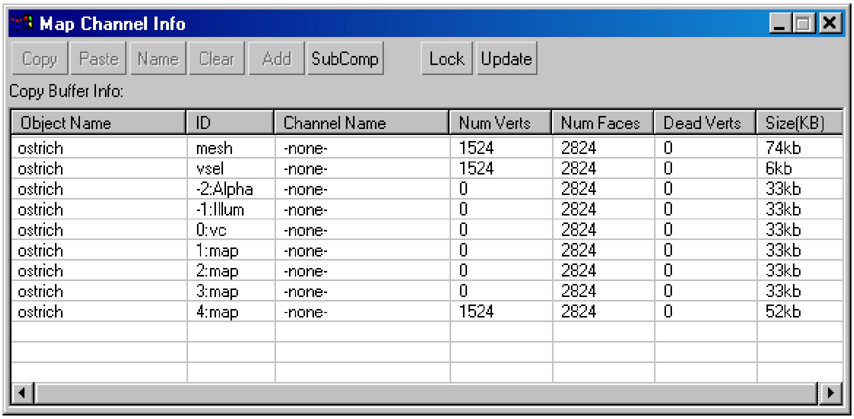
4 Create a standard material with a Checker map applied as a Diffuse map. For the Checker map, set U and V Tiling both to **4.0**, and set Map Channel to **4**.

5  Turn on Show Standard Map In Viewport, and apply the map to the ostrich model.

The map appears on the model, mapped in a planar manner parallel to the world grid.

6  Go to the Utilities panel, click the More button, then double-click Channel Info to open the utility. On the Parameters rollout, click the Channel Info button.

The Map Channel Info dialog opens:

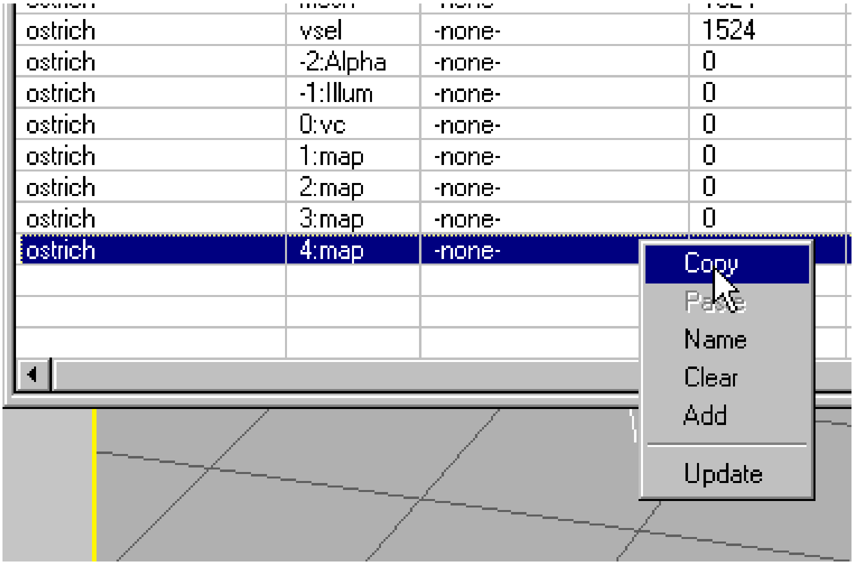


The dialog lists all pertinent channel information for the object. This is described in detail in the *Interface section*.

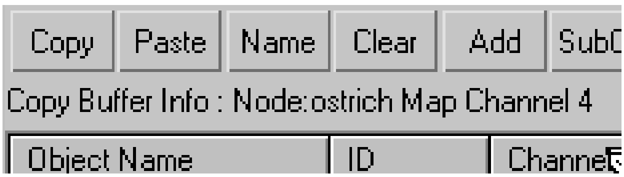
The last channel, whose ID is “4:map,” represents the mapping you applied with the UVW Map modifier. It's preceded by three empty map channels, each of which contributes about 33 kilobytes to the object's memory footprint. These were created because the software requires consecutive numbering of map channels, but the memory isn't being used for anything.

You'll use the Channel Info tools to remove the empty channels, thus freeing up the unused memory. But first you'll copy the mapping to the first available mapping channel, because you can delete channels only starting with the last one.

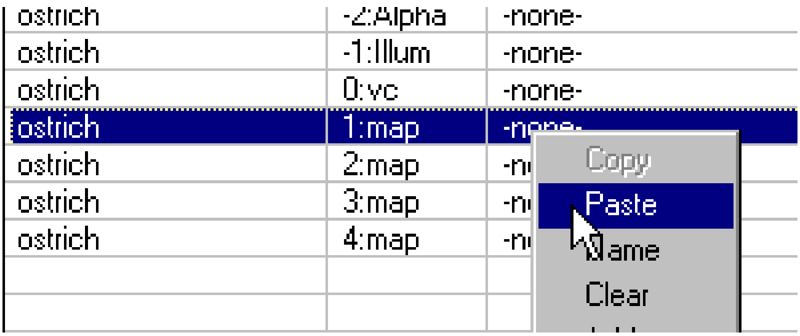
7 Right-click the last channel, and from the right-click menu, choose Copy.



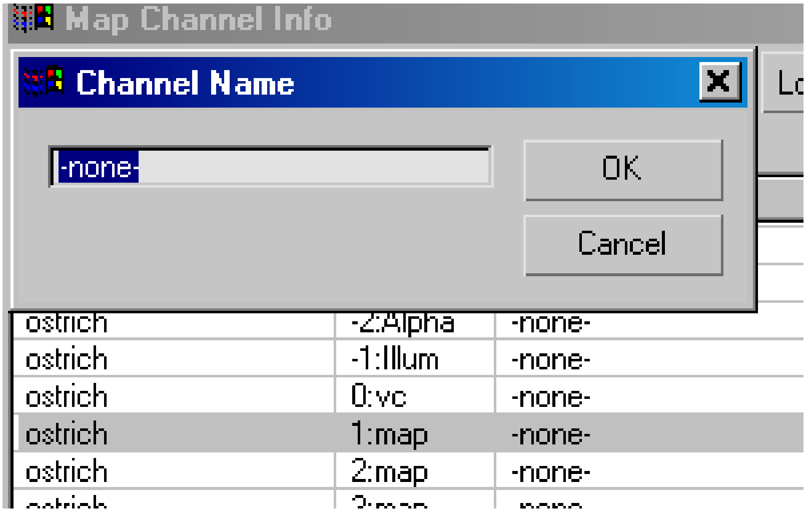
This places the texture mapping created by the UVW Map modifier into the copy buffer. The status line on the dialog, beneath the row of buttons, reads "Copy Buffer Info: Node: ostrich Map Channel 4".



8 Right-click the channel whose ID is "1:map" (the first available texture map channel), and, from the right-click menu, choose Paste.



The Channel Name dialog appears, giving you the opportunity to name the pasted channel.



9 Type **Planar Mapping** and press Enter or click OK.

Map channel 1 now also contains the planar mapping originally applied to channel 4. You can now delete the remaining map channels, but first you'll demonstrate that the planar mapping is indeed applied to channel 1.

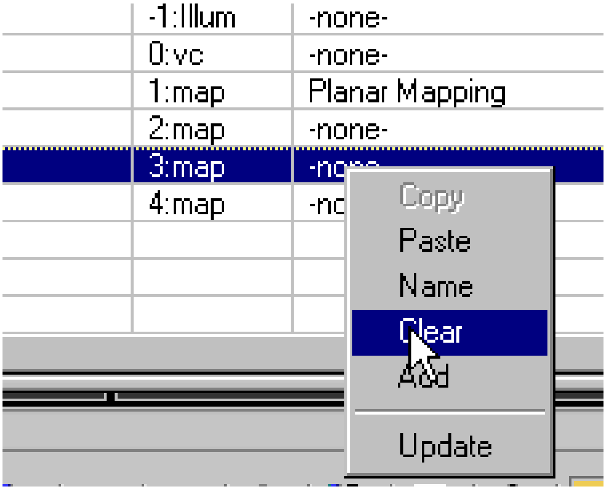
NOTE With an object that has default mapping, such as a geometric primitive, you might have pasted to channel 2 instead. This would preserve the original, default mapping as well as the planar mapping in two different channels.

---

10 Open the Material Editor, if necessary, and go to the material's diffuse map level. Use the Map Channel spinner to decrement the value to **1** by clicking the down arrow three times.

At map channels 3 and 2, no map appears on the ostrich model, because those channels don't contain any mapping values. But at map channel 1, the checker texture reappears on the object.

11 Right-click the 3:map channel, and from the right-click menu, choose Clear.



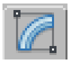
The channel remains, and still uses 33 kilobytes of memory. This demonstrates that you can't delete intermediate channels.

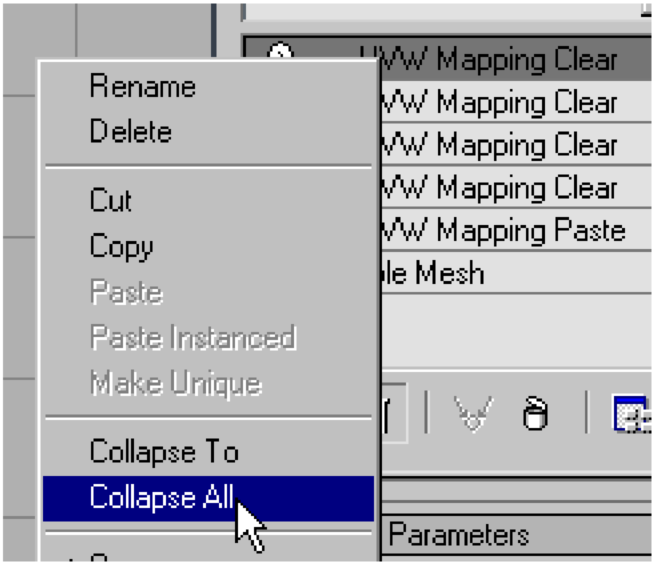
12 Right-click the 4:map channel, and from the right-click menu, choose Clear.

The channel disappears.

13 Clear the 3:map channel, then the 2:map channel.

Only map channel 1 remains. You've deleted the others, thus reducing the object's total memory footprint by approximately 99 kilobytes (the memory consumed by the three unused map channels).

14  On the Modify panel, look at the object's modifier stack. It contains a UVW Mapping Paste and four UVW Mapping Clear modifiers; the Channel Info utility uses these modifiers to help do its work. To get rid of these, simply collapse the stack.



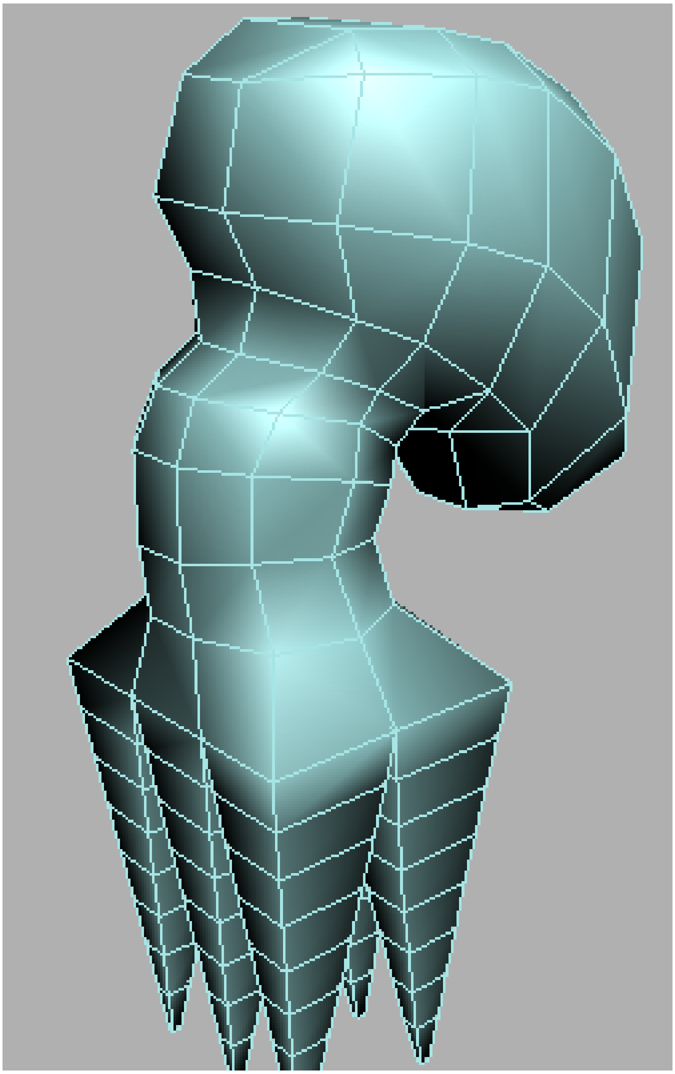
Enable vertex sub-object selections to survive topology changes and object type changes:

Because Channel Info provides access to the channel that stores the current vertex selection, and lets you copy that information to other channels, you can store the vertex selection. Once you've done so, the vertex selection will survive topology changes, such as adding mesh resolution and even changing the object type.

It's important to remember, however, that the vertex-selection channel has only one component, while map channels have three. Thus, you need to copy the vertex-selection channel to a subcomponent of a map channel.

The following task also demonstrates usage of the *Select By Channel modifier* in conjunction with Channel Info.

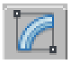
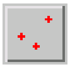
1 Open the *octopus.max* scene file.



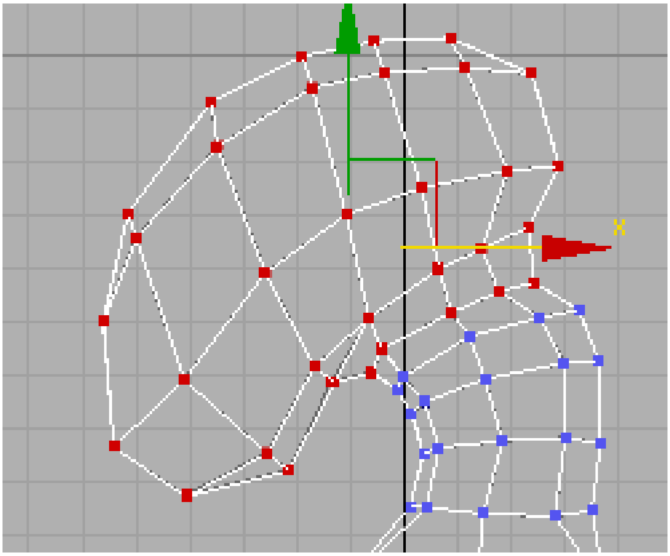
This octopus is at an early stage of modeling. You'll use it to learn how to retain sub-object selections after subdividing the mesh.

2 Select the *octopus* object, open the Channel Info utility, click one of the tracks, then click Add to create a new map channel.

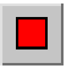
   You can use the extra map channel to store the vertex-selection data, thus retaining any information already in the original map channel.

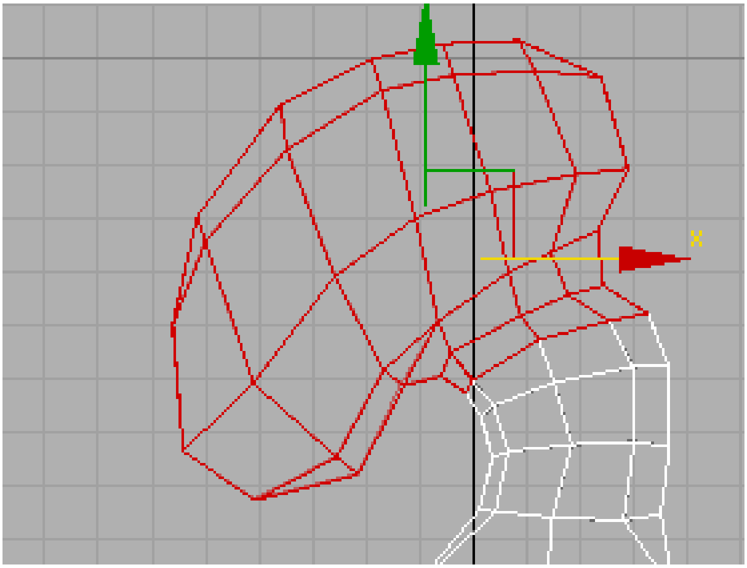
3   On the Modify panel, click the Editable Poly Object and go to the Vertex sub-object level.

4  From the Region Selection flyout on the toolbar, choose Lasso Selection Region and, in the Left viewport, select all the vertices in the octopus head. Drag out an approximate region selection; you needn't be particularly careful about not selecting non-head vertices for this exercise.

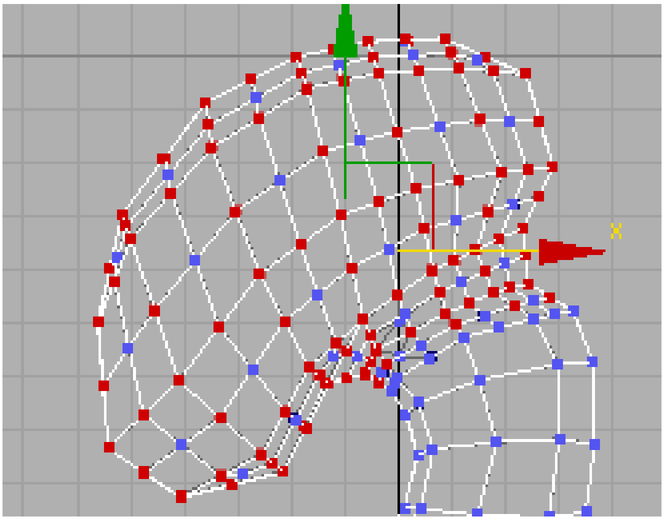


Next, you'll determine whether this selection can survive a topology change on its own. You can use a special feature of Editable Poly to automatically convert the vertex selection to a polygon selection.

5  On the Selection rollout, Ctrl+click the Polygon button to go to that sub-object level while simultaneously selecting the polygons used by the existing vertex selection.



6 On the Edit Geometry rollout, click the Tessellate button, then return to the Vertex sub-object level.

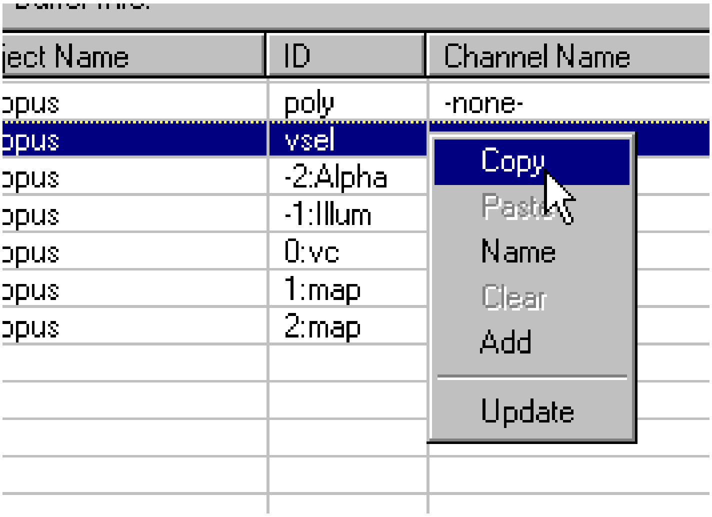


The vertices you selected before are interspersed with the new, unselected vertices that were created by tessellating the mesh. The vertex selection did not survive the topology change. That is, not all of the head vertices are still selected.

7 Press Ctrl+Z to undo the tessellation.

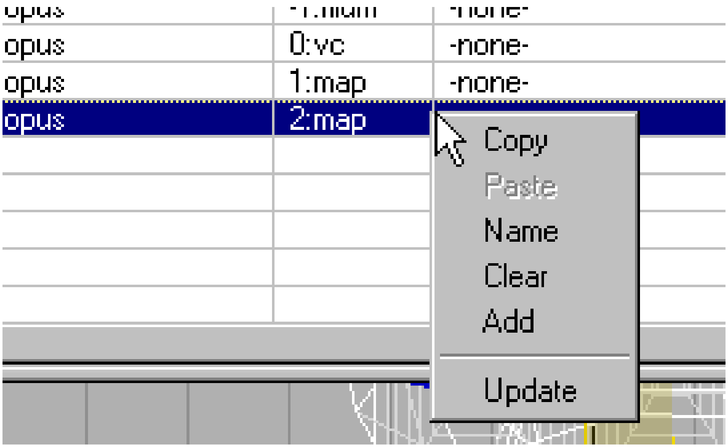
The software restores the original vertex selection.

8 In the Map Channel Info dialog, right-click the vsel channel and choose Copy.



"vsel" is short for vertex selection. This channel stores the current selection set of vertices.

9 Right-click the 2:map channel you created in step 2.



The Paste command is unavailable, because map channels each have three components, but the vertex-selection channel has only one. You can't copy and paste between a one-component channel and a three-component channel. Fortunately, Channel Info gives you optional access to individual components of three-component channels.

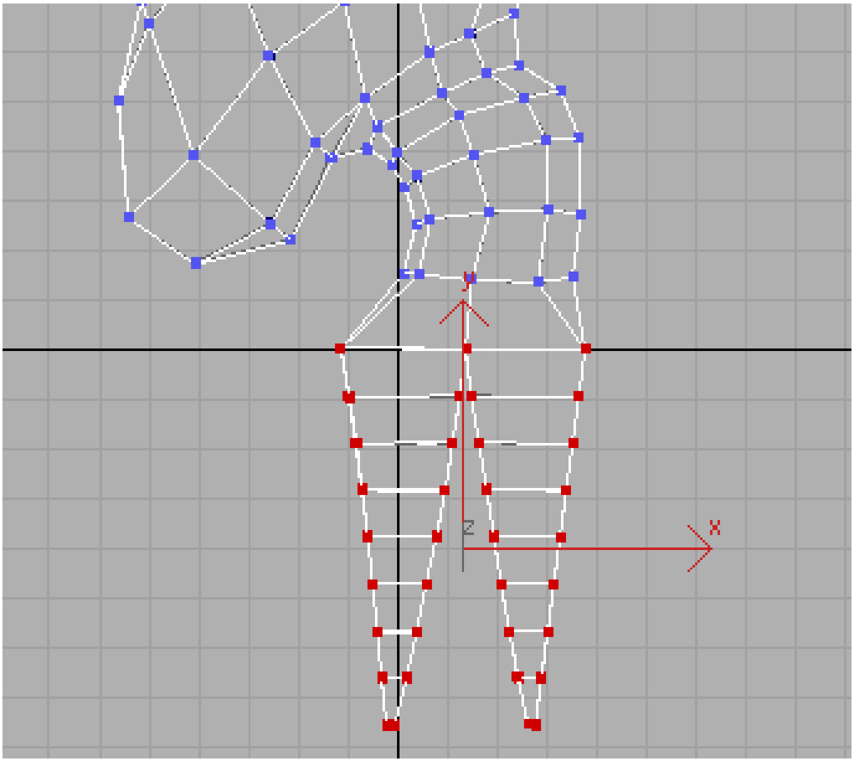
10 At the top of the Map Channel Info dialog, click the SubComp (subcomponents) button.

All three-component channels expand into their subcomponents. vsel is the only one-component channel.

11 Right-click the 2:map:X channel and choose Paste. When the Channel Name dialog opens, type **Head Vertices** and press Enter.

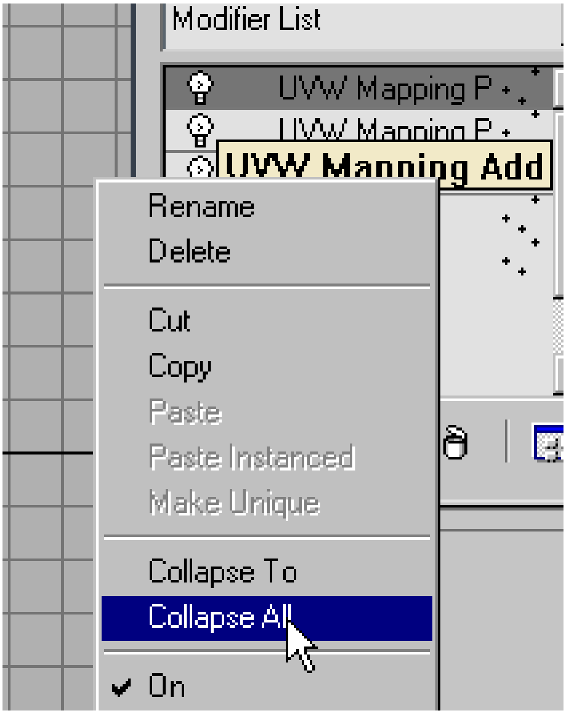
The software adds a UVW Mapping Paste modifier to the object's stack.

12 Return to the Editable Poly > Vertex sub-object level, and select all of the octopus's leg vertices.



13 Copy the vsel channel to the 2:map:Y channel, and name it **Leg Vertices**.

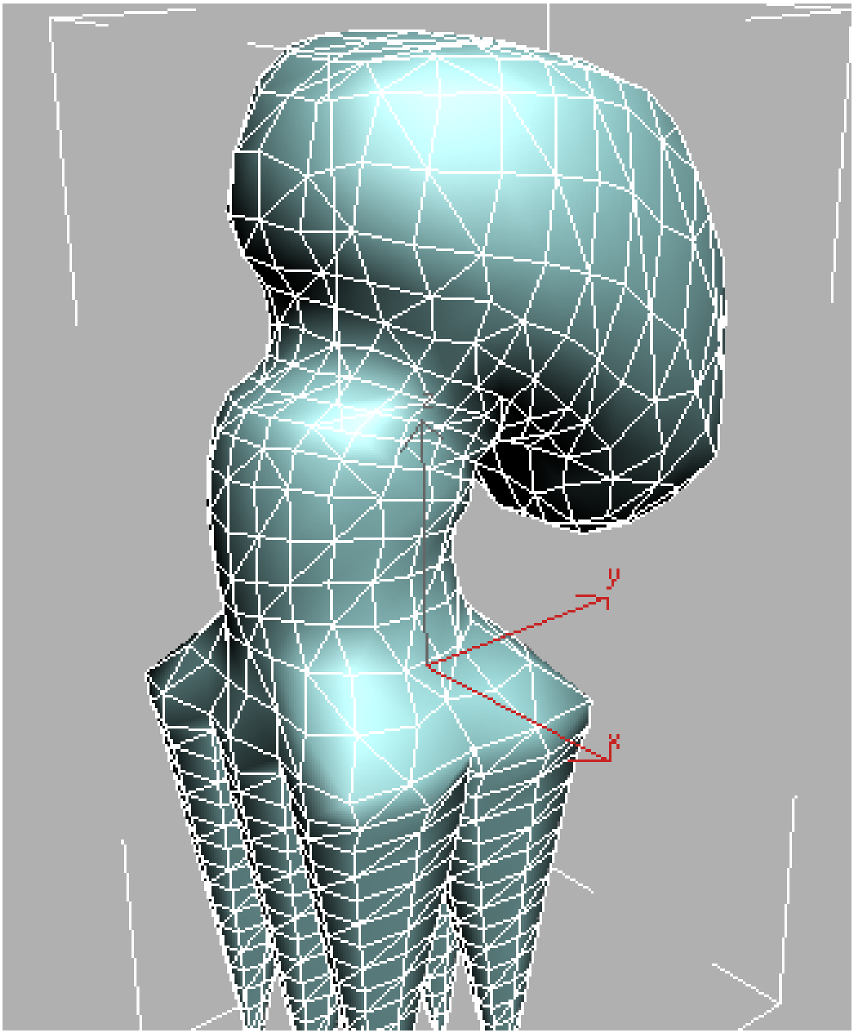
14 In the modifier stack, right-click one of the UVW Mapping Paste modifiers and choose Collapse All.



All of the additional modifiers are deleted, and the pasted data is "baked" into the object mesh.

15 Apply a Tessellate modifier to the model.

The mesh resolution increases significantly.



16 Apply a Select By Channel modifier to the octopus model.

This modifier lets you select channels that you named in Channel Info.

17 In the Select By Channel modifier, open the Selection Channel drop-down list.

The entries are the same as the vertex selections you copied and pasted to the map channel subcomponents.

18 Choose each of the items from the drop-down list in turn.

The corresponding stored vertex selection appears on the object, including all new vertices created by the tessellation. Note that the software automatically creates a soft selection for any vertices that the tessellation created between the original selected and unselected vertices; that is, on the border of the selection.

You could get the same results by copying the stored channels back to the vsel channel in the Map Channel Info dialog, but Select By Channel makes it easier to access the various stored selections. You can pass the selection in the active selection channel up the stack to further modifiers.

Normally, if you change an object's geometry type, it's possible to lose a sub-object selection. But with Channel Info, stored selections remain intact, as you'll see in the final part of this lesson.

19 Right-click the octopus and convert it to an Editable Patch object. Reapply the Select By Channel modifier and access the different stored channels.

The channels are empty, because Channel Info doesn't support stored vertex selections in patch objects. But, as you'll see in a moment, the stored mesh-vertex selections are still available.

20 Convert the octopus to an Editable Mesh object. Apply another Select By Channel modifier and access the different stored channels.

The vertex selections remain intact. If you performed the same series of conversions, starting with an editable mesh with a vertex selection, the selection would be permanently lost after the first conversion.

TIP If you're doing this sort of work and find that you can't paste a copied channel that you think you should be able to, try clicking the Update button on the Map Channel Info dialog. This step is necessary, for example, after object type conversions and topology changes.

The next procedure follows on from this one. If you'd like to try it later, save this file first.

Apply texture blending with the Vertex Color map:

In 3ds Max, the Vertex Color map works in conjunction with Channel Info to provide access to the different named channels. This lesson shows how to use the capabilities of the Vertex Color map along with stored vertex selections to blend textures on an object's surface.

If you haven't done the previous procedure, please complete it before attempting this one.

You'll create a composite material and use opacity to specify which sub-material should appear where.

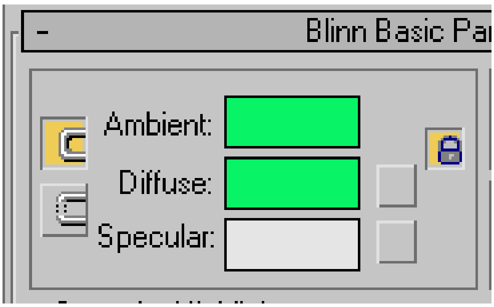
1 Continue from the previous procedure, or open the file you saved at the end, or open the included file *octopus01.max*.

2 Open the Material Editor and apply the first material (1-Default) to the octopus.

3 In the Material Editor, click the Standard button, and in the Material/Map browser, double-click Composite. When the Replace Material dialog appears, click OK to continue.

4 At the top of the Composite Basic Parameters rollout, click the Base Material button.

5 Click the Diffuse color swatch and set it to a bright green color.



6 Click the Go To Parent button, then click the Mat. 1 button. Choose a Standard material for material 1.

The Composite material uses opacity to determine how the different materials overlay the base mesh, so that's where you apply a Vertex Color map. You'll use Vertex Color because it provides access to the named, stored channels.

7 On the Blinn Basic Parameters rollout, click the Opacity map button to the right of the spinner, and choose the Vertex Color map.

8 On the Vertex Color Parameters rollout, find the Channel Name field and click the arrow button to its right.

The drop-down list shows the vertex-selection channels you pasted and named.

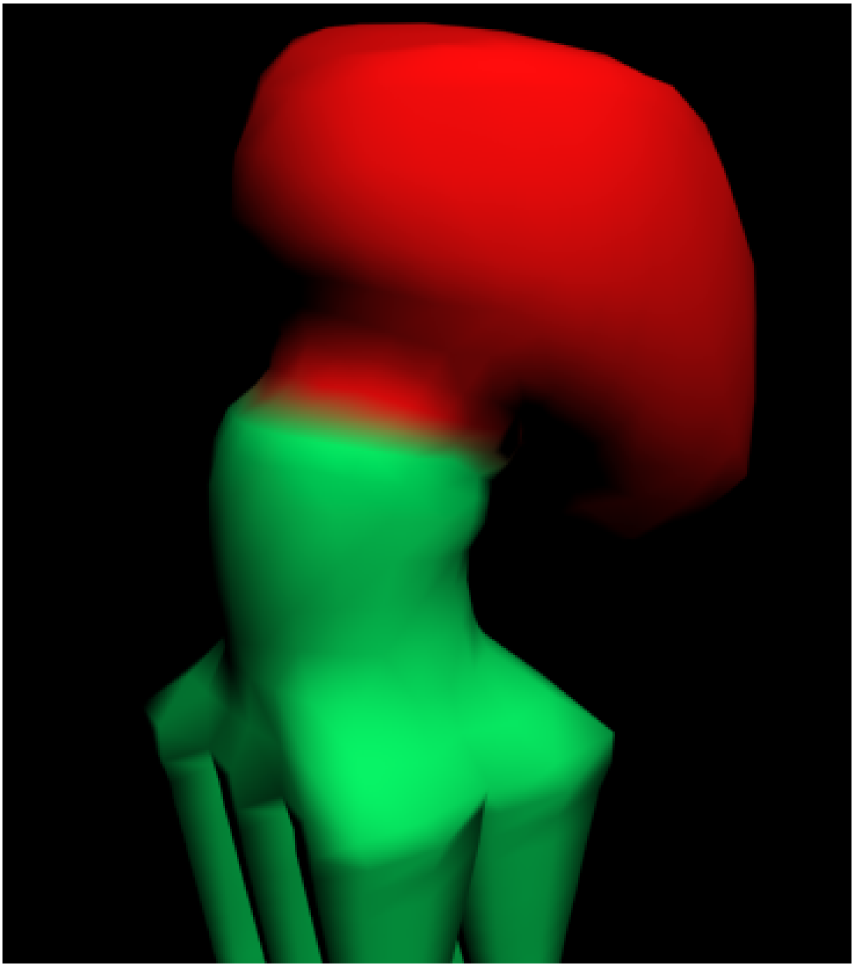
9 Choose the Head Vertices channel.

10 Click the Go To Parent button, and set the Diffuse color to a bright red.

11 Apply a UVW Map modifier to the object.

This is just so the renderer doesn't complain about missing map coordinates when you render.

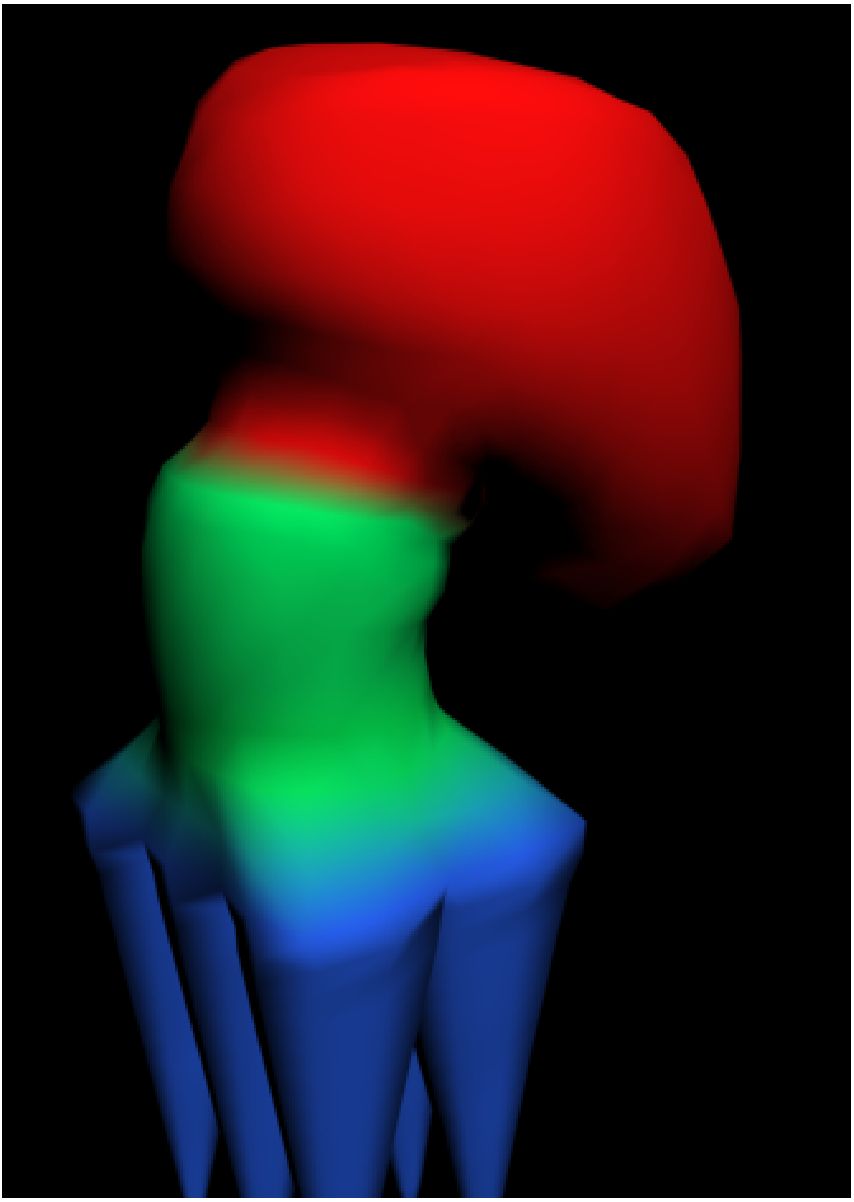
12 Render the Perspective viewport.



A slight amount of blending between the colored areas is the result of the soft-selected vertices created by the tessellation.

13 Click the Go To Parent button, and set Mat. 2 to a blue, Standard material, with Opacity mapped with a Vertex Color map set to the Leg Vertices channel.

14 Render again.



You now have an RGB octopus.

You can find the completed scene file in *octopus_final.max*.

15 Also try setting the different sub-materials to different maps such as Checker and Cellular.

This is a very powerful method of using any mapping channel to combine different materials on an object's surface.

Enable a morph object to survive a topology change:

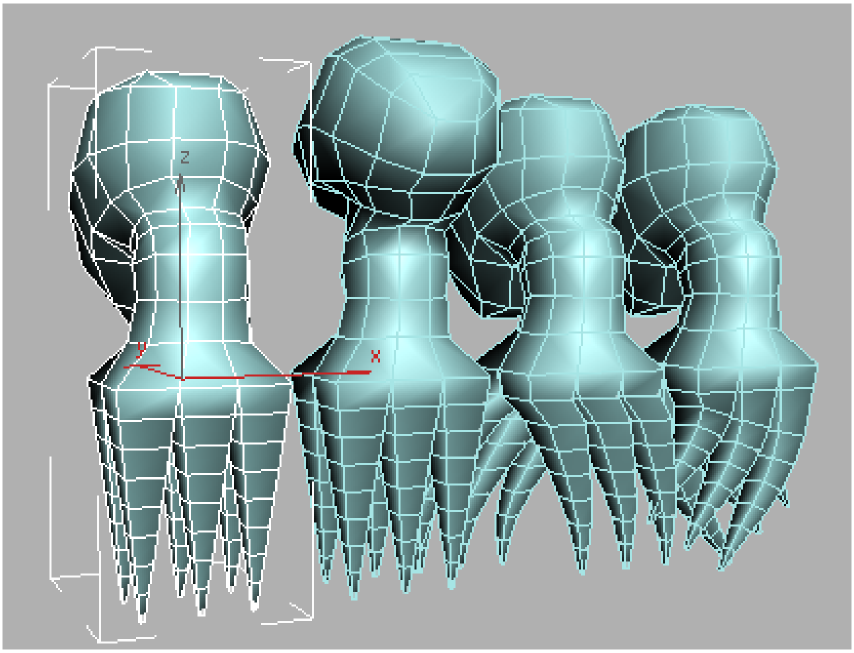
Sometimes, after you set up a morphing animation with the Morpher modifier, you need to change the object geometry. For example, the client or technical director might request that you add a facial feature such as wart, which requires you to increase mesh resolution.

Normally, if you change the topology of the base morph object, the morphing animation is completely lost because the base object's topology then differs from that of the targets. To recover, you must re-create the morph targets using the new topology, which can be a lot of work.

Instead, you can reuse the original morphing animation via the Channel Info's Copy and Paste functions, thus saving a great deal of time and effort.

1 Create a base object, convert it to Editable Mesh or Editable Poly, make several copies, and modify the copies to create morph targets. Use the Morpher modifier to set up a morphing animation on the base object.

You can use your own scene, or load the included scene file *octopus_morph.max*. The remainder of the lesson assumes you're using this scene, which contains a low-polygon octopus moving its head and legs using three morph targets.

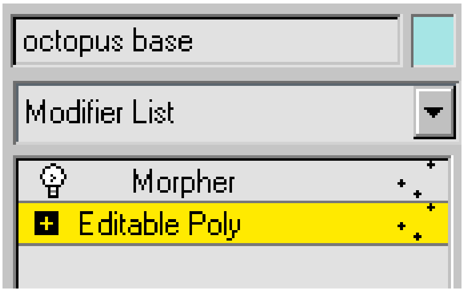


2 Play the animation.

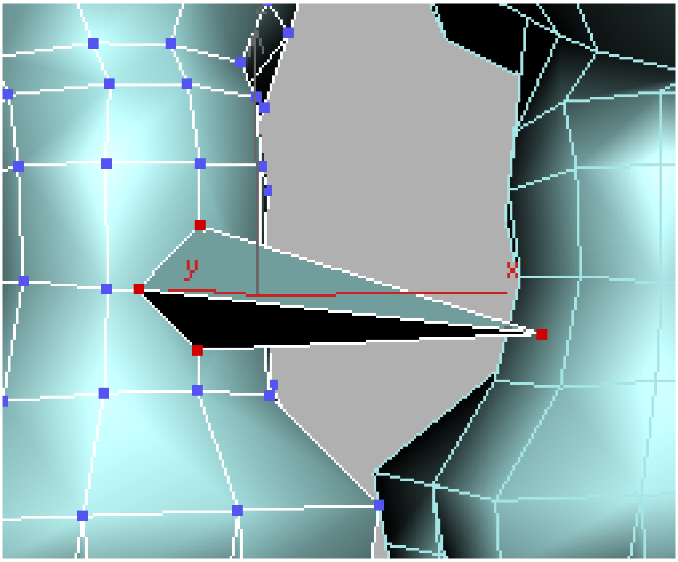
The leftmost object, the one animated with the Morpher modifier, moves its head and legs. This is also referred to as the *base object*. The remaining objects are *morph targets*; the base object uses these poses for the different phases of its animation. All four objects have the same geometry; this is a requirement for morphing animation.

Before starting, you'll demonstrate how changing the object geometry loses the morphing animation.

3 Select the base object, *octopus base*, and, on the Modify panel > modifier stack, click Editable Poly twice to go to the Vertex sub-object level.



4 On the Edit Vertices rollout, click the Extrude button, then, in the Perspective viewport, drag one of the neck vertices upward to extrude it outward.



5 In the modifier stack, click Editable Poly again to exit the Vertex sub-object level.

6 Play the animation again.

The animation is lost. This happened because the base object's geometric structure, or *topology*, is now different from that of the morph targets.

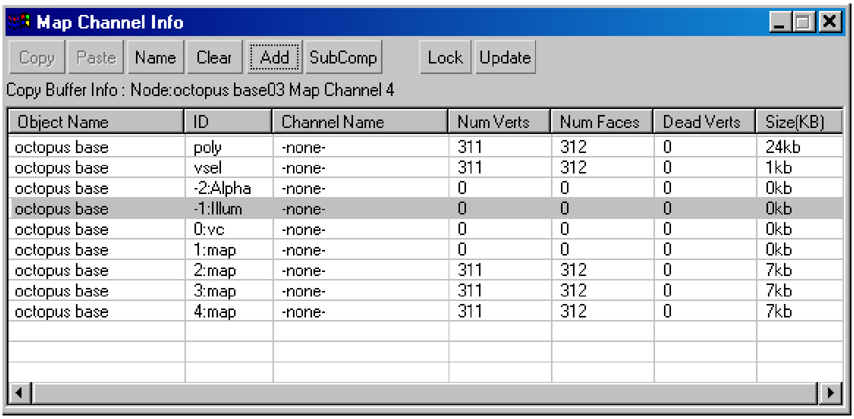
7 Press Ctrl+Z several times until the octopus is no longer selected, then play the animation.

The morphing animation is restored.

To begin, you'll use Channel Info to copy each of the morph targets' mesh channels to different channels in the base object.

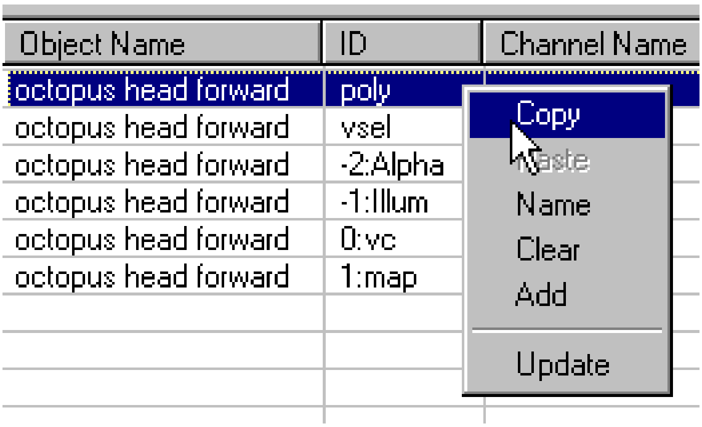
8 Select the base object, *octopus base*, then open the Channel Info utility.

9 On the Map Channel Info dialog, click any channel, then click the Add button three times to add three new map channels.



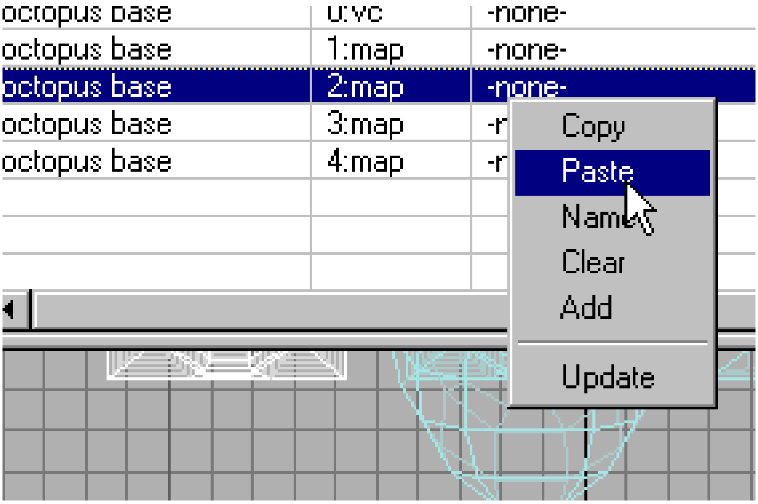
You can store the mesh data in existing channels such as Alpha, Illum, and vc, or add new channels to hold it. In this lesson, you'll do the latter.

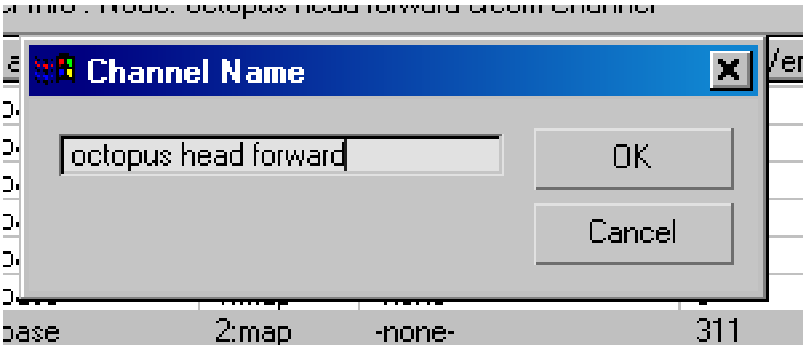
10 Select the first morph target, *octopus head forward*. On the Map Channel Info dialog, right-click the first channel, *poly*, and choose Copy from the menu.



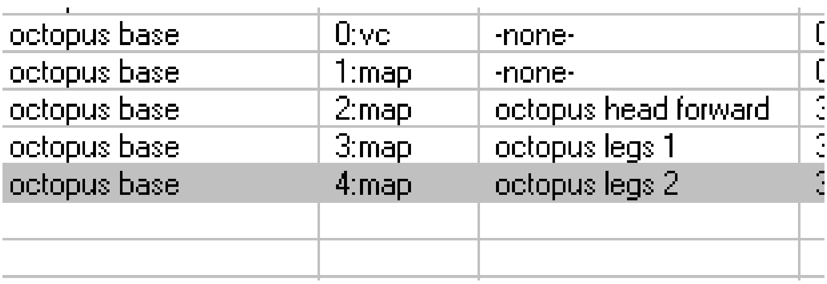
The poly channel contains the object's mesh data.

11 Select *octopus base* again and use the Map Channel Info dialog to paste to the 2:map channel, which is the first new channel you created earlier with the Add button. Name the channel **octopus head forward**.



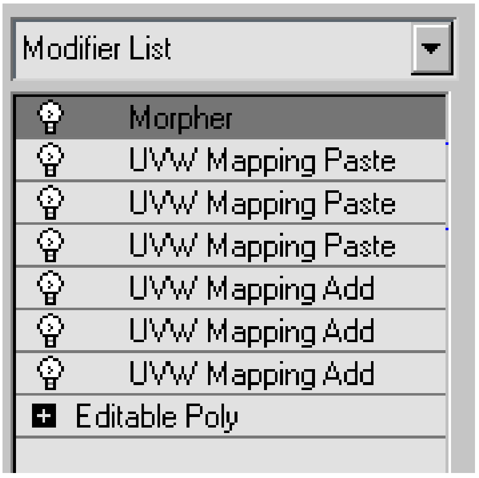


12 Similarly, copy the poly channels from the *octopus legs 1* and *octopus legs 2* objects (the second and third morph targets) to the *octopus base* object's 3:map and 4:map channels, respectively, naming the channels **octopus legs 1** and **octopus legs 2**, respectively.



TIP If you select multiple objects, they all appear in the Map Channel Info dialog, so you can copy and paste channels without having to change your selection.

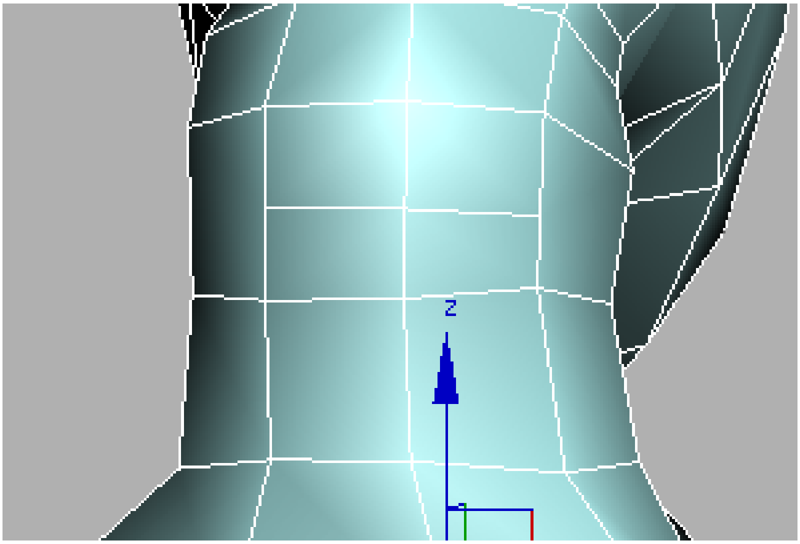
13 Select the base object and, in its modifier stack, move the Morpher modifier above any UVW Mapping Paste/Add modifiers (drag it to the top of the stack).



14 Right-click the uppermost UVW Mapping Paste modifier and from the context menu choose Collapse To.

The added/pasted channels are combined into the base object; only it and the Morpher modifier remain.

15 At the Editable Mesh/Poly level, refine the mesh. For example, you might use Slice, Cut, or Tessellate to add resolution. Try this: Select a few polygons on the front of the neck, click the QuickSlice button, click once on either side of the polygon selection, and exit the Polygon sub-object level.



16 Play the animation.

Because of its modified topology, the base object no longer morphs into the target shapes.

17 Delete all the morph targets (not the base object).

18 Make three copies of the edited base object.

Each of these copies has the same topology as the modified base object, and contains all of the original morph targets' shapes in its mapping channels.

19 Select the first copy, open the Map Channel Info dialog if necessary, and copy the *octopus head forward* channel to the poly channel. It's not necessary to rename the poly channel when you paste.

The first morph target regains its head-forward pose.

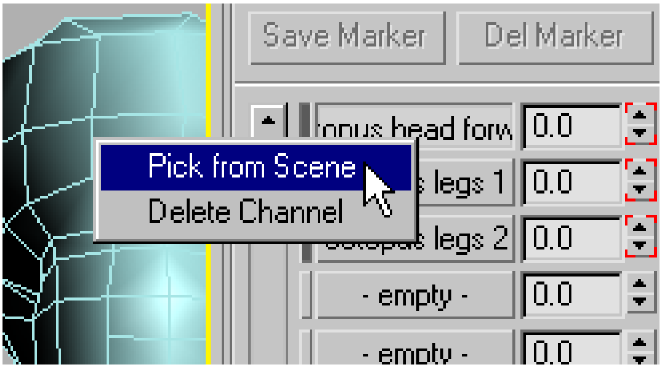
20 Similarly, copy the *octopus legs 1* and *octopus legs 2* channels on the second and third copies, respectively, to the poly channels.

21 Optional: Recover extra memory used by the morph targets by deleting the mesh data stored in their mapping channels with the Clear function.

Lastly, you'll set the Morpher modifier to use the new targets.

22 Select the base object, go to the Modify panel, and click the Morpher modifier in the stack, if necessary.

23 On the Channel List rollout, right-click the first target name button (octopus head forward), choose Pick From Scene, and click the first morph target object in the viewport (*octopus base01*).



The new target name replaces the old one on the button.

24 Similarly, use the Channel List buttons to set *octopus base02* and *octopus base03* as the second and third morph targets.

25 Play the animation.

The morphing animation is restored intact with the modified topology.

You can find the end result of this lesson in the file *octopus_morph_final.max*.

Summary

With its ability to store different kinds of information in mapping channels for later retrieval, the Channel Info utility can play a role in helping you master a variety of tasks in 3ds Max. You can use it to:

- Eliminate unused mapping channels in an object, thus minimizing memory usage.
- Enable vertex sub-object selections to survive topology changes and object type changes.
- Blend texture edges on an object's surface, in conjunction with the Vertex Color map.
- Name map channels and sub-channels for access by the Select By Channel modifier.
- Restore morphing animation to an object after changing its topology.

Mapping a Character

This tutorial explains how to map a character model with the Unwrap UVW modifier. This modifier provides a wealth of tools that go well beyond traditional mapping techniques. You will use the character you built in the Modeling a Low-Poly Character on page 241 tutorial to that effect.

You will use Unwrap UVW to map textures using simple methods like planar or cylindrical mapping. You will also use it to map textures using more elaborate methods such as Pelt mapping to map the camouflage texture seamlessly around the pants.

In this tutorial, you will learn how to:

- Apply materials to objects.
- Apply the UVW Modifier.

- Use simple mapping techniques such as Planar and Cylindrical.
- Work with Material IDs to separate mapping types.

Skill level: Intermediate

Time to complete: 1 to 2 hours

Mapping the Shirt

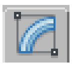
In this lesson, you use the UVW modifier to map a T-shirt onto a helicopter pilot. The materials have already been provided, you need only apply them to the objects and then use the proper mapping techniques.

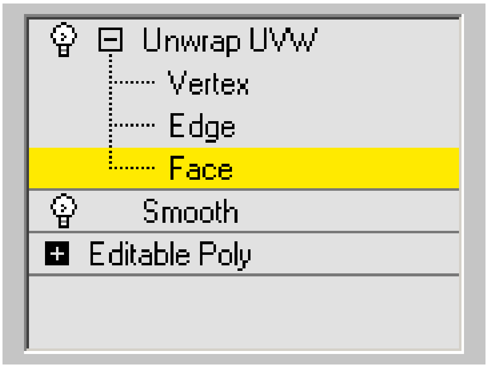
Apply the material to the shirt:

1.  On the Quick Access toolbar, click the Open File button and open the scene file *pilot01.max* from the *\materials_and_mapping\unwrap_uvw* folder.
2. Zoom in on the pilot's shirt in the Perspective viewport.
3. Press M to open the Material Editor.
4. Find the material named *Pilot_Shirt_Boots_&_Belt* (it should already be selected). Drag this material and drop it on the shirt in the Perspective view.

   The shirt turns black.
5. Close the Material Editor.

Apply and adjust the Unwrap UVW modifier:

1.  Select the shirt then go to the Modify panel.
2. From the Modifier List, choose Unwrap UVW.
3. In the modifier stack display, expand the Unwrap UVW modifier and then choose Face sub-object level.

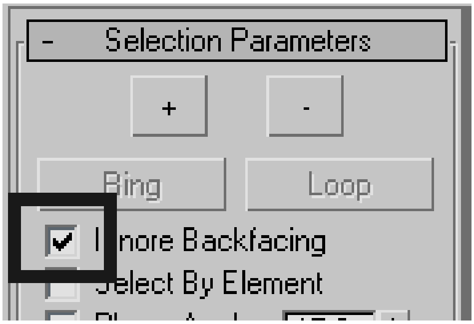


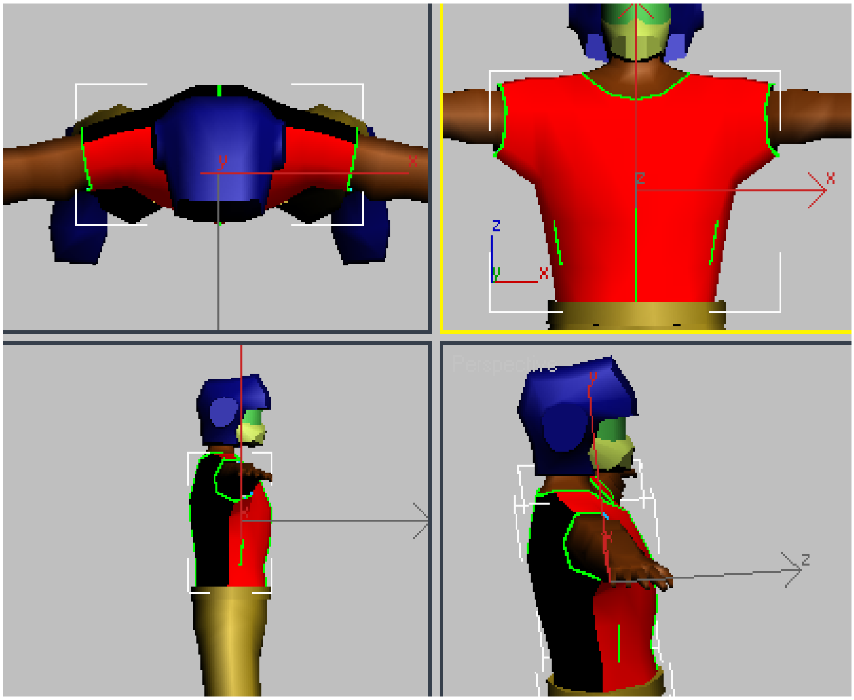
4 Press Alt+W to switch to a four-viewport configuration.

5 Pan the Front viewport so that you see the T-shirt in its entirety.

6 Using Region Select, drag a window around the shirt.

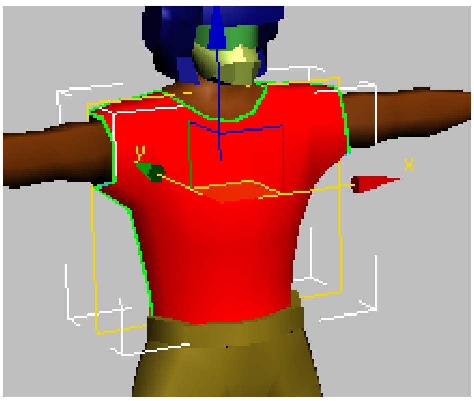
Only those polygons facing the Front viewport are selected. Notice in the Selection Parameters rollout that face selection is set to Ignore Backfacing by default.





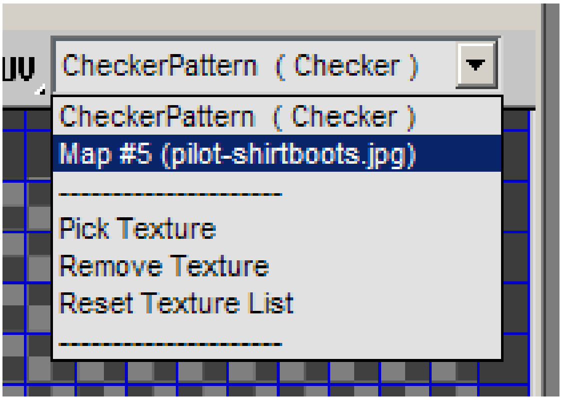
7 On the Map Parameters rollout, choose the Y axis below Preview Quick Map Gizmo, and then click Quick Planar Map.

This sets up the shirt faces to appear in the Edit UVWs dialog with the correct orientation.



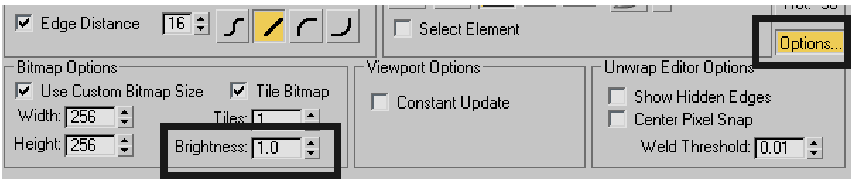
8 On the Parameters rollout, click Edit. The Edit UVWs dialog appears, displaying the selected polygons against a checkered background.

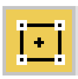
9 In the top-right corner of the dialog, from the drop-down list, choose the map that displays the texture of the T-shirt. This turns the checkered background into a tiled version of the map that is part of the material applied to the object.



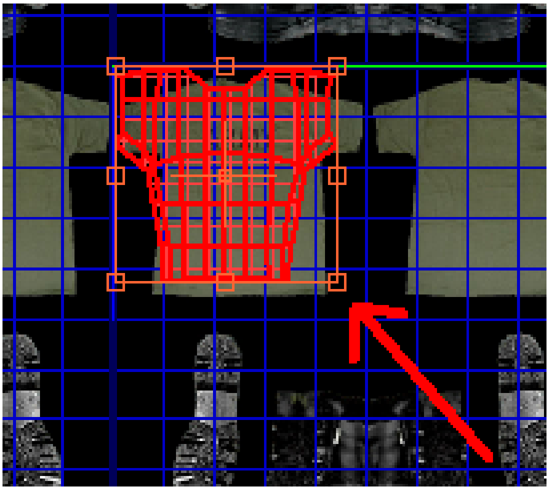
10 In the bottom-right corner of the dialog, click the Options button.

11 In the Bitmap Options group that appears, set Brightness to **1.0**. This makes the background image easier to read.



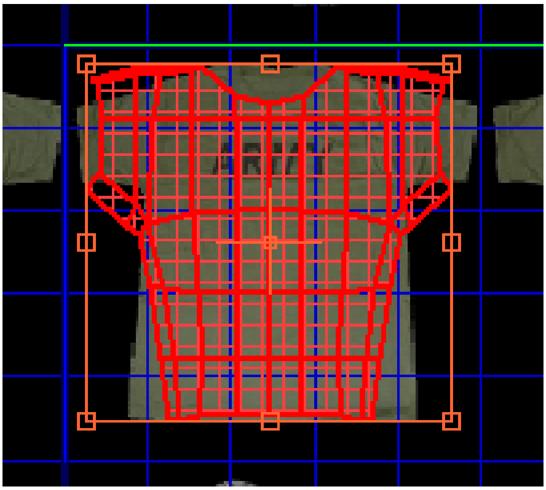
12  On the dialog's main toolbar, make sure the Freeform Mode tool is active.

13 Place the cursor on the bottom-right corner of the gizmo surrounding the red area representing the selected polygons. The mouse is now in Scale mode. Click and drag to scale the selection until it is about the size of the t-shirt in the background.

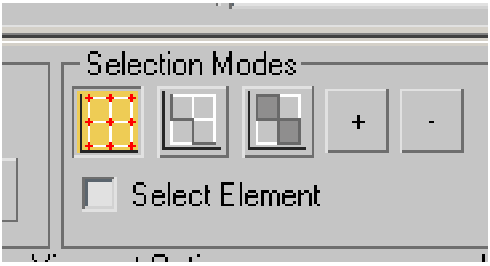


14 Zoom in on that area in the dialog. You can use the mouse wheel to zoom and pan, as in a viewport.

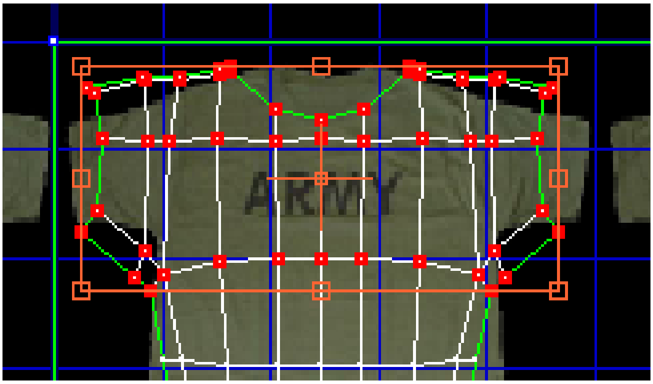
15 Place the cursor anywhere inside the area of the selected polygons. You are now in Move mode. Reposition the selected polygons over the T-shirt with the label "Army" on it.



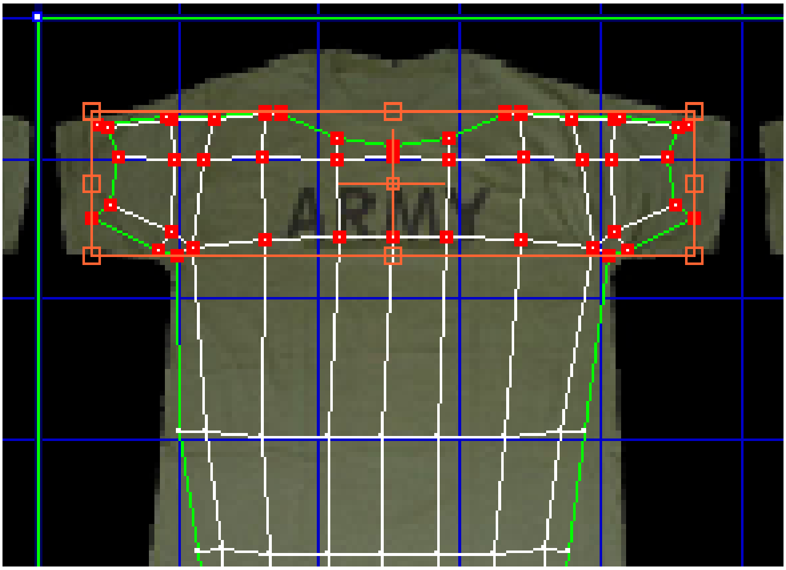
16 In the Selection Modes group at the bottom of the dialog, click the Vertex Sub-Object Mode button.



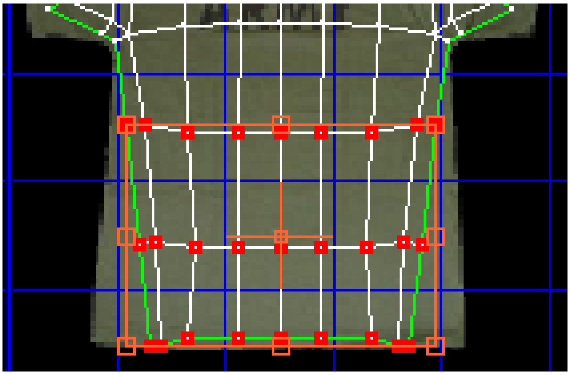
17 Drag a region to select all the vertices that make the top half of the torso, including the arms.



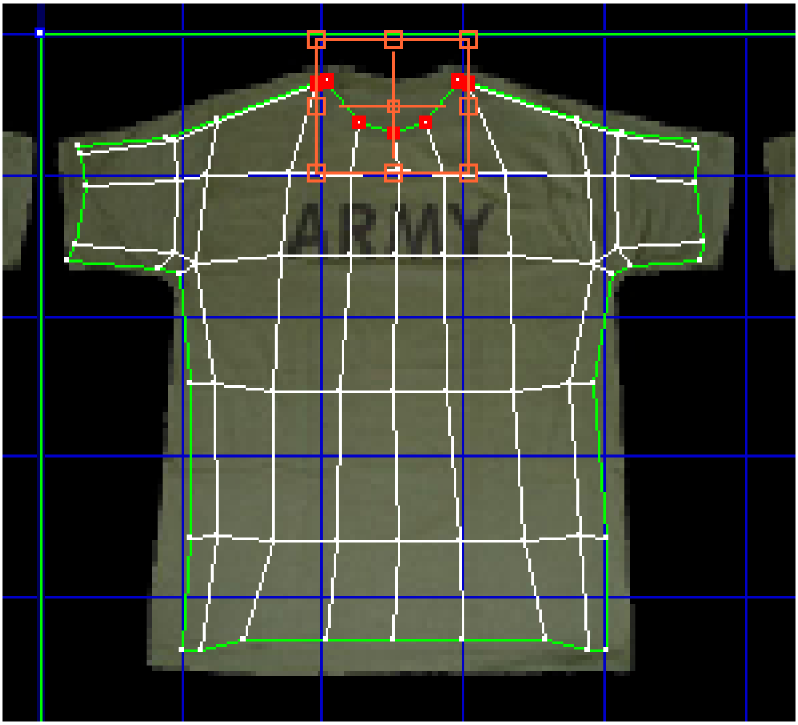
18 Using Scale (corner boxes) and Move (cursor inside the selection area), adjust the vertices so they are all contained inside the t-shirt image.



19 Select the bottom vertices representing the lower section of the shirt. Adjust scale and position to equalize the flow of vertices on the 3D-object structure.



20 Continue selecting and adjusting groups of vertices to fit the wireframe structure to the image in the background. Always try to keep the flow of the vertices even to prevent any stretching in the texture, especially when the texture has patterns or labels on it.



Map the back of the shirt:

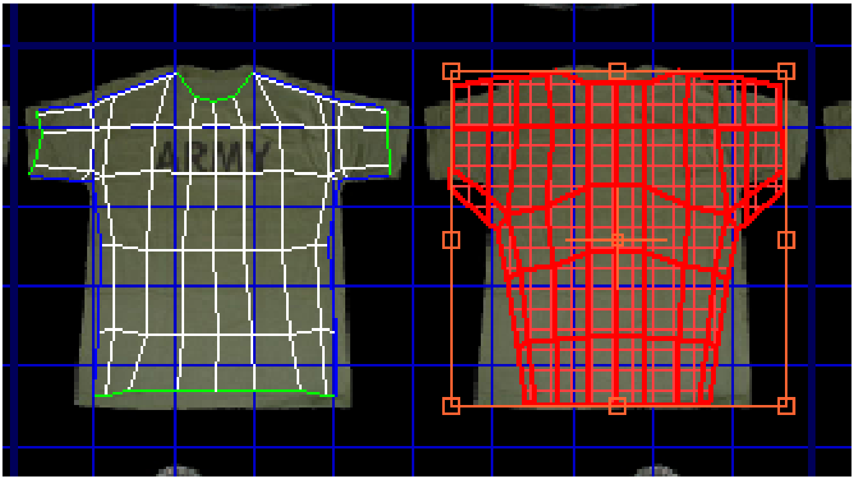
1 Click the Point Of View (POV) viewport label and choose Back.

2 In the Modifier stack, switch the Unwrap UVW sub-selection level to Face.

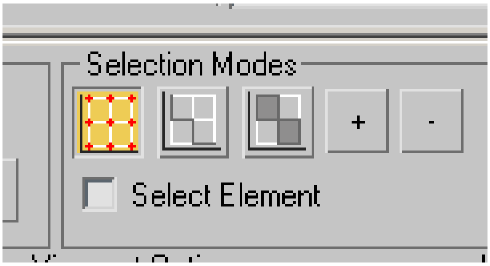
3 In the Back viewport, drag to region-select all the polygons that make the back of the T-shirt.

4 On the Map Parameters rollout, choose the Y axis and then click Quick Planar Map to reset the mapping coordinates of the selected faces.

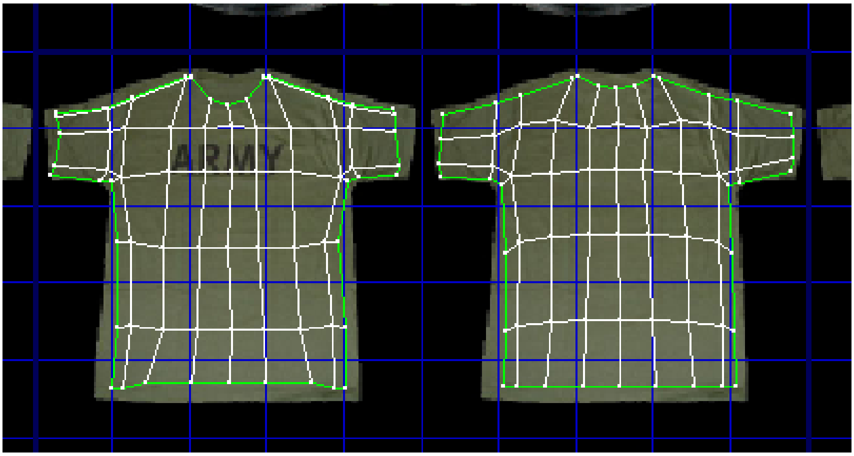
5 Using Scale and Move modes as you did earlier, position the back faces on top of the back of the T-shirt in the background picture.



6 In the Selection Modes group at the bottom of the dialog, click the Vertex Sub-Object Mode button.



7 Adjust groups of vertices, as you did earlier, to fit the wireframe structure on top of the background image.



8 Exit the Edit UVWs dialog when done.

9 Restore the Back viewport to a Front view.

10 In the Modifier stack, exit the sub-object level.

11 Save your file as **my_pilot_shirt.max**.

Mapping the Helmet

In this lesson, you use the Unwrap UVW modifier to map the helmet of the helicopter pilot. Unlike the shirt, the helmet cannot be easily mapped with a Planar projection. You will use a cylindrical projection instead.

Apply the material to the helmet:

1 Continue working on your file from the previous exercise or load the file *pilot02.max* found under *\materials_and_mapping\unwrap_uvw*.

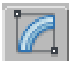
2 Zoom in on the pilot's helmet in the Perspective viewport.

3 Press M to open the Material Editor.

4 Find the material named *Pilot_Head*. Drag this material and drop it on the helmet in the Perspective view.

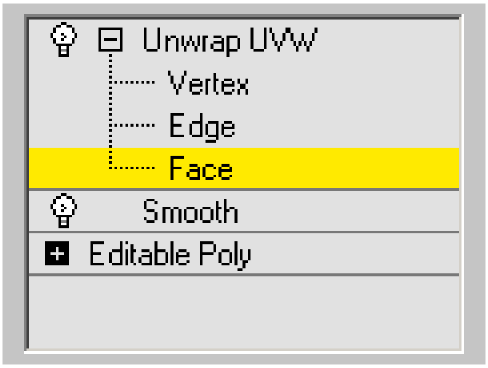
5 Close the Material Editor.

Map the helmet:

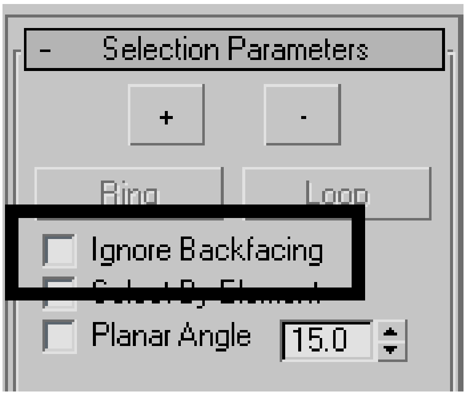
1  Select the Helmet, then go to the Modify panel.

2 From the Modifier list, choose Unwrap UVW.

3 Expand the Unwrap UVW modifier, then choose Face sub-object level.

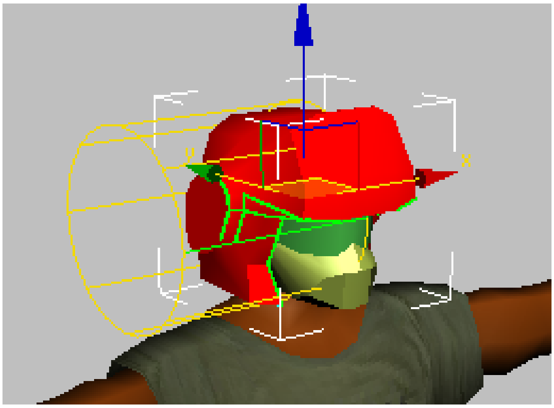


4 On the Selection Parameters rollout, turn off Ignore Backfacing.

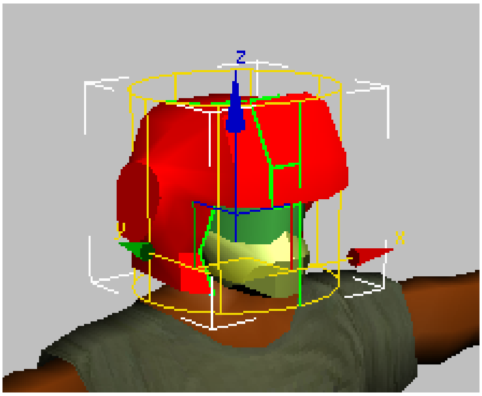


5 Drag to region-select all the faces that make the helmet. The whole helmet turns red.

6 On the Map Parameters rollout, click the Cylindrical button. A cylindrical mapping gizmo appears, but its size and orientation are incorrect.



7 On the Map Parameters rollout, click on Align Z to adjust the gizmo to the helmet.

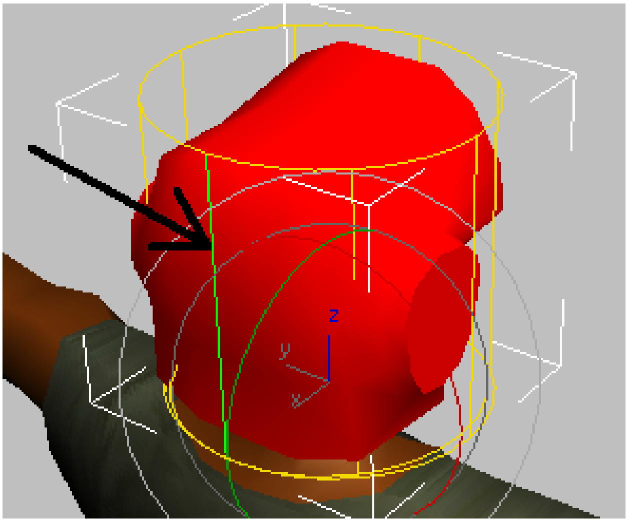


NOTE Take a look at the vertical green edge at the front of the cylindrical gizmo. This represents the edge that will be used to unfold the map. You will need to rotate that edge to the back of the helmet to better fit the map assigned to the material.

8 From the main toolbar, click the Rotate tool and set Reference Coordinate System to Local.

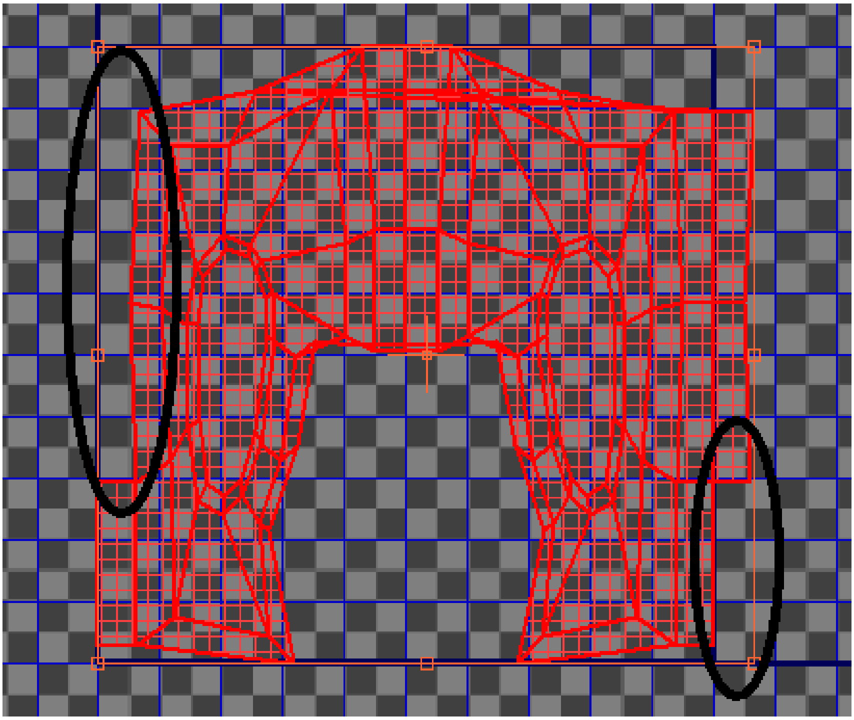
9 Press the A key to turn on Angle Snap.

10 In the perspective view, rotate the gizmo 180 degrees on the Z axis (blue axis) until the green edge is at the back of the head.

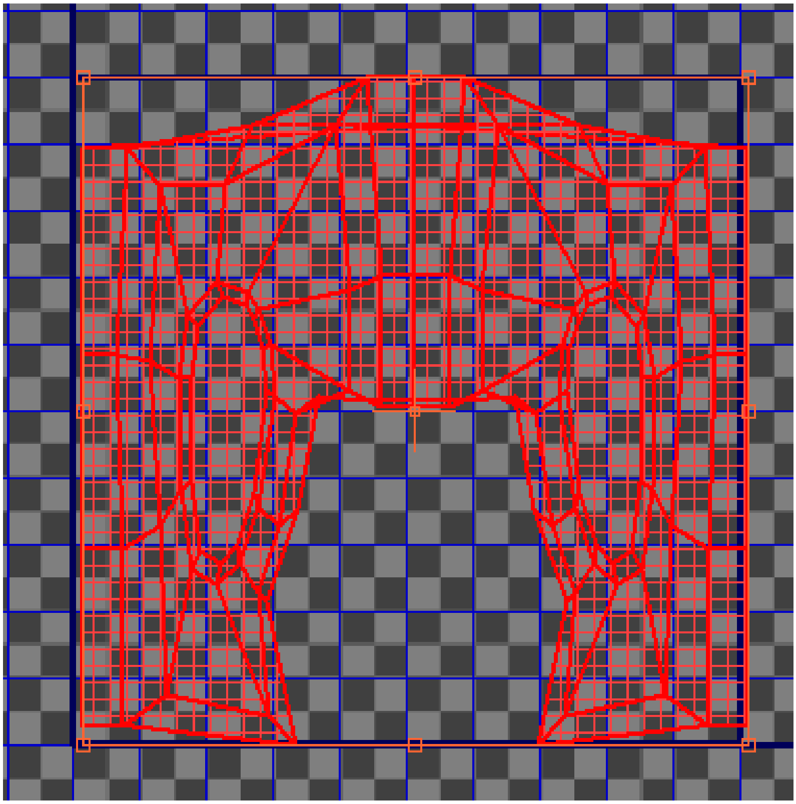


11 On the Parameters rollout, click Edit to open the Edit UVWs dialog.

The selected faces are unfolded against a checkered pattern, but it might not be completely symmetrical.

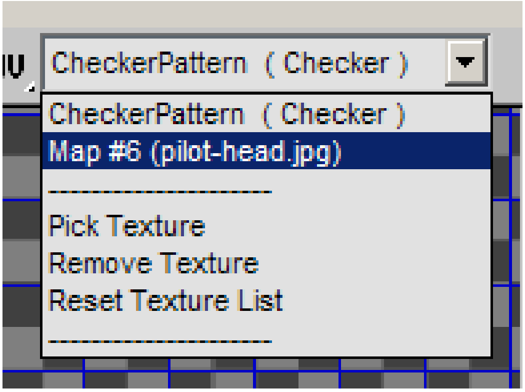


12 Rotate the cylindrical gizmo an additional 5 degrees on the Z axis. This fixes the selected faces into a perfectly symmetrical layout.



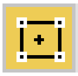
13 On the Map Parameters rollout, click the Cylindrical button to exit that mode.

14 In the editor, from the map drop-down list, choose the helmet map defined in the material.



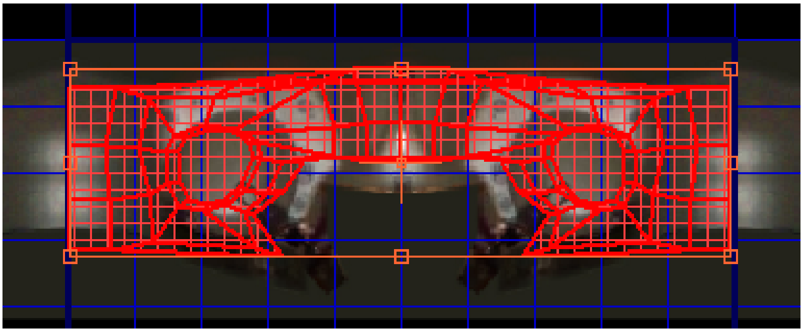
15 Make sure the Options button in the bottom right corner of the dialog is active.

16 In the Bitmap Options group, set the Brightness to **1.0**. This makes the background image easier to read.

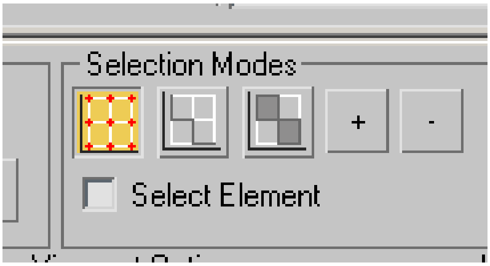
17  On the dialog's main toolbar, make sure the Freeform Mode tool is selected.

18 Position the cursor on one of the corner boxes to scale the selected faces, or anywhere inside the selection to move the selected faces.

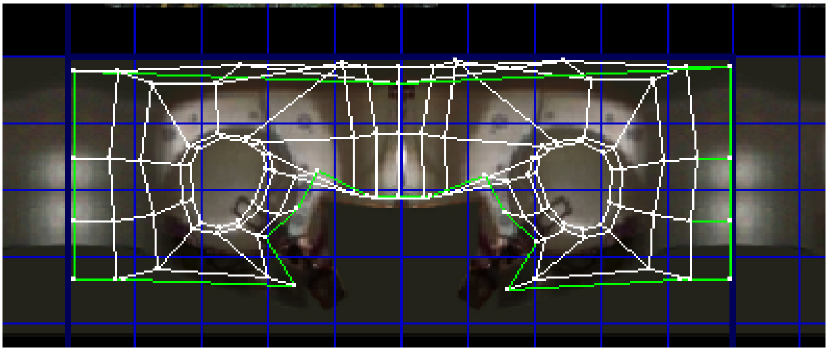
19 Make a preliminary adjustment for the selected faces to fit the background image.



20 In the Selection Modes group at the bottom of the dialog, choose Vertex sub-object mode.



21 Adjust groups of vertices, as you did in the previous exercise.



22 Exit the Edit UVWs dialog when done. In the Modifier stack, exit the sub-object level.

When you are done, save your file as **my_pilot_helmet.max**.

Mapping the Pants

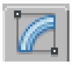
In this lesson, you use the Unwrap UVW modifier to map the pants of the helicopter pilot using a camouflage pattern. The pants would be difficult to map using conventional mapping methods, especially when you use a pattern like camouflage, without getting smearing and stretching of pixels. Using multiple planar and cylindrical maps might work to keep the pattern equal but may give you problems with stitching. It is best to use Pelt Mapping in such a situation.

An added constraint is the belt, which is part of the pants object. Since the belt will be using a different material than the rest of the pants, you need to apply a Multi/Sub-Object Material and map the two elements differently, using pelt mapping for the pants and a simpler cylindrical mapping for the belt.

Adjust material IDs:

1 Continue working on your file from the previous exercise or load the file *pilot03.max* found under *\materials_and_mapping\unwrap_uvw.*

2 Zoom in on the pilot's pants in all viewports.

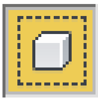
3  Select the *Pants* object and go to the Modify panel.

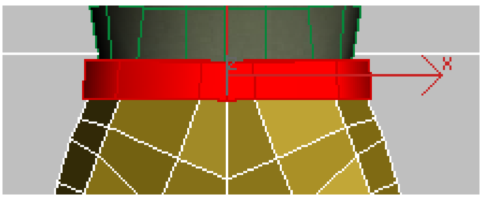
4 Expand the Edit Poly modifier in the stack and go to Polygon sub-object level.

5 Activate the Front viewport then press Ctrl+A to select all the faces that make up the pants object (pants + belt).

6 Scroll down to the Polygon: Material IDs rollout at the bottom of the Modify panel. Set the Set ID value to **1**.

This sets all the faces to be applied with the first material in a multi/sub-object material definition.

7  Using a window selection, drag to select all the faces that make the belt.

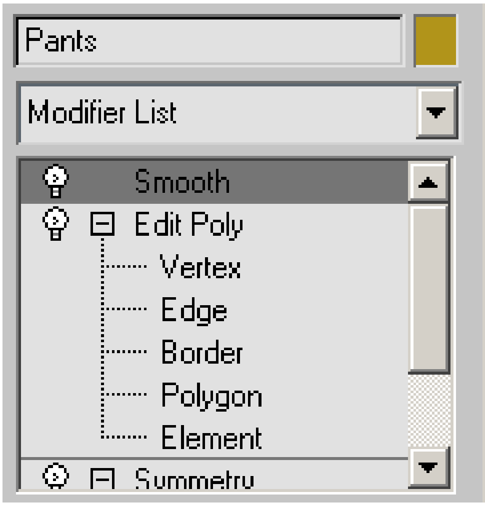


8 On the Polygon Properties rollout, set the Set ID value to **2**.

The faces representing the belt will receive the second material in a multi/sub-object material definition.

9 Click an empty area of the viewport to deselect all polygons.

10 Exit Sub-object selection level, and then go to the top of the stack by clicking the Smooth modifier entry.



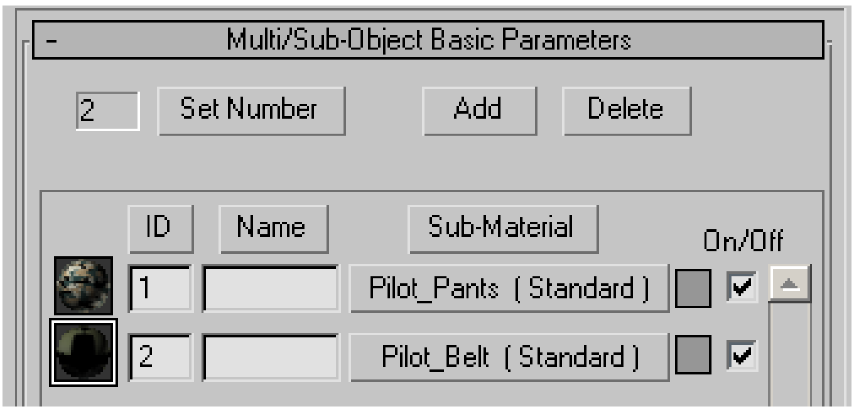
Apply the material to the pants:

1 In the Perspective viewport, zoom in on the pilot's pants.

2 Press M to open the Material Editor.

3 Find the material named *Pilot_Pants* and select it.

This is a Multi/Sub-Object material with two defined sub-materials.

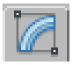


4 Drag this material to on the pants in the Perspective viewport.

5 Close the Material Editor.

Create pelt seams:

When you use Pelt mapping, it is best to start by defining pelt seams. Pelt seams are like virtual “cut” lines that the Unwrap UVW modifier uses to unfold the Pelt map.

1  Select the *Pants* object then go to the Modify panel.

2 From the Modifier list, choose Unwrap UVW.

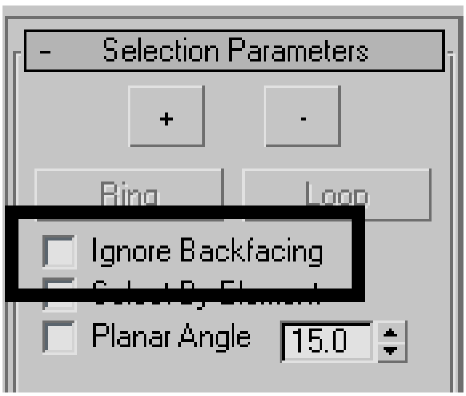
3 Maximize the Perspective view and press F4 to turn Edged Faces mode on if it is not on already.

4 Press F3 to display the view in wireframe.

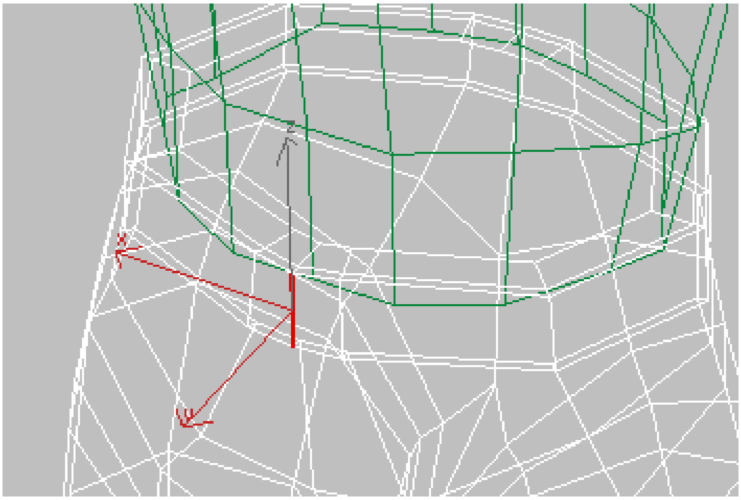
5 Expand the Unwrap UVW modifier and in the modifier stack, go to Edge sub-object level.

6 In the Parameters rollout > Display group, turn off Show Map Seam. The green map seams will make the blue Pelt seams difficult to see.

7 On the Selection Parameters rollout, turn off Ignore Backfacing.

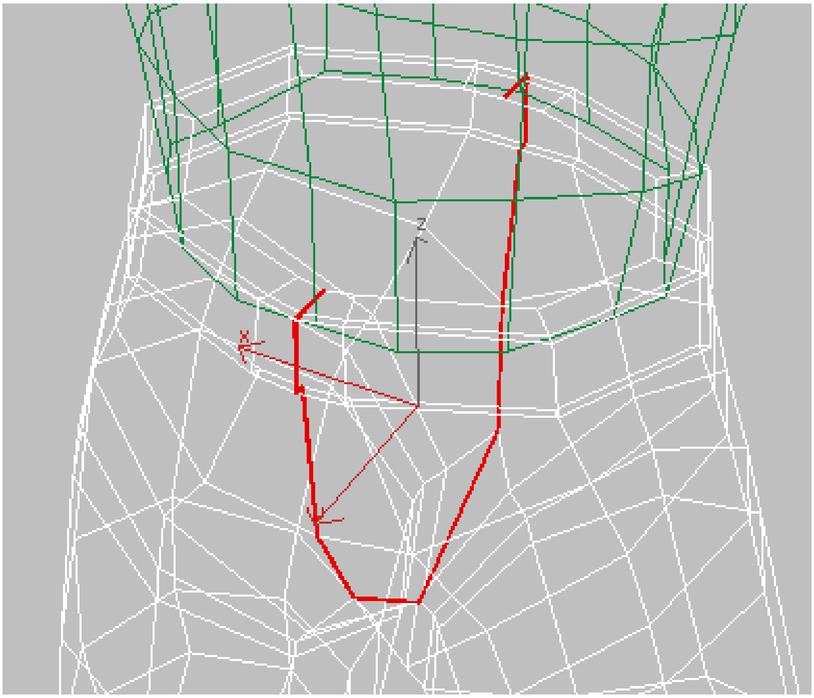


8 Select the vertical edge at the back center of the belt.



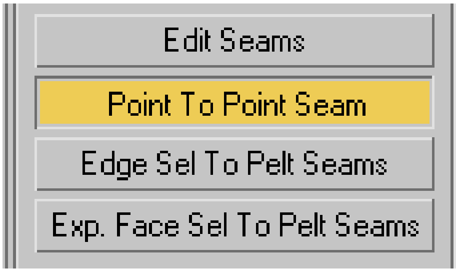
9 On the Selection Parameters rollout, click the Loop button.

The edges are now selected in a loop from the back to the front passing between the legs.

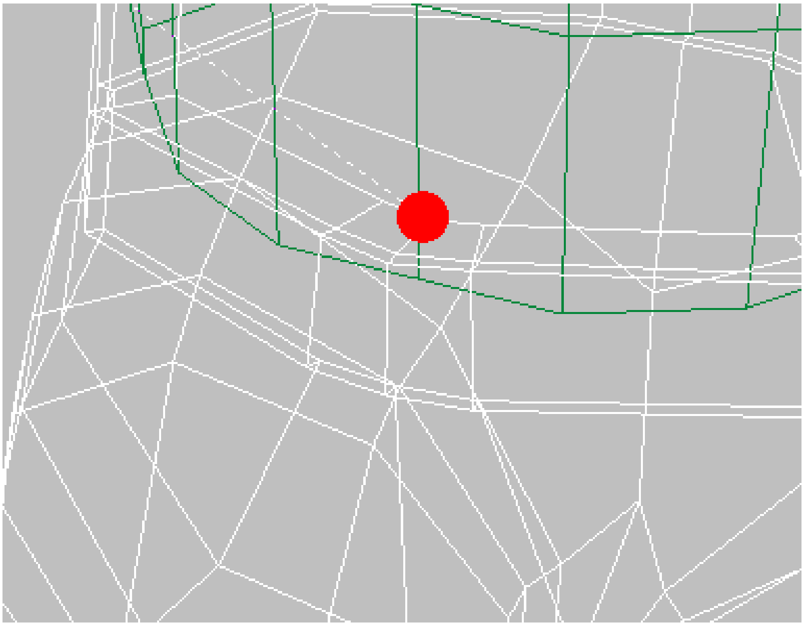


At this point, you can convert this edge selection to a Pelt Seam, but you really only need the selected edges at the back of the pants. You can deselect the edges you do not want or use a different approach called Point To Point Seam.

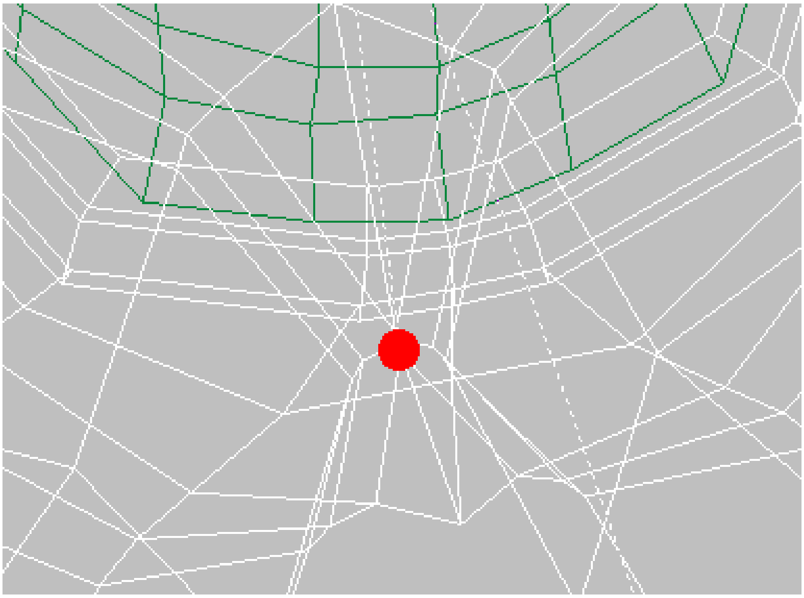
10 Click a blank area of the viewport to deselect the edges. At the very bottom of the command panel, click the Point To Point Seam button.



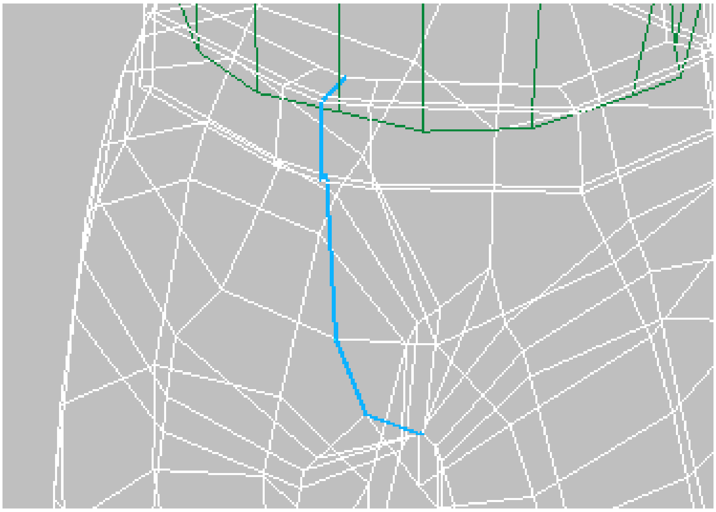
11 Click a point on the belt where you want the pelt seam to start.



12 Orbit to view the pants from a lower angle and click a point in the middle between the pants legs.

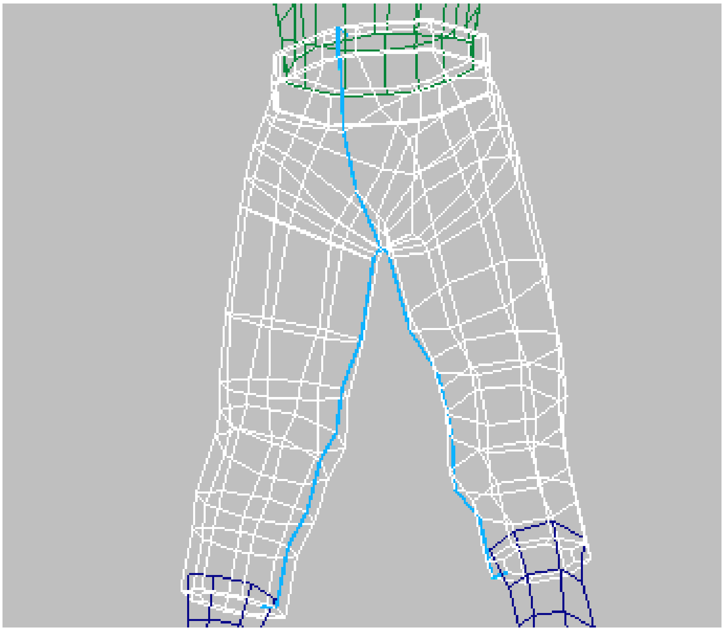


13 Right-click to accept the seam. You now have a pelt seam running along the buttocks.



14 Repeat the Point To Point procedure to create a pelt seam running along the inside of a leg.

15 Create a pelt seam for the inside of the other leg.



16 Press F3 to restore the view to shaded mode.

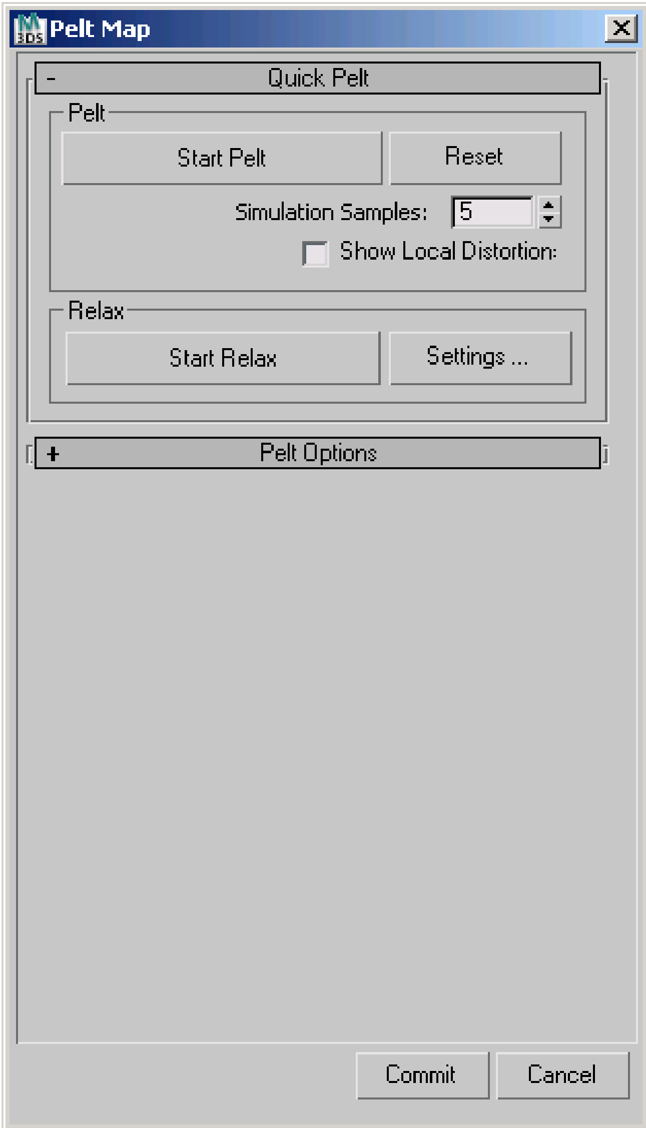
17 In the modifier stack, set the sub-object level to Face.

18 Press Ctrl+A to select all the faces that make up the pants.

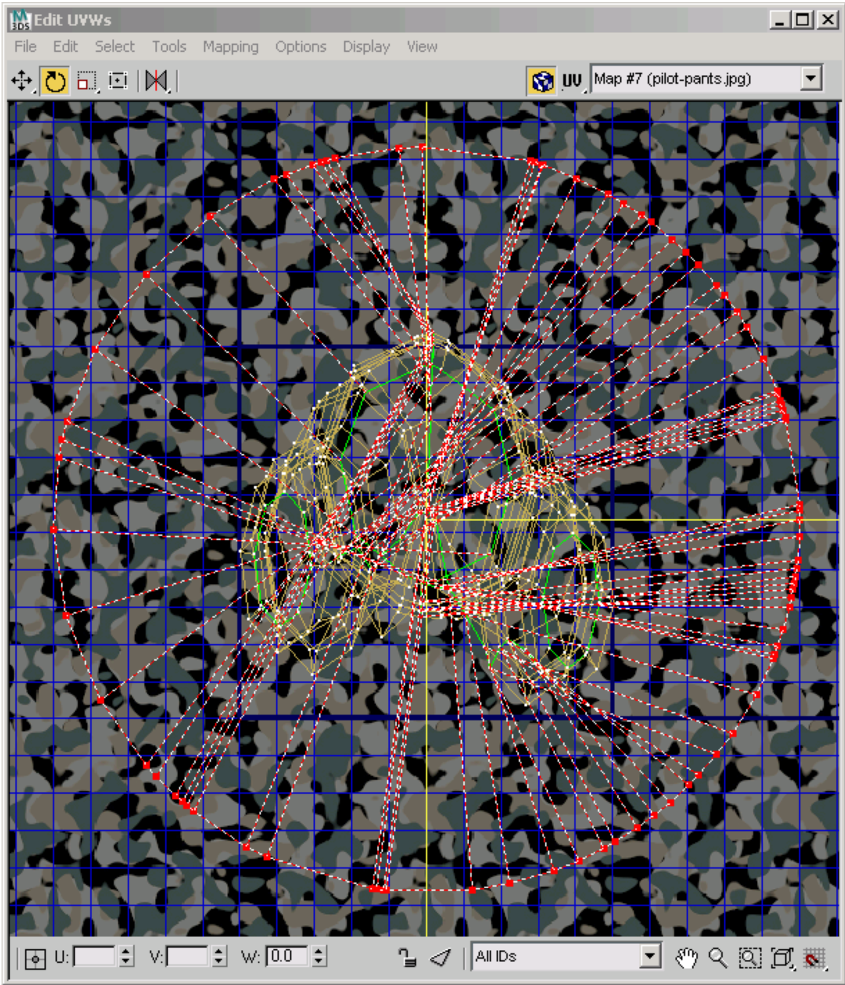
They turn red in the viewport.

19 On the Map Parameters rollout, click the Pelt button.

3ds Max opens two windows: the Edit UVWs window and the Pelt Map dialog. If they overlap, arrange them on your screen so they are side by side.

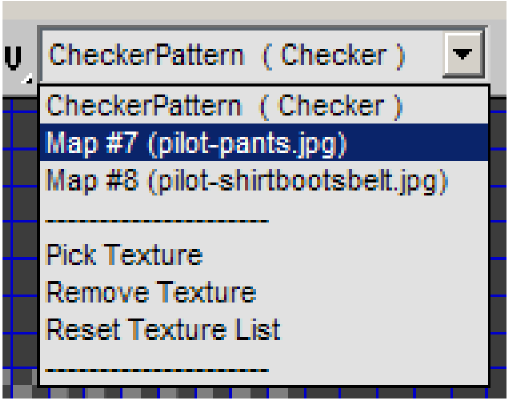


NOTE The display of the geometry in the Edit UVWs dialog is slightly different from what you have seen so far. A circular Stretcher is displayed. you'll use this to simulate Pelt mapping by stretching the geometry. You need to adjust it slightly so that it works properly.



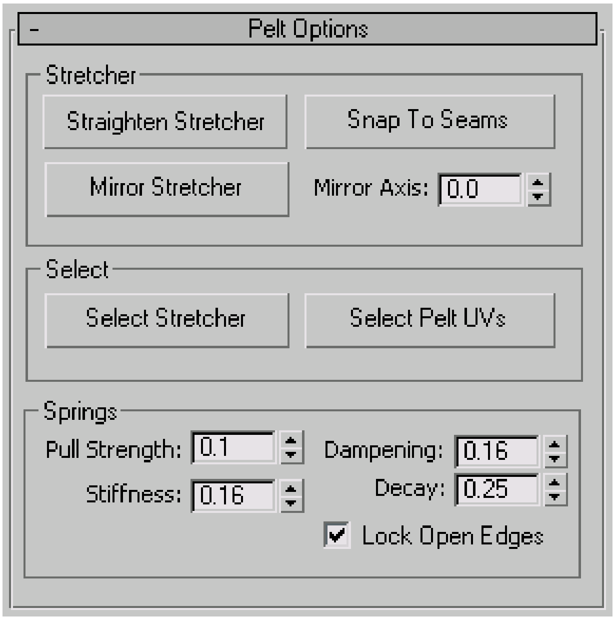
20 From the Maps drop-down, choose the map that was defined in the Multi/Sub-Object material for the pants: *pilot-pants.jpg*.

The camouflage texture appears in the background.

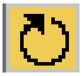


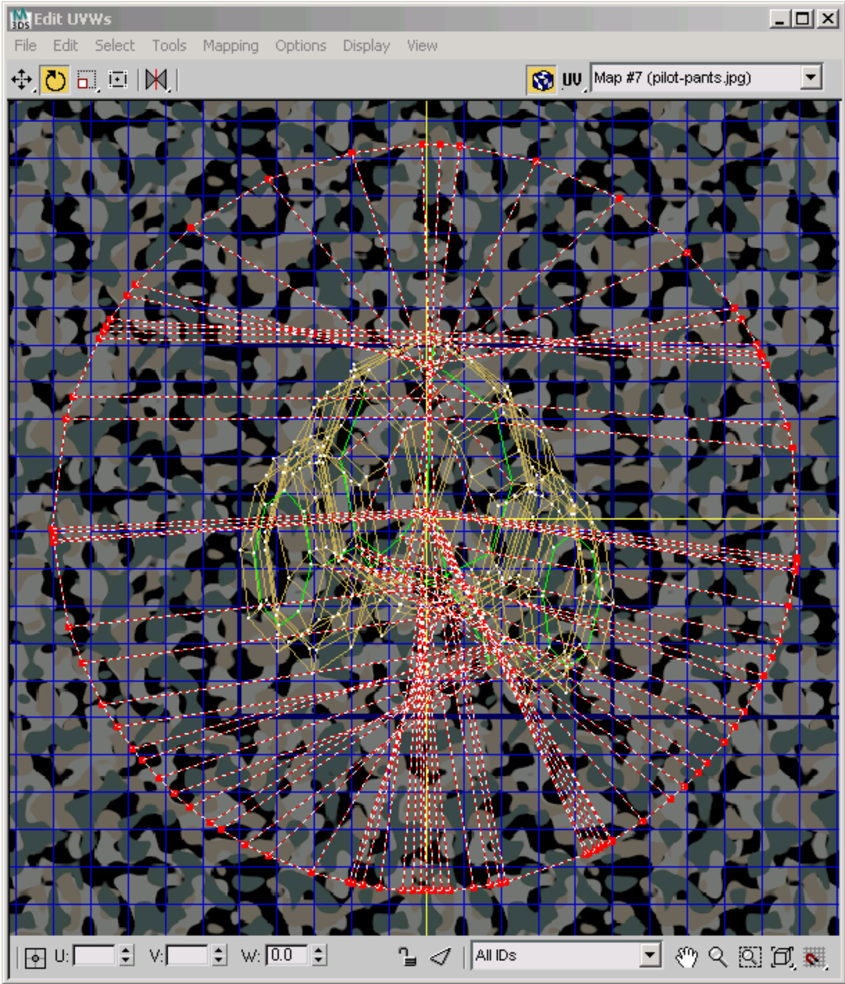
NOTE Because the material applied to the pants is a Multi/Sub-Object material, all maps used in the material definition are automatically displayed in the map drop-down menu; in this case the camouflage and the belt map.

21 In the Pelt Maps dialog, open the Pelt Options rollout.



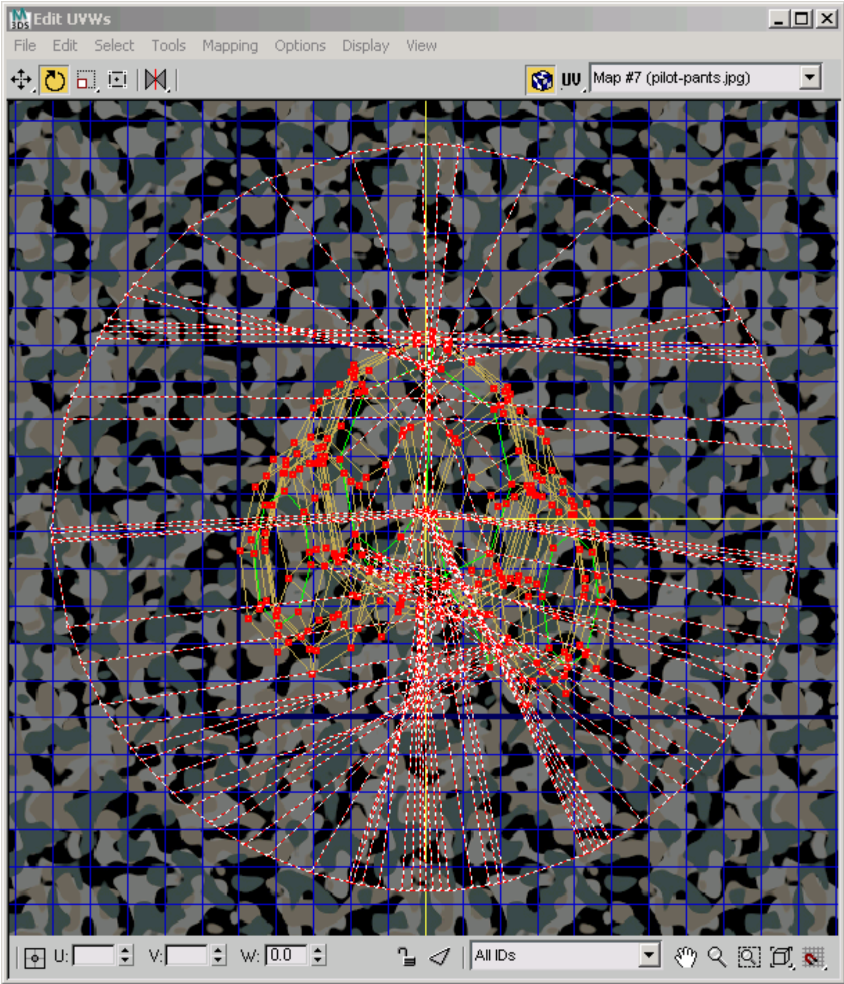
22 In the Pelt Options rollout > Select group, click Select Stretcher.

23  In the Edit UVWs window, use the Rotate tool to rotate the circular Stretcher gizmo until the stretcher lines are more or less symmetrical.



24 In the Pelt Options rollout > Select group, click Select UVs.

In the Edit UVWs window, 3ds Max highlights the pant vertices once again.



25 In the Quick Pelt rollout > Pelt group, click Start Pelt.

3ds Max begins pelt mapping. In the Edit UVWs window, you can see the stretcher lines and vertices move.

26 After the changes appear to have stabilized, click Stop Pelt (this is the same as the Start button: its label has changed).

27 Move the mapping dialogs so you can see the viewport.

The initial mapping is good, but it appears a bit stretched.

28 In the Quick Pelt rollout > Relax group, click Start Relax.

Once again, you can see stretcher lines and vertices move in the Edit UVWs window.

29 When the changes appear to have stabilized, click Stop Relax (again, this is the same Start Relax button with a new label).

30 On the Pelt Map dialog, click the Commit button to commit the pelt-mapping of the pants, and close the Pelt Map dialog.

31 Close the Edit UVWs window.

The pants now have a convincing camouflage pattern.

Map the belt:

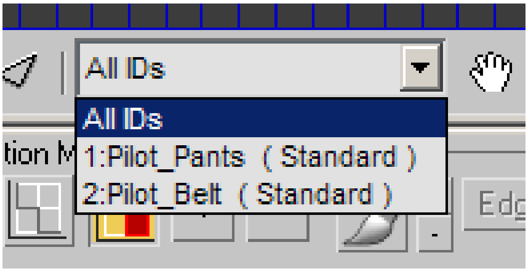
Unlike the pants, the belt uses a simple cylindrical mapping, much like the one you used on the helmet in the previous exercise.

1 In the modifier stack, switch the Unwrap UVW sub-object level to Face.

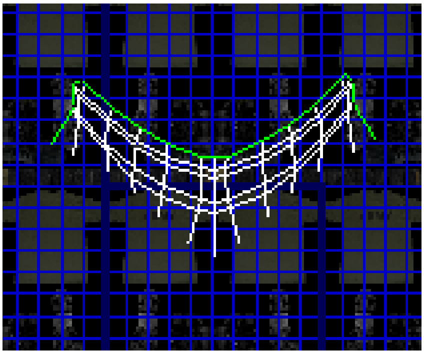
2 In the Map Parameters rollout, click the Pelt button to exit this mode.

3 Click a blank area of the viewport to deselect the faces.

4 On the Edit UVWs dialog, open the face ID dropdown list.



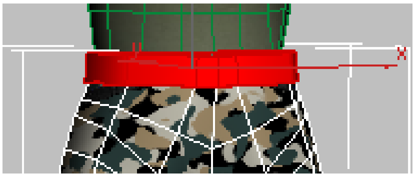
5 Choose 2:Pilot_Belt (Standard) from that list. Only the faces that make out the belt are selected.



NOTE The background automatically switches to reflect the map associated with the faces that use that Material ID.

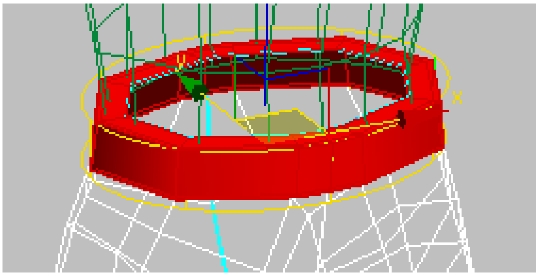
6 In the Edit UVWs window, drag to region-select all the faces representing the belt.

The corresponding faces are selected in the viewport.

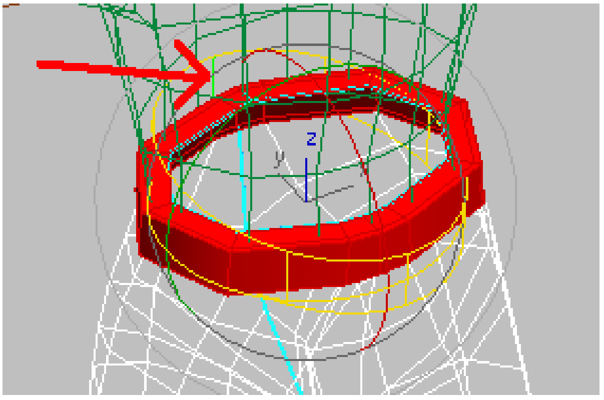


7 Press F3 to switch to wireframe display mode.

8 On the Map Parameters rollout, click Cylindrical, then click Align Z to align the cylindrical gizmo to the belt.



9 Make sure Angle Snap is on and rotate the gizmo 90 degrees on the Z axis (blue axis) so that the green seam is at the back.

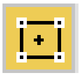


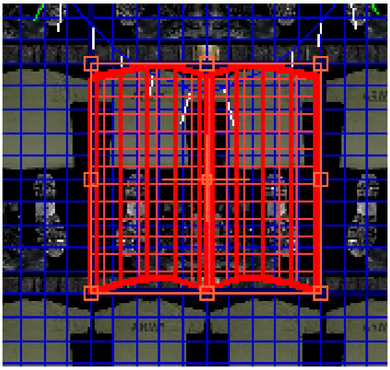
10 On the Map Parameters rollout, click the Fit button to fit the gizmo to the belt.

11 Click the Cylindrical button to turn it off.

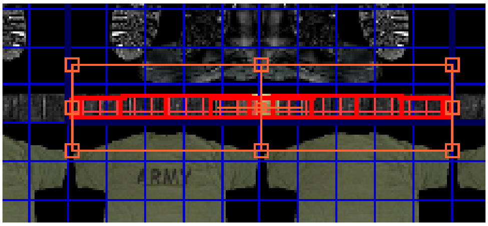
12 At the bottom-right corner of the Edit UVWs dialog, click the Options button.

13 In the extended group that appears, set the Brightness value to **1** to get a better view of the background.

14  On the Edit UVWs toolbar, click the Freeform mode tool.

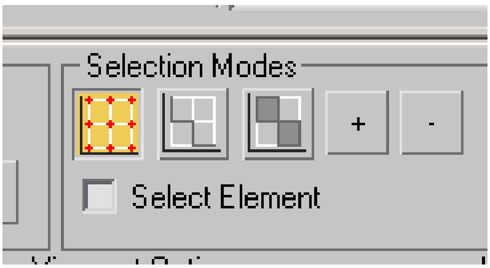


15 Make a preliminary adjustment using Scale (cursor on the corner control points) and Move (cursor inside the selection) to position the selected faces over the belt in the background image.

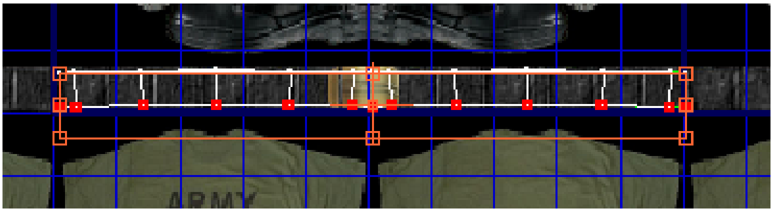


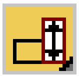
16 Press F3 to return to shaded display mode.

17 On the Edit UVWs dialog, switch the selection mode to Vertex.



18 Select all the bottom vertices on the belt line.

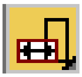


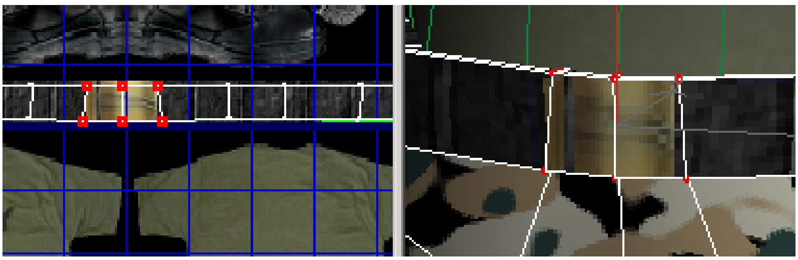
19  From the Edit UVWs window's main toolbar, open the Scale flyout and choose the Scale Vertical tool.

20 Place your cursor on one of the selected vertices then click and drag down to straighten the belt line.

21 Select the upper belt line and straighten it as well.

22 Select the vertices around the buckle.

23  Using Scale Horizontal and Move, adjust the vertices to get a better-looking buckle in the viewport.



24 Close the Edit UVWs dialog when done.

25 In the modifier stack, exit the sub-object level.

26 Save your file as **my_pilot_pants.max**.

Summary

This tutorial has introduced you to several mapping methods using the Unwrap UVW modifier. You have used simple mapping techniques such as planar and cylindrical, as well as more elaborate techniques such as pelt mapping to seamlessly wrap textures around objects. These tools can be adapted to the task of mapping any object in 3ds Max.

Using Shellac to Create a Skin Material

Human skin is difficult to simulate in computer graphics because it reflects light from a short distance beneath the surface, rather than directly at the surface. In this lesson, you'll learn how to use the Shellac material to create a material that closely resembles skin.

Skill level: Intermediate

Time to complete: 20 minutes

Creating a Skin Material

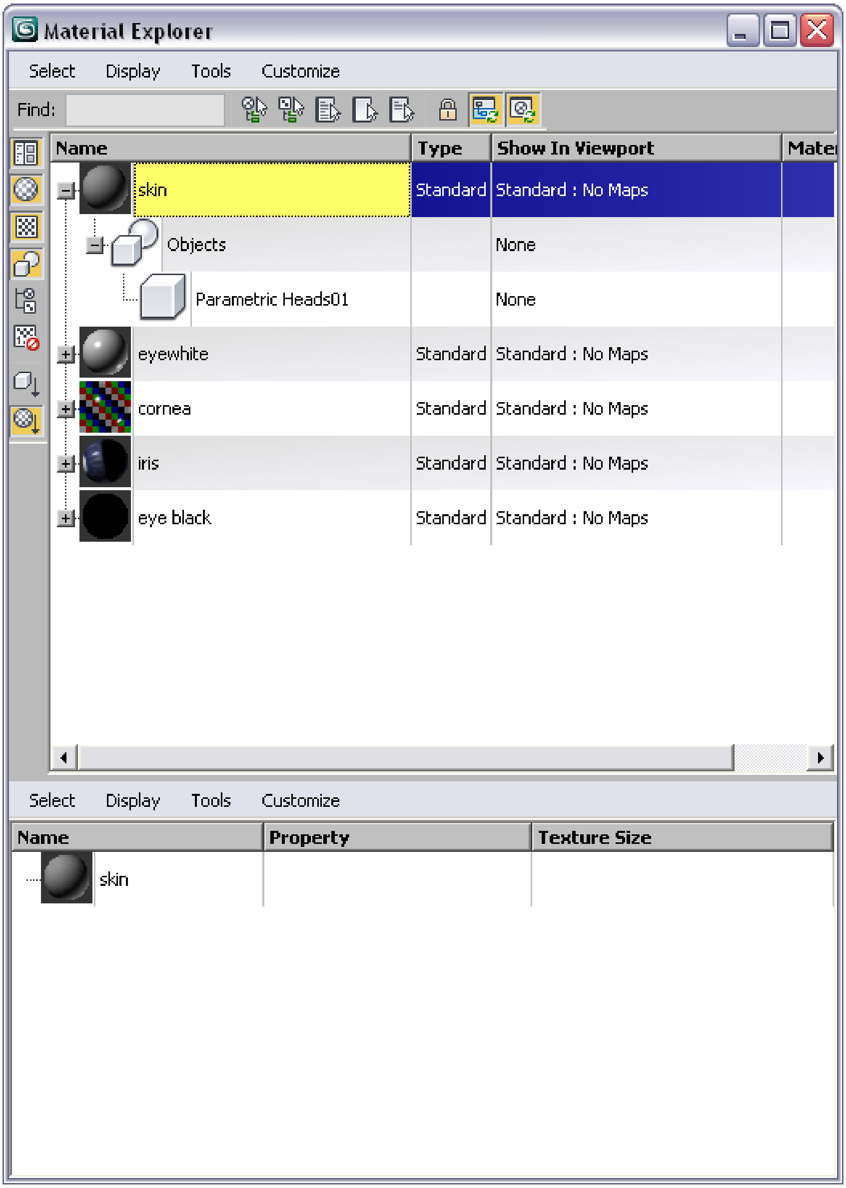
Set up the lesson:

-  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\skin_material* and open the scene file *skin_material_start.max*.

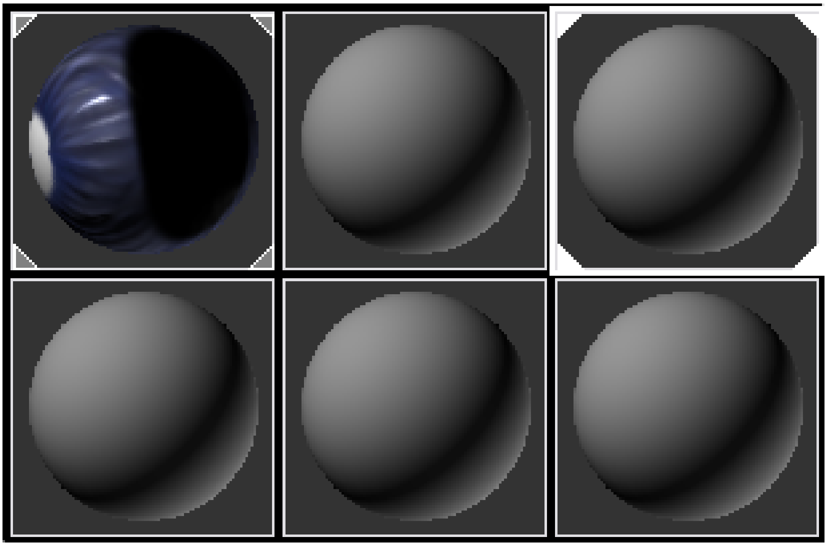
Create the skin material:

1.  Open the Material Editor.
2. Choose Rendering > Material Explorer. Move the Material Explorer so it is side-by-side with the Material Editor.

   The Material Explorer is a tool new to Autodesk 3ds Max 2010. Unlike the sample slots, whose number is limited, the Material Explorer lets you browse and manage all the materials in a scene.
3. On the upper panel of the Material Explorer, click the + icon next to the *skin* material so you can see which objects *skin* is assigned to.

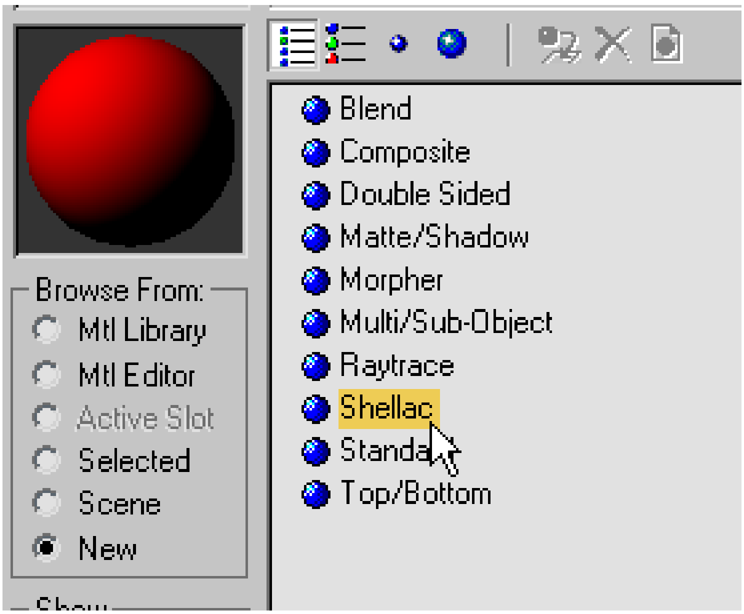


4 Drag the icon of the *skin* material from the Material Explorer to an unused sample slot in the Material Editor; for example, the third slot.



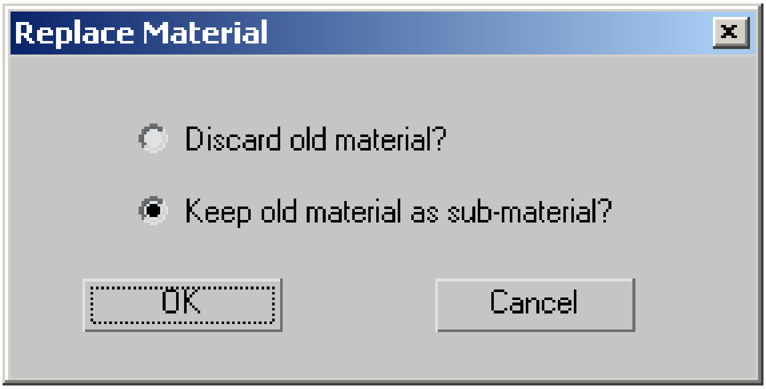
5 Close the Material Explorer.

6 In the Material Editor, click the Type button (at present labeled "Standard"), then in the Material/Map Browser, double-click Shellac.



Shellac is a special material that superimposes one material over another so that you can see through the upper material to the lower one. This capability is well suited to simulating human skin.

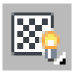
7 On the Replace Material dialog that displays, click OK to keep the old material as a sub-material.



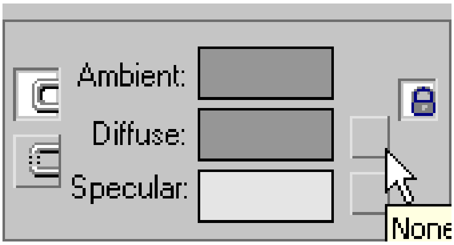
8 Name the material **Skin**.

Choose a map for the base skin material:

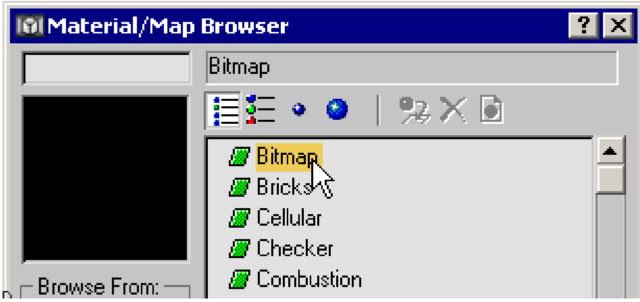
1 On the Shellac Basic Parameters rollout, click the Base Material button.

2  Click the Show Map In Viewport button to turn it on.

3 On the Blinn Basic Parameters rollout, click the map button to the right of the Diffuse color swatch.



4 In the Material/Map Browser, double-click Bitmap.

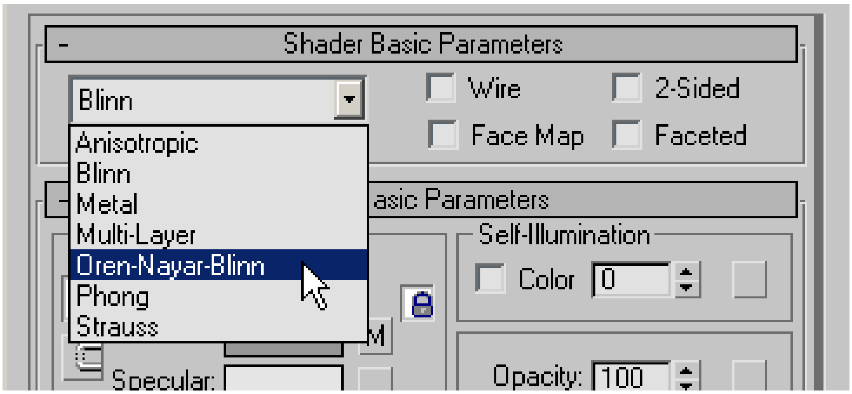


5 In the file selector dialog, choose the file *skin_tile.jpg*. This file is in the folder *\sceneassets\images*.

6 Click Open.

Adjust the shading for the base skin material:

1  Click Go To Parent, and change the Material's shading type to Oren-Nayar-Blinn.

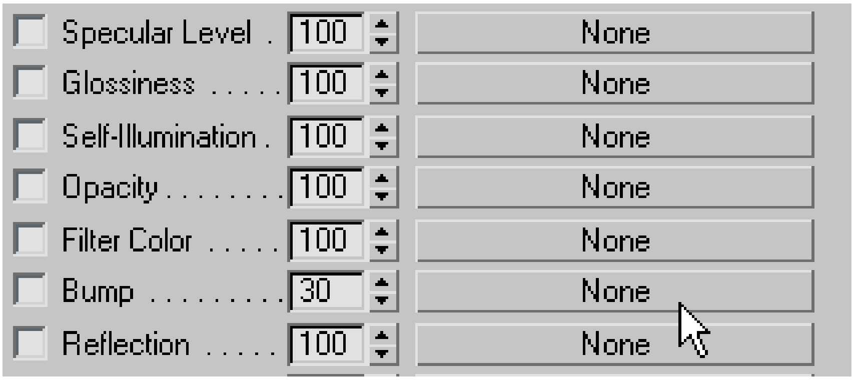


2 In the Oren-Nayar-Blinn Basic Parameters rollout > Specular Highlights group, set Specular Level to **27** and the Glossiness to **11**.

Apply bump mapping for the skin texture:

1 Expand the Maps rollout, then drag the Diffuse Color map button (labeled with the map number and the file name *skin_tile.jpg*) to the Bump map button.

On the Copy (Instance) Map dialog, choose Copy (if necessary), then click OK.

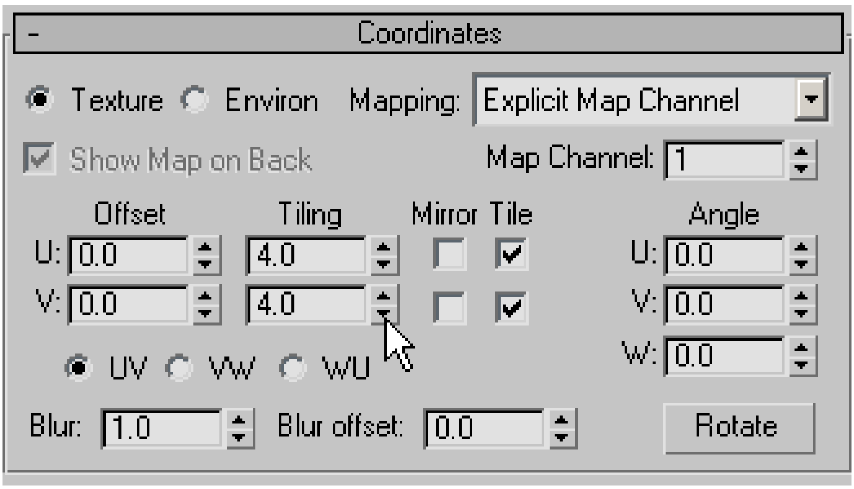


2 Click the Bump map button to open the parameters for the copied bitmap.

Set the tiling for bump mapping:

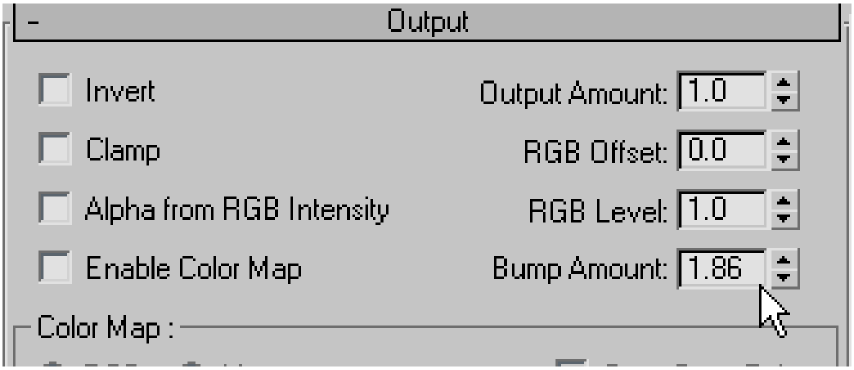
At the default tiling setting, the bump map is a bit coarse; increasing the Tiling values gives the bumpiness a finer grain.

- In the Coordinates rollout, enter **4.0** for both U and V Tiling values.



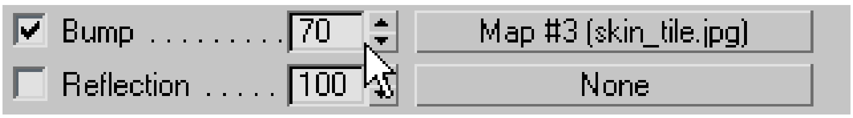
Adjust the amount of bump mapping:

1 Expand the Output rollout, and set the Bump Amount to **1.86**.



2  Click Go to Parent.

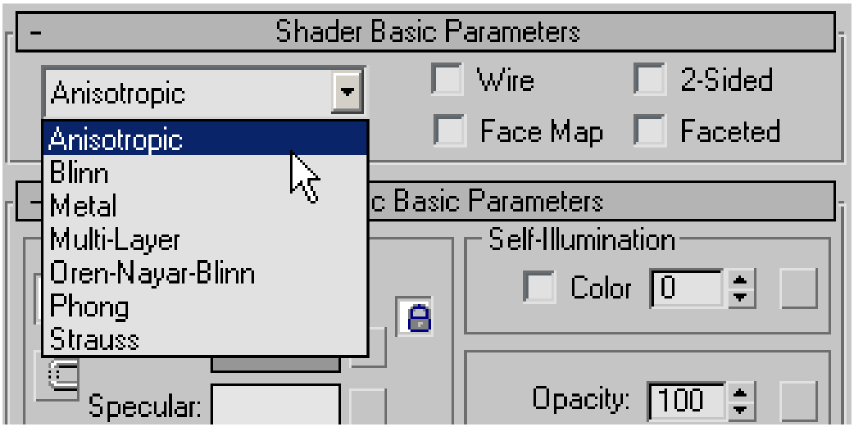
3 In the Maps rollout, change the Bump Amount setting to **70**.



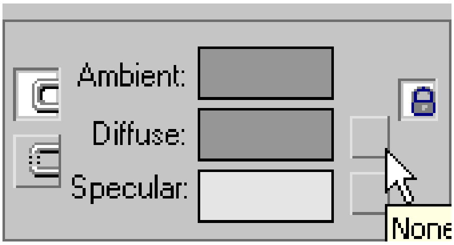
Set up the Shellac material:

1  Click Go To Parent again, and in the Shellac Basic Parameters rollout, click the Shellac Material button.

2 Change the shading type to Anisotropic.



3 Click the map button to the right of the Diffuse color swatch.



4 In the Material/Map Browser, double-click Bitmap.

5 Use the Select Bitmap Image File dialog to open the file *skin_tile.jpg*.

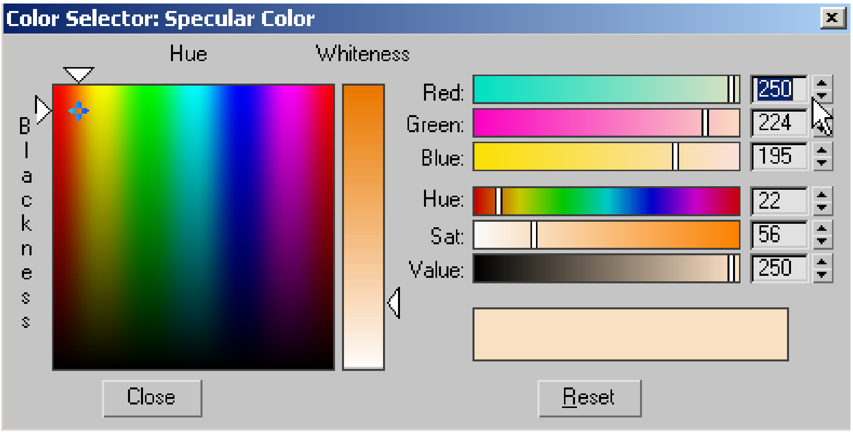
Set the tiling for the Shellac material map:

■ On the Coordinates rollout, enter **4.0** for both U and V Tiling values.

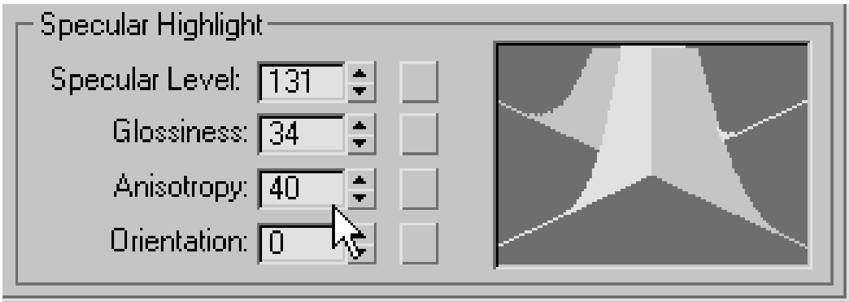
Adjust the specular highlights for the Shellac material:

1  Click Go To Parent, then click the Specular color swatch.

2 In the Color Selector, change the color to a light skin tone: Red: **250**, Green: **224**, Blue: **195**, then click OK.

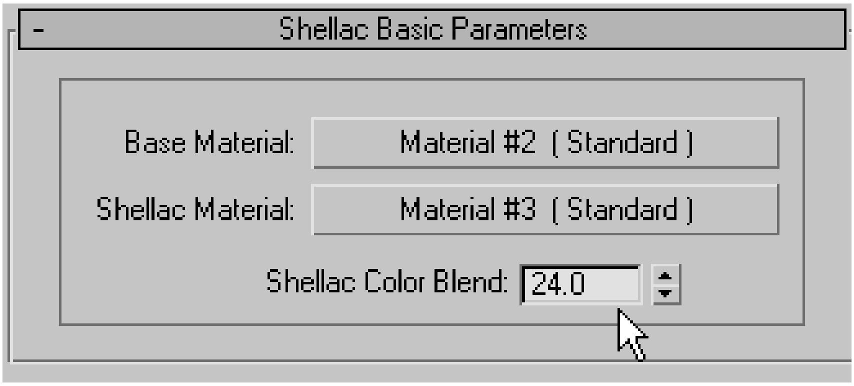


3 In the Specular Highlight group, set Specular Level to **131**, Glossiness to **34**, and Anisotropy to **40**.



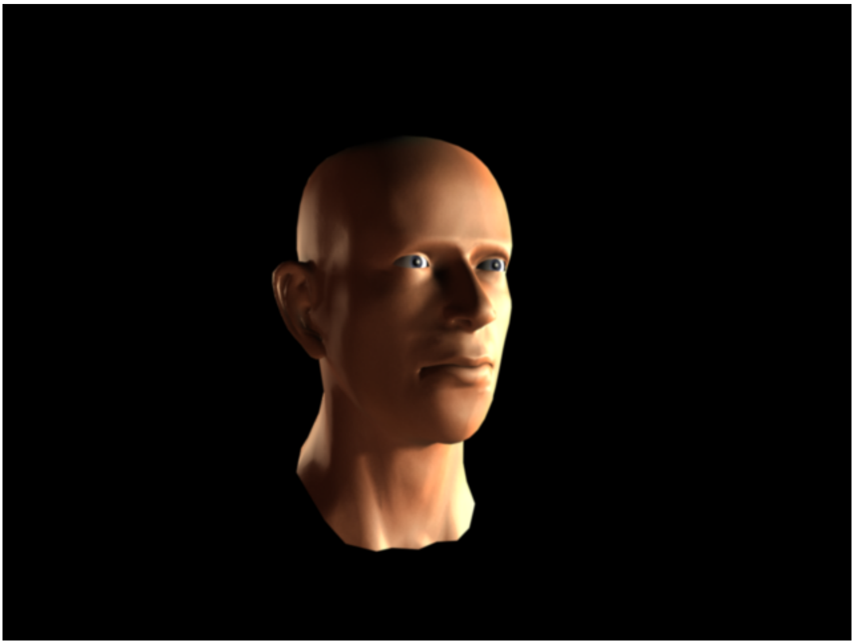
4  Click Go To Parent, and set Shellac Color Blend to **24**.

This gives the Shellac Material component a small but significant role in the look of the composite material.



5 Save the scene as **skin_material.max**.

6 Render the Camera01 viewport to see the result.



You can see a version of the finished scene in *skin_material_finished.max*.

Summary

You've created a realistic-looking skin material. Try changing the parameters and components and re-rendering to see how they affect the material. In particular, try changing the Shellac Color Blend setting to blend different amounts of the Shellac Material component into the overall material.

Vertex Color and Interactive Shading

Interactive and immersive environments such as those required in interactive games require that the scene artists employ variety of techniques to make the modeling and texturing as realistic as possible, while making sure it is “lightweight” enough to update efficiently in the display system. Minimizing polygon counts in models are discussed elsewhere, but these tutorials focus on how to “bake” textures, shading and lighting effects directly into the geometry of your scene.

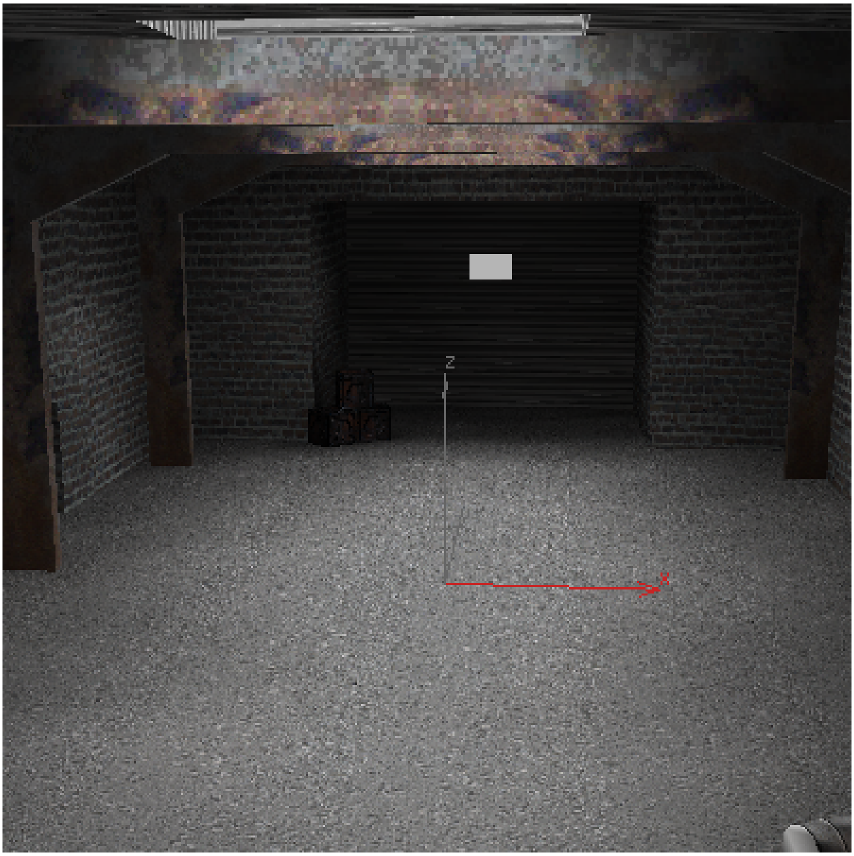
Games professionals will want to familiarize themselves with the options 3ds Max gives them to manipulate vertex color and interactive shading.

Features Covered in This Section

- Setting luminance and calculating a radiosity solution.
- Baking a radiosity solution into a vertex paint layer.
- Adjusting blur effects using VertexPaint to paint scene objects.
- Animating paint layers for dynamic lighting effects.
- Baking scene elements into textures.

Painting Vertex Color

In this tutorial, you will load in a scene of a garage, a typical games environment. You will take the lighting information in the form of a radiosity solution and learn to “bake” the radiosity into Vertex Paint modifier layers. You'll also get a chance to explore painting on multiple layers and animating the layer opacity to create the illusion of flickering fluorescent tubes in the scene.



In this tutorial, you will learn how to:

- Generate radiosity solutions using Advance Lighting Override Materials.
- Add radiosity into Vertex Color.
- Use Blur selected to correct lighting problems.
- Paint vertex color on layers.
- Animate layer opacity to create flickering lights.

Skill level: Intermediate

Time to complete: 20 minutes

Adding Radiosity to Vertex Color

You can take the lighting information from your file and add it to the vertex color information. In this exercise, you will open a scene of a garage, a typical game environment. The skylights and fluorescent tubes in the garage have advanced lighting override materials applied to them. You will calculate a radiosity solution then “bake” it in the vertex color channels using the Assign Vertex Colors Utility.

Radiosity with advanced lighting override materials

Set up the tutorial:

-  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\vertex_color* and open the scene file *tut_vertexpaint_garage_start.max*, and open it.

This file has been prepared so that it has advanced lighting override materials placed on the fluorescent tubes, the overhead skylights, the hanging lamp, and the rear red skylight in the back of the garage. First, you will adjust the luminance scale on these materials.

Adjust the Advanced Lighting Materials:

1. Open the Material Editor.

   If you only see six material slots, do the next step.

2. On the Material Editor Options menu, choose Options and set Slots to 5 x 3.

   Now you should be able to see 15 material slots.

3. Find and highlight the *Skylight* material.
4. Increase the Luminance Scale from 500 to **12000**.
5. Select the *Cone_Light* material and increase the Luminance Scale from 5000 to **10000**.
6. Select the *Fluorescent_Light* material and increase the Luminance Scale to **10000**.

   The Advanced Lighting Override Material will give the illusion that the objects are casting lighting in the scene. By increasing these Luminance Scale values the garage will become more brightly lit, once the radiosity is solved.

   NOTE This tutorial does not use Exposure Control. Generally, when working with radiosity, you can turn on Logarithmic Exposure Control for best results.

   Next, you will calculate the radiosity solution.

Calculate the radiosity solution:

1. On the Rendering menu, choose Render Setup.
2. On the Render Setup dialog, click the Advanced Lighting tab.

3 On the Radiosity Processing Parameters rollout, make sure Display Radiosity In Viewport is turned on and Initial Quality is set to **70** percent, then click Start.

The Radiosity solution is created, and the viewport displays the shadowing created using the advanced lighting.

Radiosity displayed in viewport

You'll now repeat the technique you just used one more time.

4 In the Material Editor, select the material named *Red_Light*.

5 In the Special Effects group, increase the Luminance Scale to **40000**.

6 Close the Material Editor.

7 The Radiosity Processing Parameters rollout displays a message indicating that the Solution is invalid at the current time frame. Click Reset then click Yes to confirm.

The viewport updates to reflect the reset Radiosity.

8 Click Start again.

The radiosity solution calculates then displays in the viewport. The red light color is now splashed prominently on the back walls.

Red skylight color increased

Next, you will take the radiosity lighting information and add it to the vertex color information by using the Assign Vertex Color utility. This will create a vertex paint layer that you can manipulate.

Bake radiosity into the vertex paint layer:

1 On the toolbar Named Selection Sets drop-down list, click the down arrow and choose *VertPt_set* from the list.

  This selects all the objects in the scene, except for the lights.

2  On the Utilities panel, choose More > Assign Vertex Colors.

3 In the Assign Vertex Colors rollout, leave the Channel set to Vertex Color.

4 Make sure in the Light Model group that Lighting + Diffuse is turned on.

5 In Color assignment, turn on Color By Vertex, if it isn't already selected.

6 In the Rendering Options rollout, make sure Mapping is on, and choose Radiosity, Reuse Direct Illum. From Solution.

7 Click Assign To Selected.

  The Radiosity information is assigned object by object throughout the scene. You will see each object update in the viewport.

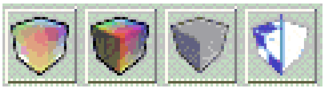
The vertex information has been applied to the geometry, but the vertex isn't properly displaying it yet. To see the vertex color information, you'll use the floating vertex paintbox.

8 On the Utility panel > Assign Vertex Colors rollout, click Edit.

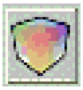
   The floating vertex paintbox appears, and the Modify panel is now displayed instead of the Utility panel. The VertexPaint modifier is now visible in the stack. It appears in italics, indicating that it is an instanced modifier, shared by several objects in the scene.

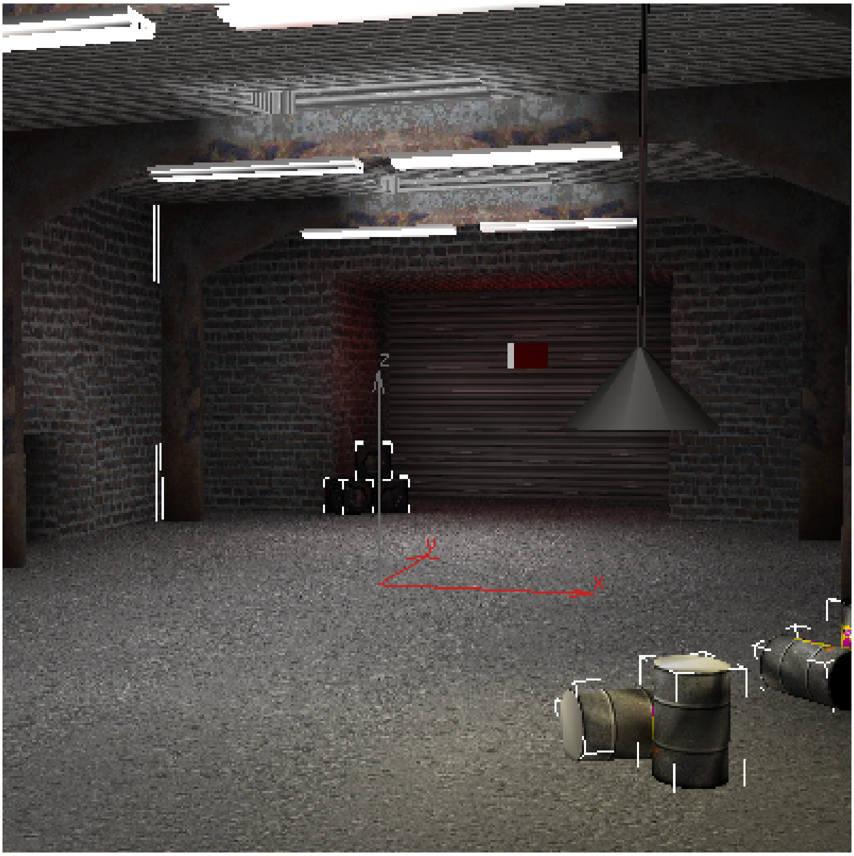
Display the vertex color in the viewport:

At the top of the paintbox, a row of buttons allow you to control the viewport display as you work.



TIP It's important to understand these modes. Otherwise, you may find yourself painting over elements hidden in the viewport.

1  Click the Vertex Color Display – Unshaded button.



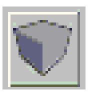
Unshaded vertex color displayed

The viewport now displays the vertex color without the viewport lighting.

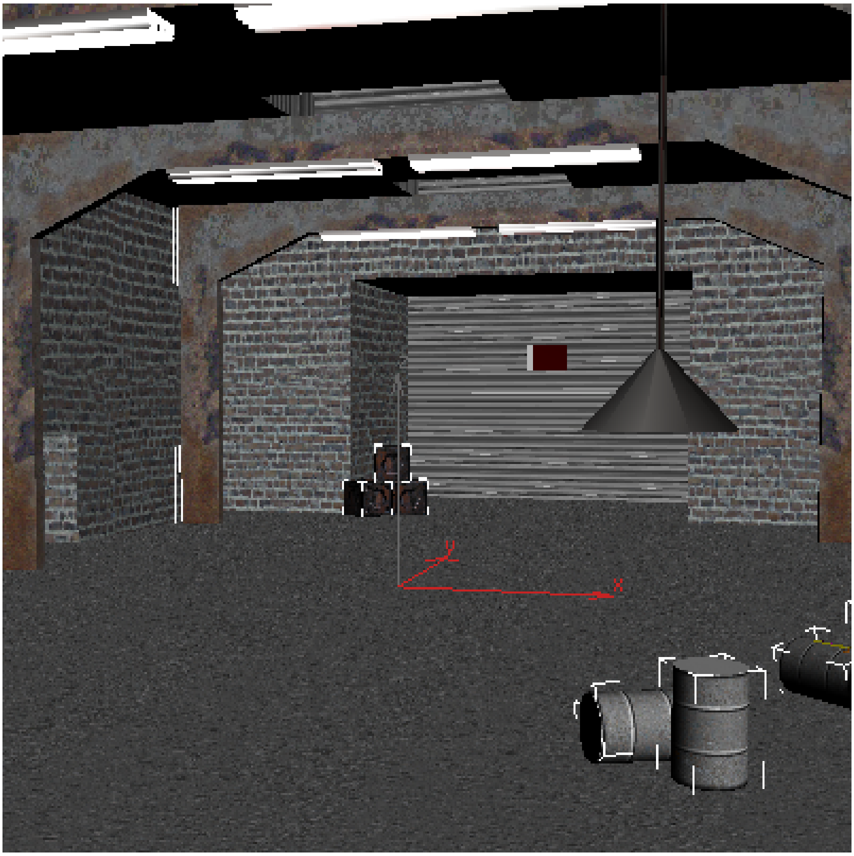
2  Click the Vertex Color Display – Shaded button.

Shaded vertex color mode

The viewport now displays the vertex color *with* the viewport lighting.

3  Click the Vertex Color Display Vertex Color button.

The vertex color is hidden.



Vertex color disabled

4  Turn Vertex Color Display – Shaded on.

This is the mode you will use when you do your vertex painting.

In the next section, you will explore using the vertex paint tools to blur shadows, adjust color and paint directly on the garage floor using multiple vertex color layers. But first you should save your work.

5 Save your file as **mygarage_vertexcolor01.max**.

Painting the Garage with VertexPaint

Now you will explore the vertex paint modifier tools.

Set up the tutorial:

- Continue from the previous exercise, or open *\materials_and_mapping\vertex_color\tut_vertexpaint_garage_blur.max*.
  If you are opening the provided file, select the *VertPt_set* from the toolbar Named Selection sets list. On the Modify panel, display the floating vertex paintbox by clicking the Edit button.

Blur the shadows:

1 Use the ViewCube as well as the pan and zoom controls to look at the skylights and fluorescent fixtures. Look up at the ceiling from the center of the room. You may notice the lighting information around the skylight is a bit coarse.

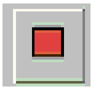
Problems on the ceiling

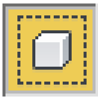
It's easy to smooth this out using the blur command.

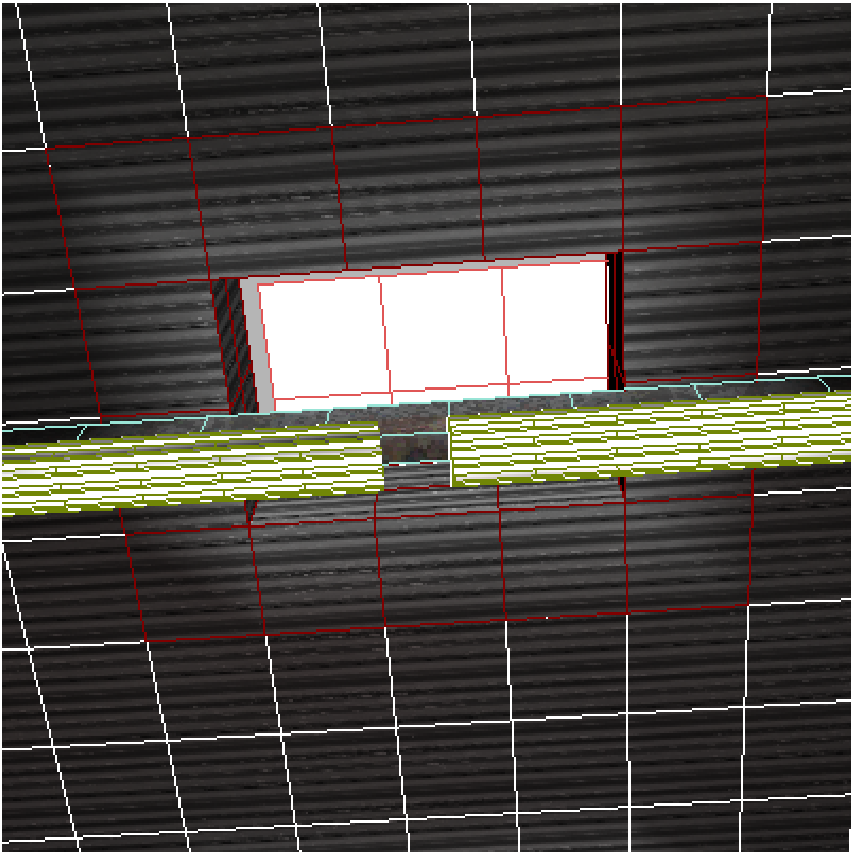
2 Click the Perspective viewport label and choose Edged Faces.

3 Press the H key on the keyboard and select the *GARAGE_WALLS* object from the list.

Next you'll select the faces that need work.

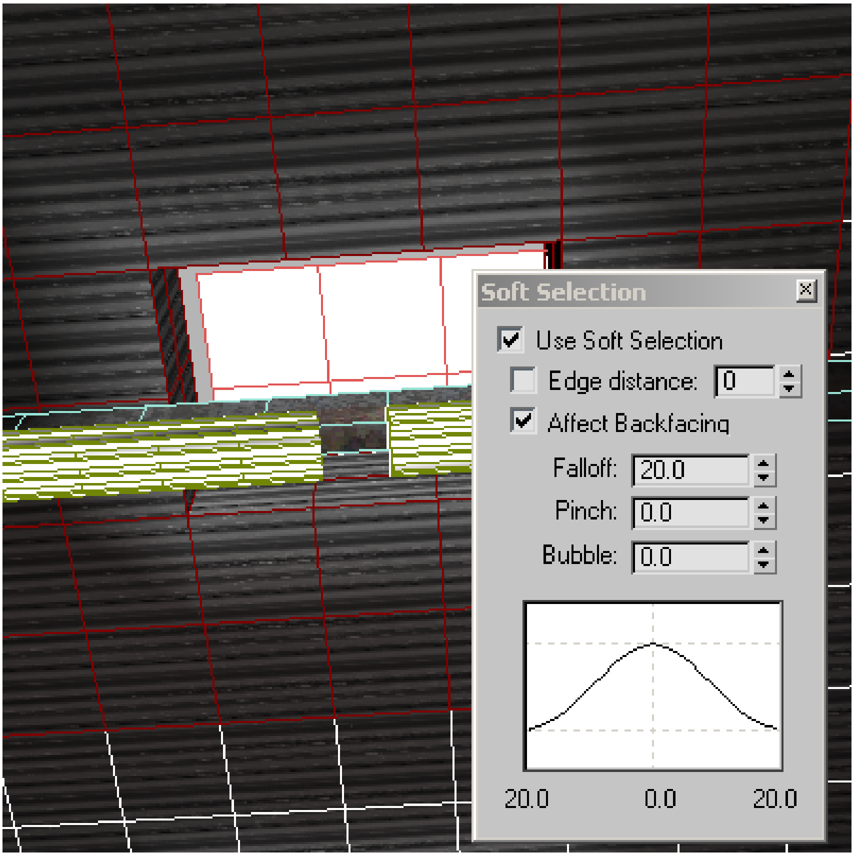
4  On the Parameters rollout in the Selection group, turn on Ignore Backfacing, then click the Face Selection button.

5  On the toolbar, turn on Window selection, then drag a selection rectangle around one of the skylight areas.



You can use Soft selection for the blur operation since you want to make sure the blur happens smoothly.

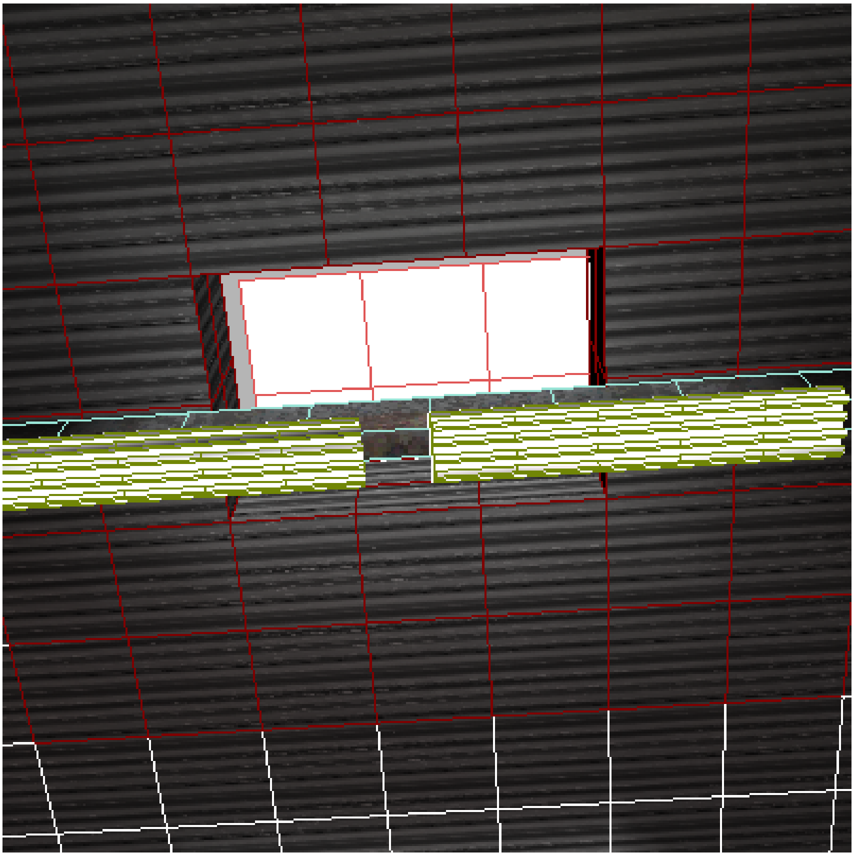
6 On the Parameters rollout, click the Soft Selection button, then in the Soft Selection dialog, turn on Use Soft Selection.



Use Soft Selection

7 On the Vertex Paintbox, click the Blur All button to blur the selected area.

The lighting is smoothed out in the ceiling.



Blur applied to ceiling faces

If you like, you can repeat the blurring procedure on the roof areas surrounding the other two skylights.

8  From the Application menu, choose Save As to save your file. Use the plus button to save to an incrementally named scene.

Paint additional layers:

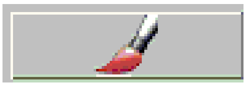
You can add as many layers as you want. Each layer is applied as another VertexPaint modifier in the stack. These layers can be adjusted or animated individually.

1  On the vertex paintbox, click New Layer. Accept the default setting in the dialog that appears, then click OK.

   A second modifier is added to the stack.

2 Click the top face of the ViewCube and zoom in to the scene so you can see the floor of the garage.

3 Click the color swatch next to the Pick Color From Object (eyedropper) button, then choose a bright yellow from the color selector.

4  Click the Paint button, then move your cursor over the garage floor and paint.

Painting a second layer

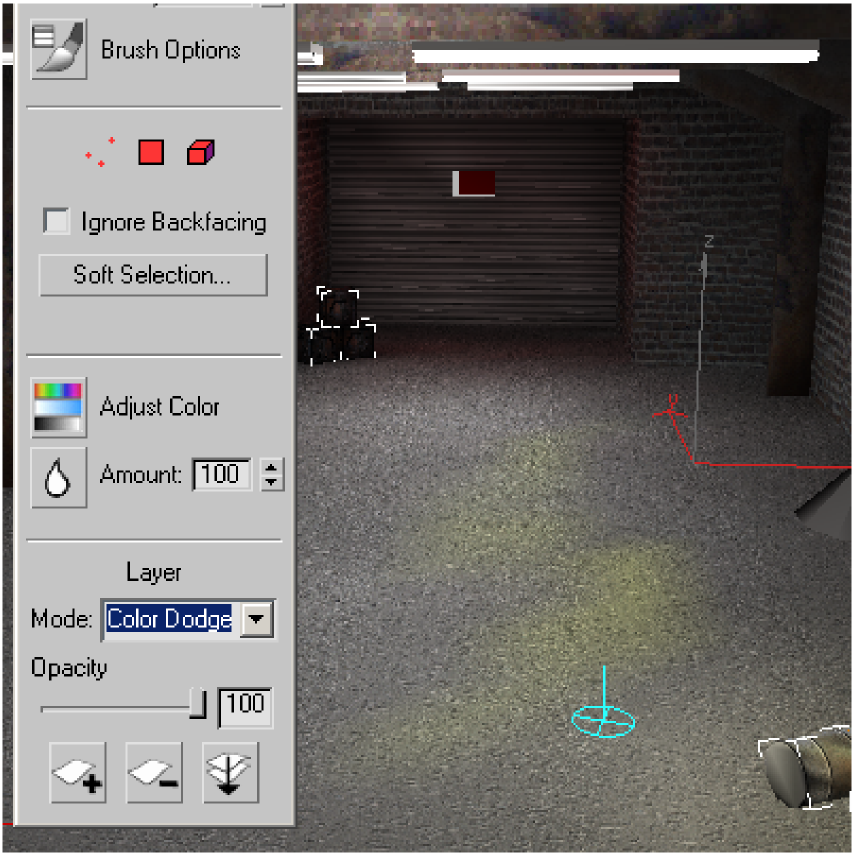
This paint layer is very versatile. In the next few steps, you'll see some of the adjustments you can make to this layer.

5 Change the opacity of the Layer by dragging the Opacity slider to the left.

6 Change the Mode. Click the drop-down arrow and choose Color Dodge, then set the opacity back to **100**.

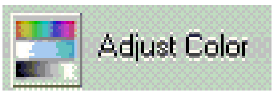
This creates the effect of a washed out spot on the floor.

7 Click Home in the ViewCube to view the scene from its default perspective.



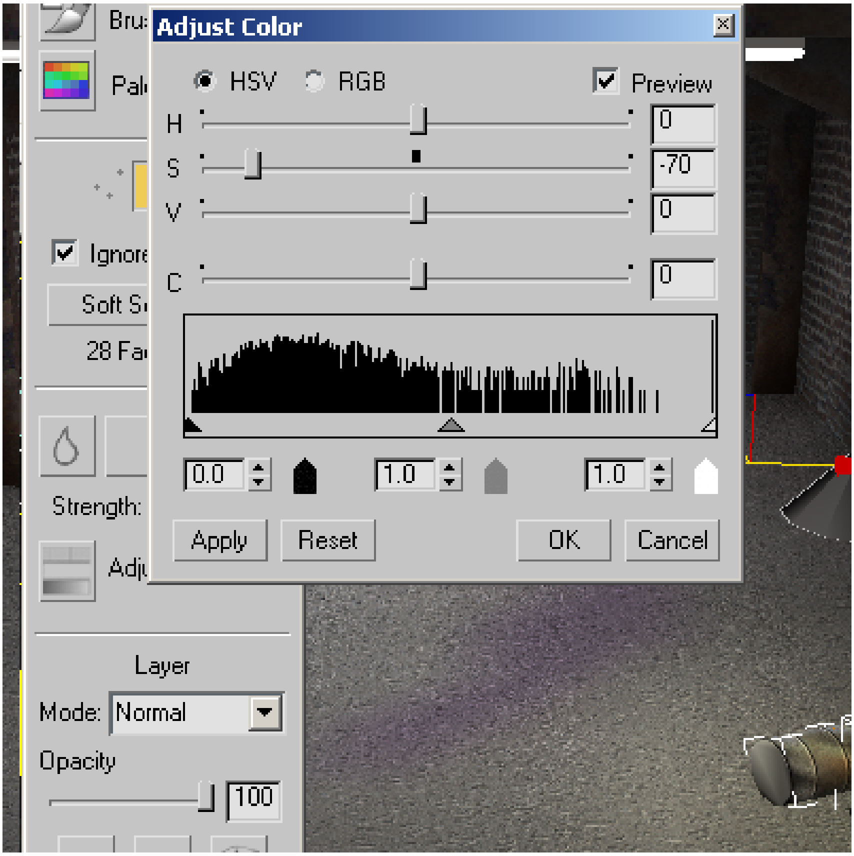
You can use the Adjust Color command to change the Hue, Saturation or Value.

8 Change the mode from Color Dodge back to Normal and change the opacity to **39**.

9 

Click the Adjust Color button. In the Adjust Color dialog, drag the hue slider to change the color. Click Apply.

10 Drag the Saturation slider to the left to produce a more subtle effect. Click Apply, then click OK to close the Adjust Color dialog.



11  From the Application menu, choose Save As. Use the plus button to increment the name to **mygarage_vertexcolor03.max**.

Animating Vertex Paint Layer Opacity

In this lesson you will separate the lighting information from the individual objects onto independent layers. We'll show you how it's done, then you will load a file that has the work completed.

You'll create the illusion of a flickering fluorescent tube by animating the opacity value of the vertex paint layer, and then keyframing the material self illumination color.

Set up the lesson:

- Continue from the previous procedure.

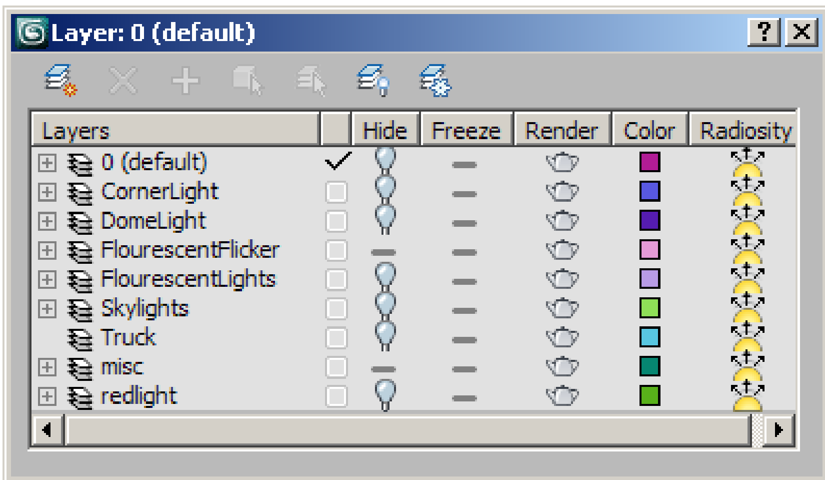
Create separate radiosity layers:

1  With the garage walls still selected, hold down the Ctrl key, then on the Modify panel select the two VertexPaint modifiers in the stack and delete them using the Remove Modifier From Stack button below the modifier window.

You can use the Layer Manager to quickly hide and unhide parts of your scene. You'll hide all the lights but one, then create a radiosity pass for that and bake it into a vertex paint layer.

2  On the toolbar, click the Layer Manager button.

3 On the Layer Manager dialog, click Hide for all the objects except *FlourescentFlicker* and *Misc*.



Layer Manager

Now the only objects visible in the scene are the garage elements and the one fluorescent tube.

4 On the Rendering menu, choose Render Setup. On the Advanced Lighting tab Radiosity Processing parameters group, click Reset. Then click Start.

The radiosity solution is calculated for the light coming from the single fluorescent tube.

5 Zoom out to view the entire scene and click Render.

Radiosity from single fluorescent fixture

Of course, the next step is to create the vertex color layer.

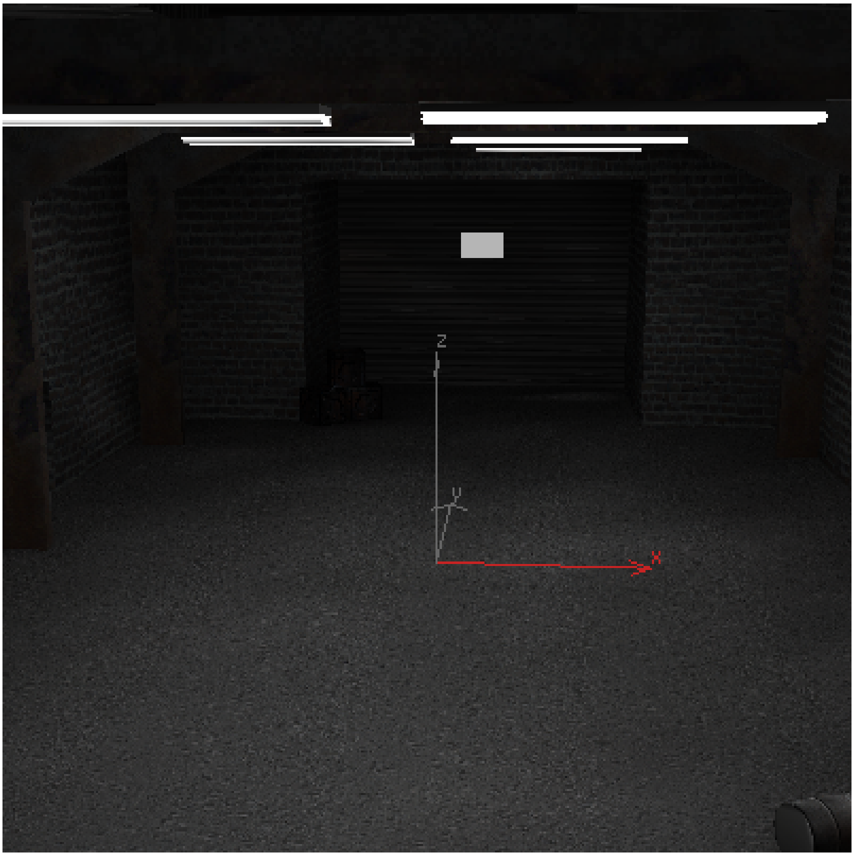
6 On the Utilities Panel, click More > Assign Vertex Colors. Make sure the selection set named*VertsPT_set* is selected, then click Assign To Selected.

The lighting coming from the one fluorescent tube is applied to this vertex color layer.

7 Click the Edit button to jump to the Modify panel.

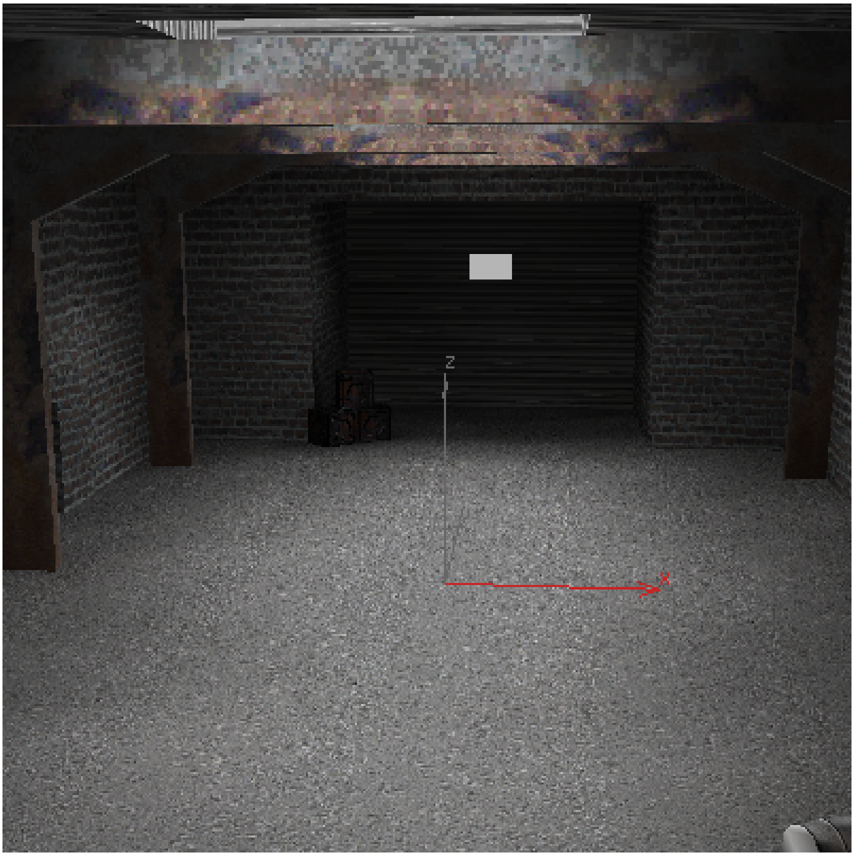
In the Modifier stack, highlight the Vertex Paint layer and right-click, then rename it *VertexPaint Flicker*.

8 Repeat the procedure for another light layer. On the Layer Manager, unhide the layer named *Fluorescent Lights*, and hide the layer named *Fluorescent Flicker*. Repeat steps 4 to 7 to reset radiosity, create a new radiosity solution, and assign it to the newly-created vertex color layer.



Radiosity for the rest of the fluorescent tubes.

You could do the same for the skylights.



Radiosity for the skylights

We've provided a finished file that has all the work done for you.

9 Save your file if you wish, then open *tut_vertexpaint_anim_start.max* to continue.

Animate the layer opacity:

Now you can create the illusion of a flickering fluorescent tube. The technique you use is simple. You select the layer with the lighting information, then in

Auto Key mode, keyframe the opacity of the layer. You'll then complete the illusion by keyframing the self-illumination color of the material.

1 In the new file you just opened, look at the modifier stack for the *VertPT_set* objects.

   There are six vertex paint layers in this file.

2 In the modifier stack, highlight *VertPT_Flicker*, then click the Edit button to display the vertex paintbox if it isn't already visible.

3 

Turn on the Auto Key button.

4 Move the time slider to frame 10.

5 On the floating vertex paintbox, move the opacity slider down slightly, then back to **100**.

   This sets a key at frame 10, and frame 0.

6 Move to frame 12 and slide the opacity slider down to **0**.

7 Move to frame 14 and slide the opacity slider up slightly, then back down to **0**.

8 Advance to frame 16 and slide the opacity slider up to **100**.

9 Play the animation in the viewport. The light flickers once.

10 Open the Material Editor and find the *Flourescent_light* material. In the Advanced Lighting Override Material rollout, click the Base Material name.

   The Base material parameters appear.

11 Move to frame 10 and click the Self-Illumination color swatch. Move the whiteness slider toward grey, then back to white.

   The color swatch is outlined in red, to show it is animated.

12 Move to frame 12. Change the Self-illumination color to Black using the Whiteness slider.

   Move to frame 14, and keyframe the color as Black again.

13 Move to frame 16 and keyframe the Self-Illumination back to white.

14 

Turn off Auto Key and close the Material Editor.

15 In the track bar, drag a selection rectangle around the keys. Hold down Shift and drag the keys to make copies so the flickering repeats.

   If you play the animation now, it's a little slow. You can improve the performance by collapsing the layers.

Preserve the flickering layer:

You'll use the Preserve Layer command to keep the animated layer while condensing the remaining ones.

1. On the Parameters rollout, with the *VertPt_Flicker* layer still selected, turn on Preserve Layer.
2. Now highlight the Layer at the top of the stack.
3.  On the floating vertex paintbox, click Condense To Single Layer.

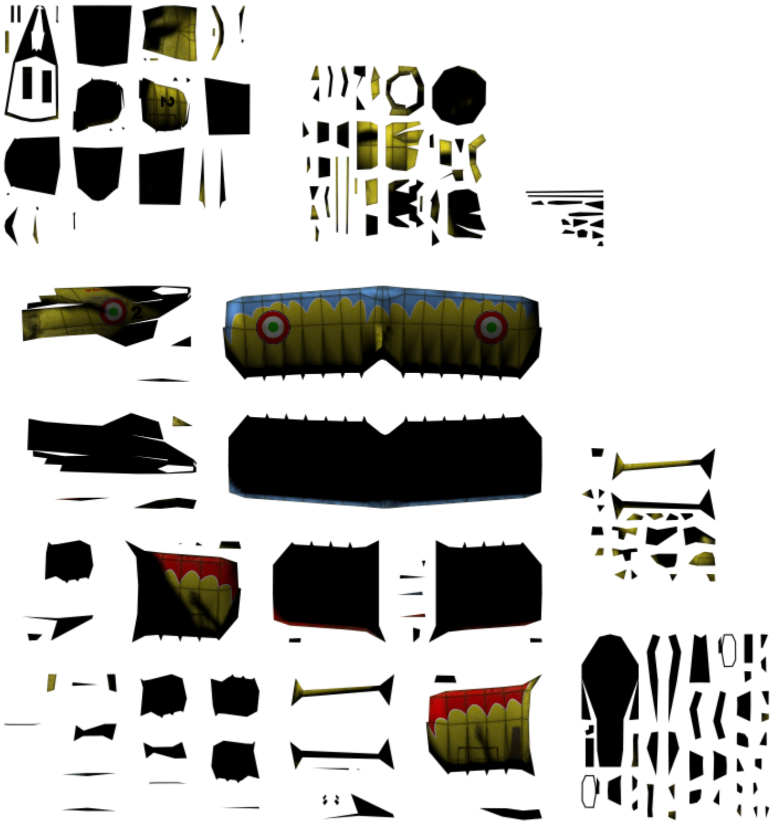
   The five other layers are collapsed into a single layer, while the flicker layer is preserved.
4. In the Modifier stack drag the Flicker layer so it is at the top of the stack, then play the animation in the viewport.

Summary

In this tutorial you have explored the use of the VertexPaint modifier. You have learned to bake radiosity into vertex color using the Assign Vertex Color Utility, and how to add paint layers in the modify panel. You have learned to animate the opacity of the layers to create a flickering lighting effect that can be exported to a game engine.

Rendering to Texture

The Render To Texture tool in 3ds Max lets you render, or "bake," various scene elements into your textures, including lighting and shadows. You can use these special textures in real-time 3D applications such as games to reduce the burden on the renderer, thus improving the frame rate.



In this tutorial, you will learn how to:

- Bake texture maps onto scene objects.
- Use Shell Material to view baked material in the viewports while rendering is taking place.

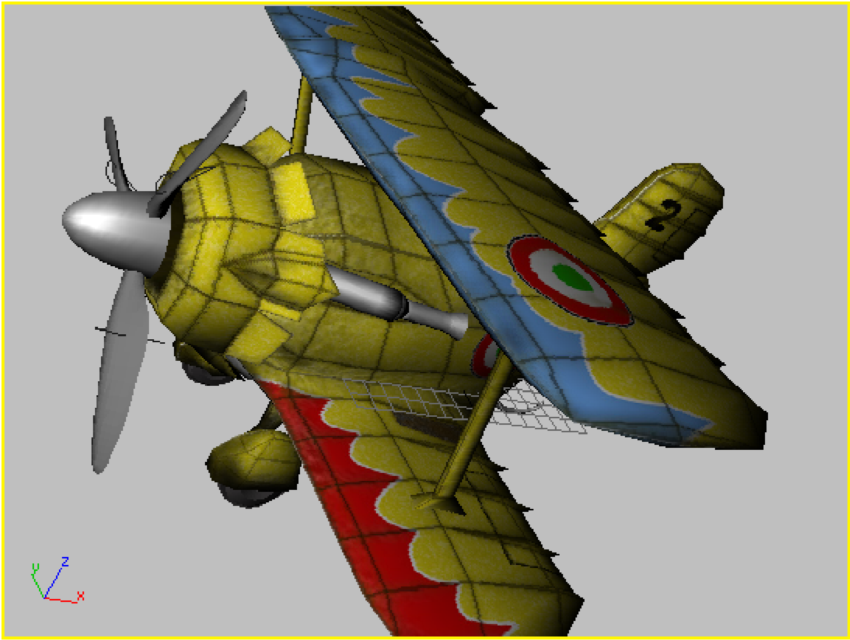
Skill level: Intermediate

Time to complete: 45 minutes

Baking Scene Elements Into Textures

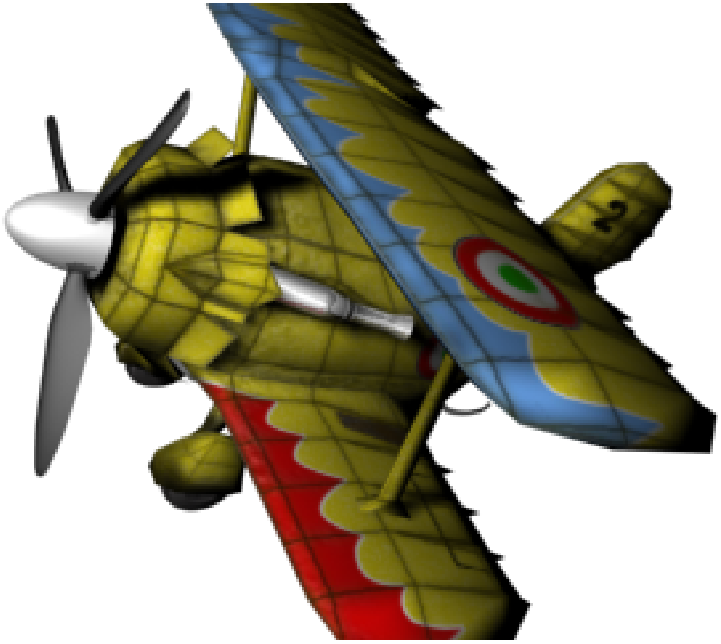
Examine the setup:

1.  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\vertex_color* and open the scene file *tut_texturebake_start.max*.

   The scene consists of a texture-mapped biplane model and a single shadow-casting Omni light. First, you'll see how the scene looks rendered in 3ds Max.

2. Make sure that the Perspective viewport is active. Press F9 to render the scene.



In the rendered image, note the presence of shadows, particularly those cast by the propeller blade and the vertical strut between the upper and lower wings. These shadows however, do not appear in the Perspective viewport.

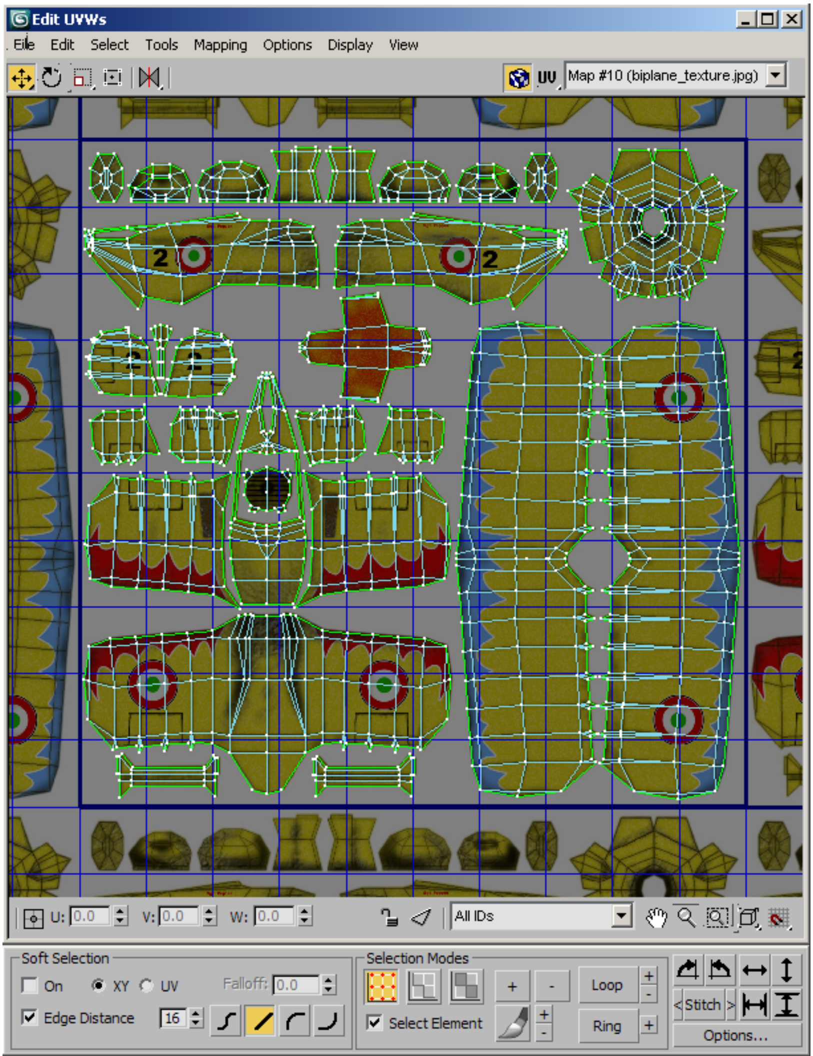
3 Close the rendered frame window.

4 Select the Fuselage object; this is the body of the biplane.

The Fuselage uses an Unwrap UVW modifier for complex and precise texture mapping. Because this is the only texture-mapped object in the scene, you'll concentrate on it for this lesson. First, you'll take a look at the texture.

5 Go to the Modify panel, and in the modifier stack display, make sure the Unwrap UVW entry is highlighted.

6 On the Parameters rollout, click Edit.



This opens the Edit UVWs dialog. You can see how the texture map is divided into various sections, with different face clusters overlaid on each. These face clusters are UVW mapping coordinates that correspond to different parts of the Fuselage mesh.

7 Close the dialog.

8 Press M to open the Material Editor, and note that the fuselage is mapped with a standard material named Fuselage. Close the editor window.

Bake the texture:

1 From the Rendering menu, choose Render To Texture.

   The Render To Texture dialog opens.

2 On the Objects to Bake rollout, note that the Fuselage is the only object listed. Also note that the Selected Object Settings group > Enabled check box is on, and All Selected is chosen. This means that Render To Texture will use any selected objects.

   If you like, try selecting different objects in the Perspective viewport, and note that the Objects To Bake list updates dynamically. Finish by selecting only the Fuselage object.

3 On the Output rollout, click the Add button.

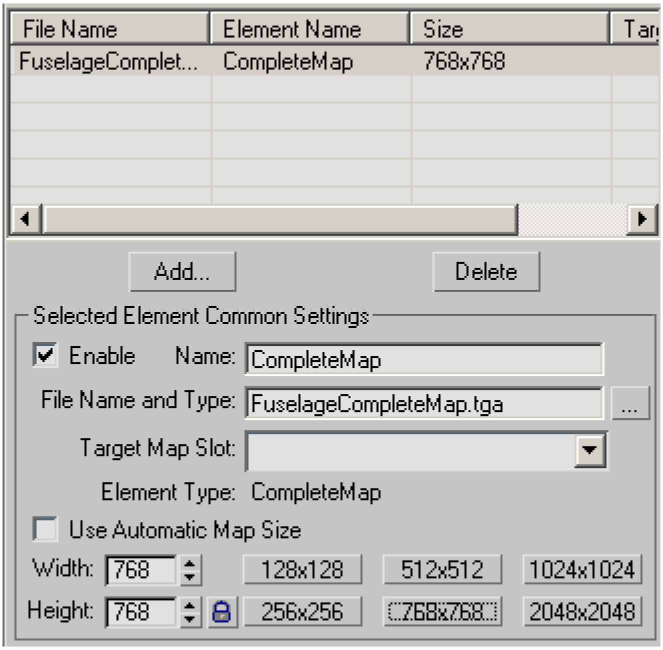
   This opens the Add Texture Elements dialog, with a list of different types of texture elements you can render. Typically, you want to combine all elements into a single texture, so you use CompleteMap.

4 In the Add Texture Elements dialog list, double-click CompleteMap or highlight it, then click the Add Elements button.

5 When you use Render To Texture, the software creates a new material. You must specify where in this new material the rendered texture will go. In the Selected Element Common Settings group, click the drop-down list next to Target Map Slot and choose Diffuse Color.

   CompleteMap appears in the Output rollout list, along with the default texture size to be generated: 256x 256. The original texture map is fairly large, so you'll probably want to render it to a bigger size.

6 Near the bottom of the Output rollout, click the 768x768 button.



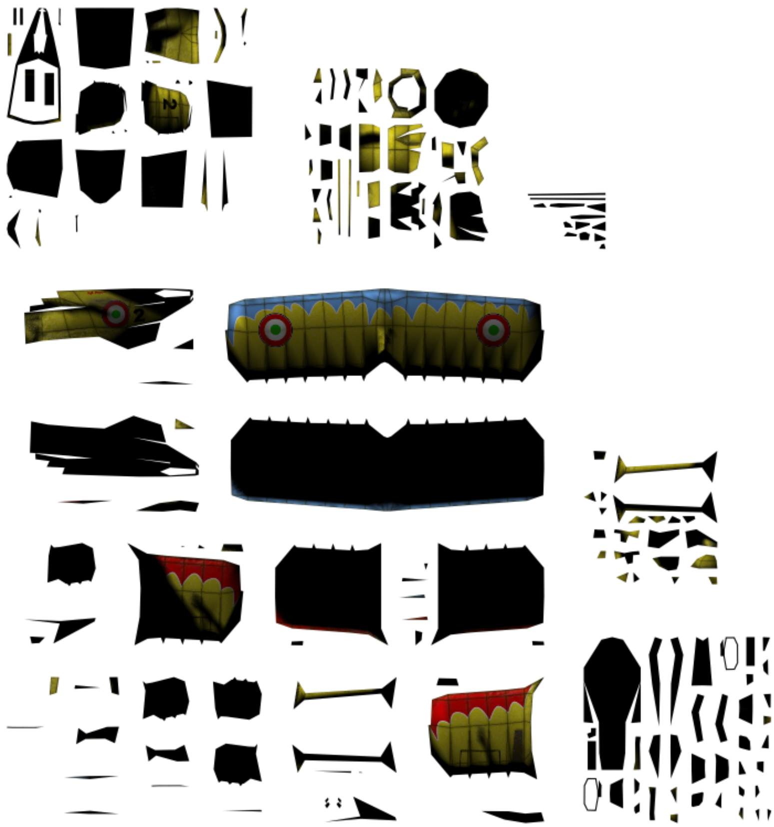
Other sizes are available from the preset buttons, and you can use the Size setting to specify any output size you want.

This size is lower than that of the original texture; using it will help you see the differences between it and the one that Render To Texture generates.

7 In the Name field, change the "CompleteMap" text to **MyCompleteMap**. Press Tab to refresh the dialog.

The name in the output list changes to reflect your edit, as does the File Name And Type entry.

8 At the bottom of the Render To Texture dialog, click the Render button.

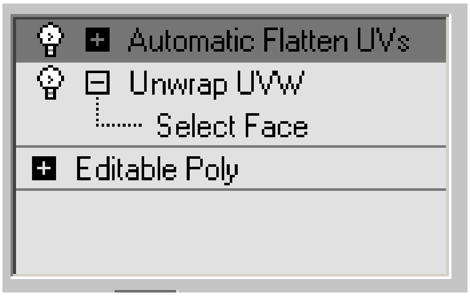


Alerts appear briefly, displaying the progress of flattening UVs and baking the texture, then a virtual frame buffer window opens with the newly rendered CompleteMap texture. This image looks similar to what you saw in the Edit UVWs window, but the texture is subdivided differently.

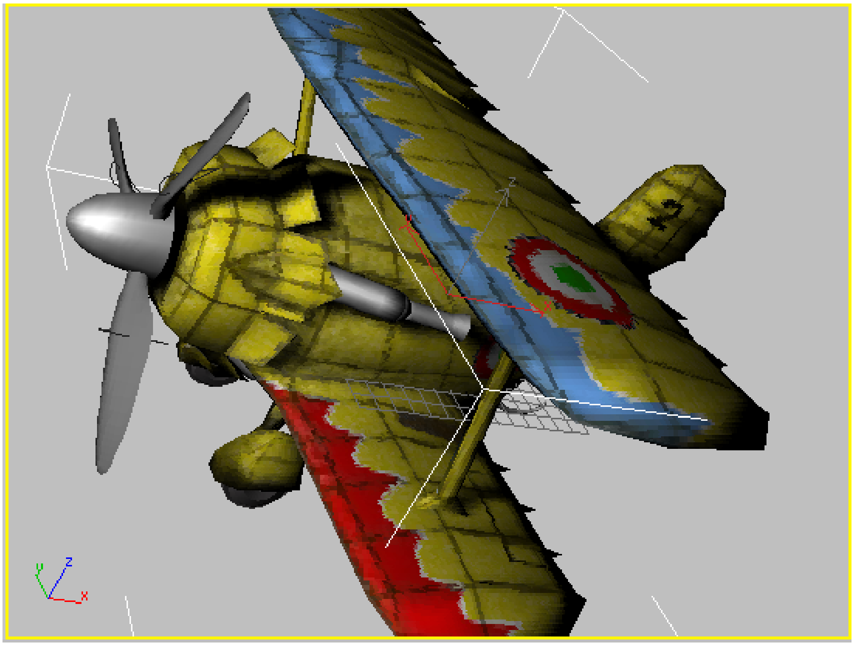
9 Close the rendered frame window, then close the Render To Texture dialog.

Examine the results:

1 Take a look at the modifier stack display, then look at the biplane in the Perspective viewport.



A second modifier, named Automatic Flatten UVs, has been added to the Fuselage. This is an Unwrap UVW modifier, but it was created and applied automatically by the Render To Texture function.



The Fuselage object is still mapped accurately, but the cast shadows now appear in the viewport. For example, if you move the light source, you can see that the shadows cast onto the fuselage from the propeller don't change with as the light source moves, because they're baked into the texture.

You can also see that the texture map as applied to the fuselage in the viewport is of lower quality, but if you render the image, the texture is of its original high quality. In the next few steps, you'll see why.

2 Open the Material Editor once again. Click the first material, which was previously named Fuselage.

The software has renamed the material *orig_Fuselage*.

3  Scroll down to find an unused sample sphere, click it, then click the Get Material button.

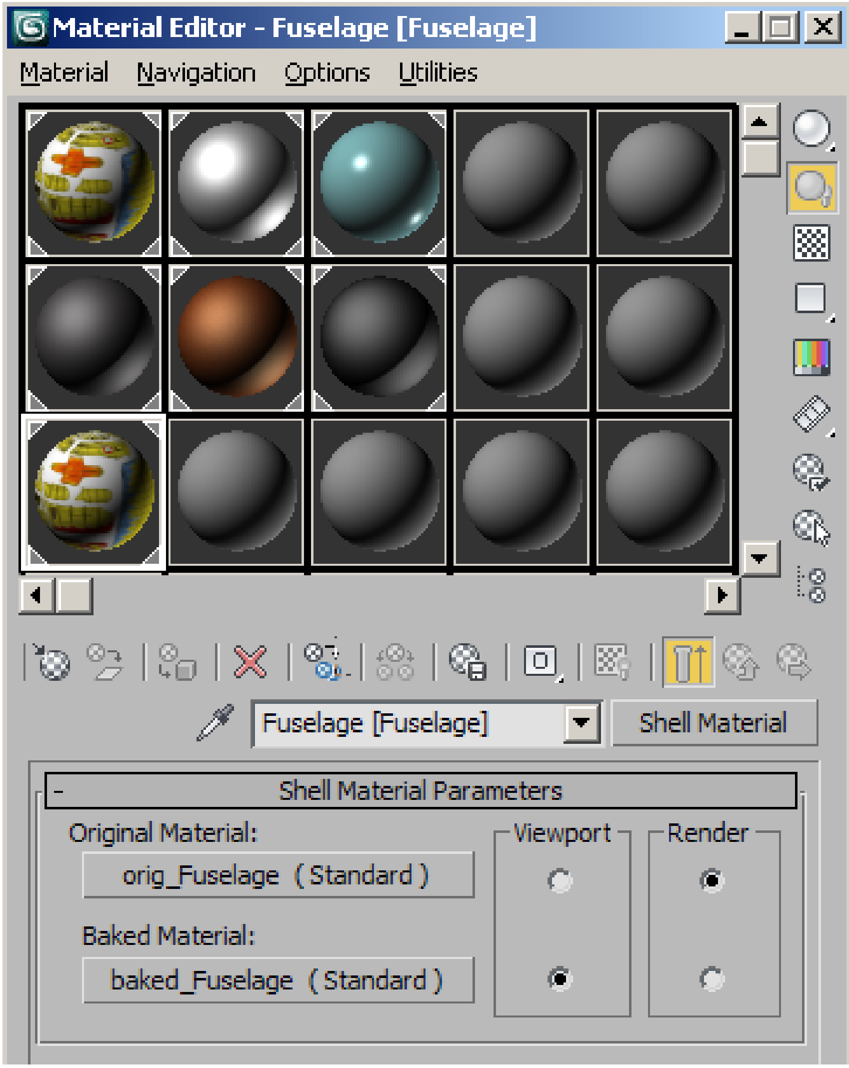
4 From the Material/Map Browser dialog > Browse From group, choose Selected.

A single material now appears in the list. Its name is Fuselage (from the object it's applied to), and the type, Shell Material, appears next to the name. This material was generated automatically by Render To Texture, then applied to the Fuselage object.

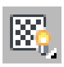
Basically, a Shell material lets you combine two materials into one; you can see one material in the viewports while rendering with the other. When Render To Texture generates a Shell material, it uses the original material for rendering, and the baked material for displaying in the viewports.

5 Double-click the texture in the list to add it in the Material Editor. Close the Material/Map Browser dialog.

You can find the scene to this point in *tut_texturebake_finish.max*.



This material has only one rollout: Shell Material Parameters. It shows that the original material (orig_Fuselage) is to be rendered with, while the baked material (baked_Fuselage, generated by Render To Texture) is to be visible in the viewports.

6  Click the Original Material button, and then, on the Material Editor toolbar, click the Show Map In Viewport button.

This step lets you see the material in the viewport in the next step.

7  Return to the top level of the material, and on the Shell Material Parameters rollout, under Viewport, click the top radio button (next to Original Material).

   In the Perspective viewport, the Fuselage returns to its previous appearance, and the shadows go away.

8 Try moving the light source, then render with the baked texture.

   The original shadows remain where you baked them. Depending on where you position the light source, you might see an additional set of shadows, cast by the light during the rendering.

9 In the shell material, return viewport display to the baked material.

Render other elements:

Besides the CompleteMap, you can render individual elements, one or more at a time.

1 Open the Render To Texture dialog and on the Output rollout, delete the MyCompleteMap element, then add a ShadowsMap element. Set Target Map Slot to Diffuse Color.

2 Click Render.

   The new material is unshaded, except where the shadows fall. You can use this type of texture if your target rendering engine supports compositing multiple textures.

   Note that the rendered frame window still shows the CompleteMap, even though Render To Texture didn't save one. This is always the case, no matter which types of elements you render. You can turn off the automatic display of the frame window on the General Settings rollout.

3 On the Render To Texture dialog, delete the ShadowsMap texture element then add, at the same time, DiffuseMap and LightingMap elements.

   They appear in that order in the list. With multiple textures in the list, you can specify output settings for each by clicking its list entry.

4 In the list, click the DiffuseMap entry, then set Target Map Slot to Diffuse Color.

5 Click Render. When the Missing Map Targets alert appears, click the Continue button.

The Missing Map Targets dialog shows any texture elements that aren't assigned to target map slots.

The new Shell material is created for the first element in the list only, as shown in the Perspective viewport. However, all textures are saved in the target directory. You can see the LightingMap texture in the viewport by deleting the DiffuseMap.

6 Delete the DiffuseMap list entry, set the LightingMap's Target Map Slot to Diffuse Color, then click the Render button.

Render To Texture generates a new material and applies it to the Fuselage, so it is now visible in the viewport. The LightingMap element includes all shading and shadows, but no diffuse coloring.

NOTE Only one texture element at a time can be set to any given target map type. Also, if you add a texture element that was previously assigned a target map type, the software automatically assigns the most recent target map type that it used, if no other active texture element is already using that target map type. If another active texture element is using that target map type, the target map slot for the newly assigned texture element is blank.

Summary

Render To Texture is a versatile tool that can save you time in generating texture maps for real-time applications. In this tutorial you learned how to bake different types of textures, and how to work with the Shell material that Render To Texture generates. Try generating other texture elements, then export them to your real-time 3D engine.

Normal Bump Mapping

Normal bump mapping is a technique that lets you simulate high resolution surface detail on low resolution polygonal models. Normal bump mapping is similar in some respects to regular bump mapping, but it conveys more complex surface detail. Normal bump maps store not only the depth information used in regular bump mapping, but also information on the direction normal of the surface, to produce more life-like results.

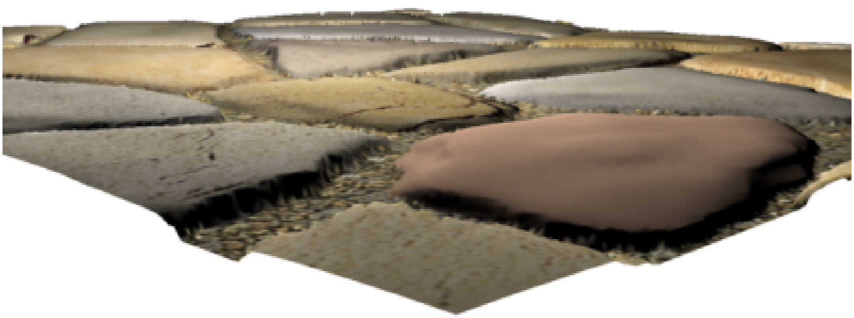
The practical benefits of normal bump mapping were first seen in real-time gaming platforms. The ability, however, to create more realistic detail with fewer polygons is desirable in all areas of digital content creation. 3D artists of every specialty should therefore be familiar with two normal bump mapping techniques: the planar projection method and the cage projection method. Each technique is presented in its own tutorial in this section.

Planar Projection Method

Normal bump mapping involves two objects: a high resolution, polygonally detailed object as the source for the normal bump map information, and a low resolution target to receive the map and use it to appear more finely detailed than it really is.

The objective in this tutorial is to assign the target object, a simple two-dimensional plane, the complex surface detail of the source: a tile of mortared stones.

The texture to be baked onto the plane will consist of a normal bump map, together with a diffuse map. You will then add a height map to give the plane the appearance of depth, and render it in mental ray.



In this tutorial, you will learn how to:

- Set up the map projection using the render to texture controls.

- Define diffuse, normal bump, and height maps and bake the resulting texture onto a destination object.
- Preview the baked result in a viewport.

Skill level: Intermediate

Time to complete: 1 hour

Creating a Normal Bump Map

Set up the lesson:

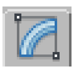
1  On the Quick Access toolbar, click the Open File button and from the *\materials_and_mapping\normal_bump_map* folder, open *pavers.max*.

The scene consists of a source object, a tile of spheres sculpted to resemble rocks set in mortar. Directly above is the target object, a simple two-dimensional plane.

Before you begin this lesson, you should make sure your workstation is set to the default Direct3D display driver. If not, you will not be able to see the bump effect in your viewports.

2 From the main menu, choose Customize > Preferences, and in the Viewports tab > Display Drivers group, make sure Direct 3D is the selected driver.

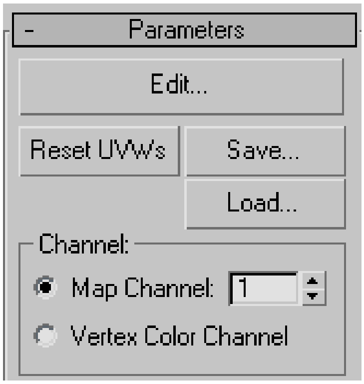
Unwrap the plane object:

1  In any viewport, select the target plane object, and go to the Modify panel.

2 From the Modifier List drop-down, choose Unwrap UVW.

This modifier sets out the mapping coordinates of the plane object, so that the textures of the source object can accurately be projected onto it.

On the Parameters rollout > Channel group, note that the mapping coordinates are automatically stored on Map Channel 1.



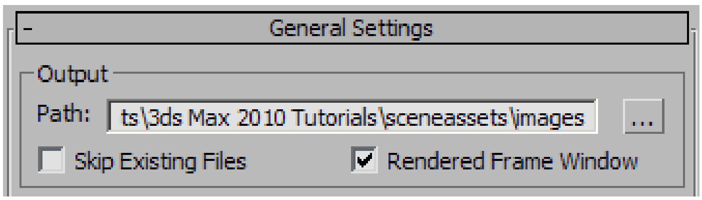
Set up the projection:

Here, you will use the Render To Texture tool to define various projection setup parameters.

1 With the plane object still selected, from the main menu, choose Rendering > Render To Texture.

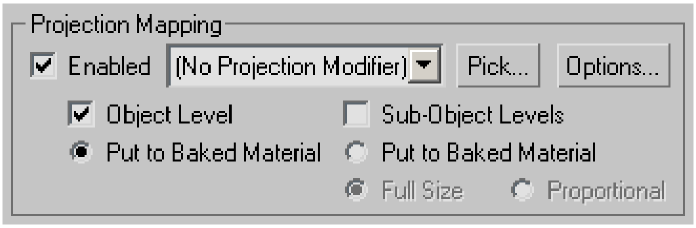
TIP The default keyboard shortcut for the Render To Texture dialog is 0.

2 On the Render To Texture dialog > General Settings rollout, define the output path where you want to save the diffuse, normal bump, and height map textures you are about to create.



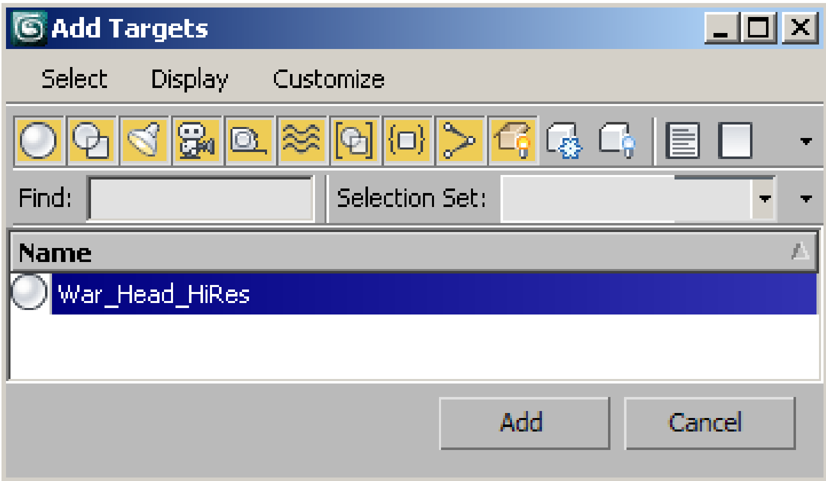
By default, the output is saved to *My Documents\3dsmax\sceneassets\images*, but you might want to specify a different storage location.

3 In the Objects To Bake rollout > Projection Mapping group, turn on Enabled. Since the plane object you will bake the texture to consists of only a single flat surface, turn off Sub-Object Levels.



If you wanted to bake textures of objects onto multiple surfaces, such as each face of a box for example, you would keep Sub-Object Levels turned on.

4 Click the Pick button to display the Add Targets dialog.

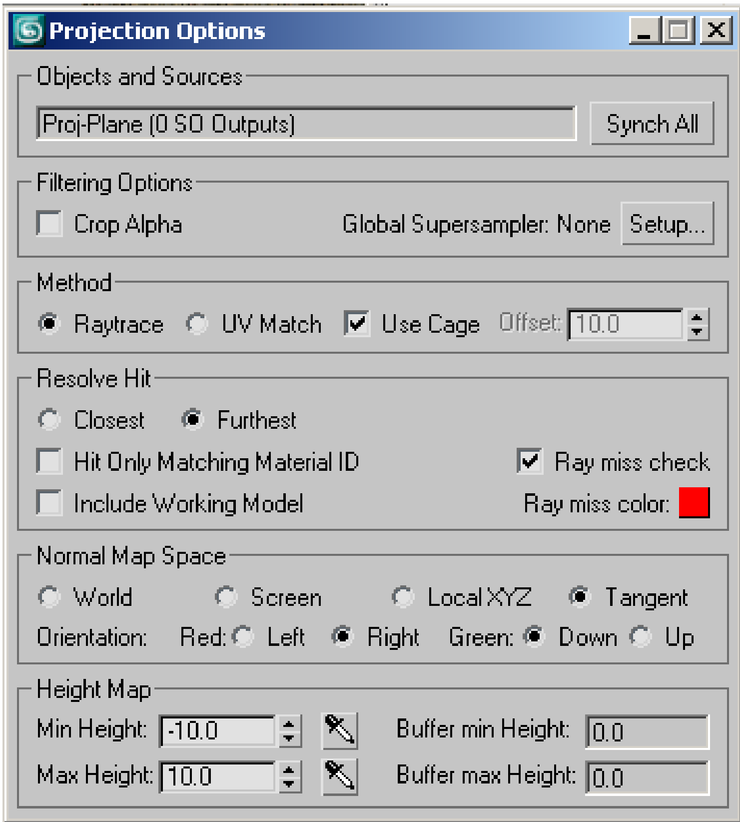


Here, you choose which objects you want to bake onto the plane object.

5 Click the first item in the list (not counting *Scene Root),* then Shift+click the last item in the list to choose all the rocks and the mortar. Click Add.

The drop-down list on the Projection Mapping group has changed from (No Projection Modifier) to Projection, indicating that a new modifier consisting of the items you just selected for projection has been placed on the stack for the plane object.

6 Click the Options button to display the Projection Options dialog.



The height map defines the stone and mortar topography of the source object. To generate the map, you must determine both the farthest and closest points between the source and plane object.

7 Activate the Top viewport and zoom in slightly until you can see the mortar regions clearly.

Before you make the next selection, be sure that you are directly above the plane. Height selection will only work if you are above the target object.

8 In the Height Map group, click the eyedropper icon to the right of the Min Height field. Drag anywhere on the mortar between the rocks. The field resets to –100.

9 Click the eyedropper icon next to the Max Height field and drag anywhere on the highest rock in the scene. You may need to sample several rocks to find the best candidate. A setting of –30 is fine, but try to obtain a value as close to 0 as possible.

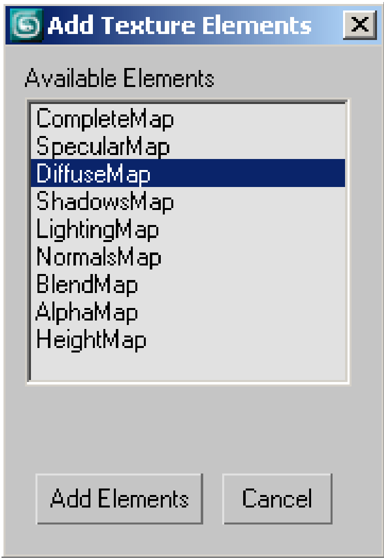
10 Close the Projection Options dialog. In the Render To Texture dialog > Objects To Bake rollout > Mapping Coordinates group, choose Use Existing Channel, if it is not already chosen.

The Use Existing Channel option indicates that you want to use the texture mapping coordinates you created from the UVW Modifier at the beginning of this lesson, rather than letting 3ds Max create new texture mapping coordinates on the fly.

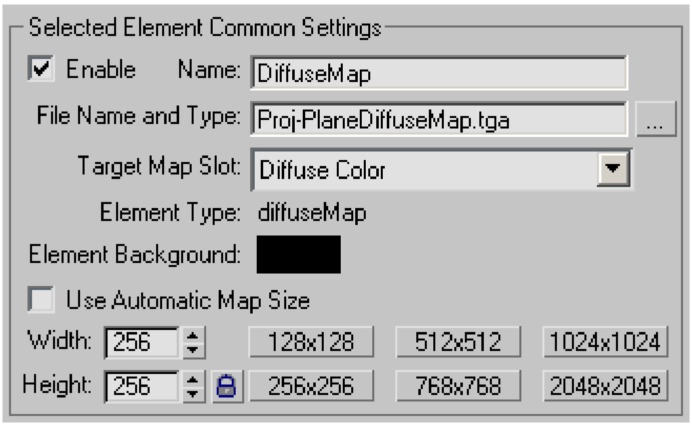
Define the texture to be baked:

Now that the projection method has been defined, the next step is to add the diffuse, normal bump, and height maps that, when combined, will form the texture to be baked onto the plane object.

1 On the Render To Texture dialog, scroll down to the Output rollout, click Add and from the Add Texture Elements dialog, click to highlight DiffuseMap, then click Add Elements.



A new Diffuse entry appears on the Output rollout. The file name of the diffuse map to be created displays in the File Name and Type field.



2 From the Target Map Slot drop-down list, choose Diffuse Color.

3 Click the 512 x 512 Width/Height button. This sets the output resolution of the diffuse map to 512 by 512 pixels.

4 On the Output rollout, click Add again and from the Add Texture Elements dialog, click to highlight NormalsMap, then click Add Elements.

A new Normals entry appears on the Output rollout, below the Diffuse map entry.

5 From the Selected Element Common Settings group > Target Map Slot drop-down list, choose Bump.

6 Click the 512 x 512 Width/Height button to set the output resolution of the normals bump map.

7 In the Selected Element Unique Settings group, turn on Output Into Normal Bump, so that the result shows up properly both in the viewport and in the rendered frame.

8 On the Output rollout, click Add and from the Add Texture Elements dialog, click to highlight HeightMap, then click Add Elements.

A new Height entry appears on the Output rollout.

Leave the Target Map Slot empty. This information is not needed, since you will be using a mental ray renderer to create a displacement map.

9 Click the 512 x 512 Width/Height button to set the output resolution of the height bump map.

At this point, you have defined all the basic elements and settings for creating diffuse, normals bump, and height maps.

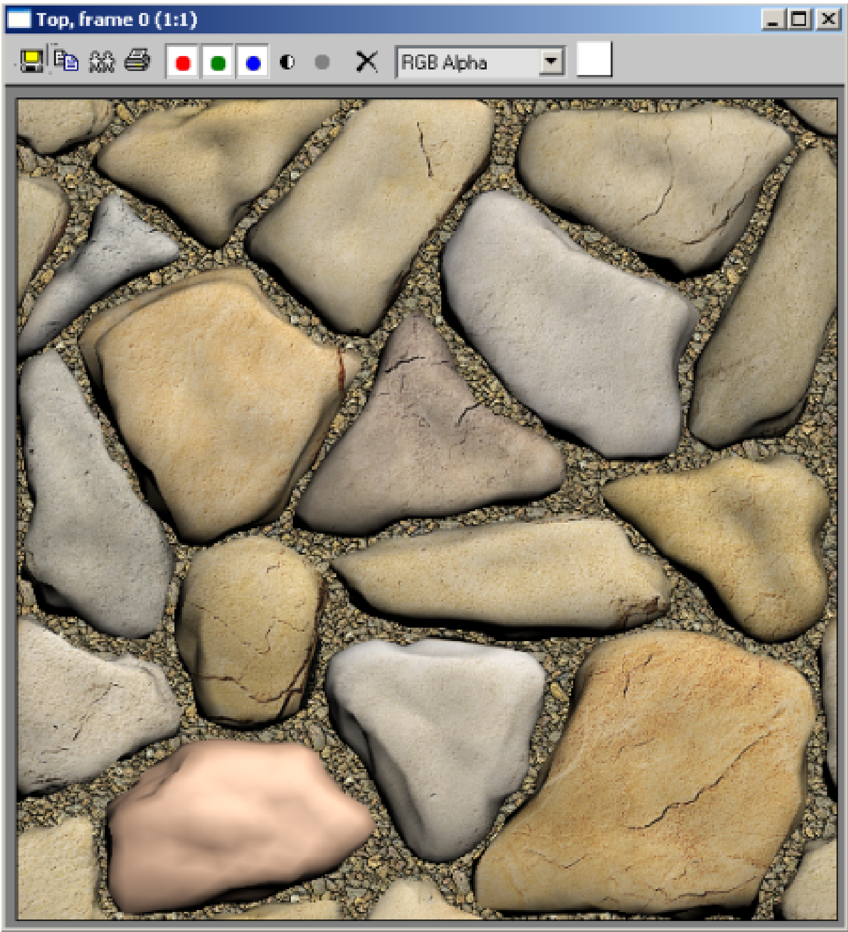
10 Switch to the Perspective view and press Alt+W to maximize the viewport.

11 With the plane object selected, press Alt+X to exit X-ray mode. This mode lets you see behind the selected object. With this mode now removed, you will be able to see the results when the plane is rendered.

12 At the bottom of the Render To Texture dialog, click Render to render the selected plane.

Click Continue to clear the Missing Map Targets message box. We deliberately left the height map unassigned since the height map will be rendered separately by the mental ray renderer.

If the Files Exists dialog displays, click Overwrite Files.



The render shows only the information from the diffuse map. The normal bump and height maps have also been baked into the texture of the plane, but they are not visible. In the next lesson, you will use the Material Editor to display the complete projected texture in the viewports.

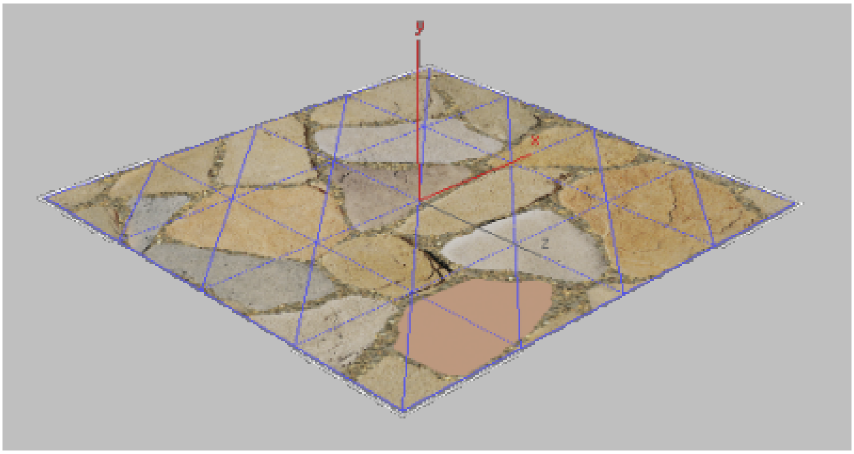
Visualizing the Projection

Preview the normals bump map

1 Continue from the previous lesson, or from the *\materials_and_mapping\normal_bump_map* folder, open *pavers_view.max*.

2 Select and right-click the plane object. Choose Isolate Selection from the quad menu.

Next, you will hide the plane's selection cage, which was generated by the projection modifier you added earlier.

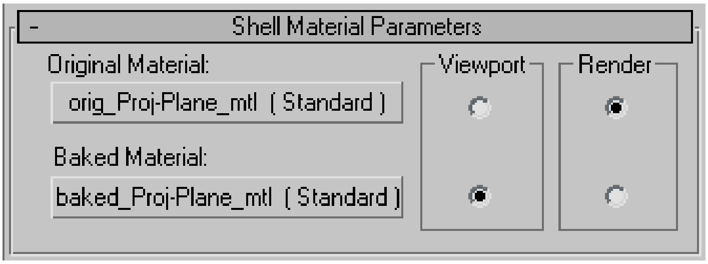


3 In the Modify panel, open the Modifier List and select the Poly Select modifier. This adds the modifier to the top of the plane's modifier stack and hides the selection cage.

4 Press to M to open the Material Editor.

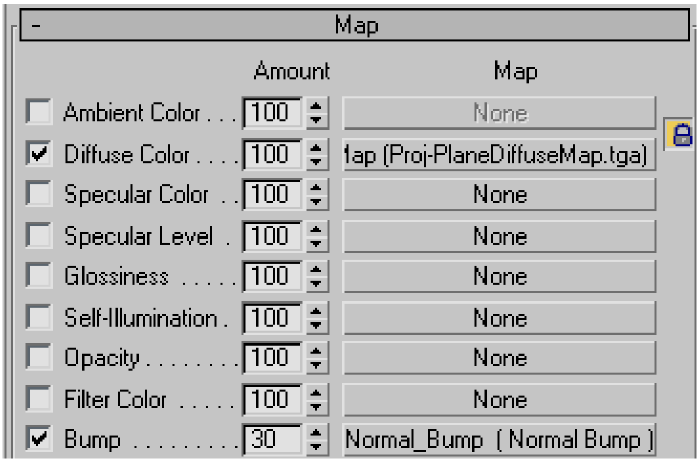
5  Click the eyedropper button (Pick Material From Object), and click the plane object to display its material in the editor.

The Shell Material Parameters rollout shows that the plane object consists of two types of material: the originally assigned plane material, which displays only when rendered, and the baked material obtained from the source object, which displays only in the viewport.

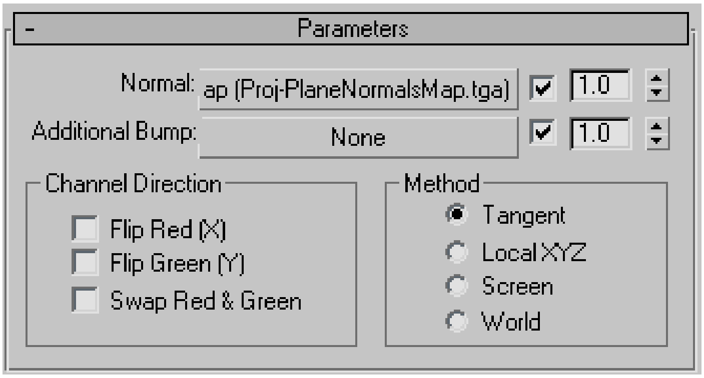


6 On the Shell Parameters rollout > Baked Material option, click the material button (labeled baked_Proj-Plane_mtl) to display more details about the baked material.

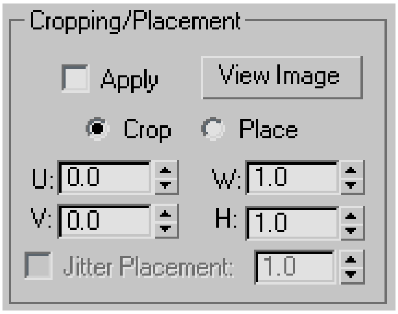
7 On the Map rollout, click the Bump map button which contains the normal bump map.



8 On the Parameters rollout, click the Normal Map button (labeled Proj-PlaneNormalsMap.tga).

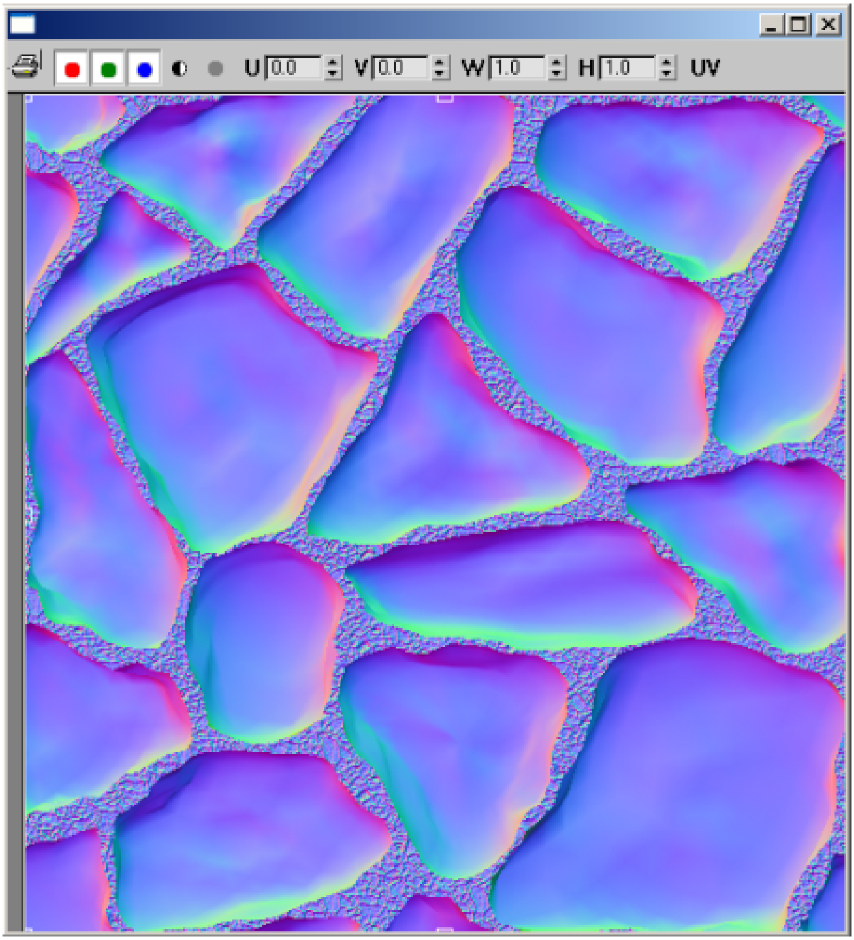


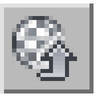
9 On the Bitmap parameters rollout > Cropping/Placement group, click View Image.



This image frame shows the normal bump map you created earlier, that is now applied to the plane object.

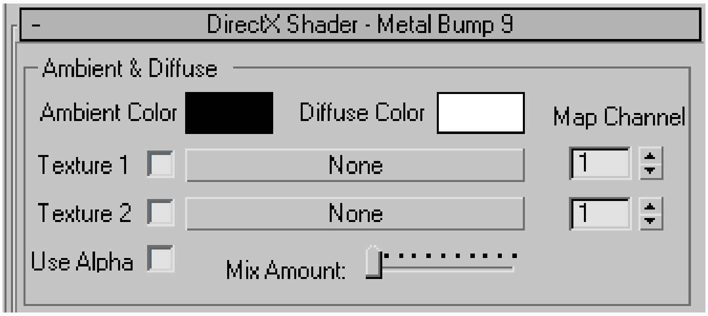
The colors on the image are significant. The reason normal bump maps convey so much more detail than regular bump maps is that normal bump maps use the entire RGB spectrum for surface detail information, whereas regular bump maps only use a single gray scale. The blue channel conveys vertical depth information, and the red and green channels enhance this information by providing a direction vector for the normal orientation of the surface at each point. This results in higher realism.



10  Close the image frame and in the Material Editor click Go To Parent twice to move up two levels.

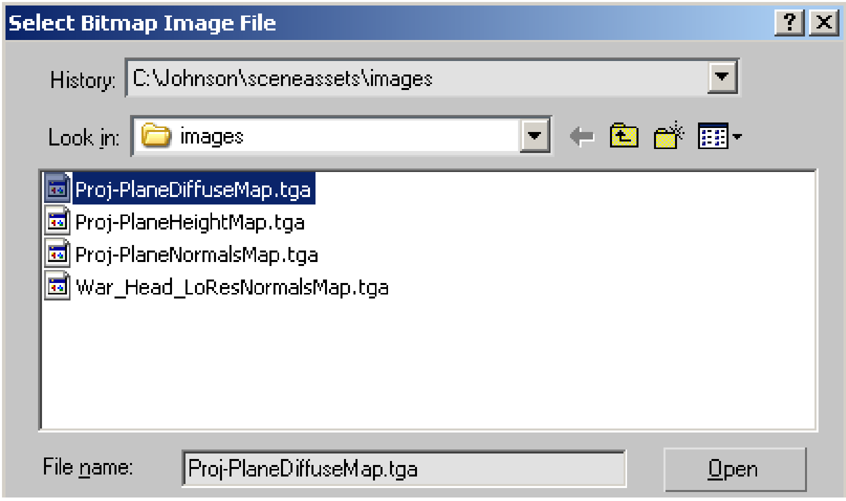
11 Scroll down to the DirectX Manager rollout and from the drop-down list choose MetalBump9.

12 On the DirectX Shader - Metal Bump 9 rollout > Ambient & Diffuse group > Texture 1 option, click the map button (at present, it's labeled None).



13 On the Select Bitmap Image File browser, choose *proj-planediffusemap.tga,* then click Open.

This file should be located in *\sceneassets\images*, or the folder you specified earlier in the Render To Texture > General Settings rollout.

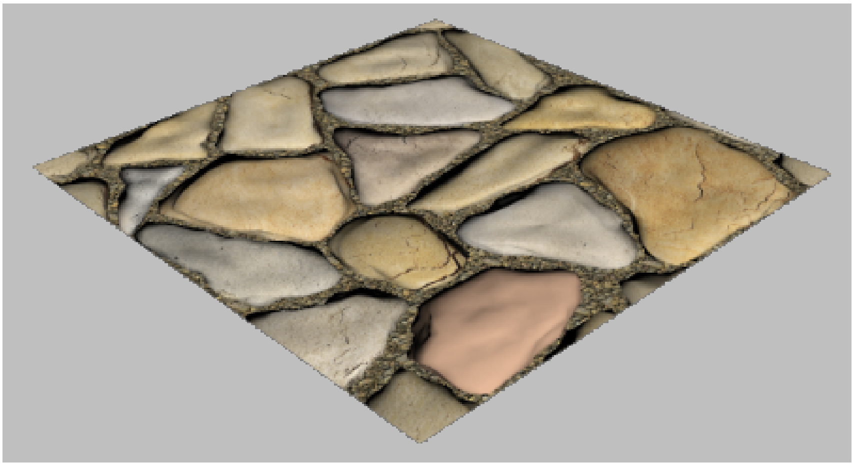


14 On the DirectX Shader - Metal Bump 9 rollout > Bump group > click the Normal map button (at present, it's labeled None).

15 On the Select Bitmap Image File browser, choose *proj-planenormalsmap.tga*, then click Open.

16 On the DirectX Manager group, turn on Enable Plugin Material.

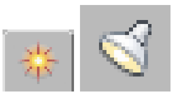
Zoom into the Perspective viewport to see how the flat surface of the plane object has now taken on a greater, three-dimensional degree of detail.

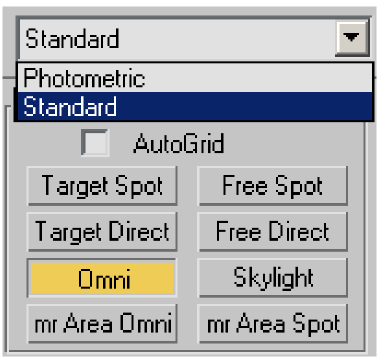


17 Turn on and off the Enable Plugin Material check box to compare the model with the simple diffuse map applied and the model with the normal bump map applied.

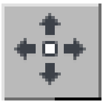
Visualize the 3D effect

Next, you will add a standard Omni light to the scene to see how effectively the normal bump map, when combined with a standard Omni light, provides a sense of depth to the object.

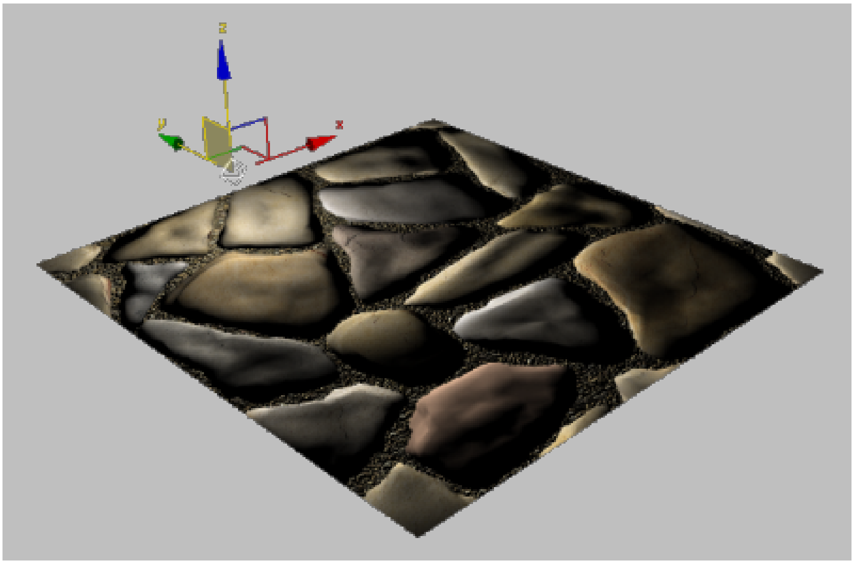
1  In the Create panel > Lights tab, choose Standard from the drop-down list, then click Omni to turn it on.



2 In the viewport, click anywhere above the plane object to place the light.

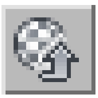
3  Move the light across the stones.

It might help to move the light vertically as well, to place it above the plane.

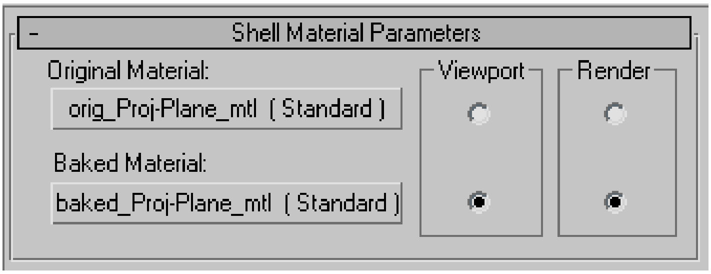


Even though this object is a flat plane, notice how the light and shadow play across the stones as if the geometry was a raised surface.

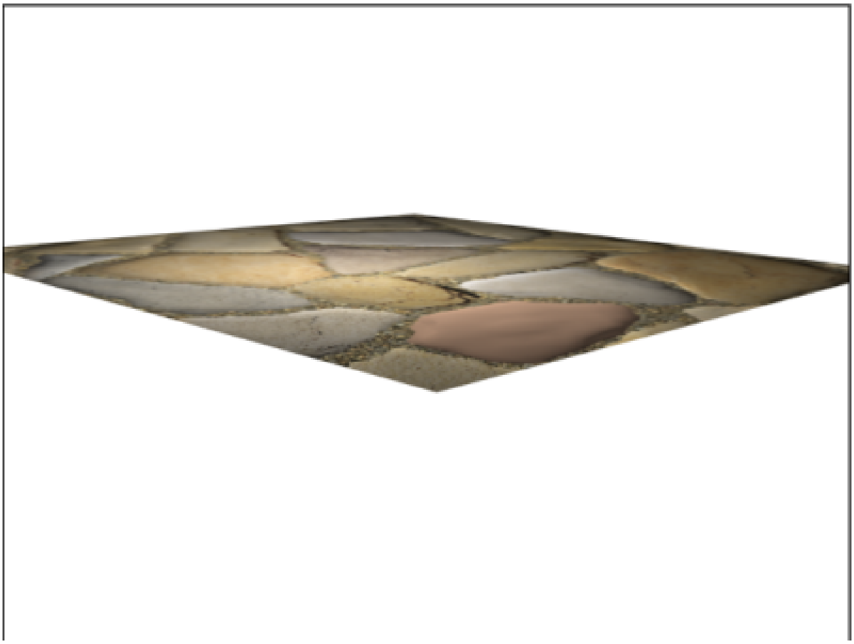
Render the height map

1  Delete the light object, press M to open the Material Editor if it is not already open, then go up one level.

2 On the Shell Materials Parameters rollout, set the Baked Material to be visible in the rendered output.



3 In the Perspective viewport, rotate the plane until it is almost horizontal, then press F9 to render the plane.



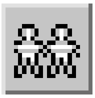
Notice how the edges of the plane still appear straight and two-dimensional.

The 3D relief you've achieved so far with the diffuse and normals bump maps is usually acceptable when you model for games development. For other uses, such as cinematics, you might need to take things one step farther.

To complete the effect, you will use the height map you created earlier and render it with the mental ray renderer.

4.  Click Render Setup to open the Render Setup dialog. On the Common tab, scroll down to the Assign Renderer rollout, then click the browse button for the Production renderer (to the right of the label, Default Scanline Renderer).

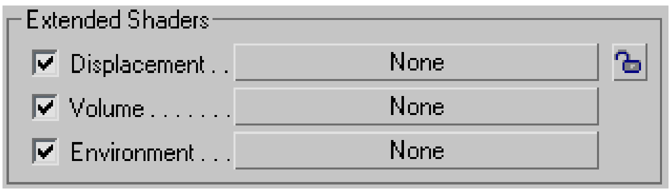
5. In the Choose Renderer dialog, choose “mental ray,” click OK, then render the plane again.

6.  In the rendered frame window, click the Clone Rendered Frame Window button, then minimize the two frames.

   You will now add the Height map to the render.

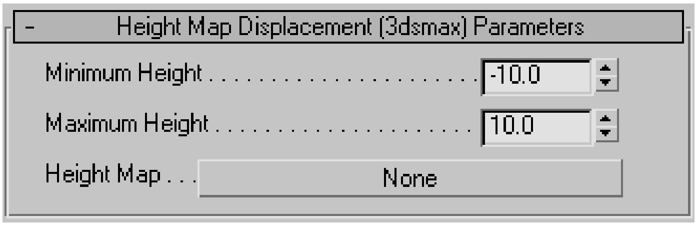
7. Select the plane object and on the Material Editor > Shell Material Parameters rollout, click the Baked Material button.

8. On the mental ray Connection rollout > Extended Shaders group, unlock Displacement.

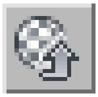


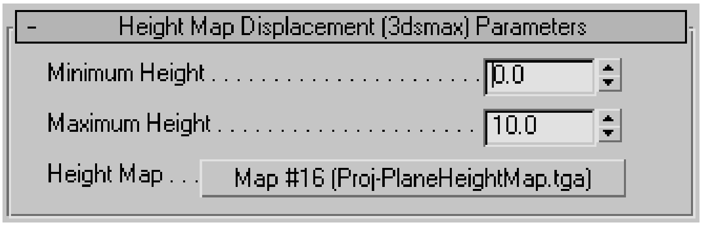
9. Click the Displacement button (initially labeled None), and in the Material/Map Browser, choose Height Map Displacement (3dsmax).

10. On the Height Map Displacement (3dsMax) Parameters rollout > click the Height Map button (initially labeled None).



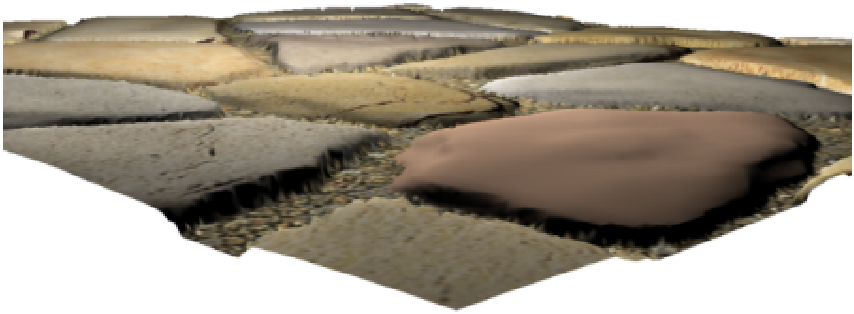
11 On the Material/Map Browser, choose Bitmap and in the Select Bitmap Image File dialog, choose *proj-planeheightmap.tga*.

12  Move up one level in the Material Editor and on the Height Map Displacement rollout, set Minimum Height to **0**.



13 Render the scene in the Perspective viewport.

14 Restore the view of the rendered frame you cloned earlier and compare the renderings.



The geometry has been pushed up based on the displacement map generated by the mental ray engine and added to the rendering.

Summary

This tutorial showed you how to project complex surface detail from a source object onto a simple, two-dimensional plane. Detail is derived from the source by including normal bump, diffuse, and height maps in the projection, then rendering them as a texture to the simple plane.

Cage Projection Method

Normal Bump Mapping using cage projection also involves a source and target object.

In this tutorial, you will create a cage object and form it to fit the contours of the target, a low-resolution model of a human head. You will then use the cage to receive the diffuse and normal bump map information from the source, a high-resolution version of the model.

Model of a warrior with diffuse map only (left) and with normal map applied (right)

In this tutorial, you will learn how to:

- Use Render To Texture to create a normal bump map.
- Use the Projection modifier to “steal” detail from a high-resolution mesh.
- Use the Normal Bump map type to render the effects of a normal bump map.

Skill level: Intermediate/Advanced

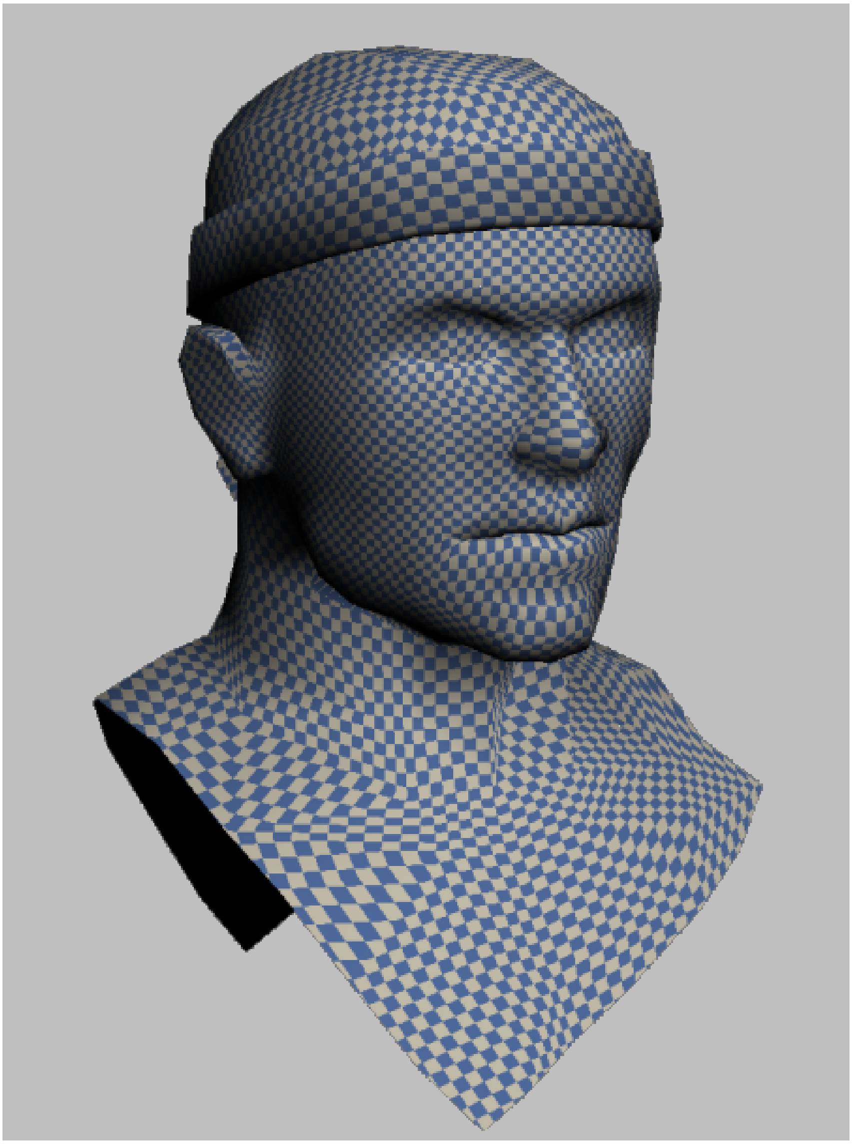
Time to complete: 1 hour

Creating a Normal Bump Map

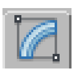
Set up the lesson:

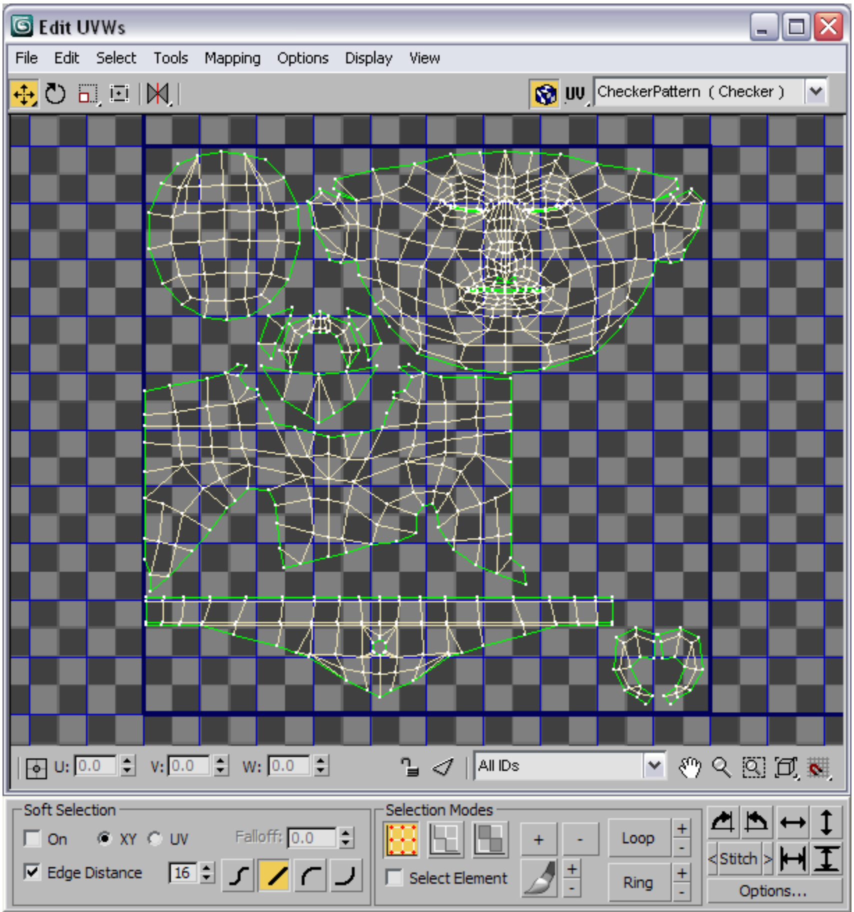
-  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\normal_bump_map* and open the scene file *warrior_head_lores.max*.

The only visible object is an editable mesh model of the head of a warrior. This is the low resolution target object, consisting of roughly 750 polygons, to which you will apply normal bump maps. Its surface is smooth, and it has a checkered texture map applied to it. This checker map was used as a visual guide in setting up the texture mapping of the surface. An Unwrap UVW modifier has already been applied.



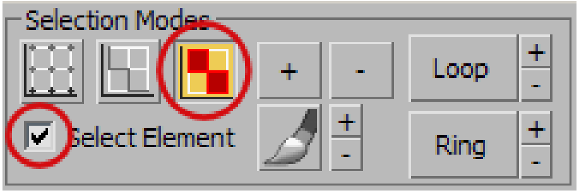
Set up the target and source models:

1  Select the model, go to the Modify panel > Parameters rollout, and click the Edit button.



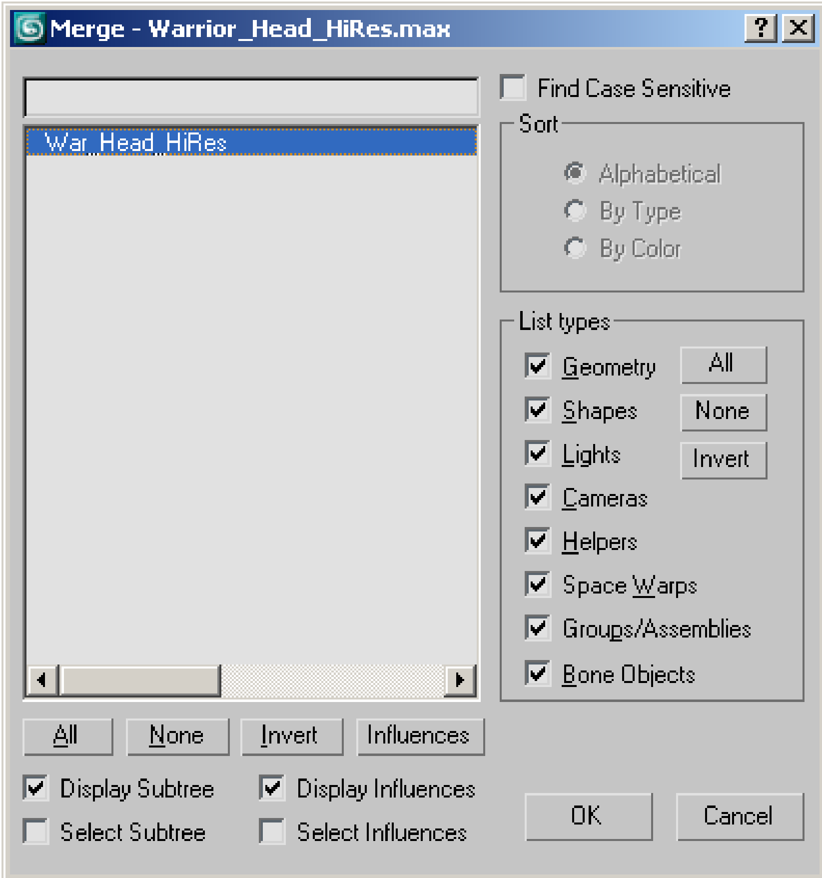
The Edit UVWs dialog displays, showing how the Unwrap UVW modifier has already been applied to the target object, and how the texture coordinates have been mapped to the surfaces of the model. This layout was designed to facilitate painting, which can be necessary for “touching up” texture mapping.

2 In the Selection Modes group, turn on Select Element and click to turn on Face Sub-Object Mode, then in the window, select geometry elements to see how they correspond to the model in the Perspective viewport. Close the dialog when you are done.



In order to extract the high-resolution information from the source model, you will now need to merge it with the low-resolution version.

3  From the Application menu, choose Import > Merge and on the Merge File dialog, navigate to the folder that contains your scene files. Select the scene that contains the high-resolution model *warrior_headhires.max,* then click Open.



4 On the dialog, click to highlight *War_Head_HiRes,* then click OK.

The two models are now visible. Both are the same size and are precisely aligned.

5 To view the high-resolution model on its own, make sure the high-resolution model is selected, select a non-checkered region in the viewport, right-click, and from the quad menu choose Isolate Selection.

   This model, at approximately 96,000 polygons, shows a much greater amount of detail.

6 Click Exit Isolation Mode to return to the merged view and then click a checkered region of the model to select the low-resolution model.

   To make sure you have the low resolution model selected, check that the Name And Color rollout displays *War_Head_LoRes*.

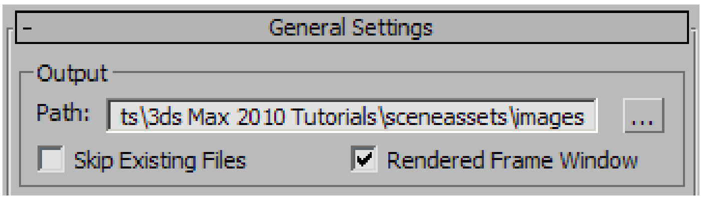
   You will now proceed and create the normal bump map based on the high-resolution model.

Set up Render To Texture (RTT)

To generate the normal bump map, you will use the Render To Texture tool.

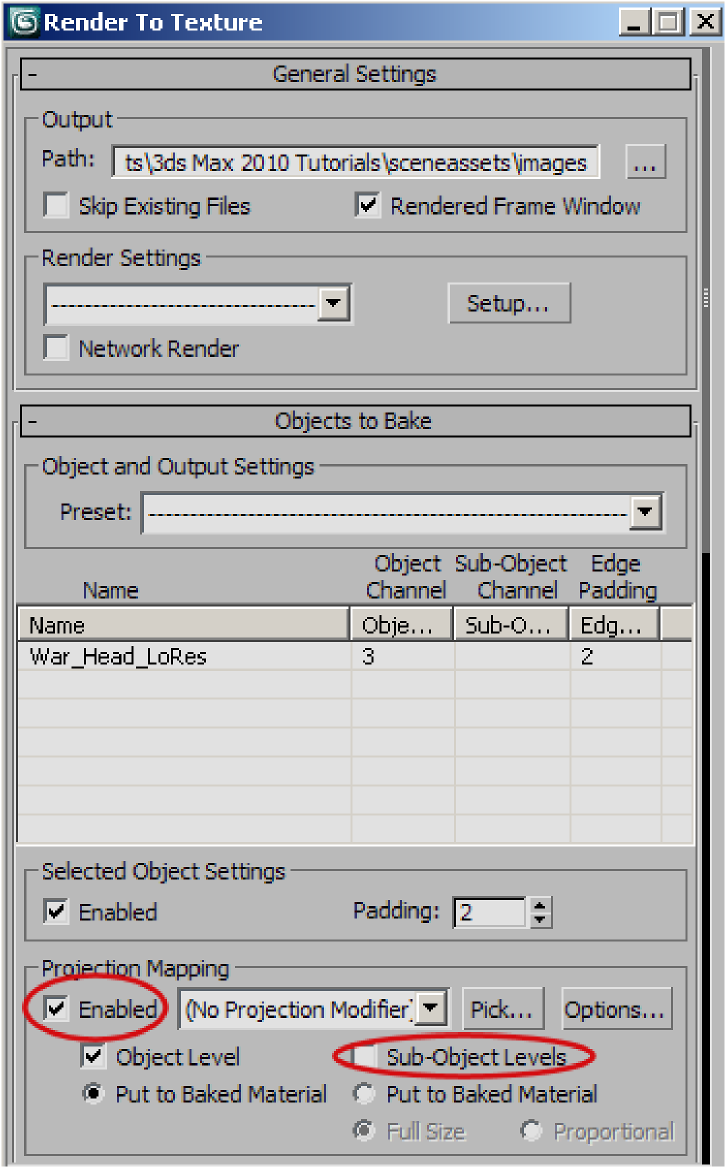
1 From the main menu, choose Rendering > Render To Texture.

2 In the Render To Texture dialog > General Settings rollout, define the output path where you want to save the diffuse and normal bump map textures you are about to create.

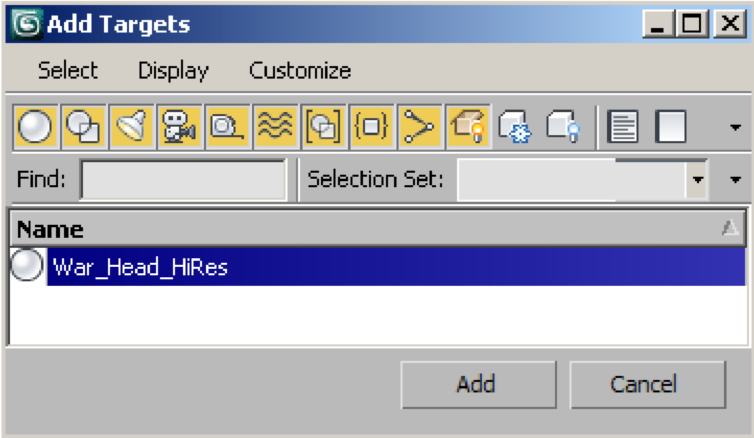


   By default, the output is saved to *my documents\3dsmax 2010 Tutorials\sceneassets\images*, but you might want to specify a different storage location.

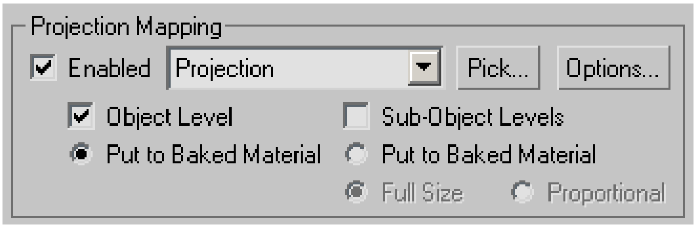
3 On the Objects To Bake rollout > Projection Mapping group, turn on Enabled, then turn off Sub-Object Levels, since no sub-selections exist in this particular model.



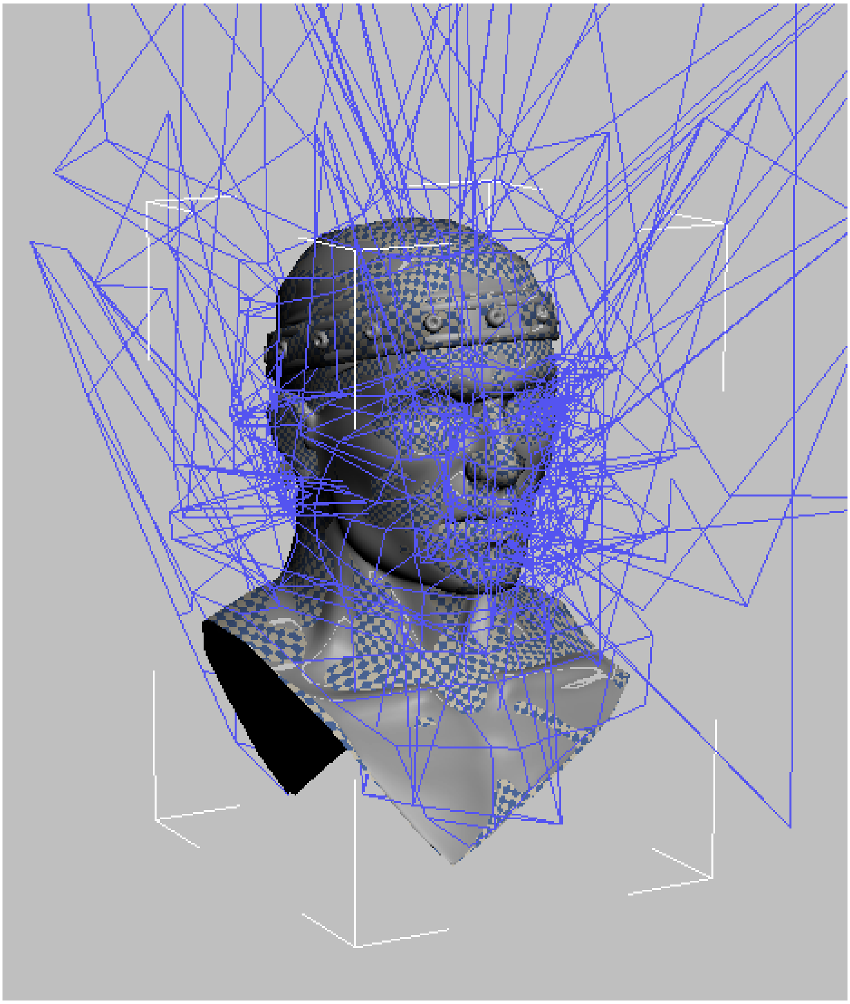
4 Click the Pick button to display the Add Targets dialog, choose *War_Head_HiRes*, then click Add.



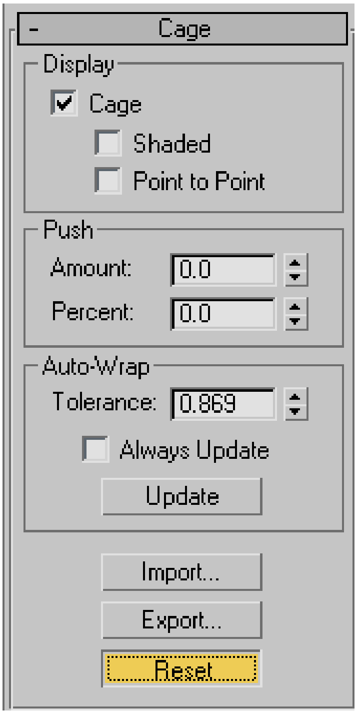
The drop-down list in the Projection Mapping group has changed from (No Projection Modifier) to Projection, indicating that a new Projection modifier has been placed on the stack for *War_Head_HiRes*.



Also, a rough wireframe cage appears around the high-resolution head object in the viewport. The cage shows a considerable amount of irregular geometry, but this is usual when it is first applied. The problem is easy to correct.



5 On the Modify panel > Cage rollout, click Reset.



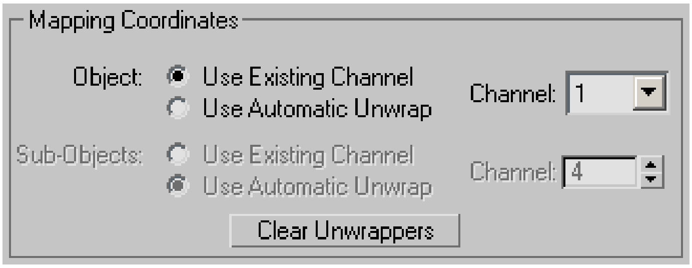
The cage resets itself to fit tightly around the target low-resolution model.

The shape of the cage is correct, but it is important that the cage fully encompass the source high-resolution model. Where the source geometry lies outside the cage, the result will be ray intersection misses, which in turn will cause flaws in the normal bump map.

6 On the Cage rollout > Push group, set Amount to **1.1**.

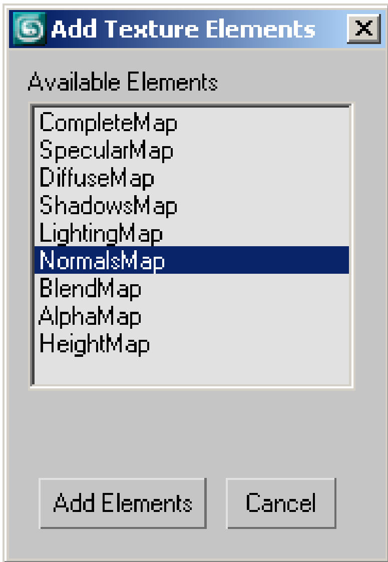
   After the value is applied, it resets to 0.0 and the cage balloons outward slightly so that the entire *War_Head_HiRes* object, with all its bumps and protrusions, fits within it.

7 On the Render To Texture dialog > Objects To Bake rollout > Mapping Coordinates group, choose Use Existing Channel.



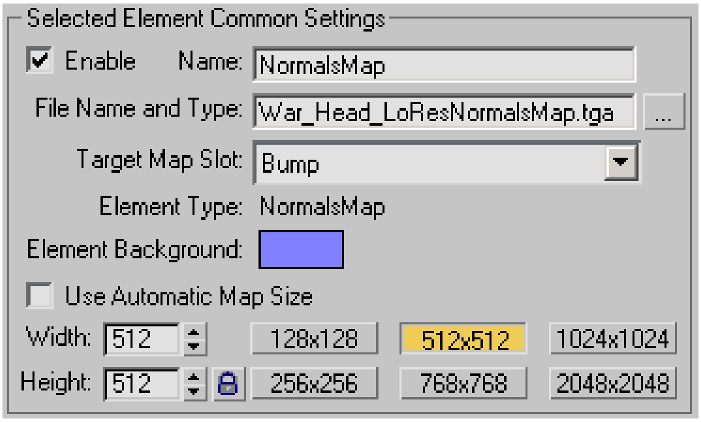
This is where you specify that you want to use the pre-assigned texture-mapping coordinates you viewed at the beginning of this lesson, rather than letting 3ds Max create new texture-mapping coordinates on the fly.

8 Scroll down to the Output rollout, click Add, and in the Add Texture Elements dialog, click to highlight Normals Map, then click Add Elements.

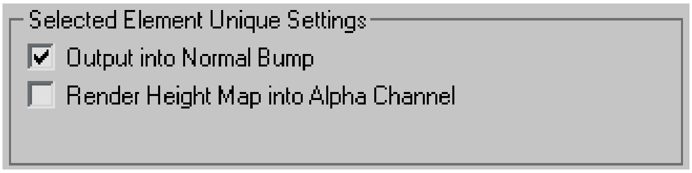


A new NormalsMap entry appears on the Output rollout of the Render To Texture dialog.

9 On the Selected Element Common Settings group > Target Map Slot drop-down list, choose Bump, then click the 512 x 512 Width/Height button, which sets the output size to 512 by 512 pixels.



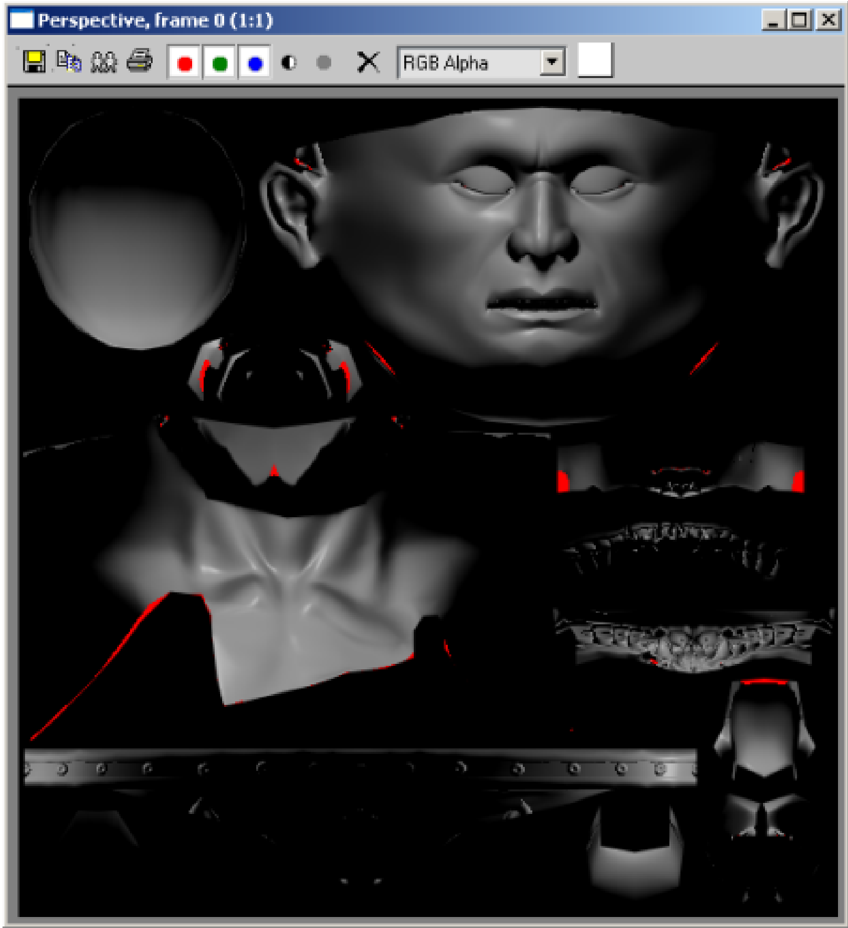
10 On the Selected Element Unique Settings group, turn on Output Into Normal Bump, so that the result shows up properly both in the viewport and in the rendered frame.



At this point, you have defined all the basic elements and settings for generating a normal bump map.

Render and fine-tune the normal bump map:

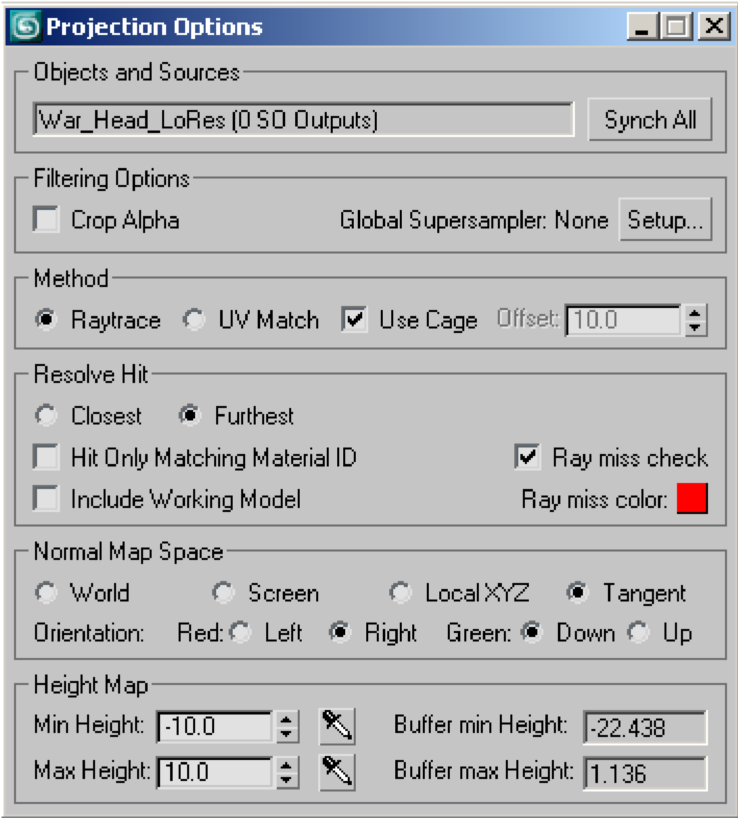
1 At the bottom of the Render To Texture dialog, click Render to render your normal bump map.



The rendered map shows an unwrapped diffuse rendering of the high-resolution model. Assorted red patches are visible, indicating where the bump map projection rays did not properly capture the underlying geometry. This is because the cage created by the Projection modifier did not completely cover the high-resolution model in these spots.

This would create problems if you applied the normal bump map to the low-resolution target. You will resolve this problem by applying neutral normal values to these red patches so they blend with their surrounding areas.

2 Make sure the *War_Head_LoRes* object is selected and on the Render To Texture dialog > Objects To Bake > Projection Mapping group, click Options to display the Projection Options dialog.



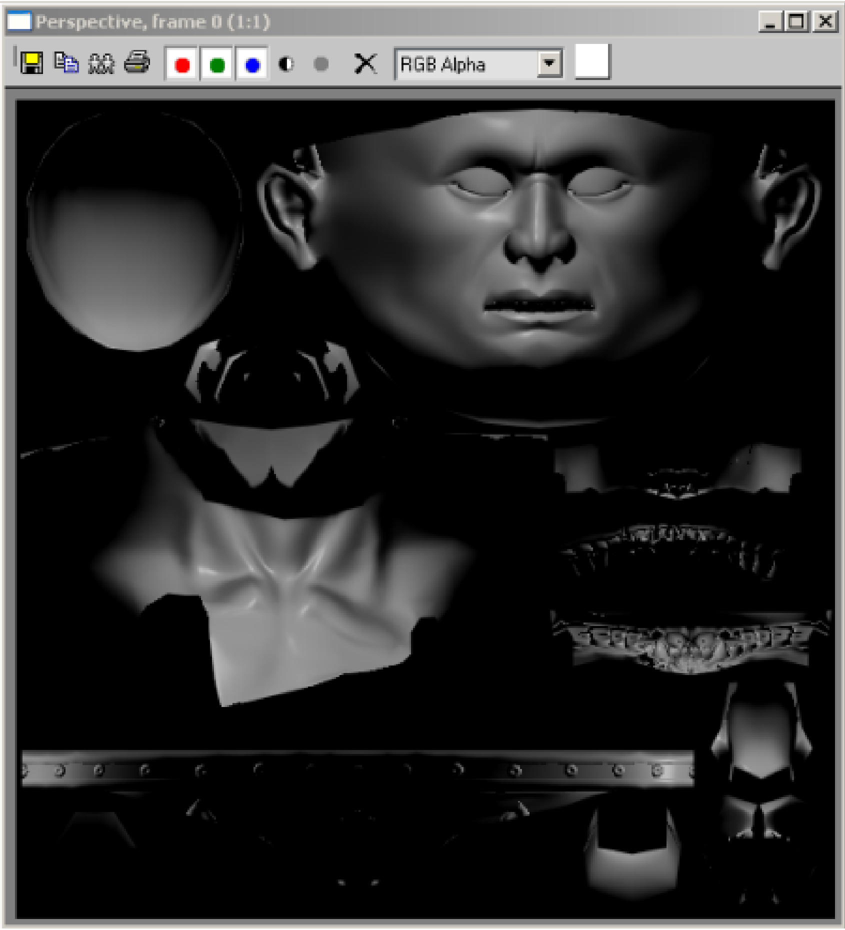
3 In the Resolve Hit group, turn off Ray Miss Check, then close the dialog.

With Ray Miss Check turned off, the red patches in the rendered normal bump map will be replaced by a neutral blue background with a normal value of 0, a value that will permit the regions to blend effectively with the normal map that will be created.

4 At the bottom of the Render To Texture dialog, click Render to render your normal bump map once again.

Click Overwrite File when you are prompted to overwrite the previous rendered file.

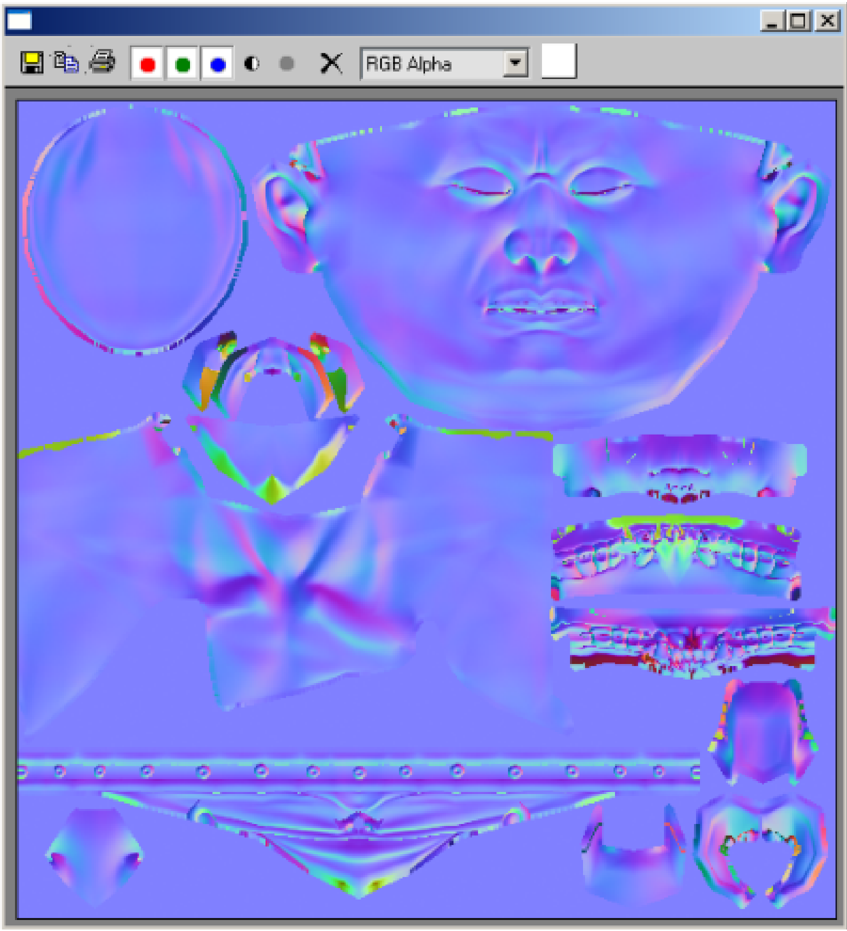
The rendered result shows that the previous ray misses now appear as black, the neutral element background.



Now you will take a look at the actual normal bump map image file to see the blending result.

5 From the main menu, choose Rendering > View Image File. In the file dialog that displays, navigate to the image file location, which is *\sceneassets\images*.

6 Select the file *war_head_loresnormalsmap.tga,* then click Open.



The blue channel conveys vertical depth information, and the red and green channels enhance this information by providing a direction vector for the normal orientation of the surface at each point. This results in higher realism.

7 Close the normal map image.

Applying Normal Bump Maps to Objects

In this lesson, you will apply the normal bump map you created in the previous lesson to the low-resolution model of the warrior.

Use NormalBump to apply the normal bump map:

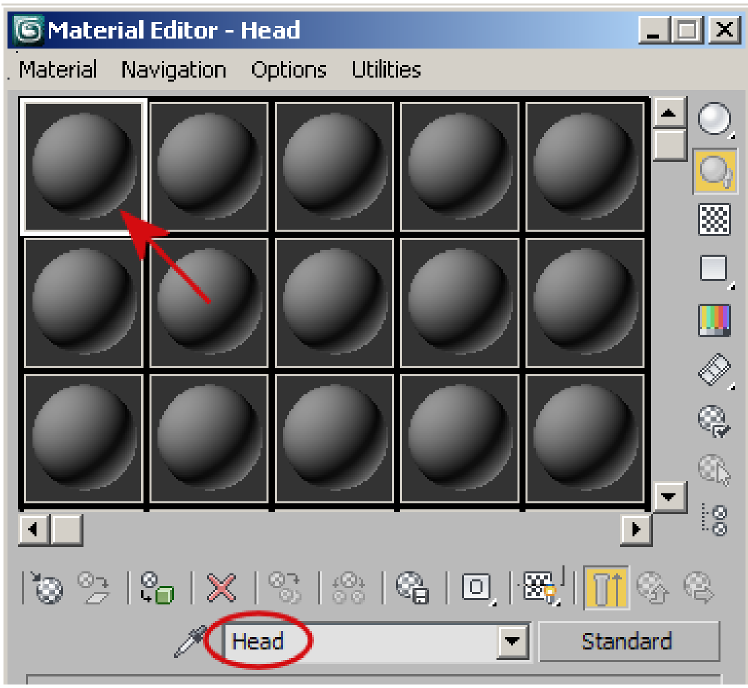
1 Continue from the previous lesson, or from the *\materials_and_mapping\normal_bump_map* folder, open the file *warrior_head_b_map.max*.

2 If a wireframe cage is still displayed on the model, go to the Modify panel and from the Modifier List, choose the Poly Select modifier.

3 Select, then right-click the low-resolution object in the viewport (any checkered region on the head), and in the quad menu choose Isolation Mode. The high-resolution model is now hidden.

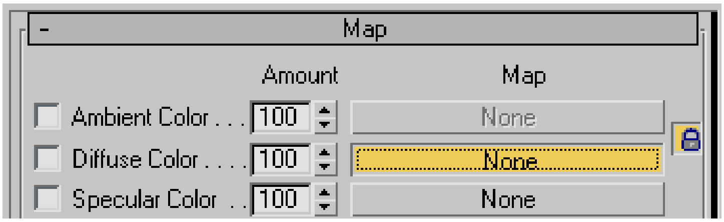
4 Press M to open the Material Editor.

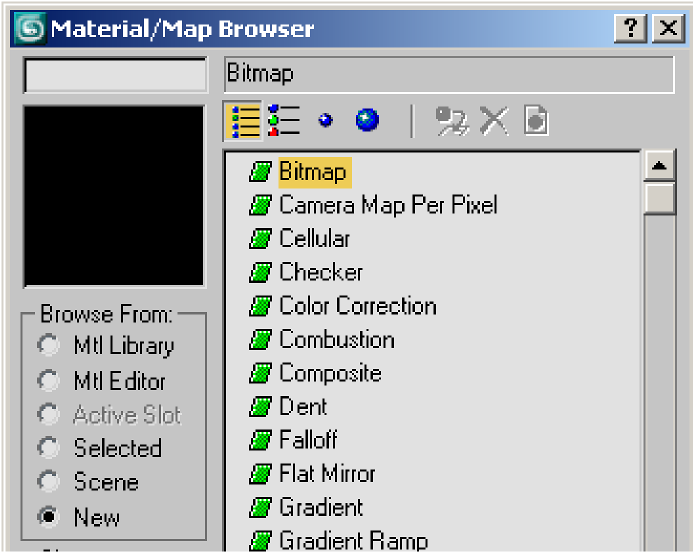
5 Click an unused sample slot, and in the Name field, rename the material **Head**.



6 Drag the newly-renamed material from its slot to the low-resolution object.

7 On the Material Editor > Maps rollout, click the Diffuse Color map button (initially labeled None) to open a Material/Map browser.

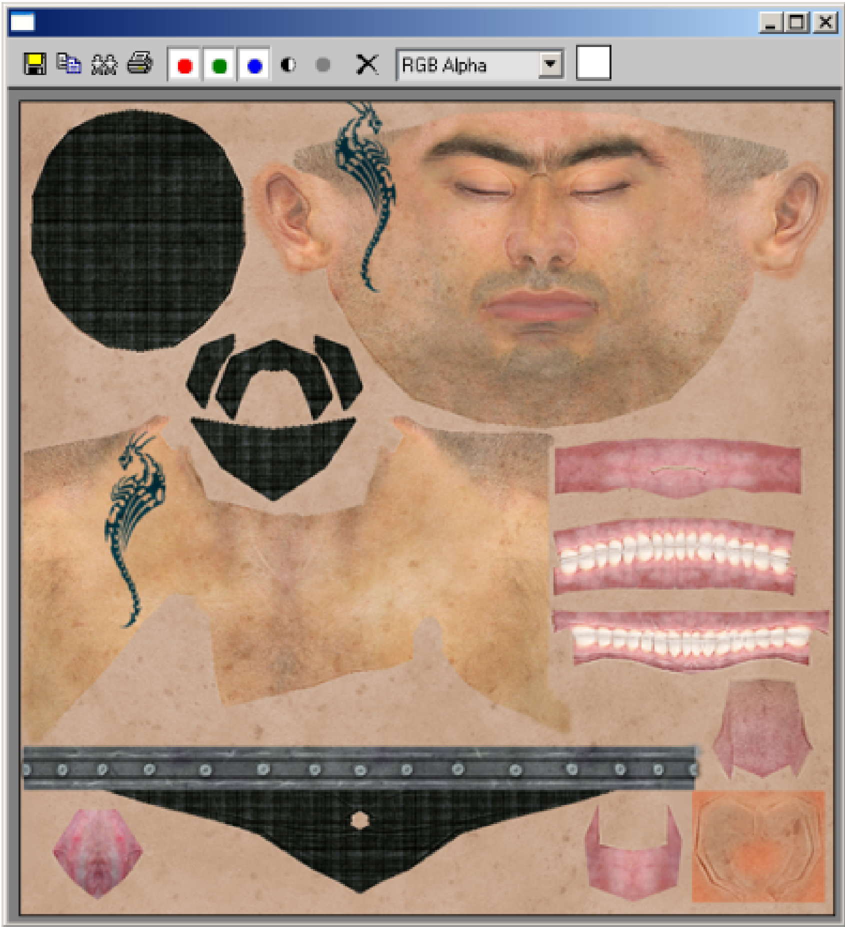




8 Double-click Bitmap to open the Select Bitmap Image File dialog.

9 In the *\sceneassets\images* folder, select the *head_diff.tga* file.

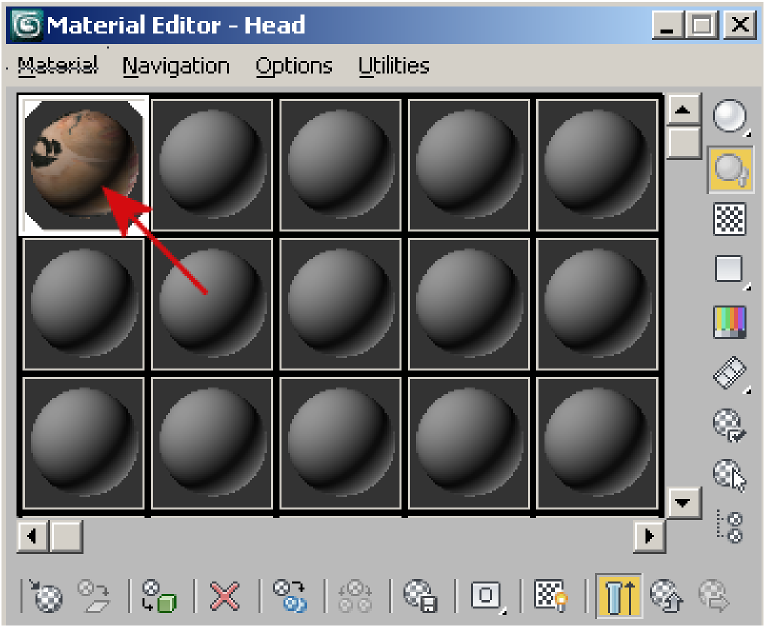
10 Click View in the dialog to display the bitmap in a larger format.

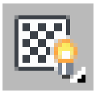


This image file is a previously created diffuse bitmap of the warrior's face, based on the unwrapped model.

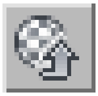
11 Close the image window and in the dialog click Open.

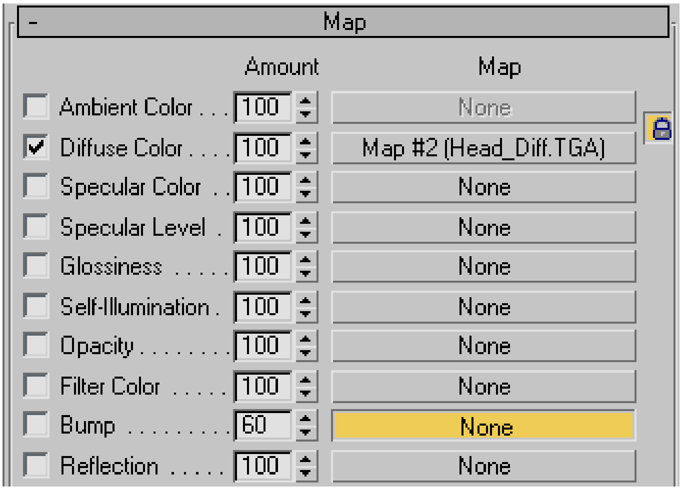
The bitmap is assigned to the selected material slot in the Material Editor.

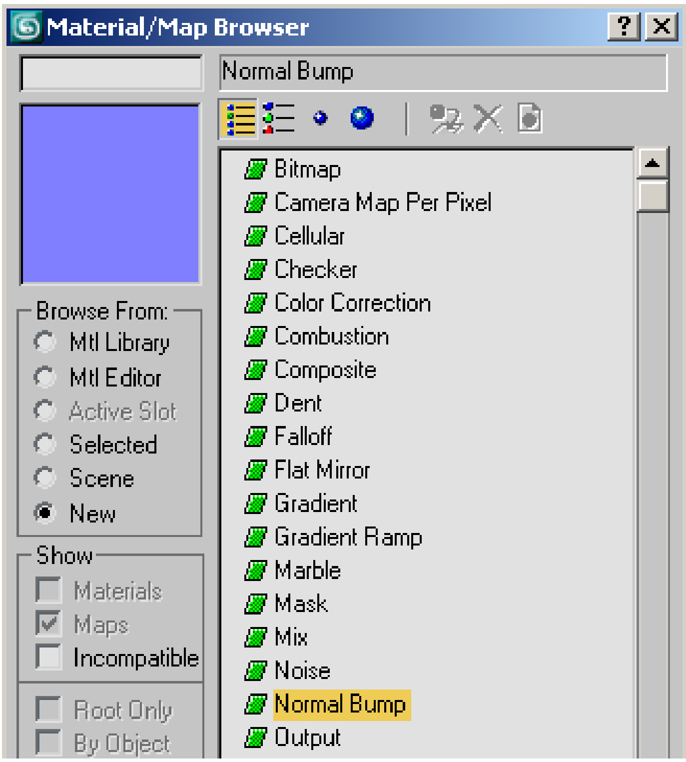


12  Click the Show Standard map In Viewport button to see the material in viewports.

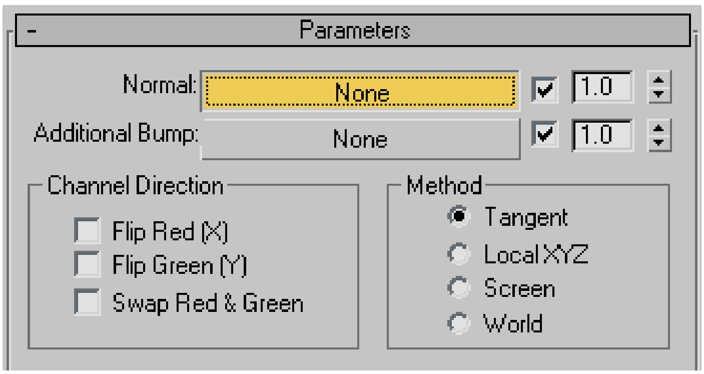
As the next illustration demonstrates, the result is fairly flat and lacking in detail. The normal bump map you will now apply should improve things considerably.

13  Go up one level in the Material Editor. On the Maps rollout, click the Bump map button (initially labeled None), then choose Normal Bump in the Material/Map Browser and click OK.





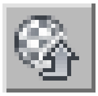
14 On the Parameters rollout, click the Normal map button (initially labeled None), then on the Material/Map Browser, double-click Bitmap.



15 On the Select Bitmap Image File dialog, choose *war_head_loresnormalsmap.tga,* then click Open.

(If you like, you can use the version of this map that you rendered yourself in the previous lesson.)

The normal bump map will be visible in the rendered image. Making the normal bump map visible in viewports will require a few more steps.

16  Go up two levels in the Material Editor.

17 Scroll down to the DirectX Manager rollout and from the drop-down list choose MetalBump9.

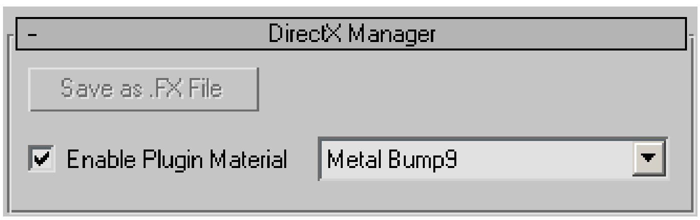
18 In the DirectX Shader - Metal Bump 9 rollout > Ambient & Diffuse group, click the Texture 1 map button (initially labeled None).

19 On the Select Bitmap Image File dialog, choose *head_diff.tga,* then click Open.

20 In the Bump group, click the Normal map button (initially labeled None).

21 On the Select Bitmap Image File dialog, choose *war_head_loresnormalsmap.tga,* then click Open.

22 On the DirectX Manager rollout, turn on Enable Plugin Material.



The model suddenly takes on a new level of detail. The low-resolution model is now picking up the normal information from the high-resolution mesh object.

23 Turn on and off the Enable Plugin Material check box to compare the model with the simple diffuse map applied and the model with the normal bump map applied.

If you like, try adding an Omni light to the scene and moving the light object across the face: first with the diffuse map selected, then the normal bump map selected. See how much of a difference a normal bump map can make.

Summary

This tutorial showed you how to use a projection cage to receive texture from a high-resolution model, then apply the result to a low-resolution version of the same model. This technique is an effective way to assign complex surface detail to low-polygon objects and thereby improve scene render time.

Composite Mapping

A composite map is two or more texture maps which have been layered onto one another to produce a more detailed image.

The end result is determined by the level of transparency defined for each layer. Transparency can be global (applied to the entire surface of the layer), derived from the layer's alpha channel, or based on a mask. The pixels of each layer can also be blended with one another in a number of different ways to fine-tune the image.

In this tutorial, you will create a complex texture map of a steel shutter for a pawn shop. The map will consist of five layers of images composited together using various transparency settings and blending techniques.

A render of the steel shutter composite map after completing this tutorial

In this tutorial, you will learn how to:

- Create a composite layer
- Color correct a layer
- Define layer transparency and contrast

- Create a layer defined by a mask
- Rearrange the order of layers
- Blend layers
- Add bump information to layers

Skill level: Intermediate

Time to complete: 45 minutes

Creating a Composite Map with Alpha Values

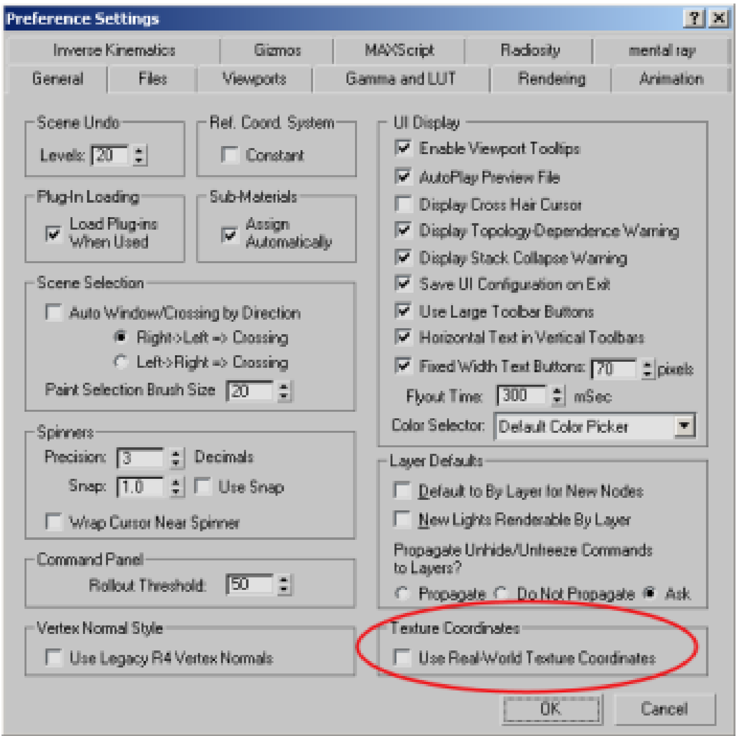
You will create the base layer of the composite map by choosing a bitmap of a steel shutter, then assigning its diffuse, or color, values to an Arch+Design building material. You will then add two more image layers, using alpha values to define how each are superimposed over the base layer.

Create a base layer and color correct it:

1.  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\composite_mapping* and open the scene file *composite-start.max*.

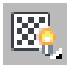
   The scene consists of a pawnshop located in a rough part of town. The storefront is missing one important element: a steel shutter that protects a plate-glass window. Your task is to create a convincing composite map of the shutter.

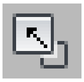
2. From the main menu, go to the Customize > Preferences > General panel > Texture Coordinates group and turn off Use Real-World Texture Coordinates, if it is not already off. Click OK.



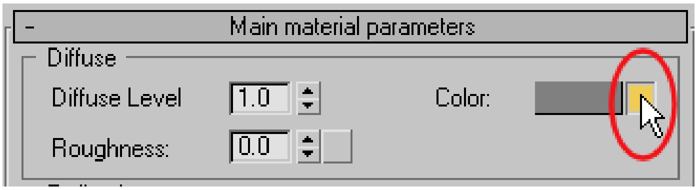
3 Press M to open the Material Editor.

The top left sample slot contains an Arch+Design material called Shop-Door.

4  Click Show Standard Map In Viewport so you will later be able to view the composite map in the viewport.

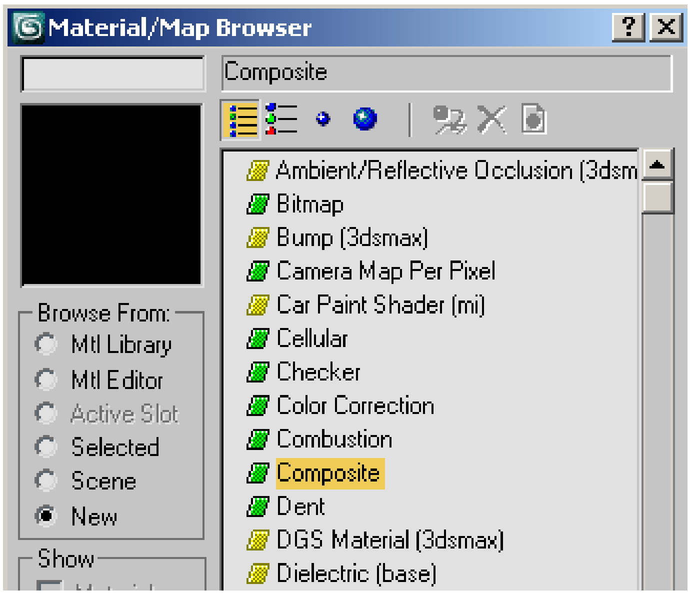
5  Maximize the Orthographic view.

6 In the Material Editor > Main Material Parameters rollout > Diffuse group, click the Diffuse Color map button.

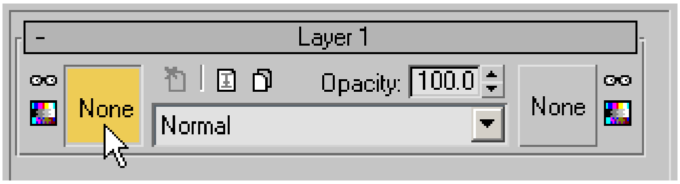


You will now add a composite map to the material's diffuse color channel.

7 On the Material/Map Browser, double-click Composite.



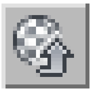
8 On the Material Editor > Layer 1 rollout, click the left-hand Assign Material button (initially labeled "None").



9 On the Material/Map Browser, double-click Bitmap.

10 On the Select Bitmap Image File dialog, double-click *shutters.jpg*.

The bitmap, which simulates a corrugated metal surface, is automatically applied as a texture map to the sample slot in the Material Editor and will form the base layer of your composite map.

11  Click Go To Parent to view the texture as a composite map.

At this level, you can monitor the appearance of the map as you add more layers of images and make further adjustments.

NOTE Any sample image you display at this level will be larger and may take more time to render.

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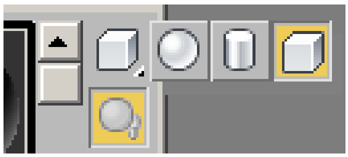
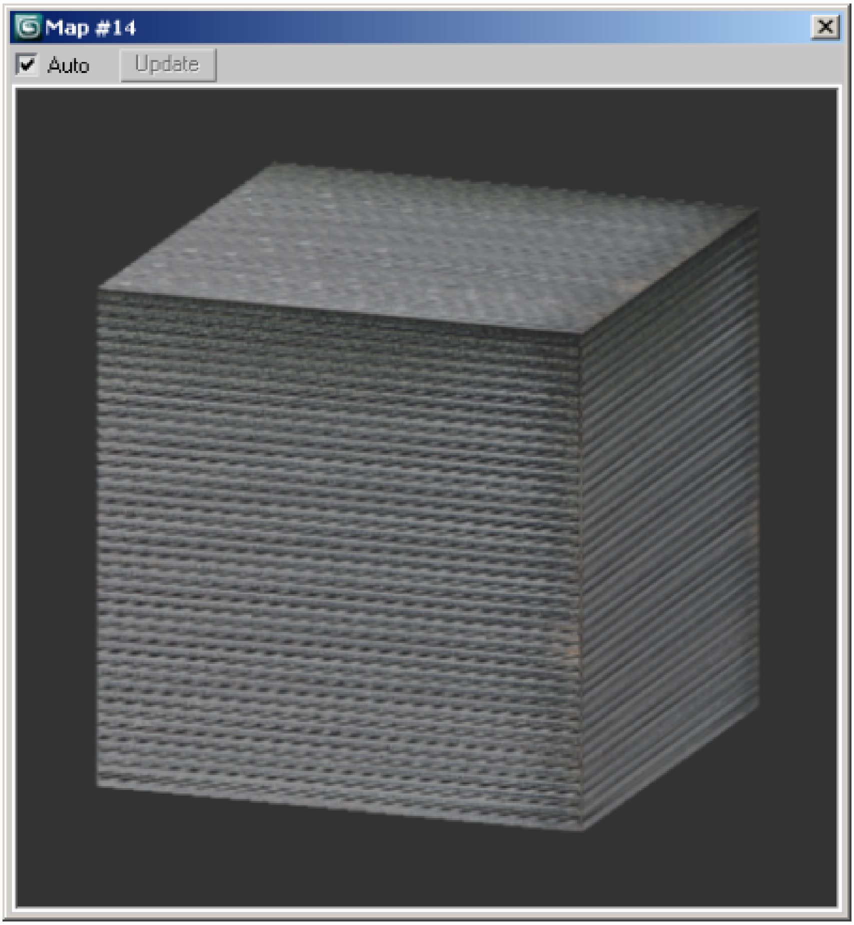
12 Click the Sample type button, then from the flyout, choose the cube option.



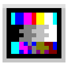
The sample slot sphere converts to a cube, which is a closer representation of the shutter geometry.

13 Double-click the Shop-Door material sample slot to display the map in a viewer. Resize the viewer if required.

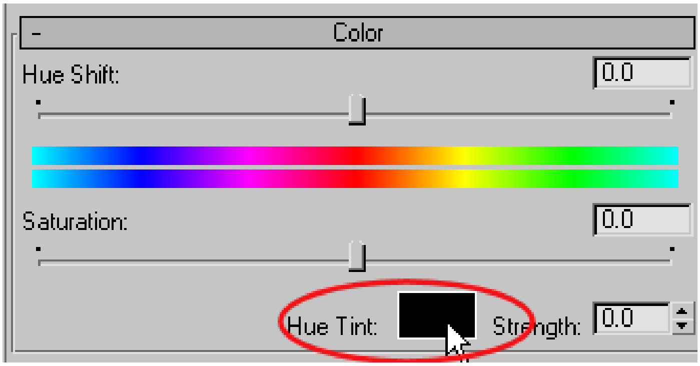


Shutter bitmap image as the base layer in the composite map

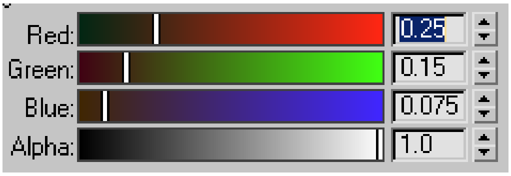
Notice how the generic material is uniformly gray in color. Let's add a little rust to give the shutter a more run-down appearance.

14  On the Layer 1 rollout, click the left-hand Color Correct button.

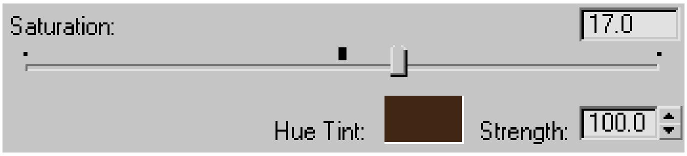
15 On the Color rollout, click the Hue Tint color chip.



16 Using the color controls, choose a dark brown color. Alternatively, type the following values in the RGB spinner boxes: **0.25**, **0.15**, and **0.075**.



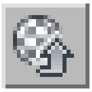
17 Drag the Saturation slider to **17.0** and in the Strength box, type **100.0**.

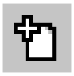


The Shop-Door material shows a brownish tint.

Add a layer defined by alpha values:

Next, you will add a second layer to your composite map, one that contains the bold strokes of a graffiti artist.

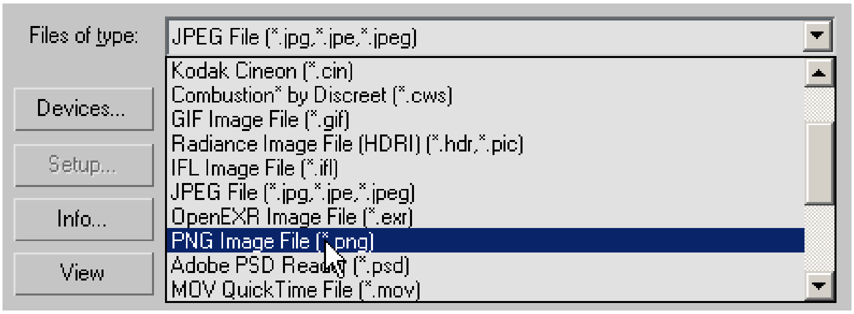
1  Click Go To Parent to view the texture at the composite level.

2  On the Composite Layers rollout, click the Add A New Layer button.

3 On the Layer 2 rollout, click the Assign Material button (initially labeled "None") to the left.

4 On the Material/Map Browser, double-click Bitmap.

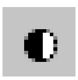
5 On the Select Bitmap Image File dialog, click the Files Of Type list box, then choose PNG Image File.



From the file list, choose *graffiti.png*. Click View to display the image in a viewer.

Graffiti bitmap used as the second layer in the composite map

In addition to red, green, and blue (RGB) information, the bitmap includes alpha channel information in its *.png* file format. This channel provides the level of opacity needed to superimpose the graffiti image over the base image.

6  Click the Display Alpha Channel button.

A black and white version of the image displays, showing the file's alpha information.

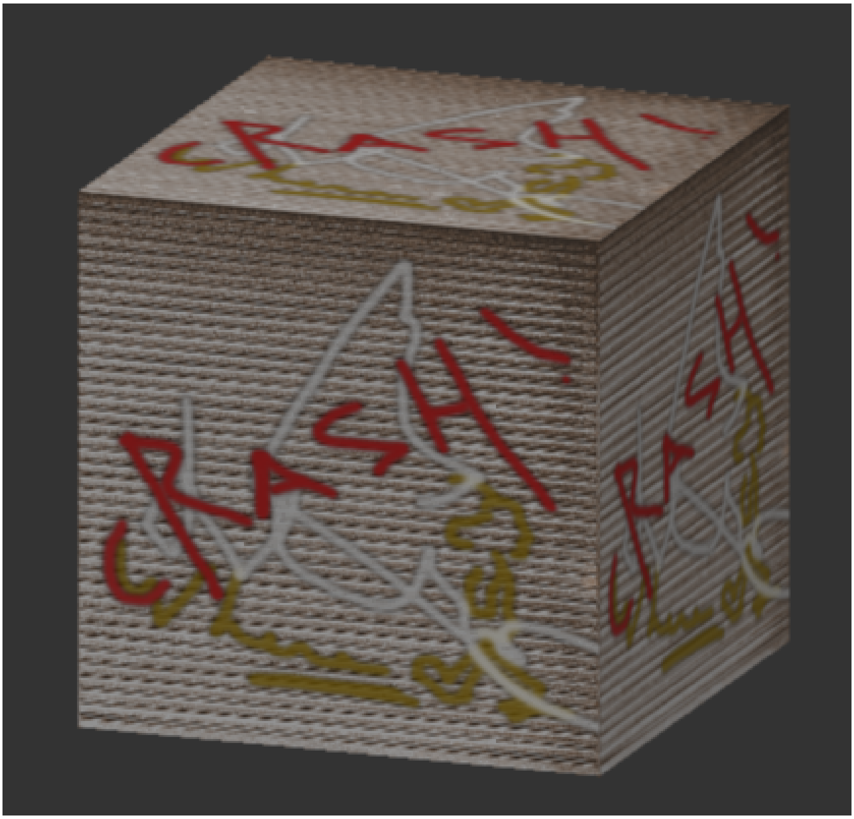
Alpha channel of the graffiti bitmap

Black regions of the bitmap will be completely transparent in the composite map. White regions, representing the graffiti strokes, will be completely opaque and fully visible in the composite map. Gray regions will be semi-transparent and provide partial visibility, giving a blurred edge to the graffiti.

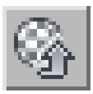
Other formats that include alpha channel information are *.tif*, *.tga*, and *.exr*.

7 Close the *graffiti.png* viewer and click Open to activate the bitmap.

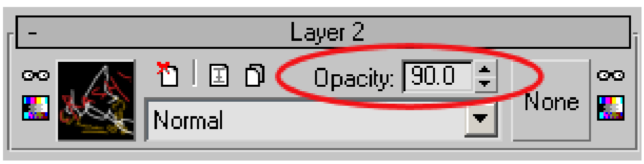
The second image layer is now composited according to its alpha channel values onto layer 1.



Composite map with the graffiti layer composited on the shutter layer

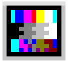
8  Click Go To Parent to return to the composite level.

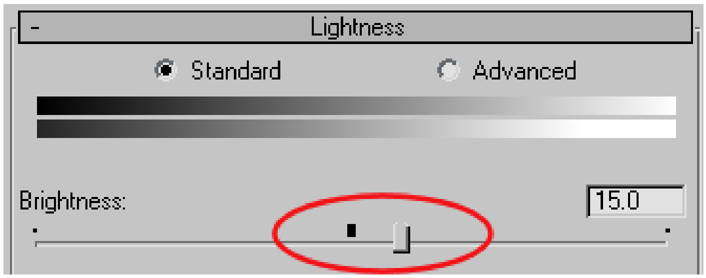
9 On the Layer 2 rollout > Opacity box, type **90.0** and press Enter.



This slightly increases the global transparency of layer 2, so that a small portion of layer 1 remains visible. The result is a more convincing blending of the graffiti onto the shutter surface.

The graffiti layer still needs to stand out a little more: you will use the color correction tools to achieve this effect.

10  On the Layer 2 rollout, click the Color Correct button to the left and on the Lightness rollout, drag the slider to the right until the Brightness box shows a value of **15.0**.



The brightness change affects the alpha channel in the semi-transparent portion of the layer as well, creating an unwanted halo effect around the graffiti strokes.

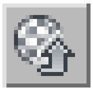
Halo surrounding graffiti strokes

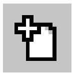
You will correct this problem by increasing the contrast level.

11 Drag the Contrast slider to the right until the box displays a value of **25.0**.

Add a layer defined by a mask:

You will now add a third layer to your composite map, one that features a poster.

1  Click Go To Parent to return to the composite level.

2  On the Composite Layers rollout, click Add A New Layer.

3 On the Layer 3 rollout, click the Assign Material button (initially labeled "None") to the left.

4 On the Material/Map Browser, double-click Bitmap.

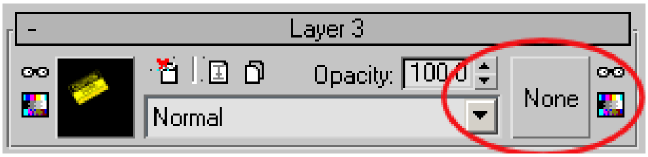
5 On the Select Bitmap Image File dialog, click the Files Of Type list box, then choose All Formats.

6 From the list of images, double-click *c-sign.jpg*.

The c-sign bitmap applied as a top layer in the composite map

Bitmaps saved in *.jpg* format have no alpha channel information, so by applying the *c-sign.jpg* image directly as a top layer, you have completely obscured all layers beneath it.

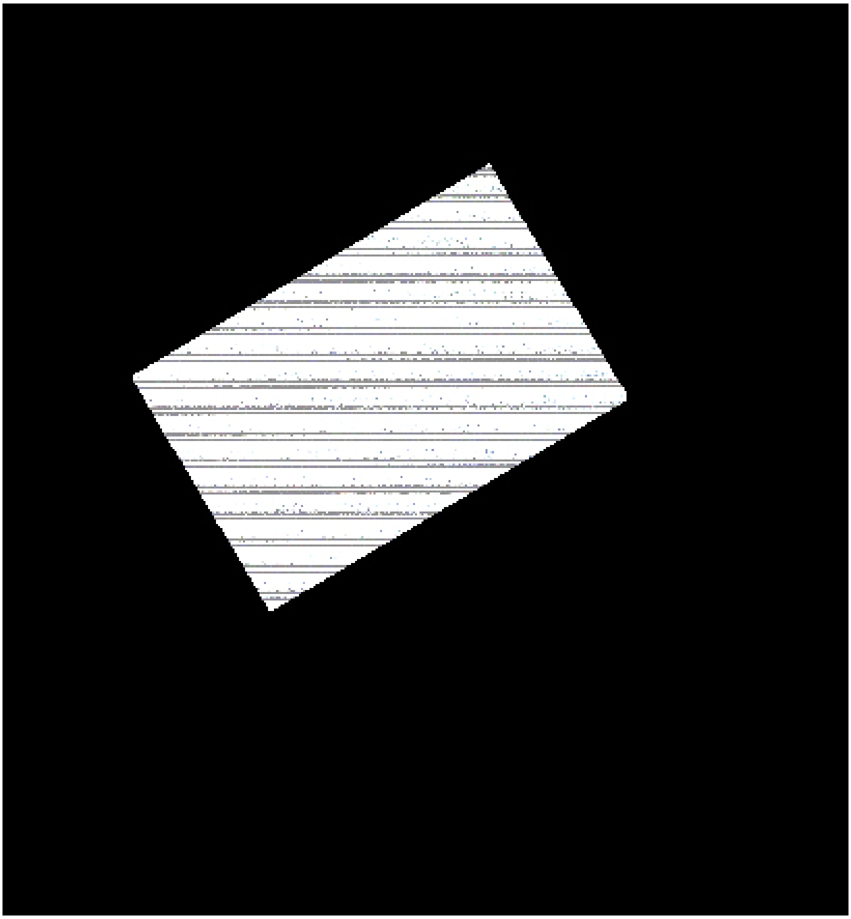
7  Click Go To Parent and on the Layer 3 rollout, click the Assign Mask button (initially labeled "None") to the right.



This button opens a browser containing images that you can use to mask out anyunwanted regions in the third layer. In this case, this includes all regions outside the poster.

While you could easily create your mask in a paint program, a mask image has already been prepared for you.

8 On the Material/Map browser, double-click Bitmap and on the Select Bitmap Image File, choose *c-sign-msk.jpg*. Click View to display the image in a viewer.



Bitmap used to create a cutout of the poster for layer 3

The mask is made up of black and white information. All black regions of the mask image will be completely transparent in layer 3, all white areas will be opaque, and gray regions will be semi-transparent.

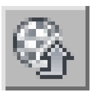
The mask will act as a “custom” alpha channel to the color map.

9 Close the image viewer, then click Open to apply the layer to the composite texture map.

Layer 3 with the mask applied

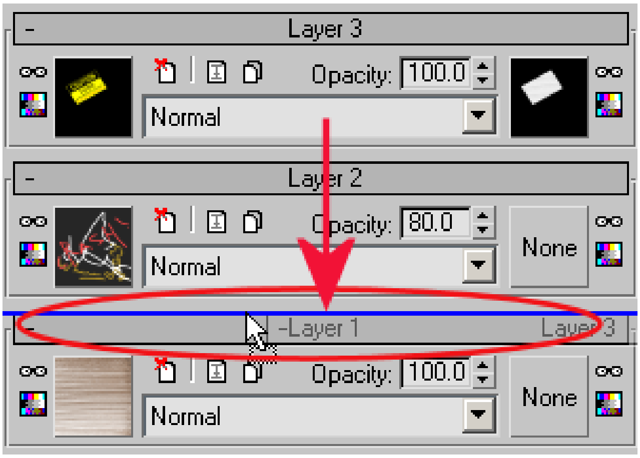
The alpha values from the mask have created a cutout for the poster. The grey, or semi-transparent regions within the cutout have permitted some of the base layer to show through and blend effectively with the top layer.

One small problem remains. You want the graffiti to cover the poster, not the other way around.

10  Click Go To Parent to return to the composite level.

11 Click and drag the Layer 3 rollout label downward to a point just above the Layer 1 label.

12 Release the mouse when a blue line displays above the Layer 1 label.



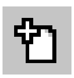
The layers are reordered and renumbered accordingly. (Layer 3 becomes Layer 2, and vice-versa.)

Blending Layers

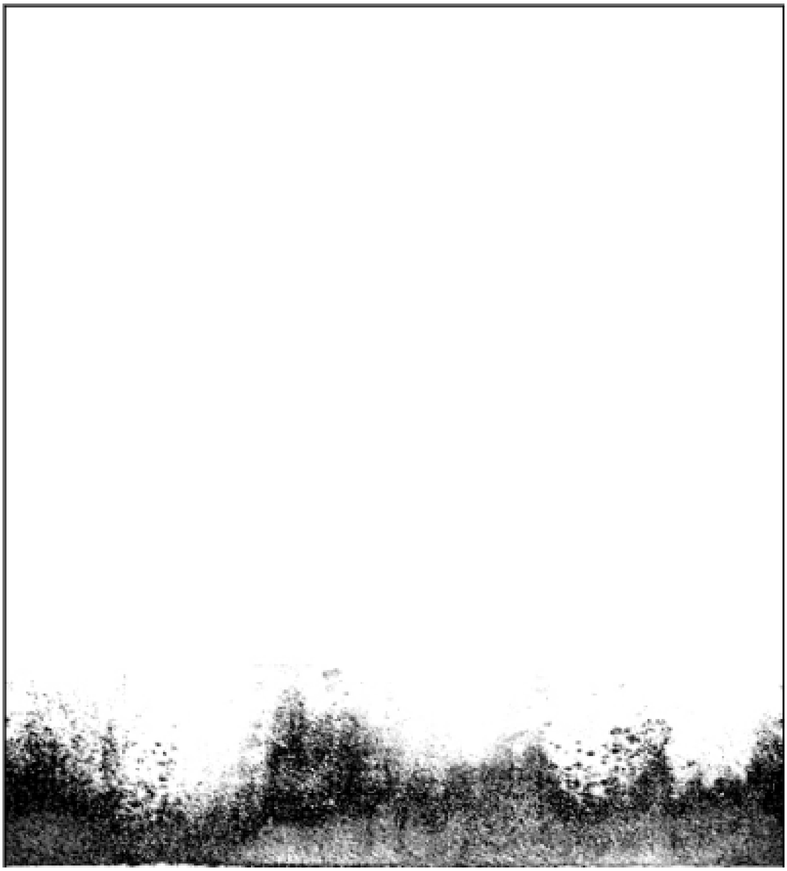
In the previous lesson you added layers to the composite map while in Normal mode. In this mode, no blending between layers takes place: visibility is determined solely by each layer's alpha channel.

In Blending mode, you can produce interesting composite effects by choosing how pixels in the top layer interact with those underneath. In this lesson, you will use two blending techniques to add several more layers to the composite map.

Use blending mode to add more textures to the composite map:

1.  On the Material Editor > Composite Layers rollout, click Add A New Layer.
2. On the Layer 4 rollout, click the Assign Material button (initially labeled "None") to the left.
3. On the Material/Map Browser, double-click Bitmap.
4. On the Select Bitmap Image File dialog, choose *dirt-bottom.jpg*.

5 Click View to display the image in a viewer.

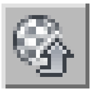


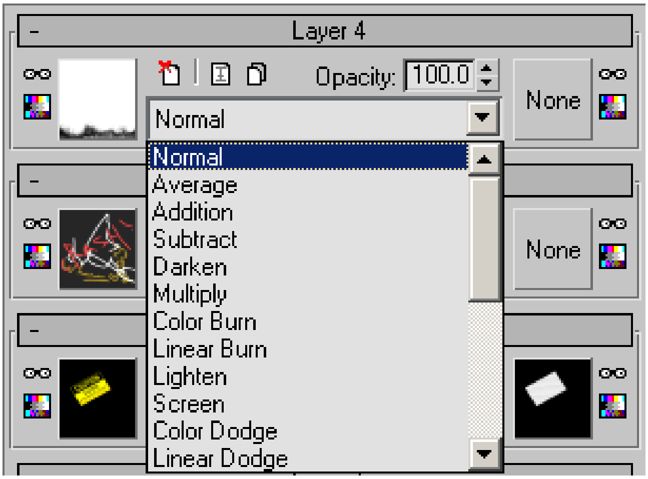
Bitmap used in the first blend operation

You will overlay this black and white image onto the composite map.

6 Close the viewer and click Open to activate the image.

Because the.*jpg* image has been applied to the composite as a texture with no alpha channel present, it completely obscures all layers beneath it. You will now use a blending option, rather than alpha information, to merge this image with other layers in the composite.

7  Click Go To Parent and on the Layer 4 rollout, click the Normal list box.



8 Experiment with various blending techniques by choosing a few options from the list.

The options resemble those available in such paint programs as PhotoShop and Combustion. Refer to the 3ds Max Help for a description of what each blending option does.

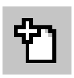
9 Choose Multiply from the list.

First blend operation using Multiply

This option multiplies the color value of all layers in the composite. The non-white color channels have a value of less than 1.0, so the multiplication tends to produce darker colors, a condition you will now correct.

10 On the Layer 4 rollout, go to the Opacity box and type **80.0**, and then press Enter.

The reduced opacity of the top layer results in a lighter overlay of grime.

11  On the Composite Layers rollout, click Add A New Layer.

12 On the Layer 5 rollout, click the Assign Material button (initially labeled “None”) to the left.

13 On the Material/Map browser, double-click Bitmap.

14 On the Select Bitmap Image File dialog, double-click *dirt-top.jpg*.

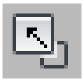
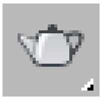
15  Click Go To Parent and on the Layer 5 rollout, choose Linear Burn from the blend mode drop-down list.

Second blend operation using Linear Burn

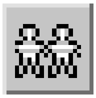
This colorizes the darker pixels of layers 1 to 4 with color from pixels in the top layer. The result, however, is too dark.

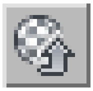
16 In the Opacity box, type **70.0**, and then press Enter.

Add bump information to the composite:

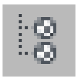
1   Click maximize, activate the Camera01 view, then from the main toolbar, click Render Production.

The shutter shows good detail, but its corrugated surface lacks depth. You will correct this by adding bump information from the *shutter.jpg* image.

2  On the rendered frame window, click Clone Rendered Frame Window.

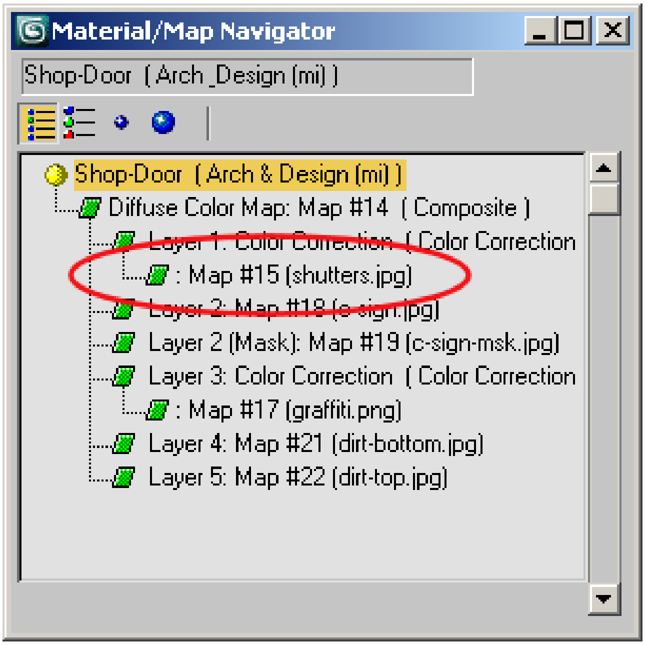
3  On the Material Editor, go up one level, then scroll down to the Special Purpose Maps rollout.

4 On the Bump spinner box, type **3.0**.

5  Click Material/Map Navigator.

6 On the Material/Map Navigator dialog, click and drag Map #15 (shutters.jpg) over the Special Purpose Maps rollout > Bump > None button as an instance.

NOTE Do *not* release the mouse button after you click on Map #15, otherwise the Material Editor will update to show the Map #15 parameters.



7 Close the Material/Map Navigator.

8 Render the Camera01 viewport again and compare the result with the cloned rendered frame.

Rendered composite without bump map (left) and with bump map (right)

The shutter has lost its flat look and appears more three dimensional.

9 If you like, open *composite_completed.max* and compare your work with a completed scene file of this tutorial.

10 If you turned off Use Real-World Texture Coordinates option at the beginning of the tutorial, from the main menu, go to Customize > Preferences > General panel > Texture Coordinates group and turn the option back on.

Summary

In this tutorial, you learned how to create a composite map consisting of multiple layers of images. You used alpha channel information to control image transparency, then used blending options to further define how the source images are composited onto one another.

Spline Mapping

This tutorial shows you how to map material to a curved surface, such as a road or a garden hose.

You will start with the same pawnshop model featured in the Composite Map tutorial and use a spline to map a brick-like material onto the building's arched entrance.

In this tutorial, you will learn how to:

- Choose a mapping method for an object
- Create a spline and use it as a guide when mapping texture to the object
- Adjust the mapping through manipulation of the object's UVW coordinates

Skill level: Intermediate

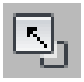
Time to complete: 1 hour

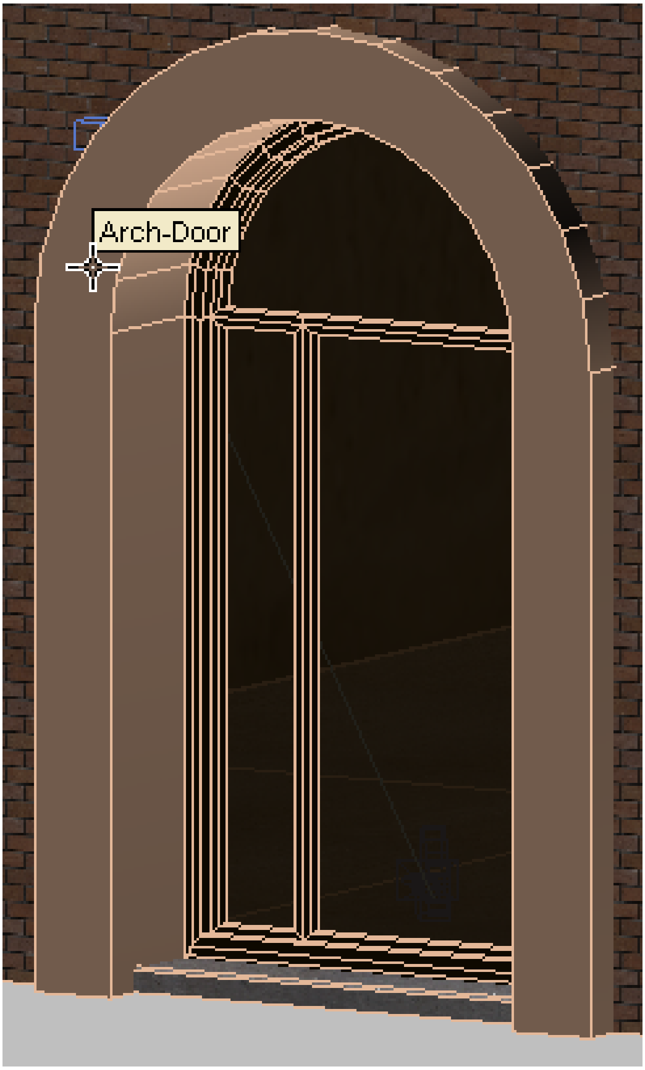
Prepare the Scene

In this lesson, you will choose a brick material to map to the building arch and specify the UVW Unwrap Modifier as the mapping method. You will then create a spline object and use it as a guide in the mapping process.

Choose the material and apply the mapping method:

1  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\spline_mapping* and open the scene file *splinemap-start.max*.

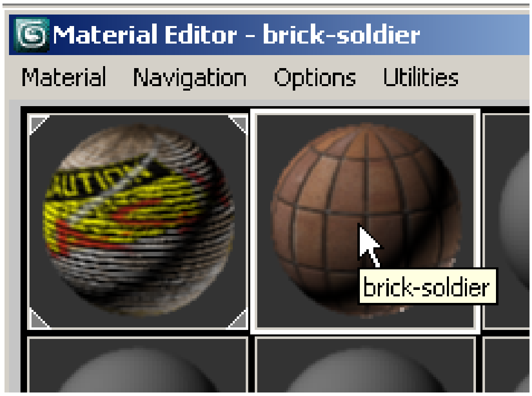
2  Maximize the Orthographic viewport and select the *Arch-Door* object.



Arch door object with no material applied

3 Press M to display the Material Editor.

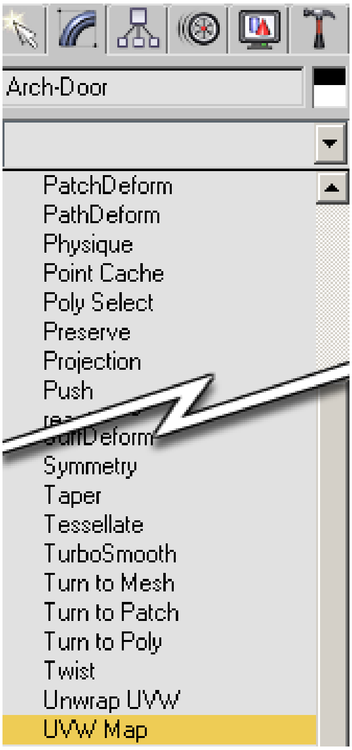
A material called *brick-soldier* has already been prepared for the arch object.



4 Click on the *brick-soldier* sample slot and drag it to the arch object.

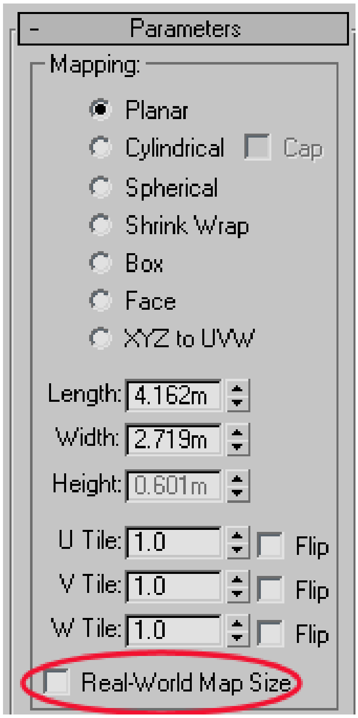
The arch turns a dark brown and shows no further detail because no mapping method has yet been specified for the material.

5 Go to the Modify panel, and from the Modifier List, choose UVW Map.



This mapping method is often used to project bitmap images onto the surface geometry of many types of primitive objects such as planes, boxes, and spheres.

6 In the Parameters rollout > Mapping group, make sure Real-World Map Size is turned off.

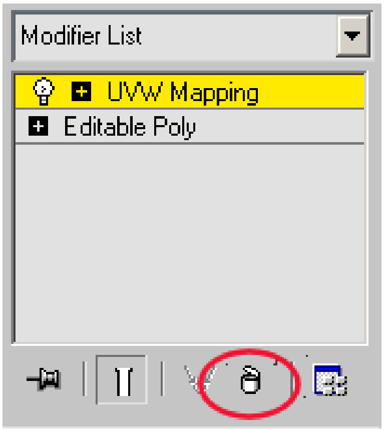


7 Choose Planar if it is not already chosen, then check the viewport to see how the mapping method attempts to project the brick material onto the arch object.

8 Choose Box, Face, and other mapping options to see how the mapping is projected differently.

No option in the UVW Map modifier is able to map the material properly.

9 Click the UVW Mapping modifier, then click Remove Modifier (the button that look like a trash can) to remove the modifier from the arch object.

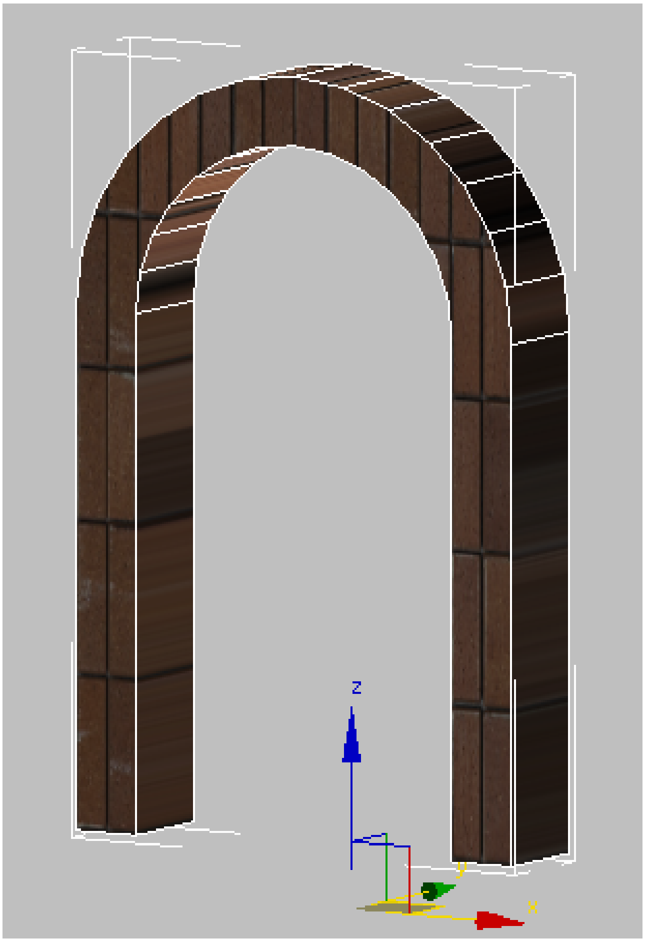


10 From the Modifier List, choose Unwrap UVW.

Unwrap UVW is better equipped to handle mapping of the arch object's complex geometry, because it breaks the arch object into sections, and applies the planar mapping technique to each component.

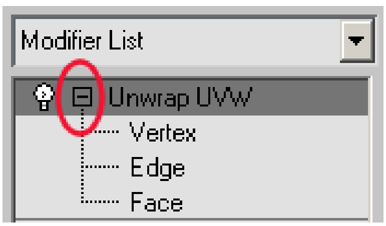
Unwrap UVW is often used to map images onto complex objects.

11 Right-click the arch object in the viewport and from the quad menu, choose Hide Unselected to isolate the object.



Arch object with brick material mapped to its surface

12 On the Modifier List, click the plus sign (+) next to the Unwrap UVW modifier to expand sub-object levels.

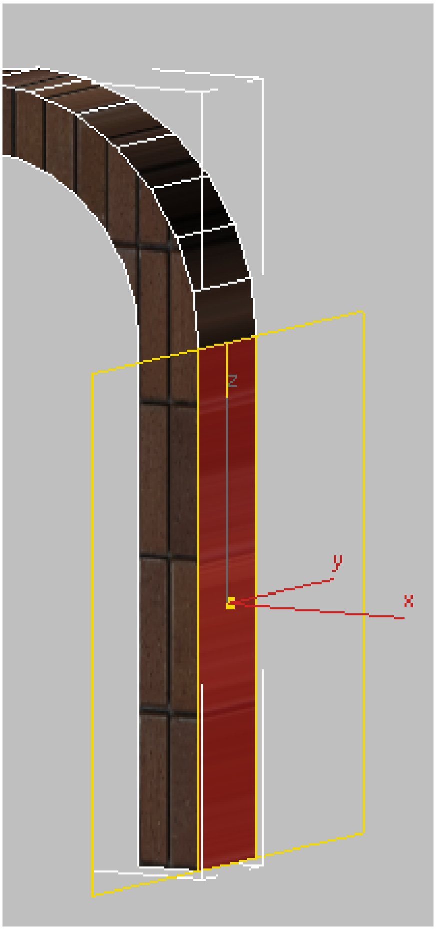


13 Click Face.

At this level, you can map the brick material onto each selected face of an object.

14 In the viewport, select a face on the arch object.

A yellow gizmo displays, representing a planar projection of brick material onto the selected face.



Planar projection of brick material onto an arch face

15 Select another face on the arch object.

Notice how the yellow gizmo resets onto the newly selected face.

On the Map Parameters rollout, there are a number of controls available that can help you use the Unwrap UVW method to map specific types of objects. The Cylinder button, for example, displays controls used to map materials onto cylindrical objects, such as a human arm or a lamp post, while the Pelt button can be used to map material onto fabric such as a pair of trousers, or a curtain.

In this scene, you will use the Spline option, which is useful for mapping curved objects with a cylindrical or square cross-section such as a snake, or a ventilation duct.

Before you use this option, you will create the spline object itself.

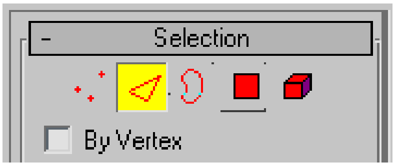
Create the spline shape to use as a map path:

1 On the Modifier List, click Face to exit sub-object mode.

  The spline you create must be centered in the arch object. You can use the line tool or the rectangle tool to draw the spline, but you need to enter the precise arch object coordinate values to do so. A convenient alternative is using existing object geometry to derive the spline values.

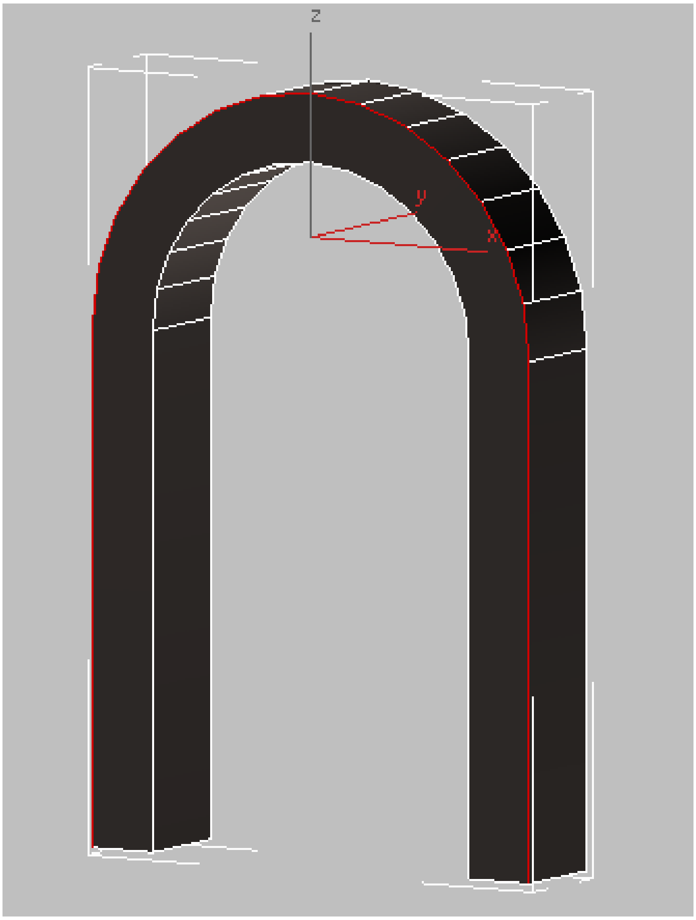
2 In the stack, click Editable Poly, then click Yes to clear the warning message.

3 On the Selection rollout, click the Edge tool.



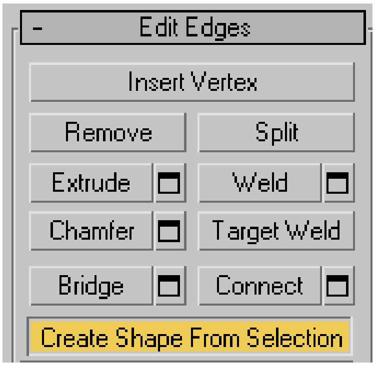
4 Ctrl+click to select all the outer edges of the arch object.

  Be sure to leave the bottom and inside edges unselected.

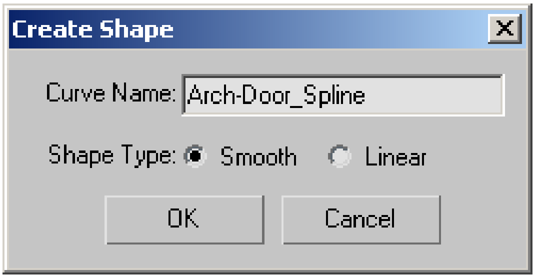


Arch object with all outer edges selected

5 On the Edit Edges rollout, click Create Shape From Selection.

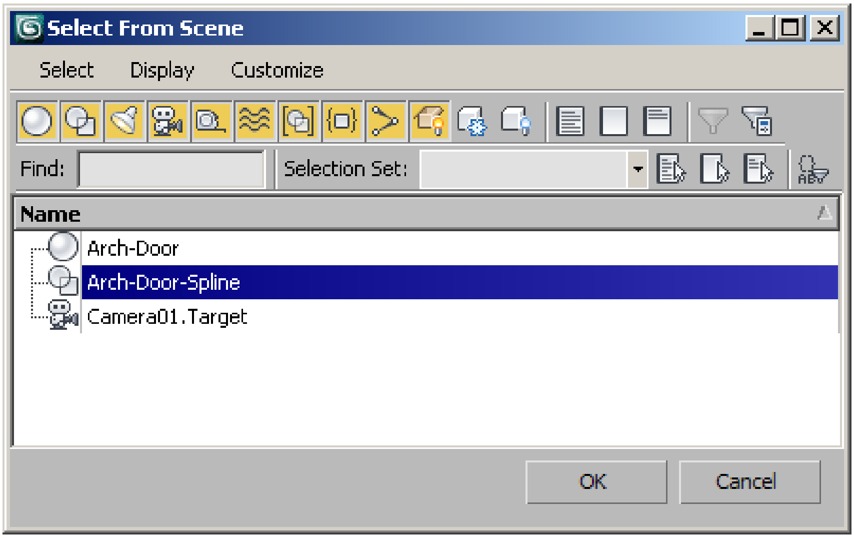


6 On the Create Shape dialog > Curve Name box, name the shape **Arch-Door-Spline**, make sure Shape Type is set to Smooth, then click OK.



7 Click the Edge tool again to exit edge selection mode and press H to open the Select From Scene dialog.

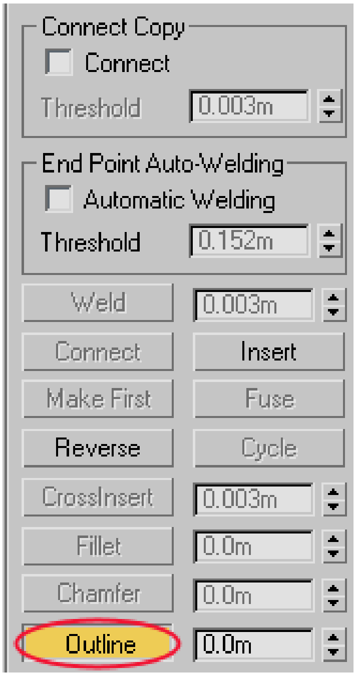
8 Choose *Arch-Door-Spline* from the list to select the newly created spline.



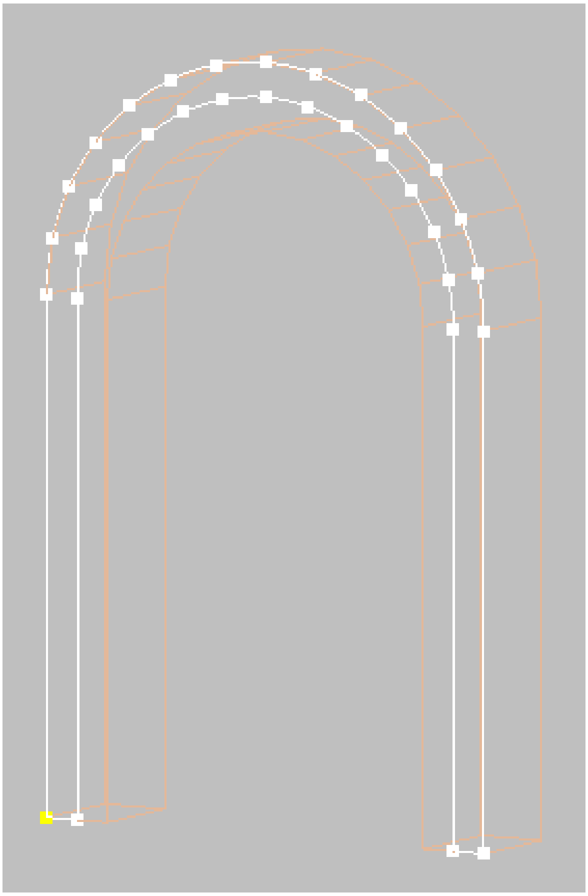
9 Press F3 to switch to wireframe mode.

10 From the Modifier List, expand the Editable Spline modifier and click Spline.

11 On the Geometry rollout, scroll down and click Outline.



12 In the viewport, click and drag the spline until it is positioned roughly at the mid point between the outer and inner edges of the object's front face.

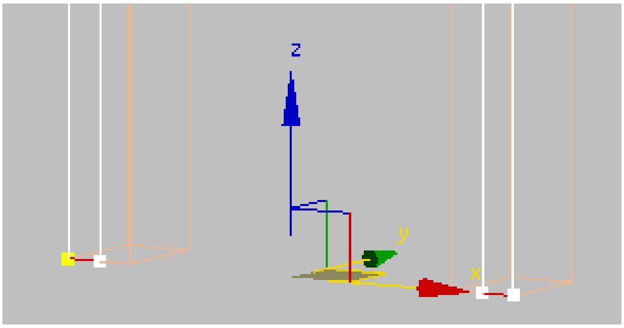


Spline centered on the front face of the arch object

The spline position does not have to be perfectly centered: you can adjust the spline later on when modifying the UVW parameters.

13 Under the Editable Spline modifier, click Segment.

14 Ctrl+click the line segments at each arch object base, then press Delete.

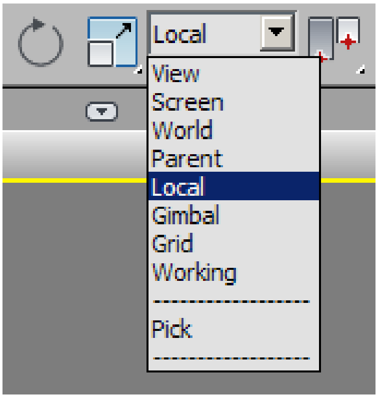


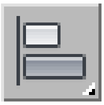
Spline base segments at the base of each arch column

15 Under the Editable Spline modifier, click Spline again, select the outer spline and press Delete.

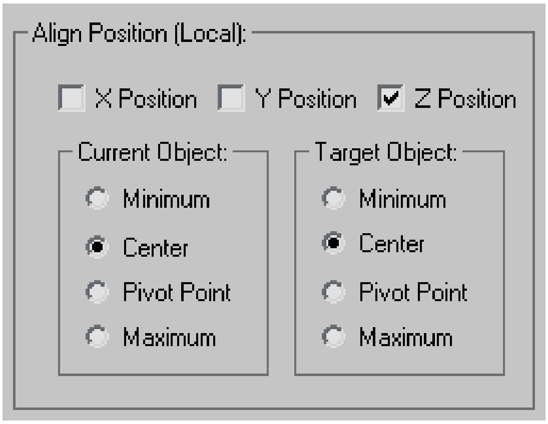
16 Under the Editable Spline modifier, click Spline again to exit the sub-object level.

17 On the main toolbar, choose the Local coordinate system.



18  Make sure the spline is selected, then on the main toolbar click the Align tool and select the arch object.

19 In the Align Selection dialog > Align Position group, turn on Z position and in both the Current Object and Target Object groups, choose Center. Click OK.



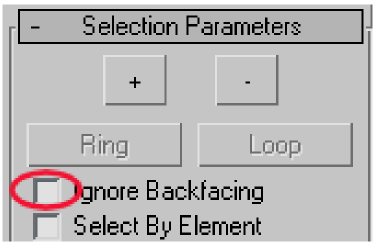
The spline is now properly placed in the center of the arch object, ready to be used as a guide to map the brick material.

Apply the spline as a guide for the mapping:

1 Press F3 to return to shaded view and select the arch object.

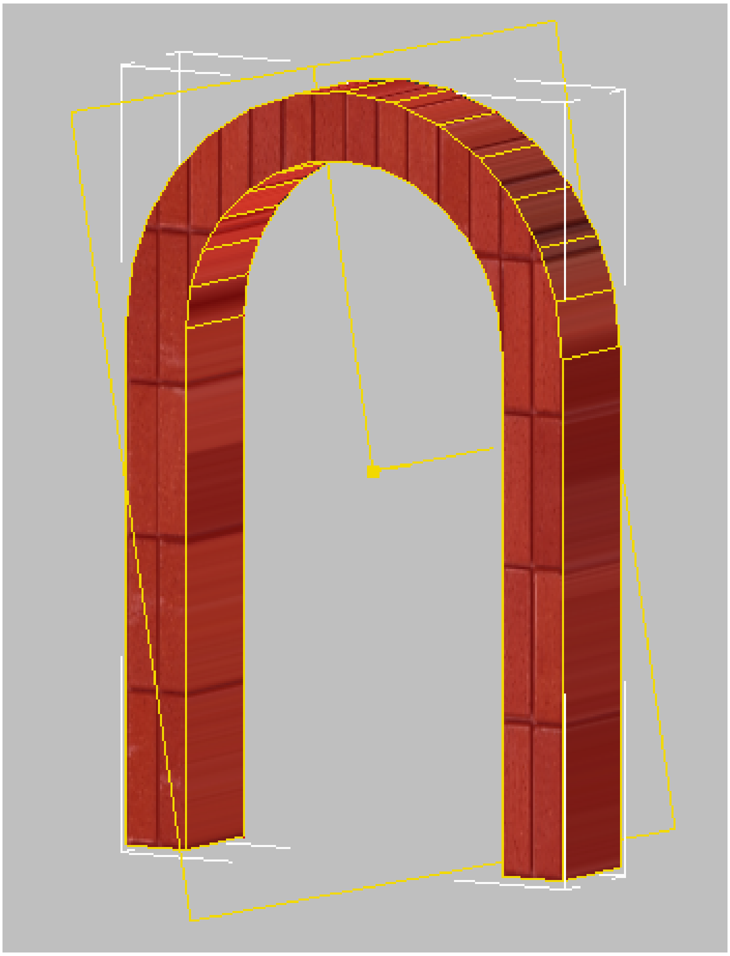
2 On the Modifier Stack > Unwrap UVW modifier, click Face.

3 On the Selection Parameters rollout, turn off Ignore Backfacing.



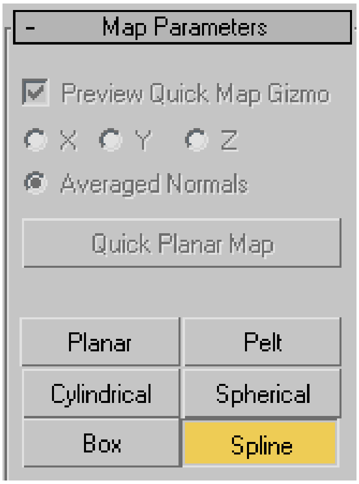
If you leave Ignore Backfacing turned on, only the polygons facing you in the viewport will be included in a selection. Polygons hidden on the other side of the model will remain unselected.

4 Starting just above the base column to the left, click and drag diagonally upward across the arch object to region-select all the faces except for those on the underside of each column base.



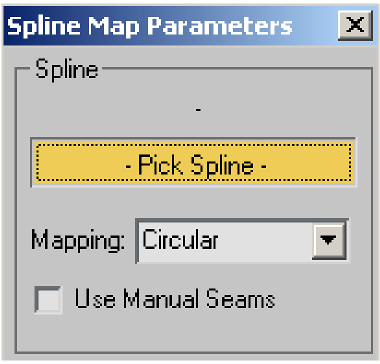
Arch faces selected

5 On the Modify panel, scroll down to the Map Parameters rollout and click Spline.



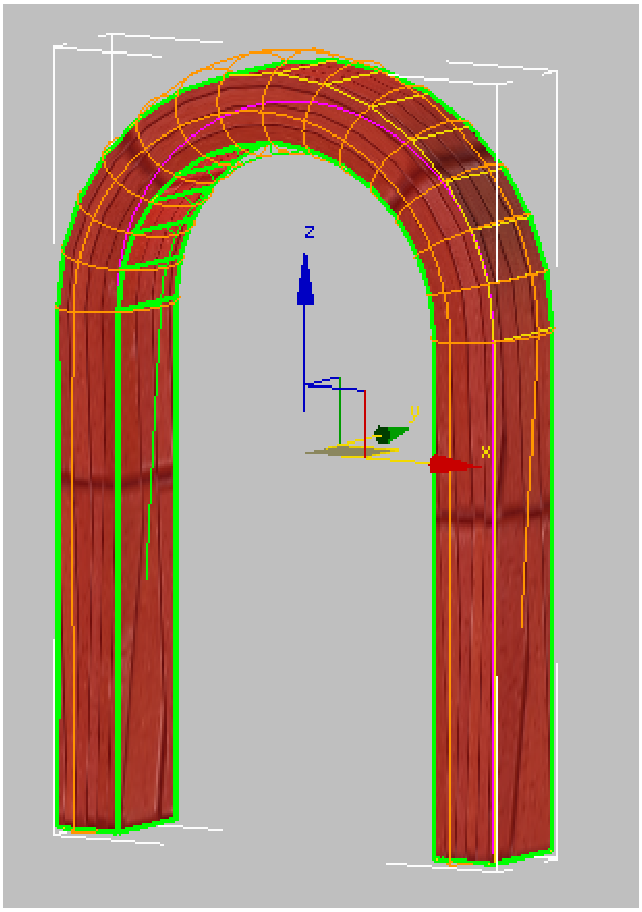
6 On the Spline Map Parameters dialog, click Pick Spline.

For now, leave the Spline Map Parameters dialog open.



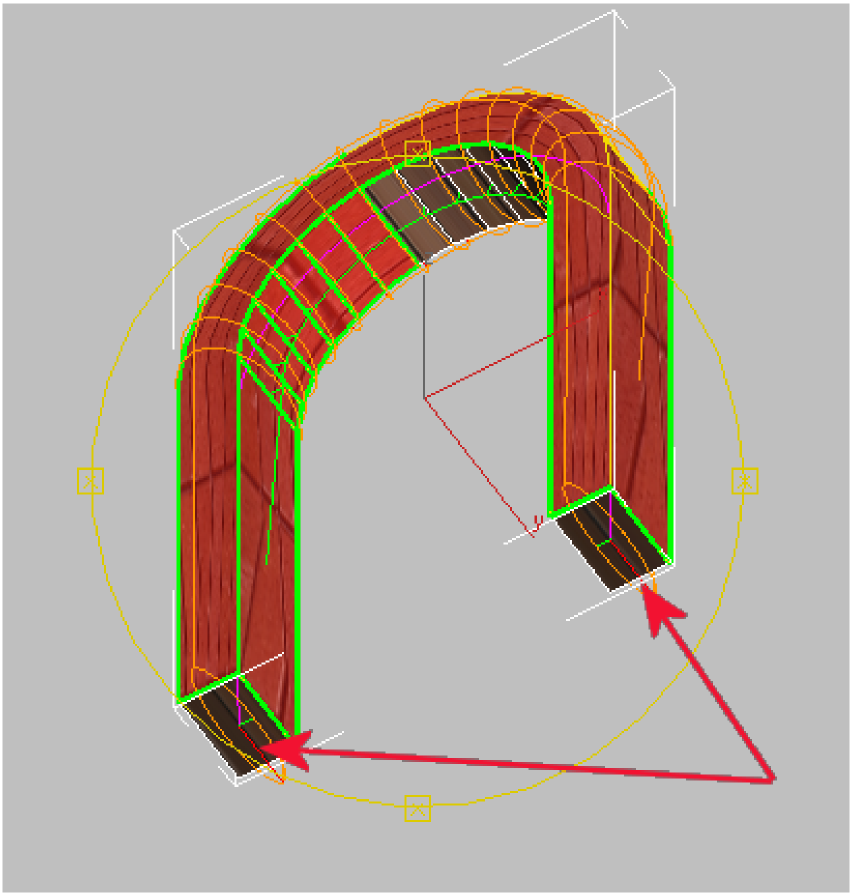
7 Press H and on the Pick Object dialog, choose the *Arch-Door-Spline* from the list, then click Pick.

The arch object is enveloped by a cage gizmo, which shows the outline and cross sections of the mapping.



Arch object enveloped by the cage gizmo

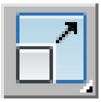
8 Orbit the viewport until the underside of its base is visible.

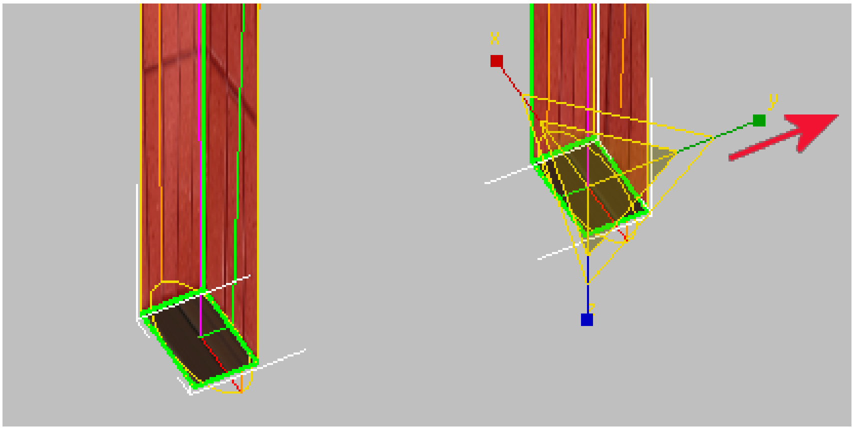


Bottom of arch, showing deformation of cage gizmo

You now need to correct the base of the cage gizmo, which is slightly deformed.

9 Ctrl+click the gizmo at each base.

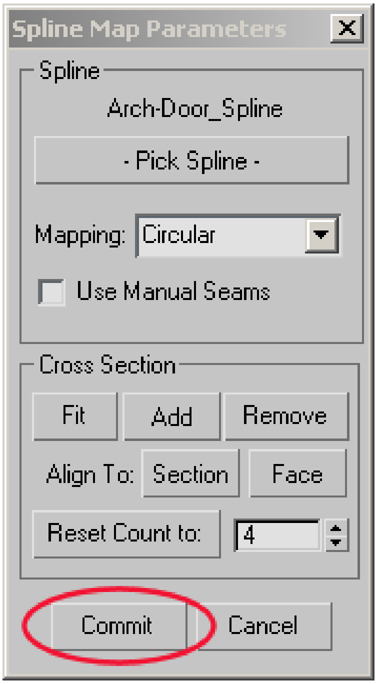
10  On the main toolbar, click Select And Uniform Scale, then drag a gizmo on its Y axis until the cage extends to the outer edges of the arch object.



Cage gizmo after resizing

You do not need to be precise at this point: you will define the cage in the next lesson using the unwrap controls.

11 On the Spline Map Parameters dialog, click Commit to accept the changes made to the spline so far.



Fine-Tune the Mapping

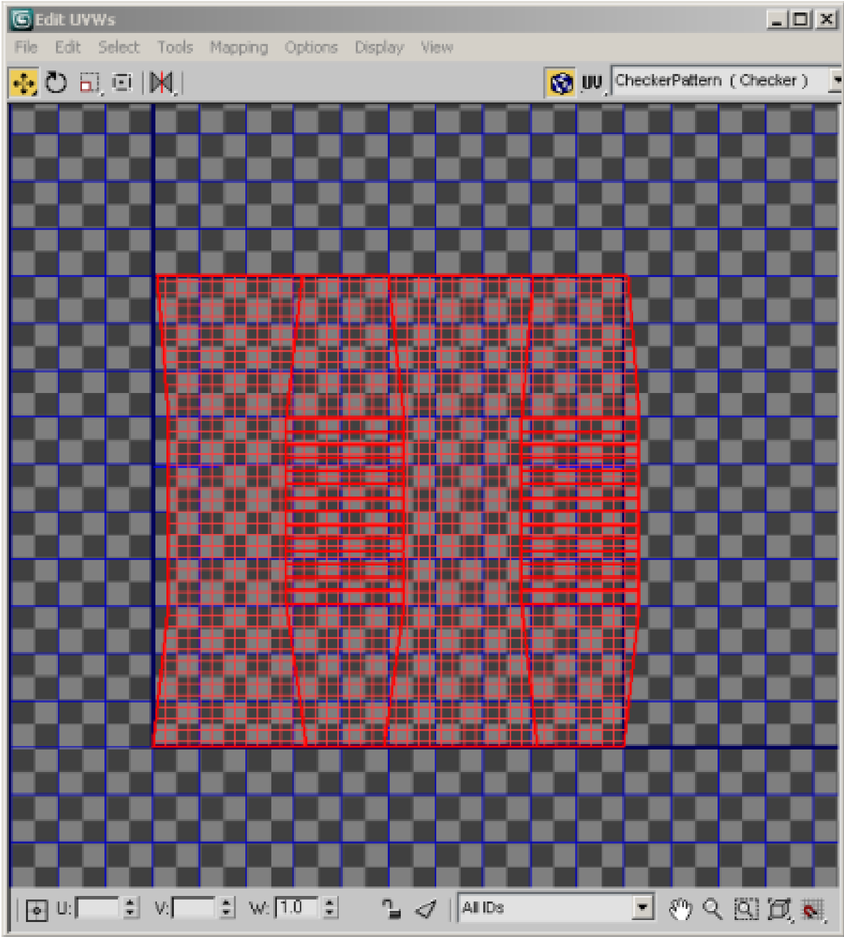
With the introduction of the spline as a guide, the brick material can now properly follow the contours of the arch object. However, the bricks in their present form are too large and are mapped vertically up the arch columns instead of horizontally across.

In this lesson, you will use the UVW editor to adjust the mapping so that the bricks map properly.

Adjust the UVW vertices:

1 On the Parameters rollout, click Edit.

The Edit UVWs window opens.



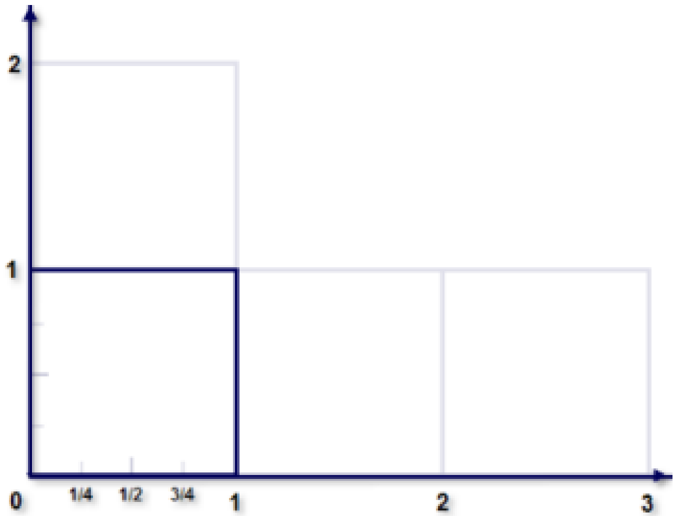
Arch object displayed as grid of UVW faces and vertices

A flattened representation of the arch object displays, comprising four red vertical panels made up of UVW faces and vertices. Each panel represents the inner, outer, left, and right face of the arch.

2  Adjust the size of the window so you can see both the edit region as well as the arch object in the viewport. Use the Edit UVWs window zoom tool to zoom out slightly.

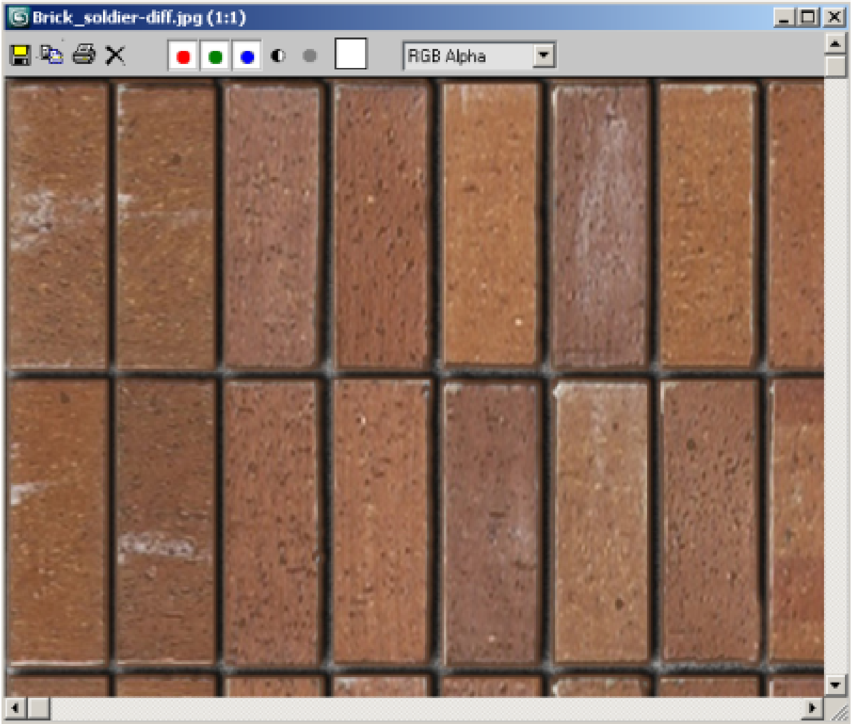
The surface of the arch object is currently mapped to a single tile of the brick-soldier material.

The black square occupied by the flattened arch object corresponds to the dark square in the next diagram, which shows the coordinate system of the Edit UVWs window.



The texture you apply to the arch object will be mapped to this area, whose coordinate system ranges from 0, 0 to 1, 1.

3 On the main menu, choose Rendering > View Image File, and on the View File dialog, navigate to the folder *\sceneassets\images*, click to highlight *brick_soldier-diff.jpg* and click Open.



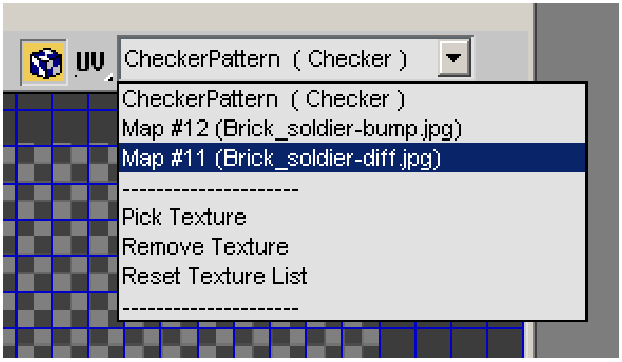
Bitmap image mapped to the arch object

An image file window opens, showing the bitmap image currently mapped to the arch object. It is mapped on a one-to-one basis on using UVW coordinates ranging from 0 to 1.

Outside of the square bounded by the 0 to 1 values, the same image is tiled once in every direction to occupy the entire UVW window.

4 Close the image file window.

5 In the Edit UVWs window > CheckerPattern list box, choose Map #11 (brick_soldier-diff.jpg) to display a diffuse map of the material in the window.



6 In the Selection Modes group, click Options.

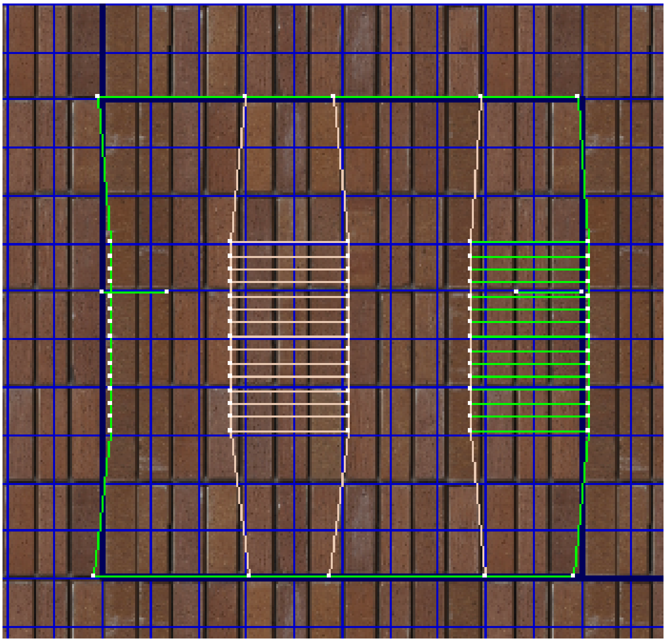
The Bitmap Options group displays below the Soft Selection group.

7 In the Bitmap Options group > Brightness spinner, type **0.75** and press Enter to increase the image tile visibility.

8 In the Selection Modes group, click Vertex Sub-object Mode.

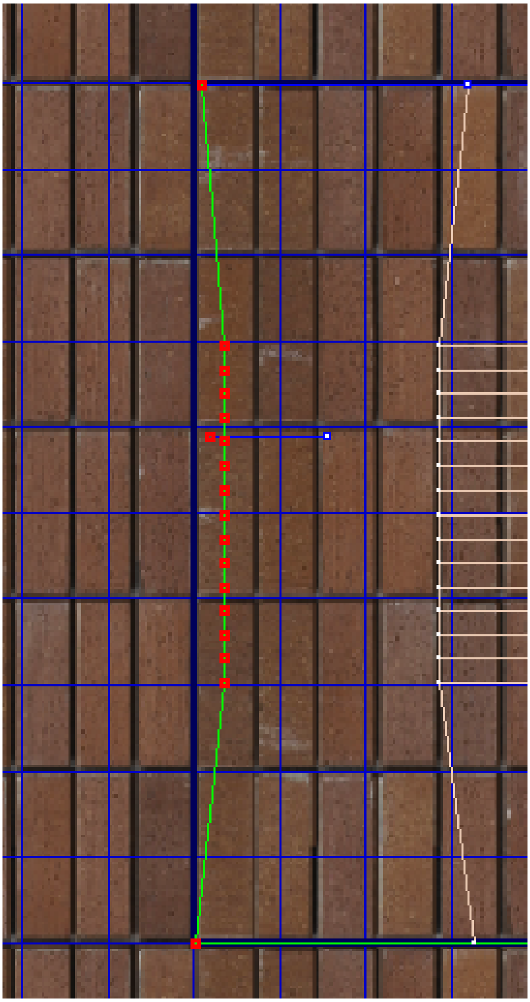
By switching to this mode, you can see how the unwrap modifier has slightly warped the contours of the arch object. These contours need to be straightened.

NOTE The contours in your unwrapped arch object might be slightly different to the one shown in the next illustration, depending on how you resized the cage gizmo in the previous lesson.



Warped contours of the unwrapped arch object

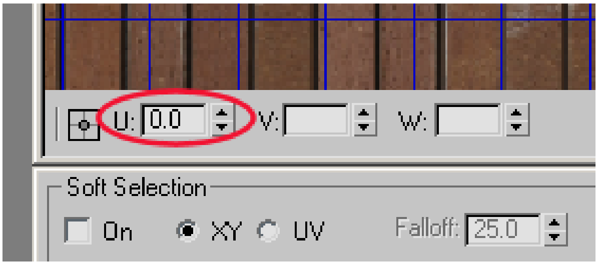
9 Zoom in to the arch object, click Select And Move, and region-select all the vertices of the left outside edge.



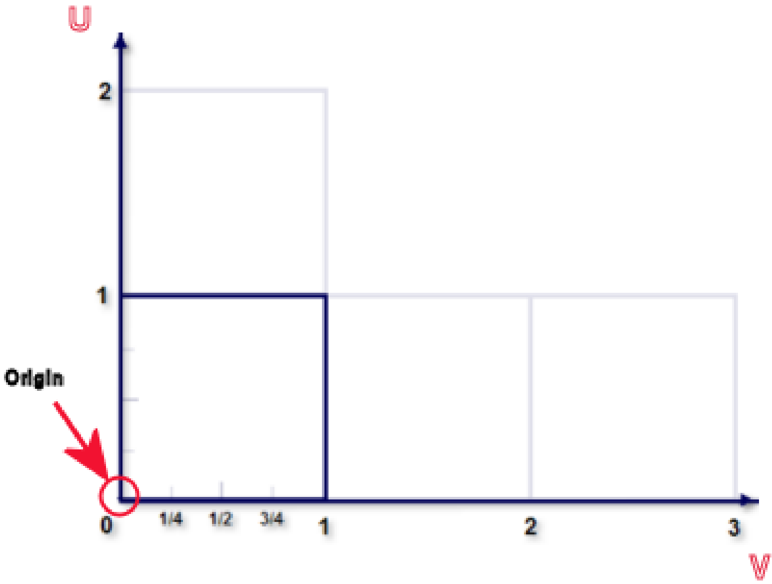
UVW vertices of left outside edge selected

For these vertices to be properly aligned with the image map, they must all have the same U value of 0.

10 On the U box, type **0.0** and press Enter.



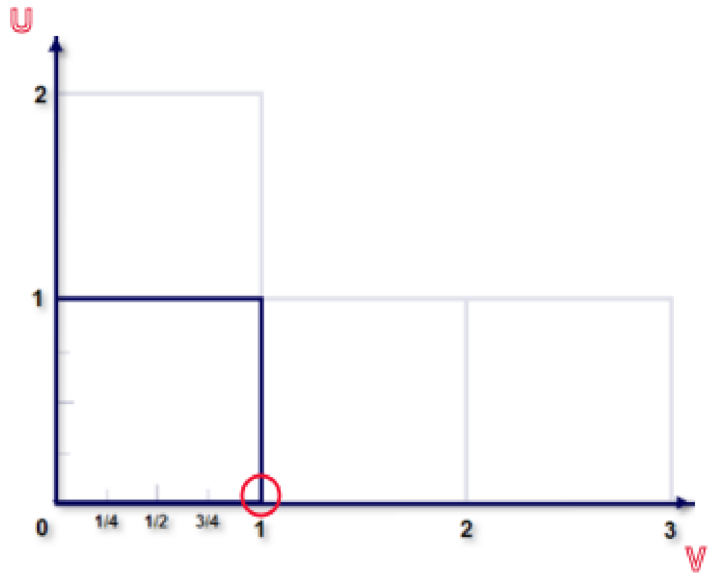
This gives the the horizontal map coordinate for each selected vertex a U value of 0, thereby aligning all the vertices vertically at their origin (0) as shown in the next diagram.



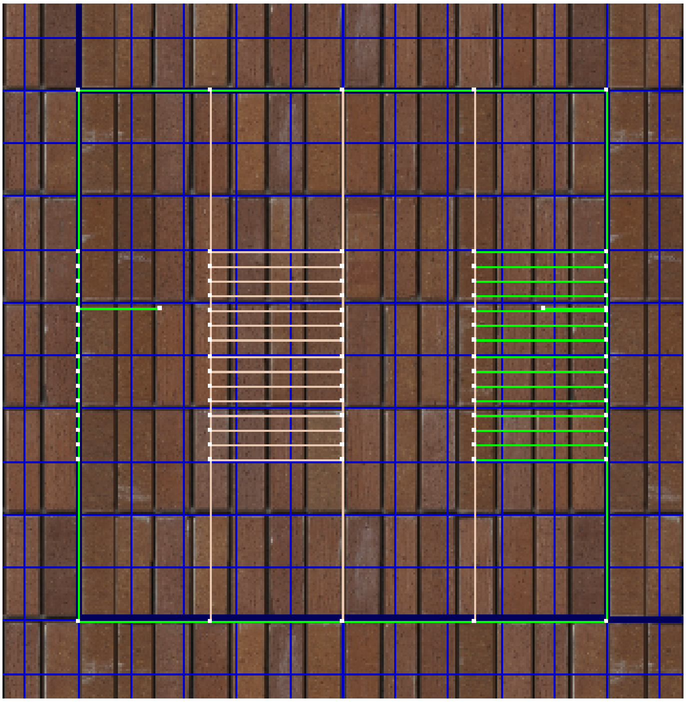
11 Region-select all the vertices at the right outside edge of the arch object.

12 On the U box, type **1.0** and press Enter.

This aligns each selected vertex vertically at a horizontal value of 1.



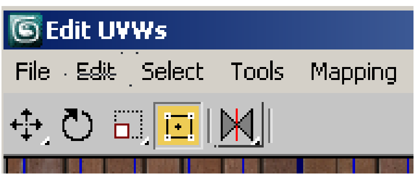
13 Select in turn, from left to right, the remaining columns of vertices for each inside edge. Give each edge a U value of **0.25**, **0.5** and **0.75** respectively.

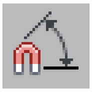


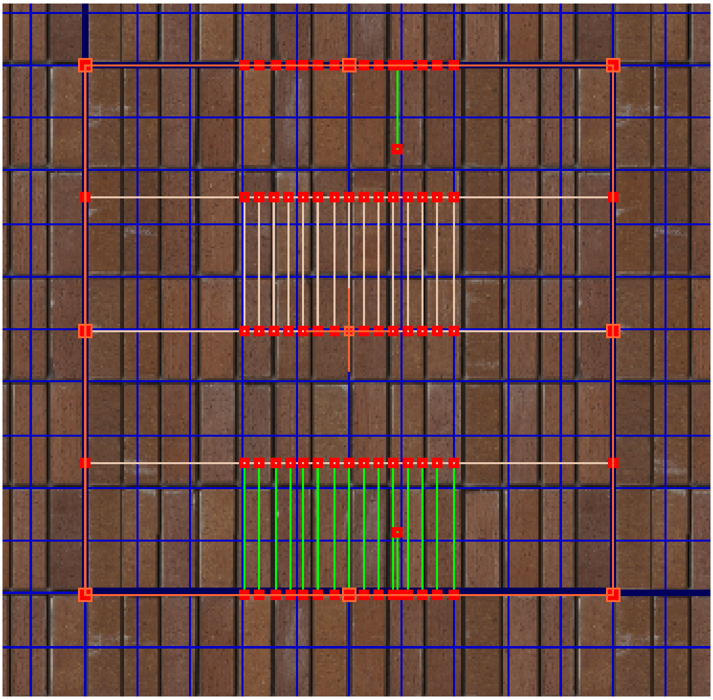
UVW vertices after alignment

The UVW map now covers the surface of the arch object must better. But, as you can see in the viewport, there remains an obvious problem. The bricks are mapped vertically, whereas they need to be mapped horizontally. To make this change, you need to rotate the mapping by 90 degrees.

14 In the Edit UVWs window, select all the vertices and on the Edit UVW toolbar, click Freefrom Mode.



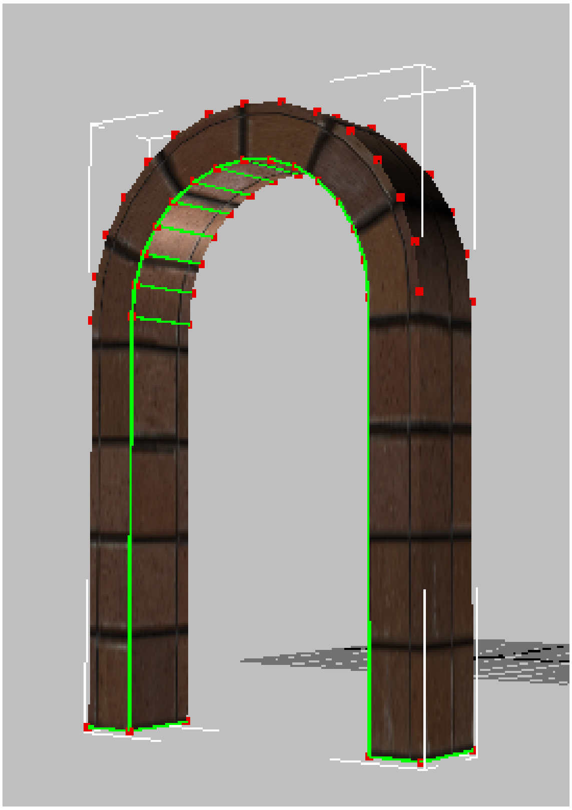
15  On the main toolbar, click Angle Snap, then position your cursor over a vertex at the mid point of any side and drag until the rotation indicator displays 90.



UVW grid after rotation

NOTE If you prefer, you can use the Edit UVWs window Rotate tool to rotate the UVW guides.

The material on the arch object is now properly oriented. Notice, however, that you have five rows of bricks mapped to the four panels that represent each face of the arch object. This causes more than one brick to be mapped onto each face.

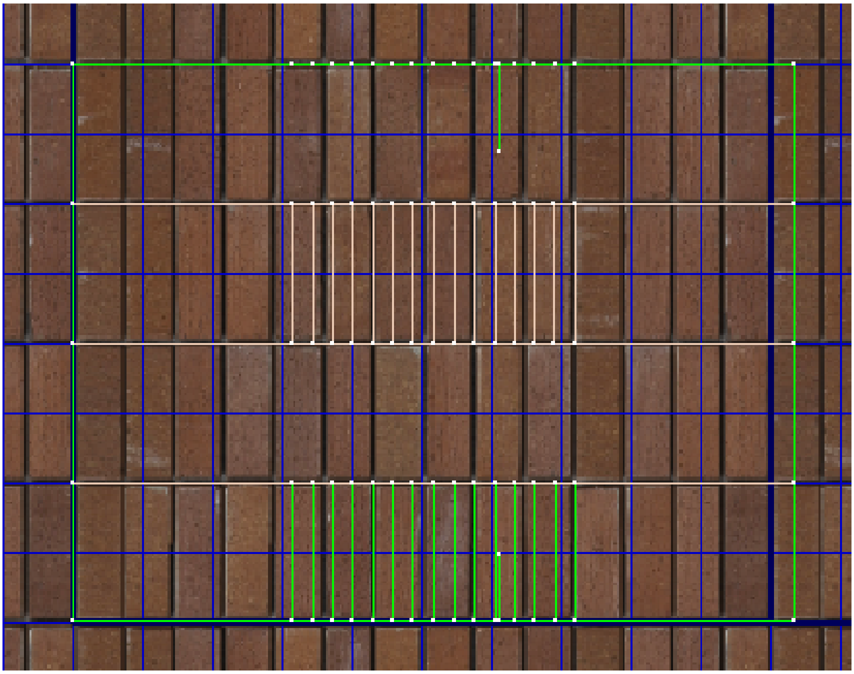


Arch object with more than one brick mapped to each face

Close-up of arch object front and side face

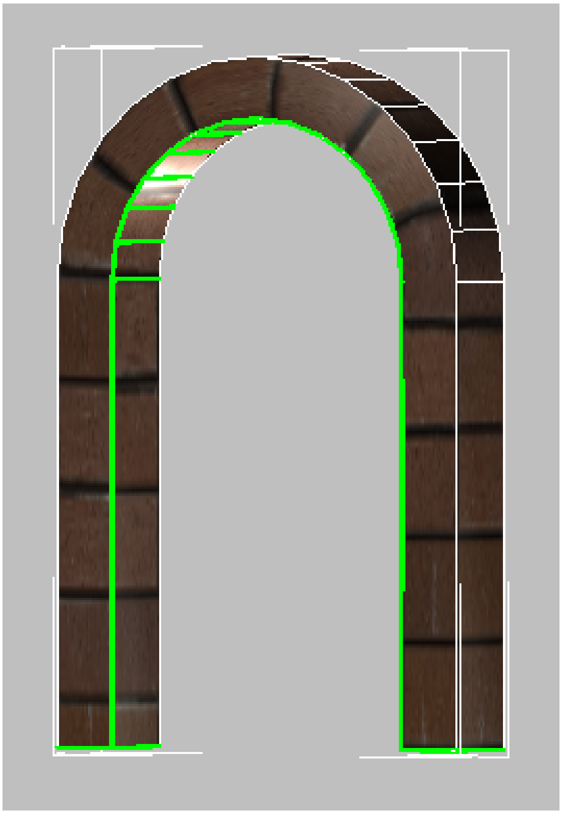
You need to resize the UVW grid over the map so that only one brick is mapped to each face.

16 Hold down the Shift key, click on the left or right corner of the UVW grid and drag down until the grid is resized vertically to fit over the four rows of bricks. Zoom in to obtain a more precise fit.



UVW grid resized vertically to cover four rows of bricks, one row per face

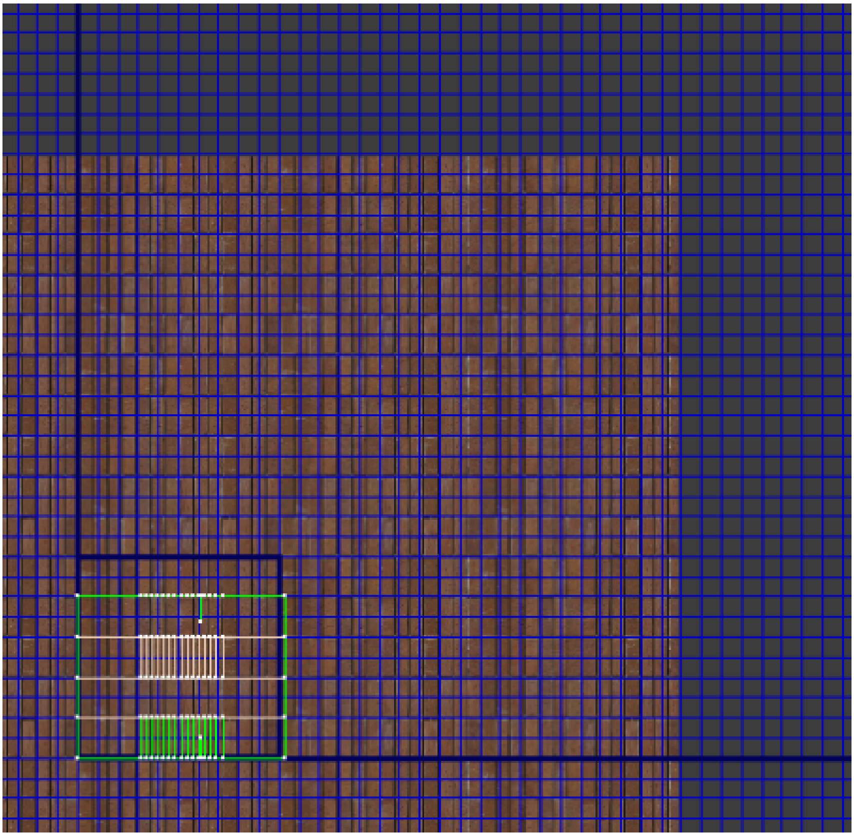
In the viewport, you can see that the number of bricks per face is now correct, but the bricks themselves are too large.



Arch object mapping, with one brick mapped per face

17 In the Edit UVWs window, zoom out and in the Bitmap Options group > Tiles box, type **2**.

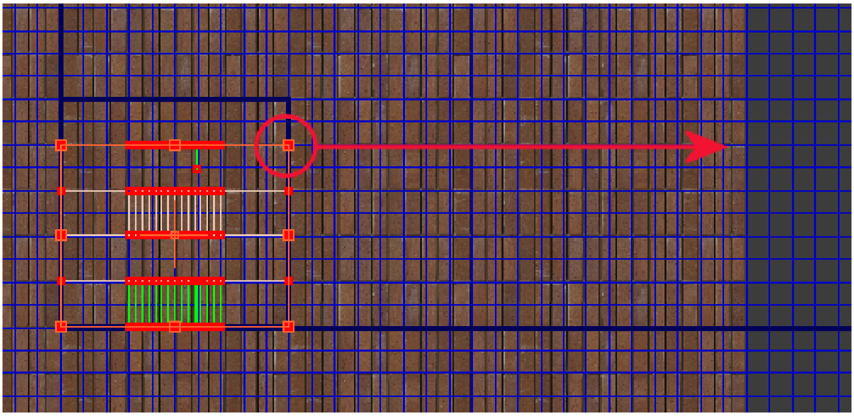
The number of tiles surrounding the UVW guides is increased from one to two in every direction.



Two image tiles surround the UVW grid in every direction

You will now take advantage of the added tiles to increase the number of bricks mapped to the arch object.

18 With all the vertices still selected, Shift+click the top right corner vertex and drag the UVW guides to the right-most edge of the map.

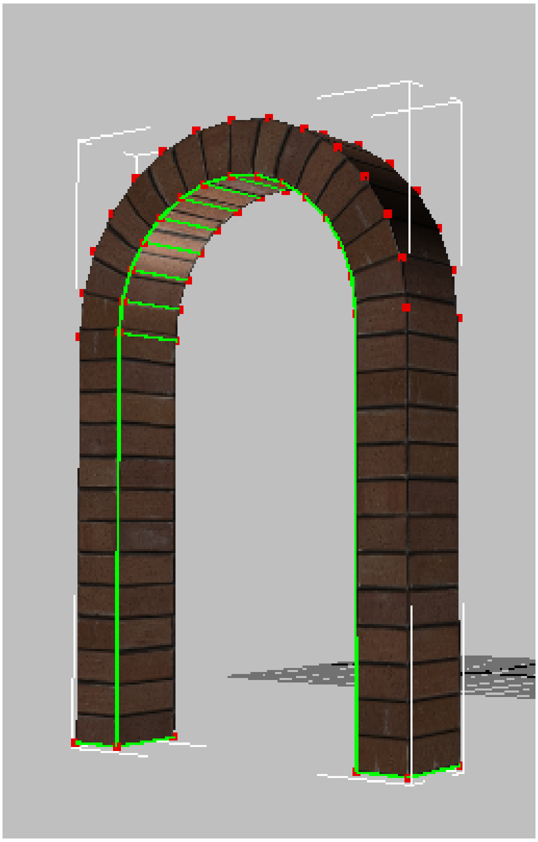


Drag the top right corner of the UVW grid to resize it horizontally

19 Zoom in to make sure the right-most vertices are properly positioned at the edge of the map.

Right edge of UVW grid aligned with the edge of the far right tile

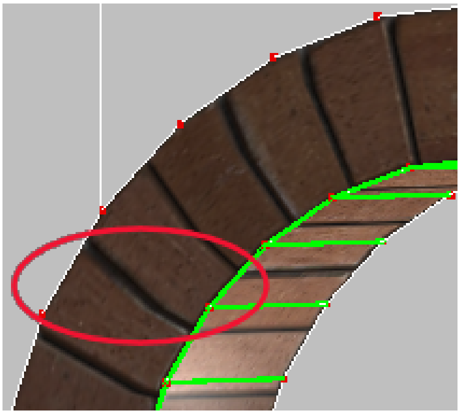
Because the UVW guides have been stretched horizontally to cover three image map tiles, three times as many bricks are now mapped to the arch object.



Three times as many bricks now mapped to the arch object

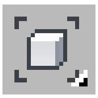
Make final adjustments to the map:

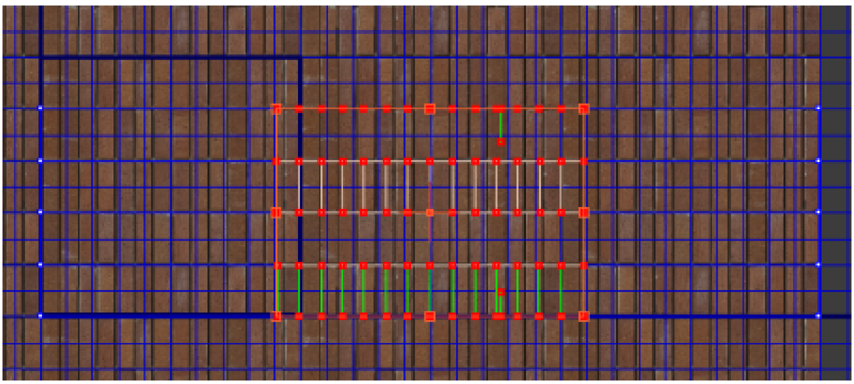
1 In the Orthographic viewport, zoom in to the arch.



Bricks in arch show deformation

Notice how some of the bricks seem to bulge out. This deformation is because the number of divisions in the arch object's polygon mesh do not match the number of bricks mapped onto them.

2  In the Edit UVWs window, use Zoom Extents to zoom in to the UVW guides, then select only the vertices in the center that correspond to the arch.

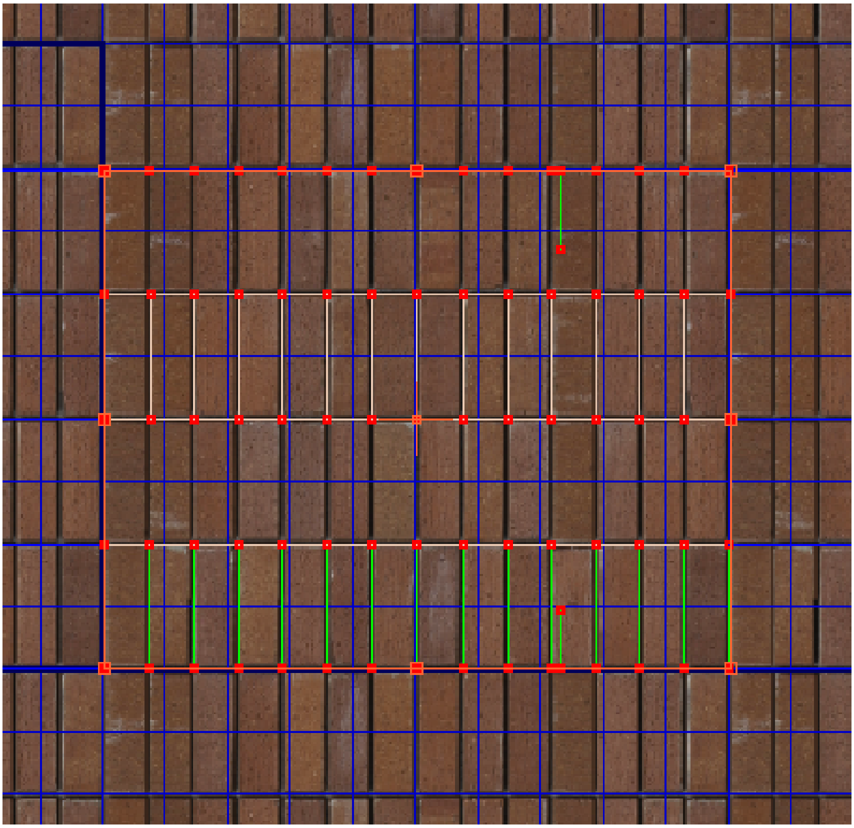


UVW grid with arch vertices selected

There are 14 divisions in the polygon mesh that define the arch, but there are 16 bricks in the underlying map. You need to resize the UVW guides so that the mesh divisions match the number of bricks in the map.

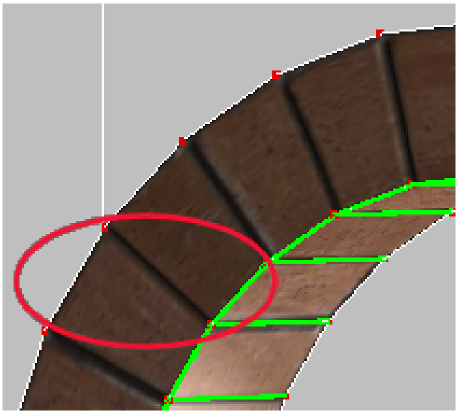
3 With the Freeform tool still active, Shift+click the top left corner vertex and drag the UVW guides to the right by one brick.

4 Shift+click the top right corner vertex and drag the UVW guides to the left by one brick.



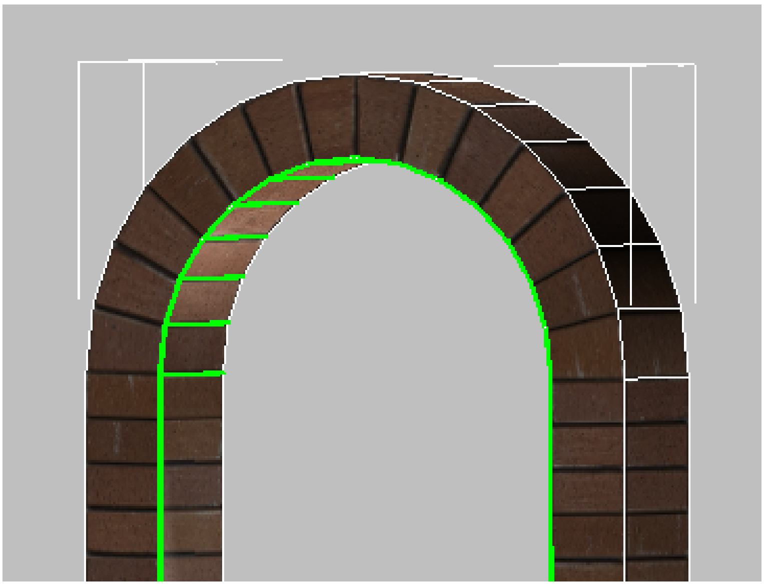
Number of arch polygons now match the number of bricks in the map

5 In the Orthographic viewport, take another look at the arch.



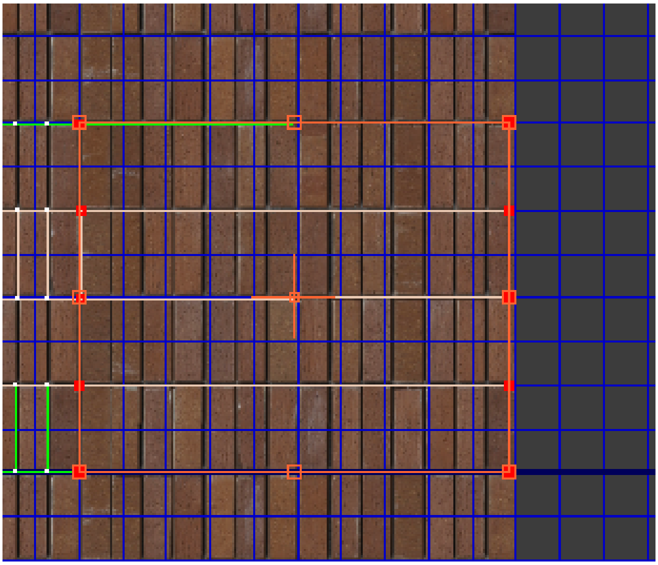
Brick deformation eliminated

The bricks are now properly mapped, but the steps you just took to correct their deformation have caused the archway bricks to appear slightly larger than those below them.



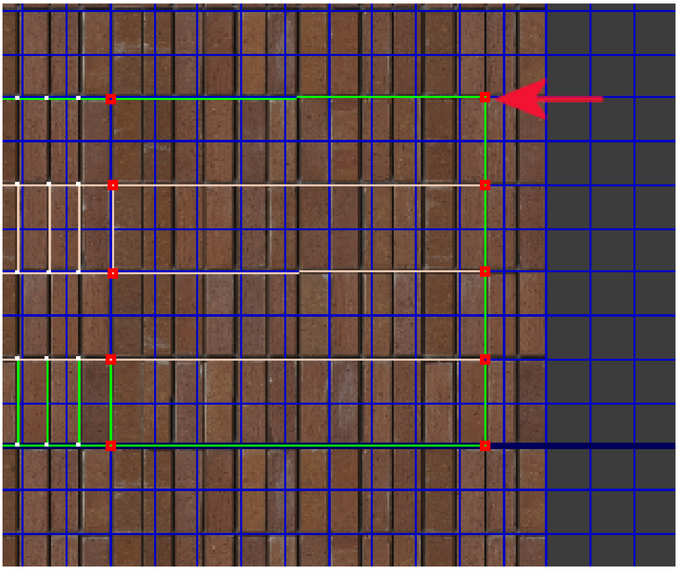
Arch bricks are larger than the column bricks

6 In the Edit UVWs window, select only the vertices that correspond to the left-hand column of the arch object.



Left column vertices

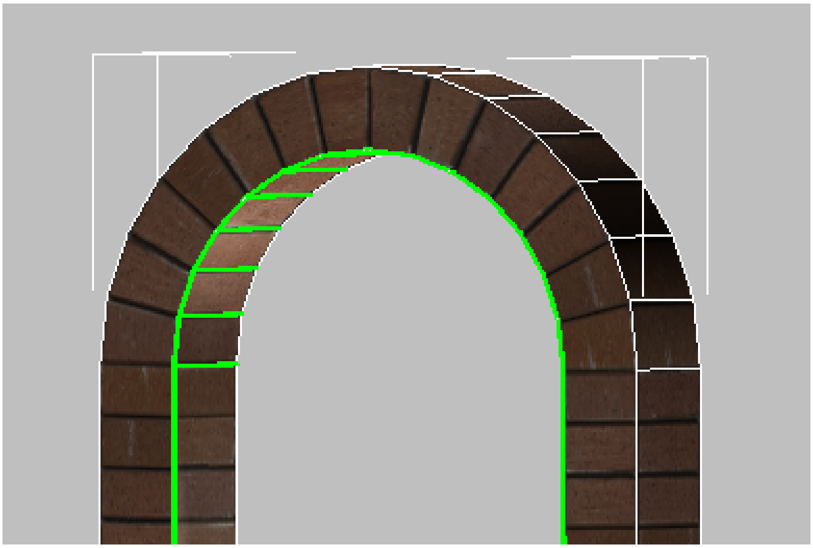
7 Shift+click the top right corner vertex and drag the UVW guides to the left by two bricks.



Left column after being resized two bricks to the left

8 Repeat the previous step for the arch object's right-hand column, dragging the UVW guides to the right by two bricks.

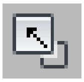
All bricks mapped to the arch object, both on the columns and the arch, now appear to be equal in size. The result is a properly mapped archway, with the bitmap convincingly following the contours of the object's geometry.



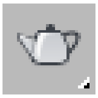
Arch object with bricks of equal size

Render the arch:

1 Close the Edit UVWs window and from the Modifier List, click Vertex to exit vertex selection mode, then click on any empty part of the viewport to de-select the object.

2  Minimize the Orthographic viewport.

3 Right-click the Camera01 viewport and choose Unhide All.

4  On the main toolbar, click Render Production to render your work.

Rendered view of brick material mapped to the pawnshop entrance

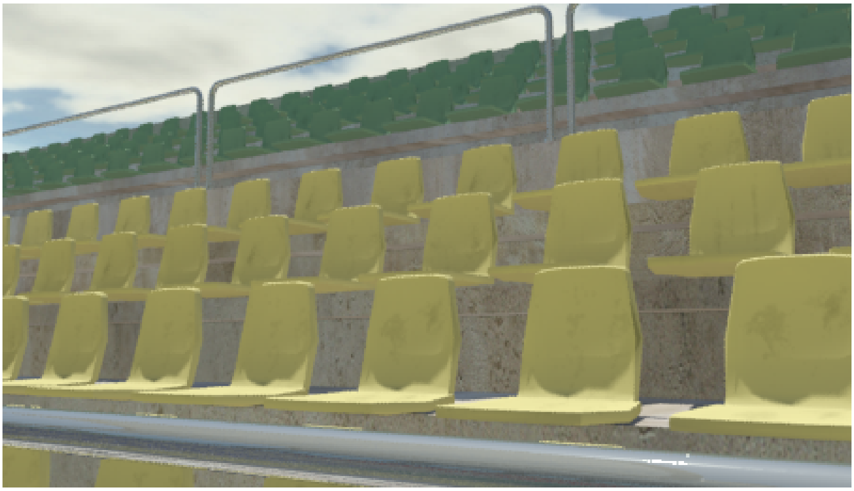
Your brick material is now properly mapped to the archway.

Summary

In this tutorial, you learned how to use the UVW Unwrap modifier combined with a spline object to map material onto a curved object. You also learned how to manipulate the object's UVW lattice in the Edit UVWs window to determine how the material's bitmap image is projected onto the target surface.

Using the Multi/Sub-Map

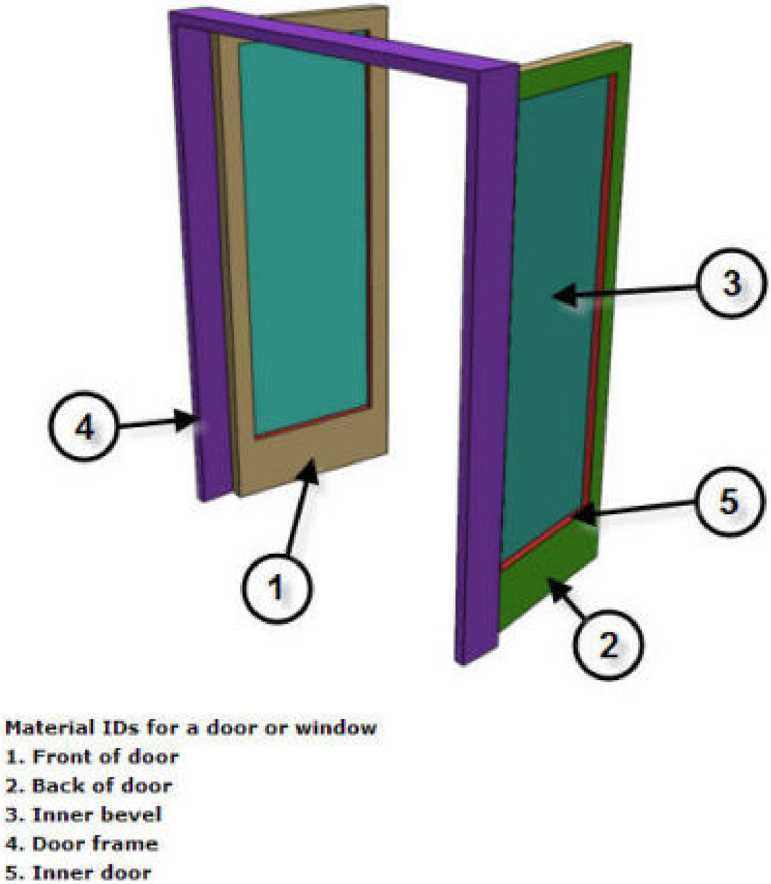
You can apply multiple sub-maps to objects in a scene whenever you need to give a group of similar objects their own unique identity. In this tutorial, you will assign an assembly of stadium seats a common material, then use a variety of sub-maps to assign each seat its own set of stains and discolorations.



You can distribute sub-maps among objects randomly, by object, or by material ID. Each sub-map can be based on a color, a bump map, or an image, among other components. You can distribute sub-maps individually, or composited with other maps to produce a more nuanced effect.

Multiple sub-mapping differs from mapping at a sub-object level, where you apply a material on a one a one-to-one basis to individual components of a single object.

The next illustration provides an example of sub-object mapping where five materials have been mapped to a door consisting of five sub-objects. In this technique, you select the polygon of each component, assign it a material ID, and apply a unique material to each ID.



The next illustration provides an example of multi/sub-mapping where multiple sub-maps have been applied to a material. The jeep surfaces are a composite of two layers: a layer of army green material and a layer of three sub-maps. Each sub-map is a bitmap image of a serial number, and is assigned to a jeep according to the vehicle's object ID number.

You can use any map channel in a sub-map. The next illustration shows three objects whose materials share the same diffuse color and specular highlights, but a sub-map with a slight variation of the bump channel has been assigned to each material to give each urn a unique surface texture.

In this tutorial, you will learn how to:

- Assign ID numbers to objects in a scene
- Create sub-maps based on multiple diffuse values
- Create sub-maps based on multiple bitmap images
- Create a material from two composited layers of sub-maps

NOTE In this tutorial, you will be creating composite maps. If you are not familiar with this technique, it is recommended that you complete the Composite Mapping tutorial on page 1292 first.

Skill level: Intermediate

Time to complete: 30 minutes

Create the Multi/Sub-Map Material

In this lesson, your objective is to divide the seating in the stadium scene into four distinct groups, and use multi/sub-mapping to assign each group its own color, with red representing the most expensive seats and green the cheapest.

Choose mental ray and group objects by ID number:

1  On the Quick Access toolbar, click the Open File button, navigate to *\scenes\materials_and_mapping\multi_maps* and open the scene file *multi-maps_start.max*.

NOTE If a dialog asks whether you want to use the scene's Gamma And LUT settings, accept the scene Gamma settings, and click OK. If a dialog asks whether to use the scene's units, accept the scene units, and click OK. If a Missing External Files dialog opens, click Continue.

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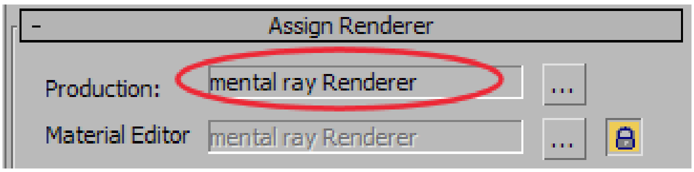
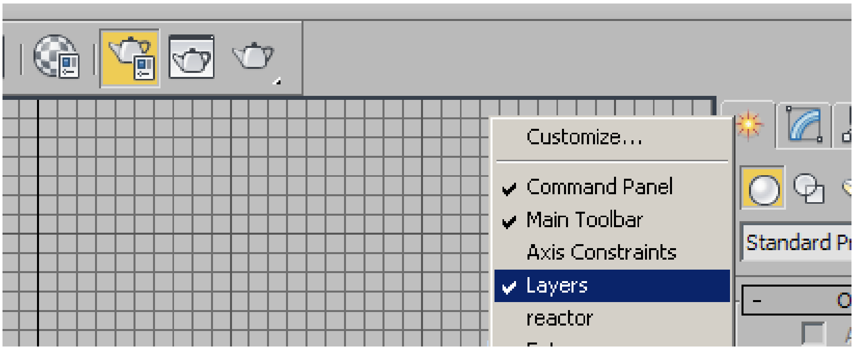
2  On the main toolbar, click Render Setup.

3 On the Render Setup dialog > Common tab > Assign Renderer rollout, make sure the Production box is set to mental ray Renderer.

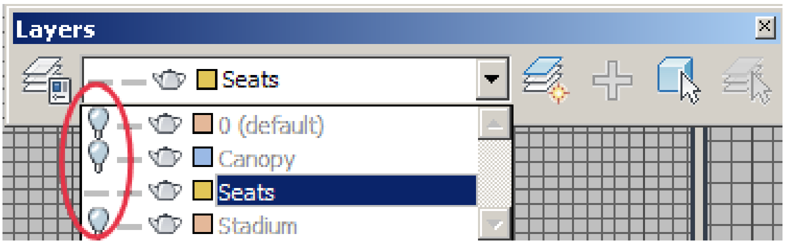


The multi sub-map is a mental ray feature. It is available only when you choose mental ray as your rendering engine.

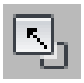
4 Right-click an empty area of the toolbar and choose Layers.

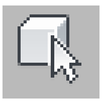


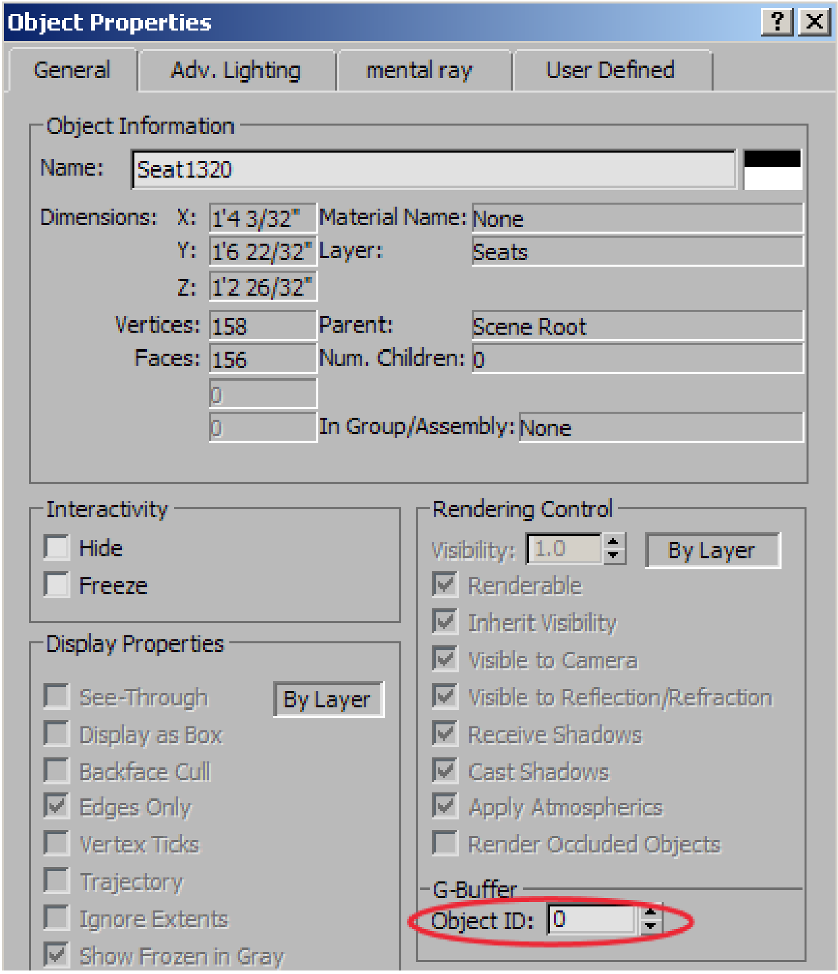
5 Open the layers list and click to hide all layers except Seats.



Now only the seats objects are visible, making their selection much easier.

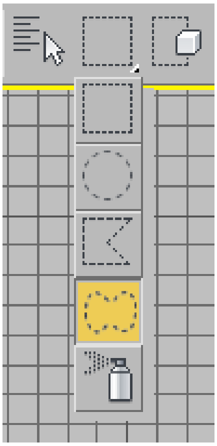
6  Close the Layers toolbar and maximize the Top viewport.

7  Select any seat object, right-click and from the quad menu, choose Object Properties.



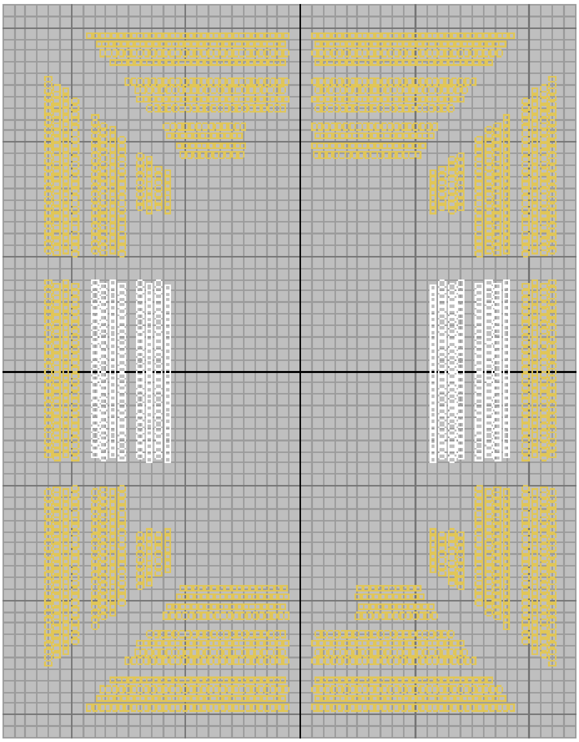
Notice that in the Object Properties dialog > General tab > G-Buffer group, the Object ID displays as 0. All objects when they are first created are assigned an ID of 0. Later on, you will change this number in order to assign certain groups of seat objects their own material variations.

8 Click Cancel to close the dialog, then on the main toolbar, choose the Lasso tool from the Select Object flyout.



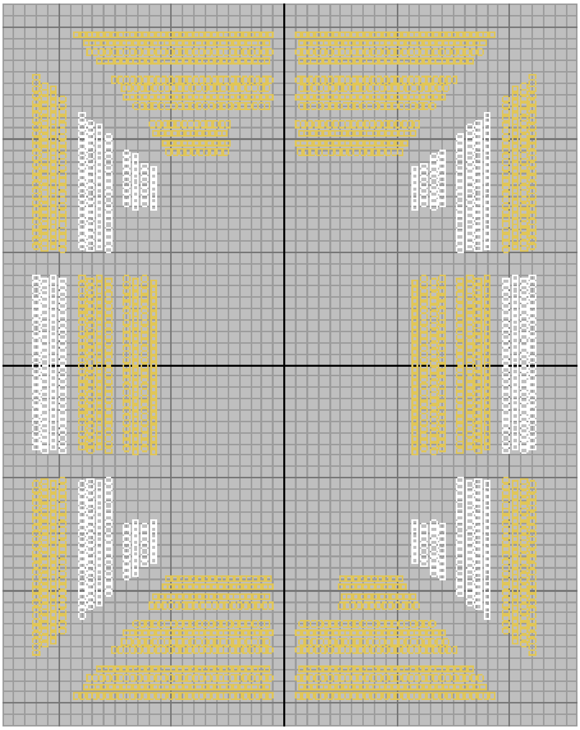
9 Use the Lasso tool to select the seats shown in white in the next illustration.

Be sure to hold down the Ctrl key as you select the seats.



10 Right-click any seat in a selected group, choose Object Properties from the menu, and in the Object Properties dialog > General tab > G-Buffer group, change the Object ID to **1**. Click OK.

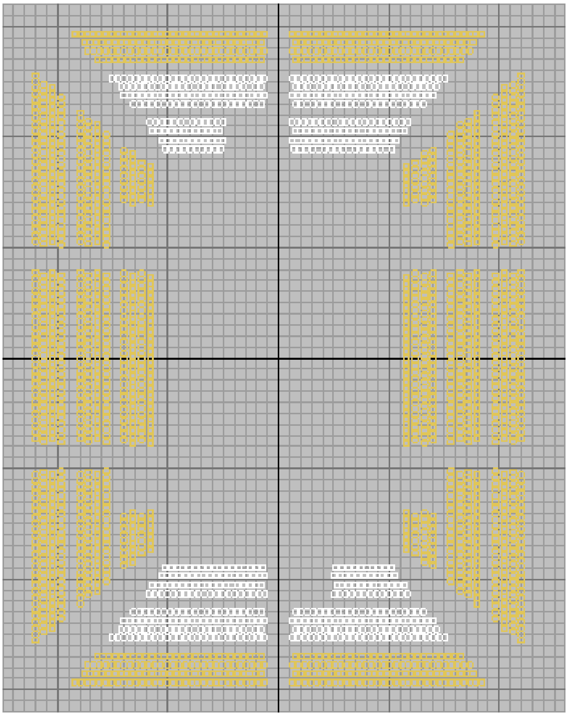
11 Use the Lasso tool to select the seats shown in the next illustration.



Be sure to hold down the Ctrl key as you select the seats.

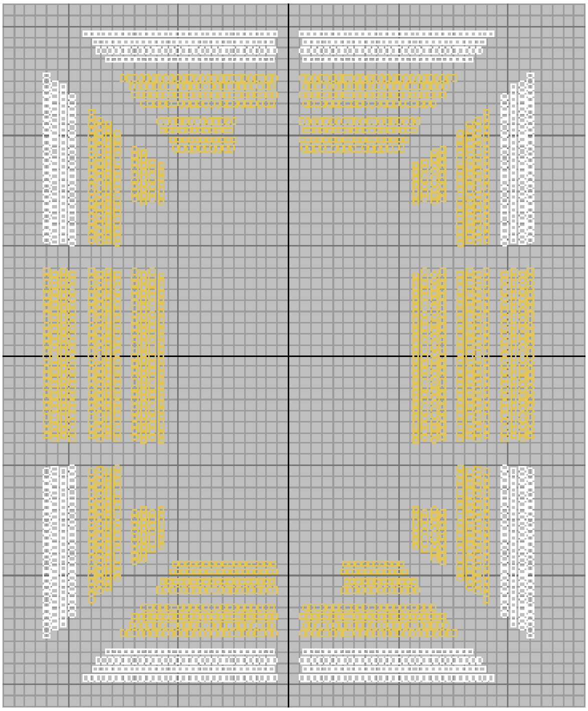
12 Right-click any selected seat, choose Object Properties from the menu, and in the Object Properties dialog > General tab > G-Buffer group, change the Object ID to **2**. Click OK.

13 Select the seats shown in the next illustration as you did in step 9.



14 Right-click any selected seat and in the Object Properties dialog > General tab > G-Buffer group, change the Object ID to **3**. Click OK.

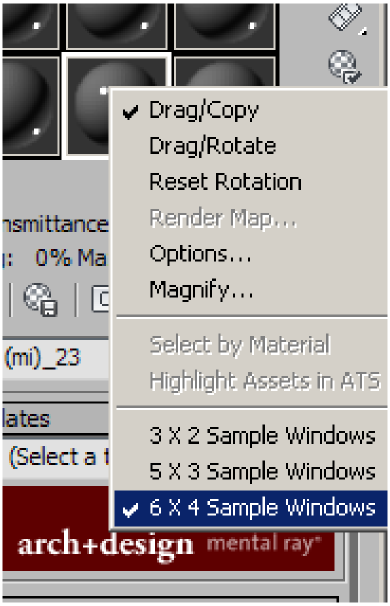
15 Repeat steps 13 and 14 for the seats shown in the next illustration, giving them an object ID of **4**.



All the stadium seats should now have an object ID of 1, 2, 3, or 4. With this in place, each seat is ready to receive its own material variation and sub-object maps.

Create a material for the seats:

1. Continue from the previous procedure, or open the file *multi-maps_01.max*.
2. Activate the Camera-Blimp viewport, then press M to open the material Editor.
3. On the Material Editor, right-click a sample slot and choose 6 x 4 Sample Windows, if your Material Editor is not already set to this display option.



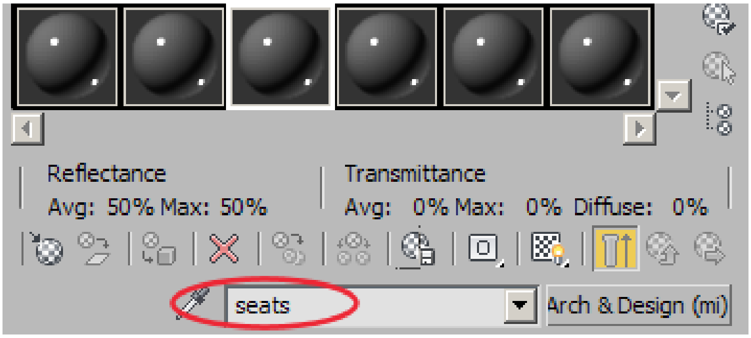
4 Activate any unused slot.

If a slot displays a white triangle at each corner, that slot's material is used in the scene.

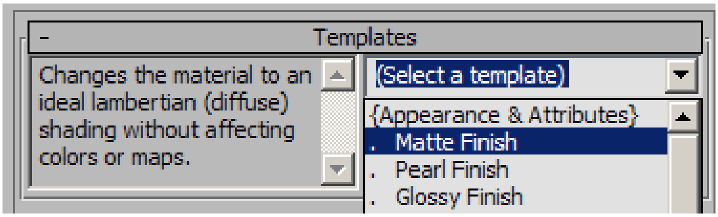
Left: Slot with a material used in the scene

Right: Unused slot

5 Change the slot name to **seats**.



6 On the Templates rollout list box, choose Matte Finish.



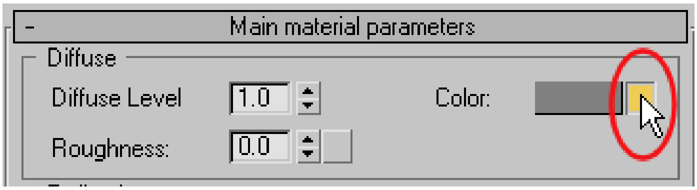
7  In the Top viewport, select all the seats, then In the Material Editor click Assign Material To Selection.

The matte finish material is assigned to all the seats.

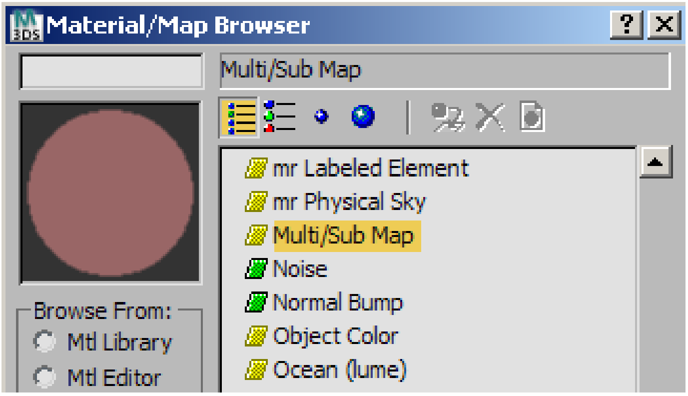
You will now add multiple sub-object maps to the seat material's diffuse color channel.

Define a multi/sub-map for the seats:

1 In the Main Material Parameters rollout > Diffuse group, click the Diffuse Color map button.

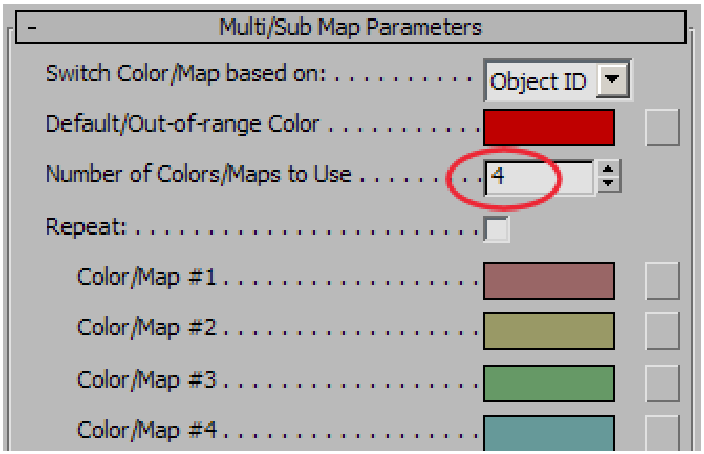


2 On the Material/Map Browser, double-click Multi/Sub-Map.



NOTE This option is available only if you have set mental ray as your rendering engine.

3 On the Material Editor > Multi/Sub-Map Parameters rollout, set the Number Of Colors To Use to **4**.

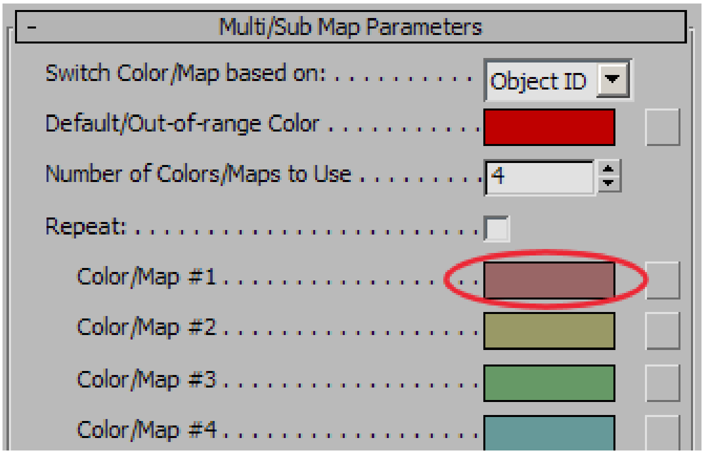


Switch Color/Map Based On is set by default to Object ID, meaning that the sub-maps will be distributed among the objects by their ID number.

The Out-Of-Range Color box is set to red. This means the material of any object in the scene with an ID other than 1 to 4 will display in red.

If you turned on the Repeat option, all objects with IDs higher than 4 would display the color sequence assigned to objects with IDs 1 to 4.

4 Click the color swatch labeled Color/Map #1.



5 On the Color Selector, change the color to a bright red: Red = **0.8**, Green = **0.0**, Blue = **0.0**, then click OK.

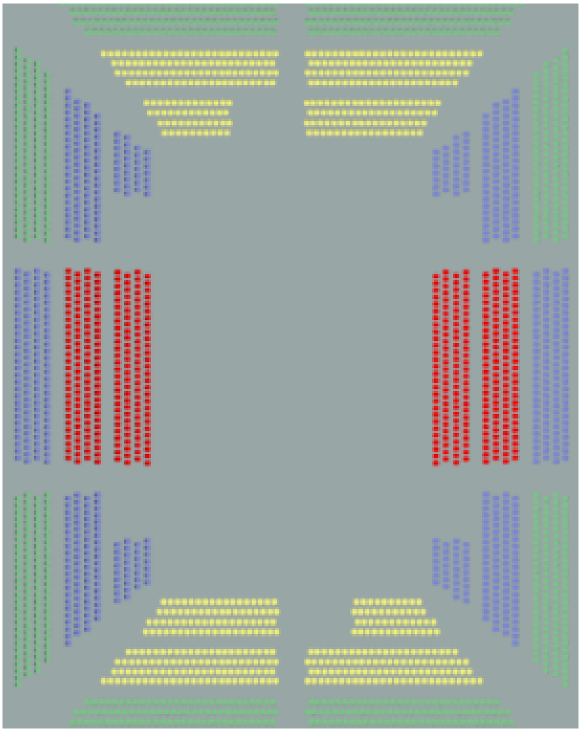
6 Click the color swatch labeled Color #2 and change the color to a blue: Red = **0.275**, Green = **0.534**, Blue = **0.814**, then click OK.

7 Click the color swatch labeled Color #3 and change the color to a yellow: Red = **0.867**, Green = **0.808**, Blue = **0.231**, then click OK.

8 Click the color swatch labeled Color #4 and change the color to a green: Red = **0.158**, Green = **0.583**, Blue = **0.141**, then click OK.

These colors will not show up in the viewports, but they will be visible when the image is rendered.

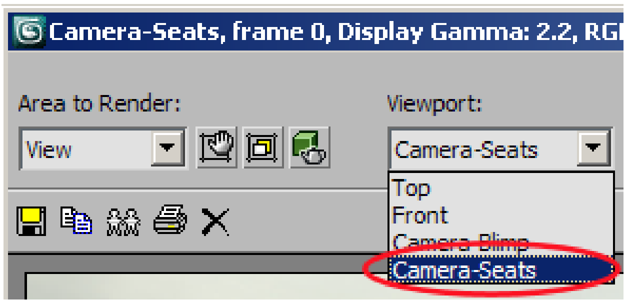
9 Press F9 to render the scene. Keep the rendered frame open.

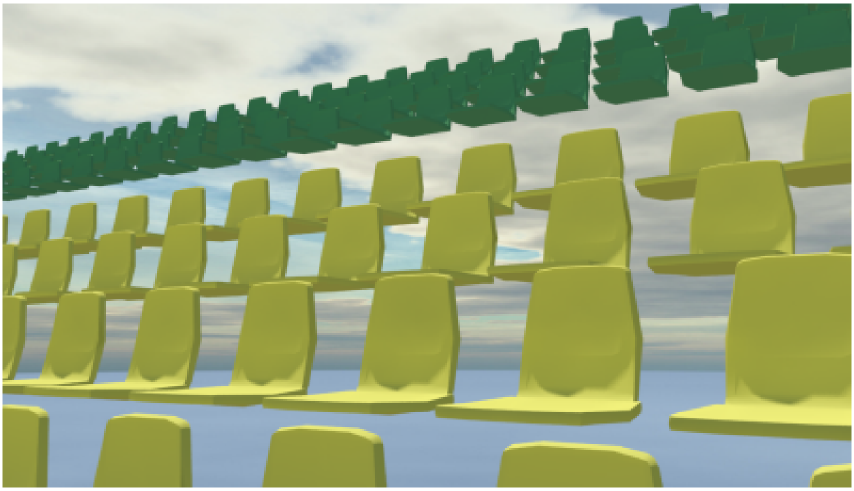


The rendered image shows seats with their sub-map material clearly visible. Seats with an object ID of 1 show the red sub-map applied, seats with an object ID of 2 show the blue sub-map applied, and so on.

10 Activate the Camera-Seats viewport.

11 In the rendered frame window's Viewport list, make sure Camera-Seats is chosen, then click Render to render the scene again.





12 Close the rendered frame.

Next

Composite Sub-Maps Onto Objects on page 1380

Composite Sub-Maps Onto Objects

The seats you mapped in the previous lesson appear too uniform: they lack individual signs of wear and tear. Now you will introduce another level of randomness to the seat material by adding sub-maps that contain blemishes and other discolorations.

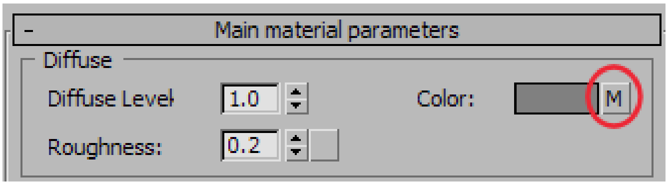
To accomplish this, you will composite two layers of sub-maps onto one another. One layer will contain the four diffuse colors you specified in the previous lesson, the other layer will contain sub-maps with a mixture of image maps of dirt patterns.

Create the composite layers:

1 Continue from the previous lesson, or open the file *multi-maps_02.max*.

2 Press M to open the Material Editor, if it is not already open, and make sure the *seats* material sample slot is active.

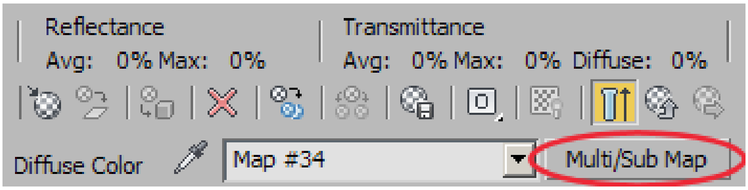
3 In the Main Material Parameters rollout > Diffuse group, click the Diffuse Color map button.



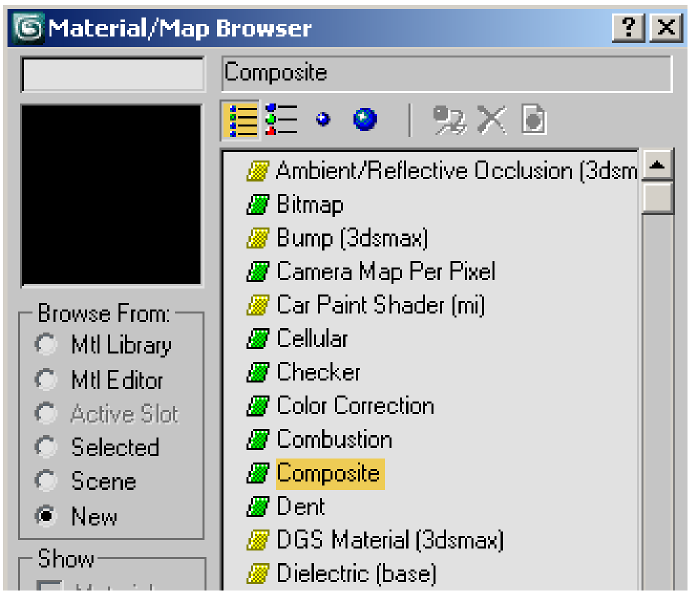
The M on the map button indicates that a map has been applied to the material.

This is the multi sub-map you created in the previous lesson, and will now form the base layer of the composite.

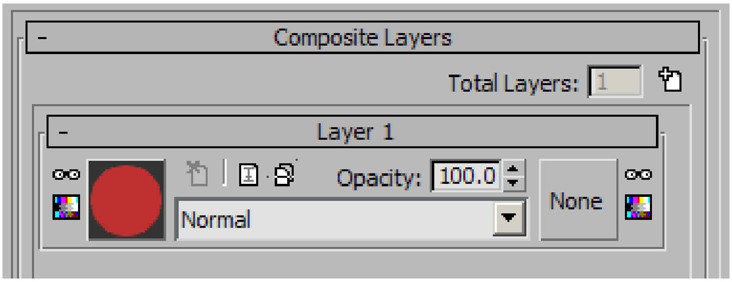
4 Click Multi/Sub-Map.



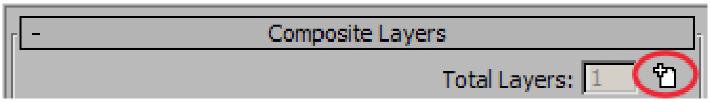
5 On the Material/Map Browser, double-click Composite.



6 On the Replace Map dialog, click OK to keep the map as the base layer of the composite.

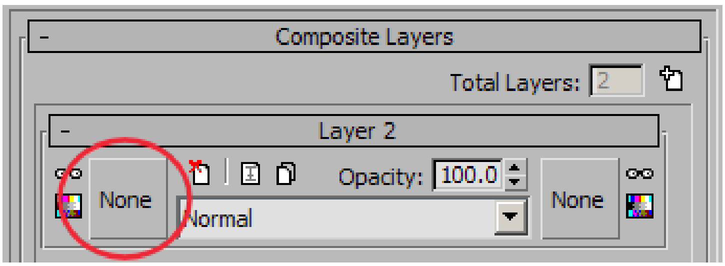


7  On the Composite Layers rollout, click Add A New Layer.



Define the sub-maps for Layer 2:

1 On the Layer 2 rollout, click the left-hand Assign Material button (initially labeled “None”).



2 On the Material/Map Browser, double-click Multi/Sub-Map.

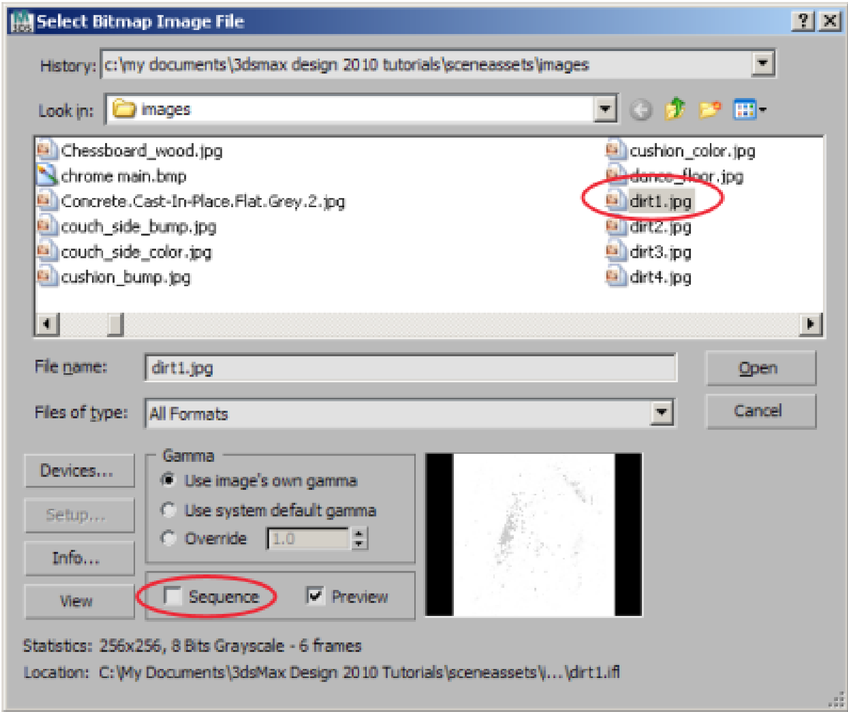
3 On the Material Editor > Multi/Sub-Map Parameters rollout, set Number Of Colors To Use to **6**.

This time, rather than add colors, you will add six bitmap images to the sub-map.

4 On the Color/Map #1 parameter, click the map button.

5 On the Material/Map Browser, double-click Bitmap.

6 On the Select Bitmap Image File dialog, highlight *dirt1.jpg* and make sure Sequence is off (otherwise, all the dirt files would also be selected for the layer).

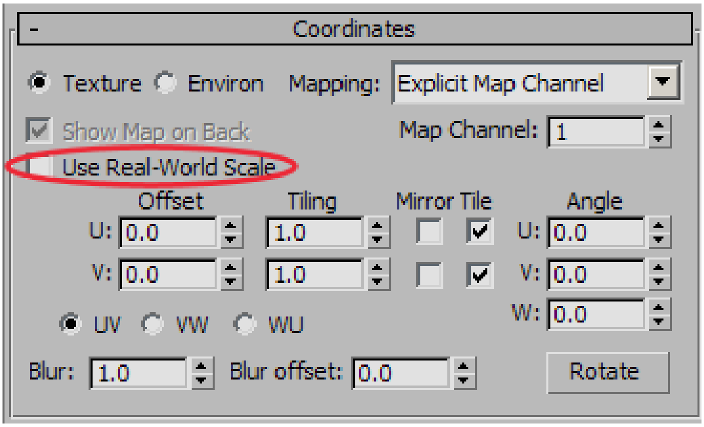


The thumbnail at the bottom right of the dialog gives you an idea of what the *dirt1.jpg* image looks like.

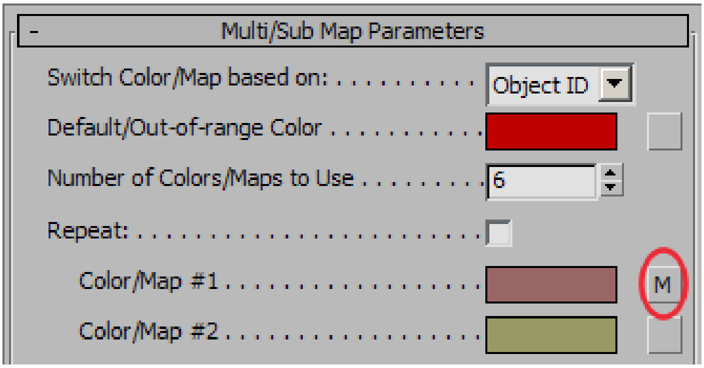
7 Click Open.

The bitmap, which consists of a black and white dirt pattern, is applied as a texture map to the base layer of your composite map.

8 On the Material Editor > Coordinates rollout, make sure Use Real-World Scale is turned off.



9  Click Go To Parent once to view the composite map parameters.



The Color/Map #1 parameter now has an M displayed on its button, indicating that it is based on a bitmap image rather than a color.

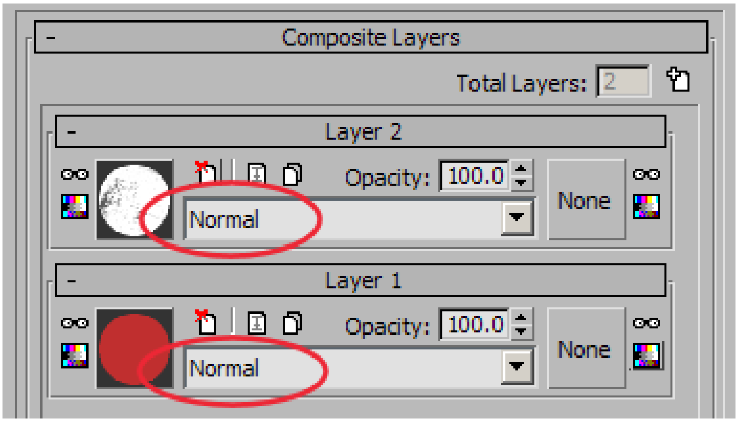
10 For the Color #2 parameter, click the map button and repeat steps 4 to 9. Choose *dirt2.jpg*.

11 Repeat steps 4 to 9 for the Color #3 to Color #6 parameters, choosing the maps *dirt3.jpg* through *dirt6.jpg,* in order.

The sub-map now has six channels of dirt maps available.

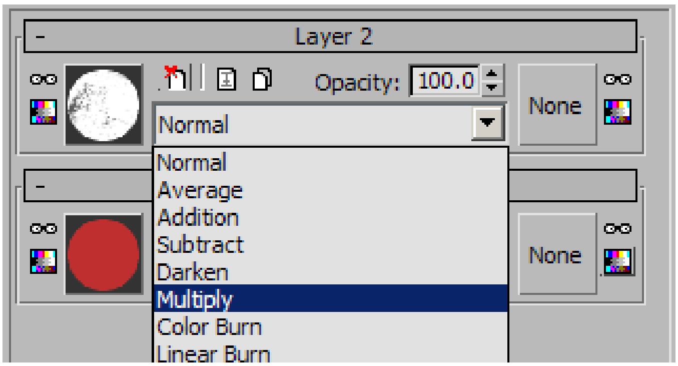
Define how the two layers composite together:

1  Click Go To Parent to view the composite layers that make up the material.



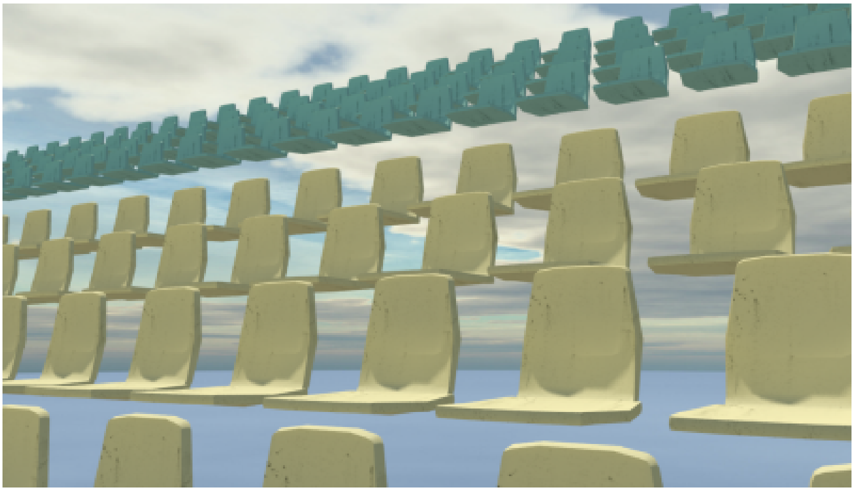
The Operations drop-down list for each layer is set to Normal, which means that the layer with the highest number obscures all layers beneath it. You need to add an operation that will blend the layers together.

2 On the Layer 2 rollout, click to open the Operations drop-down list, and choose Multiply.



Now the Composite map combines the color and dirt map layers.

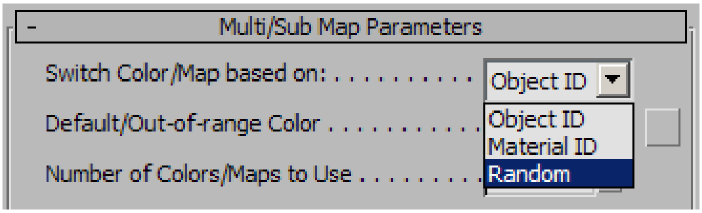
3 Make sure the Camera-Seats viewport is active, then press F9 to render the scene.



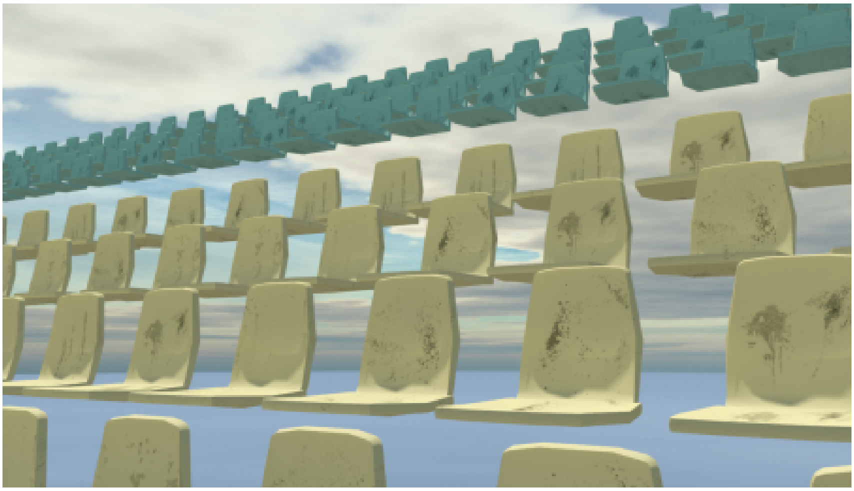
Notice how each group of seats shows the same dirt map. The *dirt1.jpg* map is applied to all objects in the scene with an ID of 1. The *dirt2.jpg* map is applied to all objects in the scene with an ID of 2, and so on. You now need to distribute a random mix of all six dirt maps for all seats groups in the stadium.

Define the sub-map distribution method and fine tune the composite image:

1 On the Material Editor > Layer 2 rollout, click the texture map thumbnail, and then on the Multi/Sub-Map Parameters rollout, open the Switch Color/Map Based On drop-down list, and choose Random.



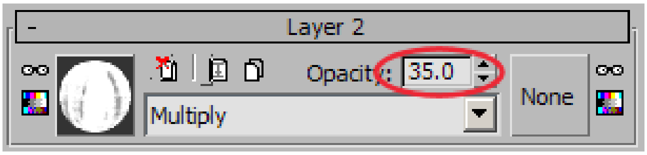
2 Press F9 to render the scene.



Now, all six dirt maps appear at random for all seats groups in the stadium. The dirt patterns, however, stand out too clearly.

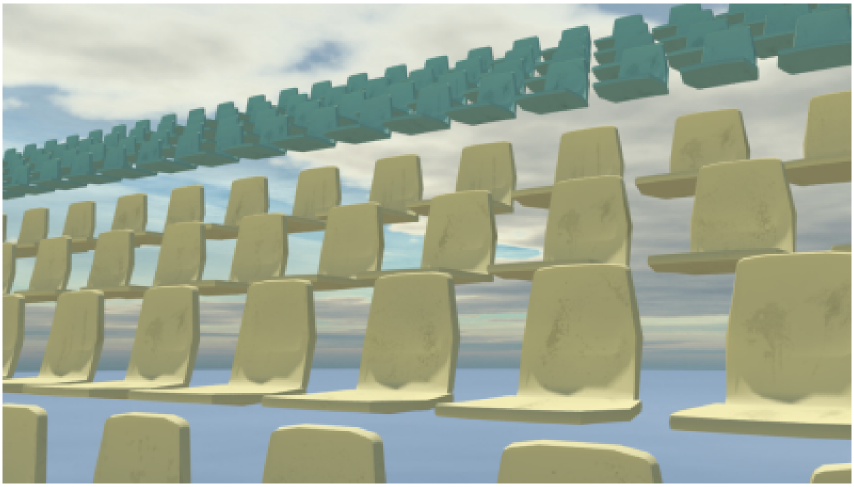
3  Click Go To Parent to view the parameters for layers in the composite map.

4 On the Layer 2 rollout, change the Opacity setting to **35.0**.



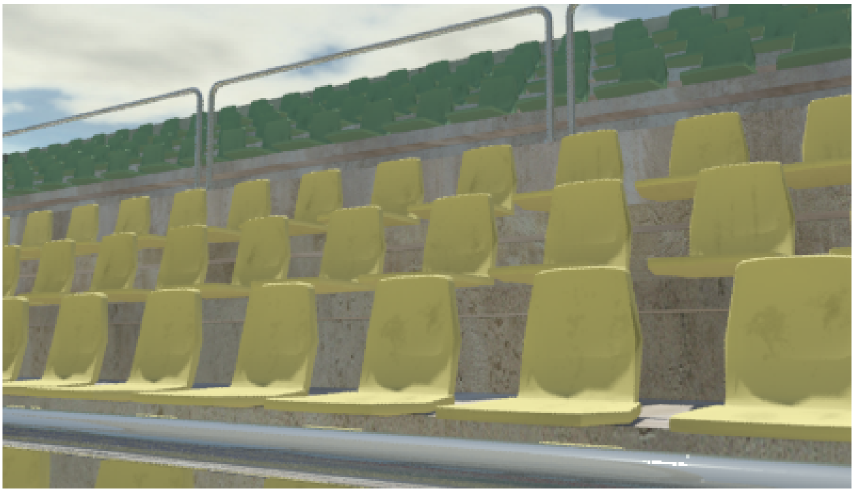
The dirt layer is reduced in visibility to 35% of its full opacity.

5 Press F9 to render the scene.



The dirt maps appear more faded, giving the seats a subtle variation that appear more realistic.

6 If you wish, open the file *multi-maps_completed.max* and render the Camera-Seats viewport to see a finished version of the stadium scene.



Summary

In this tutorial, you learned how to give similar objects their own character by adding sub-maps to their base material.