

## Precision and Drawing Aids

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3D Studio MAX gives you control over the positioning and alignment of objects in 3D space. This chapter describes the tools that make precision possible. With these tools, you can do the following:

- Choose units from the most common real-world measuring systems or define your own.
- Use the home grid as a construction plane, or use grid objects to position custom construction planes.
- Select different options to align objects with grids, points, and normals.
- Set snap priorities to include vertices, edges, and grid components. Snap to a specific angle of rotation, or to points anywhere in 3D space.
- Use “helper objects” in your work. Grids are in this category, along with Point, Tape, and Dummy.

# Tools for Precision

A set of interrelated tools in 3D Studio MAX gives you precise control of the scale, placement, and movement of objects in your scene. These are especially important tools for those who build precise models in real-world units of measurement.

## Basic Tools

The tools for precision are grouped as follows:

**Units**—Define different measurement systems.

Besides the generic unit, you have your choice of feet and inches in both decimals and fractions. Metric units range from millimeters to kilometers. You can also define other units.

**Grids**—Include the home grid and special *grid objects*. Both types of grid can act as construction planes. 3DS MAX constructs objects using the orientation and position of the active grid. While the home grid is fixed in world space, you can rotate grid objects and place them anywhere in a scene, and align them to other objects and surfaces. You can also give each grid object its own spacing, and display any grid as a dedicated viewport.

**Object alignment**—Matches an object with the position, orientation, or normal of another object, or to a point in space.

**Snaps**—Ensure precise placement by forcing the cursor to align with specified kinds of geometry. You can set snaps to find the edges and vertices of objects as well as grid lines and intersections. You can limit snaps to a 2D plane or use 2.5D or 3D selection. An angle snap sets the increment for rotation, and a percent snap sets the increment for scaling.

**Helpers**—Provide useful assistance, as the name implies. These are specialized tools in the same category as grid objects. A Tape object measures distances in current units. A Point object marks a particular spot in 3D space.

## How the Tools Work Together

The tools themselves establish a general order of use and interaction, although you can always change settings as needed without following this sequence.

1. Choose a measuring unit. The default is generic units, sufficient for many purposes.
2. Set grid spacing (the size of the smallest square), based on the measuring unit. The home grid and each grid object can have its own spacing.
3. Move and align grid objects to a useful orientation.
4. Set or vary snap settings as needed in your work.
5. Use other helper objects like Point and Tape as part of the precision process.

As you work, you can change your settings—including the measuring unit—without losing any precision.

## Using Units

Units are the key to connecting the three-dimensional world of 3D Studio MAX with the physical world.

If you want your static and animated models to reflect physical dimensions, clearances, constraints, or other precision requirements, you can set appropriate units, then change those units to another system as your needs change.

When you set units for your scene, all dimensions in 3D Studio MAX then read out in those units. When you type in exact parameters, the program reads them in the same units.

### Mixing Units

3DS MAX keeps track of all measurements in its own internal *system unit*. No matter what kind of units you use, the program maintains measurements in this absolute unit for storage and computation. If you change units, the program *displays* measurements in the new units for your convenience. You are now using a new “measuring stick.” No object is changed in this process.

This means you can mix units whenever you need to—seamlessly, with no loss of precision. Here are some examples:

- Suppose you always work in feet and inches, and a client gives you a specification for some component in centimeters. You can change your units to centimeters to input this information, then change back to your usual system.
- Suppose you download a 3DS MAX model created with custom units. You can merge this model into your scene without knowing anything about the original units. 3DS MAX converts the model to the units currently active in your scene.

As in the physical world, objects in 3DS MAX maintain their absolute size, regardless of how you measure them.



### Note on the System Unit

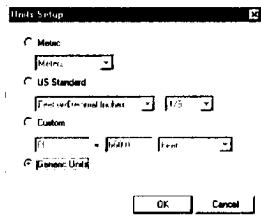
3DS MAX allows you to change its system unit to meet certain rare requirements. Objects created with an alternate system unit no longer mix with other objects as described. See “Understanding the System Unit” on page 7-5.

## Defining Current Units

You define the units you want to use from a single dialog, Units Setup. You can also use this dialog to check what units are currently in use by 3D Studio MAX.

**To access the Units Setup dialog:**

- Choose Views/Units Setup from the menu bar.



Units Setup dialog

### Four Options

The Units Setup dialog has four basic options, presented as buttons: Metric, US Standard, Custom, and Generic Units. Click one of these buttons to activate an option, then proceed with the following instructions for that option.

Only one option can be active at a time. The default option is Generic Units.

#### Metric

Click the dropdown list and choose one of these metric units:

- Millimeters
- Centimeters
- Meters
- Kilometers

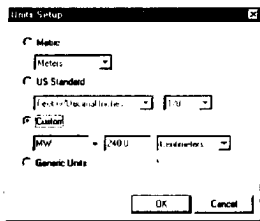
#### US Standard

Click the dropdown list and choose one of the following units. If you choose a fractional unit, the adjoining dropdown list activates to let you select the fractional component. The decimal units require no additional specification.

- Fractional Inches
- Decimal Inches
- Fractional Feet
- Decimal Feet
- Feet w/ Fractional Inches
- Feet w/ Decimal Inches

#### Custom

Fill in the fields to define a custom unit of measurement.



The options represent the following equation:

*Custom unit=some number of known units*

# Understanding the System Unit

You can define an actual unit (like cubit or fathom) or make up your own.

## To define a custom unit:

1. In the text field left of the equal sign, enter an optional abbreviation for the custom unit.

Use a one- or two-letter abbreviation to leave room for input values in numeric fields.

2. Click the pulldown list to choose a known base unit for the program to use in defining the new unit.

For a cubit, you would probably choose inches, since a cubit equals 18 inches.

3. In the text field right of the equal sign, enter the number that completes the equation.

For a cubit (if abbreviated CB), the finished equation would read: CB=18 inches

3D Studio MAX keeps track of all measurements in its own internal unit, called the *system unit*.

The default system unit is defined as 1.000 inch.

- Except in rare circumstances, you never need to change this default scale.

As long as the system unit is left at one inch, you can freely share models and change units on the fly with no effect on the underlying geometry.

Technically, the rare cases occur in rounding errors due to single floating-point precision. For instance, if you tried to model a space the size of the solar system, the program might not be able to track these measurements in inches. You might then change the system unit to feet or meters to insure the accuracy of the model.

**Warning:** Do not reset the system unit unless you have a clear need to do so.

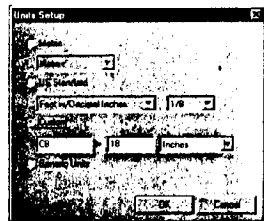
## To reset the system unit:

1. Choose File/Preferences to bring up the Preference Settings dialog.
2. On the General panel, adjust the System Unit Scale setting and click OK.

The system unit is immediately reset. This setting is saved as part of the program and remains in effect until you change it.

When the default generic units are in use, there is no observable change in objects or the interface when you reset the system unit.

If real-world units are in effect, you might notice parameters update accordingly. For example, if you changed the system unit to 2 inches, measurements based on the default system unit would double.



## Generic Units

Click to use the default unit, which is equal to the system unit used by 3DS MAX, or one inch.

# Using Grids

Grids are two-dimensional arrays of lines similar to graph paper, except that you can adjust the spacing and other features of the grid to the needs of your work.

In 3D Studio MAX, grids have these primary uses:

- As an aid in visualizing space, scale, and distance.
- As *construction planes* where you create and align objects in your scene.
- As a reference system for using snap.

## Home Grid and Grid Objects

3DS MAX provides two kinds of grids: the home grid and grid objects.

**Home grid**—The basic reference system, defined by three fixed planes on the world coordinate axes.

The home grid is present by default when you start 3DS MAX, but can be turned off. You can use any view of the home grid as a construction plane.

See chapter 3, “Viewing 3D Space” for a complete introduction to the home grid.

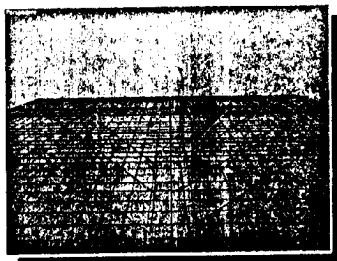
**Grid objects**—A type of helper object you can create whenever you need a local reference grid or construction plane somewhere other than the home grid.

You can have any number of grid objects in your scene, but only one can be active at a time. When active, a grid object replaces the home grid in all viewports.

You can freely move and rotate grid objects, placing them at any angle in space, or attach them to objects and surfaces. You can also

change viewports to display a plan or top view of any active grid object.

Grid objects can be named and saved like other objects, or used once and deleted.



The following topics discuss specific uses of the home grid and grid objects.

# Using the Home Grid

The home grid provides ready-to-use construction planes, much like a leveled building site marked with stakes and strings. When you create an object in a viewport, the new object is placed on the home grid plane of that viewport.

To use the home grid effectively for construction, you often need to change the defaults to the job at hand—analogueous to moving the stakes and strings to match your own site plan.

## Constructing on the Home Grid

Like a real-world building site, the home grid is fixed in space. It consists of three planes intersecting at right angles through the origin.

The three planes of the home grid create six orthographic views (Top, Bottom, Left, Right, Front, Back). These are the three planes seen at right angles from either side. You can also view these planes in 3D, as Perspective and User Views.

See home grid topics in chapter 3, “Viewing 3D Space”.

## Choosing a Construction View

When you're ready to begin construction, choose a view of the plane where you want objects to appear. Objects you create are automatically aligned with this plane. The planes' grid, set to units of your choice, serves as a visual reference for judging how large to make an object. You can use the snap feature to accurately position and scale objects on the grid as you create them.

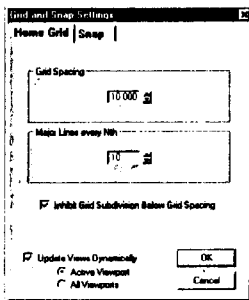
## Changing Home Grid Settings

The home grid is a single system—its three planes use the same settings for grid spacing and major line divisions. You change these settings from a single panel, Home Grid, which also contains two view settings.

To access the Home Grid panel:

1. Choose Views/Grid And Snap Settings from the menu bar.
2. Click the Home Grid tab on the Grid And Snap Settings dialog.

The following panel appears:



Home Grid panel

See the following topics for details on setting the options available on this panel.

## Setting Home Grid Spacing

Choosing useful home grid settings can simplify the construction process. As you create an object, the home grid gives you a visual reference, and all your measurements fall on a whole unit or unit subdivision. The same is true when you move an object—it “clicks into place” at predictable intervals.

### Setting Grid Spacing

Grid spacing is the size of the grid's smallest square. The basic idea is to choose a grid spacing that corresponds to your unit of measurement, then choose a larger spacing for multiple units.

**To set grid spacing for unit measure:**

1. Choose Views/Grid And Snap Settings from the menu bar.
2. Click the Home Grid tab on the Grid And Snap Settings dialog.
3. Under Grid Spacing, adjust the value, which is in current units.

For example, if you have units set to centimeters, you might make one grid space equal to 1.000 (one unit, or one centimeter in this case).

### Setting Major Grid Divisions

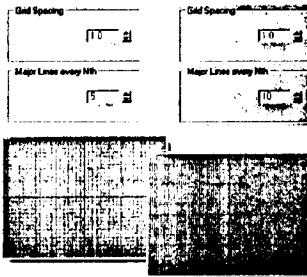
The home grid displays heavier or “major” lines to mark groups of grid squares. You can use these to represent larger units of measurement.

**To set major grid divisions for multiple units:**

- Under Major Lines every Nth, adjust the value, which is the number of grid squares between major lines. The minimum is 2.

For example, if you use a grid spacing of one centimeter, you might use a value of 10 so the major grid divisions represent one decimeter.

In perspective viewports, the displayed size of the home grid adjusts for different major grid divisions. The home grid itself is unchanged.



Major grid divisions

### Updating Views Dynamically

By default, the active viewport updates as you change values for Grid Spacing and Major Lines Every Nth. The other viewports update when you close the dialog. You can choose to have all viewports update at the same time, or turn off dynamic updates entirely.

**To set view update options:**

1. Check Update Views Dynamically (the default).  
If you uncheck this box, changes on this panel don't take effect until you click OK.
2. Choose either Active Viewport (the default) or All Viewports.



# Setting Zoom and Hide Options

The home grid has two view options that can act as construction aids. One lets you zoom into the home grid for finer granularity, and the other hides the home grid in the active viewport.

## Allowing Unlimited Zoom

When you zoom in on the home grid, 3D Studio MAX treats the grid as a fixed set of lines. In effect, the grid “stops” at the grid space setting. If you keep zooming, the fixed grid is lost from view. This is the default. You can turn this off to allow indefinite subdivision of the grid spacing. This setting affects only the zoom window.

**To allow subdivision below grid spacing:**

1. Choose Views/Grid And Snap Settings from the menu bar.
2. Click the Home Grid tab on the Grid And Snap Settings dialog.
3. Uncheck Inhibit Grid Subdivision Below Grid Spacing.

When you uncheck this box, you can zoom indefinitely “deep” into any plane of the home grid. Each grid square subdivides into the same number of smaller grid spaces.

For a grid spacing of one centimeter and a major division of 10, the next level down would subdivide into millimeter spaces, and so on.

## Zooming Out

The setting for Inhibit Grid Subdivision Below Grid Spacing has no effect when zooming out in a viewport. In this case, the home grid continues to expand indefinitely and to maintain the major grid divisions.

For a grid spacing of one centimeter, and a major grid division of 10, the next level out

would produce grid squares of a decimeter and place major division lines a meter apart.

## Hiding the Home Grid

The home grid is visible by default. In some cases you might want to turn off the home grid in one or more viewports. This choice is under the Views menu.

**To hide the home grid, do one of the following:**

- Choose Views/Grids from the menu bar and uncheck Show Home Grid.
- As a shortcut, right-click a viewport label and uncheck Show Grid on the Viewport Properties menu.

When either option is unchecked, the home grid disappears in the active viewport.

Both options act as a toggle to hide or show the home grid in the active viewport. By activating other viewports and repeating this process, you can show or hide the home grid in any of them.

When hidden, the home grid continues to act as a construction plane—newly created objects are placed on the home grid in the active viewport. However, the cursor does not snap to a hidden grid.

## Using Grid Objects

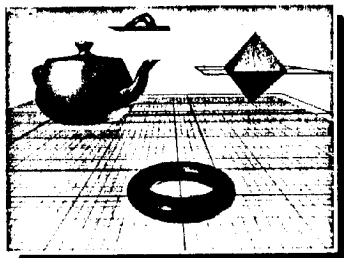
The home grid is the fixed system of planes that 3D Studio MAX uses by default as construction planes. You can create objects on the home grid and then move them into place. But a more flexible solution is to construct specialized *grid objects* exactly where you need them.

Grid objects let you bypass the home grid and work on separately defined grids to create and position objects. You can use as many grid objects as you like, each serving as a custom construction plane with its own grid settings.

You can change the size of grid objects to suit your needs, adjust their orientation in world space, and match them to a particular surface or object. You can also set the color and rendered appearance of grid objects.

Grid objects require *activating* before use, as explained later. Only one grid object can be active at a time. This includes the home grid, which is switched off when a grid object is activated.

The following topics cover the creation, adjustment, and practical use of grid objects.



Examples of objects created on different grid objects



# Creating Grid Objects

Grid objects are in the category of helper objects on the Create command panel. They are 2D parametric objects, with adjustments for overall size and grid spacing. You can move and orient them freely anywhere in world space.

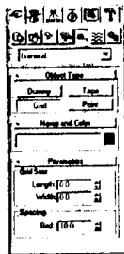
You can create any number of grid objects in your scene. They are named when you create them and are saved with the scene. They can be deleted at any time.

Like other objects created in 3D Studio MAX, grid objects are placed on the grid of the current viewport. By default, this is a plane of the home grid, but can also be another *activated* grid object.

To create a grid object:

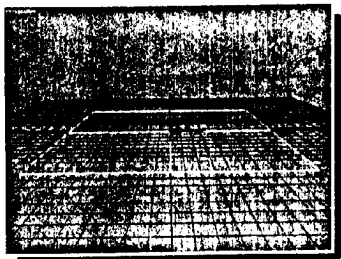
1.  Click the tab on the Create command panel.
2.  Click the Helpers button.
3. Click Grid on Object Type rollout.

A Parameters rollout appears on the Create command panel.



4. In a viewport, drag out a rectangle and release the mouse button.

This creates and selects a grid object, which appears in white wireframe, divided into four quadrants with coordinate axes at the center.



Newly created grid object

While the newly created grid object is still selected, you can change its settings on the Parameters rollout. See the following topics for instructions on activating a grid object and adjusting its parameters.

## Activating Grid Objects

A grid object requires *activating* before use—standard selection does not activate it.

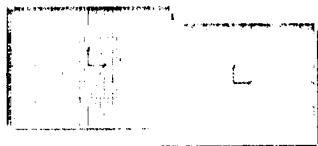
Only one grid can be active for construction at a time, whether it's the home grid or a grid object. Activating a grid object “deactivates” the home grid.

### To activate a grid object:

1. Select a grid object.
2. Do one of the following:
  - Choose Views/Grids/Activate Grid Object from the menu bar.
  - Right-click the selected grid object and choose Activate Grid from the Viewport Properties menu.

The grid object changes to show its internal grid structure. Except for its main axes, the home grid disappears in all viewports.

Either option changes the setting on the Views/Grid menu or right-click menu to Activate Home Grid.



Grid object selected and activated

If you have more than one grid object in your scene, you have to activate each one separately for use. Select the grid object you want to make active and follow the same procedure. Activating another grid object deactivates the current one.

**To return to the home grid, do one of the following:**

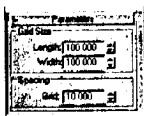
- Choose Views/Grids/Activate Home Grid from the menu bar.
- Right-click the selected grid object and choose Activate Home Grid from the Viewport Properties menu.

This deactivates the grid object and returns the home grid in all views.

If you delete an activated grid object, the home grid is also reactivated.

## Adjusting Grid Objects

After creating a grid object and while it's still selected, you can adjust its dimensions and scaling on the Parameters rollout of the Create command panel. This rollout is also available from the Modify command panel for a selected grid object.




Parameters rollout for grid object

You can adjust parameters whether the grid object is selected or activated. As noted below, you don't see the effect of changes to the grid spacing until you activate the grid object.

### Adjusting Parameters

There are two parameters, Grid Size and Grid Spacing. These settings are unique for each grid object.

**To adjust parameters of a grid object:**

1. Select and activate the grid object.
2.  Click the tab on the Modify command panel.
3. Adjust parameters on the Parameters rollout.

**Grid Size**—Sets overall size of the grid object.

This size determines the extents of a viewport set to the grid object. It does not affect the useful limits of the grid, which continues as a plane beyond its visible size.

**Grid Spacing**—Sets the size of the smallest square in the visible grid. This setting appears on the status line when the grid is activated.

**Note:** You can set Grid Spacing when a grid is selected, but you won't see the grid spacing until the grid is activated.

## Using a Grid Object for Construction

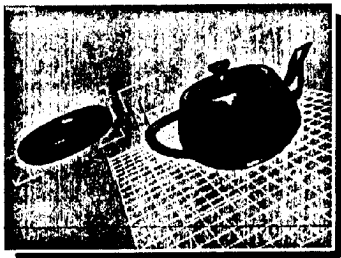
When activated, a grid object replaces the home grid as the frame of reference for creating objects.

An activated grid object creates a true plane in 3D space. No matter how small an activated grid object appears on screen, its XY plane is effectively infinite, just as if it were the XY plane of the home grid.

**To use a grid object as construction plane:**

1. Activate the grid object.
2. Create any category of object from the Create command panel.

3D Studio MAX creates the object directly on the plane of the grid object, with the object's Z axis perpendicular to the plane.



Objects created on a single grid object construction plane

See Align topics later in this chapter for details on aligning objects and grids. This is an important aspect of using a grid object as a construction plane.

## Moving and Rotating Grid Objects

Like other objects in 3D Studio MAX, grid objects can be moved anywhere in your scene. You can also rotate them freely in space. These transforms, along with alignment, are essential in positioning a construction plane in 3D space. Alignment is discussed later in this chapter.

**To move or rotate a grid object:**

1. Select or activate the grid object.
2. Do one of the following:
  - Click the toolbar button for Move or Rotate.
  - Right-click the grid object and choose Move or Rotate from the menu.
3. Apply the transform. Both are constrained by the current coordinate axis setting.



Grid moved to create objects at different positions

### Scaling Not Advised

As a rule, don't use scaling to resize a grid object. Scaling enlarges or reduces the *apparent* size of the grid object but has no effect on grid spacing. A sphere 20 units in radius created on a grid object appears smaller than another 20-unit sphere created on a scaled-up version of the same grid.

If you want to increase or decrease the *actual* size of the grid object, select it and go to the Parameters rollout on the Modify command panel.

# Setting View Alignments

There are two view options for grid objects. In one, the grid object is moved in world space. In the other, the grid object appears fixed.

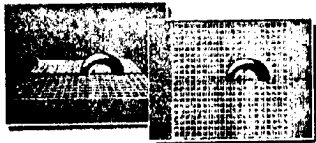
## Grid-to-Viewport Alignment

This option moves an activated grid object to make it parallel to the current view.

**To align a grid object with a viewport:**

1. Activate a grid object.
2. Choose a viewport by clicking or right-clicking in it.
3. Choose Views/Grids/Align to View from the menu bar.

The grid object rotates to align itself with the selected view. The grid object is now planar, or parallel, with the viewport.



Grid object aligned to viewport

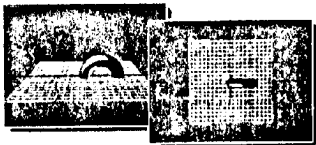
## Viewport-to-Grid Alignment

This option fixes the view on an activated grid object.

**To align a viewport with a grid object:**

1. Activate a grid object.
2. Right-click the label of a viewport and choose Views/Grid.

The view changes to align with the center of the grid. This is a locked-in view, with the center of the viewport “fastened” to the center of the grid.



Viewport aligned to grid object

When you try to move a grid object aligned with a viewport, the view pans with the grid. Other objects appear to move past the grid object in this viewport.

## Switching to Another Grid


Assume you have a grid object aligned with a viewport. If you activate another grid object, the view switches to become planar with this grid object. If you reactivate the home grid, the viewport switches to become planar with the ground plane—essentially the same as a top view.


## Using Align Options


The align options let you match the position and orientation of objects to one another. A common use is to align an object in your scene with a grid object. You often want to do the reverse—aligning a grid to an object provides a reference for moving or modifying the object.

### Align Options

There are three Align options on a flyout of the default toolbar. The options are also on the menu bar under Edit.

 **Align**—Aligns one object with another. Settings let you align with one or more axes of the target object, as well as choose different alignment points on each object.

 **Align Normals**—Aligns a face normal on one object with a face normal on another. The aligned object can be rotated around the normal of the target object, or be offset along any axis of its axes.

 **Place Highlight**—Aligns a light, camera, or other object with a specified point on an object. See chapter 20, “Lighting Your Scene”, in volume 2 of this guide.

### Source and Target Objects

Alignment involves two objects: one is the *source* object, where the process begins; the other is the *target* object, where the process ends.

**Source object**—Object you want to move into alignment with another object. You select a source object to begin the alignment process.

**Target object**—Object used as the center of alignment. You select the target object during the alignment process. It cannot be selected beforehand.

## Aligning with a Point Object



Using a point helper object with Align, you can move an object to any location in 3D space, or define a particular spot on an object's surface as the source or target for alignment to another object. See “Point” on page 7-29.

### Aligning to a Point in Space

The point object is used as the target. Any selected object can be the source. This is one of the simplest alignments—using defaults, the object's center and orientation is matched exactly to the point.

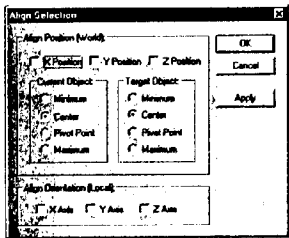
You can replace the point object with a 3D object to see the default effect of aligning objects. See “Aligning Objects” on page 7-18.

#### To align an object with a point object:

1. Create a point helper object and position it at a target location in your scene. Rotate it as necessary to adjust final orientation.
2. Select a source object.
3.  Click Align on the default toolbar, or choose Edit/Align.  
 The Align cursor appears attached to a crosshair.
4. Move the crosshair over the point object and click.

The Align Selection dialog appears. If necessary, move the dialog out of the way so you can see the active viewport.





5. In the Align Position area, check X Position.

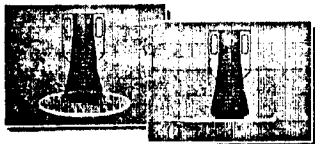
The selected source object shifts to align with the X axis of the point object.

6. Check Y Position and Z Position.

The source object moves so its center is at the point object.



7. Check X, Y, and Z Axis in the Align Orientation area to reorient object to match the coordinates of the point.



Alignment complete and final orientation

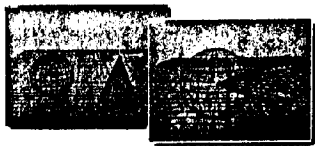
## Aligning to the Surface of an Object

By linking a point object to an object's surface, you can align that surface to another object. Following are the general steps.

To align to any point on an object:

1. Create a point object and move it to a surface location on the object. (In some cases, you might want the point inside the object.)
2. Link the object to the point, making the point the parent of the object. (See chapter 27, "Building Hierarchies", in volume 2 of this guide.)
3. Select the point object as the source and align it to another object. See further details in the following topic, "Aligning Objects."

The point moves into alignment, bringing its child object with it.



Aligning a surface point to another object

## Notes on Point Alignment

- You can reverse the process by using the parent point as the target. This moves objects onto the surface of the child object.
- You can link a point to each of two objects, then align between points.
- If you animate this process, leave the point object linked. If you unlink the point, only the point remains animated.

# Aligning Objects

Any two objects can be aligned, with one as the source object that takes on the alignment of the target object. There are many uses for this feature. For precision, an important use is grid alignment. You can create a new grid object and align it to an existing object. Or conversely, you can move an object onto a grid anywhere in your scene.

## Setting a Coordinate System

The effects of alignment depend on the current reference coordinate system, such as View, World, Local, and so on. You should decide what system you want to use before beginning alignment.

**Reference Coordinate System**—Determines the axes used for positional alignment and the size of the bounding box for maximum and minimum positions.

**To align objects using active grid axes:**

- Choose Grid as the reference system from the dropdown list in the tool bar.

**To align two objects using their own axes:**

- Choose Local as the reference system. Alignment is then strictly between the two objects. Object bounding boxes determine maximum and minimum positions.

As a reminder, the current reference system appears in parenthesis following the Align Position label in the Align Selection dialog (see figure in this topic).

## Basics of Aligning Objects


Alignment controls are on a single dialog. As you make a setting, the object being aligned moves immediately to the new position. This lets you experiment with alignment until you get what you want.

You can also work step-by-step, by applying position choices, for example, before deciding on final orientation. You can cancel at anytime, returning the scene to its original state. You can also undo any alignment and start over.

Settings can be made in any order. The following procedure suggests a logical sequence. See "Align Settings and Options," below.

**To align objects by position and orientation:**

1. Select a source object. This is the object that you want moved into alignment with the target object.

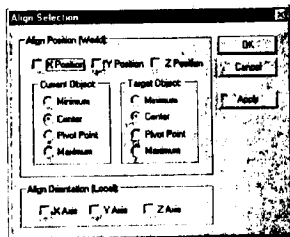
2.  Click Align in the default toolbar, or choose Edit/Align.



The Align cursor appears attached to a crosshair.

3. Move the crosshair over the target object and click.

The Align Selection dialog appears. By default, all options in the dialog are turned off, so no alignment occurs.



4. Under Current Object and Target Object, click Minimum, Center, Pivot Point, or Maximum.

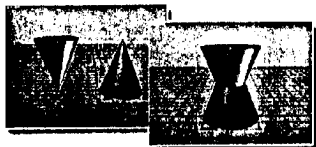
These settings establish the points on each object that become the alignment centers.

5. Begin alignment by clicking X, Y, and Z Positions.

The source object moves in relation to the target object, along the axes of the reference coordinate system. Setting all three moves the objects as close as possible, given the Current and Target Object Settings.

6. In the Apply Orientation area, click X, Y, or Z Axis.

The source object realigns accordingly. If the objects share an orientation, that axis has no effect. Once two axes are aligned in orientation, the third is automatic.



Objects aligned X, Y, and Z—center to center



Objects aligned X, Y, and Z—pivot point to center

## Aligning Multiple Objects

When you select multiple object for alignment, the same settings apply to all of them. However, the effect on each individual source object is different. In practice, you're aligning separate objects at the same time with the same settings.

To align a collection of objects as a single unit, select the objects and group them. The alignment now takes place relative to the pivot and bounding box of the entire group.

## Align Settings and Options

**Current Object**—The currently selected source object that is moved during alignment.

**Target Object**—The object used as the center of alignment.

**Center**—Geometric center of either object.

**Pivot Point**—Local pivot of either object.

**Minimum, Maximum**—Refer to intersections of either object's bounding box with the reference coordinate axes. Maximum occurs in the positive direction along a given axis. Minimum in the negative.

If the local axes of an object are skewed to the reference system, the program draws a larger (invisible) bounding box to enclose the object and uses it to calculate Maximum and Minimum.

**X,Y,Z Position**—Offsets for current object along the axes of the reference coordinate system.

**X,Y,Z Axis**—Local axes of current and target objects. The current object aligns its local axes with the local axes of the target.

**Apply**—Accepts alignment based on current settings and unchecks all X,Y,Z settings.

# Aligning Normals

In 3D Studio MAX, you can align the normals between any two objects. In the case of mesh objects, the alignment is between individual faces, since each face has its own normal.



See chapter 22, “Adjusting Normals and Smoothing”, in volume 2 of this guide.

## Basics of Aligning Normals

Before you begin, select a view that lets you see both objects you want to align. If necessary, you can navigate the view after selecting the first normal.

To see face normals clearly, work in a wireframe viewport.

### To align normals:

1. Select a source object. This is the object that moves during alignment.
2.  Click Align Normals in the default toolbar, or choose Edit/Align Normals.
3. Drag across the surface of the source object.  
 The Align Normal cursor appears attached to a crosshair. A blue arrow at the crosshair indicates the current normal.
4. Move the crosshair and blue arrow until you locate the normal you want to use, then release.

The blue arrow remains as reference to the source normal.

5. Drag across the surface of the target object.

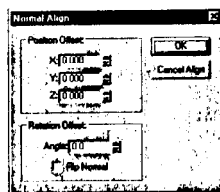
A green arrow at the crosshair indicates the current normal.



Selecting the target normal

6. Move the crosshair and green arrow until you locate the normal you want to use as a target, then release.

The source object moves into alignment with the target normal, and the Normal Align dialog appears.



7. Do one of the following:
  - Click OK to accept the alignment.
  - Using the dialog, make modifications to the alignment before clicking OK. The next section covers dialog controls.

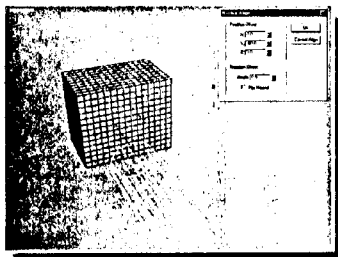
## Modifying Normal Alignment

When the Normal Align dialog appears, alignment between normals is complete. The source object is moved and rotated to conform to the target normal.

Before accepting this alignment, you can make adjustments in position, rotation, as well as the direction of the normal. These settings are interactive. You see their effect in the viewport as you make them. None are final until you click OK to dismiss the dialog.

**Position Offset**—Moves the source object relative to the coordinates of the target normal.

Setting Z moves the source object in and out along the target normal. Setting X and Y moves the source object back and forth along the corresponding axes.



Effect of repositioning source object

**Rotation Offset**—Includes settings for Angle and Flip Normal.

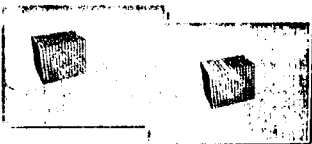
- *Angle* rotates the source object around the Z axis of the target normal. The default alignment produces centered rotation, since the two normals are in the same position. If you

reposition the source object, the rotation is off-center.



Effects of rotating source object, centered and off-center

- *Flip Normal* reverses the Z direction of the target normal. The source object, its normal aligned with the target normal, is flipped end for end.



Effect of flipping normal

# Setting Snaps

Snaps give you control in creating, moving, rotating, and scaling objects. The snap features in 3D Studio MAX are listed below. They are discussed in the topics that follow.

Buttons indicate those features that can be turned on and off at the status line.

**Snap strength**—Sets the relative strength of the search region around the cursor.

**Snap priority**—Determines what you can select during a snap based on categories of geometry and spacial settings.

- Prioritizes four categories of object and grid geometry. Any of these categories can be turned off to prevent snapping to them.
- Sets the spatial range in which snaps operate: 2D, 2.5D, or 3D.

**Angle snap**—Sets the increment at which objects are rotated about a given axis.

**Percent snap**—Sets a percentage increment during a scaling operation.

**Relative/absolute snap**—Toggles two possible snap states when moving objects.

- *Relative* moves objects in increments of the grid spacing and maintains the object's position relative to the active grid.
- *Absolute* allows free movement with snaps determined by Snap Priority settings.

**Spinner snap**—Sets a numerical increment for spinner fields. You set this value on the General panel of the Preferences Setting dialog. Right-clicking the button opens the General Panel.

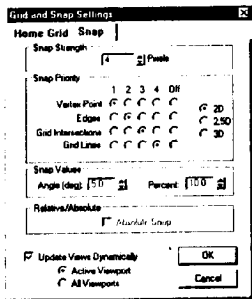
## Snap Panel

Except for spinner snap, you make all snap settings from a single panel. You can easily change these settings as the situation in your work requires.

To access the Snap Settings panel, do one of the following:

- Choose Views/Grid And Snap Settings from the menu bar, then click the Snap tab on the Grid And Snap Settings dialog.
- Right-click any of the snap buttons on the Status line (except Spinner snap).

The following panel appears:



Snap panel showing defaults

## Returning to Defaults

Snap settings stay in effect during a single session of 3DS MAX. They are reset to defaults for each new session.

## Setting Spinner Snap


By default, a single click on a spinner's up or down arrow raises or lowers the number in its field by 1.0 or other minimal increment, depending on the value range of the field.

Spinner snap lets you set and toggle an alternate value. If you're using generic units of 1 inch, a setting of 12 would let you resize objects by one foot with every click, or add 12 segments to a sphere.

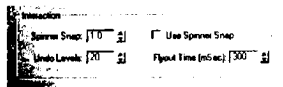
The same setting applies to all spinner fields. Since spinner snap is a toggle, you can easily turn it on when needed and use the default at other times. Spinner snap has no effect on dragging a spinner, only on single clicks.

### To set and toggle spinner snap:

#### 1. Do one of the following:

- Choose File/Preferences and click the General tab on the Preference Settings dialog.
-  Right-click the Spinner Snap button in the status line.

Either method brings up the General panel. The two controls for spinner snap are in the Interaction area of this panel.



Spinner snap interface

## Setting Snap Strength

Snap strength determines how close the cursor needs to approach a snap point before the snap takes place. This is a global setting, affecting all snap interactions.

Snap strength is controlled by a single spinner on the Snap panel. Possible values range from 1 to 20, representing the pixels in a “search region” around the active point of the cursor. The default is 8.

Setting snap strength to higher or lower values has these effects:

**Higher values**—Increase snap strength by enlarging the region around the cursor. The larger region more easily triggers a snap.

**Lower values**—Decrease snap strength by reducing the region around the cursor. The smaller region is more selective, requiring the cursor to be nearer a snap point before triggering a snap.

#### 2. Set a value in the Spinner Snap field.

#### 3. Check Use Spinner Snap.

When you exit the dialog, the Spinner Snap button is turned on.

#### 4. As you work, use the Spinner Snap button to toggle the alternate setting.

# Setting Snap Priority and Spatial Snaps

Snap priority has two distinct settings. One determines how snap interacts with the components of objects and grids. The other determines the level of spatial interaction.

## Setting Geometric Priority

Geometric priority for snaps establishes the kind of geometry you want the cursor to find, and the relative importance of that geometry in the search. For example, by setting grid intersections to high priority, you can easily snap to the grid of a construction plane.

The four kinds of priority geometry are:

- Vertex Point
- Edges
- Grid Intersections
- Grid Lines

Each type of geometry can be set to one of five priority values, including *off*. Choosing *off* means that no snap can be made to that type.

The default settings for snap priority are shown in the following figure. The top priority is given to vertex points, with the others trailing off in descending order.

| Snap Priority      | 1 | 2 | 3 | 4 | Off |
|--------------------|---|---|---|---|-----|
| Vertex Point       | ☑ | ☐ | ☐ | ☐ | ☐   |
| Edges              | ☐ | ☑ | ☐ | ☐ | ☐   |
| Grid Intersections | ☐ | ☐ | ☑ | ☐ | ☐   |
| Grid Lines         | ☐ | ☐ | ☐ | ☑ | ☐   |

Snap Priority defaults

## How Snap Priorities Work

The setting for the four priorities dictate how the program decides among possible snaps. In the default settings, if all four geometry types were within snap strength range, the vertex

point would get the snap. If only the other three were within range, the edge would get the snap, and so on.

## Switching Between Snap Priorities

You can set snap priorities on a case-by-case basis. While creating new geometry on a grid, you might turn off vertex points and edges entirely, so all snaps go to the grid.

The situation might be reversed at a later stage when you're modifying complex objects. Then the grid snaps might be a distraction, and all you need are the object-level snaps.

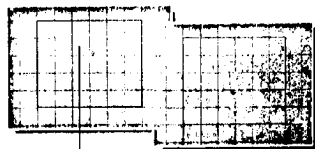
## Setting Spatial Snaps

Spatial snaps give you control over the range of 3D space where snaps are active. For example, you can limit snaps to a 2D plane.

- Three buttons in the Snap Priority section of the Snaps panel let you choose among the following spatial snaps. Only one can be active at a time.

## 2D Snap

The cursor snaps only to the active construction grid, including any geometry on the plane of that grid. The Z axis, or vertical dimension, is ignored.



line snaps to active grid

Example of 2D snap



## 2.5D Snap

As in 2D snap, the cursor snaps only to the active grid. But it will snap to the vertices or edges of the *projection* of an object.

Suppose you create a grid object and make it active. You then position the grid object so you can see through the grid to a cube further off in 3D space. Now, with 2.5D set, you can snap a line from vertex to vertex on the distant cube—but the line is drawn on the active grid. The effect is like holding up a sheet of glass and drawing the outline of a distant object on it.



Example of 2.5D snap

## 3D Snap

This is the default. The cursor snaps directly to any geometry in 3D space.

## Spatial Snaps on Status Line

When you check a spatial snap and click OK, the corresponding button is turned on in the status line:



## Using Snaps During Creation

When you create objects, Snap Priorities are in effect whenever one of the spatial snaps is turned on. This means that if grid geometry is set as a high priority, the first point you pick to begin creation can be a grid intersection. This also works for the second point.

When you drag an object vertically off the grid during creation, the snap follows grid spacing.

With object priorities set, you can make the first point coincide with the vertex of another object in the plane of the active grid.

In some cases, you might want to increase snap strength to make it easy for the cursor to lock onto an intersection or vertex.

## Setting Angle Snap

Angle snap is a global setting that determines the *angle of rotation* for a number of features in 3D Studio MAX, including the standard Rotate transform. As you rotate an object (or group of objects), the object moves around a given axis in the increment you set.

Angle snap also affects the following:

- Pan/Orbit camera controls
- FOV and Roll camera settings
- Hotspot and Falloff spotlight angles

### How to Set Angle Snap

Angle snap is controlled by a single spinner in the Snap Values area of the Snap panel.


- You can set the value to any angle, including angles greater than 360 degrees. The default is 5 degrees.

For example, if set to 180 degrees, an object would flip around to show its opposite side. You can, of course, animate such effects.



Example of angle snap



To turn angle snap on:

-  Click the Angle Snap button on the prompt line.

When turned on, angle snap affects all rotational transforms.

## Using Relative and Absolute Snap

When you move an object with snap set, a pair of buttons in the status line determine the kind of “snapped move” you can make.



-  *Relative* snap, the default, moves objects in multiples of grid spacing along all axes.
-  *Absolute* snap uses current Snap Priority settings, letting you move and snap one object to another, or to a grid intersection.

### Using Relative Snap

As the default snap for moving objects, relative snap has a single function: to limit the move to increments of the *grid spacing* of the active grid. Relative snap maintains the position of an object relative to the grid. It does not automatically “snap to the grid” if the object is not already on the grid.

Relative snap works in any viewport and along any axis available for movement. It is not affected by the setting for 2D/2.5D/3D snap.

To move objects with relative snap:

1.  Turn on any of the spatial snap buttons.
2.  Click the Relative snap button in the status line.

Moves are now linked to grid spacing.

To change grid spacing, see these topics in this chapter: see “Setting Home Grid Spacing” on page 7-8 and “Adjusting Grid Objects” on page 7-13.

### Using Absolute Snap

When moving objects, absolute snap gives you access to the current settings for Snap Priority. This lets you do both grid and object snaps.

# Turning Snaps On and Off

**Grid snaps**—Set Snap Priority to favor grid intersections and lines. Allow some priority to vertices and edges so you can pick precise points on objects you want to move. Snaps now “go to the grid” when moving objects. Once an object is snapped to a grid intersection, switch to relative snap to “lock” the movement to the grid.

**Object snaps**—Set Snap Priority to favor vertices and edges. Snaps now go to object geometry. You can turn off grid priority entirely if you want “object-only” snaps.

## Conditions for Absolute Snap



The button for absolute snap is available under the following conditions:

- The active viewport is an orthographic view.
- The reference system is Screen or View.

Once absolute snap is set, activating another viewport type or reference system switches back to relative snap. When you return to a viewport with the right conditions, absolute snap is automatically turned on.

Absolute snap works point-to-point. The point you pick as you begin a move is the “snap point.” You can pick a vertex or any point along an edge.

### To move objects with absolute snap:

1. Activate an orthographic viewport with Screen or View reference system.
2.  Click a spatial snap button to allow the kind of snap you want to make.
3.  Click the Absolute snap button in the status line.

Moves are now controlled by absolute snap.

To put snap settings into effect, *you must turn snaps on*. Since the default is *off* for all snaps, you need to activate snaps when you’re ready to use them. Changing Snap Priorities has no effect on the on/off state.



**Spatial snap (2D/2.5D/3D)**—Three-way flyoff. These are the basic snaps for creating and moving objects.

To change to another button, click and hold the current button to bring up the three options, then drag to the button you want and release. The button is turned on as you do this.



**Relative/Absolute**—Two-mode button for using snap when moving objects. When a spatial snap turned on, relative mode is automatically in effect—you do not have to click the button. When absolute mode is available, clicking the Relative button toggles to the Absolute button and turns it on.



**Angle**—On/off toggle for Angle snap.



**Percent**—On/off toggle for Percent snap.



**Spinner**—On/off toggle for Spinner snap.

Remember to turn snaps on and off as needed.

- No snap is active until you turn it on.
- A snap remains on during a session until you turn it off.
- Changing Snap Priorities has no effect on the on/off state of any snap.

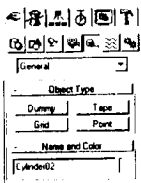
## Using Helper Objects

Helper objects play a supporting role, like stage hands or construction assistants. Grid objects are one type of helper object. See topics beginning with "Using Grid Objects" on page 7-10.

The other helper objects that ship with 3DS MAX are Dummy, Tape, and Point. These are discussed in following topics. Other helper objects might be available in your configuration.

### To create a helper object:

1. Click the tab on the Create command panel.
2. Click the Helpers button to display the Helpers panel.



3. Click a Helper on the Object Type rollout.

From this point, the details depend on the individual helper object. See the following topics.

For the basics of creating objects, see chapter 8, "Creation Methods".

## Dummy

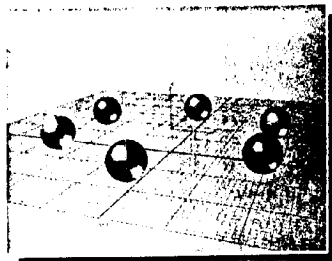
A Dummy helper object is a wireframe cube with a pivot point at its geometric center. It has a name but no parameters, cannot be modified, and does not render. Its only real feature is its pivot, used as a center for transforms. The wireframe acts as a reference for transform effects.

The dummy object is used primarily in hierarchical linkages. For example, you can use a dummy object as a center of rotation by linking a number of different objects to it. When you rotate the dummy, all its linked children rotate with it. A dummy is often used this way to animate linked motion.

See chapter 27, "Building Hierarchies", in volume 2 of this guide.

### To create a dummy object:

- Click Dummy and drag out a cube to any convenient size.



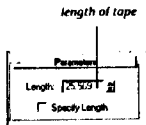
Dummy helper object

## Tape

The Tape helper object provides an on-screen “tape measure” for determining and setting distances. The tape is composed of two named objects, in the same way targeted lights and cameras are. A tape icon and its target are connected by a line representing the current distance between them.



Tape helper object



A toggle lets you drag a length (the default), or enter a specific length. Either end of the tape can be snapped, aligned, or linked to objects in your scene. Deleting either end deletes the tape.

### To measure a distance:

1. Click Tape and drag from one point to create the tape, then move to a second point and release to create the target.

The distance between tape and target appears in the Length field, which is grayed out to indicate that this is a read-only measurement.

2. Move either end to a new location. The line between stretches to the new distance, shown in the Length field.

### To set a distance:

- Check Specify Length in the Parameters rollout and enter a length, then create the tape.

The line is now the distance you specified. You can reorient this line as required. You can also uncheck Specify Length and adjust the length.

## Point

The Point helper object provides a specific point in 3D space that can be used as a reference or by other program functions. See “Aligning with a Point Object” on page 7-16 for a common application.

### To create a point in space:

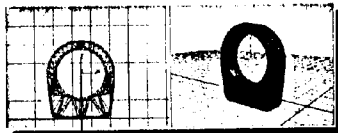
1. Click Point and drag anywhere in your scene.

An axis tripod follows the cursor, indicating the current location of the point object.

2. Move the cursor to where you want the point object and release.

The point object appears as a small cross with a default axis tripod.

The point can be moved as needed. Its axes can be reoriented by rotating the tripod.



point object  
Point helper object

### Point Parameters

**Show Axis Tripod**—Indicates the position and orientation of the point object with a tripod axis. The axis remains visible when the point object is no longer selected. If unchecked, the point appears as a small cross when unselected. Default=checked.

**Axis Length**—Sets length of tripod axis. Use to minimize the axis, or increase its size to aid in locating it. Default=20.

## Creation Methods

### Topics

- Using the Create Command Panel 8-2
- Interface to the Create Command Panel 8-4
- Basic Object Categories 8-6
- Creating an Object 8-8

The Create command panel provides the controls for creating objects—the first step in building a new scene in 3D Studio MAX. You are also likely to continue adding objects throughout an entire project. For example, a final rendering of your scene could require a new light or two. Along the way you might need to create some helper objects, which act as aids but don't appear in the rendered scene.

To populate your scene, 3D Studio MAX provides a wide range of possible object types, including familiar geometric primitives such as Box, Sphere, and Cylinder, and 2D splines such as Line, Donut, and N-Gon. Once you've created geometric objects, you can modify, combine, and copy them to create more complex objects.


Objects also include Lights and Cameras, Space Warps, and Helper objects such as grids.

Despite the variety of object types, the creation process is generally the same for all objects, as this chapter describes. The remaining chapters in this section (chapters 9 through 14) give more detail about creating the specific object types that ship with 3DS MAX.

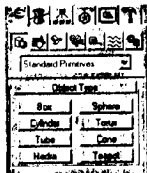
## Using the Create Command Panel

The Create command panel provides the controls for creating objects and adjusting them. By default, this panel is open when you start a new session of 3DS MAX.

**To access the Create command panel:**

-  Click the Create tab in the command panels.

The Create command panel appears.



Create command panel at the start of a new session

### The Creation Process

The actual creation of an object is accomplished with a single drag of the mouse—the process is almost effortless. The general approach is that you first make an object to give it an approximate size and location in your scene, then adjust its parameters and position—either immediately or later.

The process of creating objects is fully detailed in the topics in this chapter. The general sequence is as follows:

- You choose a category of object from the buttons at the top of the Create command panel (Geometric, for example).

For some categories of objects, you then choose a subcategory from a dropdown list (Geometric, and then Standard Primitives, for example).

- Labeled buttons show the object types available in this particular category (Box, Cylinder, Sphere, for example).
- You click a button to choose an object type (Box, for example). The command panel presents the options for that object type, such as parameters and possibly a choice of creation methods.
- You create the object. This involves a drag-and-click mouse operation in a viewport. As you do this, the object is placed on the active grid in that viewport.
- When the object is complete and *while it's still selected*, you can change the object's parameters on one or more rollouts specific to that object.

You can use view commands to look at the object from different angles while you remain in this creation mode. Selecting a transform, command panel, or other object exits this mode and completes object creation.

## Example: Creating a Cylinder

The steps for creating an object are perhaps easiest to understand by going through them at your computer. This section shows the steps for creating a cylinder.

### To create a cylinder:

1. Start a new session of 3DS MAX. If the program is running, reset it with File/Reset and go to the Create command panel.

The Create command panel appears with the Geometric button highlighted.

2. In the dropdown list below the Geometric button, make sure that Standard Primitives is chosen.

While Standard Primitives is chosen, several buttons appear in the Object Type rollout, including Cylinder, Box, and Sphere. All these buttons create geometric primitive objects in much the same way.

3. Click Cylinder.

Once you're familiar with the process, the next steps form a nearly continuous motion.

4. In the Perspective viewport, *press and hold down on the mouse button.*

The point at which you press defines the *center* of the cylinder's base.

5. Drag the mouse.

This defines the *radius* of the cylinder.

6. Release the mouse button and move the mouse upward.

This defines the *length* of the cylinder.

7. Click once to set the length.

This completes the cylinder, which is now selected. Continue with the following adjustment while the cylinder is still selected.

### To adjust the cylinder:

On the Create command panel, you can now fine-tune the parameters for this newly created cylinder.

- In the Parameters rollout, use the spinner or number field to increase the Height value.

The cylinder grows in length.

The parameter controls let you change the radius, height, number of segments, number of sides, and other characteristics of the cylinder. Experiment to see the effects of adjusting parameters other than Height.

## Creation Parameters and Modifying Objects

The parameters you set when you create an object are the object's *creation parameters*. You can adjust the creation parameters in the Create command panel only *after* you create the object in a viewport and *before* you deselect the object, transform it in some way (by moving it, for example), or go to a different command panel.

Creating another object deselects the current object. So does clicking elsewhere in a viewport while Select is active.

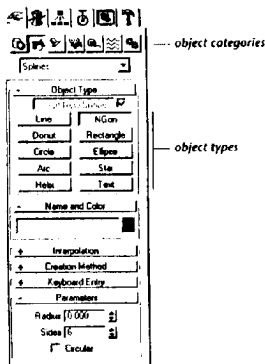
To change creation parameters when they're no longer visible in the Create command panel, you use the Modify command panel instead. Select the object and then click the Modify tab. See chapter 15, "Modification Methods".



# Interface to the Create Command Panel

Controls in the Create command panel vary depending on the kind of object you are creating. However, certain controls are always present, and others are shared by many different kinds of objects.

The following figure shows the layout of the Create command panel for a 2D spline shape, an N-Gon.



Create command panel for an N-Gon

## Basic Features

The Create command panel has a set of basic features common to all object types.

**Category**—Buttons at the top of the panel give you access to the seven basic categories of objects in 3DS MAX.



Object category buttons

**Object Type**—Labeled buttons give you access to the available set of objects that can be created in a particular category.

**Name and Color**—Text field lists the automatically assigned name of the object. You can edit this name or replace it with another, including duplicate names. The square color swatch button brings up a color selector for the wireframe of the object.

## Other Features

The following interface features are optional on the Create command panel. Their appearance and use are determined by the type of object being created.

## Subcategories

Some object categories have a dropdown list for subcategory selection. Each subcategory contains one or more object types. If you've installed plug-in components for additional object types, these might be grouped as a single subcategory.

## Creation Method Rollout

You often have a choice of how you use the mouse to create an object. For example, you can use either the center (radius) or edge (diameter) to define the size of a circle shape.

There's always a default creation method. If you want to use an alternate method, choose the option *before* you create the object. The creation method has no effect on a finished object; the options are for your convenience during creation.

## Parameters Rollout

Most objects have a Parameters rollout showing *creation parameters*—the defining values for that object. Some parameters can be preset, while others are only for adjustment after an object has been created.

In general, you drag-click in a viewport to define the initial position and dimensions of an object. After the object is complete and still selected, all the parameters in the Parameters rollout become available.

For an N-Gon, you can set the number of sides and decide to make it into a circle *before* you create it; however, setting the radius has no effect until *after* you create it.

## Keyboard Entry Rollout

Geometric primitive and shape objects let you enter creation parameters from the keyboard. This rollout contains the controls for keyboard creation.

## Other Rollouts

Depending on what kind of object you create, you might see one or more additional rollouts on the Create command panel. These rollouts are covered in later chapters that deal with the specific object.

## After Creation

Once you create an object and then select another object or command panel, the parameters for that object disappear from the Create command panel. This is because the object is now “complete,” with nothing left to “create.”

All of its parameters reappear when you select the object and go to the Modify command panel. See chapter 15, “Modification Methods” for details on modifying objects once you’ve created them.

**Tip:** Sometimes after creating an object, you apparently see the creation parameters in the Create command panel, but when you change them the new object doesn’t change. This happens when you have inadvertently clicked in a viewport—the click created a *newer* object of near-zero size. Right-click or press DEL to remove this accidental object. Now you can select the previous object and then go to the Modify command panel to adjust the creation parameters.

# Basic Object Categories

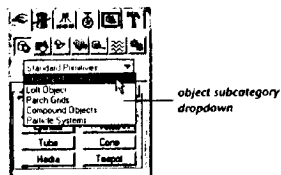
3DS MAX uses a system of *categories* and *subcategories* to manage the many different object types.

## Seven Basic Categories

At the category level, 3DS MAX has seven basic classifications for objects. These categories are represented by seven buttons on the Create command panel:



Each of these categories can have one or more subcategories, available through the dropdown list below the category buttons. The Create command panel's Object Type rollout always contains labeled buttons that show the types of objects in the currently chosen category and subcategory.



**Note:** The following headings describe the categories and subcategories of objects that are provided with 3DS MAX. If your site includes plug-in components from independent developers, your 3DS MAX configuration might include subcategories and object types besides those listed here.

## Geometry

The Geometry category has these subcategories:

**Standard Primitives**—3D geometric objects such as Box, Sphere, and Cylinder. You can use Primitives as the starting point for creating more complex geometry. See chapter 9, "Creating Geometric Primitives and Patches".

**Patch Grids**—Patch grids are 2D surfaces. See chapter 9, "Creating Geometric Primitives and Patches".

**Compound Objects**—Compound objects include morphs and booleans. Booleans combine the geometry of two objects using Boolean operations (union, intersection, difference). Morphs are animated objects that change one geometric shape into other shapes over time. See chapter 12, "Creating Morphs, Booleans, and Particle Systems".

**Particle Systems**—Particle systems are animated objects that simulate rain, snow, dust, and similar collections of small objects. See chapter 12, "Creating Morphs, Booleans, and Particle Systems".

**Loft Object**—A *super object* that uses shapes as cross sections along a path to produce a 3D object. See chapter 11, "Creating Lofts".

## Shapes

The Shapes category has a single subcategory:

**Splines**—Includes 2D objects like Line, Donut, and N-Gon, as well as certain 3D spline-based shapes like Helix. 2D spline shapes are used as loft shapes and loft paths. See chapter 10, “Creating Spline and Text Shapes”.

## Lights

The Cameras category has a single subcategory:

**Default**—Lights enhance the visibility and realism of a scene. Types of lights include Omni, Directional, Target Spot, and Free Spot. See chapter 20, “Lighting Your Scene” in volume 2 of this guide.

## Cameras

The Cameras category has a single subcategory:

**Default**—Cameras provide a point of view onto a scene that you can animate by moving the camera or changing its settings. Types of cameras include Target and Free. See chapter 21, “Using Cameras” in volume 2 of this guide.

## Helpers

The Helpers category has a single subcategory:

**General**—Includes Dummy, Grid, Point, and Tape. Helper objects are aids in constructing a scene; they help you position, measure, and animate the scene's renderable geometric objects. See chapter 7, “Precision and Drawing Aids” for details on creating and using helper objects.

## Space Warps

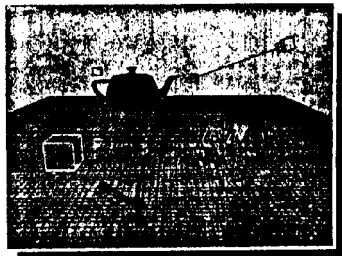
The Space Warps category has a single subcategory:

**Default**—Space warps produce various kinds of distortions in the space surrounding other objects. Types of space warps include Ripple and Wave; some space warps, such as Wind, are meant especially for use with particle systems. See chapter 13, “Creating Space Warps and Systems”

## Systems

The Systems category has a single subcategory:

**Basic**—Systems are pre-created combinations of objects, controllers, and hierarchies designed to work together. The systems provided with 3DS MAX, Bones and Ring Array, are simple hierarchies; plug-in systems can be more complex. See chapter 13, “Creating Space Warps and Systems”





Objects of different categories

# Creating an Object

With some variations, these steps apply to creating any type of object on the Create command panel.

## Choose a category of object:

1.  Click the Create tab to view the Create command panel.
2.  Click the Geometric button at the top of the Create command panel.
3. Choose the subcategory Standard Primitives from the dropdown list.

A number of buttons appear on the Object Type rollout.

## Choose an object type:

- Click the button for the type of object you want to create.

The button turns green, showing that it is active. Four rollouts appear: Name and Color, Creation Method, Keyboard Entry, and Parameters.

## Choose a creation method (optional):

You can accept the default method and skip this step.

- Choose a method in the Creation Method rollout.

## Preset the creation parameters (optional):

You can adjust *all* creation parameters *after* you create an object. Skip this step if you prefer.

In the Parameters rollout, you can set parameters before you create an object. However, the values of parameters you set by dragging the mouse—for example, the Radius and Height of a cylinder—have no effect until *after* you create the object.

## Create the object:

1. Press at a point in any viewport where you want to place the object, and *hold the mouse button down*—do not release the button.
2. Drag the mouse to define the first parameter of the object—for example, the circular base of a cylinder.
3. Release the mouse button.

The first parameter is set with this release.

4. Move up or down *without touching the mouse button*.

This sets the next parameter—for example, the height of a cylinder.

*If you want to cancel:* Until you complete the next step, you can cancel the creation process with a right-click.

5. Click when the second parameter has the value you want, and so on.

The number of times you press or release the mouse button depends on how many spatial dimensions are required to define the object. (For some kinds of objects, such as Line or Bones, the number varies.)

When the object is complete, it is in a selected state and ready for adjustments.

## Name the object (optional):

- Highlight the default object name in the Name and Color rollout, and then enter a name you choose.

## Adjust the parameters:

You can change the creation parameters *immediately after you complete an object*, while it's still selected.

You can also change the object's display color by clicking the color swatch in the Name and Color rollout, then using the Object Color dialog to choose a new color.

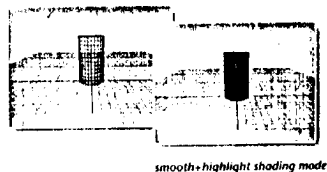
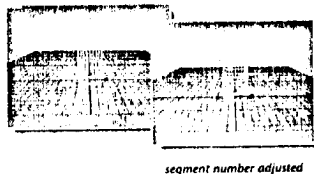
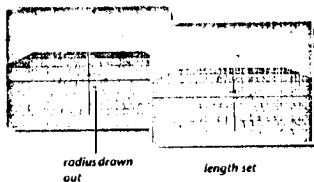
While making adjustments, you can use viewport navigation controls like Zoom, Pan, and Arc Rotate to change your view of the selected object. You can also adjust the time slider.

When you end the creation process—see below—the Parameters rollout disappears from the Create command panel. Once this rollout is no longer visible in the Create command panel, you must go to the Modify command panel to adjust the object's creation parameters. See chapter 15, "Modification Methods".

### To end the creation process:

While the object type button remains active, you can continue creating objects of the same type until you do one of these actions:

- Select an object other than the one you created most recently.
- Transform an object.
- Change to another command panel.
- Use commands other than viewport navigation or the time slider.



Creating and adjusting a cylinder