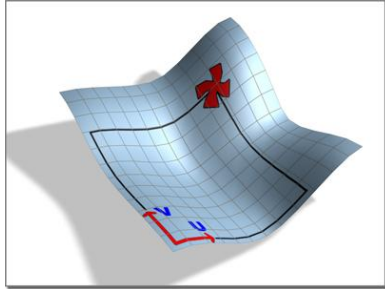


# UVW Mapping

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Most material maps are a 2D plane assigned to a 3D surface. Consequently, the coordinate system used to describe the placement and transformation of maps is different from the X, Y, and Z axis coordinates used in 3D space. Specifically, mapping coordinates use the letters U, V, and W; the three letters preceding X, Y, and Z in the alphabet.



## Local UV coordinates shown on a surface

The U, V, and W coordinates parallel the relative directions of X, Y, and Z coordinates. If you look at a 2D map image, U is the equivalent of X, and represents the horizontal direction of the map. V is the equivalent of Y, and represents the vertical

direction of the map. W is the equivalent of Z and represents a direction perpendicular to the UV plane of the map.

You might question why you need a depth coordinate like W for a 2D plane. One reason is because it's sometimes useful to be able to flip the orientation of a map, relative to its geometry. To do this, you need the third coordinate. The W coordinate also has a meaning for 3-dimensional procedural materials

## Maps and Mapping Coordinates

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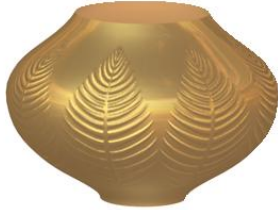
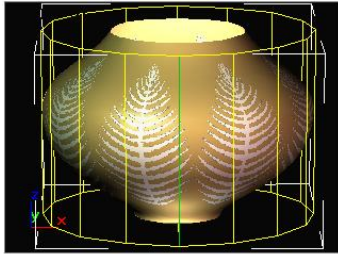
Mapping coordinates specify how a map is placed, oriented, and scaled onto geometry. Mapping coordinates are often specified in terms of U, V, and W, where U is the horizontal dimension, V is the vertical dimension, and W is the optional third dimension, specifying depth. In general, geometric primitives have mapping coordinates applied by default, but surface objects such as Editable Poly and Editable Mesh require you to add mapping coordinates to them.

If you apply a material with maps to an object that has no mapping coordinates, the renderer displays a warning.

3ds Max provides a number of ways to generate mapping coordinates:

- When you create a primitive object, use the Generate Mapping Coords option. This option, which is on by default for most objects, provides mapping coordinates automatically with a projection appropriate to the shape of the object type.
- Mapping coordinates require additional memory, so turn the option off if you don't need them.
- Apply the [Unwrap UVW modifier](#). This powerful modifier offers a wealth of tools and options for editing mapping coordinates.

- Apply a **UVW Map modifier**. You can choose from several types of projection; customize the placement of the mapping coordinates on the object by positioning a mapping gizmo; and animate the transformations of the mapping coordinates.



**Decoration on the vase is a map positioned by rotating the UVW Map Modifier gizmo.**

Set an appropriate projection type for the geometry:

- **Box projection** places a duplicate of the map image on each of the six sides of a box.
- **Cylindrical projection** wraps the map image once around the sides of an object (duplicate image are also projected onto the end caps).
- **Spherical projection** wraps the map image once around a sphere, gathering the image at the top and bottom.
- **Shrink-wrap projection** is also spherical, but truncates the corners of the map and joins them all at a single pole, creating one singularity instead of two.
- Use special mapping coordinate controls for special objects. For example, the Loft object provides built-in mapping options that let you apply mapping coordinates along the length and around the perimeter.
- Apply a **Surface Mapper modifier**. This world-space modifier takes a map assigned to a **NURBS surface** and projects it onto the modified object or objects. Surface Mapper is especially useful for seamlessly applying a single map to a group of surface sub-objects within the same NURBS model. You can also use it for other kinds of geometry.
- There are three cases where you can apply a map without specifying the mapping coordinates:
  - **Reflection maps, Refraction maps, and Environment maps**
  - These use an environmental mapping system, in which the placement of the map is based on the rendered view, and fixed to the world coordinates of the scene.
  - **3D procedural maps** (such as Noise or Marble)
  - These are procedurally generated, based on the local axis of the object.
  - Face-mapped materials


Each facet of the geometry is mapped individually.

You can specify face mapping for the Standard material (see [Shader Basic Parameters Rollout](#)), Raytrace material (see [Raytrace Basic Parameters Rollout](#)), and [Ink 'n Paint material](#).

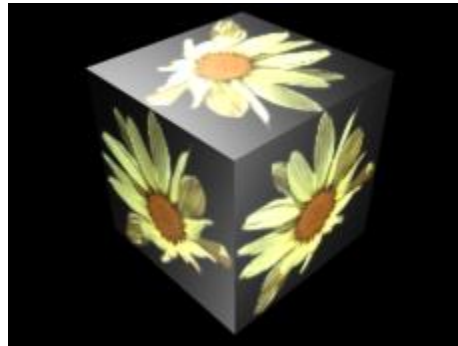
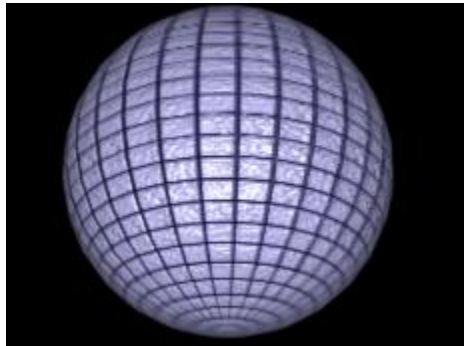
## UVW Map Modifier

By applying mapping coordinates to an object, the **UVW** Map modifier controls how mapped and procedural materials appear on the surface of an object. Mapping coordinates specify how bitmaps are projected onto an object. The **UVW** coordinate system is similar to the XYZ coordinate system. The U and V axes of a bitmap correspond to the X and Y axes. The W axis,

which corresponds to the Z axis, is generally only used for procedural maps. A bitmap's coordinate system can be switched in the Material Editor to VW or WU, in which case the bitmap is rotated and projected so that it is perpendicular to the surface.

- Select an object. >  Modify panel > Modifier List > Object-Space Modifiers > **UVW** Map
- Standard menu: Select an object. > Modifiers menu > UV Coordinates > **UVW** Map
- Enhanced menu: Select an object. > Modifiers menu > UVs, Maps and Materials > **UVW** Map

#### Procedures Interface



#### **Mapping a sphere and a box.**

By default, primitive objects such as spheres and boxes have mapping coordinates, as do loft objects and

NURBS surfaces. Scanned, imported, or hand-constructed polygonal or patch models do not have mapping coordinates until a **UVW** Map modifier is applied.

**NOTE: Drawings that are imported or linked from Autodesk Architectural Desktop and Autodesk Revit do retain the mapping coordinates that were assigned to objects by those products.**

If you apply a **UVW** Map modifier to an object with built-in mapping coordinates, the applied coordinates take precedence if map channel 1 in the **UVW** Map modifier is used. The Generate Mapping Coordinates option, available during the creation of primitives, uses map channel 1 by default.

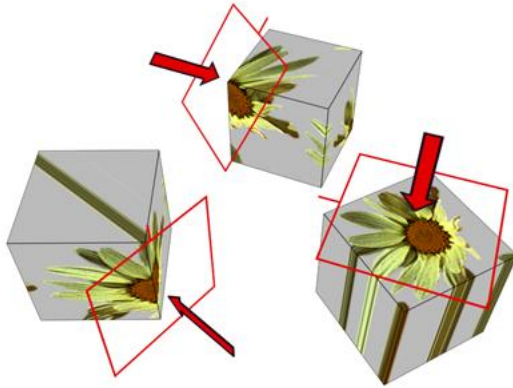
You use the **UVW** Map modifier to:

- Apply one of the seven types of mapping coordinates to an object on a specified map channel. A diffuse map on map channel 1 and a bump map on map channel 2 can have different mapping coordinates and can be controlled separately by using two **UVW** Map modifiers in the modifier stack
- Apply one of the seven types of mapping coordinates to an object.
- Transform the mapping gizmo to adjust map placement. Objects with built-in mapping coordinates lack a gizmo.
- Apply mapping coordinates to an object with no mapping coordinates, an imported mesh, for example.
- Apply mapping at the sub-object level.

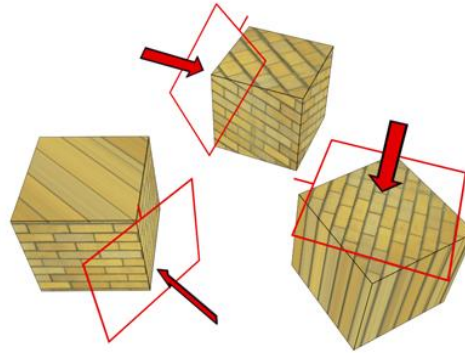
#### **Map Channels**

You can control the type of mapping coordinates and the placement of the mapping gizmo for each bitmap in a material that uses multiple bitmaps by assigning explicit map channels to the

bitmaps. In the Material Editor you assign each map a different channel number, then you add multiple **UVW** Map modifiers to the object's modifier stack, each **UVW** Map modifier is set to a different map channel. To change the type of mapping or gizmo placement for a particular bitmap, you select one of the **UVW** Map modifiers in the modifier stack and change the parameters. You can change the name of a **UVW** Map modifier in the Edit Modifier Stack dialog to correlate the modifier to the bitmap.



**Transforming **UVW** Map Gizmos**    **Changing a map's location by moving the gizmo.**

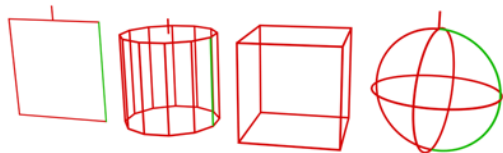


The **UV** **W** Map gizmo projects mapping coordinates onto an gizmo to can also

object. You can position, rotate, or scale a adjust map coordinates on an object; you animate the gizmo. Gizmo transformations remain in effect if you select a new map type. For example, if you scale a spherical mapping gizmo and then switch to planar mapping, then the planar mapping gizmo is also scaled.

**Gizmo Display for Different Map Types**

For planar, spherical, cylindrical and shrink wrap maps, a short yellow line indicates the top of the map. The green edge of the gizmo indicates the right side of the map. On a spherical or cylindrical map the green edge is the seam where the left and right edge meet. Gizmo must be selected in the modifier display hierarchy to display the gizmo.



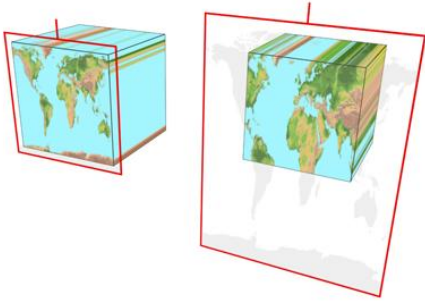
**Gizmos for different projection types**

Left to right: planar, cylindrical, box, and spherical

**Effects of Transforming the **UVW** Map Gizmo**

Moving the gizmo changes the center of projection and affects all types of mapping. Rotating the gizmo changes the orientation of the map, which affects all types of mapping. Uniform scaling does not affect spherical or shrink-wrap mapping. Non-uniform scaling affects all types of mapping.

If you scale a gizmo smaller than the geometry, then a tiling effect is created, unless scaling has no effect on the map type in use. Tiling based on gizmo size is in addition to tiling values set in the Material Editor Coordinates rollout for the map or the **UVW** Map modifier tile controls.



The size of the gizmo affects how the mapping is applied to an object.

### Manipulators for UVW Map

The UVW Map modifier has graphic manipulators to help you adjust the mapping dimensions and tiling. To use

these, turn on  (Select And Manipulate). The

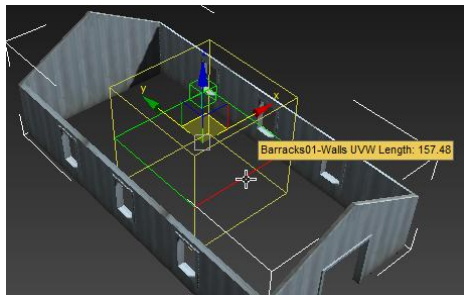
manipulators are available at the main UVW Map level in the modifier stack, and also at the UVW Map modifier > Gizmo level.

Manipulators appear as edges at the sides of the gizmo; typically they display as green. If the mapping type and gizmo are 3D, a green cube also appears at the top of the gizmo. When you move the mouse over a manipulator, the manipulator typically turns red to show that dragging or clicking it will have an effect. Also, a tooltip appears, showing the object name, the parameter, and its value.

There are no manipulators for these mapping types:

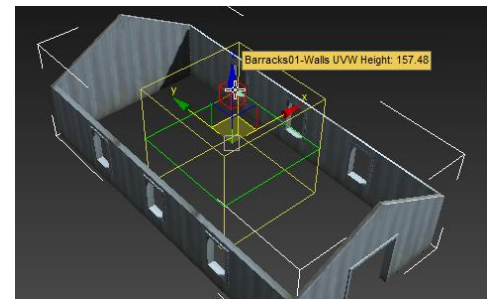
- Shrink Wrap
- Face
- XYZ to UVW

**NOTE:**When Real-World Map Size is on, gizmo manipulators appear only for the Planar and Box mapping types.



Adjusting an edge manipulator for Box mapping

Adjusting the height manipulator for Box mapping



When you use the manipulator to adjust the Height, the gizmo remains centered on the Length/Width plane, so the Height adjustment scales the mapping.

### Tile Controls

Use the UVW Tile controls if you want a map to repeat. Tiled maps are useful for bricks on a wall, or tiles on a floor. Rather than creating one large map, seamless maps can be tiled to surface a large area without visible seams, to give the illusion of a large map.

Tiling in the UVW Map modifier affects only the objects that use this modifier. Tiling a map in the Material Editor affects tiling on all the objects that use the material.

Material and **UVW** Map tiling are multiplied. For example, if a map in the Material Editor has a tile value of 2 on one axis, and a **UVW** Map modifier has a tiling value of 3 on the same axis, then the result is a tiling value of 6.

### **Objects with No Mapping Coordinates**

If you render an object that doesn't have mapping coordinates or a **UVW** Map modifier, and the object uses a material with 2D bitmaps or 3D procedural maps that use explicit map channels, then a Missing Map Coordinates alert is displayed. The alert lists both the name of the object and the **UVW** channels or Vertex Color channels that are missing the coordinates. For example: (**UVW** 2): Torus01.


### **Mapping Selection Sets or Grouped Objects**

You can apply one **UVW** Map modifier to a selection of objects. One large mapping gizmo will encompass the entire selection unless the Use Pivot Points option is turned on in the modifiers rollout before applying the **UVW** Map modifier. If the Use Pivot Points option is used then each object is encompassed with its own mapping gizmo.

If any of the objects in the selection has had its pivot point shifted in the Hierarchy ► Pivot panel, and you use the Use Pivot Points option with the **UVW** Map modifier, then the mapping gizmos are centered to the pivot points rather than the object center and the mapping may be tricky to position the way you want.

### **Procedures**

#### **To apply the **UVW** Map modifier:**

1. Assign a mapped material to an object.
2. On the  Modify panel ► Modifier List, choose **UVW** Map.
3. Adjust the mapping parameters.  
By default, the **UVW** Map modifier uses planar mapping on map channel 1. You can change the type of mapping and the map channel to suit your needs. There are seven types of mapping coordinates, ninety-nine map channels, tiling controls, and controls to size and orient the mapping gizmo in the **UVW** Map modifier.

**NOTE:** If a **UVW** Map modifier is applied to multiple objects, the **UVW** Map gizmo is defined by the selection, and the mapping that results is applied to all the objects.

#### **To use multiple **UVW** channels in the same object:**

1. Assign Map channel 1 to an object. You can do this by either turning on Generate Mapping Coordinates in the Parameters rollout of any primitive, or by assigning a **UVW** Map modifier with channel 1 chosen.  
Generate Mapping Coordinates uses map channel 1 by default.
2. Assign a **UVW** Map modifier (or a second one, if you're using the first to assign channel 1). Choose channel 2 for this modifier.  
Both coordinate channels are now assigned to the geometry. The next step is to assign a mapped material that uses both channels.



3. Create a material with two maps. You can do this using a Composite map, or a Blend material with two maps, or you can have one map assigned to Diffuse and another assigned to Bump. Perhaps the easiest way to see the effect is to composite two maps, with the second map containing an alpha channel.
4. Go to the level of one of the maps and, in the Mapping list, choose Explicit Map Channel 2. The other map is already assigned channel 1 by default.
5. Assign the mapped material to the object.  
You can switch between viewing the maps in the viewport using the Show Map In Viewport control in the Material Editor. You can adjust the mapping of channel 2 without altering the mapping of channel 1 if you've assigned two **UVW** Map modifiers. Render the scene to see the effect.

**Example: To use the XYZ to **UVW** option:**

The XYZ to **UVW** option lets you make a 3D procedural texture, like Cellular, follow the animated surface of an object. If the object stretches, so does the 3D procedural texture.

1. In the Top viewport, create a box.



2. Create a material with a Cellular diffuse map.

3. In the Material Editor, on the Coordinates rollout of the Cellular map, open the Source drop-down list, and choose Explicit Map Channel.

On the Coordinates rollout, the Map Channel parameter activates, leave the value at 1.

4. Assign the material to the box.



5. On the **UVW** Modify panel ► Modifier List, choose **UVW** Map.

6. On the **UVW** Map modifier, turn on XYZ to **UVW**.

By default, the Map Channel value is 1.

7. Render the Front viewport.

The cellular pattern renders normally on the surface of the box.

8. Right-click over the object and choose Convert To: ► Convert to Editable Mesh from the Transform (lower-right) quadrant of the quad menu.


The box is converted to an editable mesh.

9. On the **UVW** Modify panel ► Selection rollout, click  (Vertex) to turn it on.

10. In the Front viewport,  select the top vertices of the box, and move them up.


11. Render the Front viewport again.

The cellular pattern stretches with the box. This effect is enabled by the XYZ to **UVW** option. To see the difference, we will change the Source option in the Coordinates rollout in the Material Editor.



12. In the  Material Editor, locate the diffuse Cellular material.
13. On the Coordinates rollout of the Cellular diffuse map, open the Source drop-down list and choose Object XYZ.
14. Render the Front viewport.

The cellular pattern is no longer stretched.



#### To transform the **UVW** Map gizmo:

1. On the  Modify panel, choose the **UVW** Mapping modifier in the stack display.
2. In the stack display, choose the Gizmo sub-object level.  
The gizmo changes to a yellow color, with one green edge.  
The green edge indicates the right edge of the texture.
3. Move, scale, or rotate the gizmo in the viewports, or use the Length and Width controls in the **UVW** Map modifier.  
Transforming the map gizmo shifts the bitmap, allowing you to orient and move the map on the object's surface.

#### To use manipulators to control the width and length:

1. On the  Modify panel, choose the **UVW** Map modifier in the stack display.  
You can also be at the Gizmo level of the modifier.
2. On the main toolbar, click to turn on  (Select And Manipulate).  
Green edges appear along the sides of the **UVW** Map modifier's gizmo. An edge turns red when you move the mouse over it.
3. Drag an edge of the gizmo to adjust the width or length.  
A tooltip shows the new width or length value.

#### To use manipulators to control vertical scale:

1. On the  Modify panel, choose the **UVW** Map modifier in the stack display.  
You can also be at the Gizmo level of the modifier.
2. On the main toolbar, click to turn on  (Select And Manipulate).  
For 3D mapping types, a green cube appears at the top of the **UVW** Map modifier's gizmo.  
The cube turns red when you move the mouse over it.
3. Drag the cube to adjust the height of the gizmo.



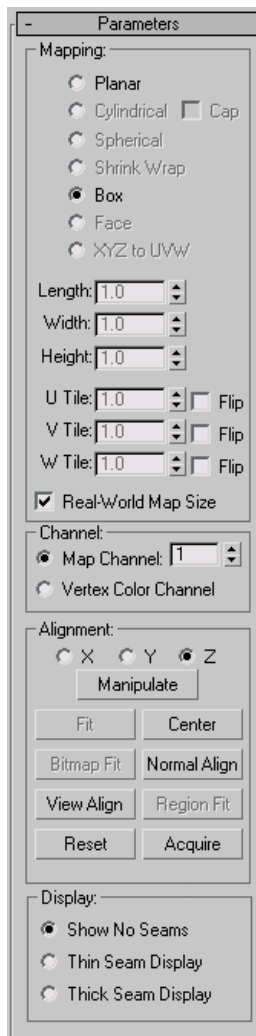
A tooltip shows the new tiling value in the vertical dimension.

## Interface

### Modifier Stack

#### Gizmo sub-object level

Enables gizmo transformations. At this sub-object level you can move, scale, and rotate the gizmo in the viewports to position the mapping.



**TIP:**To see the map move on the object surface as you transform the gizmo, enable one of the Show Map In Viewport options.

### Parameters rollout

#### Mapping group

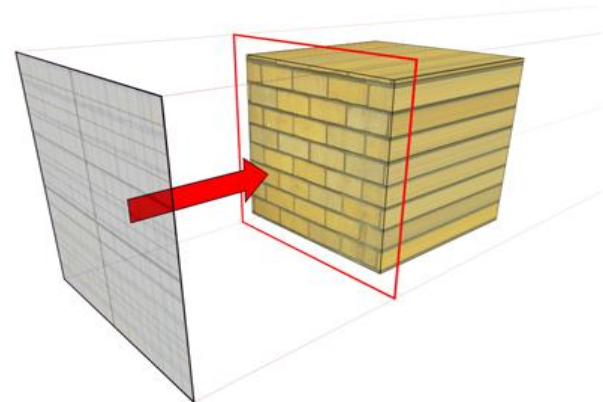
Determines the type of mapping coordinates used. Different kinds of mapping are distinguished by how the map is geometrically projected onto the object and how the projection interacts with the object's surfaces.

**NOTE:**When Real-World Map Size is on, only the Planar, Cylindrical, Spherical, and Box mapping types are available. Similarly, if one of the other options (Shrink Wrap, Face, or XYZ To **UVW**) is active, Real-World Map Size is unavailable.

#### Planar

Projects the map from a single plane flat against the object, somewhat like projecting a slide.

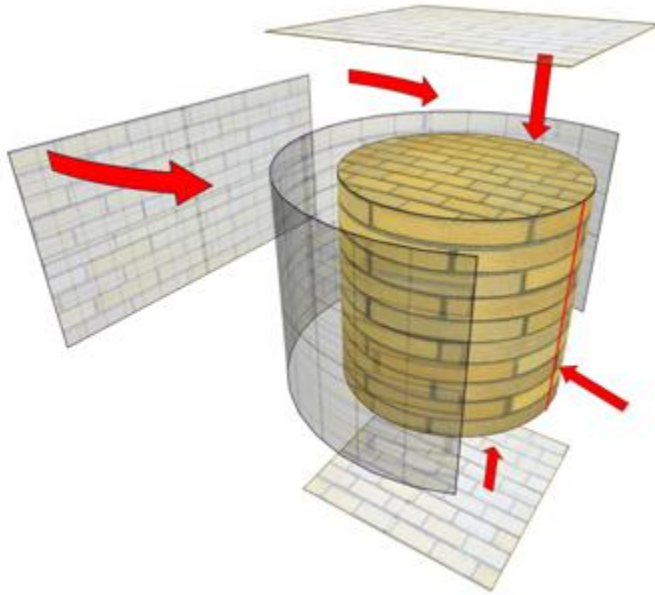
Planar projection is useful when only one side of an object needs to be mapped. It is also useful for obliquely mapping multiple sides, and for mapping two sides of a symmetrical object.



**Planar map projection**

## Cylindrical

Projects the map from a cylinder, wrapping it around an object. Seams where the edges of the bitmap meet are visible unless a seamless map is used. Cylindrical projection is useful for objects that are roughly cylindrical in shape.



### Cylindrical map projection

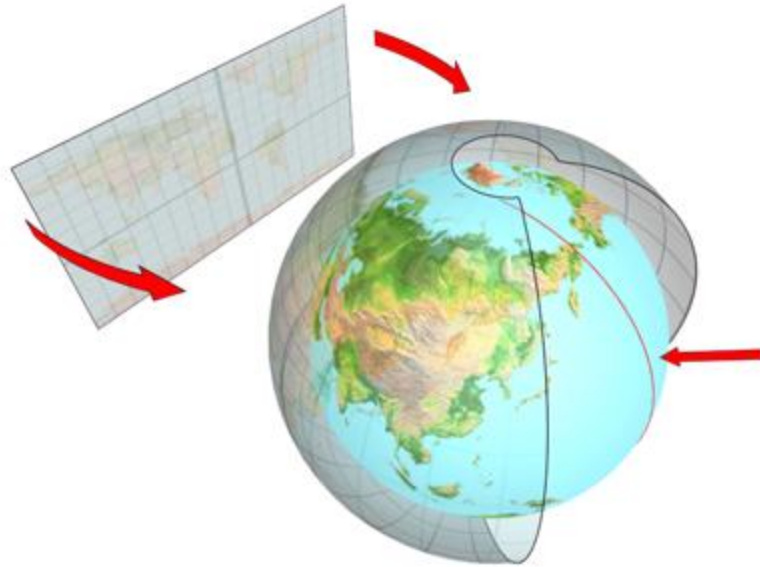
#### Cap

Applies planar mapping coordinates to the caps of the cylinder.

**NOTE:** If the ends of the object geometry are not at right angles to the sides, the Cap projection bleeds onto the sides of the object.

#### Spherical

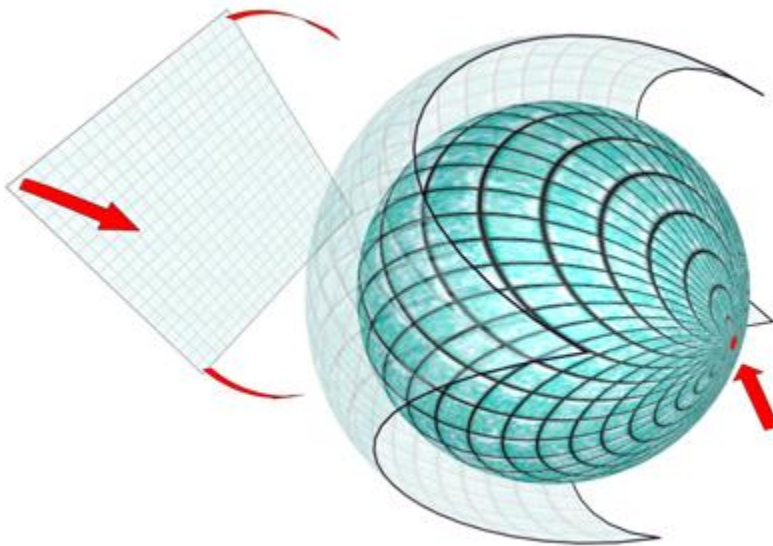
Surrounds the object by projecting the map from a sphere. You see a seam and mapping singularities at the top and bottom of the sphere where the bitmap edges meet at the sphere's poles. Spherical mapping is useful for objects that are roughly spherical in shape.



### Spherical map projection

#### Shrink Wrap

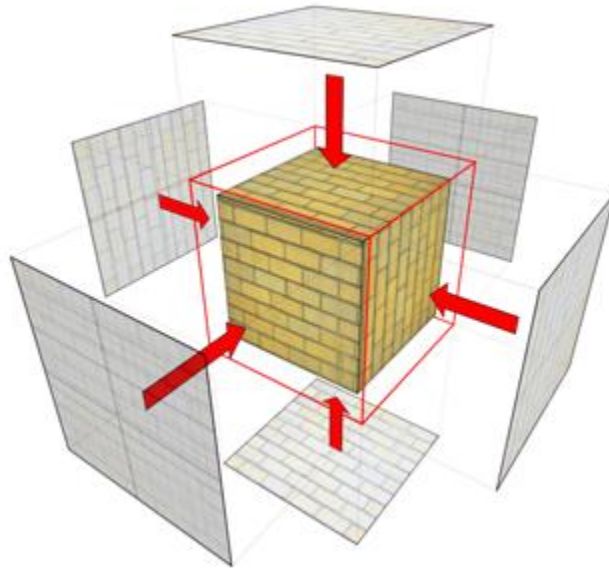
Uses spherical mapping, but truncates the corners of the map and joins them all at a single pole, creating only one singularity. Shrink-wrap mapping is useful when you want to hide the mapping singularity.



### Shrink-wrap projection

#### Box

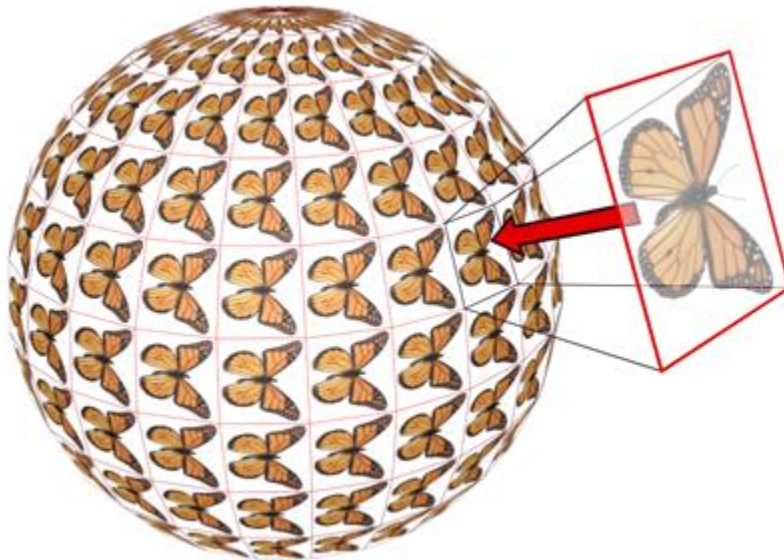
Projects the map from the six sides of a box. Each side projects as a planar map, and the effect on the surface depends on the surface normal. Each face is mapped from the closest box surface whose normal most closely parallels its own normal.



### Box projection (shown on a box and on a sphere)

#### Face

Applies a copy of the map to every face of an object. Pairs of faces sharing a hidden edge are mapped with the full rectangular map. Single faces with no hidden edge are mapped with a triangular portion of the map.

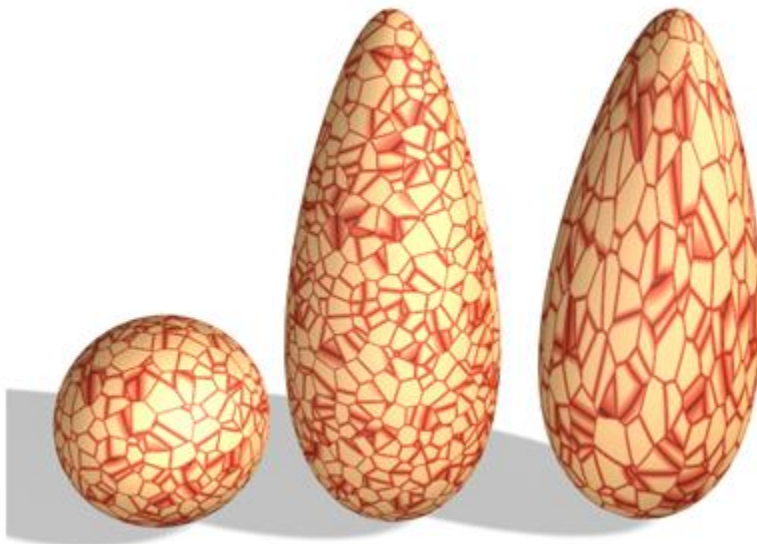


## Face projection

### XYZ to UVW

Maps 3D procedural coordinates to UVW coordinates. This "sticks" the procedural texture to the surface. If the surface stretches, so does the 3D procedural map. Use this option with procedural textures, like Cellular, on objects with animated topologies. For more information on how to use this option, see Example: To use the XYZ to UVW option:XYZ to UVW option (UVW map modifier).

**TIP:**In the Material Editor's Coordinates rollout for the map, set Source to Explicit Map Channel. Use the same map channel in the material and UVW Map modifier.



**A sphere with a 3D procedural texture is copied, and the copies are stretched.**

Right: Using XYZ to UVW on the object enables the 3D procedural texture to stick and stretch with the surface.

### Length, Width, Height

Specify the dimensions of the UVW Map gizmo. The default scale of the mapping icon is defined by the largest dimension of the object when you apply the modifier. You can animate the projection at the gizmo level. Note the following facts about these spinners:

- The dimensions are based on a bounding box of the gizmo.  
The Height dimension is unavailable for the Planar gizmo: It does not have depth. Likewise, the dimensions for Cylindrical, Spherical, and Shrink Wrap mapping all display the dimensions of their bounding box and not their radiuses. No dimensions are available for the Face map: Each face on the geometry contains the entire map.

- The three dimensions are set to 1 or 2, depending on map type and dimensions, when you load files created in Autodesk VIZ or earlier versions of 3ds Max. (This maintains compatibility with files from previous releases, in which gizmos were scaled non-uniformly to adjust their dimensions.).

The dimensions essentially become scale factors rather than measurements. You can reset the values to dimensions by clicking the Fit or Reset buttons, which will lose the original non-uniform scaling.

### **U Tile, V Tile, W Tile**

Let you specify the dimensions of the **UVW** map, for tiling the image. These are floating-point values, which you can animate to displace the map's tiling over time.

### **Flip**

Reverses the image about the given axis.

### **Real-World Map Size**

When on, uses real-world mapping for texture-mapped materials that are applied to the object. The scaling values are controlled by the Use Real-World Scale settings found on the applied material's Coordinates rollout. (Both Real-World Map Size and Use Real-World Scale should be either off or on at the same time.) Default = off for 3ds Max, on for 3ds Max Design.

When on, the Length, Width, Height and Tiling spinners are unavailable.