

Viewing 3D Space

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Everything you create in 3D Studio MAX is located in a single, three-dimensional universe, effectively infinite in size. The 3DS MAX interface provides a variety of options for viewing this enormous stage-like space—from the mesh components of the smallest object to the full extent of your current scene.

The viewing options discussed in this chapter let you move from one scale or angle or object to another, as your work and imagination require. You can fill your screen with a single, large viewport, or set multiple viewports to track various aspects of your scene. For exact positioning, flat drawing views are always available with a single keystroke, as are 3D perspective and axonometric views.

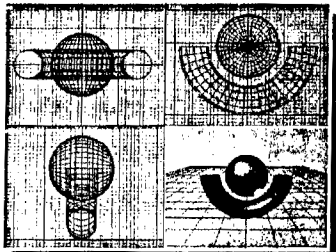
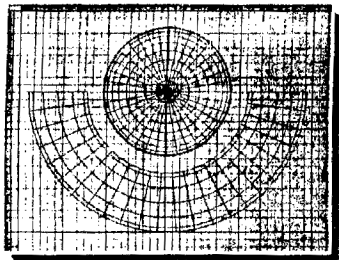
3D Studio MAX gives you full control of how objects are rendered and displayed on the screen. When speed is more important than realism, you can choose options that decrease the calculation load on the computer. You can also hide and freeze objects while you work on other parts of your scene.

General Viewport Concepts

Viewports are openings into the three-dimensional space of your scene, like windows looking into an enclosed garden or atrium. But viewports are more than passive observation points. While creating a scene, you can use them as dynamic and flexible tools to understand the 3D relationships among objects.

At times you might want to look at your scene through a large, undivided viewport, giving you a "picture window" view of the world you're creating. More often, you use multiple viewports, each set to a different orientation.

If you want to slide an object around, you might do this in a top viewport, looking directly down on the object as you move it. At the same time, you could be watching a shaded perspective viewport to see when the object you're moving slides behind another. Using the two windows together, you can get exactly the position and alignment you want.



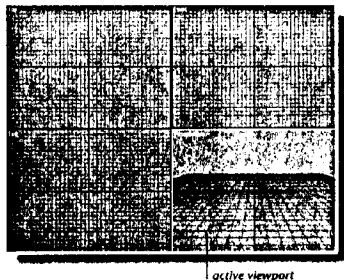
You also have pan and zoom features available in either view, as well as grid alignment. With a few mouse clicks or keystrokes, you can reach any level of detail you need for the next step in your work.

Another way to use viewports is to place a camera in your scene and set a viewport to look through its lens. When you move the camera, the viewport tracks the change. You can do the same with spotlights.

Continue through this chapter for more in-depth discussions of viewing 3D space in 3D Studio MAX.

Making Viewports Active

When you start 3D Studio MAX, the main screen contains four equal-sized viewports. The one in the lower right is a perspective view, and the others correspond to the three views used in traditional drafting: top, front, left.



Active Viewport

One viewport, marked with a white border, is always *active*—this is where commands and other actions take effect. Only one viewport can be in the active state at a time. Other viewports are set for observation only; unless disabled, they simultaneously track actions taken in the active viewport.

In general, a viewport becomes active as you work in it. You can move an object in one viewport, then drag the same object in another viewport to continue the move.

To make a viewport active, do either of the following:

- Click in any viewport. You can start a selected command with the same click.
- Right-click in any viewport. A right-click activates a viewport without changing the selection state of objects.

Active Viewport and Track Viewport

A viewport set to Track View is a special case. Clicking in a Track viewport does not move the focus from the active viewport.

Saving the Active Viewport

You can save the view in any active viewport and later restore it. For example, you might have a perspective viewport with a good angle on your work. You could save that view and move to another angle, or even switch to another viewport type. You can then restore the saved view. If you find a better view angle, you can save that view, replacing the currently saved one.

To save an active view:

1. Activate the viewport with the view you want to save.
2. Choose Views/Save Active View from the menu bar.

The view is now saved.

To restore a saved view:

1. Activate the viewport where you saved the view.
2. Choose Views/Restore Active View from the menu bar. This option is only available in a viewport with a saved view.

The viewport returns to the saved view.

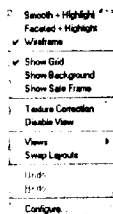
Only one active viewport can be saved at a time. Each new save overwrites the existing one. To restore a view, you need to activate the viewport where the view was saved. If you're not sure whether a viewport has a saved view, check the Views menu. Restore Active View is grayed out unless a view is saved in the active viewport.

Viewport Properties Menu


Each viewport carries a Viewport Properties menu. Menu items are shortcuts to frequently used settings, and most affect only the current viewport. This lets you customize each viewport to specific viewing requirements.

To access the Viewport Properties menu:

- Right-click the label in the upper-left corner of any viewport.



Viewport Properties menu

 This icon appears over the label if a viewport is inactive to indicate a right-click for menu access. A left-click on this icon activates the viewport.

The Track viewport has no label. To access the Views list in the Viewport Properties menu, right-click in any gray area between buttons on the Track View toolbar.

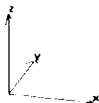
Viewport Undo and Redo

The Undo and Redo commands in this menu affect only *viewport* changes—not work that you've done. For example, if you rotate a view a number of times and want to go back to an earlier view, use Undo.

Other menu items are covered in detail under appropriate topics in later chapters.

Home Grid: Views Based on the World Coordinate Axes

The grids you see in the viewports represent one of three planes that intersect at right angles to one another at a common point called the *origin*. Intersection occurs along three lines—the *world coordinate axes*, X, Y, and Z—familiar from high-school geometry as the basis of the Cartesian coordinate system.

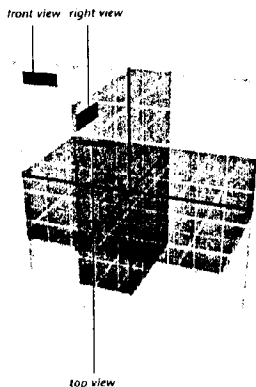


World coordinate axes

Home Grid

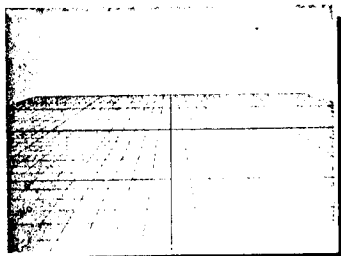
In 3D Studio MAX, the three planes based on the world coordinate axes are called the *home grid*, the basic reference system of the 3D world of 3DS MAX.

To simplify the positioning of objects, the program makes only one plane of the home grid visible in each viewport. The following figure shows all three planes as they would appear if placed in a single perspective viewport.



Axes, Planes, and Views

Two axes define each plane of the home grid. In the default perspective viewport, you are looking across the *XY* plane (*ground plane*), with the *X* axis running left-to-right, and the *Y* axis running front-to-back. The third axis, *Z*, runs vertically through this plane at the common point.



Default perspective viewport with ground plane

Home Grid and Grid Objects

The home grid is aligned with the world coordinate axes. You can turn it on and off for any viewport, but you can't change its orientation.

For flexibility, the home grid is supplemented by *grid objects*—independent grids you can place anywhere, at any angle, aligned with any object or surface. They function as “construction planes” you can use once and discard or save for reuse. See chapter 7, “Precision and Drawing Aids”.

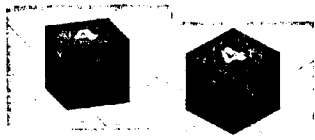
Understanding User Axonometric Views

Axonometric refers to the parallel projection of a 3D object onto a drawing surface (or computer screen). With the object inclined so that three sides are visible, the projection maintains horizontal and vertical scale, but distorts diagonals and curved lines.

Special Cases

The six orthographic views discussed in the next topic are a special case of axonometric, with the viewing angle aligned to one of the world coordinate axes.

Isometric is another special case of axonometric, with the sides of the object equally inclined to the screen, producing equal foreshortening along the edges.



Axonometric and Isometric views


You can produce an isometric view in 3DStudio MAX by rotating the home grid in the viewport. But you cannot produce an *isometric drawing* view, which maintains scale along the diagonals and therefore has no foreshortening.

User View

The label *User* appears on axonometric viewports. In this view parallel lines remain parallel, no matter how extreme the foreshortening. You get a sense of three-dimensional relationship without the single viewpoint implied by perspective views.

Changing a Viewport to User View

There are four ways to change the current viewport to a User view:

- Press the **U** keyboard shortcut.
-  Use Arc Rotate to rotate the grid of an orthographic view. The viewport label changes to *User* as you do this.
- Right-click the label of the viewport, pull out Views from the Viewport Properties menu, and choose User.
- Use the Layout panel in the Viewport Configuration dialog to change the viewport type. See “Setting Viewport Layout” on page 3-10 for details.

The Six Orthographic Views

Whether produced on computer or paper, most 3D design relies on *orthographic* views for accurate description of objects and their positioning. Maps, plans, cross-sections, and elevations are all orthographic views. In familiar terms, you might think of these views as “flat” or “straight-on,” or as “looking at right angles.” As noted in the previous topic, orthographic views are a special case of axonometric view.

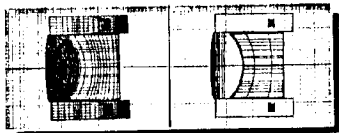
Orthographic views are two-dimensional, each defined by two world coordinate axes. Combinations of these axes produce three pairs of orthographic views: top, bottom; front, back; left, right.

To toggle between orthographic views:

1. Click in a viewport to make it active.
2. Press one of the following keyboard shortcuts to select an orthographic view:
 - Press **T** for top view.
 - Press **B** for bottom view.
 - Press **F** for front view.
 - Press **K** for back view.
 - Press **L** for left view.
 - Press **R** for right view.

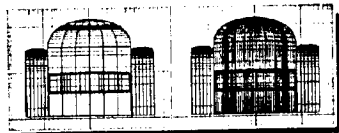
What You See in Orthographic Views

In top view, you are looking straight down the Z axis at the XY plane. In bottom view, you are looking up from the other side of the XY plane.



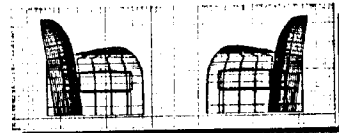
Top and bottom orthographic views

In front and back views, the X axis runs left and right. The Z axis is the vertical, and you are looking along the Y axis.



Front and back orthographic views

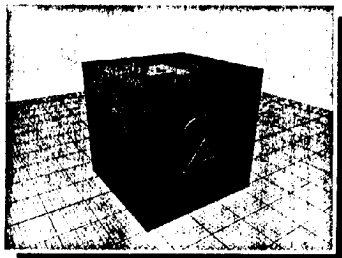
In left and right views, the Y axis runs left and right. The Z axis is the vertical, and you are looking along the X axis.



Left and right orthographic views

Understanding Perspective Views

Perspective views most closely resemble human vision. Objects appear to recede into the distance, creating a sense of depth and space. For most 3D computer graphics, this is the view used in the final output—what the client sees on-screen or on the page.



Perspective view in a Perspective viewport

Three Perspective Views

3D Studio MAX provides three ways to create a perspective view in a viewport.

Perspective View

A perspective viewport, labeled *Perspective*, is one of the startup viewports in 3DS MAX. You can change any active viewport to this “eye-like” point of view by pressing the keyboard shortcut **P**.

Camera View

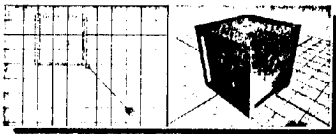
Camera view requires that you first create a camera object in your scene. See chapter 21, “Using Cameras” in volume 2 of this guide.

To change a viewport to Camera view:

1. Right-click a viewport label to access the Viewport Properties menu and then click Views.
2. Choose one of the cameras in the Views list.

This assigns the camera to the viewport and changes the label to the camera name.

A camera viewport tracks the view through the perspective of that camera. As you move the camera (or target) in another viewport, you see the scene swing accordingly. If you alter the camera's field of view on the Modify command panel, you see the changes as they are applied.



A targeted camera and its viewport

Spotlight View

Spotlight view works much like a targeted camera view. You first create the spotlight and then set the viewport to that spotlight. See chapter 20, “Lighting Your Scene” in volume 2 of this guide.

Defining Viewports

This and the next five topics cover the basics of viewport use, including the selection of viewport layout, switching between a variety of views, and disabling viewports to improve the speed of screen redraws.

All viewport parameters are controlled from a master Viewport Configuration dialog. This dialog has five separate panels:

- Rendering Method
- Layout
- Safe Frames
- Adaptive Degradation
- Regions

You choose the viewport arrangement from the Layout panel. Other panels on this menu are discussed under appropriate topics in this chapter and other chapters.

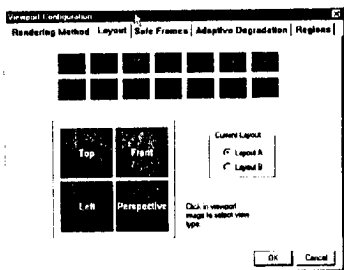
Setting Viewport Layout

3D Studio MAX defaults to a two-over-two arrangement of viewports. There are 13 other layouts possible, but the maximum number of viewports on the screen remains four.

Using the Layout panel of the Viewport Configuration dialog, you can set up two different layouts and customize the viewports in each. You can then switch between these layouts as you work. Your choices are saved with the file.

To access the Layout panel, do one of the following:

- Choose Views/Viewport Configuration from the menu bar, then click the tab marked Layout.
- Right-click a viewport label and choose Configure, then click the tab marked Layout.



Layout panel on Viewport Configuration dialog

There are 14 basic layouts for viewports across the top of the Layout panel. The current onscreen layout is highlighted. A large version of this layout appears in the square at the bottom of the panel.

In the Current Layout area of the dialog, there are two buttons labeled Layout A and Layout B. Clicking either of these buttons switches the

large layout to a pre-set arrangement. See the following instructions for resetting these two layouts.

To set a new viewport layout:

1. Check Layout A or Layout B.
2. Click one of the 14 layouts.
3. Click any viewport area of the large layout.

This brings up a list of viewport types: Grid, Perspective, User, Front, Back, Top, Bottom, Left, Right, Track, and Shape. The current type has a check mark next to it. Any cameras or spotlights in the scene also appear in the list.

4. Click a viewport type.

The name at the center of the viewport area updates accordingly.

5. Repeat for other viewports as desired.

When you are through with one layout, you can follow the same procedure for the other layout.

To switch between layouts while you work:

- In any viewport, right-click the viewport label and choose Swap Layouts on the Viewport Properties menu.

The current layout, A or B, is replaced by the other.

Changing the View Type

As you work, you can quickly change the view in any viewport—for example, switching from front view to back view. You can use either of two methods: menu or keyboard shortcut.

Both methods change the current layout, A or B, discussed in the previous topic. The new view stays with the viewport and is saved as part of the file.

Menu Method

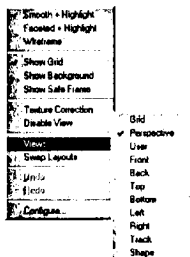
To change the active viewport:

1. Right-click the label of the viewport you want to change and choose Views.

This presents the Views list of the Viewport Properties menu. If you've created cameras or spotlights in your scene, their names appear at the top of the list, separated from the standard choices. The current view has a checkmark next to it.

2. Click a new view type in the list.

The menu goes away, and the viewport updates.



Views list on Viewport Properties menu

Keyboard Shortcut Method

To change the active viewport:

- Activate the viewport you want to change by clicking in it, then press one of the keyboard shortcuts in the following table. The view switches after each key press.

Key	View type
T	Top view.
B	Bottom view.
F	Front view.
K	Back view.
L	Left view.
R	Right view.
C	Camera view. If your scene has only one camera, or you select a camera before using this keyboard shortcut, that camera supplies the view. If your scene has more than one camera, and none are selected, a list of cameras appears.
\$	Spotlight view. Works like Camera view.
P	Perspective view. Retains viewing angle of previous view.
U	User (axonometric) view. Retains viewing angle of previous view.
G	Grid view. Automatically changes to the active grid type. If you first activate a grid object, the view switches to an orthographic top view of that object. If you don't activate a grid object, the view switches to the ground plane—identical to a Top view.
E	Track view. Displays the same view as a Track View window.
None	Shape view. Use menu method. Automatically aligns view to the extents of a selected shape and its local XY axes.

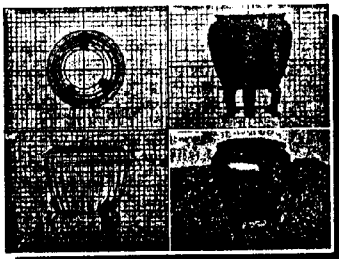
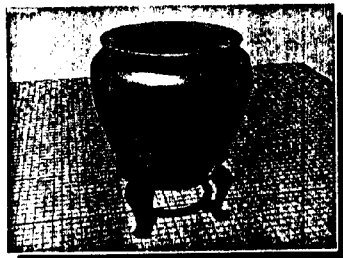
Switching to a Single Viewport

It's often convenient to work in a single, large viewport. There's a quick switch you can make at any time, then toggle back to your multi-viewport layout.

Min/Max Icon



The Min/Max icon is a toggle located at the bottom-right corner of the screen. One click fills the available screen area with the active viewport. Another click returns the original layout.



Keyboard Shortcut

Press the keyboard shortcut **W** to make the same toggle as the Min/Max icon.

Switching Views When Maximized

You can change the view type of a maximized viewport—for example, from Top to Left. Two rules apply when you do this, although you won't notice the difference until you minimize and return to a multi-viewport layout.

- If you switch to a view type that already exists in one of the other viewports, that viewport becomes active.

When you minimize, the active viewport is *not* the one you originally maximized, and no viewport has changed type.

- If you switch to a view type that does not exist in other viewports, the maximized viewport changes type.

When you minimize, the active viewport is the same one you originally maximized, but is now a different type.

Disabling Viewports

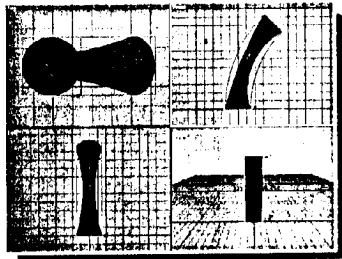
You can disable one or more viewports as you're working, preventing them from displaying changes made in other viewports. This saves redraw time, especially in a complex scene. It can also reduce the visual distraction of changes occurring simultaneously in every viewport.

To disable a viewport, do one of the following:

- Right-click the label of the viewport you want to disable and choose **Disable View**.
- Use the keyboard shortcut **D** in the viewport you want to disable.

Both methods are toggles. Repeat to return a disabled viewport to the normal state.

When a viewport is disabled, the word "Disabled" appears as part of the viewport label. When you switch to another viewport, the word "Inactive" appears in the center of the disabled viewport.



How a Disabled Viewport Behaves

Changes made in other viewports do not update in a disabled viewport. However, as soon as you click in the disabled viewport and make it active, the view updates immediately.

You can work in a disabled viewport just as you would in a normal one. But the viewport remains disabled, and does not display changes from other viewports when inactive.

Redrawing Viewports

3D Studio MAX usually clears any screen artifacts that are not part of the scene. If such clutter appears, you can redraw the viewports with either a menu command or keyboard shortcut.

To redraw all views, do one of the following:

- Choose Views/Redraw All Views.
- Press the keyboard shortcut **1**.

Controlling Viewport Rendering

3D Studio MAX supports many ways of displaying your scene. Viewport display can range from displaying objects as simple boxes to rendering your objects with smooth shading and texture mapping.

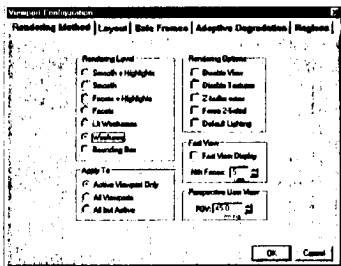
You can choose a different display method for each viewport.

Using Viewport Rendering Controls

Viewport rendering controls are found on the Rendering Methods panel of the Viewport Configuration dialog. Using this panel you choose a rendering level and any options associated with that level. You then choose whether to apply those settings to the active viewport or all viewports.

To set the viewport rendering method:

1. Choose Views/Viewport Configuration.
2. Click the Rendering Method tab.
3. Click the desired rendering level and any options available for that level.
4. Determine how to apply the rendering method.
 - *Active Viewport Only* applies the rendering method to the active viewport. This choice is always the default.
 - *All Viewports* applies the rendering method to all configured viewports. The rendering method is applied to all viewports even if a single viewport is maximized.
 - *All But Active* applies the rendering method to all viewports except the active one. This lets you work in wireframe in the active viewport and see rendered updates in the other viewports.



Rendering Method panel of Viewport Configuration dialog

Rendering Methods versus Display Speed

The various rendering methods not only affect the quality of your view display, they can also have a profound effect on display performance.

Note: Using higher quality rendering levels and realistic options slows display performance.

3DS MAX has a number of controls that you can use to adjust display performance after setting your desired rendering method. One of these is a feature called Adaptive Degradation that speeds up display performance when using realistic rendering levels.

Adaptive Degradation and other performance features are described later in this chapter. See topics beginning with "Controlling Display Performance" on page 3-18.

Controlling Display Performance

3D Studio MAX contains a number of controls to help you adjust display performance—the balance between quality and time in displaying objects.

Depending on your needs, you might give up some display speed to always work at the highest level of rendering quality, or you might choose Wireframe or Bounding Box display to maximize display speed. Which method you choose depends on your preferences and the requirements of your work.

Display Performance Controls

You use the display performance controls to determine three display functions:

How objects are rendered—A feature called Adaptive Degradation dynamically drops the rendering level while you work based on display performance. You set the parameters controlling the trade-off between display quality and display speed.

How objects are displayed—Some display performance controls are similar to the render options. (See topics under “Controlling Viewport Rendering” on page 3-15.) Where render options apply their effects to an entire viewport, these controls apply their effects to *objects*.

Which objects are displayed—One way to increase display speed is *not* to display something. You use these controls to hide and freeze objects in your scene.

Choosing Adaptive Degradation Levels

The Adaptive Degradation feature dynamically adjusts your rendering levels to maintain a desired level of display speed. You have direct control over how much “degradation” occurs and when it occurs.

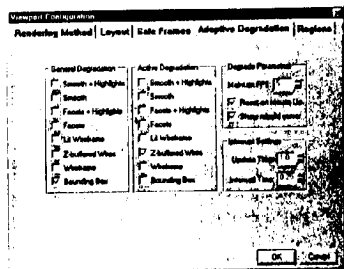
There are two forms of Adaptive Degradation:

Active Degradation—Controls how the active viewport degrades.

General Degradation—Controls how the inactive viewports degrade.

To access the Adaptive Degradation controls:

1. Choose Views/Viewport Configuration.
2. Click the Adaptive Degradation tab.



Adaptive Degradation panel in the Viewport Configuration dialog

Choosing Degradation Levels

Active and General Degradation use the same choices as the viewport Rendering Levels. (See topics under “Controlling Viewport Rendering” on page 3-15.) The main difference is that the degradation choices are check boxes so you can choose more than one rendering level.

The selected levels determine which rendering levels 3DS MAX falls back to when it cannot maintain the desired display speed. You can choose as many levels as you want but you are advised to choose only one or two levels for each type of degradation.

How Adaptive Degradation Works

The following steps illustrate the way Adaptive Degradation works:

1. Set the General Degradation to Wireframe and Bounding Box.

2. Move an object in any viewport.

If 3DS MAX cannot maintain the specified display performance, display of the object in the inactive viewports drops to Wireframe mode.

3. Continue moving the object.

If 3DS MAX still cannot keep up, display of the object drops again to Bounding Box mode.

If too many rendering levels are chosen, 3DS MAX wastes time jumping between rendering levels. The best strategy is to set your degradation levels for the lowest level you're willing to accept.

A typical setup might be:

- General Degradation set to Bounding Box.
- Active Degradation set to Wireframe.

You can force the viewport renderer to maintain smooth rendering, no matter how much the speed is reduced. To do this, set Active Degradation to Smooth+Highlights with no lower option.

Setting the Display Speed

The Degrade Parameters area of the Adaptive Degradation panel includes these controls:

Maintain FPS—Determines the display speed threshold that triggers a drop to the next level of degradation. The setting represents a playback speed of a certain number of frames per second (FPS).

Set this value for the slowest speed you find tolerable for object dragging and playback speed. Default=5.

Reset On Mouse Up—Resets the rendering level as the mouse is released. If checked, the program tries various rendering levels to achieve optimal quality while still maintaining FPS. If unchecked, the program immediately drops the rendering level to the previous minimum. Default=checked.

Show Rebuild Cursor—Displays a cursor to show when the program is busy recalculating the viewport rendering. Default=checked.

Changing Interrupt Settings

The Interrupt Settings area of the Adaptive Degradation panel includes these controls:

Update Time—Sets the interval between updates during viewport rendering. At each interval, a new section of the rendering is drawn on screen. If set to 0, nothing is drawing until the rendering is complete. Default=1.0 second.

Interrupt Time—Sets the interval between times when the program checks for a mouse-down event during viewport rendering. Small values free the mouse more quickly, so you can use the mouse elsewhere without waiting for it to "wake up." Default=0.25 second.

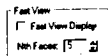
Setting Fast View

Fast View increases display performance by reducing the number of faces displayed. This reduction is achieved by displaying one face out of every group of a certain number of faces.

You have control over how many faces are dropped, but no control over exactly which faces. This results in objects that give you a hint about their shape and orientation but are often lacking important details. Use Fast View when you need to increase display speed at the expense of display detail.

Controlling Fast View Display

The Fast View controls are found in the Rendering Method panel of the Viewport Configuration dialog.



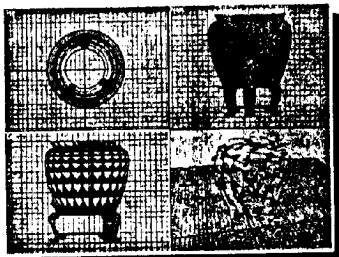
Fast View controls

There are two Fast View controls:

Fast View Display—Toggles the display of a reduced number of faces for all objects. Fast View is applied to the active viewport or all viewports based on the state of the Apply To buttons. Default=unchecked.

Nth Faces—Determines how many faces will be dropped. The valid range of N is from 1 to 100. N indicates that one face out of every N faces will be dropped from the display. Default=5.

For example, a value of 2 drops one face out of every two. A value of 3 drops every third face. A value of 100 drops only one face out of every 100 faces. The higher N is, the more faces remain.



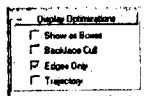
Example of Fast View display

Setting Display Optimizations

3D Studio MAX lets you select display optimizations—ways to reduce the geometric complexity of selected objects in a scene, resulting in faster response time because the computer has less to calculate.

To set display optimizations:

1. Click the icon on the Display command panel.
2. Click Display Optimizations, if necessary, to show the following rollout:



3. Select one or more objects in a scene and check the optimizations you want to apply.

If multiple objects are chosen, a grayed-out box indicates that the optimization is set differently for one or more objects in the selection set. Check or uncheck the box to make the optimization uniform for the set.

Options for Display Optimization

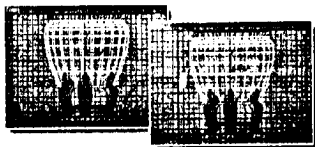
The Display Optimization rollout has four check boxes. Two are checked by default.

Show as Boxes—Toggles the display of selected objects, both 3D objects and 2D shapes, as wireframe boxes. Produces minimum geometric complexity. Default=unchecked.

Backface Cull—Toggles the display of faces with normals pointing away from view. When unchecked, you see through the wireframe to the back faces, and on rendered objects you see the interior surface, if visible. Default=checked.

Edges Only—Toggles the display of face edges when editing mesh objects. When checked, only polygonal facets appear in wireframe. When unchecked, diagonal edges between faces appear as dotted lines. For interactions with other edge settings, see chapter 18, “Editing Meshes”. Default=checked.

Trajectory—Shows any animation paths associated with selected objects. Position keys appear as white squares connected by a dotted line indicating the path. When a position key is selected in Track View, its white square turns red. Default=unchecked.



Effects of Backface Cull and Edges Only (checked)



Effects of Edges Only (unchecked) and Set To Boxes

Navigating 3D Space

Topics

- Using Standard View Navigation Buttons 4-2
 - Zooming a View 4-2
 - Using Zoom Extents and Zoom Selected 4-3
 - Panning a Standard View 4-4
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 - Rotating a View 4-6
 - Undoing Standard View Navigation Commands 4-8
- Using Camera and Spotlight View Navigation 4-9
 - Dollyng a Camera or Spotlight View 4-10
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 - Changing Spotlight Falloff Size 4-14
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 - Trucking a Camera or Spotlight View 4-16
 - Panning a Camera or Spotlight View 4-16
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 - Rolling a Camera or Spotlight View 4-18
 - Undoing Camera and Spotlight View Changes 4-19

You navigate 3D space by adjusting the position, rotation and magnification of your views. You make these adjustments using a set of buttons in the lower-right corner of the 3D Studio MAX window. These buttons are referred to as the view navigation buttons.

3D Studio MAX has three sets of view navigation buttons. Your active view determines which set of buttons you see. The standard view navigation buttons are available for all views except for Camera and Spotlight views. Camera and Spotlight views are each navigated with their own set of view navigation buttons.

This chapter first discusses the use of the standard view navigation buttons and then presents buttons for navigating camera and spotlight views.

Using Standard View Navigation Buttons

The previous chapter described the three methods of viewing 3D space as orthogonal, axonometric, and perspective. All of these view types, except for Camera and Spotlight views, use the standard set of view navigation buttons.

The standard view navigation buttons are visible when any viewport other than a Camera or Spotlight view is active. The buttons change these basic view properties:

- View magnification
- View position
- View rotation



Standard view navigation commands

Button Operation

Standard view navigation buttons have two methods of operation:

- Clicking the button executes the command and returns to your previous action.
- Clicking the button activates a view navigation mode.

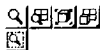
You can tell that you are in a mode because the button remains selected and is highlighted in a green background color. This mode remains active until you right-click or choose another command.

While in a navigation mode, you can activate other viewports of the same type without exiting the mode by clicking in any viewport.

Zooming a View

Use the Zoom buttons to change view magnification. Which button you choose determines whether zooming occurs in the active view or simultaneously in all non-camera views.

Zoom is modal and stays active until you right-click or choose another command.



Location of Zoom buttons

Zoom—Changes view magnification only in the viewport where you drag.

Default shortcuts:

- Zoom=Z
- Zoom In 2X=SHIFT+GREY PLUS (+)
- Zoom Out 2X=SHIFT+GREY MINUS (-)

Zoom All—Changes view magnification in all non-camera viewports.

Press CTRL, while using Zoom All, to prevent zooming Perspective views.

To zoom a view:

1. Click Zoom or Zoom All.
2. Drag in a viewport to change magnification:
 - Drag up to increase magnification.
 - Drag down to decrease magnification.

The default zoom is centered on the viewport. You can set zoom to center on the cursor.

To set Zoom to center on the cursor:

1. Choose Preferences from the File menu to display the Preference Settings dialog.
2. Turn On Zoom About Mouse Point in the Viewports panel.

Using Zoom Extents and Zoom Selected

Use the Zoom Extents flyouts to change the magnification and position of your view to display the extents of objects in your scene. Your view is centered on the objects and the magnification changed so the objects fill the viewport.

There are two Zoom Extents flyouts, each with two Zoom Extents buttons. The button you choose determines whether the extents are calculated on all visible objects or just the selected objects, and whether the effect is displayed in one viewport or all non-camera viewports.



Location of Zoom Extents buttons

Zoom Extents—Centers and magnifies the active viewport to display all objects.

Default shortcut: Zoom Extents=ALT+CTRL+Z

Zoom Extents Selected—Centers and magnifies the active viewport to display the selected objects. If no objects are selected, the effect is the same as Zoom Extents.

Zoom Extents All—Centers and magnifies the views in all non-camera viewports to display all visible objects.

Press CTRL, when clicking the button, to prevent zooming in Perspective views.

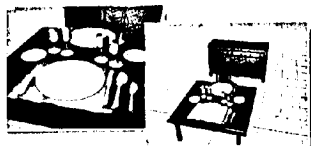
Default shortcut:
Zoom Extents All=SHIFT+CTRL+Z

Zoom Extents Selected All—Centers and magnifies the views in all non-camera viewports to display the selected objects. If no objects are selected, the effect is the same as Zoom Extents All.

Press CTRL, when clicking the button, to prevent zooming in Perspective views.

To use zoom extents:

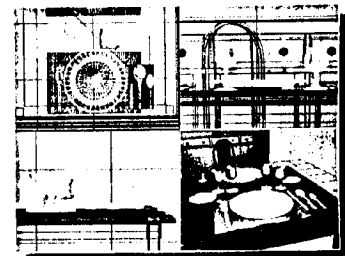
1. Activate the viewport that you want to zoom to extents.
2. Click one of the four Zoom Extents buttons.



Example of Zoom Extents



Example of Zoom Extents Selected



Example of Zoom Extents Selected All

Panning a Standard View

Use Pan to move your view parallel to the current viewport plane.

Pan is modal and it stays active until you right-click or select another command.



Location of Pan button

To pan a non-camera viewport:

1. Click Pan.
2. Point to a viewport and drag in the direction you want to move.

Default shortcut:

- Pan=CTRL+P

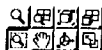


Panning a viewport

Using Zoom Region

Use Zoom Region to drag a rectangular region within the active viewport and magnify that region to fill the viewport. Zoom Region is available for all standard views except the Perspective view. In a perspective view Zoom Region is replaced by Field-of-View.

Zoom Region is modal and stays active until you right-click or select another command.



Location of Zoom Region button

To zoom a region:

1. Click Zoom Region.
2. Drag a rectangular region in any viewport displaying a non-perspective view.
3. When you release, the region is magnified to fill the viewport.

Default shortcut:

- Zoom Region=CTRL+W



Example of Zoom Region

Tip: Use the following technique to perform a Zoom Region in a Perspective view.

1. Convert the Perspective view to a User view: right-click the viewport label, then choose User from the pop-up menu.
2. Use Zoom Region in the User view.
3. Convert the view back to a Perspective view.

Changing Perspective Field of View

Use Field of View (FOV) to change the amount of the scene visible and the amount of perspective flare applied to a Perspective view. Field of View appears in the standard view navigation commands when a Perspective view is active.


Field of View is modal and stays active until you right-click or select another command.



Location of Field of View button

Field of View defines the width of your view as an angle with its apex at your eyepoint and the ends at the sides of the view. The effect of changing FOV is similar to changing the lens on a camera. As the FOV gets larger you see more of your scene and the perspective becomes distorted, similar to using a wide-angle lens. As the FOV gets smaller you see less of your scene and the perspective flattens, similar to using a telephoto lens.

To change the Field of View:

1. Activate a viewport with a Perspective view.
2.  Click Field of View.
3. Drag in the viewport to change the FOV angle:
 - Dragging down widens (increases) the FOV angle, displays more of your scene, and exaggerates perspective.
 - Dragging up narrows (decreases) the FOV angle, displays less of your scene, and flattens perspective.



Widening the FOV in a Perspective view




Narrowing the FOV in a Perspective view

Entering a Field of View Angle

A Perspective view uses an imaginary camera with only one setting, FOV. The FOV angle for the active Perspective view is displayed in the Perspective User View area of the Rendering Methods panel of the Viewport Configuration dialog. You can type a value in the FOV field of the dialog to precisely set FOV for the active Perspective view.

To type an FOV value in a Perspective view:

1. Activate a viewport with a Perspective view.
2.  Right-click Field of View to display the Viewport Configuration dialog.
3. Click the Rendering Methods tab.
4. Enter an angle in the FOV field.

Rotating a View


Use Arc Rotate to rotate your view around a center point. When you rotate an orthogonal view, such as a Top view, it is converted to a User view.


There are two buttons located in the Arc Rotate flyout. The button you choose determines whether your viewpoint rotates about the center of the view or about the center of selected objects.

Rotate View is modal and remains active until you right-click or choose another command.



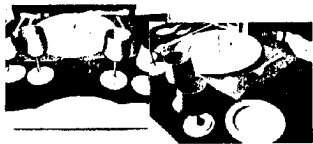
Location of Arc Rotate buttons

 **Arc Rotate**—Uses the view center as the center of rotation. If objects are near the edges of the viewport they may rotate out of view.

 **Arc Rotate Selected**—Uses the center of the current selection as the center of rotation. The selected objects remain at the same position in the viewport while the view rotates around their center.

Default shortcut, Arc Rotate=CTRL+R

The default shortcut activates whichever version of Arc Rotate is currently visible.



Rotating a view about selected objects

Tip: Use Zoom Extents Selected to magnify and center the selected objects in your active viewport. Then use Arc Rotate Selected to view those objects from any angle.

How Arc Rotate Works

Clicking either of the Arc Rotate buttons displays the arc rotation archball. This device is a circle with handles placed at the quadrant points. Dragging the mouse on and around the archball produces different types of view rotations. The cursor changes to indicate what type of rotation you are about to perform.

1.

2.

3.

4.

Rotate View archball and four rotation cursors

To freely rotate a view, do either of the following:

- Drag inside the archball to rotate the view freely about the viewplane. Your cursor movement is translated into combined horizontal and vertical rotation giving you a fine level of control.
- Press SHIFT and drag inside the archball to freely rotate the view using true archball motion. The effect is similar to normal dragging except that rotations occur much faster.

If the cursor crosses outside of the arcball during dragging, you convert to roll rotation. When the cursor crosses back into the arcball you revert to free rotation.



Free rotation of a view

To roll a view, do one of the following:

- Drag in space outside the arcball to rotate the view about the depth axis perpendicular to the screen.

If your cursor crosses inside the arcball during dragging, you will convert to free rotation (described previously). When the cursor crosses back outside the arcball you revert to roll rotation.



Spinning a view

To rotate a view vertically, do one of the following:

- Drag vertically from the top or bottom handle to rotate the view about the horizontal screen axis.
- Press CTRL and drag vertically anywhere inside the arcball to lock view rotation about the horizontal screen axis.



Rotating a view vertically

To rotate a view horizontally, do one of the following:

- Drag horizontally from the left or right handle to rotate the view about the vertical screen axis.
- Press CTRL and drag horizontally anywhere inside the arcball to lock view rotation about the vertical screen axis.



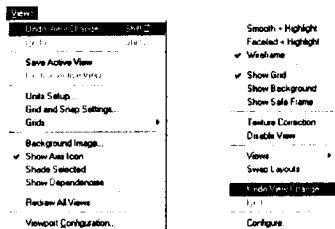
Rotating a view horizontally

To rotate a view with keyboard shortcuts:

1. Press CTRL+R to activate Arc Rotate mode.
2. Press the following keys to rotate the view.
 - LEFT ARROW and RIGHT ARROW rotate the view horizontally.
 - UP ARROW and DOWN ARROW rotate the view vertically.
 - SHIFT+LEFT ARROW and SHIFT+RIGHT ARROW roll the view.

Undoing Standard View Navigation Commands

You use Undo View and Redo View commands to undo and redo standard view navigation commands without affecting other viewports or the geometry in your scene. These commands are found in the Views menu, and in the Viewport Properties menu displayed when you right-click a viewport label.



Location of viewport Undo/Redo commands

The Undo View and Redo View commands are separate from the Undo and Redo commands in the Edit menu or the toolbar. 3DS MAX maintains separate Undo/Redo buffers for scene editing and for each viewport.

Using the Undo View and Redo View Commands

View navigation commands for non-camera views are stored in the viewport undo buffers. The Views menu item indicates what type of view command is in the active viewport buffer.

Imagine that you have performed a Pan in the upper-left viewport and an Arc Rotate in the upper-right viewport

To undo and redo the view commands:

1. Activate the upper-left viewport.
2. Choose Views/Undo View Pan.

The view reverts to what it displayed before the Pan.

3. Activate the upper-right viewport.

4. Choose Undo View Rotate from the Views menu.

The view reverts to what it displayed before the Arc Rotate.

5. Activate the upper-left viewport again.
6. Choose Redo View Pan from the Views menu.

The Pan of the view is restored.

The default shortcuts for View Undo and View Redo are:

- View Undo=SHIFT+Z
- View Redo=SHIFT+A

The View Undo/Redo buffer stores your last 20 view navigation commands for each viewport. You can step back through the Undo/Redo buffer until you have undone all of the stored view-navigation commands. If no commands are left in the Undo/Redo buffer, the menu items are grey and unselectable.

Using Camera and Spotlight View Navigation

The Camera and Spotlight view navigation buttons are the same with a few exceptions. The buttons are visible whenever a viewport with a Camera or Spotlight view is active. The buttons change these basic properties:

- Camera field of view (FOV) or spotlight hotspot and falloff angle
- Camera and spotlight position
- Target position
- Roll angle

All Camera and Spotlight view navigation buttons are modal and stay active until you right-click or choose another command.



Camera and Spotlight view navigation buttons

Special Nature of Navigating Camera and Spotlight Views

The Camera and Spotlight view navigation buttons do more than adjust your view. They transform and change the parameters of the associated camera or spotlight object.

Spotlight views behave similarly to camera views. The spotlight is treated as if it is a camera, with the camera body located at the spotlight source and the camera target at the spotlight target. The spotlight falloff is treated the same as the camera field of view.

Keep in mind the following information:

- Using the Camera and Spotlight viewport navigation buttons is the same as moving or rotating the camera or spotlight, or changing their base parameters.
- Changes made with Camera or Spotlight view navigation buttons can be animated the same as other object transforms and parameter changes.

See chapter 3, "Viewing 3D Space".


Dollying a Camera or Spotlight View

Use Dolly to move the camera or spotlight along its line of sight.



Location of Dolly button

To dolly a camera or spotlight:

1. Activate a Camera or Spotlight viewport.
2.  Click Dolly Camera/Spotlight.
3. Drag to move the camera or spotlight.
 - Drag up to move the camera or spotlight forward along its line of sight.
 - Drag down to move the camera or spotlight backward along its line of sight.

A target camera or target spotlight dollies in relation to its target object. Dragging up moves the camera or spotlight closer to its target; dragging down moves the camera away from its target.

A special situation occurs as you drag a target camera or target spotlight through its target object. When the camera or spotlight passes through the target it flips over to continue looking at the target. At this moment the meaning of your cursor movements are reversed until you release the drag operation.

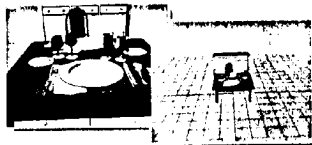
Dollying a Target Camera or Spotlight through its target has the following effect:

- Dragging up now moves the camera or spotlight away from its target and dragging down moves the camera closer to its target.
- Releasing the drag resets the cursor and when you drag again the camera or spotlight will move as expected.

Because free cameras and spotlights have no target object, they move forward and back along an infinite line of sight passing through your scene.



Example of dollying a camera forward



Example of dollying a camera backward

Effect of Dollying a Spotlight on Illumination

When you dolly a spotlight the light source moves closer and away from its target. Because falloff and hotspot angles remain constant during a dolly, the area illuminated by the spotlight will change.

- Dollyng a spotlight closer to its target causes the area illuminated at the target to shrink.
- Dollyng a spotlight away from its target causes the area illuminated at the target to expand.

Light intensity at the surface of illuminated objects might also change when you dolly a spotlight.

- If spotlight attenuation is turned off, the light intensity in the illuminated area increases as the spotlight moves away from its target.

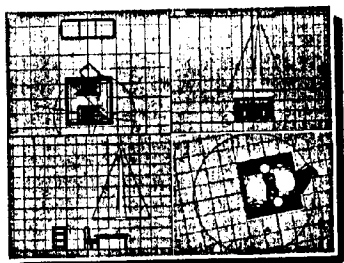
This is because more of the light illuminating the surface is coming from the center of the spotlight cone. The light strikes the surface at a steeper angle.

- If spotlight attenuation is turned off, the light intensity in the illuminated area decreases as the spotlight moves closer to its target.

This is because more of the light illuminating the surface is coming from the edges of the of the spotlight cone. The light strikes the surface at a shallow glancing angle.

- If spotlight attenuation is turned on, light intensity in the illuminated area is also affected by the attenuation range.

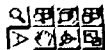
See chapter 20, "Lighting Your Scene," in volume 2 of this guide.



Example of dollyng a spotlight forward

Changing Camera Field of View (FOV)

Use Field of View (FOV) to adjust the amount of the scene visible and the amount of perspective flare in a Camera view.




Location of Field-of-View button

The Field of View defines the width of your view as an angle with its apex at your eyepoint and the ends at the sides of the view. The effect of changing FOV is exactly like changing the lens on a camera. As the FOV gets larger you see more of your scene and the perspective becomes distorted, similar to using a wide-angle lens. As the FOV gets smaller you see less of your scene and the perspective flattens, similar to using a telephoto lens.

Using the FOV command changes both the FOV and Lens Length values in the camera's creation parameters. FOV and Lens Length are inversely related. For example, choosing a 12 degree FOV is the same as choosing a 200mm telephoto lens, and choosing an 84 degree FOV is the same as choosing a 24mm wide-angle lens.

To adjust the Field of View:

1. Activate a Camera viewport.
2.  Click Field of View.
3. Drag in the viewport to adjust the FOV angle.
 - Dragging down widens (increases) the FOV angle, reduces lens length, displays more of your scene, and exaggerates perspective.
 - Dragging up narrows (decreases) the FOV angle, increases lens length, displays less of your scene, and flattens perspective.



Widening the FOV in a Perspective view



Narrowing the FOV in a Perspective view


Changing Camera Perspective

Use Perspective to change the Field of View (FOV) and dolly the camera simultaneously. The effect is to change the amount of perspective flare while maintaining the composition of the view.



Location of Perspective button

To change perspective:

1. Activate a Camera viewpoint.
2.  Click Perspective.
3. Drag to change FOV and dolly simultaneously.
 - Drag up to move the camera closer to its target, widen the FOV, and increase perspective flare.
 - Drag down to move the camera away from its target, narrow the FOV, and decrease perspective flare.



Example of adjusting perspective, dragging up



Example of adjusting perspective, dragging down

As with Dolly, a target camera can pass through its target object while changing perspective.

Dragging a target camera through its target while changing perspective has the following effect:

- FOV reaches its maximum angle of 180 degrees at the target location.
- Cursor motion is reversed until you release the drag.
- Releasing the drag resets the cursor. When you drag again the camera moves as expected.

A free camera uses an implied target position to control the FOV change rate during a perspective change. Using perspective, you can drag a free camera up to, but not past, its implied target position.

Dragging a free camera to its implied target position during a perspective change has the following effect:

- FOV reaches its maximum angle of 180 degrees at the target location.
- The camera stops moving forward and can only move back towards its previous location.

This implied target is defined as a point specified by the Target Distance field in the free camera base parameters.

For information on adjusting a Free Camera's View Center, see chapter 21, "Using Cameras" in volume 2 of this guide.

Changing Spotlight Falloff Size

Use Spotlight Falloff to change the falloff angle of a spotlight in a Spotlight view. The visual effect in the view is similar to changing FOV for a Camera view.




Location of Spotlight Falloff button

The spotlight falloff is the outer of the two circles or rectangles visible in a Spotlight view. The falloff fills the viewport from side to side and might be truncated at the top and bottom depending on the viewport proportions. Only objects inside the area of the falloff are illuminated by the spotlight.

Using Spotlight Falloff changes the spotlight's Falloff creation parameter and can change the Hotspot parameter.

To change spotlight falloff:

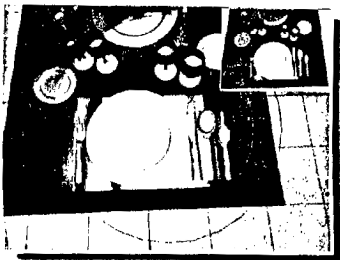
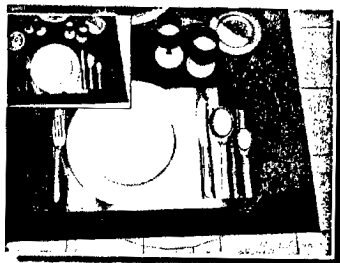
1. Activate a Spotlight viewport.
2.  Click Spotlight Falloff.
3. Drag in the Spotlight view to change the falloff angle:
 - Dragging down widens (increases) the falloff angle and illuminates more of the scene.

The inner hotspot appears to shrink as the difference between the hotspot angle and the falloff angle increases.

- Dragging up narrows (decreases) the falloff angle and illuminates less of the scene.

The inner hotspot appears to grow as the difference between the hotspot angle and the falloff angle decreases. If you decrease the falloff angle far enough, the hotspot angle also decreases to stay 2.0 degrees less than the falloff angle.

Press CTRL while dragging to change the falloff and hotspot angles at the same time. The difference between the two angles is maintained.



Changing Spotlight falloff

Changing Spotlight Hotspot Size

Use Spotlight Hotspot to change the hotspot angle of a spotlight in a Spotlight view. The hotspot shrinks and grows inside the falloff.




Location of Spotlight Hotspot button

The hotspot is the inner of the two circles or rectangles visible in a Spotlight view. Objects inside the hotspot are illuminated with the full intensity of the spotlight. Objects between the hotspot and the falloff are rendered with decreasing intensity as they approach the boundary of the falloff.

Using Spotlight Hotspot changes the spotlight's Hotspot creation parameter and can change the Falloff parameter.

To change a spotlight's hotspot:

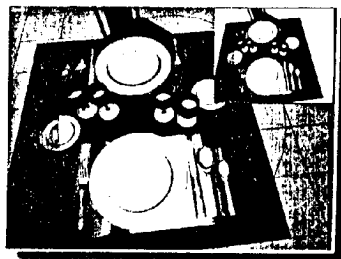
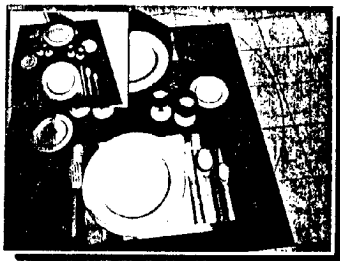
1. Activate a Spotlight viewport.
2.  Click Spotlight Hotspot.
3. Drag in the Spotlight view to change the hotspot angle:
 - Dragging down widens (increases) the hotspot angle and illuminates more of the scene.

The hotspot grows inside the falloff as its angle increases. If you increase the hotspot angle far enough, the falloff angle also increases to stay 2.0 degrees greater than the hotspot angle.

- Dragging up narrows (decreases) the hotspot angle and illuminates less of the scene.

The hotspot shrinks inside the falloff as its angle decreases.

Note: Press CTRL while dragging to change the hotspot and falloff angles at the same time. The difference between the two angles is maintained.



Changing Spotlight hotspot


Trucking a Camera or Spotlight View

Use Truck to move the camera or spotlight and its target parallel to the view plane.



Location of Truck button

To truck a camera or spotlight:

1. Activate a Camera or Spotlight viewport.
2.  Click Truck Camera/Spotlight.
3. Drag to move the camera or spotlight and its target.

The camera or spotlight and its target move parallel to the view plane, which is perpendicular to the camera's line of sight.


Panning a Camera or Spotlight View

Use Pan to rotate a camera or spotlight around the camera or spotlight position. This button is a flyout that shares the same location with Orbit.



Location of Pan button

To pan a camera or spotlight:

1. Activate a Camera or Spotlight viewport.
2.  Click Pan Camera/Spotlight.
3. Drag to rotate the view about the camera or spotlight.
 - Dragging rotates the view freely using the world X and Y axes.
 - Press CTRL and drag horizontally to lock view rotation about the world Y axis. This produces a horizontal pan.
 - Press CTRL and drag vertically to lock rotation about the world X axis. This produces a vertical pan.



Example of panning a camera


Orbiting a Camera or Spotlight View

Use Orbit to rotate a camera or spotlight around the target position. The effect is similar to Arc Rotate for non-camera viewports. This button is a flyout that shares the same location with Pan.



Location of Orbit button

To orbit a camera or spotlight:

1. Activate a Camera or Spotlight viewport.
2.  Click Orbit Camera/Spotlight.
3. Drag to rotate the view around the target.
 - Dragging rotates the view freely using the world *X* and *Y* axes.
 - Press **CTRL** and drag horizontally to lock view rotation about the world *Y* axis. This produces a horizontal orbit.
 - Press **CTRL** and drag vertically to lock rotation about the world *X* axis. This produces a vertical orbit.



Example of orbiting a camera

Orbiting a Free Camera or Free Spotlight

The Orbit command rotates a camera or spotlight around its target. A free camera or free spotlight uses an implied target position for this purpose. This implied target is defined as a point specified by the Target Distance field in the free camera base parameters.

See chapter 20, “Lighting Your Scene” and chapter 21, “Using Cameras” in volume 2 of this guide.


Rolling a Camera or Spotlight View

Use Roll to rotate a camera or spotlight about the line of sight. The line of sight is defined as the line drawn from the camera or spotlight to its target. In 3D Studio MAX the line of sight is also the same as the camera's or spotlight's local Z axis.



Location of Roll button

To roll a camera or spotlight:

1. Activate a Camera or Spotlight viewport.
2.  Click Roll Camera/Spotlight.
3. Drag horizontally to roll the view.



Example of rolling a camera

Rolling a Spotlight

Roll is particularly useful for orienting a projector spotlight or a spotlight with a rectangular light cone. For details on rectangular and projector spotlights, see chapter 20, "Lighting Your Scene" in volume 2 of this guide.

Undoing Camera and Spotlight View Changes

All of the camera and spotlight view navigation commands transform and adjust the parameters of camera and spotlight objects. Because these commands change objects in your scene (camera and spotlight objects), they are stored in the Edit/Undo and Edit/Redo buffer and not in the Views/Undo and Views/Redo buffers.

The Edit menu item displays the camera or spotlight operation to be undone. For example, after Panning a camera the Edit pulldown menu displays, “Undo Camera Pan.”

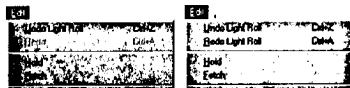
To undo or redo a camera view command:

- Choose Undo or Redo from the Edit menu or toolbar.

The default shortcuts for Undo and Redo are:

- Undo=CTRL+Z
- Redo=CTRL+A

See chapter 1, “Overview of 3D Studio MAX” for details about the Undo and Redo commands.



Undoing a spotlight or camera command