

MAPS



Figure 14.1 The Taj Mahal is mapped with scanned photographs.

Maps make your scene look real. By introducing texture and pattern, maps put grain in wood, rust on metal, streaks in paint, and frost on glass. They paint a blush on rosy cheeks and draw cracks on a concrete sidewalk. To set the stage, maps put stars in the sky, reflect the moon in the water, and place a scene in India or Spain (**Figure 14.1**).

3D artists routinely “dirty up” their models with maps to make them look real. To give a boat the appearance of age, you add texture maps of peeled paint, and make the edges look cracked and broken. A spaceship that has been through the stresses of hyperspace needs burns, dents, shockwave patterns, and faded insignia.

Scanners, digital cameras, and photo CDs are indispensable to the serious 3D artist for capturing realistic details. To create custom maps, you should know at least one image-editing program, such as Adobe Photoshop.

About Maps and Mapping

A **map** is a pattern of color arranged in a rectangular array of bits (as in a bitmap) or described by a mathematical procedure (as in a procedural map).

You can add maps to lights, fog, backgrounds, materials, and other maps; however, you cannot assign a map directly to an object.

Mapping is a mathematical function or procedure that projects maps onto objects, effects, and backgrounds. Different mapping functions serve different purposes (**Figure 14.2**):

Texture mapping transfers the pattern of a bitmap or procedural map onto the surface of a 3D object.

Procedural mapping uses the coordinates of a surface to generate patterns and variations in two or three dimensions.

Bump mapping creates the illusion of surface roughness by perturbing normals using the intensity values of a map.

Displacement mapping uses the intensity values of a map to create “real” surface roughness by displacing faces.

Environment mapping surrounds objects with a map to quickly generate surface reflections. Environment background maps use billboard mapping to create a background that stays locked to the view.

Raytrace mapping simulates the action of photons by tracing a ray of light as it bounces from one object to another to create highly accurate surface reflections.

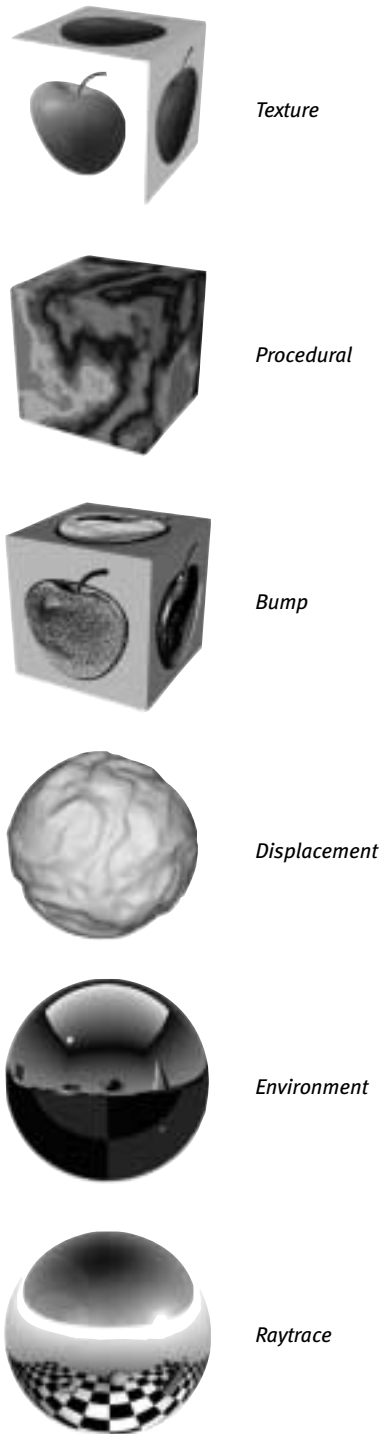


Figure 14.2 Mapping functions create different types of surface effects.



Figure 14.3 As you choose each Browse From option, the maps that are available at that location appear in the Material/Map Browser.





Figure 14.4 A large thumbnail of the map appears in the upper-left corner of the Material/Map Browser.

Browsing Maps

When you add a map to another map, it builds a hierarchy called a map tree. Map trees can either stand alone, or be part of a material tree. When you save your scene, map trees are stored in the .max file, but the maps that they reference remain external. Maps also remain external when you store map trees in material libraries.


The Material/Map Browser lets you browse map trees and load maps from material libraries, the Material Editor, and the current scene. You can also use the Browser to load new map types.

To browse maps:

1. Open a scene that has some materials and maps in it, such as Earth.max.
2.  Open the Material Editor.
3.  Click Get Material.
The Material/Map Browser appears.
4. Uncheck Materials in the Show area so that just maps are displayed.
5. Choose a display option by clicking an icon at the top of the Browser.
6. Choose a source to browse from (**Figure 14.3**).
7. Scroll through the list and click on any map that interests you (**Figure 14.4**).

In order to create and adjust maps, you must first load them into the Material Editor.

To load a map:

1.  Open the Material Editor.

2.  Click Get Material.

The Material/Map Browser appears.

3. Select a map from any source.
4. Drag your selection from the Material/Map Browser onto a sample slot in the Material Editor (**Figure 14.5**).

or

Double click the map to load it into the active sample slot.

The map is loaded into the Material Editor (**Figure 14.6**).

5. Close the Material/Map Browser.

✓ Tips

- You can also load maps directly into materials. See “Adding Maps to Materials” later in this chapter.
- You can browse and load bitmaps from your system or the Web using the Asset Browser utility. To access, open the Utilities panel and click Asset Browser. Navigate to a folder that contains maps. Then choose Filter > All images from the Asset Browser menu to automatically generate and display thumbnail images of all the bitmaps in the current folder (**Figure 14.7**). To load a bitmap, drag a thumbnail onto a sample slot.

Thumbnails of every image that you browse are stored in the 3dsmax6\abcache folder. To empty the cache or decrease its size, choose File > Preferences in the Asset Browser.

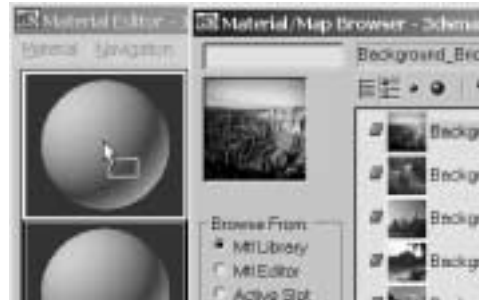


Figure 14.5 Drag the map onto a sample slot.

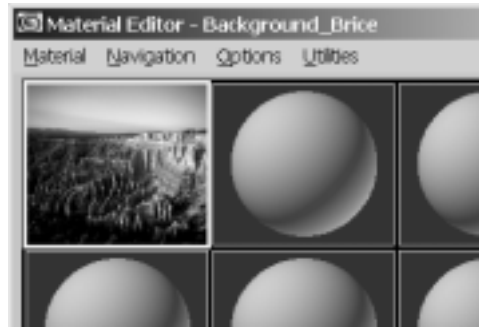


Figure 14.6 The map appears as a thumbnail image that fills the sample slot from edge to edge.

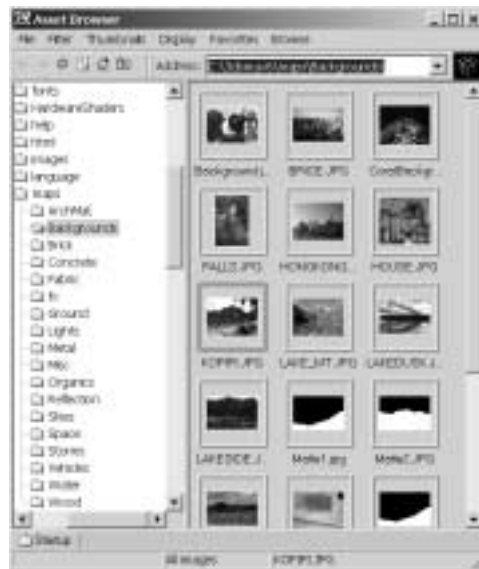


Figure 14.7 The Asset Browser allows you to browse and load bitmaps.

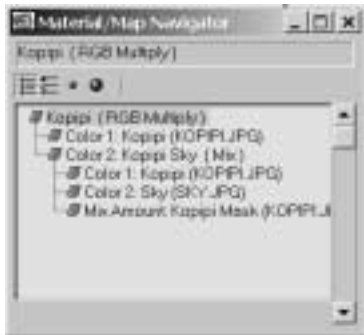


Figure 14.8 The Material/Map Navigator displays the components of a map tree.



Figure 14.9 Select a branch in the map tree to view the parameter settings in its rollouts.



Figure 14.10 Giving each branch a descriptive name helps you navigate map trees more easily.

The Material/Map Navigator shows how a map is constructed, and provides access to map settings at every level of its tree.


To navigate a map tree:

1. Load a map into a sample slot, or load a material that contains a map tree.

2.  Click the Material/Map Navigator button.


The Material/Map Navigator appears. It displays the map tree of the currently active sample slot in list format (**Figure 14.8**).


3. To browse through the map tree visually, choose a graphical display option by clicking an icon at the top of the Navigator.

4.  Click a branch in the map tree. The Material Editor moves to the branch of the tree that you selected (**Figure 14.9**).


5. You can also navigate a map using the controls underneath the sample slots.

Move to a deeper level by selecting from the Material type field drop-down list.

-  Click Go to Parent to move up the map tree one level.

-  Click Go Forward to Sibling to move across the map tree to a different branch at the same level of the tree.

✓ Tips

- Red icons indicate that the Show Map in Viewport option is enabled.
- As you build a map tree, it helps to give each branch a descriptive name as you go along (**Figure 14.10**).
-  To save a map to an open material library, click Put to Library.

Creating Maps

3ds max 6 ships with 33 different types of maps. Using the Material/Map Browser, you can browse map types by category (**Figure 14.11**):

- ◆ **2d Maps**—Two-dimensional bitmaps, procedural maps, or filters used for texture mapping and special effects.
- ◆ **3d Maps**—Solid texture procedural maps that can be used for special effects.
- ◆ **Compositors**—Maps that combine multiple maps into a single map.
- ◆ **Color Modifiers**—Maps that change the color output of a material or a map.
- ◆ **Other**—Maps that create reflections and refractions, include all mental ray maps.

Most maps contain map buttons that allow you to add other maps to them. You can also click the map type button to turn the current map into a sub-map of a new map.

2D maps and 3D maps are applied in different ways. For a 3D map, the process is fairly simple: Take the XYZ coordinates from the surface of an object, and plug them into a procedure. The procedure returns a series of RGB values and assigns them to the XYZ location, creating a pattern. When you cut away part of the object using a Boolean operation, you see that the pattern continues in three dimensions (**Figure 14.12**).

Applying a 2D map to an object is not as straightforward because, like wrapping paper, the map may not fit very neatly onto the 3D surface. To make this process a little easier, the coordinates of the surface and the coordinates of the map are converted to UV mapping coordinates, in which U and V correspond to the width and height of both the surface and the map. To enable rotation, a third axis called W is added (**Figure 14.13**).



Figure 14.11 Maps come in a wide variety of patterns.

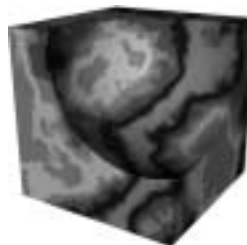


Figure 14.12 Subtracting part of a box reveals why 3D maps are called solid textures.

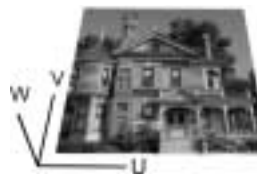


Figure 14.13 For UVW coordinates, the U axis corresponds to width, the V axis to height, and the W axis runs perpendicular to the UV plane.

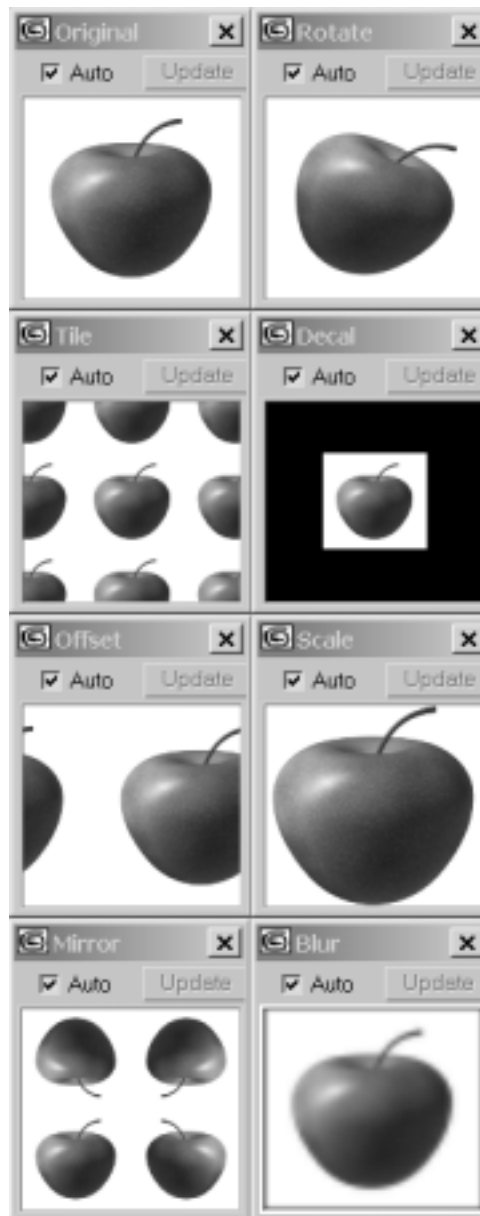


Figure 14.14 Adjusting the coordinates of a map changes its placement.

Common adjustments for 2D maps (2D), 3D maps (3D) or both include (**Figure 14.14**):

- ◆ **Texture** or **Environment** (2D)—Sets the mapping function that will be applied.
- ◆ **Source** (3D) or **Mapping** (2D)—Determines the mapping coordinate system. Explicit Map Channel uses the coordinates of the current map channel.
- ◆ **Show Map on Back** (2D)—Enables a map to appear on the back of an object when planar mapping projection is in use.
- ◆ **Map Channel**—Determines which set of mapping coordinates will be used by the object.
- ◆ **Axes**—Sets the direction in which a map is offset, tiled, mirrored, or rotated.
- ◆ **Offset**—Sets the distance that a map is moved, or offset, from its original location.
- ◆ **Tiling**—Scales a map. Values greater than 1 or less than -1 shrink a map and cause it to repeat. Values between 1 and -1 enlarge a map.
- ◆ **Tile**—Enables tiling.
- ◆ **Mirror** (2D)—Flips maps along their edges. If tiling is enabled, the map will repeat in a symmetrical pattern.
- ◆ **Angle**—Rotates a map around an axis.
- ◆ **Blur**—Blurs a map in world space depending on its distance from the viewplane. Helps prevent anti-aliasing.
- ◆ **Blur Offset**—Blurs a map in object space regardless of distance from the viewplane.
- ◆ **Rotate** (2D)—Rotates a map around its W axis.

Bitmaps are 2D maps that import color and alpha channel information from an external bitmap or movie file. They also reference Adobe Photoshop filters and Premiere filters.

To create a Bitmap:


1.  Open the Material/Map Browser. Set Browse From to New and set 2D Show to Maps and 2D maps.
2. Drag a Bitmap onto an available sample slot.
3. In the Select Bitmap Image File dialog box, change Files of Type to All Formats. Then navigate to a map and open it (**Figure 14.15**).
4. In the Bitmap Parameters rollout, click View Image (**Figure 14.16**). Drag the handles in the corners and along the sides of the image to crop it. Then close the window and check Apply.
5. In the Coordinates rollout, adjust the placement of the Bitmap (**Figure 14.17**). See **Figure 14.14** to view the results:
 - ▲ To offset the map horizontally or vertically, adjust the U or V Offset amount.
 - ▲ To rotate the map, adjust the W angle.
 - ▲ To tile the map so that it repeats across the surface horizontally or vertically, increase the U or V Tiling amounts.
 - ▲ To mirror the map in either direction, check the U or V Mirror option.
 - ▲ To create a decal, uncheck Tile and Mirror. To enlarge the width or height of the map, reduce the Tiling amount.
 - ▲ Increase the Blur or Blur offset amount to make the map appear softer.
 - ▲ To reload a map after it has been updated externally, click Reload.
 - ▲ To eliminate moiré patterns on tiled maps, enable Summed Area in the Bitmap Parameters rollout.



Figure 14.15 Select a map from the 3dsmax6\Maps directory, or from an image file anywhere on your system.

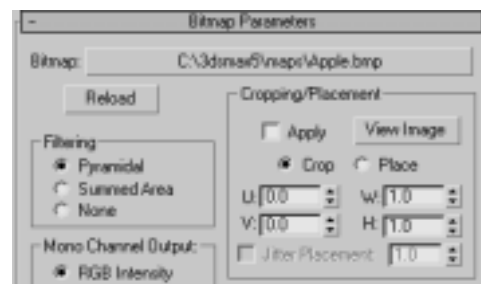


Figure 14.16 The Bitmap Parameters rollout controls how bitmap information is used.



Figure 14.17 You adjust the placement of a Bitmap with the Coordinates rollout.

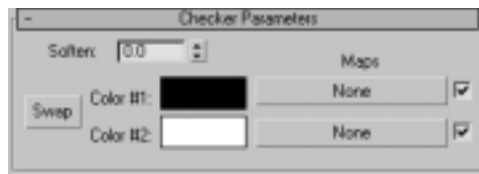


Figure 14.18 The Checker Parameters rollout allows you to choose checker colors or patterns.

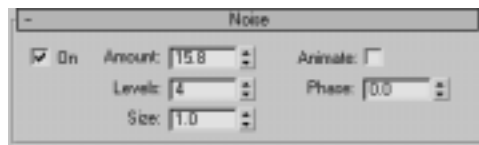


Figure 14.19 Use the Noise rollout to disturb the checker pattern.

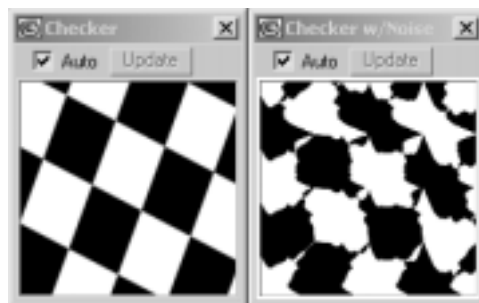



Figure 14.20 Left, tiling and rotating a Checker map. Right, after adding noise to the map.

Checker maps are 2D procedural maps that form a two-color checker pattern.

To create a Checker map:

1.  Open the Material/Map Browser and check Show Maps and 2D maps.
2. Drag a Checker map onto an available sample slot.
3. In the Checker Parameters rollout, select a color for each checker (**Figure 14.18**).
or
Click the Maps button next to each color swatch to replace the color with a map.
4. If you want to blur the edges between the checkers, increase the Soften amount.
5. In the Coordinates rollout, adjust the placement of the map:
 - ▲ Increase the U and V Tiling values to increase the number of checkers.
 - ▲ Use the Offset and Angle coordinates to move and rotate the checkers.
6. To disturb the checker pattern, open the Noise rollout and check On. Then adjust the Amount, Levels (iterations), and Size of the noise (**Figure 14.19**).
The edges of the checker pattern wiggle and wave (**Figure 14.20**).

✓ Tips

- **2D maps** all have Noise rollouts. Many other maps types have noise built in.
- **Tile maps** create brick and mortar patterns based on traditional brick-laying.
- **Swirl maps** create two-color swirls that can be twisted, blurred, or mapped.
- **Gradient maps** create a gradient of up to three colors that can be mapped.
- **Gradient Ramp maps** create a wide spectrum of colors and patterns.

A Noise map is a 3D map that creates random marks. Use Noise to roughen the colors of other materials and disturb the patterns of other maps.

To create a Noise map:

1. In the Material/Map Browser, check Maps and 3D maps in the Show area.
2. Drag a Noise map onto an available slot.
3. In the Noise Parameters rollout, set the Size of the noise, and select a Noise Type (**Figure 14.21**).

Fractal noise produces a more abundant grain. Turbulent is a type of fractal noise that creates a craggier look (**Figure 14.22**).

4. Select colors for the noise pattern, or click the Maps buttons next to the color swatches to replace the color with a map.
5. To filter high- and low-intensity values, set the High and Low Noise Threshold amounts. By setting these values close together, you can simulate a starry sky (**Figure 14.23**).
6. To increase the resolution of fractal or turbulent noise, increase the Levels setting. This increases the number of iterations of the fractal function (**Figure 14.23**).
7. To change pattern of the noise, change the Phase setting. Animating this parameter changes the pattern of the noise over time.
8. Use Blur or Blur offset when you want to soften noise.

✓ Tips

- **Falloff maps** have advanced controls for creating three-dimensional gradients.
- Depending on the functions that are used to generate them, 3D procedural maps create ordered patterns or random marks. Cellular, Marble, Perlin Marble, Planet, Water, and Wood maps create distinct patterns. Dent, Smoke, Speckle, Splat, and Stucco maps create random marks.

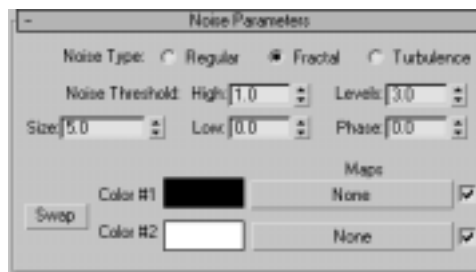


Figure 14.21 The Noise Parameters rollout allows you to set the size, type, color, and threshold parameters of the noise.

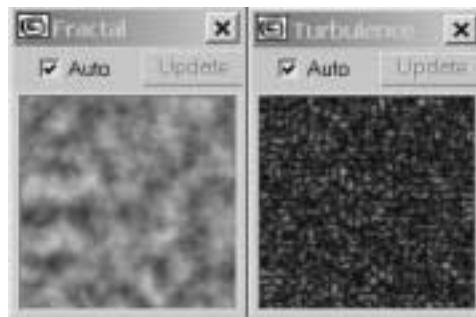


Figure 14.22 The Fractal and Turbulence options affect how the noise is shaded.

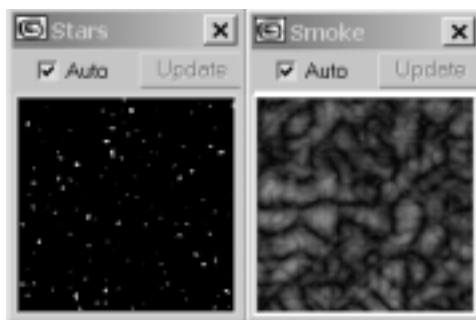


Figure 14.23 Use Noise maps to create starry skies and billowing smoke.



Figure 14.24 The Mix Parameters rollout allows you to blend colors and maps.



Figure 14.25 Mixing a Bitmap with a Checker map (left) and another Bitmap (right).



Figure 14.26 Placing a mask in the Mix Amount map button allows you to composite the island and the clouds without blending them.

A Mix map is a Compositor map that blends two maps together in varying proportions.

To create a Mix map:

1. In the Material/Map Browser, check Maps and Compositors in the Show area.
2. Drag a Mix map onto an available slot.
3. In the Mix Parameters rollout, select a color for each color swatch or build a compound map by adding a map to one or both map buttons.
4. Adjust the Mix Amount from 0 to 100% (**Figure 14.24**).

The maps blend together in the proportion that you designate (**Figure 14.25**).

5. To limit the upper and lower threshold of mixing, click Use Curve. Then adjust the transition zones of the mixing curve.

✓ Tips

- By adding a black-and-white mask to the mix amount, you can filter out areas of each map (**Figure 14.26**).
- The **RGB Multiply map** combines two maps and multiplies their color and alpha channels together. Use this to combine two Bump maps together while retaining the strength of each.
- The **Composite map** allows you to composite up to 1000 maps in layers using alpha channels for masking.
- The **RGB Tint** adds a color tint to a material or map using separate channels for red, green, and blue.
- The **Vertex Color map** enables the display of colors that have been applied to vertices. To learn more, look up the VertexPaint modifier and the Assign Vertex Colors utility.
- For more information on these and other maps types, look up “maps” in the User Reference. Remember that you must enable a map type or choose Show All to see it in the Material/Map Browser.

Output maps allows you to adjust the hue, saturation, value, and alpha information of a map.

To adjust the output of a map:

1. In the Material Editor, select a map that you want to adjust.
 Bitmap, Cellular, Falloff, Gradient, Gradient Ramp, Mix, and Noise maps have Output rollouts built into them. To adjust the output of these map types, skip to step 5.
2. Click the Type button.
3. In the Material/Map Browser, click Show > Color Mods. Then click Output.
4. In the Replace Map dialog box, choose Keep old map as sub-map (**Figure 14.27**).
5. In the Output Parameters rollout, check the options you want to apply (**Figure 14.28**):
 - ▲ Invert reverses the colors of the map like a color negative of a photo (**Figure 14.29**).
 - ▲ Clamp limits the intensity of a map when you increase its RGB Level.
 - ▲ Alpha from RGB Intensity generates an alpha channel from the intensity of the map's color channels.
 - ▲ Enable Color Map allows you to use the graph at the bottom of the rollout to adjust the intensity range of a map.
7. Adjust the Output spinners.
 - ▲ Output Amount controls the amount of the map that will be added to or removed from the composite map.
 - ▲ RGB Offset lightens or darkens the map.
 - ▲ RGB Level adjusts the saturation of the map.
 - ▲ Bump Amount adjusts the bumpiness of a bump map independent of the Bump Amount parameter in the Maps rollout. This comes in handy for Bump maps when two maps are mixed together.



Figure 14.27 Choosing to keep a map as a sub-map adds another level to the material tree.

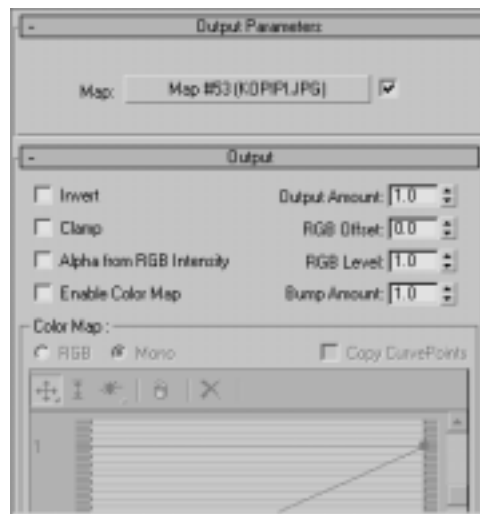


Figure 14.28 The Output rollout contains commands for altering the color properties of a map.



Figure 14.29 Checking the Invert option reverses map color information.

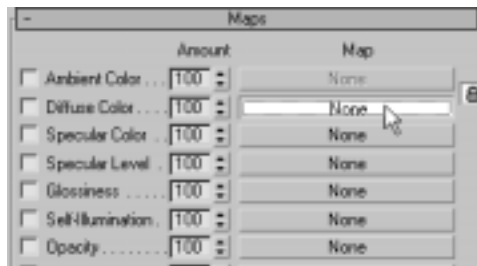


Figure 14.30 Click a Map button to load a map into it.

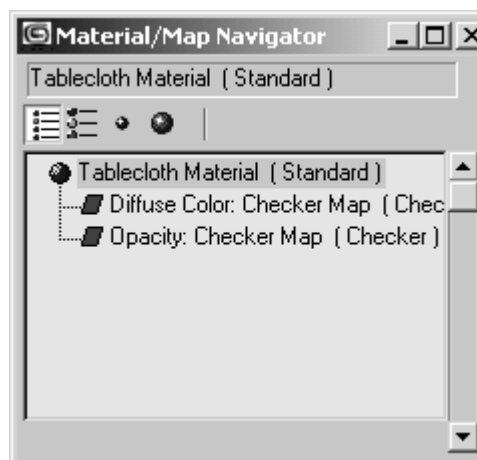


Figure 14.31 You build map and material trees by adding maps to map buttons.

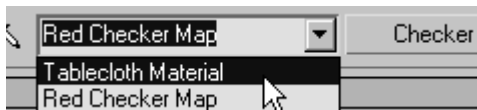


Figure 14.32 Use the material name field drop-down list to navigate back up the material tree.

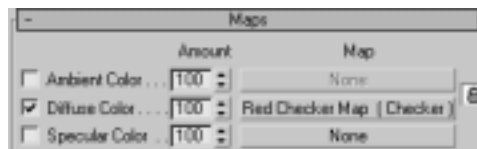


Figure 14.33 The name of the map appears on the Map button.

Adding Maps to Materials


You cannot assign a map directly to an object. Instead, you add maps to materials and assign mapped materials to objects.

Materials can use the complete color information of a map, or just its intensity (light and dark) values. When you add a map to a material, the name of the map appears on a button in the Maps rollout. The amount of influence that the Map has on the material is set by the Amount spinner.

Because grayscale maps use about one third less RAM than color maps, use grayscale copies whenever you don't need color information. Viewing maps in grayscale also makes it easier to predict their effects.

There are two ways you can add a map to a material: by clicking or by dragging.

To add a map to a material by clicking:

1. Select a material sample by activating an available sample slot.
2. Open the Maps rollout.
3. Click a map button (Figure 14.30). The Material/Map Browser appears.
4. In the Material/Map Browser, double-click a map type. The map is added to the material tree (Figure 14.31). The Material Editor moves to the new map branch.
5. Name the material branch and adjust it as needed.
6.  To move back up the material tree, click Go to Parent, or choose the name of the material from the material name field drop-down list (Figure 14.32). The Maps rollout reappears. The name of the map appears on the map button that you clicked earlier (Figure 14.33).
7. To turn off a map, uncheck the box next to the map type in the Maps rollout.

The small gray buttons in the Basic Parameters rollout are duplicate map buttons that make it easier to add maps to the parameters.

To add a map to a material by dragging:

1. Select a material sample by activating an available sample slot.
2. Open the Maps rollout.
3. Drag a map from the sample palette or the Material/Map Browser, and drop it onto a map button in the Maps rollout or the Basic Parameters rollout (**Figure 14.34**). An “M” appears on the map button to indicate that a map has been added to it (**Figure 14.35**).
4. To adjust the parameters of the map, click the map button to navigate the Material Editor down to the map level.

✓ Tips

- You can drag a map from one map button to another to instance, copy, or swap the map with another map (**Figure 14.36**). Instanced maps update whenever you change the parameters of any of the other instances.
- When the map is turned off in the Maps rollout, the “M” on a small map button changes to a small “m” (**Figure 14.37**).
- To clear a large or small map button, drag an empty map button over the map button you want to clear, or click the map button and choose NONE in the Material/Map Browser.
- If you drag a map from the Asset Browser onto a material sample rather than onto a map sample or a material map button, it is automatically loaded into the Diffuse Color map button of the material.



Figure 14.34 Dragging a Checker map onto the Diffuse map button.

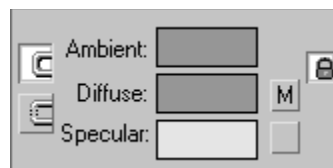


Figure 14.35 The “M” indicates that a map is loaded in the map slot.

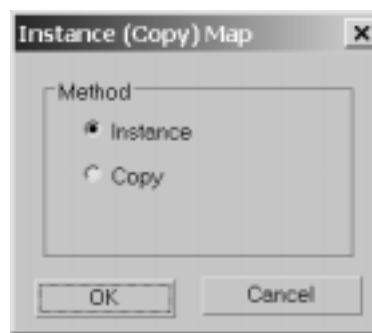


Figure 14.36 This dialog box allows you to instance, copy, or swap a map.

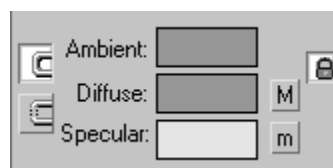


Figure 14.37 The small “m” indicates a map is inactive.



Figure 14.38 Adding a map to the Diffuse map button replaces the diffuse color of the material.



Figure 14.39 Click Show Map in Viewport to turn on viewport display of the map.







Figure 14.40 The diffuse map appears on the surface of the object.

Diffuse maps replace the overall diffuse color of a material with a map. Diffuse maps are often referred to as **texture maps**.

To add a Diffuse (texture) map:

1. Select a material sample.
2. In the Basic Parameters rollout, click the small gray button next to the Diffuse color swatch. Then select a map in the Material/Map Browser.
 - or**
 - Drag a map onto the button.

The map replaces the diffuse color of the material (**Figure 14.38**).
3. Adjust the parameters of the map.
 - The map updates on the material sample.
4.  Click Go to Parent. In the Maps rollout, drag the Amount spinner to adjust the amount of influence that the map has on the diffuse color.
5. Drag the panning hand downward on an empty part of the Maps rollout to access the Basic Parameters rollout.
 - You can also use the thin scroll bar.
6. Adjust the material's basic parameters.
 - To increase the brightness of a map, increase the self-illumination of the material.
 - To assign face-mapping coordinates to the map, click Face Map in the Shader Basic Parameters rollout.
7.  Assign the material to a mesh primitive, or to any other object that has mapping coordinates applied to it. (To learn how to apply mapping coordinates to objects, see the next section.)
8.  Click Show Map in Viewport.
 - The map appears on the surface of the object (**Figure 14.39**). If the map looks askew, right click on the viewport label and choose Texture Correction.
9.  Render the scene (**Figure 14.40**).

Opacity mapping uses the intensity values of a map to calculate transparency. Lighter areas create more opaque surfaces. Darker areas create more transparent surfaces.



To add an Opacity map:

1. Select a material sample.
2. In the Basic Parameters rollout, click the small gray button next to the Opacity spinner. Then select a map in the Material/Map Browser.

or

Drag a map onto the button.


Usually you choose a grayscale map that you have created specifically for this purpose. For practice, try using a Checker map (**Figure 14.41**).

3. Adjust the basic parameters of the material. For instance, you might want to make the material two-sided by checking 2-Sided.
4.  Assign the material to an object.
5.  Click Show Map in Viewport.

The Opacity map appears as an opaque pattern on the surface of the object.

6.  Click Go to Parent. At the root level, click Show Map in Viewport.

If you are using OpenGL display, the object becomes transparent wherever the Opacity map is dark (**Figure 14.42**).

7.  Render the scene.
If you checked 2-Sided, the inside surface of the object is visible through the transparent parts of the outside surface (**Figure 14.43**).

✓ Tips

- Opacity maps are great for filing down edges without adding extra polygons. And Ray Traced Shadows are cast from the edges of an object's Opacity map instead of from the edges of the object.
- You can use the alpha channel of a 32-bit bitmap file to generate an Opacity map by setting Mono Channel Output to Alpha in the Bitmap Parameters rollout.



Figure 14.41 An Opacity map adds a transparent pattern to a white material.

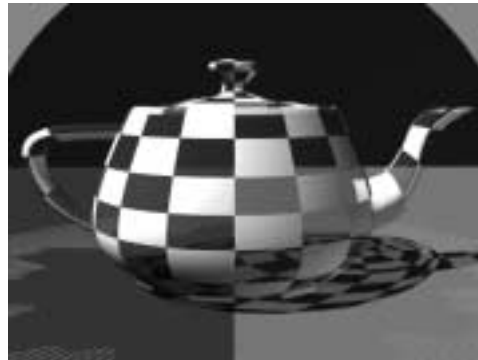


Figure 14.42 You can get a good idea of how the object will render by viewing the Opacity map in the viewport.



Figure 14.43 Checking 2-Sided makes the inside of the object visible through the transparent areas on the outside. To make the inside easier to read, Receive Shadows has been turned off in the Object Properties dialog box.

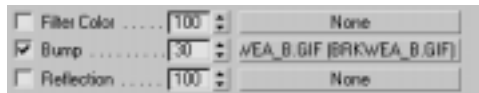


Figure 14.44 The bump map BRKWEA_B.GIF may be found in the 3dsmax6\Maps\Bricks folder.



Figure 14.45 Increasing the Bump amount increases the effect of the Bump map.






Figure 14.46 The surface of the teapot appears bumpy. The silhouette of the object is unaffected.

A Bump map creates the illusion of displacement by altering how a surface is shaded. Artists often add Bump maps to diffuse-mapped materials to make a texture-mapped surface look more convincing. For example, you could add a Noise map to make a surface look rougher, or a grayscale version of the texture map to make the bump pattern match the texture map.

You can also create your own Bump maps by scanning textured surfaces into Photoshop or Painter or by rendering images from 3ds max.

To add a Bump map:

1. Select a material sample and open the Maps rollout.
2. Add a map to the Bump map button (**Figure 14.44**).
3.  Click Go to Parent.
4. Increase the Bump amount until the effect of the Bump map is visible on the material sample (**Figure 14.45**).
5.  Assign the material to an object. Note: Bump maps are not displayed in the viewports.
7.  Render the scene (**Figure 14.46**).

The surface of the object appears bumpy.

✓ Tips

- Reducing the Bump Amount to a negative number creates an inverted Bump map in which light values indent and dark values are raised.
- A quick way to create a Bump map is to drag an instance of the Diffuse map onto the Bump Map button.
- Noise and Dent Bump maps make a surface look coarse or dirty.
- To make a map displace geometry, add it to the Displacement Map button. Note that you will need to use a very dense mesh in order to obtain good results.

Applying Mapping Coordinates to Objects

Mapping coordinates wrap a two dimensional map around a three dimensional object by matching the coordinates of the map to the mapping coordinates of the object.

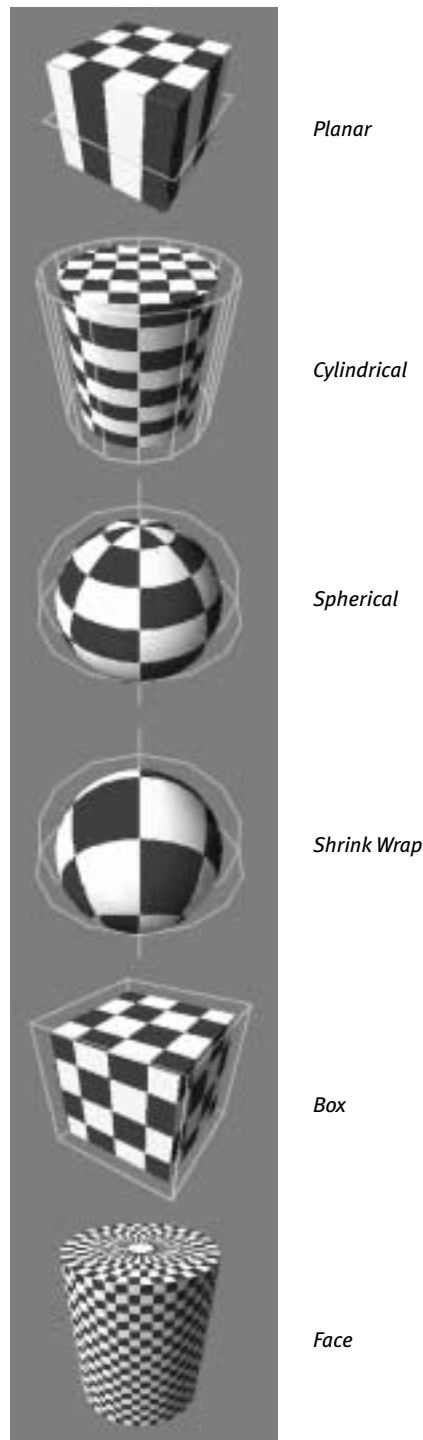
Mesh primitives and all compound objects except Boolean objects, are automatically assigned mapping coordinates when they are created. Other types of objects must have mapping coordinates assigned to them by applying a UVW Map modifier.

While generating mapping coordinates is very convenient, the UVW Map modifier offers several advantages. First, it allows you to assign mapping coordinates to objects that cannot generate them, such as editable meshes. Second, it allows you to adjust object mapping coordinates, which in turn adjusts the placement of maps. Third, it allows you to change mapping channels in order to “tune in” different sets of material mapping coordinates. Finally, it allows you to choose a system of mapping projection using the gizmo of the UVW Map modifier, commonly known as a mapping gizmo.

The shape of a mapping gizmo determines the method of projection: planar, cylindrical, spherical, box, and so on (**Figure 14.47**). Map placement is further affected by the position, orientation, and scale of the gizmo.

For example, a planar gizmo projects a map in a single direction, like a projector. If the surface is not parallel to the plane of the gizmo, the map stretches as the surface turns away from it. To avoid stretching a map, choose a gizmo whose shape more closely resembles that of your object.

Figure 14.47 Map gizmos determine how a map is applied to an object. Planar is the default gizmo type.



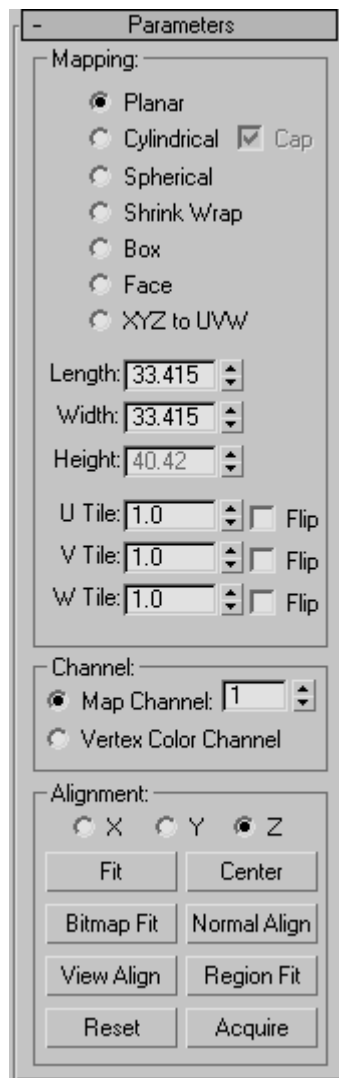




Figure 14.48 The UVW Map modifier adjusts the placement of a map on an object that it modifies. It does not adjust map placement for a material.

UVW Map modifiers have three groups of controls for assigning mapping coordinates (**Figure 14.48**):

- ◆ **Mapping**—Determines the shape and proportions of the mapping gizmo. Sets parameters for tiling and flipping maps.
- ◆ **Channel**—Allows you to create up to 99 sets of object mapping coordinates. To display a channel, the UVW mapping coordinates of an object must be set to the same channel as the UVW coordinates of the map that is applied to it.
- ◆ **Alignment**—Matches the position, orientation, or scale of a gizmo to maps, objects, or the world. Alignment controls include:
 - ◆ **X, Y, and Z**—Aligns a mapping gizmo to the axes of the local coordinate system.
 - ◆ **Fit**—Resizes a mapping gizmo to match the extents of an object. Try this first to prevent distortions of the map.
 - ◆ **Center**—Realigns a mapping gizmo to the center of the selection.
 - ◆ **Bitmap Fit**—Resizes a mapping gizmo in proportion to the size of a bitmap. Use this to prevent distortion of bitmaps after you have tried the Fit command.
 - ◆ **Normal Align**—Aligns a mapping gizmo to a face normal by dragging the cursor over the surface of an object.
 - ◆ **View Align**—Aligns a mapping gizmo to the current view.
 - ◆ **Region Fit**—Allows you to drag out the dimensions of a mapping gizmo.
 - ◆ **Reset**—Returns a mapping gizmo to its default alignment.
 - ◆ **Acquire**—Matches the mapping coordinates of the current object to the mapping coordinates of an object that you pick.

Generate Mapping Coordinates is a base parameter found in the creation rollouts of mesh primitives, shape primitives, editable splines, lathed objects, and extruded objects.

To generate object mapping coordinates:

1.  Select an object.
 2.  Open the Modify panel and locate the Generate Mapping Coords parameter.
For mesh primitives, go to the bottom of the Parameters rollout (**Figure 14.49**). The parameter is turned on by default.
For lathed or extruded objects, go to the bottom of the Parameters rollout.
For spline objects, open the Rendering rollout and check Renderable.
 3. Check the box if it is not already checked. If the object is a spline object, check the Renderable box as well.
- Mapping coordinates are applied to the object. If a mapped material is applied to the object, the map will now render correctly.

✓ Tip

- Some maps do not need additional mapping coordinates because they generate their own based on other input:
 - 3D maps (use the local coordinates of the object that they are applied to)
 - Environment and Reflection/Refraction maps (use a combination of World and View coordinates)
 - Face-mapped materials (use face coordinates from the object they are applied to)

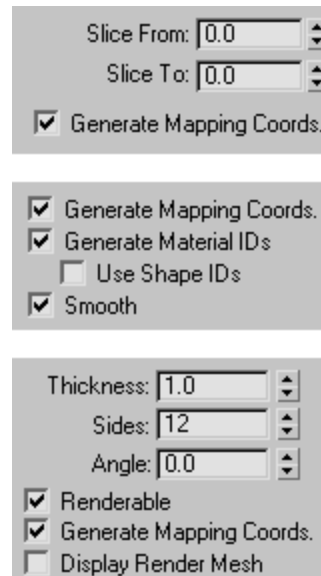


Figure 14.49 The Generate Mapping Coords. parameter for a primitive object (top), lathed object (middle), and a spline object (bottom).

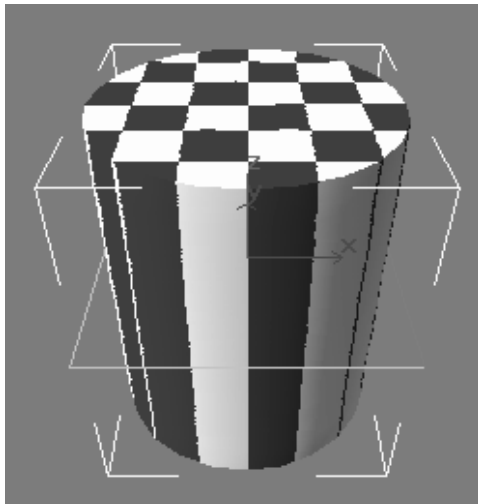


Figure 14.50 Planar mapping applies a map along an object's Z axis. The map stretches along the sides of the object.

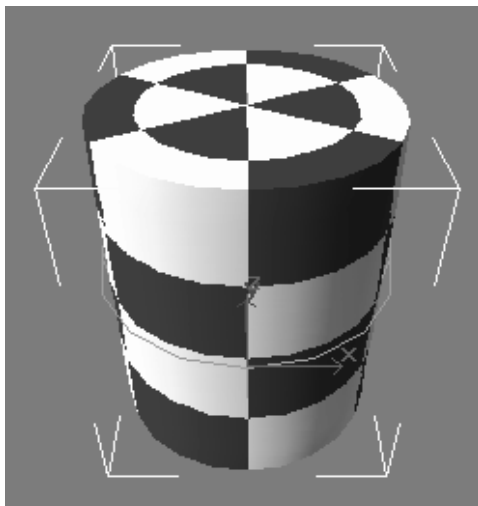





Figure 14.51 Spherical mapping wraps the map around the object and gathers it together at the poles of the sphere gizmo.

You assign mapping coordinates to an object by applying a UVW Map modifier and choosing a mapping gizmo. To fine tune the placement of your coordinates, you can move, rotate or scale the mapping gizmo.

To assign mapping coordinates to an object:

1.  Select an object.
2.  Apply a mapped material to the object so you can see the effect of different types of mapping coordinates. Make sure Show Map in Viewport is enabled for the map you want to display.
3.  Apply a UVW Map modifier to the object.
The modifier gizmo applies mapping coordinates to the object.
Planar mapping coordinates are applied by default (**Figure 14.50**).
4. Select a gizmo type. Choose from Planar, Cylindrical, Spherical, Shrink Wrap, Box, Face, or XYZ to UVW (**Figure 14.51**).
5. To adjust the gizmo, use the Mapping and Alignment controls
or
Select the gizmo in the stack display and transform it.

✓ Tip

- Scaling up a Spherical or Shrink Wrap gizmo makes the placement of the gizmo easier to see without changing its effect.
- Mapping coordinates are set to channel 1 by default. By changing channels in the UVW Map modifier, you can assign a different set of mapping coordinates to each channel.

Using Environment Maps

Environment maps add context to a scene and make it more interesting. Use them to add background images at rendering time and to create surface reflections on objects.

As scene backgrounds, Environment maps provide additional visual information without your having to build everything that you see.

As surface reflections, Environment maps give objects a finishing touch. Reflections are explained in the section following this one.

To create an Environment map:

1. Load a map type into a sample slot.
You can choose a simple 2D or 3D map, or build a compound map by mixing, masking, and mapping colors (**Figure 14.52**).
2. Adjust the parameters of the map type so that the image looks right toward you.
To brighten the map, click the map type button and choose Output. Choose to keep the old map as a sub-map. Then increase the RGB Level or Output Amount (**Figure 14.53**).
3. Adjust the coordinates of the map. Pay particular attention to size and placement.
For 2D maps, be sure to change the coordinates of all maps and sub-maps from Texture to Environment. Screen mapping, which matches a map to the viewplane of a camera is the default (**Figure 14.54**).



Hint: Use Go to Forward to Sibling to navigate the map tree.

✓ Tip

- Use Screen mapping if you plan on using the Environment map as a background image for your scene. Use Spherical Environment, Cylindrical Environment, and Shrink-Wrap Environment to change the appearance of reflection maps.



Figure 14.52 Any type of map can be turned into an Environment map.

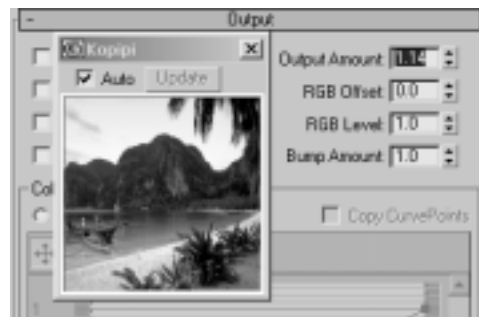


Figure 14.53 You often need to brighten a map before using it as an Environment map.

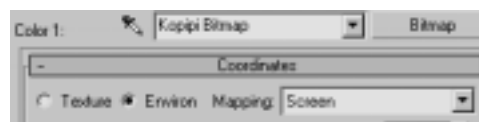


Figure 14.54 Choose the Environment option to turn a 2D map into an Environment map.

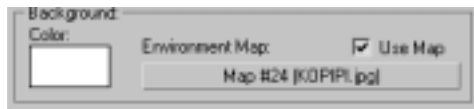


Figure 14.55 After loading the Environment map.



Figure 14.56 Use the viewport Background map and camera horizon to aid object placement.



Figure 14.57 The Environment map renders in the background of the scene.

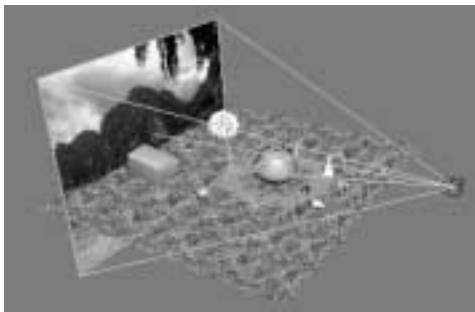



Figure 14.58 Create a background with a plane by matching it to the cone of a camera.

To add an Environment map to the background:




1. Choose Rendering > Environment
or
Press 8.
2. In the Environment dialog box, drag a map onto the Environment Map button.
or
Click the button and choose a map with the Material/Map Browser.
If you load a map from the Material Editor, choose to instance the map, so that you can edit it later as needed (Figure 14.55).
3. Press Alt + B. In the Viewport Background dialog box, check Use Environment Background and Display Background. Click OK.
4. Arrange your objects using the viewport background and camera horizon for reference (Figure 14.56).
5.  Render the scene.
The Environment map appears behind the objects (Figure 14.57).
6. To adjust the background, drag an instance of the map onto a sample slot in the Material Editor and adjust it there.

✓ Tips

- To save rendering time, render objects in the back of your scene to a high-resolution bitmap image; then load the image into the Environment map as a background.
- Because Environment Background maps are locked to the viewplane, they do not change perspective when you move the camera. If you need to use a background that is located in space, position a plane behind your objects so it is perpendicular to the line of sight of your camera. Then match the dimensions of the plane to the viewplane of the camera and assign it a mapped material that is not shiny and fully self-illuminated (Figure 14.58).

A Matte/Shadow material causes the environment background show through an object. This enables you to cast shadows, add reflections, or place objects in the background.

To place an object in a background:

1. Load a map into the environment and viewport backgrounds of a scene.
2. Load a Matte/Shadow material into a material sample slot.
The Matte/Shadow Basic Parameters rollout appears (**Figure 14.59**).
3.  Assign the material to an object.
The object becomes a matte object.
4.  Position matte object so that one of its edges matches an object in the background. Then place an object behind the matte object so that it emerges along the matched edge (**Figure 14.60**).
5.  Render the scene (**Figure 14.61**).
6. To make a matte object receive shadows, check Receive Shadows (**Figure 14.62**). Use the Shadow Brightness and Color parameters to make the shadow match the background image more closely.

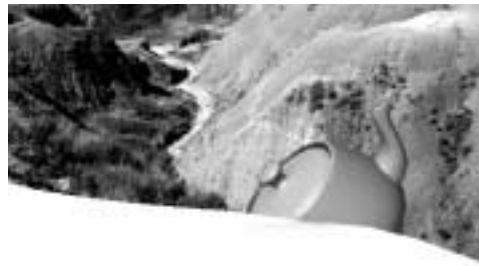


Figure 14.60 Hiding part of an object behind the matte object.



Figure 14.61 When you render the scene, the partially hidden object appears to be inside the pictorial space of the background.

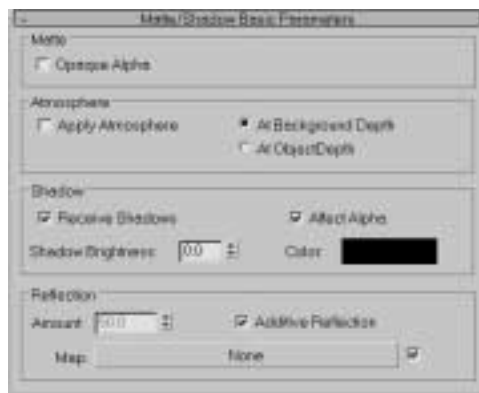


Figure 14.59 The Matte/Shadow material allows you to create a new environment for an object.



Figure 14.62 After checking Receive Shadows, the object appears to cast a shadow in the background.



Figure 14.63 The Taj Mahal is reflected in a Flat Mirror map.

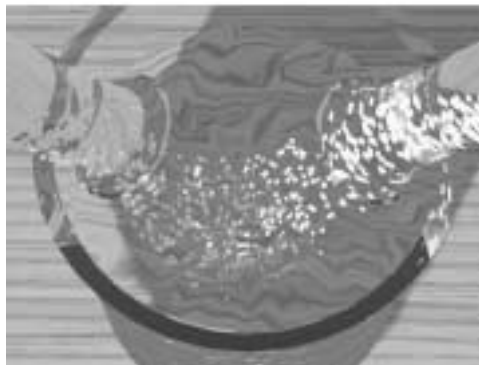


Figure 14.64 This chemistry visualization uses refraction mapping for the water and the glass.

Reflection and Refraction

Everything that you see is an illusion of light. Earth, sun, sky, clouds, moon, stars, and every person, place, or thing is visible because of emitted or reflected light.

Reflections appear when a pattern of color is carried by rays of light from a shiny surface into your eyes (**Figure 14.63**). 3D programs create reflections by simulating the interaction of light and objects in nature.

To create reflections in 3ds max, you need to do three things:

- ◆ Assign a reflective material to an object.
- ◆ Surround the object with other objects, or an Environment map.
- ◆ Illuminate the scene so that light reflects off the object and into the viewplane.






You create reflective materials by adding a Reflect/Refract or a Raytrace map to a Standard material, adding a Flat Mirror map to a Standard material, or setting a Raytrace material to be reflective.

Reflection maps are locked to world coordinates so they will appear constant as objects move through them. They only appear to move when the camera you are viewing them with moves. Because reflections are not tied to objects, objects do not need to be assigned mapping coordinates in order to display reflections.

Refraction is a phenomenon that makes light bend when it passes through transparent objects. You can create refractions with a Reflect/Refract map or a Raytrace map, but I find the refractions that are produced by Raytrace material to be more satisfactory and easier to control (**Figure 14.64**).

The best way to create reflections on a flat surface is with a Flat Mirror map.

To create a reflection on a flat surface:

1.  Select a plane that has a few objects sitting on it.
2.  Open the Material Editor.
3. Select one of the sample slots.
4.  Click the Reset Map/Mtl to Default Settings button to change the colors of the material to shades of gray.
5. Open the Maps rollout.
6. Click the Reflection Map button. The Material/Map Browser appears.
7. Select the Flat Mirror map type. The Flat Mirror Parameters rollout appears (**Figure 14.65**).
8.  Click Assign Material to Selection.
9.  Render the scene. The planar surface reflects the scene (**Figure 14.66**).
10. To change which side of the object reflects, check Apply to Faces with ID and change the ID number at right. This number corresponds to the Material ID number of the object's faces.

✓ Tips

- Flat Mirror maps work only when applied to coplanar faces of an object, usually the top side. To create reflections on more than one side, use a Multi/Sub-Object material and set each Flat Mirror map to a different material ID.
- An extruded shape also makes a good reflecting surface.
- Adding a little noise to a Flat Mirror map creates the appearance of ripples on water (**Figure 14.67**).



Figure 14.65 The rollout for a Flat Mirror map allows you to add an Environment map to the reflection, and to disturb the reflection with noise or a Bump map.



Figure 14.66 A Flat Mirror map makes a plane reflect the scene.



Figure 14.67 Adding noise creates a ripple effect.

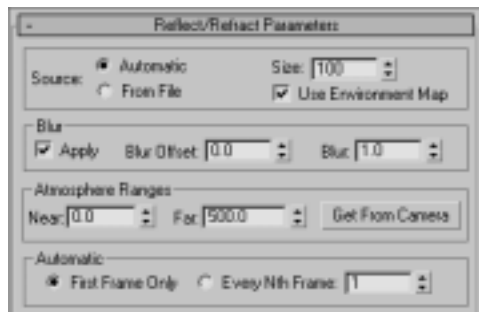


Figure 14.68 Use the Reflect/Refract map to create an automatic reflection.

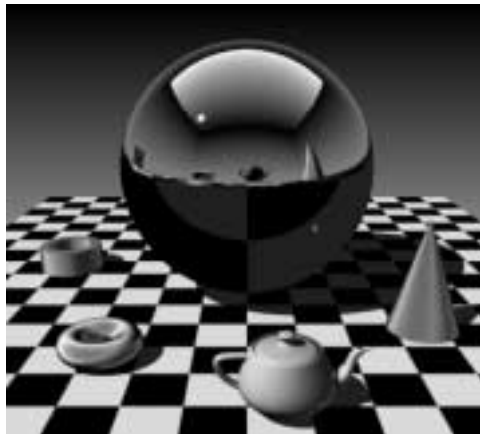


Figure 14.69 Increasing the contrast of the material colors strengthens the reflection.

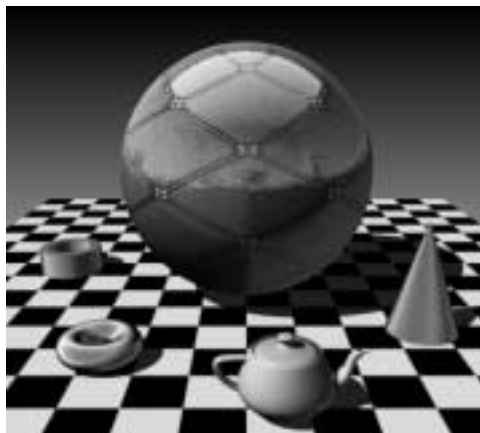




Figure 14.70 Reflections are usually secondary to the diffuse color of an object.

The fastest way to create reflections on a curved or irregular surface is with a Reflect/Refract map.

Reflect/Refract maps take snapshots of the scene from six directions and map them onto a surface using a cubic Environment map.

To create a reflection on a curved surface:

1. Select a material that you want to add reflections to.
2. Open the Maps rollout.
3. Add a Reflect/Refract map to the Reflection Map button.
4. In the Reflect/Refract Parameters rollout, make sure that the Source is set to Automatic and that Use Environment Map is checked (**Figure 14.68**).
5. Set the Blur or Blur Offset amount if you want the reflection to blur.
6.  Apply the material to a curved or irregular surface.
7. Assign a Background map to the environment of a scene.
8.  Activate a Perspective or Camera viewport. Then render the scene. A reflection of the scene appears on the surface of the object. The reflection mixes with the base color of the material, but it does not mix with its specular highlights.
9. To give the reflection more contrast, so that it looks like a mirror, set the Ambient and Diffuse colors to black and the Specular color to white (**Figure 14.69**).
10. To mix the reflection with the diffuse color of the object, reduce the Reflection Amount in the Maps rollout (**Figure 14.70**).



✓ Tip

- If an object intersects the object you are working with, it may not appear in the reflection. Correct this by moving the object.

Raytrace maps eliminate seams by tracing a series of paths, or rays, from every pixel that you see on the viewplane into the scene. As the rays bounce from one object to another, they accumulate color and lighting information that they use to paint surface colors and reflections.

Because they require more calculation than cubic environment mapping, ray-traced reflections take longer to render.

To create ray-traced reflections:

1. Select a material and open the Maps rollout.
2. Add a Raytrace map to the Reflection Map button.
3. In the Background area of the Raytracer Parameters rollout, choose a source of reflection mapping. To reflect the current environment map, choose Use Environment Settings. To reflect a solid color, choose the color swatch and pick a color. To reflect a map, including an external bitmap, click the map button. Spherical environment coordinates will automatically be assigned to the map (**Figure 14.71**).
4.  Apply the material to an object.
5.  Activate a Perspective or Camera viewport. Then render the scene. A reflection of the scene appears on the surface of the object. This time the reflection does not have any seams.
6. Adjust the brightness, contrast, and tint of the reflection by changing the colors of the material and the Reflection Amount, or by changing the output of the Environment map (**Figure 14.72**).
7. To create a refraction instead of a reflection, load a Reflect/Refract map or a Raytrace map to the Refract Map button (**Figure 14.73**).

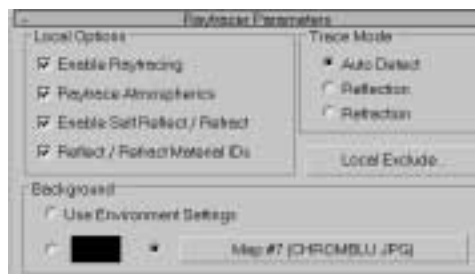


Figure 14.71 The Raytrace map rollout allows you to add an Environment Background map that encloses the surface of the reflecting object.

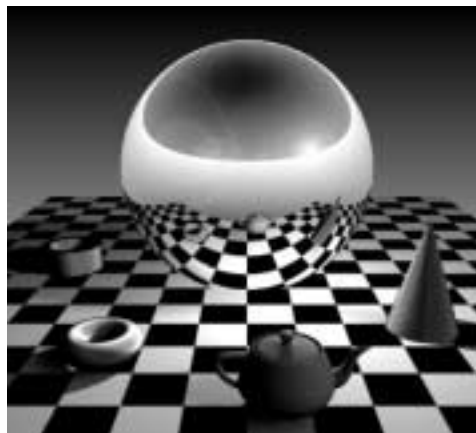


Figure 14.72 This highly polished reflection was created by adjusting the contrast of both the material and the map.

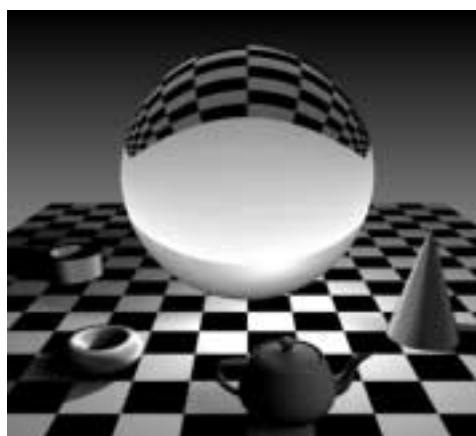


Figure 14.73 A Refraction map inverts the scene that surrounds the refracting object.



Figure 14.74 Setting Transparency to white is the same as making an object 100% transparent.





Figure 14.75 After adjusting the Raytrace Basic Parameters for a refracting crystal ball.



Figure 14.76 The ball reflects and refracts the scene.

Raytrace materials map reflections using the same ray-trace rendering engine as Raytrace maps. They have additional controls for creating refraction, transparency, translucency, and fog.

To create a refraction:

1. Click a sample slot.
2. Click the Type button, and choose Raytrace from the Material/Map Browser.
3. In the Raytrace Basic Parameters rollout, set the Transparency color to white, or 100% transparent (**Figure 14.74**).
4. Set the Index of Refraction to a value between 1.5 and 2, depending on if your crystal is made of glass, quartz, or diamond. Higher values increase the curvature of the refracted image.
5. Set the Specular Level to 100 and the Glossiness to 90.
6. To make the crystal ball reflect as well as refract, uncheck Reflect and increase the reflection amount by 5 to 20%. Higher amounts obscure the refracted image.
If you are using an Environment map, you may need to offset the U coordinates of the map to eliminate the map seam.
7. Click the Environment map button and select the map that you want to refract. You can also drag a copy of the scene's Environment Background map onto this button (**Figure 14.75**).
8.  Assign the material to a curved object, such as a sphere.
9.  Render the scene (**Figure 14.76**).

✓ Tip

- For more information on Raytrace materials and how to adjust them, see the help files.