Chapter 8: Transforms - Move, Copy, Rotate, Scale

Transforms change the location, rotation, number and shape of whole objects by moving, mirroring, arraying, rotating, scaling, shearing, twisting, bending, and tapering. The transform commands do not break the objects into pieces or cut holes in them.

Note: For all of the following exercises, the images were captured using Shaded mode display.

Move

Use the Move command when you want to move an object a certain distance or if you want to use object snaps to place an object accurately.

Move objects using distance values
The Move command requires a from and to location.
You can pick these locations on the screen or type coordinates at the command prompt.

Practice moving objects

The object of this exercise is to move an object from a specific location on the object to a location in the coordinate system.

1. Start a new model using any template.
2. Draw a Sphere of any size anywhere on the screen.
3. Select the sphere.
4. Start the Move command.
5. At the **Point to move from** prompt, with the **Cen** object snap on, move the mouse around the edge of the sphere until the **Cen** tooltip displays and click.

6. At the **Point to move to** prompt, type **0,0,0**. The sphere moves to the **0,0,0** coordinate point.

**Tip:** Simply typing **0** is a shortcut for the coordinates **0,0,0**.

**Move objects by dragging**

The quickest way is to click the object and drag it. Rhino provides tools for making dragging objects accurate. You can drag objects in any viewport. Object snaps will help align objects to each other.

**Practice dragging objects**

1. Open the tutorial model **Drag Objects.3dm**.
2. In the **Osnap** control, turn on the **Cen** (Center) object snap.
3. In the **Perspective** viewport, click the cone at the bottom edge and pause until the **Cen** object snap tooltip displays.

4. Drag the cone until the center of the cone's base lines up with the top surface of the cylinder and the **Cen** object snap for the cylinder's top face displays.

5. Release the mouse button to place the cone.

6. In the **Front** viewport, drag the cone to the top of the cylinder. Watch what happens in the **Perspective** viewport.

   There are many times when you have to watch what is happening in other viewports to accurately place your objects.

**Elevator mode**

You can press the **Ctrl** key to move objects in the z-direction. This is called **elevator mode**. **Elevator mode** is like **Ortho**, except the movement is vertical to the active construction plane.

To practice using the **Ctrl** key to move vertically, you are going to move the box to a location 5 units above the center of the sphere. Using elevator mode to move objects vertically lets you work more in the **Perspective** viewport.
Move the box vertically

Note: For the following images, Shade-highlight selected surfaces and polysurfaces has been turned on. (Options > View > Display Modes > Shaded > Objects > Selection)

1. Turn Ortho off.
2. On the Transform menu, click Move.
3. In the Perspective viewport, rotate the view so the sphere is toward the front, and select the box.

4. At the Point to move from... prompt, turn on the End object snap and click a corner of the box.
5. At the **Point to move** prompt, turn on the **Cen** object snap, hold down the **Ctrl** key, and click the center of the sphere.

6. Release the mouse button and the **Ctrl** key and start to drag the box. The box can now move only up and down in the z-direction.

7. At the command prompt, type 5. The box will be placed with the selected corner 5 units in the z-direction from the center of the sphere.
Copy

The **Copy** command makes copies of objects. Some transform commands like **Rotate**, **Rotate3D**, and **Scale** have a **Copy** option. This lets you create a copy of the object as you rotate or scale it.

**Practice copying objects**

1. On the **Transform** menu, click **Copy**.
2. In the **Perspective** viewport, use a crossing window to **Select** the cone and the cylinder.
3. At the **Point to copy from** prompt, click anywhere in the **Top** viewport.

4. At the **Point to copy to** prompt, click where you want the first copy. Zoom in or out if you like.

5. At the next **Point to copy to** prompts, click other places to make some copies of the box. When you have enough copies, press **Enter** to end the command.
**Rotate**

The **Rotate** command rotates an object in relation to the construction plane around a center point.

**Rotate an object**

1. Open the tutorial model **Rotate-Scale.3dm**.

2. On the **Transform** menu, click **Rotate**.
3. In the **Top** viewport, select the green half-cylinder as shown in the illustration below.
4. At the **Center of rotation**... prompt, with the **End** object snap on, click the lower left corner of the box.

5. At the **Angle or first reference point**... prompt, check to see that **Ortho** is turned on, drag the cursor to the right and click.

6. At the **Second reference point**... prompt, toggle **Ortho** on or off depending on whether you want to rotate the box in 90-degree increments or to rotate it freely.
7. Drag the cursor up to rotate the box as shown in the illustration below, and click.
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Scale

The Scale commands give you control over the direction of the scale. You can re-size objects uniformly in one, two, or three directions, or scale an object with a different scale factor in each direction.

Scale the prism

1. Select the prism shape.

2. On the Transform menu, click Scale, and then click Scale 3-D.

3. At the Origin point... prompt, click the corner of the prism as shown in the illustration below.

The origin point is the base point from which the object will be scaled. It is like an anchor point. The object will grow or shrink around this point.

To scale an object, you must first show an original size, and then show a new size. Drag the cursor and click another point on the object to show the original size, and then drag the cursor and click again to show the new size.
4. At the **Scale factor or first reference point** prompt, click the corner of the prism as shown in the illustration below.
This establishes the first reference point.

5. At the **Second reference point** prompt, drag the cursor.
The object grows the amount you drag the cursor.
6. Click to set the second reference point.

**Enter a number to set the scale factor**
- To make the object twice its original size, at the command prompt, type **2**.
- To make the object half its original size, at the command prompt, type **.5**.

**Scale an object to a specific size**
- To make the prism in this example 2.35 units along the original side, at the **Second reference point** prompt, at the command prompt, type **2.35**.
Mirror

In this exercise, you are going to practice another basic editing command: **Mirror**. The **Mirror** command makes a reverse-image copy of the object. Objects are mirrored across a line that you draw in a viewport.

**Mirror an object**

1. Open the tutorial model **Mirror Objects.3dm**.

2. On the **Transform** menu, click **Mirror**.

3. On the status bar, turn **Ortho on**.

4. **Select** the object.
5. At the **Start of mirror plane...** prompt, in the **Top** or **Front** viewport, click to the right of the face as shown in the illustration below.

6. At the **End of mirror plane...** prompt, drag the line toward the bottom of the screen, and click to end the mirror line.
**Array**

The **Array** commands copy objects into evenly spaced rows and columns or around a circle.

**Orient**

The **Orient** commands combine move or copy, scale, and rotate operations to help you position and size objects in one command.