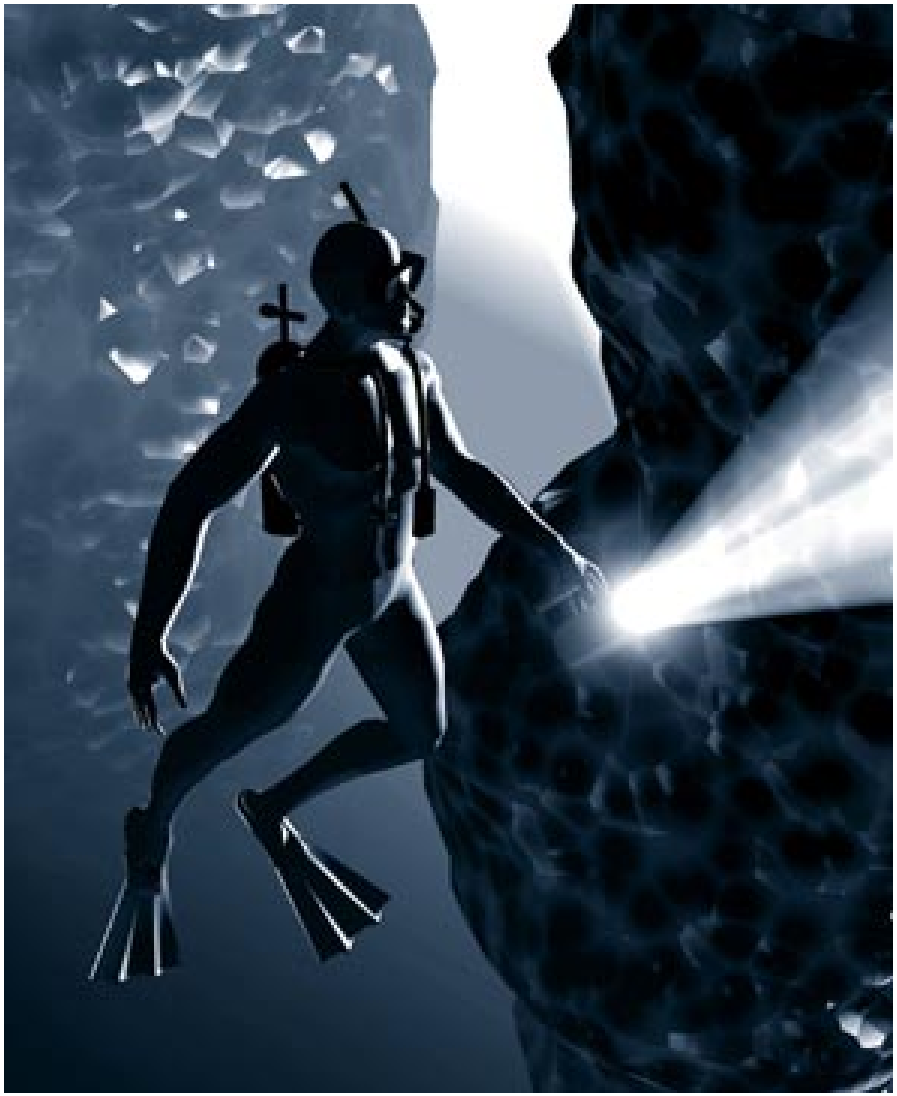


12

Arranging Objects

Overview

This chapter describes the 3D workspace displayed in the **Perspective** window (where you build your scene). It also covers the different ways of moving and arranging your objects.

All arrangement procedures take place in the **Perspective** window.

The Workspace

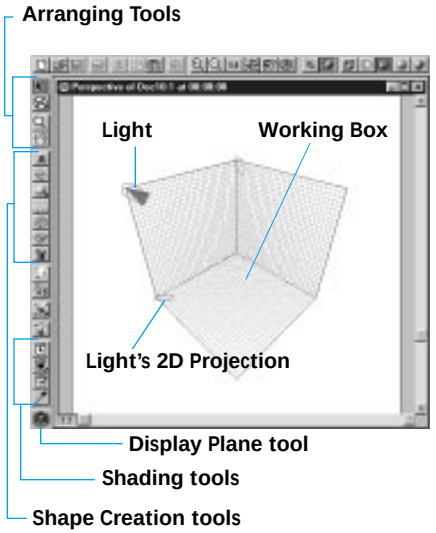
The Universe

Ray Dream Studio 5's three-dimensional workspace is called the **universe**. The universe is where all objects are displayed, assembled and manipulated. By default, Ray Dream Studio opens new scenes with one light and one camera in the universe. This camera provides the view of the scene universe shown in the **Perspective** window.

Ray Dream Studio uses a coordinate system called the **Cartesian** coordinate system to reference positions in the universe. A triplet of unique coordinates (x, y, z) is associated with each individual position in the universe.

The maximum volume of the universe is a 3.32 kilometer cube. On the other end of the scale, the minimum dimension of an object is 0.006 millimeters. You can specify your object sizes in the measurement unit of your choice as long as they stay within that range. In a practical sense, only the region of the universe where objects exist is part of your scene.

The grids displayed in the **Perspective** window describe faces of a cube called the **working box**. The working box is a visual reference of the global universe and a tool to help you manipulate objects. You'll find out more about the working box later in this chapter.



The Perspective window contains many features to allow you to display and view your images.

The Arranging Tools

The **Arranging** tools let you perform every basic operation (alignment, orientation, positioning) by dragging in the **Perspective** window. These tools are located in the upper or left-most part of the toolbar.

To select a tool, click its icon or use press its keyboard shortcut.

The mouse pointer takes on a distinctive cursor shape that depends upon the tool chosen.

Selection Tool (Shift-T)

Use the **Selection** tool to select, move or resize 3D objects, 2D projections and groups of objects.

Double-click on an object to open it in the modeling window. Double-click on a group to jump into it.

Virtual Trackball Tool (Shift-V)

Use the **Virtual Trackball** tool to orient selected objects in 3D space.

Rotation Tool (Shift-Q)

Use the **Rotation** tool to rotate an object in 2D along one of the working box planes.

The Viewing Tools

The viewing tools let you change scale and navigate the display, which helps when arranging objects.

Zoom tool

Use the **Zoom** tool to magnify the view in the **Perspective** window.

You can press **Command-Spacebar**/**Ctrl+Spacebar** to temporarily choose the **Zoom** tool. When you release the keys, the previous tool returns.

Note: The **Zoom** tool and **Zoom** pop-up only enlarge the view displayed in the **Perspective** window. They do not move the camera that provides the view of the scene.

To zoom in and out:

Click once to magnify the window's view by a factor of two.

Hold down the **Option**/**Alt** key and click to zoom back out.

To magnify a specific area of the scene:

Drag a marquee around it. Ray Dream Studio magnifies the selected area to the closest corresponding zoom level.

To set a specific magnification:

Use the **Zoom Level** pop-up, located in the bottom left corner of the window, to choose a magnification level.

Hand Tool

Use the **Hand** tool to pan around the window. Drag the area you want into view.

You can press the **Spacebar** to temporarily choose the **Hand** tool. When you release the **Spacebar**, the previous tool returns.

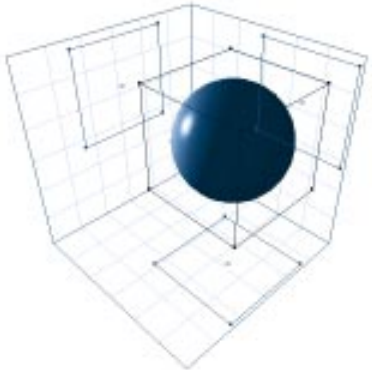
Alternatively, you may use the window scroll bars to pan the view.

The Working Box

The working box appears in the **Perspective** window as three intersecting grids, like three sides of a box. These grids are a visual reference for the dimensions of the universe.

When you open a new scene, the "floor" might be the only plane visible. You can change display of the working box to show none, one, two or all three of its grid planes.

The working box planes show projections (like shadows) for the objects in the scene. These projections help you see which objects are "farther away," "higher" or "tilted," and help you move the objects into the positions and orientation you want.



The working box consists of grids which can be used as a visual reference in the universe.

By default, the working box is centered on the origin (0, 0, 0 of the universe) and aligned with the axes of the universe. The lines where the grid planes meet show the x, y and z dimensions of the universe.

The working box is moveable, though, so you can set it at different angles and move it away from the origin. A number of useful operations require you to move the working box into position first.

If you like, you can think of the working box as a three-dimensional ruler that helps you bring objects together more easily and accurately.

Changing Display of the Grid Planes

By default, only one of the grid planes is visible when you first launch the program. You can customize the display of the working box to display any, all, or none of the grid planes for all sessions by setting the **Plane Display** button.

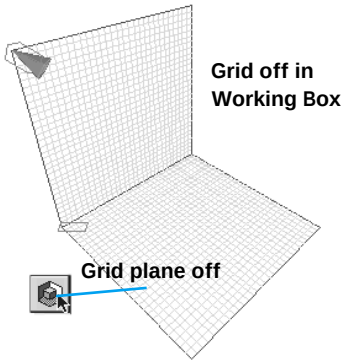
Use the Plane Display tool to toggle the grid planes on and off.

The **Plane Display** tool is the only tool in the **Planes** toolbar. It has four active areas: the three planes and the object preview.

To display or hide a working box plane:

Click on the plane you want to show or hide to toggle it on or off. Shaded planes are displayed; white ones aren't.

The object preview, represented by the cube at the center of the **Plane Display** button, allows you to toggle display of the object preview.



Click on the grid plane to turn the sides of the working box on and off.

The Active Plane

The active plane is the plane of reference used when dragging objects in the **Perspective** window and for other positioning operations. The working box shows the active plane in a different color from the other two. The **Plane Display** tool identifies the active plane by displaying it in blue.

You can set the active plane to control your next series of operations.

To change the active plane:

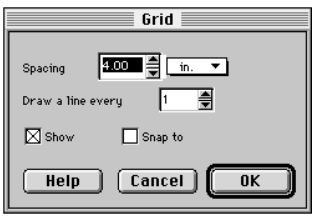
Hold down the **Option**/**Alt** key and click on the plane you want active in the **Plane Display** tool.

Changing Grid Options and Color

The working box's grid can be used for estimating real world size, or positioning objects.

To set grid options:

1. Choose **View menu▸ Grid** or press **Command-J**/**Ctrl+J**. The **Grid Settings** dialog appears.



Use the Grid Settings dialog to set the grid increments.

2. Enter a **Spacing** amount to set the grid increment. You can type in a value or click the increment/decrement buttons. You can also drag the increment button up or drag the decrement button down to move quickly to a new value.

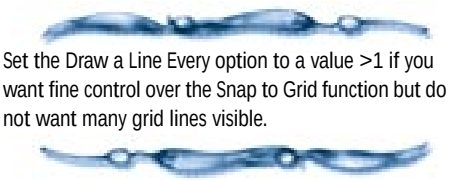
   The **Spacing** increment is used for "nudging" (moving an object with an Arrow key).

3. Choose a unit from the pop-up.

The unit you choose should make sense for the scene you are building. For example, if you're creating a building, one foot or meter should provide enough accuracy for most operations.

4. Change the **Draw Line Every** value to control how many grid lines are drawn.

   The value sets the number of increments between grid lines. When the setting is 1, the increment and displayed grid correspond directly.



Set the Draw a Line Every option to a value >1 if you want fine control over the Snap to Grid function but do not want many grid lines visible.

5. If you want to hide the grid lines, disable **Show Grid**.

   When **Show Grid** is disabled, only the edges of the planes are shown.

Note: Even if the **Show Grid** option is not selected, object hot points will snap to the grid if **Snap to Grid** is selected.

6. Enable **Snap to Grid** if you want objects to "jump" to the nearest grid increment when you drag them.

Note: The hot point of the object, not the edge of the projection, snaps to the grid.

Working Box Properties

To change working box properties:

1. Choose the **Selection** tool.

2. Choose **Windows menu▸ Properties**. The the **Properties** palette appears.

3. Hold down the **Command**/**Ctrl** key and click on the working box grid.

   The **Properties** palette updates to show the working box properties.

   - The **General** tab contains controls for the plane display colors and grid options.
   - The **Transform** tab contains controls for working box size, orientation, and position in the universe.

You can set your preference for the size and colors of the working box in new documents in the **File menu▸ Preferences dialog**: **Perspective and Colors panels**.

Changing the Position and Attitude of the Working Box

It is possible to move and orient an object anywhere in the universe without making any adjustment to the working box. However, using the working box can simplify many types of arrangement operations.

You can set the attitude of the working box for a particular arrangement operation, or set of operations. For example, to make orienting objects on an angle easier, you can reset the angle of the working box, then "slide" an object down the slope of the active plane. This is just one example. You'll find a number of ways to take advantage of the working box.

After each operation, you'll need to move or re-orient the working box for the next task.

Moving the Working Box

There are several ways to orient the working box: Rotate it with the **Virtual Trackball**, send it to another coordinate system or set its attitude numerically.

Note: Changing the working box does not affect your existing objects. The orientation of the working box applies only to subsequent arrangement operations.

To move the working box:

1. Choose the **Selection** tool.
2. Hold down the **Command**/**Ctrl** key and drag the working box.

To resize the working box:

1. Choose the **Selection** tool.
2. Hold down the **Command**/**Ctrl** key and drag a corner of one of the grid planes.

To orient the working box with the Virtual Trackball:

1. Choose the **Virtual Trackball** tool.
2. Hold down the **Command**/**Ctrl** key and drag on the working box grid.

   The working box revolves about its center as you drag.

To position or orient the working box numerically:

1. Choose the **Selection** tool.
2. Hold down the **Command**/**Ctrl** key and click the working box to select it.

   "Handles" appear at the working box corners when it is selected.
3. Choose **Windows menu▸ Properties**.
4. Choose **Properties palette: Transform tab**.

   The transform properties include **Position**, **Orientation** and **Size** controls.
5. Choose the coordinate system you want from the **System** pop-up.

   In most cases, you'll move the working box in relation to the global universe.
6. Use the **Position** controls to set the Center x, y, z position values for the center of the working box.
7. Use the **Orientation** controls to set the yaw, pitch, and roll values to orient the working box.
8. Use the **Size** (Scaling) controls to change the dimensions of the working box.
9. Click **Apply** to make the changes.

To align the working box to an object or group:

1. Select an object or group.
2. Choose **Arrange menu▸ Align Working Box**.

   Ray Dream Studio sets the working box planes parallel to the sides of the selected object or group bounding box. The coordinate systems of the working box and object (or group) are now aligned.

The **bounding box** is the smallest box that encloses an object or group of objects. Bounding boxes appear around objects that are selected.

To align the working box on gravity

1. Hold down the **Command**/**Ctrl** key and click the working box to select it.
2. Choose **Arrange menu▸ Align▸ On Gravity**. You'll find a description of this command in "Special Orientation Features" on page 243.

To send the working box to a position:

You can send the Working Box to a particular position. The position may be determined by the Global Universe or an Object/Group bounding box.

1. If you want to send the working box to an object or group, select that object or group.

2 Choose **Arrange menu▸ Send Working Box To▸** and select the position you want: **Global Universe**, **Local Universe**, or **Selection**—if you have one.

Global Universe The Working Box moves to align its origin with the origin of the global universe.

Local Universe This option is available only when "Jumped Into" a group. The Working Box moves to align its origin with the center of the group bounding box.

Selection This option is available only when an object or group is selected. The Working Box moves to align its origin with the center of the object or group bounding box.

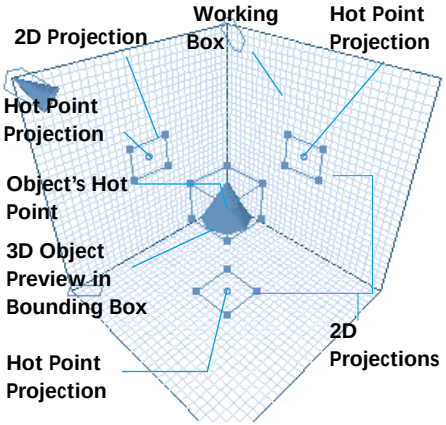
In all cases, the working box is resized to a scale appropriate to the new position.

Objects in the Scene

Object Preview

Objects are shown in the **Perspective** window by a preview. The display is called a preview because the level of detail is below that of the final rendering.

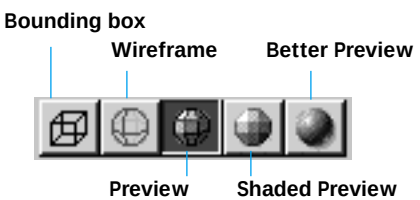
In all preview modes, objects create projections on the working box planes. And selected objects display their bounding boxes.



The Perspective window displays projections of objects in the form of bounding boxes.

To set the level of preview detail for all the objects in the Perspective window:

Choose **View menu▸** and select the preview mode you want. You may also click on the standard toolbar icon for the preview quality you want.

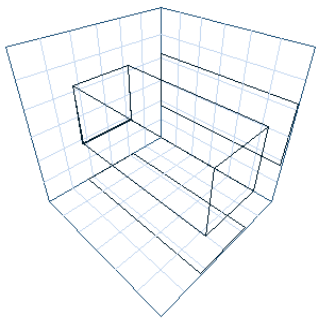


Click on one of the icons from the Rendering toolbar to change the quality of the objects in the Perspective window.

No Preview does not show the objects themselves; however, their bounding box projections still appear on the working box planes.

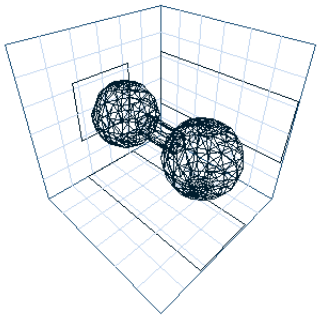
Note: There is no toolbar icon for **No Preview**.

Bounding Box displays only the bounding boxes for the objects.



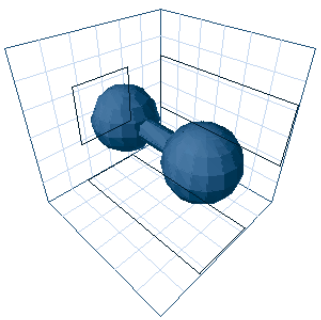
Bounding box preview example.

Wireframe displays objects as a mesh of wires.



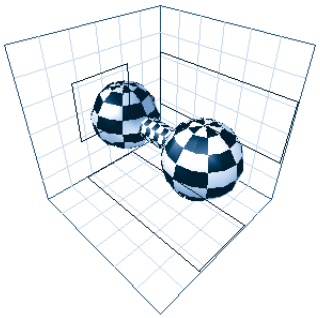
Sample object displayed in the Wireframe preview mode.

Preview displays objects with colored surfaces. Only the outlines of painted shapes are shown. The lighting is arbitrary.



Sample object displayed in the Preview mode.

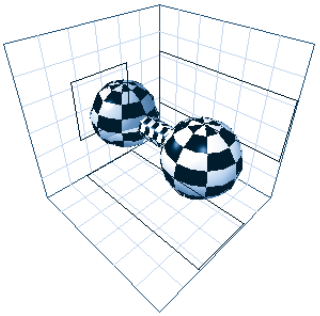
Shaded Preview displays objects using scene lighting to shade it and show its 3D shape. This display mode uses lower resolution textures and a faster shading method than Better preview.



Sample object displayed in the Shaded preview mode.

Note: Shaded Preview is the only display mode that uses QuickDraw 3D or Direct3D acceleration. For more information, refer to "Shaded Preview Preferences" on page 24.

Better Preview displays objects using ambient light and your specific light sources to show color, highlights, gel effects, and depth shading. Displays shading, texture maps, and paint regions, in detail. Provides better details of the shape and color of objects.



Sample object displayed in the Better preview mode.

Using Better Preview increases the time required to calculate and draw or redraw the Perspective window. To increase the efficiency of the application, work in Wireframe, Preview or Bounding Box mode at the outset of a project, then switch to Better Preview mode only as specific shading detail becomes more important. Use the Render Area tool whenever possible instead of switching to Better Preview.

To hide an object:

1. Select the object.
2. Choose **View menu▸ Object Visible/ Object Invisible**.

Bounding Boxes and Projections

The **bounding box** is the smallest box that encloses an object or group of objects. Bounding boxes appear around objects that are selected.

The bounding boxes of all objects, including cameras and spot lights, cast 2D profiles, called **projections**, on the planes of the working box. These projections show the object's position and orientation in relation to each of the three planes. You can drag the projection to manipulate the object with respect to that plane.

Objects may be collected to form a group. All of the positioning, scale and orientation features available for objects apply equally to groups. For more information on how to build groups, refer to "Building a Hierarchical Structure" on page 254.

Naming Objects

New objects are named by default **Type n**, where **Type** is the object description (**Free Form**, **Sphere**, **Text**, etc...) and **n** is the number of similar objects in the order created—**Free Form 1**, **Free Form 2** and so forth.

You can change the name of objects and groups. Giving objects and groups descriptive names can make them easier to locate and select.

To change the name of an object or group:

1. Select the object or group with the **Selection** tool.
2. Choose **Windows menu▸ Properties**. The **Properties** palette appears.
3. Click the **General** tab.
4. Enter a new, descriptive name.

Note: You may also select an object's listing in the hierarchy and press **Return/Enter** to change the name.

Selecting Objects

You'll select one or more objects before choosing a command.

A selected object displays its bounding box, the 2D projections have handles at the corners, and its item in the hierarchy is highlighted.

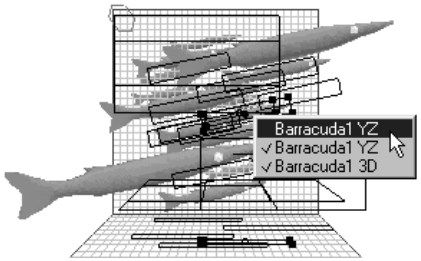
Ray Dream Studio 5 provides several ways to select objects:

- By using the **Selection** tool in the **Perspective** window to click on the object preview or one of the projections.
- By clicking an item or dragging a marquee over one or several items in the hierarchy.
- With the **Find** command.

To select objects with the Selection tool:

1. Click the **Selection** tool.
2. In the **Perspective** window, click on the preview or on one of the projections for the object you want to select.

   Hold down the **Shift** key and click other objects to add to the selection. **Shift**-click an object that's already selected to subtract it from the selection.
3. If a number of objects overlap, position the cursor over the object (preview or projection) and hold the mouse button down. A pop-up appears, listing all of the objects beneath the cursor at that point. Select the object you want.
4. Choose the object name followed by XY, ZX or YZ for a 2D projection or 3D, for a 3D object. To select the object's Hot Point, choose the item containing the object's name followed by HP.



Hold down the mouse button on an object to display the Selection pop-up.

To select objects in the hierarchy:

Click the object's icon in the hierarchy.

You may also drag a marquee around the objects, if you want to select several.

Hold down the **Shift** key and click other objects (or drag another marquee) to add to the selection. **Shift**-drag over items that are already selected to subtract them from the selection.

You'll find complete information on working with the hierarchy in Chapter 13, "Building a Scene."

To Find and select an object:

1. Choose **Edit menu▸ Find**. The **Find** dialog appears.

Use the Find dialog to locate a specific object.

2. Enter the name of the object to locate. You may enter a portion of the name.
3. Click the radio button for the appropriate matching method—Is, Contains, Starts with, or Ends with.
4. Click **Find** to begin the search.

   Ray Dream Studio selects the first object that matches the search criteria.
5. Click **Find** again to select the next object that matches the search criteria.

Arranging Objects

Arranging is the process of positioning and orienting objects. The most significant part of an object's arrangement is its spatial relationship to other objects. In most cases, the absolute arrangement (in relation to the Global Universe) is relevant only to the extent of what seems "upright" to you. For example, you'd probably find it confusing to work in an upside-down scene, and a glass of wine placed at any attitude other than upright would seem to defy gravity if the wine did not spill.

If you like, you can create a tilted or upside down world simply by changing the attitude of your camera. This is far easier than working in a skewed universe.

Arranging one object in relation to another may require a series of positioning, orientation, and alignment operations. Many of these commands operate under the constraints of the working box. Setting the working box appropriately before starting an operation greatly simplifies the procedure.

Because the relationship of objects to one another is the most important part of arrangement, resizing may also be necessary.

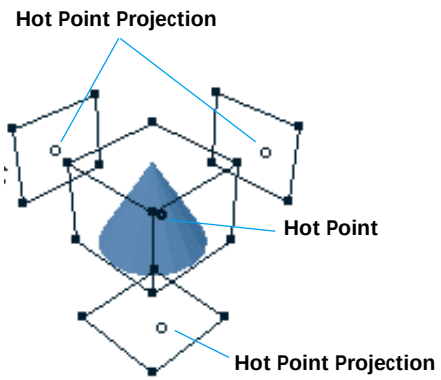
Except where noted, all of the positioning, orienting, aligning, and resizing commands work with either simple or grouped objects.

For information on grouping objects, refer to "Building a Hierarchical Structure" on page 254.

The Hot Point

The hot point is the single point of an object or group that identifies its center of rotation.

The hot point of selected objects and groups appears in the **Perspective** window as a small 3D sphere, which also casts 2D projections.



Hot Point and projections.

By default, an object or group's hot point is at the center of its bounding box. You can move the hot point to any point in, on the surface, or some distance from the object.

Where you put the hot point depends on the type of arrangement operation you are planning. Different operations suggest different placements of the hot point.

For example, with the hot point at the center of an object, a rotate command spins the object in place. However, with the hot point placed some distance away, the object will rotate around its hot point, like a planet orbiting around its sun.

To move a hot point by dragging:

1. Choose the **Selection** tool.
2. Select the object or group whose hot point you want to move.
3. Drag the hot point in 3D or drag one of its 2D projections.

   Hold down **Option/Alt** to drag the hot point perpendicular to the active plane.

   If you turn on **Caps Lock** on your keyboard, you can lock the object to its hot point. In this case, if you drag the hot point, the object moves with it.

   If you drag in 3D with the **Command/Ctrl** key down, the hot point snaps to the surface of the object beneath it.

By putting on Caps Lock and holding down Command/Ctrl while dragging, you can drag an object by its hot point across a contoured surface. The object you drag maintains its distance from the surface across any contour.

To automatically center a hot point:

1. Select the object or group in the Perspective window.
2. Choose the **Arrange menu▸ Center Hot Point** or press **Command-Option-H/Ctrl+Alt+H**. Ray Dream Studio moves the hot point to the center of the object or group bounding box.

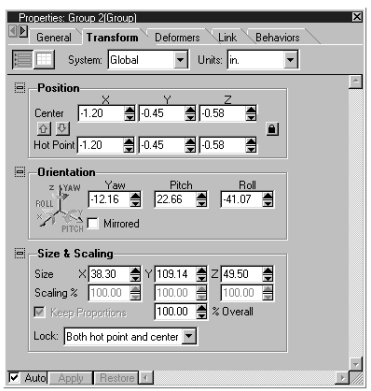
   You may also use the "Send to" arrow (points up) on the **Properties palette: Transform tab: Position controls** to send the hot point to the center.

Use the Send To button to send the hot point back to the center.

To move a hot point numerically:

1. Select the object or group.
2. Choose **Windows menu▸ Properties**. The **Properties** palette appears.
3. Choose the **Transform** tab.

   The **Properties palette: Transform tab: Position controls** display the position of the hot point (x,y,z coordinates).



The Transform tab in the Properties palette can be used to numerically set the hot point position.

4. Use the **System** pop-up to select the coordinate system you want to use.

   Global lets you specify the hot point location in the universe.

   Working Box lets you specify the hot point location in relation to the working box. This will be useful if you've moved the working box to a particular, significant location and attitude.

   Local lets you specify the hot point location with respect to the center of the object or group bounding box. This is useful if you want to move the hot point (out from the center) on a particular axis.

   Raw Data lets you use Studio's internal transform data to control the object.

   If you are using **Global** or **Working Box** and you want the object to move with its hot point, click the **Lock** icon.

   The hot point is locked in relation to the object when the **Lock** icon "connects" the **Center** and **Hot Point** fields.

   Click the **Lock** again to disconnect the references and allow them to move independently.

5. Enter new position values for the hot point.
6. Click **Apply** to move the hot point to that location.

   You can enable **Auto** (Apply) if you want the hot point to move to the positions you enter automatically.

To place the hot point back in the center of the object:

1. Select the object or group.
2. Display the **Properties palette: Transform tab: Position controls**.
3. Click the "Send to" arrow (points up between Hot Point and Center) to send the hot point to the center of the object or group bounding box.

Positioning Objects

You'll position objects to move them to particular locations in your scene.

In most cases, the most important part of an object's position is its location relative to other objects. Often, to create the desired relationships, you will use the positioning tools in conjunction with the orientation and alignment tools.

Positioning applies to objects and groups, as well as lights and cameras. In this section, the term "object" also refers to cameras and lights.

Remember that the appearance of your scene is determined not only by the position of objects, but by your point of view—the location of the camera you're looking through. With two objects in your scene, you can switch their relative positions, left-to-right, by simply placing the camera on the other side of the scene.

Note: Most artists build the scene around the center of the universe (0, 0, 0). This offers the advantage that an objects global position describes its position from the center of the scene.

Ray Dream Studio 5 provides several ways to position objects: Dragging, Nudging, and Numerical Positioning.

Dragging Objects

The easiest way to move an object through space is to drag it with the **Selection** tool.

These dragging operations use the working box planes as the dimensional reference. Remember that you can orient the working box to a particular attitude before dragging an object. For information on moving and orienting the working box, refer to "Changing the Position and Attitude of the Working Box" on page 227.

Remember that the planes of the working box extend throughout the universe. The visible grid is merely a reference of the orientation of those planes and does not restrict you to the visible space.

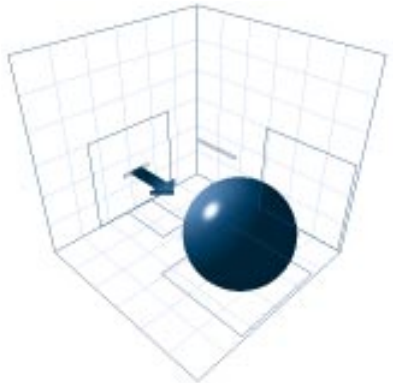
To move an object parallel to the active plane:

1. Choose the **Selection** tool.
2. Drag the object's preview where you want it.

   Hold down the **Shift** key to constrain the drag angle to an increment of 45°.

Note: For information on the active plane, refer to "The Active Plane" on page 226.

For example: The default active plane is the "floor" of the working box, which is defined by the x, y axes. Drag the object to move it anywhere in the working box x and y dimensions. The object maintains its height above the floor, so its position in the working box z dimension doesn't change.

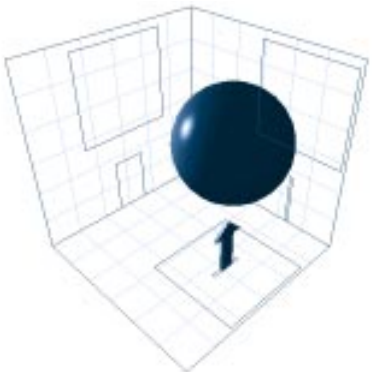


Dragging along active plane moves it parallel to that plane.

To move an object perpendicular to the active plane:

1. Choose the **Selection** tool.
2. Hold down the **Option**/**Alt** key and drag the object preview.

   Continuing the above example: To raise or lower the object (move it in **z**), hold down **Option**/**Alt** when you drag it. In this case, the object moves in working box z, but the working box x and y do not change.



Hold down the Option/Alt key to drag an object perpendicular to active plane.

To move an object along a specific plane:

1. Choose the **Selection** tool.
2. Drag the object's projection in that plane.

   Hold down the **Shift** key to constrain the drag angle to an increment of 45°.

Collision Detection

Studio's Collision Detection option instructs objects to "respect each other's space." With Collision Detection turned on, you can drag one object into another, and the object stops when its surface contacts the other object. If you continue to drag, Studio releases the object and you can drag it right on through.

With Collision Detection disabled, you can drag one object through another without resistance. Objects pass through each other without resistance.

Collision Detection is a great feature for bringing one object into contact with another—for example, putting plates and silverware on the dinner table. Collision Detection makes it easy to place the objects precisely on the table surface. Without Collision Detection, you might accidently leave a knife floating just above the table or embed it in the table itself.

To enable or disable Collision Detection:

1. If necessary, display the **Rendering** toolbar.
2. In the **Rendering** toolbar, click the **Collision Detection** button.

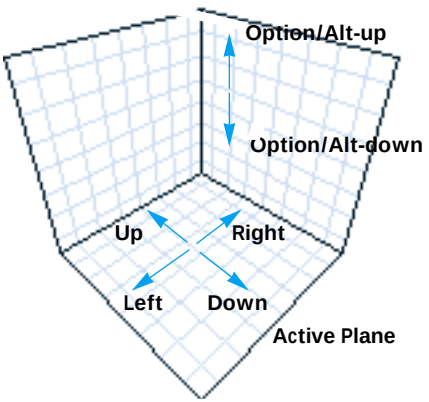
   Collision Detection is on when the button is darkened.

The Collision Detection button.

Nudging Objects

Nudging lets you move an object by pressing one of the **Arrow** keys on your keyboard.

Nudging uses the working box active plane as the reference. The grid lines on the active plane indicate the directions that the **Arrow** keys move the object.



Use the Arrow keys on your keyboard to nudge objects in the active plane.

Remember that you can orient the working box to a particular attitude and change which of the three is the active plane before nudging an object. For information on orienting the working box, refer to "Changing the Position and Attitude of the Working Box" on page 227. For information on the active plane, refer to "The Active Plane" on page 226.

To nudge an object:

1. Select one or more objects
2. Press one of the **Arrow** keys.

   The selected objects move parallel to the active plane one increment of the grid increment setting. For information on changing the grid increment, refer to "Changing Grid Options and Color" on page 226.

   Hold down the **Shift** key when nudging to increase the nudge distance (grid increment) by a factor of 5.

To nudge perpendicular to the active plane:

1. Hold down the **Option**/**Alt** key and use the **Up** or **Down Arrow** key.

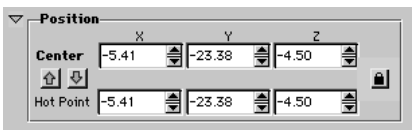
   Hold down the **Shift** key when nudging to increase the nudge distance (grid increment) by a factor of 5.

Numerically Positioning Objects

Numerical positioning lets you enter x, y, z coordinate values to locate the object.

To position an object or group numerically:

1. Select the object or group.
2. Display the **Properties palette: Transform tab: Position controls**.



Use the position controls to numerically position objects.

3. Use the **System** pop-up to select the coordinate system you want to use.

   Global lets you specify the object location in the universe.

   Working Box lets you specify the object location in relation to the working box. This will be useful if you've moved the working box to a particular, significant location and attitude.

   Local lets you specify the object location with respect to the center of the group bounding box. This is useful if you've jumped into a group and want to specify the location with respect to the center of the group's bounding box (local origin).

   Raw Data lets you use Studio's internal transform data to control the object.

4. Choose the preferred units, if necessary.
5. If you want to maintain the relationship between the object center and hot point, click the **Lock** icon.

   The hot point is locked in relation to the object when the **Lock** icon "connects" the **Center** and **Hot Point** fields.

Note: If you want to move the object, but leave the hot point where it is: Disable the **Lock** and use the **Center** fields to move the object.

   When the hot point and center are locked, you may use either the bounding box **Center** or the **Hot Point** as the reference on the object or group.

6. Enter x, y, z values position values for either the object **Center** or the **Hot Point**. You can type in a value or use the scroll arrows.
7. Click **Apply** to move the object to that location.

   Enable **Auto** (Apply) if you want the object to move to the positions you enter automatically.

To send the object (center) to the hot point:

1. Select the object or group.
2. Display the **Properties palette: Transform tab: Position controls**.
3. Click the **Send to** arrow (points down between **Center** and **Hot Point**) to move the center of the object or group bounding box to the hot point.

Measuring and Setting the Distance of Objects

Ray Dream Studio lets you measure the distance between any two objects. You may enter a distance value to move one of the objects into position.

This is particularly useful when the objects are aligned with one another and you want to move one of them closer to or farther from the other.

To measure and set distance:

1. Select two objects. This feature does not work if more than or less than two objects are selected.
2. Choose **Windows menu▸ Properties**. The **Properties** palette appears.

With two objects selected, **Distance** is the only tab available. The **Distance** field shows the distance between the object centers.

3. Choose the units you'd like to use from the pop-up.
4. From the **Lock** pop-up, choose which object you want to keep its position. The other object will move.
5. Enter a new distance value. You can type in a value or use the scroll arrows.
6. Click **Apply** to move the "unlocked" object to the specified distance from the other.

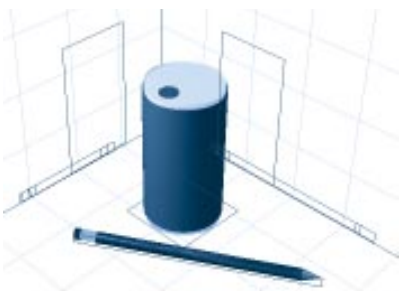
Setting distance is particularly useful when positioning a camera. For example: The camera points directly at an object, but it's just too far away and the object looks small. Select both the camera and the object. Lock the object, and set the distance lower to move the camera closer.

Resizing Objects

When you create an object, you model it at a particular size. Once in the scene, you can scale the object to new dimensions.

The most important aspect of an object's size is its relationship to other objects. For example, if the cork is larger than the wine bottle, one of them has the wrong scale.

Because Ray Dream Studio allows you to work with real world units (inches feet, centimeters, meters, etc.), many artists scale objects equivalent to their size in the real world. For example, a soft drink can is 4.75 inches tall and 2.5 inches in diameter, so it makes sense to scale a can object to these dimensions. When you put a pencil object (0.62 inches in diameter and 7.4 inches long, unsharpened) next to the can, the two objects have the correct size relationship.



Ray Dream Studio allows you to work with real world units to maintain true size relationships between objects.

Note: Scaling in the scene does not change the size of the original (master) object.

Ray Dream Studio allows you to resize an object or group in one of two ways: by dragging its bounding box or 2D projection handles (free resizing), or by using the **Properties palette: Transform tab: Size & Scaling controls**. In both cases, you can resize an object proportionally or disproportionally.

The size you create objects has little relationship to the size they appear in the final rendered image. The size of objects in the rendered image is determined not only by their dimensions, but more importantly by their distance from the point of view. This is just like in the real world: a car right in front of you appears larger than when it's parked down the block. In Ray Dream Studio 5, the point of view is the camera, so if you want to make objects appear larger in the rendering, either move the camera closer, or increase its focal length. For more information on moving the camera, refer to "Navigating the Current Camera" on page 290.

Free Resizing

Free sizing lets you scale an object or group by dragging a corner of its bounding box or projection.

To resize an object or group:

1. Select an object or group.

You may select several objects, then resize one of them to apply the same scaling factor to all.

2. With the **Selection** tool, drag one of the corners of the object's bounding box. You may also drag the corner of a projection to scale in the dimensions of that plane.

   With no keys down, you'll scale the object disproportionally in the axes parallel to the active plane. The reference—which remains anchored in place—is the opposite corner (from the one you drag).

Note: Groups cannot be resized disproportionally. They are always scaled equally in all three dimensions.

The following modifier keys give you control resizing:

Shift: Maintain proportions. Resize equally in all three dimensions.

Option/Alt: Resize only in the dimension perpendicular to the active plane.

Command/Ctrl: Resize using the hot point as the reference. The hot point stays in place, and all eight corners of the bounding box move to resize the object.

Note: When using modifier keys, start dragging, hold down the modifier key, release the mouse, then release the key.

3. When you are satisfied with the object's new size, release the mouse.

The object bounding box and working box may not be aligned. In this case, the scaling dimensions are described by the bounding box axes that are closest to being parallel with the active plane. Or with the Option/Alt key down, the scaling axis is the box axis that's closest to being perpendicular to the active plane.

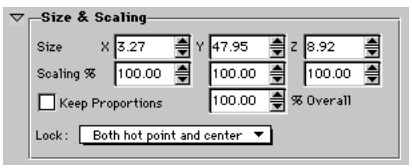
Resizing may change the relative positions of two objects. For instance, a glass on a table, if enlarged, may go through the table, and if shrunk, may seem to float over it. You can prevent this by using the plane at the bottom of the glass as the reference for resizing—that is, by dragging a corner at the top of the bounding box, not at its bottom.

Numerical Resizing

Numerical resizing allows you to enter size values or scaling percentages to resize the object in any or all dimensions.

To resize numerically:

1. Select an object or group.
2. Display the **Properties palette: Transform tab: Size & Scaling controls**.



The Scaling Controls in the Properties palette's Transform tab allow you to resize numerically.

3. You can choose the units from the **Units** pop-up.
4. Enabled the **Keep Proportions** option to maintain the ratio between an object's height, width, and depth.
5. Enter values in any **Size** or **Scaling** field to describe the size or relative scale in that dimension. You can type in a value or use the scroll arrows.

   The values in the **Size** fields give the dimensions (height, width, and depth) of the object's bounding box.

   The **Scaling** fields give the scaling percentages in each dimension. When all three are at 100% the object is at the scale it was created.

Note: To return the object to its original size, enter 100 in each of the **Scaling** fields.

6. Click **Apply** to move the object to that location.

   Enable **Auto** (Apply) if you want the object to scale to the values you enter automatically.

Orienting Objects

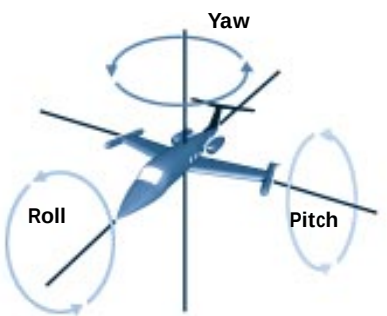
Most real-world objects have a logical "upright" and some have a logical "front." For example, airplanes and automobiles have both. In simple terms, you can think of an object's orientation as "the direction it faces."

Ray Dream Studio 5 determines the native upright and front of objects by the way they were modeled.

Orientation applies to objects and groups, as well as lights and cameras. In this section, the term "object" also refers to cameras and lights.

If you are building a complex object, you will orient the parts as you assemble them. Then, group the complex object so you can orient it as a single object. Of course, you can still "Jump Into the group" and change the relative orientations of the objects.

The technical terms that describe orientation movements in an object's own local coordinate system or frame of reference are taken from aviation. **Yaw** (blue axis) is the degree of rotation about the upright axis. **Pitch** (pink axis) is the degree of front-to-back rotation. **Roll** (red axis) is the degree of side-to-side rotation. Sometimes the term attitude is used to describe the combined effect of yaw, pitch, and roll.



Ray Dream Studio uses theory from aviation for orientating objects.

Ray Dream Studio 5 allows you to change an object's orientation in several ways: with the **Virtual Trackball**, with the **Rotate** tool and numerically.

Free Rotating

The **Virtual Trackball** allows you to orient an object by dragging its 3D preview.

With the **Virtual Trackball**, the object rotates around its hot point. You might want to position the hot point before proceeding. For information on changing the default hot point position, refer to "The Hot Point" on page 233.

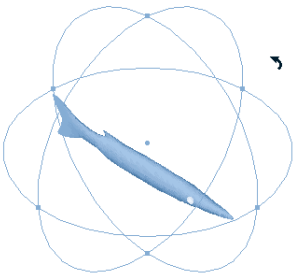
To orient an object with the Virtual Trackball:

1. Choose the **Virtual Trackball** tool.]

2. Click the object or group you want to orient.

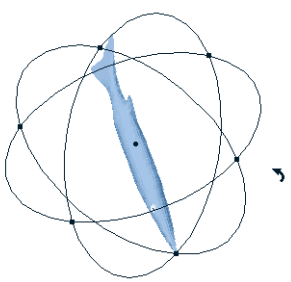
   You may select more than one object. **Shift-click** to add objects to the selection. **Shift-click** to remove selected objects.

A set of rings appears around the object hot point. The rings describe the axes of rotation. (If you have a multi-object selection, only one set of rings appears.)

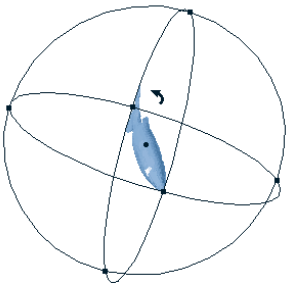


Once an object is selected, you can drag to change the orientation.

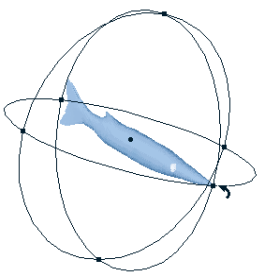
3. Drag in the perspective window to change the object orientation. The following descriptions will help you control the orientation change:



Drag outside of the circle to rotate in relation to the monitor screen.

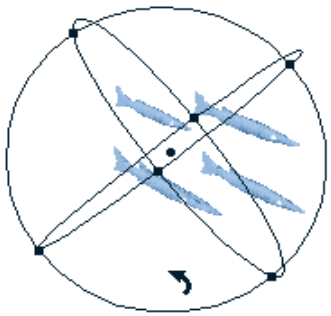


Drag within the rings to roll the object in three dimensions.



Hold down the Shift key and drag one of the rings to rotate the object only on the corresponding axis. Hold down the Option/Alt key while you drag to constrain rotation to increments of the Rotation Angle constraint.

Note: The point of rotation is at the hot point. If you have a multiple selection, each object rotates about its own hot point. To rotate several objects around a single point, you must first group them.



A group of objects rotated in 3D.

To constrain rotation to a given plane:

1. If necessary, orient the working box and position the object hot point. Setting these allows you to control the plane and axis of rotation.

   For information on changing the orientation of the working box, refer to "Changing the Position and Attitude of the Working Box" on page 227. For information on moving an object or group hot point, refer to "The Hot Point" on page 233.

2. Choose the **2D Rotation** tool. The **Rotation** tool shares a space on the toolbar with the **Virtual Trackball**. You can "pop-up" the **Virtual Trackball** icon to choose the **Rotation** tool.]

3. Drag inside one of the three projections to rotate the object parallel to that plane. Drag the projection in a circular path.

   Hold down the **Shift** key while you drag to constrain rotation to increments of the **Rotation Angle** constraint. You can change the setting in **File menu▸ Preferences: Perspective**.

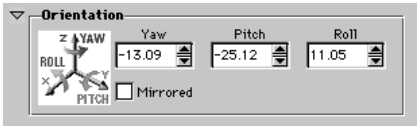
Numerical Orienting

The **Properties** palette lets you orient an object numerically. Numerical orientation uses the center of an object as the reference point.

To orient an object or group numerically:

1. Select the object or group.

2. Display the **Properties palette: Transform tab: Orientation controls**.



Use the orientation controls with the Properties palette's Transform tab to change the orientation of the object.

3. Use the **System** pop-up to select the coordinate system you want to use.

   Global lets you specify the object orientation with respect to the universe.

   Working Box lets you specify the object orientation with respect to the working box. This will be useful if you've moved the working box to a particular, significant location and attitude.

   Local lets you specify the object orientation with respect to its own coordinate system. This is useful when, regardless of the object's current rotation, you want to rotate it a set number of degrees.

Note: Local **Yaw**, **Pitch** and **Roll** values revert to zero after you apply changes.

   Raw Data lets you use Studio's internal transform data to control the object.

4. Enter new values in the **Yaw**, **Pitch** and **Roll** fields. You can type in a value or use the scroll arrows

5. Click **Apply** to update your changes to the selected object or group. When Auto is enabled, the object's orientation automatically updates when you click in another field.

Using the Axis Indicators

Ray Dream Studio offers a set of axis indicators for the object's hot point. The indicators are a visual reminder of the object's original x, y, z orientation.

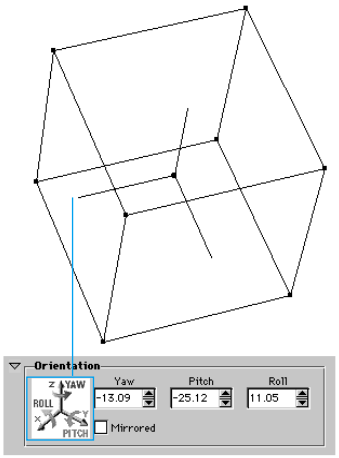
To display the axis indicators:

1. Choose **File menu▸ Preferences**. The **Preferences** dialog appears.

2. Choose **Perspective** from the pop-up.

3. Enable the **Show Axis Information** option.

   The colors of the X (purple), Y (red) and Z (blue) axes match the colors of the **Pitch**, **Roll** and **Yaw** key in the **Orientation** controls.



The hot point axis colors match the yaw, pitch, roll axes in the Orientation controls.

Mirroring an Object's Orientation

You can automatically "mirror" an object's orientation across an imaginary plane. The mirror plane is parallel with the bottom plane of the working box and passes through the object's hot point.

To mirror an object or group's orientation:

1. Orient the working box to describe the angle you want for the mirror plane.

2. Select an object or group.

3. If necessary, position the hot point to describe the location you want for the mirror plane.

4. In the **Properties palette: Transform tab: Orientation controls**, enable the **Mirror** option.

5. Click **Apply** to update your changes to the selected object or group.

Special Orientation Features

You can align objects with the working box, with the universe, or with gravity.

When the working box is in its "home" orientation (aligned with the universe), there is no difference between aligning with the working box and with the Local Universe.

To align objects with the working box:

1. Select one or more objects.

2. Choose **Arrange menu▸ Align▸ On Working Box** or press **Command-Shift-K/Ctrl+Shift+K**.

   Ray Dream Studio rotates the objects the minimum amount to put the sides of the object's bounding box parallel to the planes of the working box.

To align an object with the universe:

1. Select an object.
2. Choose **Arrange menu▸ Align▸ On Universe** or press **Command-Option-K/Ctrl+Alt+K**.

   Ray Dream Studio places the object upright and sets its bounding box parallel to the axes of the universe.

To align on gravity:

1. Select an object.
2. Choose **Arrange menu▸ Align▸ On Gravity** or press **Command-Shift-G/Ctrl+Shift+G**.

   Ray Dream Studio sets the Roll of the selected object to zero without affecting its Pitch or Yaw.

Gravity is absolute. It refers only to the Global Universe.

This feature is particularly useful for correcting the attitude of a camera. For example, if you were looking through a camera and the horizon slanted diagonally across the frame, **Align with Gravity** would adjust the roll of the camera to level the horizon.

To reset orientation:

1. Select the object.
2. Choose **Arrange menu▸ Align▸ Reset Orientation** or press **Command-Option-Shift-K/Ctrl+Alt+Shift+K**

   Ray Dream Studio returns the object to its native orientation in terms of the local universe.

Aiming Cameras and Lights

All of the positioning and orientation commands work on cameras and lights as well as simple objects.

Note: Because the current camera is not visible as an object, manipulation by dragging isn't possible.

The **Point At** command directs the light beam or camera view toward an object you specify.

To point a camera or light at an object:

1. Select the camera or light and the object you want to point at.

   You may select multiple cameras and lights, but only one object or group. If you don't select a camera or light, Ray Dream Studio 5 points the current camera.
2. Choose **Arrange menu▸ Point At** or press **Command-M/Ctrl+M**.

   The light or camera points at the hot point of the selected object or group.

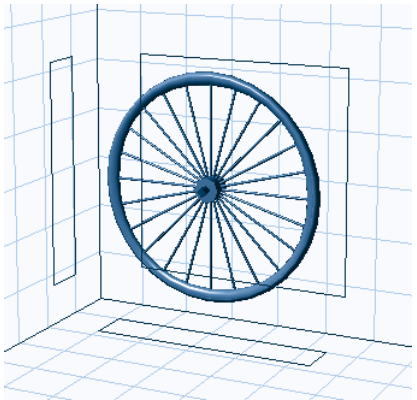
Aligning Duplicating Objects

Aligning an Object Relative to Another

Ray Dream Studio 5's relative alignment feature lets you arrange several objects with respect to each other. This can be quite useful.

Aligning works with respect to the Working Box. For example, if you were building a bicycle wheel, you would use relative

alignment to arrange the axel, hub, spokes, rim, and tire to be concentric and co-planar.

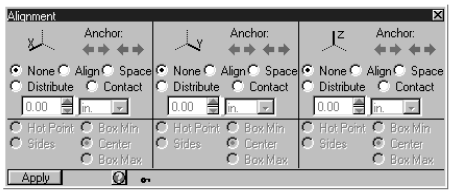


It is possible to align object in relation to other objects.

When aligning many objects, you might want to start by aligning only two of them. Once you have aligned the two objects, group them. Then align a third object to the group. Continue to group and align objects until all objects are aligned.

To align objects relative to one another:

1. Orient the Working Box to set the axes of constraint you want to use.
2. Select two or more objects. The first selected object becomes the anchor object.
3. Choose **Arrange menu▸ Align Objects** or press **Command-K/Ctrl+K**. The **Alignment** dialog appears.



Use the Alignment palette to align your objects.

   You'll align your objects in each dimension (x, y, and z) separately. The selected dimension is called the **axis of constraint**.

4. Choose the axis of constraint from the **Axis** pop-up.

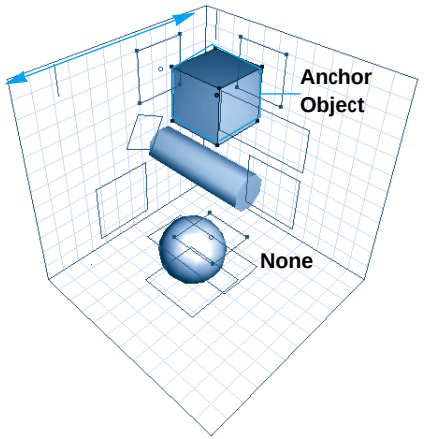
   If you'd prefer to see each axis of constraint at once, you may. Click the **Key** icon at the bottom of the **Alignment** palette to expand it.

5. Select the alignment command you want for this axis: **None**, **Align**, **Space**, **Distribute** and **Contact**.

Note: You'll often use a different command on each axis.

None leaves the objects at their original position. along the axis of constraint.

Selected Axis of Constraint



Objects aligned using None.

Align sets the reference point of each object co-linear with the reference point of the anchor object along the axis of constraint.

Space puts the specified distance between the reference points of each object along the axis of constraint.

For **Space**, enter a spacing value and use the pop-up to set the units.

Distribute places the reference point of each object, evenly spaced between the two anchor objects, along the axis of constraint.

The reference objects do not move in distribution. Therefore, Distribute requires a selection of at least three objects.

Contact brings the **BoxMax** of each object into contact with the **BoxMin** of the next object along the axis of constraint.

6. Using the red **Anchor** arrows, select the object to be used as the anchor. The anchor object keeps its current position. All of the other objects move in relation to this object.

   Alternatively, the **Tab** key advances the selection, and **Shift-Tab** retreats it. The 2D projection of the selected anchor object is shown in red.

   For the **Distribute** command, click the blue **Arrow** buttons to select the second anchor. Select two anchor objects. The 2D projection of the second anchor object is shown in blue.

7. Select the reference point on the objects.

Note: Object reference points that are grayed out are unavailable for that alignment command.

Hot point specifies each object's hot point.

BoxMin specifies the side or edge of each object's bounding box with the lower coordinate value along the axis of constraint.

Center specifies the center of each object's bounding box.

BoxMax specifies the side or edge of each object's bounding box with the higher coordinate value along the axis of constraint.

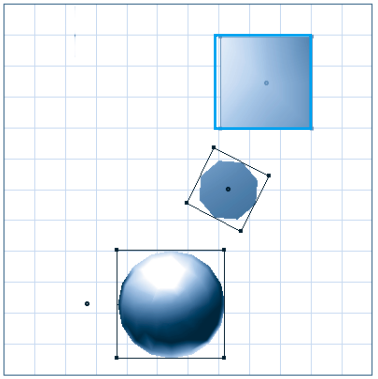
Sides specifies the sides of the object's bounding box.

8. Click **Apply**.

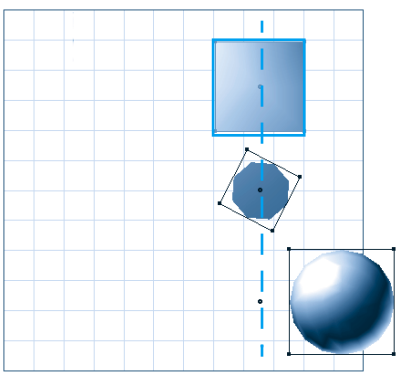
Note: The **Undo** command restores the objects to their original orientation after the last alignment operation until you change the axis of constraint, or leave the **Alignment** window, deselect the objects, and attempt another operation.

9. When you have achieved the alignment you want in one constraint axis, move on to the next one. (Return to step 3.)

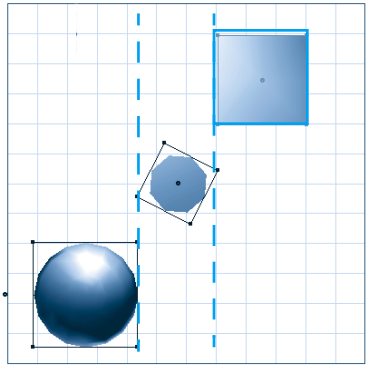
Depending on your design for this set of objects, you may use relative alignment in one, two, or all three axes of constraint.



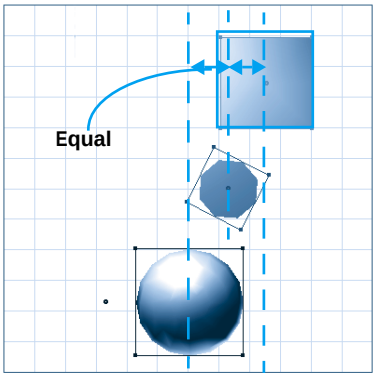
Align with None as the reference.



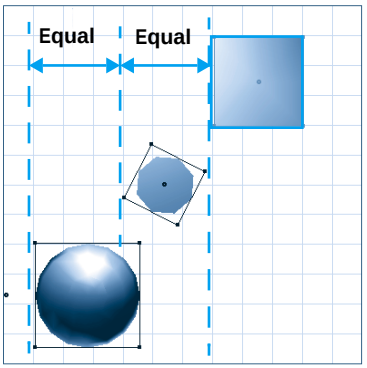
Align with Hot Point as reference.



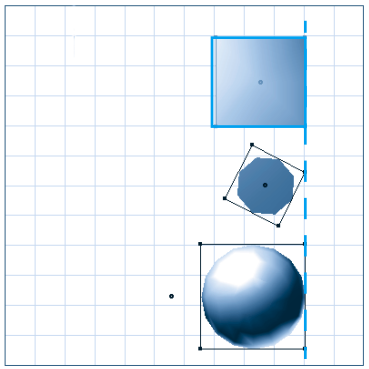
Contact with Sides as the reference.



Distribute with Center as the reference.



Space with BoxMax as the reference.



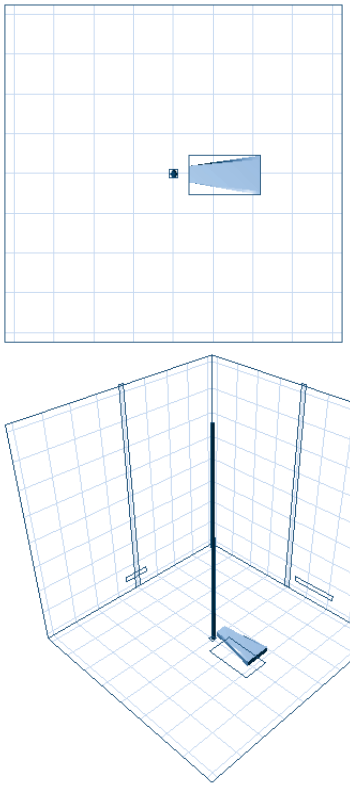
Align with BoxMin as reference

Duplicating Objects

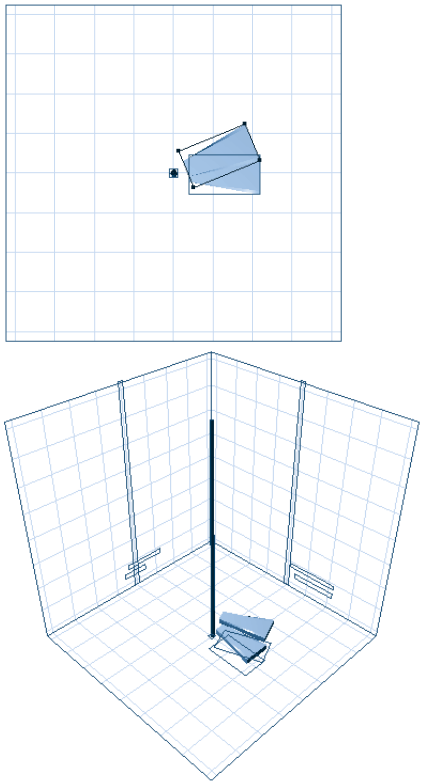
Duplication is a handy method of automatically repeating a series of position, orientation, and resize operations on a duplicate object. Duplication is an efficient way of working and has a number of practical applications.

For example, you could use this feature to build a spiral staircase. Create the first stair and set its hot point to the axis of spiral. Then, duplicate the stair, raise the duplicate to the level for the next step, and rotate it an appropriate amount. Choose duplicate again and again until you have built the staircase.

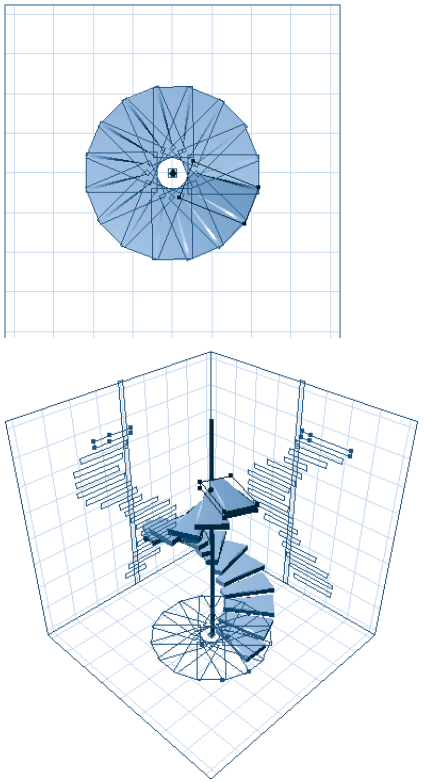
Duplicated objects are multiple instances of a single master object. For more information, refer to "Working with Master Objects" on page 266.



1. Select the object...



2. Duplicate and position the new object...



3. Replicate (repeats 1, 2)

To duplicate an object:

1. Select one object.
2. Choose **Edit menu▸ Duplicate** or press **Command-D/Ctrl+D**.

Note: When created, the duplicate occupies the same space as the original.

3. Perform any number of position, orientation, and resize operations without deselecting the object.

4. Choose **Duplicate** again.

   Each time you duplicate, the new copy receives the same set of positioning, orientation, and resizing operations relative to the last duplicated object.

Changing the Object Symmetry

Many real-world objects exhibit symmetry. Airplanes, automobiles, and the human body are a few examples. To help you build complex symmetrical objects, Ray Dream Studio 5 provides two commands—**Flip** and **Duplicate with Symmetry**.

The Symmetry Plane

Both symmetry commands use an imaginary plane parallel to the bottom plane, passing through the center of the left and right planes of the working box (working box z=0). This plane acts as a mirror across which the objects are reflected, or flipped.

The attitude of the working box and the object's z coordinate value (in the working box system) are important for a successful **Flip** or **Duplicate with Symmetry** operation.

- For example, if you want to flip the object in place, the center of the object should be at z=0.
- For another example, you're going to **Duplicate with Symmetry** and you want the mirrored duplicate to lie precisely alongside the original. Set the bottom plane of the working box parallel to that side of the object bounding box and move the working box to put the working box z=0 plane in contact with that side of the object bounding box.

To flip an object:

1. Orient and position the working box to put the plane of symmetry where you want it.

2. Select the object you want to flip.

3. Choose **Arrange menu▸ Flip**.

   Ray Dream Studio flips the object across the plane of symmetry.

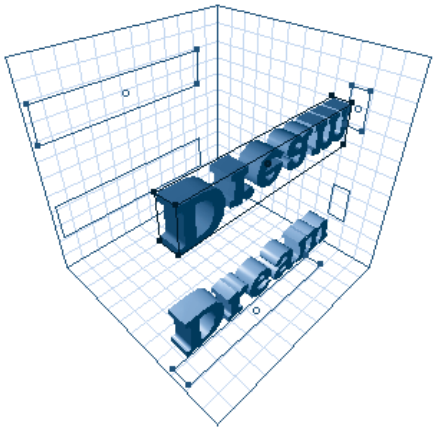
To duplicate with symmetry:

1. Orient and position the working box to put the plane of symmetry where you want it.

2. Select the object.

3. Choose **Edit menu▸ Duplicate with Symmetry** or press **Command-Option-D**/**Ctrl+Alt+D**.

   Ray Dream Studio duplicates the object across the plane of symmetry.



Duplicating an image with symmetry.

Other Features

Shadow Casting

By default, all objects that are not transparent cast shadows. There might be a case where you don't want a particular object to cast shadows. Studio allows you to turn Shadow Casting on and off for individual objects.

To set shadow casting for one or more objects:

1. Select one or more objects.
2. Choose **Arrange menu▸ No Shadow Casting** to turn off shadow casting for the selected objects.
3. Choose **Arrange menu▸ Shadow Casting** to turn on shadow casting for the selected objects.

Note: For a single object, you can set whether or not it casts shadows in the **Properties palette: General tab**.

Using the Counter

The counter is a utility that tracks the complexity of the geometry in the scene. The Counter maintains the following data:

- The number of objects in the scene
- The number of modeled patches
- The number of modeled facets
- The number of triangles that would be created in an exported version of this file.

This technical information may be useful to some artists who intend to export the scene for use in another program. The number of triangles has a direct correlation to file size in the exported document.

To use the Counter:

1. Choose **Arrange menu▸ Counter**.
2. When you're done viewing the information, click **OK**.

The counter keeps track of the number of objects in the scene and their complexity.