
Tutorial 4: Texture Mapping Techniques

Completion time 40 minutes


In the previous tutorial we learned how to create materials, and how to assign texture maps to those materials. In this tutorial we will explore texture mapping in more depth. Specifically we will concentrate on commands that determine how a texture is mapped onto an object.

In this tutorial you will learn:

- What a texture map is
- How to set different mapping types
- How to re-size a texture in relation to an object
- How to perform test-renderings in the Object Designer viewport
- How to change the orientation between a texture and an object
- How to determine the way a texture is repeated as it is mapped onto an object
- How to assign a different material to an object
- How to define and use a bump map
- How to use a bump map in conjunction with an image map
- How to assign materials to parts of objects using the Select Toolbox
- How to create material libraries

What is a Texture Map?


A texture map is any bit map image used in a material definition. As we mentioned in the previous tutorial, there are three different kinds of texture maps that can be assigned to a material: a Color Texture, Bump Texture and Reflect Texture. When a material containing a texture map is rendered onto an object, the texture is "mapped" onto the polygonal faces of the object according to a variety of criteria assigned in the Object Designer window. These criteria include the size, position and rotation of the texture map in relation to the object onto which it is to be mapped. To more fully explore the texture mapping features in the Object Designer we will load a new project.

- Restart Renderize Live.
- From the TUTOR directory, load project 'tutor4.eye'.
- Drag and drop 'viewvase' from the Resource Palette into the viewport.
- Set "Test:1" and select the  button to perform a quick-render. The object "cube.dxf" has the material "fish" assigned to it. It looks good on one side, but appears to be smeared on the others: this is due to the "Ortho" mapping type that has been set for the cube. Note that the texture map is repeated about three

quarters of the way up the cube. This has to do with the way the texture map is scaled in relation to the object.

Setting Mapping Types

Let's set a different mapping type for the cube.

- Click the  button.
- Drag and drop the object "cube.dxf" into the Edit Well. Note the Mapping Type selections on the Object Designer: these choices affect the way in which the texture is projected onto the surface of the object.

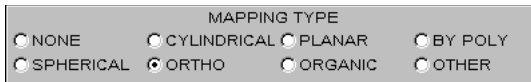


Figure 44. *The Mapping Type determines how a texture is mapped onto an object.*

Currently, the "Ortho" button is selected: the texture is applied to the cube orthogonally, washing over the surface from a single direction (the way a slide projector casts images against a wall). This explains why the image was correct on one face of the rendered cube, but smeared on the other faces.

We want the texture to be mapped "flush" against each face of the cube: to do so, we'll select the "Planar" mapping type, so that the texture will be mapped down the polynormal of each face.

- Set the Mapping Type to "Planar".

Scaling Textures in Relation to Objects

Often you will need to change the scale of the texture map you are working with so that a pattern appears on the object at a realistic scale. Let's change the scale of our fish texture.






Look in the Object Designer viewport. The object "cube.dxf" is represented as a yellow and white square (it only appears as a square because we are looking at it head-on), and the texture mapped area of the square (where the fish is) is highlighted in yellow. The aspect ratio of this rectangle matches the aspect ratio of the image that is used as a texture map. Notice the rectangle is sized so that it fills the side of the cube horizontally, but not vertically: this explains why the texture map was repeated as it is was rendered onto the face of the cube.

Remember that there can be up to three different image texture maps assigned to any given material: Color, Bump and Reflect Textures. Each of these texture maps can be positioned and scaled independently for an object. The map that is currently being manipulated is determined by the Mapping Select options.



Figure 45. The Mapping Select options determine which image map is being manipulated in the Object Designer viewport.




We want to change the scale of the Color Texture. Therefore:


- Make sure the Color option is selected in the Mapping Select area of the Object Designer. Notice the first three buttons to the left of the Object Designer viewport:
- When the  button is pressed, a group of buttons are displayed below the viewport for the re-orientation the object in relation to the texture.
- When the  button is pressed, a group of buttons are displayed to move and scale the texture in relation to the object.
- When the  button is pressed, you can alter the angle from which you view the relationship between the object and the texture map.
- Make sure the  button is pressed. With this button pressed, we can scale and reposition a texture map using the buttons below the Object Designer viewport.
- Select the  button below the viewport to change the horizontal and vertical scale of the texture map simultaneously.
- Move the pointer into the viewport, then select and drag to change the scale of the yellow rectangle. When you release the mouse button, the "Scale X" and "Scale Y" type-ins update to reflect our changes. Their starting value is "1"; reduce the scale of the texture until these values read approximately 0.65.

It is important to note that the texture's vector representation is drawn from the material appearing in this Test Material Well. Make sure before you size and/or orient a material in the Object Designer's viewport that you are manipulating the right material.

Performing Test Renderings in the Object Designer Viewport

You can perform a test-render directly into the Object Designer viewport to quickly view your changes without performing a full rendering in the main Project Designer viewport.

- Select the  button to the left of the Object Designer viewport to execute a test-rendering in the viewport. Notice how the image of the fish is mapped onto the cube at its new scale. If you wish to see more detail you may enable the  button below the  button to achieve a full quality render. However, selecting this button will increase the test rendering time fourfold.

- Select "Save" and confirm "Replace".
- Minimize the Object Designer.
- Select the  button on the Render Toolbox to quick-render the image. Notice how the fish texture is now mapped onto each face of the cube in the same way: this is the effect of the "Planer" mapping type. Planer is the type used most often on rectilinear objects such as our cube. Notice also that the scale of the fish texture is reduced, and the texture is repeated as it is mapped onto the cube. Note that the texture does not "wrap" around the edges of the cube: when the Planer Mapping Type is selected, texture maps are re-started for an adjoining polygons, unless the adjoining polygons are in the same plane.

Orienting Textures in Relation to Objects

Often it is important to change the orientation of a texture in relation to an object, to determine in which direction a pattern will be applied.



- Maximize the Object Designer with "cube.dxf".
Before we change the texture map's orientation, let's select another Mapping Type.
- Set the Mapping Type to "Organic".

Organic mapping can be thought of as the "gift-wrap" mapping type: the texture is wrapped around all facets of an object. This mapping type is particularly useful for irregular shapes.

Notice that the scale of the texture is reset to "1" when we change mapping types. This is because the scale has different meanings for different mapping types: for Planar mapping, a scale of "1" maps the entire image over one face of the cube; for Organic mapping, a scale of "1" maps the entire image over the entire cube. Let's reset this scale back to 0.65, but this time we'll type in values instead of scaling the texture in the viewport.

- Enter the value 0.65 in the "Scale X" and "Scale Y" type-ins.

Now let's change the orientation of the texture map in relation to the object: we'll do this in the Object Designer viewport. The texture map always appears as a rectangle in the same plane as the viewport: however, the orientation of the wireframe object "behind" the texture can be altered, changing the relative orientations of texture and object.

- Select the  button to the left of the viewport: this allows to manipulate the object.
- Select the  button this allows you to roll the object in relation to the texture map. Notice that the viewport still displays our last test-rendering. This will be replaced by the wireframe representation as soon as we select in the viewport.
- Move the pointer into the Object Designer viewport, then select and drag to roll the cube about 45 degrees.

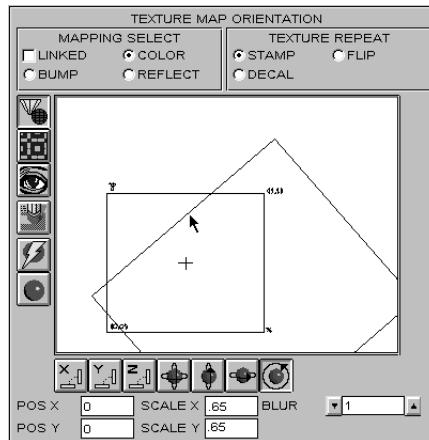



Figure 46. *Re-orient an object in relation to a texture to alter the direction in which the texture map is rendered onto the object.*

- Select "Save" and confirm "Replace".
- Minimize the Object Designer.
- Select the  button on the Render Toolbox to quick-render the view. Notice that the texture map is now rendered onto the object at an angle. Also notice that the texture "wraps" around the edges of the cube: this is an important difference between the "Planer" and "Organic" Mapping Types.

Determining the Texture Repeat Type

The options that determine how a texture is repeated during mapping are displayed on the Texture Repeat area of the Object Designer.





- Maximize the Object Designer with "cube.dxf". Notice the Texture Repeat options.



Figure 47. *The Texture Repeat options determine how a texture is repeated as it is mapped onto an object.*

The "Stamp" option repeats the texture normally. "Flip" repeats by flipping the texture on the X and Y axes. "Decal" will turn off all repeat, applying the texture map only once as if it were a decal (this Repeat Type is explored in Tutorial 8: Advanced Materials).


Until now we've been using the "Stamp" Repeat Type. Let's change to the "Flip" Repeat Type to see the difference.

- Select 
- Select  and  return the cube to its original position.
- Select the "Flip" option under Texture Repeat.
- Select "Save" and confirm "Replace".
- Minimize the Object Designer.
- Select the  button at "Test:1" in the Project Designer. Notice that as the fish is repeated over each of the faces of the cube, the image is mirrored on the X and Y axes.

Assigning a Different Material to an Object

When a DXF model is imported into Renderize Live, materials are created and assigned to the different objects, or parts of objects, depending on the selections in the DXF Browser. These assignments can be changed by simply assigning a new material to the object as a whole, or by assigning new materials to parts of the object on a polygon-by-polygon basis. We'll explore each of these methods during the course of this tutorial.

Let's assign a different material to the Object "cube".

- Re-open the Object Designer with "cube.dxf"..
- Select the  button on the Resource Manager to display the Material Resource Palette.
- Now drag the material "blue" from the Material Resource Palette and drop it into the Material Well at the bottom of the Object Designer.

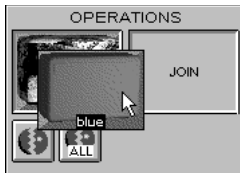




Figure 48. *Drop a material into the Material Well of the Object Designer to assign it to an object.*

- Select "Save" and confirm "Replace".
- Minimize the Object Designer.
- Select the  button on the Render Toolbox to quick-render our changes. The cube's "fish" material has been replaced by the "blue" material. If the "blue" material also contained texture maps, the sizing and orientation values we set earlier would have an effect on them.

Applying a Bump Texture

Images can be used not only as Color Textures, as demonstrated above, but also as Bump Textures. When an image is used as a Bump Texture, the colors in that image are used to define a surface topography which creates a textured effect on otherwise flat polygonal surfaces.


Right now the material "blue" is a simple matte color with no texture maps assigned to it. Let's edit this material to incorporate a Bump Texture.

- Drag and drop the material "blue" in the Edit Well.
- Select the  button on the Resource Manager to display the Image Resource Palette.
- Drag the image "bump2" from the Image Resource Palette and drop it into the Bump Texture Well on the Material Designer.
- Select "Save" and confirm "Replace" to update the material.
- Close the Material Designer.

Now let's set the size, position and amplitude (height) of the bump map.

- Maximize the Object Designer with "cube.dxf"

Now let's scale the Bump Texture.

- Select the "Bump" option under Mapping Select.
- Set the Mapping Type to "Planar".
- Select the  button below the viewport: this button allows us to scale the texture in relation to the object.
- Move the pointer into the viewport and change the scale of the texture until it is a little larger than the face of the cube (X and Y scale about 1.3).



Now we'll set the height, or amplitude, of the Bump Texture.

- Enter a value of 3 in the "Bump Height" type-in. Note that you can enter positive or negative values for the bump amplitude.

Finally, let's reset the repeat type for the texture.

- Set the Texture Repeat to "Stamp".
- Select "Save" and confirm "Replace".
- Close the Object Designer window.

Now we'll render the view with this texture map.

- Select the  button on the Render Toolbox to perform a full render of the view (the  button does not display bump map effects).






The surfaces of our cube no longer appear smooth: the Bump Texture that we included in the material is used to create a textured surface. Bump Textures like this are useful in creating a wide variety of surface effects without the expense of modeling them. The Bump Texture we used here can be fine-tuned to create materials such as concrete, stucco or asphalt. In Tutorial 8: Advanced Materials, we'll explore the use of Bump Textures to create an even wider variety of effects.





Using Color Textures and Bump Textures Together

As noted earlier, Color Textures and Bump Textures are manipulated completely independently in the Object Designer. The Color Texture and Bump Texture can be two completely different images set at different scales and positioned in different locations over the cube.

It is desirable to use the same image as the Color Texture and the Bump Texture, and to manipulate the two in unison to enhance the realism of a material. In the following steps we'll explore the use of Color Textures and Bump Textures together.

Let's begin by assigning a new material to our cube. Last time we did this by dropping the new material into the Test Material Well of the Object Designer: this time we'll try something different.

- Select .
- Drag the object "cube.dxf" from the Object Resource Palette and drop it into the Move Well on the Project Designer. Notice that a wireframe now replaces a rendered model.
- Select .
- Drag the material "brick" from the Material Resource Palette and drop it into the Move Well over the object "cube.dxf". The material "brick" is now assigned to the object "cube". Let's render the cube to take a look at this material.
- Select the  button on the Command Bar to display the Render Toolbox.
- Select the  button on the Render Toolbox to render the view. The material "brick" has been mapped onto our cube. It looks pretty good, but it might look even better if we give it a little more topography.
- Select .
- Drag the material "brick" and drop it into the Edit Well to load it into the Material Designer. Notice that the image "brick9" is used as the Color Texture. Let's use this image as a Bump Texture as well.
- Drag the image "brick9" from the Color Texture Well and drop it into the Bump Texture Well on the Material Designer.
- Select "Save" and confirm "Replace".
- Close the Material Designer.

- Select .
- Drag the object "cube.dxf" and drop it into the Edit Well to open the Object Designer. We want to manipulate the position and scale of the Color and Bump Textures in unison so that the topography matches the image.
- Select the "Linked" option under Texture Map Orientation. Now the Color and Bump Textures are manipulated in unison.
- Select the  button to scale the textures simultaneously in the horizontal and vertical directions.
- Move the pointer into the viewport and scale the textures until the Scale X and Scale Y type-ins are set to about 0.7.
- Select "Save" and confirm "Replace", and close the Object Designer.
- Select the  button on the Render Toolbox to render the view. Now the brick texture appears more realistic. However, notice that the mortar is sticking our further than the bricks: our Bump Texture effect is working in the wrong direction. Let's fix this.
- Re-open the Object Designer by dragging "cube.dxf" to the Edit Well.
- Select the "Linked" Mapping Select option, if it is not already selected. Notice that the Bump Height is set to 3. Let's reverse this.
- Set the Bump Height to -3.
- Select "Save" and confirm "Replace", and close the Object Designer.
- Select the  button on the Render Toolbox to render the view. Now the brick material looks correct.

Assigning Materials to Parts of Objects

Until now, when we assigned a material to an object, the material was assigned to all of the polygons that made up that object. The only time a single object had multiple material assignments was if it was imported that way (this is the way our table appeared at the beginning of Tutorial 3). The ability to assign multiple materials to an object based on that object's layer, block or color definitions in the DXF file is quite useful, but always relying on the DXF to define material-to-object relationships would be inflexible. Using the Select Toolbox, multiple material assignments can be created for each object.

- Select the  button on the Command Bar to open the Select Toolbox.



Figure 49. *The Select Toolbox is used to view and change the relationships between objects and materials.*

The Select Toolbox can be used to edit a material-to-object assignments by selecting a material from the pop-down list of material names and then picking polygon(s) to which the current material is to be applied. Simply put, you select a material, then tag a group of polygons that you wish to assign to that material.

Let's put a different material on each visible side of the cube.

- Pop-down the material list on the Material area of the Select Toolbox, and choose the material "brick".

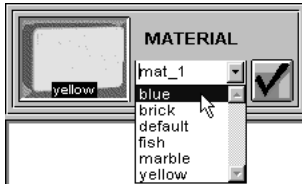




Figure 50. Select a material from the Material pop-down list on the Select Toolbox.

Notice that the polygons associated with the selected material are highlighted in green. Notice also that the icon of the selected material appears in the Select Toolbox's Current Material Well.

Let's clear the highlighted area and select another material.

- Select the  button on the Select Toolbox to clear the highlighted polygons.
- Select "yellow" from the material pop-down list on the Select Toolbox. Notice that nothing highlights: the material "yellow" is not applied to any of the polygons in our view. Let's place the material "yellow" onto the left side of the cube.
- Make sure the  Mode button is depressed on the Select Toolbox so that the Polygon Selection command buttons appear.

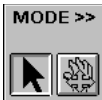





Figure 51. The Mode buttons are used to toggle between selecting polygons and changing the view.

The Mode buttons determine whether the mouse is being used to pick polygons or move things around in the viewport (moving objects and the camera while in the Select Toolbox is discussed later in this tutorial). The area to the right of the Mode buttons on the Select Deck display commands relating to the Mode button that is selected: in this case, buttons appear pertaining to the selection of polygons.


- With the left mouse button click anywhere within the polygon that constitutes the left face of the cube. The face should highlight in green. Simply pointing to a polygon and clicking will select that polygon (or de-select it if it is already highlighted).

- From the Change area of the Select Toolbox, select the  button to apply your material changes. Now this polygon has the material "yellow" assigned to it. The  button must be selected in order for the assignment to be recorded.

Now we'll create a new material and assign it to a different face of the cube.

- Select on the material type-in in the Select Toolbox, and type in the name "red", replacing the name "yellow".
- Select the  button in the Material area of the Select Toolbox to create a new material of this name. We have just created a new material resource, "red": this new material is created with the default gray color.




Now let's apply the material "red" to the top polygon of the cube. To do so, we'll use a different polygon picking method. The single click method is fine when there is no overlapping geometry, but it can be inaccurate when polygons overlap. A more accurate method is to use the Polygon Selection buttons to pick polygons in a bounding box. Let's make it easier to pick polygons by turning off the display of backfacing polygons.



- Make sure the  button on the Command Bar is not selected.

Now let's use the Polygon Selection commands.



Figure 52. The Polygon Selection buttons determine how polygons are selected or deselected.

- Select the  button from the Polygon Selection area of the Select Toolbox. When this button is enabled we are adding polygons to a material assignment.
- Select the  button from the Polygon Selection area of the Select Toolbox. When this button is selected, all polygons within or intersected by the bounding box we draw are added to the material assignment; when the  button is selected, only those polygons completely surrounded by the bounding box are selected.
- Move the pointer into the Project Designer Viewport to define a rectangle over an edge of the top of the cube. Be careful to intersect only the top back edge of the cube. To define a rectangle, move the pointer to the desired starting point, then hold down the left mouse button and drag the pointer to expand the rectangle. When the desired area is encompassed by the rectangle, release the mouse button. The top of the cube will highlight.
- The top of the cube and all the polygons in the lower area of the vase (that visually coincide with the top plane of the cube) become highlighted. To deselect/subtract

the unwanted highlighted area of the vase one must select  (subtract) and  . Highlight the polygons you want to remove from the selection.

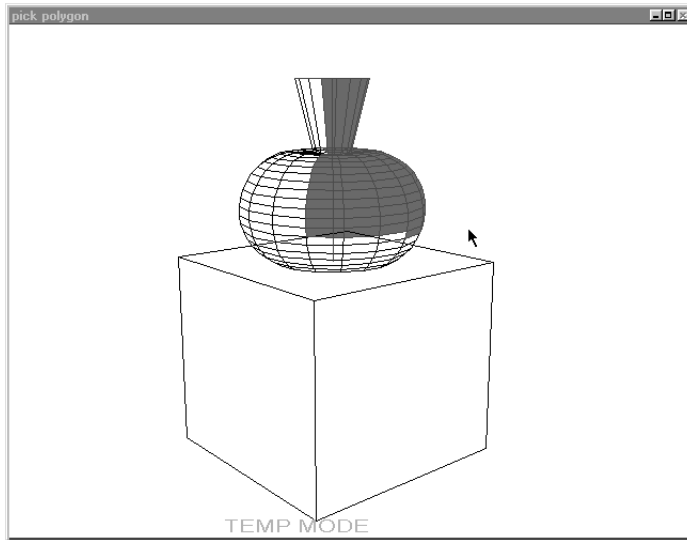



Figure 53. Select polygons by drawing a bounding box that "clips" the polygon.


- Select the  button on the Change area of the Select Toolbox to save our changes.

Changing the Viewport Display During Selection

Detailed objects can get to be quite complex, and when viewed as wireframes the vectors can be difficult to distinguish. Renderize Live provides the ability to zoom in on a part of the viewport during the selection process, and to actually move objects or the camera to get at polygons that would otherwise be difficult to select.


Notice the words "TEMP MODE" at the bottom of the viewport. While in both the Select Toolbox or Normals Toolbox (discussed in Tutorial 10) all movements of the camera and objects are temporary. Upon leaving the Select and Normals Toolboxes the camera and the objects in the viewport are reset to their prior assigned positions. This makes it very easy to maneuver in the Select and Normals Toolboxes to pick polygons without having to worry about upsetting a carefully designed scene.

First let's zoom our view.

- Select the  button on the Command Bar at the top of the Project Designer window; this allows us to define a "zoom box".

- Move the pointer into the viewport, then drag a bounding box around the vase portion of the display in the Viewport. The words "ZOOM MODE" appear at the bottom of the viewport to indicate that the display is zoomed.


Now let's rotate our vase to get at some polygons that are currently facing away from the camera. The resource that we are moving, whether it is an object or a camera, must be loaded into the Move Well.

- Drop the object resource "vase.dxf" into the Move Well. The  Mode button on the Select Toolbox is enabled automatically to change to the Move mode.



Now the mouse is being used to move the vase, as opposed to selecting polygons. Notice that the Polygon Selection buttons on the right side of the Select toolbox are replaced with Viewport Control buttons.



Figure 54. The Viewport Control buttons are used to move objects or the camera in a temporary mode.

- Select the  button on the Viewport Control area of the Select Toolbox.
- Move the pointer into the viewport, then select and drag to rotate the vase along a vertical axis.

Now let's change the material assignment for a group of polygons while in this Zoom Mode. We'll continue to assign polygons to our current material, "red".

- Select the  Mode button on the Select Toolbox to change to the Polygon Selection mode.
- Using the selection methods learned above, select a group of polygons on the vase.
- When satisfied select the  button on the Change area of the Select Toolbox to save your changes.

Now before we render, let's give the "red" material a colorful look.




- Load the material "red" into the Material Designer.

To change the Matte Color to a deep red you can do one of the following :

- Right Click Method: Click the right mouse button on the Matte Well in the Material window. A Color Bar appears in the Selection Area. Select HSV or RGB as needed and move the sliders on each of the 3 color bars until the desired shade of Red is achieved. Notice that as you do this the color also changes in the Matte

box of the Material Window.

or

- Select Color Box / Drag and Drop Method : Move the Material Window out of the way. Select . The Color Bar appears. Again find a suitable shade by adjusting the sliders. Click on the Color Well, which now has your desired shade of red, hold the button down, drag and drop it into the Matte Well.
- Regardless of which method you used, click 'SAVE' in the Material Window.
- Select "Save" and confirm "Replace".
- Close the Material Designer.
- Click  in the change box to save these changes.
- Select the  button on the Command Bar to display the Render Toolbox.

As soon as we open the Render Toolbox the Zoom Mode is terminated and we return to the normal camera display.

- Select the  button on the Render Toolbox to render our changes.

Notice that the material "yellow" is now applied to the left face of the cube. The material "red" is applied to the top of the cube and to those polygons that we selected on the vase.

Picking polygons and applying materials in the Select Toolbox may take some practice, but the power and flexibility it lends can make it well worth it.

Creating Material Libraries

If you would like to save a material created in one project for use in other projects, simply create and save a project which contains only material resource information. When you want to include that material resource in a project, load the project containing the materials into your working project. When you save the new project, it will include these materials.