3ds max 8 Visual Handbook

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Dedication

To My Art Teachers

CONTENTS AT A GLANCE

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INTRODUCTION

Figure i.1 The cadaceus is an ancient symbol of power and healing. 3ds max 7 gives you all the tools you need to quickly make images like this.

3ds max is one of the most powerful desktop 3D graphics programs available today. It is used for a wide variety of commercial and artistic applications, including architecture, computer games, film production, web design, forensics, medical visualization, scientific visualization, virtual reality, and fine art.

This book was written for artists, designers, students, teachers, working professionals, and anyone who wants to build their dreams. At the beginning of each chapter, the introduction gives you a sense of the possibilities. The section headings present the theory you need just in time to do the step-by-step tasks that follow. Tips and tables give you important clues about pitfalls, shortcuts, and advanced techniques. By studying both the theory and the mechanics, you will be equipped not only to push the right buttons, but also to create art, solve problems, and invent solutions.

This book is designed to be as clear as possible and presumes no prior experience on the part of the reader. To assist your learning, over 1400 figures show you what to do and how to do it. By the end of this book, you will have learned how to create, model, map, animate, and render objects in 3ds max 7.

To get the most out of this book, you should be familiar with the Windows environment and have access to an installation of 3ds max 7. You should also have a good understanding of a 2D graphics program like Adobe Photoshop.

There are as many ways to work in 3ds max as there are artists who use the program. By breaking down complex ideas into plain English and carefully organizing the information, I have tried to present the material in such a way that you can quickly find what you need and apply it.

The chapters of the book are meant to be followed in order, but each one is designed to be able to stand alone. If you are new to 3ds max, the best thing to do is start at the beginning and work your way through the topics in order. More advanced students may want to skip to areas of particular interest. To use this book as a "how to" reference, look up your task in the table of contents or look up topics in the index. Extensive tables of commands may be found in the chapters as well as in the appendices.

Chapter 1 gets you up and running, from installing the program to navigating the interface and learning essential file commands.

Chapters 2–4 teach you how to create and select objects, control the display, render images, and navigate 3D scenes. Since the last edition of this book, new objects, group commands, and sidebars have been added.

Chapters 5–7 show you how to manipulate and animate objects using transforms, modifiers, and animation controllers. The sequence of topics has been significantly revised, in accordance with changes to the user interface as well as for clarity.

Chapters 8–10 explain more advanced modeling techniques, including sub-object editing and compound objects. New to this edition are sections on polymesh editing in Chapter 8 and AEC Objects in Chapter 10.

Chapters 11 and 12 describe the use of lights and cameras for illuminating and composing views of your scenes. The section on animating cameras in Chapter 12 has been expanded to include more on walkthrough, flythrough, and flyby animations.

Chapters 13 and 14 cover materials and mapping, so that you can make your scenes realistic as well as beautiful. Special care went into these chapters to make the figures larger and more beautiful.

Chapter 15 rounds out the book with rendering and shows you how to add effects to produce high-quality pictures and movies. Many new figures have been added here for clarity, beauty, and visual interest.

Enjoy!

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CREATING OBJECTS

2

Everything in nature can be represented with a combination of geometric forms. As the painter Paul Cézanne once wrote, "Treat nature in terms of the cylinder, the sphere, the cone; everything in proper perspective." He also is also reported to have said, "One must first of all study geometric forms: the cone, the cube, the cylinder, the sphere."

Today, 3D artists use geometric forms called objects to create and animate entire worlds. Starting with the cone, the cube, the cylinder, and the sphere (**Figure 2.1**), you can combine and manipulate basic objects to create highly complex and realistic scenes.

This chapter explains how to create mesh objects and shape splines, which are the basic building blocks of 3D scenes. You will also learn how to create helper objects to assist you in placing objects in your scene. In later chapters, you will learn to create lights and cameras, and to create compound objects by combining objects together.
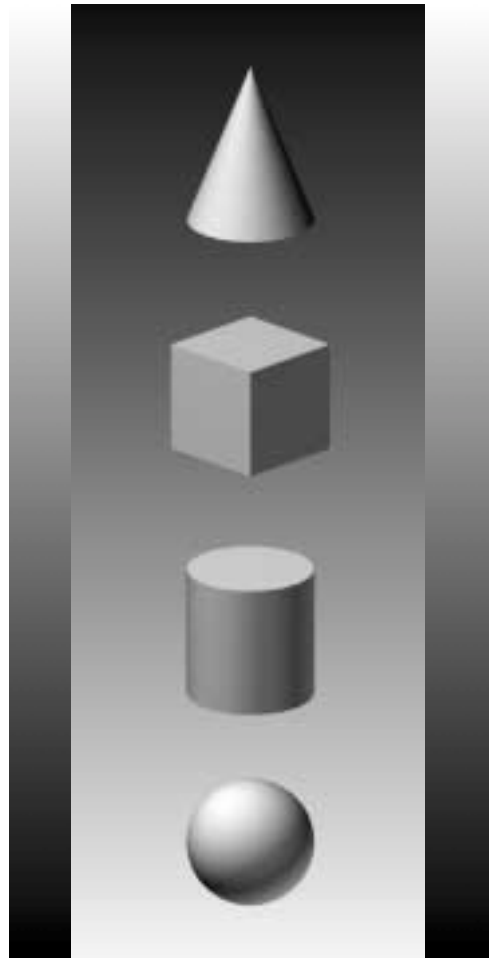
Figure 2.1 The cone, the cube, the cylinder, and the sphere are basic objects in 3ds max.

About Creating Objects

3ds max is written in an **object-oriented** programming language called C++. This means that the state of an object determines which commands may be applied to it. If a command may not be applied to an object, the command becomes unavailable, until the object changes to an appropriate state.

When you create an object in 3ds max, the program automatically assigns it a name, color, position, orientation, pivot point, axis tripod, display properties, and rendering properties. If an object can be rendered to an image output file, a white **bounding box** appears at the dimensional extents of the object when it is selected (**Figure 2.2**).

As you place objects in a scene, the viewports display them from different angles. The Front, Left, and Top viewports always view objects from the front, left, and top of the world. By default, objects in these views are displayed in **wireframe**. In contrast, the Perspective viewport can display an object from any angle. By default it looks at the scene from in front and a little above, and draws objects using a smooth shaded mode of display (**Figure 2.3**).

The grids that you see in the viewports are all part of the **home grid**. The home grid provides construction planes for creating objects. What this means is that objects automatically sit on top of the grid when they are created. Because the grids of the home grid are perpendicular to one another, objects created in different viewports may orient in different directions (**Figure 2.4**).

For more information on navigating viewports and viewport modes of display, see Chapter 3, "Viewport Navigation and Display."

World Axis   Axis Tripod   Bounding Box
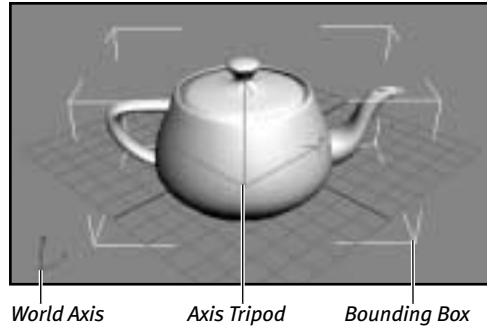
Figure 2.2 The axis tripod and bounding box are displayed when the object is selected. The origin of the axis tripod is located at the pivot point of the object; the bounding box is drawn at the object's extents.
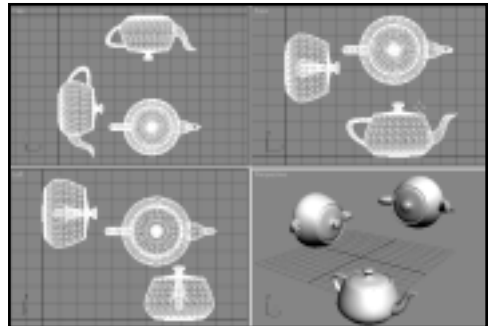
Figure 2.3 Viewing a scene from four different angles. Three of the views are displayed in wireframe; the Perspective view is shaded.
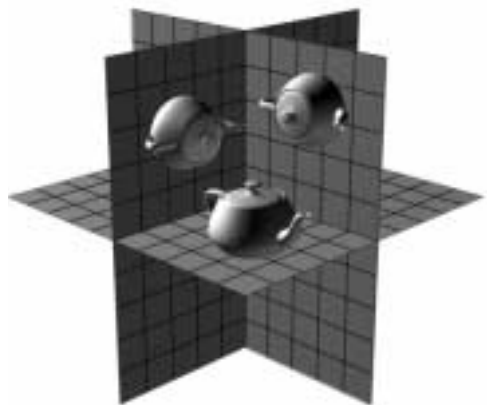

Figure 2.4 The home grid consists of three intersecting grids. Creating objects on different grids orients them to different directions in space.

Most objects that you create in 3ds max start out as **_parametric objects_**. Parametric objects are mathematically defined forms that you give exact size and proportion by assigning numerical values called **_parameters_**. Objects that define basic geometric forms are known as **_parametric primitives_**, or simply **_primitives_**.

Non-parametric objects are created by converting them from parametric objects or by building them from smaller components. Rather than being defined by mathematical equations, non-parametric objects are defined by explicit descriptions of each of their parts. Most non-parametric objects include built-in commands for editing their structures. Such objects are called **_editable objects_** in 3ds max.

All commands for creating objects are found in the tab panels and drop-down menus of the Create command panel (**Figure 2.5**). For your convenience, 3ds max provides shortcuts to some of these commands:

● **Create menu** (**Figure 2.6**). Organized by object type, contains shortcuts to nearly all of the object creation commands in a series of flyout menus.

● **Primitives quad menu** (**Figure 2.7**). Contains shortcuts to the most commonly created primitives. Access this menu by Ctrl + right-clicking in any viewport.

● **Reactor panel**. Contains advanced objects for simulating complex physical phenomena (**Figure 2.8**). Found on the left-hand side of the user interface, this panel may be dragged by its upper edge and closed when not in use.
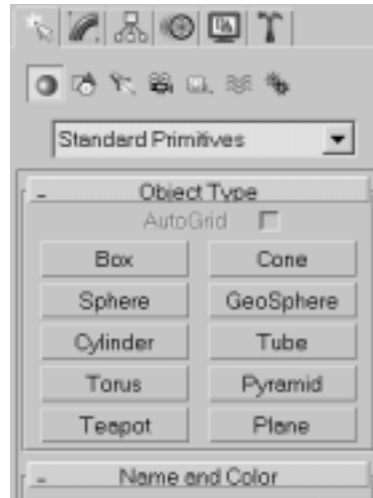
Figure 2.5 The Create command panel contains the object creation commands.
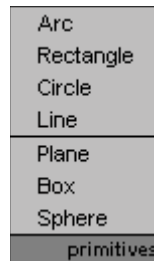
Figure 2.6 The Create menu contains shortcuts to most of the object creation commands.
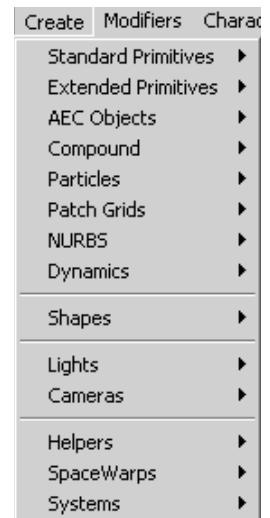
Figure 2.7 The primitives quad menu contains short-cuts for creating the most commonly used primivies.

Figure 2.8 The Reactor panel contains shortcuts to commands for creating simulations of physical phenomena.

To create an object by clicking and dragging:

1. In the Create panel, click the button for the object you want to create.

   The creation rollouts for the object appear (**Figure 2.9**).

2. Choose an option from the Creation Method rollout, or simply use the default.

3. In the Perspective viewport, click and drag across the grid to create the base of the object. Release the mouse button when the base is the right size (**Figure 2.10**).

4. If the object is not complete, move and click to set other parameters as needed.

5. In the Parameters rollout, adjust the parameters of the object by entering new values into the input fields or by dragging their spinners.

   The object updates in the viewport interactively (**Figure 2.11**).

6. Right-click in any viewport to exit object-creation mode.

The Utah Teapot

Students often ask me why the Teapot object is included among the Standard Primitives. After all, how many forms are based on teapots? It all started in the 1970s at the University of Utah when a computer graphics researcher named Martin Newell created an elegant wireframe model of a teapot. His colleague, James Blinn, used the teapot to experiment with methods of surface rendering. Soon, so many people were making reflecting teapots that the "Utah Teapot" became immortalized as a symbol of the field.
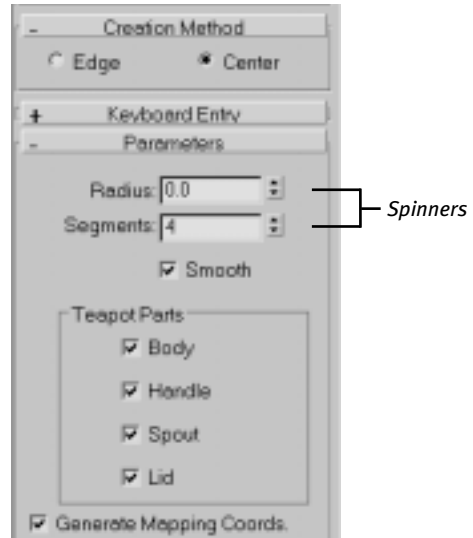

Spinners

Figure 2.9 The teapot creation rollouts.

Figure 2.10 The quickest way to create a mesh object is to click and drag.

Figure 2.11 Increasing the value of the Radius parameter increases the size of the teapot.

To create an object using the keyboard-entry method:

1. Activate the Perspective viewport.

2. In the Create panel, click on the button for the object you want to create.

3. Open the Keyboard Entry rollout, and enter the dimensions of the object.

    If you want to position the object in a place other than the origin, enter location coordinates for X, Y, and Z as well.

4. Click Create (**Figure 2.12**).

5. Adjust the creation parameters in the Parameters rollout of the Create panel or the Modify panel (**Figure 2.13**).

◎ Tip

✔ You can create as many objects as you like by clicking the Create button repeatedly. Or you can change the settings a little each time to get variations on a theme (**Figure 2.14**).

Disappearing Parameters

Beginners are often surprised when their creation parameters disappear. This usually happens when they click in a viewport and inadvertently start creating another object.

As long as a newly-created object remains selected, its parameters will appear in the Create panel. Once the object is deselected, you access its parameters in the Modify panel. To do so, click the Modify tab and then click the object to reselect it. The creation parameters reappear. Now you can adjust them as much as you like.
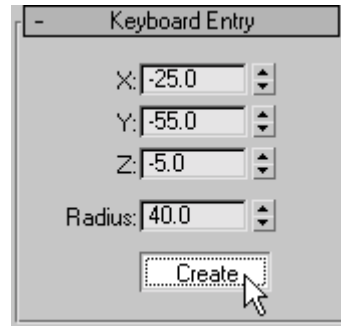
Figure 2.12 After entering the location and dimensions of an object, click Create.
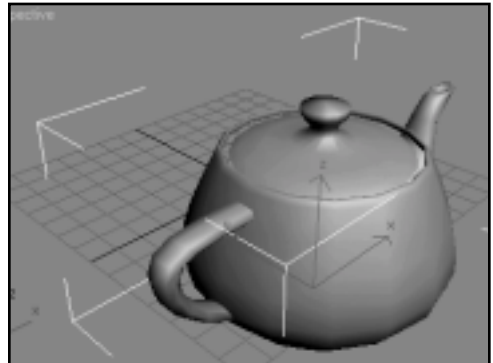
Figure 2.13 Increasing the number of segments makes the teapot object appear smoother.
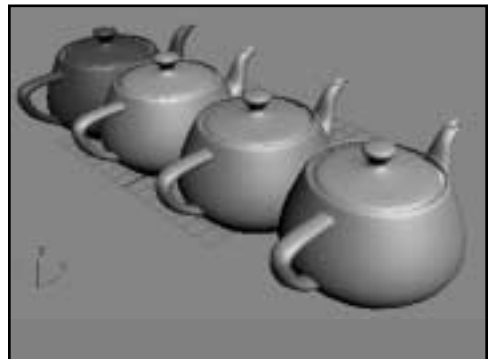
Figure 2.14 You make variations on a theme by changing settings before you click Create.

3ds max automatically assigns names to objects based on the object type and the order in which it was created. For example, the first, second, and third sphere that you create will be named Sphere01, Sphere02, and Sphere03. After you create your objects, it is helpful if you assign more descriptive names so you can identify them quickly when your scene becomes more complex.

3ds max also assigns colors to objects as you create them. By default, color assignment is random, but you can change the color of objects after they are created, or set an option so that all objects are assigned the same color.

## To assign a name and a color to an object:

1. Create an object, or select an existing object by clicking on it.

2. In the Create panel, highlight the name of the object in the Name and Color rollout (**Figure 2.15**). Then enter a new name.

3. Click on the color swatch located just to the right of the name field.

   The Object Color dialog box appears (**Figure 2.17**).

4. Click on a swatch to pick color, and click OK.

    The object changes to the new shade.

5. To assign the same color to objects as you create them, uncheck Assign Random Colors in the Object Color dialog box.

6. To assign the same color to existing objects, click and drag a selection region around them before picking a color (**Figure 2.18**). Note that you cannot assign a name to a multiple selection.
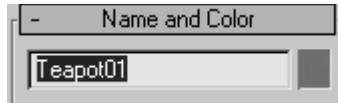
Figure 2.15 Highlight the name of the object.
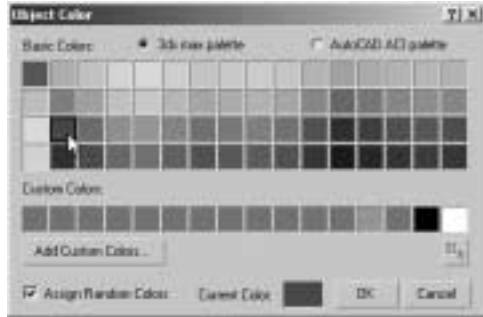
Figure 2.16 Pickia color from the Object Color dialog box.
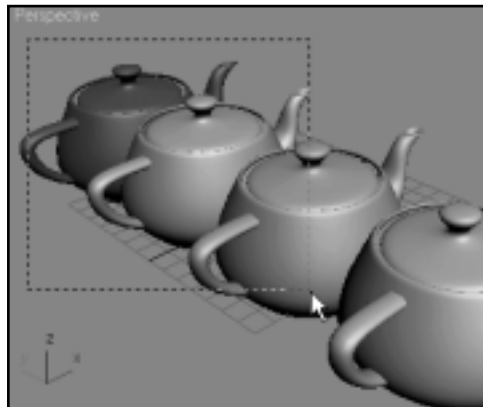
Figure 2.17 Selecting a group of objects by dragging a selection window around them.

About Mesh Objects

Mesh primitives come in two varieties: *Standard Primitives,* which include basic geometric forms, and *Extended Primitives*, which are more complex objects. By clicking on different object types, you can quickly create objects from predefined forms.

The components of a mesh object include:

Vertices   point locations in space.

Edges   lines that connect vertices.

Faces   triangular surfaces bounded by 3 edges and 3 vertices.

Surface normals, or *normals* for short, are vectors that stick straight up from the center of each face. By indicating which direction each face is "facing." they help the progarm determine which side to render and what value, based on current lighting conditions, to shade the face (**Figure 2.18**).

Smoothing creates gradations of value across mesh surfaces by averaging the intensity of light between vertices. The more vertices that are present, the subtler the gradations will be, and the smoother the mesh surface will appear (**Figure 2.19**).

In the next few pages, I'll show you how to create objects using the click and drag method. After you master this simple technique, try creating a few objects with the keyboard entry method to see what this approach has to offer.

Vertex   Face   Normal   Edge
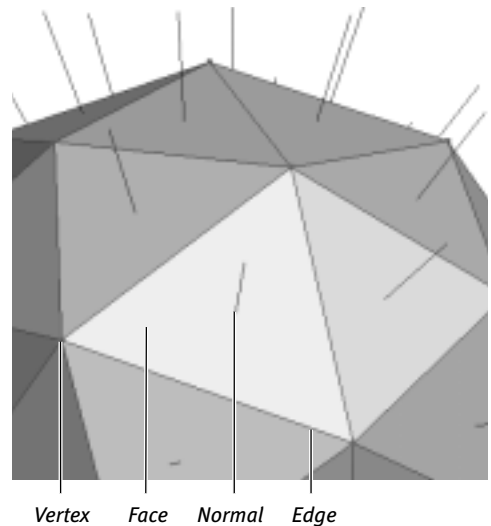
Figure 2.18 Mesh objects are made up of vertices, edges and faces. Surface normals in the middle of each face determine which side of the face is rendered.

Figure 2.19 When a mesh object is smoothed, edge divisions disappear. Above: a teapot with unsmoothed faces. Below: a teapot with smoothed faces.

Creating Standard Primitives

There are ten Standard Primitives in 3ds max 6: the Box, Cone, Sphere, GeoSphere, Cylinder, Tube, Torus, Pyramid, Teapot, and Plane (**Figure 2.20**).

Standard Primitives are found in the Geometry branch of the Create panel, which is "on deck" when you start the program (**Figure 2.21**). Shortcuts to these commands are located in the Create menu.

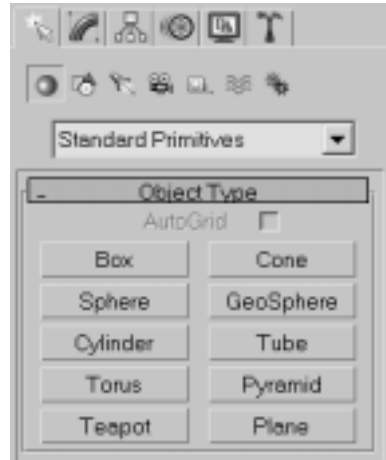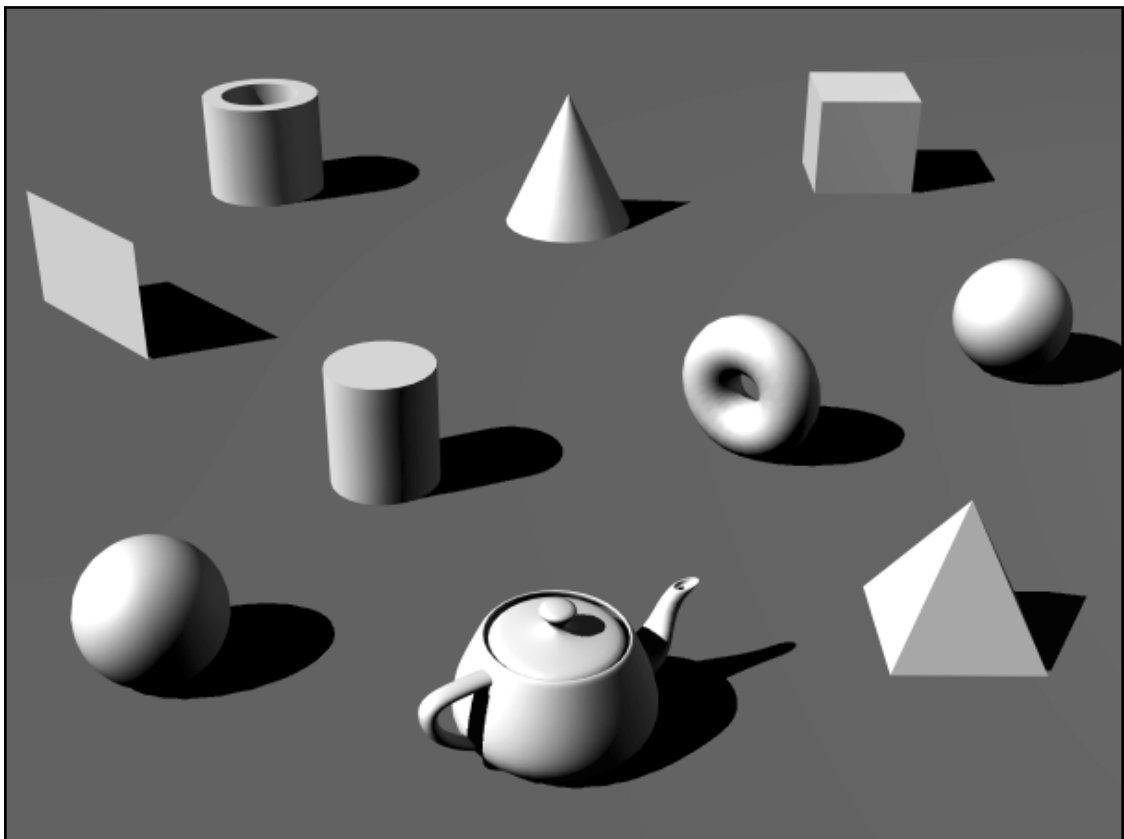Shortcuts to the most commonly used primitives are found in the primitives quad menu, as described on page 33.

Figure 2.21 Standard Primitives are located in the Geometry branch of the Create panel.

**Figure 2.20** Standard Primitives are used to make basic geometric forms.

To create a sphere:

1. In the Create panel, click Sphere.
   The Sphere creation rollout appears
   (**Figure 2.22**).

2. In the Perspective viewport, click and drag a
   sphere of any size (**Figure 2.23**).

3. Release the mouse button to set the radius.

◉ Tips

✔ To make a round object appear smoother,
  increase the Sides parameter. To make the
  object appear faceted, uncheck Smooth.

✔ To make a sphere sit on top of the grid,
  check Base to Pivot. This moves the pivot
  point of the object to its base.
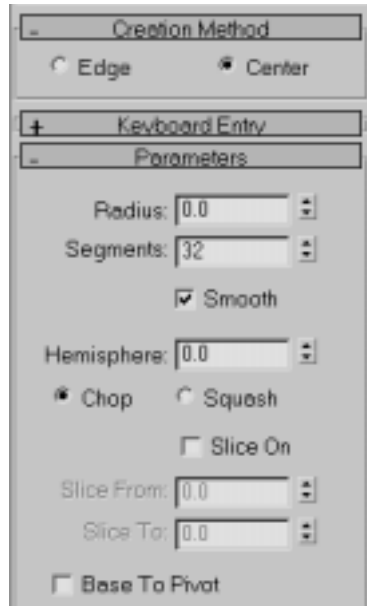
**Figure 2.22** The main parameter of a
Sphere is its Radius.

Low-Poly Objects

Low-polygon count objects, or "low-poly
objects," are the lifeblood of interactive
applications like 3D games. Because they
have fewer faces, low-poly objects can be
redrawn more quickly than other objects.

With a GeoSphere, you can easily create
low-poly spheres, such as a tetrahedra,
octahedra or icosahedra (above).

To find out how many faces there are in an
object, select the object, and press 7. This
toggles the display of the Polygon Counter,
which appears in the upper-left corner of the
active viewport.
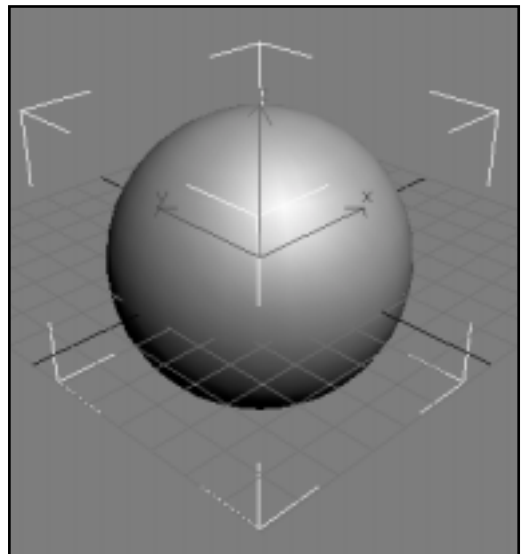
Figure 2.23 Click and drag to create the sphere.
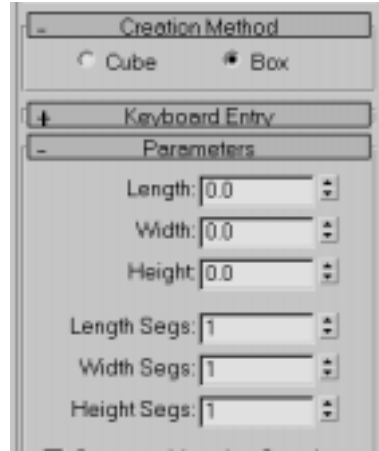
To create a box:

1. In the Create panel, click Box.

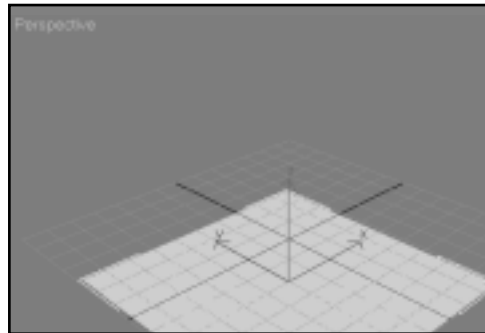   The Box creation rollout appears (**Figure 2.24**).

2. In the Perspective viewport, click and drag across the grid to form the base of the box.

3. Release the mouse button to set the length and width of the box (**Figure 2.25**).

4. Without clicking, move the cursor upward in the viewport.

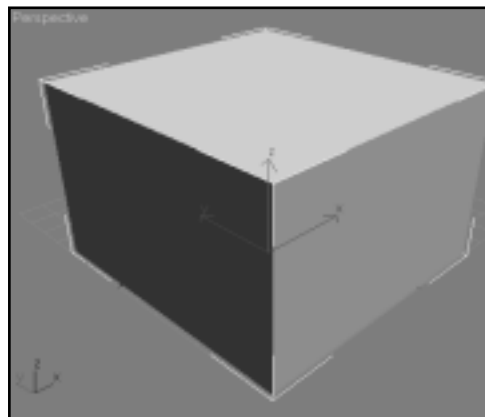5. Click to set the height (**Figure 2.26**).

◎ Tips

✔ Planes are simple to create. You just click and drag to set the length and width, as in step 2.

✔ To create a box that hangs below the grid plane, move the cursor downward in step 4.

✔ To create a box with equal sides, choose Cube in the Creation Method rollout.

Figure 2.24 A box has inputs for length, width, and height.

Figure 2.25 Drag to set the length and width.
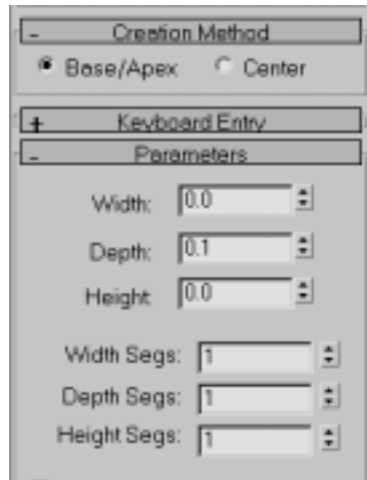
Figure 2.26 Move and click to set the height.
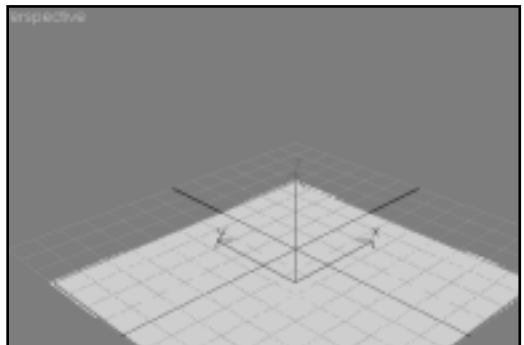
To create a pyramid:

1. In the Create panel, click Pyramid.
   The Pyramid creation rollout appears
   (**Figure 2.27**).

2. In the Perspective viewport, click and drag
   across the grid to form the base of the
   pyramid.

3. Release the mouse button to set the width
   and depth of the base (**Figure 2.28**).

4. Without clicking, move the cursor upward in
   the viewport.

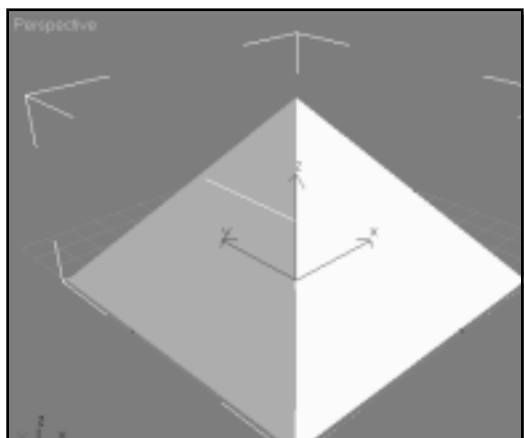5. Click to set the height (**Figure 2.29**).

◎ Tips

✔ To create a square base for a box, plane, or
   pyramid, hold down the Ctrl key as you drag
   out the base. In this method, the first click
   sets the center of the base, and dragging
   causes the base to grow equally in all direc-
   tions.

✔ To increase the number of divisions in a box,
   plane, or pyramid, increase the segment
   parameter values.

Figure 2.27 A pyramid has width and
depth as well as height.

Figure 2.28 Drag to set the base of the pyramid.

Figure 2.29 Move and click to set the height.

Cylinders have a radius and a height. Cones, torii, and tubes have two radii and a height..

To create a cylinder:

1. In the Create panel, click Cylinder.

   The Cylinder creation rollout appears (**Figure 2.30**).

2. In the Perspective viewport, click and drag the base of the cylinder. Release the mouse button to set the radius (**Figure 2.31**).

3. Without clicking, move the cursor up in the viewport.

4. Click to set the height (**Figure 2.32**).

◎ Tip

✔ To slice a radial object like you slice an apple, check Slice. Then set the beginning and end of the slice in degrees of arc by entering Slice From and Slice To values.

Slicing a Pie

Using the keyboard entry method, you can create and slice mulitple cylinders that fit together like the pieces of a pie.
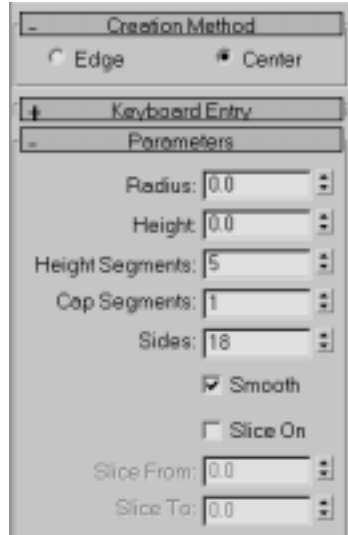
Figure 2.30 A cylinder has a radius and a height. It can also be sliced.
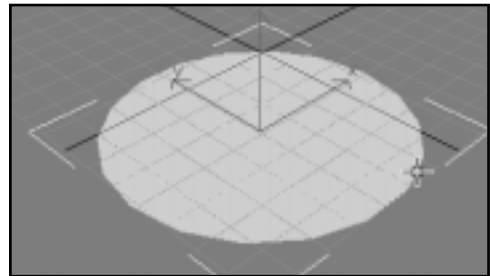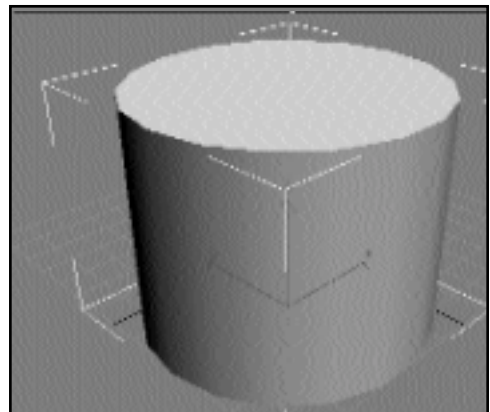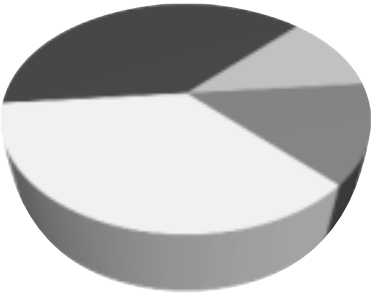

Figure 2.31 Drag outward to set the radius.

Figure 2.32 Drag upward and click to set the height.

A cone is created in the same manner as a cylinder, with two additional steps at the end.
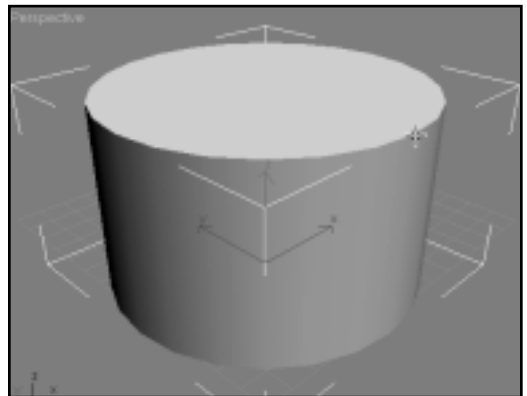
To create a cone:

1. In the Create panel, click Cone.

   The Cone creation rollout appears (**Figure 2.33**).

2. In the Perspective viewport, click and drag the base of the cone. Release the mouse button to set the base radius (**Figure 2.34**).

3. Without clicking, move the cursor up in the viewport.

4. Click to set the height (**Figure 2.35**).

5. Without clicking, move the cursor down to establish the radius for the top.

   If you want to close up the point at the top of the cone, drag downward from the top until it closes up.

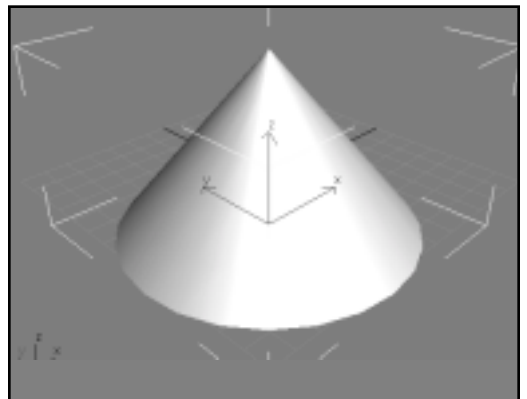6. Click to set the radius of the top (**Figure 2.37**).

◎ Tip

✔ You can make the radius of the top wider than the radius of the base by dragging upward in the viewport in step 6.
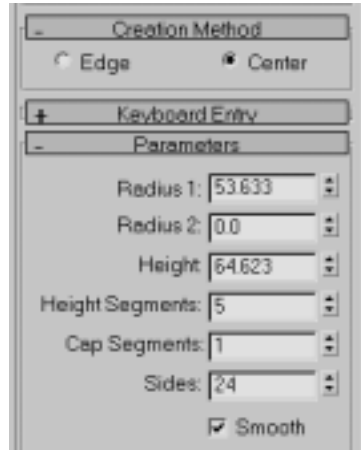
Figure 2.33 A cone has two radii.

Figure 2.34 AFter dragging out the base, drag upward to set the height.

Figure 2.35 Move down and click to complete the top.

The second radius of a torus defines the thickness of its cross section.

To create a torus:

1. In the Create panel, click Torus.
   The Torus creation rollout appears (**Figure 2.36**).

2. In the Perspective viewport, place the cursor where you want the center of the torus to be. Then click and drag outward.

3. Release the mouse button to set the first radius (**Figure 2.37**).

4. Without clicking, move the cursor back toward the center of the torus.

5. Click to set thickness of the torus (**Figure 2.38**).
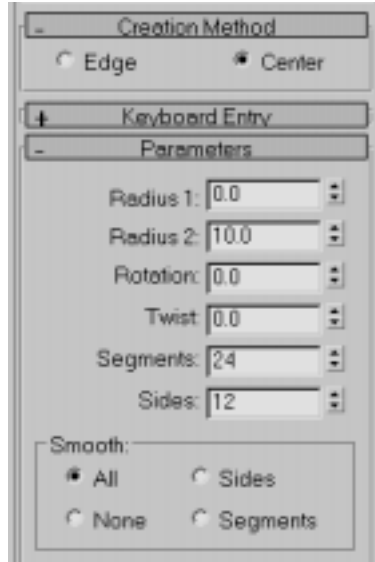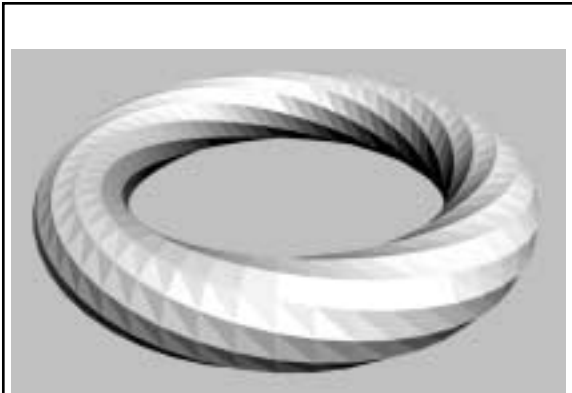

Figure 2.38 A torus has two radii.

Fun with Parameters

If you take a closer look at some of the object creation parameters, you will find that you can make a lot of interesting variations. For example, this torus was created by setting Twist to 360, Segments to 54 and Smooth to None.
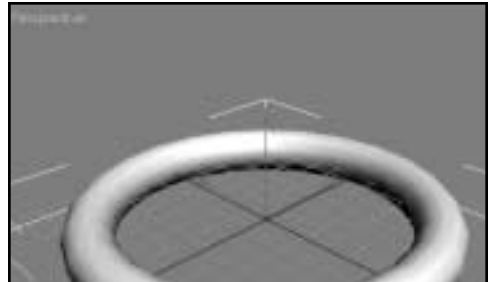

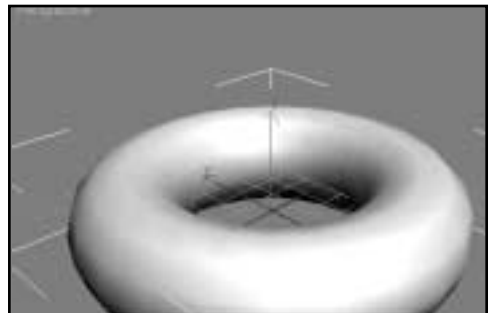**Figure 2.39** Drag outward to set the first radius.

Figure 2.40 Drag inward to set the second radius.

A tube has an inner and outer radius, as well as a height.

To create a tube:

1. In the Create panel, click Tube.

    The Tube creation rollout appears (**Figure 2.39**).

2. In the Perspective viewport, place the cursor where you want the center of the tube to be. Then click and drag outward.

3. Release the mouse button to set the first radius (**Figure 2.40**).

    This will be the outer wall of the tube.

4. Without clicking, move the cursor back toward the center of the tube.

5. Click to set the second radius (**Figure 2.41**).

    This defines the inner wall of the tube.

6. Move the cursor up in the viewport. Then click to set the height (**Figure 2.42**).
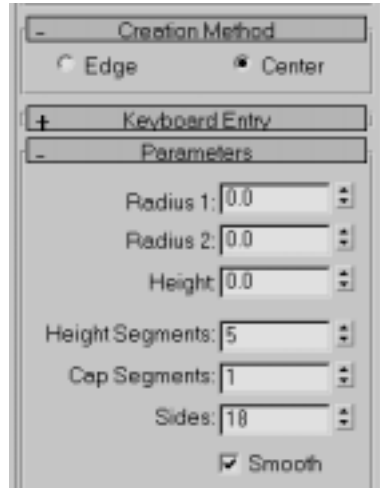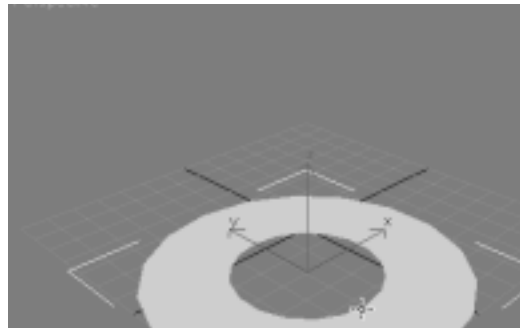

Figure 2.39 A tube has two radii and height.

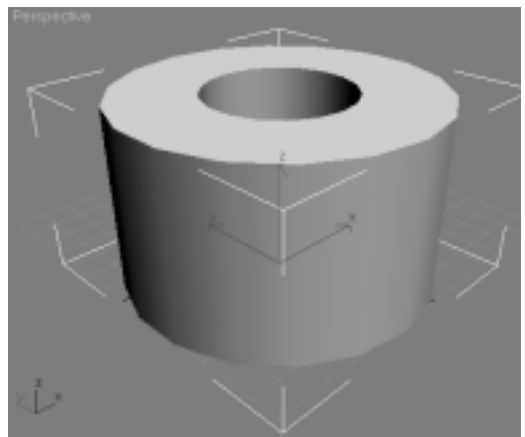**Figure 2.40** Drag inward to set the second radius.

Figure 2.41 The completed tube.