Ray Dream Studio 5

User Guide

for Macintosh® and Windows™

Return to Mac Demo

Return to PC Demo

Trademarks

Copyright

Notice

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Credits

Ray Dream Studio® was originally created by Pascal Belloncle, Pierre Berkaloff, Yann Corno, Eric Hautemont and John Stockholm.

Ray Dream Studio® 5 was created by Pascal Belloncle, Pierre Berkaloff, Eric Brayet, Yann Corno, Joël Derriennic, Eric Graham, Greg Mitchell, Thomas Ripoche, Logan Roots, Damien Saint-Macary, John Stockholm, Emil Valkov and Joshua Van Abrahams.

Product Management by Gray Norton and Stephanie Arvizu.

Quality Assurance testing by Curt Hironaka, Randy Hollingsworth, Joe Grover, Steve Yatson and Jason Green; managed by Michael Cinque.

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FRACTAL DESIGN CORPORATION

Welcome to Ray Dream Studio 5

Welcome to Ray Dream Studio™ 5, the leading 3D program for desktop artists and animators, Web designers, and multimedia producers. Ray Dream Studio 5 is ideal for creating 3D graphics for magazines, ads, or virtually any illustration that would benefit from the powerful 3D impact of realistic perspective and shading.

Ray Dream Studio's powerful animation features let you create professional quality animations for video and multimedia. With Ray Dream Studio's key-event and timeline-based animation, you can produce anything from flying logos to character animations.

Ray Dream Studio 5 can also be an invaluable tool for interactive multimedia. It support for low-polygon modeling and popular formats like GIF, JPEG, VRML and Real VR ™.

Your Ray Dream Studio 5, package includes:

- The Ray Dream Studio CD-ROM
- The Ray Dream Studio 5 User Guide
- The Ray Dream Studio Quick Reference Card
- Your Ray Dream Studio 5 serial number
- A Fractal Design Software Registration Card

If you are missing any of these items, please contact your Ray Dream Studio 5 dealer or distributor, or contact Fractal Design Customer Service at (800) 846-0111.

About your User Guide

This manual provides all the information you need to get the most out of Ray Dream Studio 5. It will help you learn the application and serve as a reference as you attempt more sophisticated procedures and effects.

This user guide assumes you are already familiar with basic Macintosh and Windows concepts—menus, dialogs, and mouse operations, such as clicking and dragging. If you need more information on these subjects, or on the Macintosh Finder or the Windows Desktop, refer to the Macintosh User's Manual or the Microsoft Windows User's Guide, respectively.

The best way to learn Ray Dream Studio 5 is to read Chapter 4, "Ray Dream Studio 5 Basics,"and then complete Chapter 5, "Tutorial." The tutorial leads you through the process of creating illustrations and animations in Ray Dream Studio and also explains some of the important concepts you'll need to know to model and animate in 3D.

After you complete the tutorial, open a new file and start building your own scene. Take advantage of Ray Dream Studio 5's Scene Wizard and the Modeling Wizard™. Use the Scene Wizard as a quick way to set up your indoor or outdoor scene with the appropriate lighting and background, and use the Modeling Wizard to build objects.

You may also want to review Appendix C, "Technical Tips," which provides answers to many commonly asked questions.

Computer graphics and three-dimensional modeling use special terms that are usually explained where they are introduced. In addition, Appendix B, "Glossary," provides concise definitions of a number of terms.

Conventions

The Ray Dream Studio 5 User Guide is for both Macintosh and Windows. By convention, Macintosh commands precede Windows commands in the text. For example, **Command/Ctrl+I**, is equivalent to the Macintosh **Command-I** and the Windows **Ctrl+I**. For simplicity, the term ***folder*** refers to directories as well as folders. Screenshots usually alternate between the Macintosh and Windows versions. The Ray Dream Studio 5 interface for both platforms is identical, unless otherwise specified.

There are also several conventions used to identify paths to certain tools and controls. The convention to a menu follows the rule of the **menu name▸ menu item**. The convention to a palette follows the rule of the **palette name: subpalette name** or **palette item**. The convention to a palette menu follows the rule of **palette name: palette menu▸ menu item**.

Modifier Keys

When a modifier key differs between the Macintosh and Windows platform, the Macintosh modifier is listed first followed by a slash and the Windows modifier key. **Option**/**Alt** means Macintosh users press the **Option** key and Windows users press the **Alt** key.

Getting Help

Ray Dream Studio offers a few ways to get help. From within Ray Dream Studio 5, you can access Ray Dream Studio's on-line help. You may also connect to the Fractal Design Web site.

If you're connected to the internet via a dedicated line or modem connection, Ray Dream Studio's Internet toolbar offers and easy way to access the Web sites of Fractal Design and selected third-party partners.

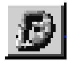
On the Fractal Web site, you'll find technical support, software updates, the latest Ray Dream Studio news and information on Ray Dream Studio extensions.

You can also register your copy of Ray Dream Studio 5 online.

Connecting to the Web Site

To visit the Fractal Design Web site:

Click the **Goto Fractal Online** button on the **Internet** toolbar.



If the toolbar is not visible choose **View menu▸ Toolbars** and enable the **Internet** option.

To visit a third-party Web site:

Click the appropriate button on the **Internet** toolbar.

If the toolbar is not visible choose **View menu▸ Toolbars** and enable the **Internet** option.

On-Line Help

Detailed on-line help can be accessed from within Ray Dream Studio, using the Help menu. The help file contains a wealth of information from the Ray Dream Studio User Guide. With the Ray Dream Studio Help system, you can do keyword searches, and set bookmarks.

Using Macintosh Help

To use Ray Dream's help on the Macintosh:

1. Choose **Help menu▸ Ray Dream Studio Help** to display the help dialog.
2. Use the **Contents** button to view the table of contents, the first page of the file. Use the underlined hypertext to jump to a topic.
3. Use the **Go Back** button to retrace your steps. Use the **History** button to return to any previously-viewed screen.
4. The **Search** button lets you search by keyword or topic.
5. Drag a sticky note from the pad onto a specific page. You can type your own note on the sticky note.

Using Windows Help

To use Ray Dream's help in Windows:

1. Choose **Help menu▸ Contents** to display the Ray Dream Studio Help contents.
2. Use the **Contents** tab to view the table of contents. Select a "book" icon and then click **Open** to see the topics available. To view a topic, select it and click **Display**.

3. Use the **Help Topics** button to return to the table of contents. Use the **Back** button to retrace your steps.

4. The **Index** tab lets you search by keyword or topic.

Using Ray Dream Studio Tool Tips

On Windows, Tool Tips are displayed by default whenever you rest your cursor over an interface element.

On the Macintosh, Tool Tips are provided by Balloon Help.

To turn off Tool Tips (Windows):

1. Choose **File menu ▸Preferences.**

2. Choose **General** from the popup.

3. Disable the **Show Tooltips/Help Balloons** option.

To turn off Tool Tips (Macintosh):

Choose **Help menu▸ Show Balloons**.

What's New in Ray Dream Studio 5

The new Ray Dream Studio 5 has many new tools, features and improvements. For those upgrading, the following overview will provide a head start on locating, learning, and taking advantage of these additions.

Properties and Browser Palettes

One of the biggest changes in Ray Dream Studio 5 is the new compact user interface. The new **Properties** palette displays the controls and data for any object you select. As you select different scene elements, the palette's controls change.

To learn more about the **Properties** palette refer to "Properties Palette" on page 10.

The **Browser** palette acts like warehouse of all the items you can use to create a scene in Ray Dream. You can use the **Browser** palette to store Objects, Shaders, Deformers, Behaviors, Lights, Cameras and more.

To learn more about the **Browser** refer to "Using the Browser Palette" on page 28.

Physically-Based Behaviors

The new **Physically-Based Behaviors** let you create incredibly realistic animations. The behaviors automatically simulate natural forces like gravity, wind, and friction. With these new behaviors you can shoot a bullet out of gun or drop a ball down a flight of stairs.

To learn more about **Physically-Based Behaviors** refer to "Physical Forces" on page 318.

Mesh Form Modeler

The new **Mesh Form** modeler adds a new way of creating 3D objects to Ray Dream Studio. The new modeler lets you create polymesh objects. Objects are created by adjusting the position of vertices to change the object's shape. This way of modeling is similar to creating an object out of clay or some other malleable medium.

It also provides precise control over intricate details, for unprecedented modeling power.

To learn more about the **Mesh Form** modeler, refer to "Mesh Form Modeling" on page 137.

Environmental Primitives

The new environmental primitives let you quickly create natural objects like clouds, fog, fire and fountains.

To learn more about environmental primitives, refer to "Creating Environmental Primitives" on page 99.

Render Filters

Ray Dream Studio now includes a series of render filters that let you add some spectacular lighting and camera effects to your scene. Some of the effects you can add are: Depth of Field, 3D Light Cones, Lens Flares, and Stars.

To learn more about the new render filters, refer to "Render Filters" on page 349.

New Deformers

There are several new **Deformers** included in Ray Dream Studio that you can apply to your objects. This new set of **Deformers** let you create amazing new effects.

To learn more about the new **Deformers**, refer to "Deformers" on page 171.

Natural Media Renderer

The **Natural Media** renderer expands the stylistic range of Ray Dream Studio beyond photorealism. This new renderer lets you create 3D images in a number of hand-drawn styles.

To learn more about the Natural Media renderer, refer to "The Natural-Media Renderer" on page 343.

Collision Detection

Collision Detection lets you turn all the objects in your scene into physical solids. When this feature is active, objects collide instead of passing through each other. This feature can be extremely useful when you're trying to align objects directly in the **Perspective** window.

To learn more about **Collision Detection**, refer to "Collision Detection" on page 236.

Direct Manipulation Controls

The **Direct Manipulation** controls let you adjust the properties of many scene elements directly on screen. When you click an element that has **Direct Manipulation** controls, its control handles appear. As you drag these handles, you change the elements properties.

There are several scene elements that have direct manipulation controls:

- For Light controls, refer to "Controlling a Spot Light Directly" on page 277.
- For Camera controls, refer to "Controlling a Camera Directly" on page 288.
- For Link controls, refer to "Controlling Links Directly" on page 264.
- For Deformer controls refer to "Controlling a Deformer Directly" on page 172.

Formula Editor

The **Formula Editor** lets you use mathematical formulas to customize many of the features of Ray Dream Studio. You can create formula objects, deformers, links, shaders and others.

To learn more about creating Formula objects, refer to "Creating Formula Objects" on page 106.

Since formula editing is such a technical process, the **Formula Editor** is covered separately. Refer to the "Using Formulas in Ray Dream Studio 5" PDF on the Ray Dream Studio 5 CD.

And More

In addition to the new features listed here, Ray Dream Studio features dozens of user-requested improvements, and a wide variety of new content.

Getting Technical Support

You will find the answers to most of your questions within the pages of this User Guide. If you need further assistance, you may contact Fractal Design's Technical Support in any of the following ways:

Phone: 408 430-4200 between the hours of 8am and 5pm, Pacific Standard Time

FAX: 408 438-9672

www: http://www.fractal.com
To automatically launch your Web Browser and go to Fractal's Web site, choose **Windows menu▸ Goto Fractal Online** or click the Goto Fractal Online button on the **Internet** toolbar.

Mail: Technical Support
c/o Fractal Design Corporation
P.O. Box 66959
Scotts Valley, CA 95067

Who is Fractal Design

Fractal Design is a major force in multi-platform graphic software, developing and marketing next generation products that unite traditional art and design techniques with digital technology. Fractal Design products are engineered to facilitate and extend the range of creativity for all design professionals and graphic hobbyists working on desktop computers.

Fractal Design's focus is maintained by three product values:

- Faithfully replicate Natural-Media® and real world looks in the digital medium.
- Facilitate and extend the range of creativity by allowing artists to do things they couldn't do before.
- Capture human expression and allow the artist's perspective and intent to show through.

For More Information

For more information about Fractal Design products, see our World Wide Web site on the Internet:

www: http://www.fractal.com

Supplementary Products

The following companies have contributed to this software package:

Acuris, Inc.

Included with your Ray Dream Studio 5 software are 3D models from Acuris, Inc. All 3D models are copyright Acuris. For more information on the 3D models that Acuris has to offer, contact Acuris at:

1313 Lord Sterling Road
Washington Crossing, PA 18977

Phone: (215) 493-4302

Toll-Free: (800) OK-ACRUS

www: http://www.acuris.com

ArtBeats

Included with your Ray Dream Studio 5 software are textures from ArtBeats. All images are copyright ArtBeats. For more information, contact ArtBeats:

PO Box 709
Myrtle Creek, OR 97457

Phone: (541) 863-4429

Toll-Free: (800) 444-9392

Fax: (541) 863-4547

www: http://www.artbeats.com

Form and Function

Included with your Ray Dream Studio 5 software are textures from Form and Function. All images are copyright Form and Function. For more information, contact Form and Function:

1595 17th Avenue
San Francisco, CA 94122

Phone: (415) 664-4010

KETIV Technologies, Inc.

Included with your Ray Dream Studio 5 software are 50 textures from Just Textures™. You can use the textures royalty free in your rendering work. Just Textures is a library with 1,250 royalty free textures on CD-ROM for use in Ray Dream Studio 5. Over 900 textures are seamlessly tileable and repeat in all directions when wrapped onto 3D objects.

The tileable textures include brick, carpets, clouds, fabric, fences, floor tiles, flower fields, food, granite, ground, laminates, marbles, metals, plants, rock, roof tiling, soil, stone, walls, wallpapers, water, wood and much more. The remaining 250 textures show cut-out objects than can be rendered in any 3D scene. The object textures include animals, bush, cars, people, plants, rugs, trees, and much more. **Just Textures** is a product of KETIV Technologies, Inc. and Modern Medium Inc. For more information contact KETIV Technologies, Inc.:

KETIV Technologies, Inc.
6601 NE 78th Court, Suite A-8
Portland, OR 97218

Phone: (503) 252-3230

Fax: (503) 252-3668

Toll-Free: (800) 458-0690

www: http://www.ketiv.com

MetaTools

Included with your Ray Dream Studio 5 software are textures created with MetaTools TextureScape™. This Eddy-award winning program allows you to create an infinite variety of textures for print, multimedia, and desktop video. TextureScape not only allows you to create your own textures, it also comes with a CD-ROM filled with over 800 textures for your use.

MetaTools
6303 Carpinteria Ave.
Carpinteria, CA 93013

Phone: (805) 566-6200

Fax: (805) 566-6367

Toll-Free: (800) 472-9025

www: http://www.metatools.com

Viewpoint DataLabs

Included with your Ray Dream Studio 5 software are models from Viewpoint DataLabs International, Inc. All 3D Datasets are copyright Viewpoint DataLabs. For more information on the over 1000 3D Datasets that Viewpoint has to offer, contact Viewpoint DataLabs:

625 South State St.
Orem, UT 84058

Phone: (801) 229-3000

Fax: (801) 229-3300

Toll-Free: (800) DATASET (328-2738)

www: http://www.viewpoint.com

PhotoDisc

Included with Ray Dream Studio 5 is a sample of professional images from PhotoDisc, the Leader in Digital Stock Photography!

PhotoDisc award winning Photos give you a powerful edge for conveying your message. The images are part of the carefully edited PhotoDisc collection of stock photographs selected for advertising, creative design and corporate communications. Each of the photographs is carefully scanned with the highest quality drum scanning technology, color-corrected and stored in full-color for dazzling impact. You are licensed to use the photographs for all of your design, advertising and multimedia needs, with no additional fees.

PhotoDisc Customer Service

Phone: (206)-441-9355 (International)

Fax: (206)-441-4961

Toll-Free: (800)-528-3472 (8am-6pm PST)

www: http://www.photodisc.com

Royalty free and color correct for immediate use.

1

Installation

Installing Ray Dream Studio

This chapter covers the installation and launching of Ray Dream Studio.

This section gives instructions for installing the Macintosh and Windows versions of Ray Dream Studio software. Follow the instructions appropriate for your system.

Macintosh Installation

System Requirements

Ray Dream Studio works on any Power Macintosh with at least the following configuration:

- Power Macintosh or compatible model running system 7.0 or later.
- A minimum of 20MB of available application RAM (24+ MB is recommended).

  Ray Dream Studio can take advantage of more RAM, if you have it. Because of the variation in individual system configurations, our minimum RAM requirements are based on the amount of memory available to run applications after the system is loaded. Choose **Apple menu▸ About This Macintosh** to verify the amount of available memory you have.

- A minimum of 20 MB of hard drive space reserved for program files, plus 20 MB free disk space.

  See "Selecting the Scratch Disk" on page 23 for information on how Ray Dream Studio uses the hard disk.

- CD-ROM player.
- Color display (24 bit recommended).

To use your Ray Dream software with text, you need either:

- TrueType™ fonts
- Type 1 PostScript™ fonts and Adobe Type Manager™.

Installation

To install your Ray Dream Software:

1. Turn off any virus protection and compression programs and close any other applications currently open.
2. Insert the Ray Dream Studio CD-ROM into your CD-ROM drive.
3. Double-click the **Installer** icon from the CD-ROM and follow the instructions on the screen.

   The installer gives you the option of doing an **Easy** or **Custom** installation. **Easy Install** will install your software in a standard configuration appropriate for most users.

   Choose **Custom** if you want to select the individual files for installation. Choose your custom options carefully — your Ray Dream software includes large volumes of content that could take up valuable space on your hard disk. Your best strategy is to install the options that you'll use frequently and use the CD-ROM to access your models and shaders.

   If you want to install any of the additional Ray Dream extensions, choose the **Custom** installation option and select the extensions you want from the list. To use the add-on extension, you need to purchase a serial number from Fractal Design. For more information, call Fractal Sales at (800) 846-011, or visit Fractal Design Online at http://www.fractal.com
4. Choose the Install Location for your Ray Dream folder and click **Install**.
5. After your Ray Dream software has finished installing, click **Quit** to quit the Installer.

Software Support for Macintosh

Your Ray Dream Software can open and import files saved in the following formats:

These file formats can be imported directly into the Free Form modeler:

- Adobe Illustrator™ version 1.1, version 88, or versions 3 and 5.

These file formats can be used to import or export images or import files as texture maps:

- Adobe PhotoShop™

- RIFF (Fractal Design Painter® and Detailer™)
- PICT
- GIF
- TIFF (RGB only)
- Corel Photo-Paint
- JPEG
- EPS (export only)

Movie formats:

- QuickTime
- Sequenced still images

These file formats can be used to import or export 3D objects:

- Ray Dream Designer 3 (Macintosh and Windows versions)
- Ray Dream Designer 4 (Windows versions)
- 3D DXF (3D faces only)
- 3DMF (Apple's QuickDraw 3D format)
- VRML (export only)

Windows Installation

System Requirements

Ray Dream Studio works on any PC compatible computer with at least the following configuration:

- 486, Pentium or Pentium Pro-based PC computer with minimum of 16 MB RAM (24+ MB recommended).
- Microsoft Windows 95™ or Windows NT 4.0.
- 20 MB hard drive space reserved for program files, plus 20 MB free disk space.

For information on how your Ray Dream Studio software uses the hard disk, refer to "Selecting the Scratch Disk" on page 23.

- Color Display and Windows-compatible graphics card with minimum of 256 colors (16- or 24-bit accelerated graphics card recommended).
- CD-ROM player.

To use your Ray Dream software with type, you need:

- TrueType™ fonts

Windows Installation

Your Ray Dream CD-ROM supports the Windows Autorun feature. When you insert the CDROM into any PC running Windows software, an Autorun window automatically appears. You can choose to install your Ray Dream software or to explore the other files on the CD-ROM.

To install your Ray Dream software:

1. Start Windows.

   No other application should be running during installation.

2. Insert the Ray Dream Studio CD-ROM into your CD-ROM drive and click the **Install** button.

   Windows locates the Ray Dream installation program on the CD-ROM.

3. Follow the instructions on the screen. Click Next to confirm each option and move to the next screen.

   You have the option of running a **Typical**, **Compact** or **Custom** installation. **Typical** will install your software in a standard configuration appropriate for most users. **Compact** installs a minimum configuration.

   Choose **Custom** if you want to select the individual files for installation. Choose your custom options carefully — your Ray Dream software includes large volumes of content that could take up valuable space on your hard disk. Your best strategy is to install the options that you'll use frequently and use your CD-ROM to store your models and shaders.

   If you want to install any of the additional Ray Dream extensions, choose the **Custom** installation option and select the extensions you want from the list. To use the add-on extension, you need to purchase a serial number from Fractal Design. For more information, call Fractal Sales at (800) 846-011, or visit Fractal Design Online at: http://www.fractal.com

You will also be given options to choose your **Destination Directory** and **Program Folder**.

4 Once you've made these selections you'll be able to confirm your installation settings. Then click **Start** to install.

5 After your Ray Dream software has finished installing, click **Finish**.

Alternatively you can install your Ray Dream software without using Autorun from the CD. Choose **Start menu▸ Control Panels**. Then double-click **Add/Remove Programs** from the **Control Panel** and follow the directions given.

Software Support for Windows

Your Ray Dream software can open and import files saved in the following formats:

These file formats can be imported directly into the Free Form modeler:

- Adobe Illustrator™ (*.AI)
- Computer Graphics Metafile (vector-based) (*.CGM)
- Windows Metafile (*.WMF)
- CorelDRAW® (*.CDR)

These file formats can be used to import or export images or import files as texture maps:

- Corel Photo-Paint (*.CPT)
- GIF
- JPEG
- Photoshop (*.PSD) (RGB only)
- RIF (Fractal Design Painter/Detailer format)
- TIFF or Tag Image File Format (*.TIF) (RGB not CMYK)
- Targa (*.TGA)
- Windows Bitmap (*.BMP)
- Windows PaintBrush (*.PCX)

Movie Formats:

- Video for Windows (*.AVI)
- Sequenced still images

These file formats can be used to import or export 3D objects:

- Ray Dream Designer 3 (Windows & Macintosh versions)
- Ray Dream Designer 4 (Windows & Macintosh versions)
- 3D DXF (3D faces only) (*.DXF)
- 3DMF (Apple QuickDraw 3D format)

Installation Troubleshooting

If the installation was not successful, verify that your hard disk has sufficient storage space for the installation. You may have to clear your disk for the recommended amount of space and repeat the installation. If you have verified that your hard disk has enough free space and the program fails to install after a second attempt, please contact Fractal Design Technical Support at (408) 430-4200.

2

Ray Dream Studio 5 Overview

Introduction

This chapter introduces some of the major features and concepts of Ray Dream Studio 5.

With Ray Dream Studio 5 you can create dazzling 3D illustrations in five easy steps:

- Build true three-dimensional objects with easy-to-use, intuitive modeling tools
- Paint colors and textures on your objects, giving them realistic properties like transparency and reflection
- Arrange your objects together in a scene
- Light your scene to enhance realism and depth

- Render your scene with Ray Dream Studio's acclaimed ray-tracing engine to produce extraordinary, photorealistic illustrations or animations.

Ray Dream Studio 5 combines power with an easy-to-use, intuitive interface. It provides all the features necessary to create full-color 3D illustrations and animations.

Ray Dream Studio's modelers use many of the tools standard to 2D drawing programs and feature a variety time saving utilities and tools to make creating complex spline-based and polymesh objects quick and easy.

Ray Dream Studio 5 features state-of the-art shading technology, which lets you apply colors and surface textures to your objects.You can even paint directly on a 3D object with shaders that emulate wood grain or marble, or with effects like bump, transparency and reflection.

The Ray Dream Studio workspace is like a photographer's studio. You can position multiple light sources and cameras, and shift between cameras to gain different perspectives on your work. You can also use the Scene Wizard to guiding you through the process of creating 3D scenes.

When you've created all the objects in your scene, you can use the easy-to-use features of the **Time Line** window to create key frames for animations.

When your scene is completed, you can render it. Rendering is the process of capturing a two-dimensional image, like a photograph, from your three-dimensional scene. You can also render your key frames as an animation.

Ray Dream Studio's rendered images are compatible with popular Macintosh and Windows 2D graphics and page-layout programs. You'll have no trouble compositing renderings with other images or integrating text with your artwork.

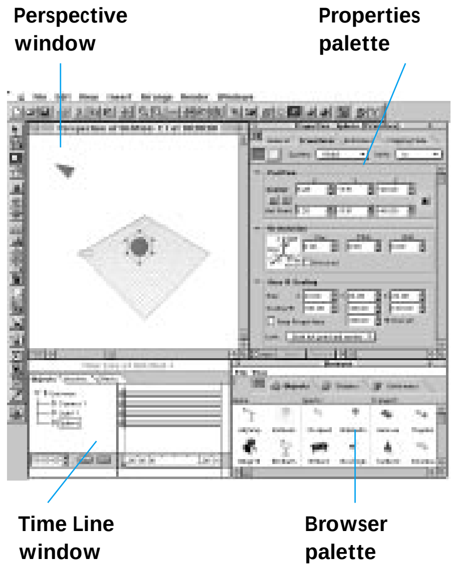
Application Overview

What is a Scene?

A Ray Dream Studio 5 document is called a scene. A scene is the collection of objects, light sources, and cameras, saved together in a file. Each new scene has two windows—the **Perspective** window and the **Time Line** window.

Ray Dream Studio 5 Windows

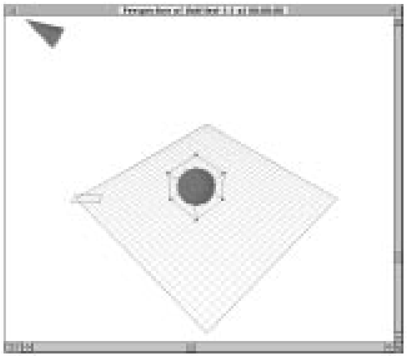
When the application opens for the first time, you see Ray Dream Studio's four main interface elements: **Perspective** window, **Time Line** window, **Browser** palette, and the **Properties** palette. These are the primary work areas. The four elements are described here, but instructions for working in them appear in subsequent chapters.



Ray Dream Studio 5's main interface elements.

Perspective Window

The **Perspective** window shows a view of the 3D workspace, where objects, lights and cameras are arranged to create a scene. The workspace itself is called the universe.



The Perspective window displays a view of all the objects in your scene.

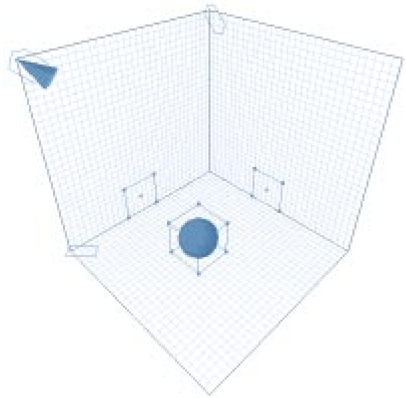
The view of your scene shown in the **Perspective** window is taken through a camera. You can move this camera to see different views of your scene or you can add other cameras to get other viewpoints.

The current zoom ratio (1:1, 2:1, etc.…) is shown in the lower left of the window. The status (Idle, Drawing, Shading, etc.) of the application is displayed in the status bar.

Note: If you hide the status bar, using the **View menu▸ Status Bar** command, it becomes part of the **Perspective** window, otherwise it remains a separate window.

Working Box

The main area of the **Perspective** window is called the **Working Box**. The Working Box is represented by three intersecting planes. It provides a framework that helps you work in a three-dimensional universe with two-dimensional devices—the mouse and monitor.

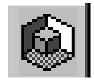


The Working Box is made up of three grids which represent the X, Y and Z axes.

Each plane of the working box has a grid. Each grid represents an axis in three dimensional space: X, Y and Z.

When you're arranging objects you'll need a specific plane to act as a reference. This plane is referred to as the *active plane* and is displayed in light green. The **active plane** is the plane of reference for many arranging operations, like moving and aligning.

You can hide or display the grids using the **Display Plane** tool. By default the **Display Plane** tool appears on the left side of the screen beneath the main toolbar. Planes that are visible in the **Perspective** window are shown in dark gray. Invisible planes are white.



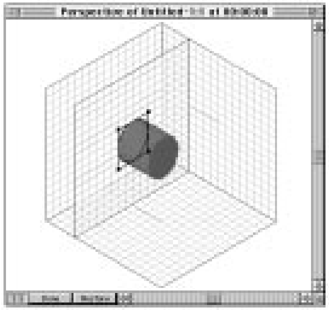
Use the Display Plane tool to set which Working Box planes are visible in the Perspective window.

Modeling Windows

The **Perspective** window is where you arrange and view your scene. To create the objects that go into the scene you need to use a modeler.

The two modelers available in Ray Dream Studio are the **Mesh Form** modeler and the **Free Form** modeler. Each modeler has its own window with individual tools and menu commands.

When you "Jump Into" an object by double-clicking it, the **Perspective** window "zooms in" on the object (to the exclusion of other objects). The menus change to display the modeler's menu, and the **Perspective** toolbox changes to the **Modeler** toolbox.



The Free Form modeling window is used to create Free Form objects.

The modeling and **Perspective** windows look similar but there are a few ways you can tell which window you're in:

- In the **Perspective** window all the objects in your scene are visible. In a modeler only the object you're modeling is visible
- In the modelers, the **Done** button appears at the bottom of the window.
- Many of the tools in the **Perspective** window, like the camera, lights and object creation tools are not visible in the modeling windows

Object Preview

The **Perspective** window has six modes for displaying your objects:

- No Preview
- Bounding Box
- Wireframe
- Preview (Fast)
- Shaded Preview (Gouraud)
- Better Preview (Phong)

Better Preview mode shows details of the shape and color of your objects, but takes longer to calculate and draw. To increase application efficiency, you might want to work in **Wireframe** or **Preview** mode at the outset of a project, then switch to **Better Preview** mode as specific details become important.

You can also use View menu▸ Objects Invisible to make selected objects invisible. Invisible object(s) are still listed in the **Time Line** window where their names are italicized.

Time Line Window

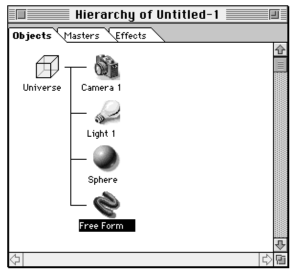
The **Time Line** window shows a logical (as opposed to visual) representation of the scene. All objects, cameras, and lights that you bring into the universe are listed in the Objects panel of the **Time Line**.

The **Time Line** window provides certain information on the scene's construction that is not immediately apparent in the **Perspective** window; for example, how several elements may be grouped.

The **Time Line** window has two modes: Time Line and Hierarchy. When in Time Line mode, the window displays the events, transition and length of your animation. This mode gives you control the events in your animation.

The Time Line window in Time Line mode. The Time Line mode is used to set the position of key frames in your animation.

In Hierarchy mode, the window displays all the elements in your scene as icons. This mode provides a graphic display of how elements are grouped and linked.



The Time Line window in Hierarchy mode. The Hierarchy mode is used to see a graphical representation of the groups and links in your scene.

The **Perspective** and **Time Line** windows are synchronized. As you add or remove objects from one, the display in the other updates automatically.

As well, any object selected in the **Hierarchy** window is also selected in the **Perspective** window. When you're working with complex scenes, you might find it easier to select small or hidden objects in the **Time Line** rather than in the **Perspective** window.

The **Time Line** window has 3 separate tabs: **Objects**, **Masters**, and **Effects**. Use the tabs at the top of the window to switch back and forth.

- The **Objects** tab displays all of the objects in your scene.
- The **Masters** tab displays only Master objects. You use the **Masters** panel to manage multiple copies of a single object. When you duplicate a single object you create a class of objects that are linked to the Master object. To edit an individual copy, select it in the **Objects** tab. To make a change to all copies of the object, select the Master object in the **Masters** tab.
- The **Effects** tab shows any **Render Effects** that you've added to your scene.

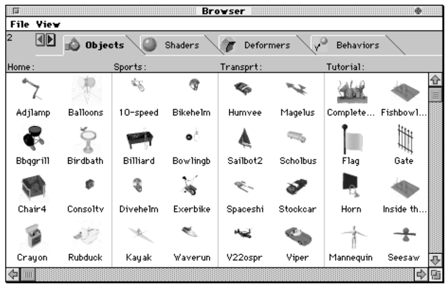
For more information about the Master objects, refer to Chapter 13, "Building a Scene."

The Browser Palette

The **Browser** palette is a visual catalog of all the elements you can use to create a scene. The **Browser** palette has eight tabs, each for a different category of element:

- Shaders
- Objects
- Lights
- Cameras
- Deformers
- Behaviors
- Links
- Render Filters

You can retrieve any item by dragging it out of the **Browser** palette and into either the **Time Line** or **Perspective** windows.



The Browser palette, showing the Objects tab. The Browser palette is used to store a variety of scene elements.

Each tab can display a multiple number of directories. You can use the **Browser** palette commands to add and remove directories from your hard disk. You can also add some items from the **Time Line** window or the **Properties** palette by dragging them directly into the **Browser** palette.

You can view **Browser** palette items by small icon, large icon, or text using the **Browser palette: View menu▸** commands.

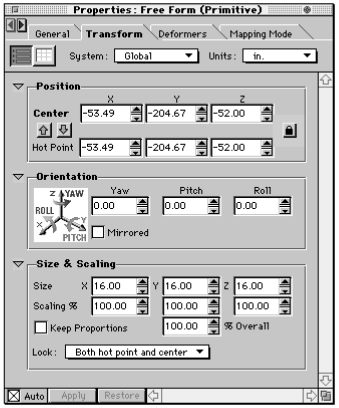
Double-clicking a **Shader**, **Deformer**, **Link**, **Behavior** or **Render Filter** tab in the **Browser** palette opens the appropriate editor for the item. For example, double-clicking a **Shader** opens the **Shader Editor**.

Objects, **Lights** and **Cameras** are stored in standard Ray Dream (RDS) document files. When you double-click them in the **Browser** palette, its document file is opened in the **Perspective** window.

For more on the using the **Browser** palette, refer to "Using the Browser Palette" on page 28.

Properties Palette

The **Properties** palette is a dynamic palette that displays the properties of any element selected in the **Perspective** or **Time Line** windows.



The Properties palette controls and data update for each scene item you select.

The controls available in the **Properties** palette change as you select different items:

- When you select an object in the **Perspective** window, the palette displays controls to change the object's name, position, deformers, shading, behaviors, links and rendering settings.
- When you select a light, the palette displays the light's properties and controls for changing the light type, color and other properties.
- When you select a camera, the palette displays the camera's name, position and camera type properties.
- When you select a point in the **Free Form** modeler, the palette displays the point's position and angle.
- When you select an object in the **Mesh Form** modeler, the palette displays controls for adjusting its numerical position.

  Many of the tools in the **Mesh Form** modeler also have a number of properties. When a tool has no properties, the palette is blank.

Toolbars

Ray Dream Studio's toolbars provide quick access to many of Ray Dream Studio's frequently used commands and functions.

There are eight different toolbars available in Ray Dream Studio:

- Standard
- Zoom
- Rendering
- Time Controller
- Status
- Tools
- Planes
- Internet

You can use the **Toolbar** dialog, available from the **View menu▸ Toolbars**, to choose which toolbars you want displayed.

The tools available in the **Tools** toolbar change as you switch between the **Perspective**, **Time Line**, **Mesh Form** and **Free Form** windows.

Toolbars can be docked along the top, bottom, left, or right edge of the screen. They can also be undocked as floating palettes.

The Time Controller toolbar as floating palette. Use this toolbar to preview your animation.

Workspace Preferences

As you work, you can resize windows, move them around your screen and customize your workspace. When you quit, Ray Dream Studio 5 remembers your settings and uses them the next time you launch the application.

If you like, you can save different workspace layouts in configuration profiles, which you can load at any time.

For more information on saving workspace settings, refer to "Setting up your Workspace" on page 25.

Starting to Think in 3D

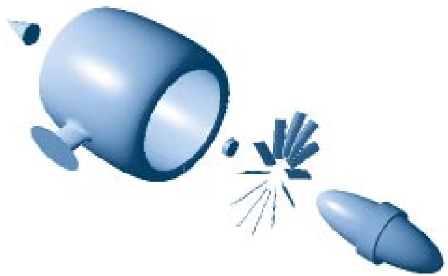
Whether you're used to working with 2D illustration applications, or using a 3D illustration application for the first time, there are several things you should consider when creating 3D illustrations. The scene you create and the objects you use to populate it are all in 3D, meaning that you need to consider how your scene will look in all three dimensions.

When you look at a real-world object. You may think it's structurally complex. Its shapes curve, twist, join, and separate in ways that may seem impossible to recreate in a computer art program but Ray Dream Studio 5 makes constructing such objects easy. You build them one piece at a time.

Before beginning a complex object, examine it for its components. Keeping in mind the way Studio's modeling tools work, divide the object into simple elements. For example, you can "disassemble" a mini-sub engine into the engine housing, the blades, and motor.

In Ray Dream Studio 5, it's easy to model each of these components separately. Then, using the positioning and alignment tools in the **Perspective** window, you can assemble the pieces into the mini-sub.

When a subassembly is built, like the sub engine, you can group the components. Grouping lets you manipulate the



You can disassemble a mini-sub engine into simple elements, which can be modeled separately.

subassembly as a single object. Working in this way, there's no limit to the complexity of objects you can build. Finish the mini-sub, place it under water, add a terrain and some ruins, and you've built an underwater scene.

Underwater scene created by assembling a mini-sub and adding terrain and ruins.

You can shade the different objects to describe their surfaces. Shading involves not only color but also textures, like gravel on a sea floor, and surface properties, like shininess.

Underwater scene with shading applied.

To enhance realism and three-dimensional effects, you can add light sources to your scene. In fact, lighting is necessary for the same reasons it's required in photography—nothing can be seen without it. With different lighting, the underwater scene can change from a shallow algae-filled lake to the murky depths of the ocean.

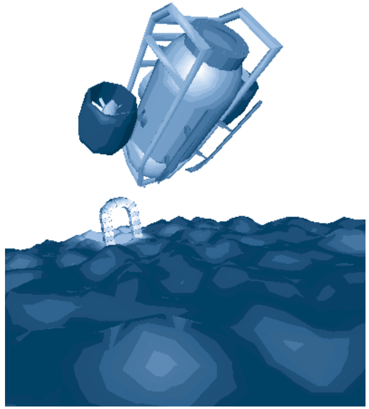
Underwater scene with lights added.

In the lake, the lighting is bright green and comes from overhead. The shadows are short, directly beneath the objects. In the murky depths, the light is fainter, and dark blue.The mini-sub's spotlights create high contrast shadows on the ruins.

Because you're working in three dimensions, you can view your scene from any angle and at any degree of magnification. In Ray Dream Studio, you can get different views by simply placing cameras at different positions in your three-dimensional workspace.

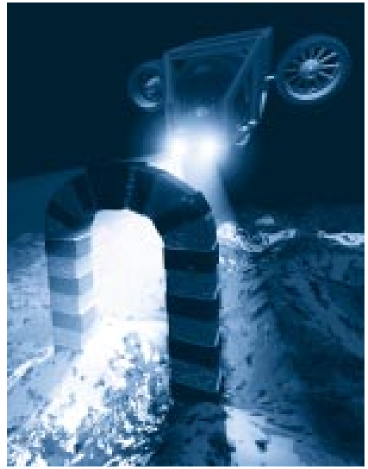
For example, you can view your scene as if you were looking down from the surface.

You can also view the scene from below, or show it from the view of a diver on the sea floor watching the mini-sub glide by. It's the same scene, but what appears in the window depends entirely on the viewpoint you select.



Diver's view of scene.

After you decide on the best viewpoint, you'll render the scene. Rendering is the culmination of a Ray Dream Studio 5 project. Rendering is like taking a photograph. It reduces your three-dimensional scene to a two-dimensional image. The rendered image, which can have a much higher resolution than can be seen on the screen, can be printed directly from Ray Dream Studio or opened in virtually any Macintosh or Windows graphics application.



The final rendered image.

If the rendering doesn't turn out quite right, you can always go back into your scene and adjust the viewpoint, lighting, shading, or even the shape of objects. Then, simply take another rendering.

3

Animation in Ray Dream Studio

Animation Overview

Animation with Ray Dream Studio 5 is a matter of adding a fourth dimension—time—to your 3D illustrations. To create an animation you arrange your scene at key points in time. Ray Dream Studio then fills in the gaps to complete the animation.

You can animate almost everything in your scene:

- the motion of objects, lights, and cameras
- object size, shape, and shading attributes
- object deformer settings
- camera and light parameters
- ambient lighting, background, backdrop, and atmospheric effects.

The Animation Process

Animation is like an extension to creating an illustration. To create a scene you need to set up scene properties. To create an animation, you change those properties over time. When you play the animation, the changing properties create action.

The steps to creating an animation are as follows:

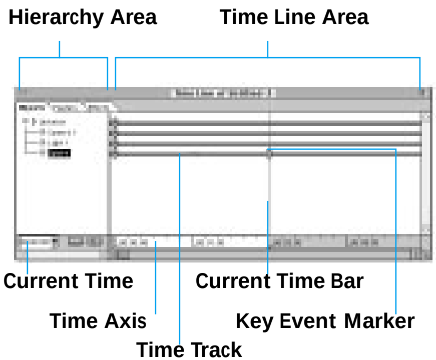
- Create objects using the **Primitive** tools, the **Mesh Form** modeler and the **Free Form** modeler.
- Build the scene by arranging objects and setting lights and cameras.
- Animate the scene by making changes to the properties of the elements in your scene at different points in time. Each time you change a property, you create a *key event*. Ray Dream Studio creates the illusion of motion by filling in the transitions between key events.
- Render the final animation. You can save your rendered animation as a QuickTime™ (Macintosh) or AVI (Windows) movie or as a series of sequential image files in a variety of Windows and Macintosh formats.

Animation Tools

Ray Dream Studio has a number of tools for creating animations.

Time Line Window

The **Time Line** window is the principal tool for creating animations. The window displays a graphical representation of your animation.

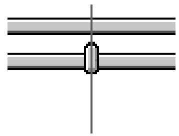


The Time Line window is used to position key frames in your animation and add tweeners.

The **Time Line** window consists of three areas:

- The Hierarchy area shows the scene's hierarchical structure, including links and groups. Individual objects and effects in the **Time Line** window's Hierarchy area can be expanded to show their animatable properties. This allows you to animate each property individually.
- The Time Line area to the right of the hierarchy area displays a time track for each item (object, effect, or property) currently shown in the hierarchy area.

  A key event marker on a particular time track indicates a key event that modifies the associated object, effect, or property. Key event markers can be created, copied, deleted, or moved along the Time Axis by dragging them



The key event marker on time line is shows the position of a key frame in an animation.

- The Time Axis extends across the bottom of the window. It's a ruler, with marks indicating time increments (minutes, seconds, and frames).

The Time Axis in time line shows the length of your animation.

The location of the Current Time Bar along the Time Axis indicates the current time—the point in the animation that is currently being edited and displayed in the **Perspective** window.

You can change the current time by dragging the **Current Time** bar along the **Time Axis**.

If you are working on an illustration project in Ray Dream Studio and prefer to work with an iconic Hierarchy mode rather than the Time Line mode, bring the **Time Line** window to the front and choose **View menu ▸ Vertical** or **Horizontal**. This replaces the **Time Line** view with the **Hierarchy** view.

Time Controller Toolbar

The Time Controller's VCR-like controls allow you to preview your animation in the **Perspective** window. You can also use the **Time Controller** to change the current time.

Use the Time Controller toolbar to preview your animation or change the current time.

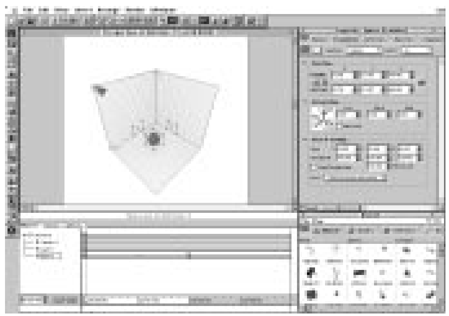
If the **Time Controller** toolbar is not visible, you can choose **View menu ▸ Toolbars** and select it in the dialog that appears.

Customizing your Workspace for Animation

You can optimize the layout of your Ray Dream Studio windows by choosing a workspace designed specifically for animation. Ray Dream Studio includes preset animation workspaces to fit most popular screen resolutions.

Generally, the preset animation workspaces widen the **Time Line** window and display it in the lower portion of your screen. The **Browser** palette moves to the upper right corner. The wider **Time Line** window allows you to view more of the time line without scrolling.

You can also create your own custom workspace by arranging the windows in the position you want and then saving the configuration. For more information on configuring your workspace, refer to "Setting up your Workspace" on page 25.



You can customize the layout of the workspace to look something like one shown when you're working on an animation.

Special Animation Features

Ray Dream Studio 5 has several special features to help you create professional-quality animations:

- Tweeners
- Behaviors
- Animating with the modelers
- Rotoscoping
- Animating deformers.

Tweeners

Ray Dream Studio uses formulas called *tweeners* (from in-be*tween*) to calculate the state of each object between key events. By specifying which tweener to use for each transition, you can control the rate of change between key events in your animation.

Ray Dream Studio includes four different types of tweeners: **linear** (for a constant rate of change), **Bezier** (for smooth motion paths and greater control over acceleration and deceleration), **discrete** (for instantaneous change), and **oscillate** (for alternating back and forth between key events).

For more information on tweeners, refer to "About Tweeners" on page 309.

Behaviors

Behaviors are a class of tools that help automate the animation process. Some behaviors, like **Bounce** and **Spin**, automatically animate common types of motion. Others, like **Point At** and **Track**, animate one object based on the position or orientation of a second object.

Inverse kinematics is a specialized behavior that ensures complex, jointed models move realistically when animated. This is an invaluable tool for animating characters or mechanical models.

Physically-based behaviors are a special set of behaviors that let you simulate real-world physical actions.

For more information, refer to "Behaviors" on page 314.

Animating with the Modelers

You can animate the shape of any model you create using the **Free Form** or **Mesh Form** modelers by modifying its cross sections, sweep path and vertices over time. This lets you achieve fluid, Bezier-based object metamorphosis, or precise animation of details like facial features.

For more information, refer to Chapter 16, "Animating Techniques."

Rotoscoping

Rotoscoping lets you add live action or moving textures by incorporating existing animations or digitized videos (movies). You can use QuickTime or Microsoft Video (AVI) files as texture maps or paint shapes on objects, backgrounds, backdrops and light gels.

For more information, refer to "Rotoscoping" on page 334.

Animating Deformers

Ray Dream Studio lets you animate the settings of any deformer. This means you can easily animate the shape of objects and groups without having to edit them in a modeler. Deformers can also be used to animate models you import from other applications.

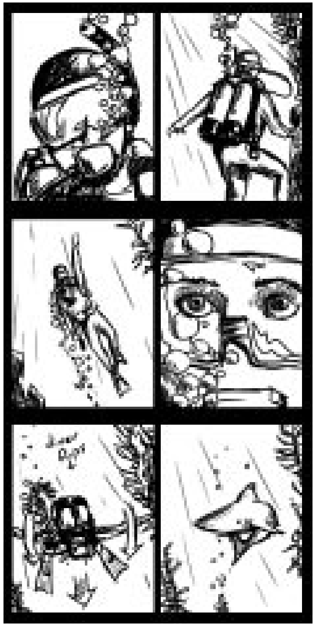
For more information on the various deformers and their settings, refer to "Using Deformers" on page 171. For more information on animating deformers, refer to "Animating with Deformers" on page 332.

Managing your Project

Storyboarding

If you are attempting anything other than a brief animation, it's a good idea to create a storyboard first. A *storyboard* is a series of drawn images showing the key actions in an animation. The storyboard helps you quickly work out the animations viewpoint, framing and composition. Because you're just sketching, it's easy to make changes and other arrangements, Your work on the storyboard will give you an idea of the types of objects you'll need to model and how to arrange the scene.

You can make sample storyboards by drawing a series of horizontal screen outlines on a sheet of paper, using a 4 to 3 aspect ratio (ratio of width to height). Draw the screens as large as necessary, and leave a block of space for the narration or description. You can also purchase cartooning storyboards at art supply stores.



You can use a storyboard to help you layout the action in your animation.

Simplifying your Scenes

In general, the 3D scenes you create for animation need not be as complex as a typical illustration scene. The viewer's eye tends to be drawn toward motion and foreground elements. Static objects and background elements are scanned only casually.

By reducing unnecessary detail, you can reduce rendering times dramatically and keep the size of your scene files manageable. When preparing a scene for animation, keep the following guidelines in mind:

- Refine your animation. Keep the objects as simple as possible. Detail is usually lost in an animation.
- Use fewer objects, and limit the number of reflective and transparent objects.
- Use the minimum number of lights required to achieve an effect. Additional light adds significantly to the rendering time.
- Limit texture map size, and use 8-bit texture maps instead of 24-bit.
- If a complex model remains in the background for the duration of the animation, try substituting a simpler version.
- Avoid using a modeled background. Use a rotoscoped image or procedural background instead.
- If your camera view remains unchanged for an entire scene, consider rendering a still image with just the scene's background elements. Then use this image as a backdrop and animate only the foreground elements. This technique requires some planning to make sure that shadows and transparent objects don't give the "trick" away.

Rendering without Compression

If you are not pressed for hard disk space, it usually makes sense to render your animation without compression. This ensures that you'll have a high quality copy of the animation to work with.

Working from your uncompressed original, you can save copies, experimenting with various compression settings until you are satisfied with both the image quality and playback rate.

An animation compressed multiple times degrades significantly, so you should always render without compression if you intend to do any postprocessing in another application.

Motion and Timing Principles

As an animator, the most important skill you can master is the ability to portray motion convincingly, whether it is intended to be realistic or exaggerated and cartoonish. No matter how good a 3D modeler you are, the timing of the events in your animation are of paramount importance.

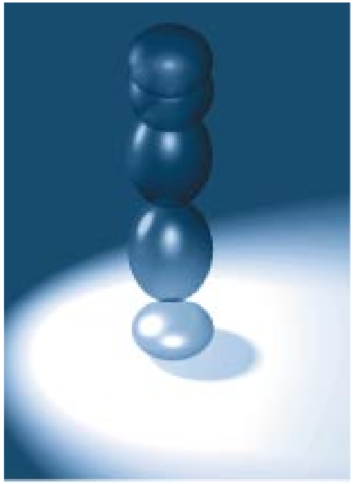
Many of the principles of timing and motion developed by cel animators apply to 3D animation with Ray Dream Studio as well. Many of these principles apply especially to character animation, but most are useful for any subject matter. For more information, you can refer to one of the many excellent books on cartoon animation.

Squash and Stretch

Squash and stretch are animator's terms for the exaggerated re-distribution of an object's mass as it moves or shifts positions. Squash and stretch portray the qualities of elasticity and weight in a character or an object.

Think of a bouncing rubber ball. As it falls it stretches; as soon as it hits the ground it is squashed. If the ball failed to change shape, the audience would interpret it as a solid, rigid mass.

You can accomplish squash and stretch in Ray Dream Studio by animating an object's shape using either the **Mesh Form** or **Free Form** modeler and the Stretch deformer.



This ball's bouncing motion is exaggerated by deforming its shape so that it stretches as its descending and squashes when it hit the surface.

Lag and Overlap

When an object moves from one point to another, not everything has to move at once. For true-to-life movement, action that is secondary to the main activity can lag and overlap. For example, when you animate a character in pursuit of a bus, different parts of the body move at different speeds. The character's head may lead, followed by his torso, and finally by his arms and legs. In Ray Dream Studio, the Inverse Kinematics behavior can be used to experiment with poses that convey this type of motion.

A realistic turn is created by moving the head of the skeleton first, followed by the shoulders and then the hips.

A flag waving back and forth is another example of lag and overlap. It lags at one end of the arc and overlaps when moving in the opposite direction. You can use Ray Dream Studio 5's **Free Form** modeler to create lagging and overlapping effects.

Arc versus Straight Line Movement

Character motion appears more realistic if it follows an arc or curved path instead of a straight line. Most objects affected by gravity also follow curved, rather than straight trajectories.

Ray Dream Studio's Bezier tweener is optimized for arc type movements. Try experimenting with its **Tighten In** and **Tighten Out** settings to produce narrower or wider arcs.

Secondary Motion

Secondary motion adds realism and credibility to a scene. A character turning his head to stare at something in disbelief shouldn't just turn his head; his jaw should drop and his eyes should blink as well. The viewer focuses on the main action, but registers the secondary motion as supporting it. Ray Dream Studio's time line gives you enough control to manage even the finest details of your animation, so you can add this kind of secondary detail.

Anticipation and Follow-through

In anticipation of a major action, an animated character often makes a small preliminary action in the opposite direction. For example, a character about to move screen right might first make a slight movement screen left, then strike a pose before moving screen right.

Before moving screen right, the skeleton moves slightly to the left.

Follow-through is the continuance of motion after a major action is completed. A baseball bat does not stop moving after hitting the ball; rather, it continues along its arc of motion. Anticipation and follow-through make actions more believable.

Exaggeration

Exaggerating an action emphasizes it making it more prominent. For example, if intrigue is called for, have a character sneak instead of walk.

If you want your animation to resemble footage from a hand-held camera, give your camera an exaggerated bobbing motion. Virtually any type of action can be exaggerated to get an idea across.

Timing

Timing is as important in animation as it is in any dramatic form. Consider the difference between an abrupt stop and a gradual slowdown. Each conveys a completely different impression. In general, a motion that continues at the same pace lacks interest and seems unreal.

If you are trying to animate realistic character action, act out the sequence yourself, timing how long each pose is held and how long each action takes with a stopwatch.

Timing is one of the most difficult aspects of animation to master. The key events you define at different points on the time line need to be synchronized with those that came before and those that follow. Fortunately, you can use the interactive nature of computer animation to fine-tune your timing. Test your animation frequently by previewing it in the **Perspective** window or by dragging the Current Time bar back and forth between key events. Adjust the event's position until you're satisfied with the timing.

4

Ray Dream Studio 5 Basics

Overview

This chapter describes how to setup Ray Dream Studio and some of the basic operations you'll need to know when creating 3D illustrations and animations.

Learning about Ray Dream Studio 5 Files

Everything in Ray Dream Studio can be saved as a file. You can save entire scenes as **filename.RDS** files, which store all the information in the scene including objects, lights cameras and render settings. You can also save the individual components of a scene as separate files.

Objects, Shaders, Deformers, Links, Behaviors and Render Filters can all be saved as individual files (.BRW) that only the **Browser** palette can open. Once loaded into the palette, they can be dragged into your scene. You can also store file sets in different folders to create libraries of components like, **Shader** and **Object** libraries. The **Browser** palette commands let you save, add and remove different folders, or families, from the **Browser** palette. Refer to "Using the Browser Palette" on page 28 for more on using **Browser** palette commands.

Lights and cameras can be saved either as part of scene or as separate scene files, which you can store in the **Browser** palette. In this way you can create libraries of lighting and camera setups the same way you would **Shader** libraries.

Setting Up Ray Dream Studio 5

Launching Ray Dream Studio

The first time you launch the application, a dialog appears requesting your name, organization and Ray Dream Studio 5 serial number. In your Ray Dream Studio package, you'll find a peel-off sheet containing several copies of your serial number. Be sure to place one of the serial number labels on your Registration Card and return it to Fractal Design. Place the remaining labels where you'll be able to find them easily for later reference. For example, on the cover of the manual and on the CD case.

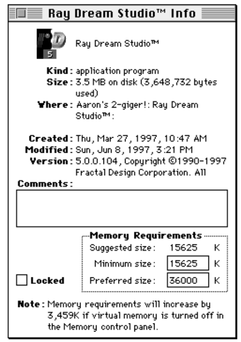
Once Ray Dream Studio 5 has been personalized, the startup screen appears, followed by the Ray Dream Studio 5 windows.

The last five digits of your serial number are replaced by an x on the opening screen to discourage piracy (You will need the entire number when you call Technical Support.)

Ray Dream Studio 5 is a color application. For the best preview display, use the Macintosh Monitors control panel, the Windows Setup options or your video adapter control panel to set your display to the highest color depth possible.

Allocating Memory on a Macintosh

By default, the Macintosh version of Ray Dream Studio 5 is allocated a specific amount of RAM appropriate for most systems. If you have more memory available, you should increase Ray Dream Studio's memory allocation. Application performance will improve when you allocate more RAM to Ray Dream Studio. To check how much RAM you have available, choose **Apple menu▸ About This Macintosh** in the Finder.



Use the Get Info dialog to allocate memory to Ray Dream Studio on a Macintosh.

To allocate memory to Ray Dream Studio (Macintosh):

1. Make sure the application is not running.

2. Click the **Ray Dream Studio 5** program icon on your system.

3. Choose **File menu ▸ Get Info**. The **Studio Information** dialog appears.

4. Increase the **Preferred Size** to a level appropriate for your system.

Selecting the Scratch Disk

Ray Dream Studio 5 uses free space on your hard drive to store portions of the scene you are working on. The program periodically reads and writes to this disk space as you zoom in or make changes in your scene. The disk space used by Ray Dream Studio 5 for this purpose is called the “scratch disk.”

Ray Dream Studio 5 works more efficiently when the selected scratch disk is fast and has plenty of free space. If scratch disk space and memory are limited, zooming is limited. You may want to use a disk utility to keep your scratch disk optimized.

By default, Ray Dream Studio 5 chooses the disk where the application is installed as the scratch disk. However, you can select any of your hard disks as the scratch disk.

To select the scratch disk:

1. Choose **File menu ▸ Preferences**.

2. Choose **Imaging, Scratch Disk** from the pop-up.

3. Select the scratch disk you wish to use.

4. Click **OK**.

Using Extensions with Ray Dream Studio 5

Ray Dream Studio 5 has an extensible, open architecture. Application developers can create extensions to integrate with Ray Dream Studio. Extensions might include a new modeler (a tool set for shaping objects), procedural shaders, new types of lights, cameras, or even an alternative rendering engine.

There are currently several extensions packages available for purchase. You can install extension from the Installer on you Ray Dream Studio CD, or download them from the Fractal Design web site. To “unlock” extensions and add their functions to Ray Dream Studio, you need to purchase a serial number from Fractal Design. For more information, contact Fractal Design sales at 1-800-846-0111.

The complete Extensions Toolkit and API for creating Ray Dream Studio extensions is available on the Ray Dream Studio CD. Refer to the Extensions Portfolio User Guide on the Ray Dream Studio CD for more information on developing extensions.

At any time when the program is running, you can get information on the Ray Dream Studio 5 extensions installed in your system. Choose **Apple menu ▸ About Extensions** (Macintosh) or **Windows Help menu ▸ About Extensions**.

Using Plug-Ins with Ray Dream Studio

Plug-in filters let you apply image editing filters to your rendered images. Ray Dream Studio supports Adobe Photoshop-Compatible Plug-ins. By default, Ray Dream Studio searches for plug-ins in the Plug-ins folder. However you can set a new folder using the **Preferences** dialog.

If you move any of these folders from this location or remove an element from them, you may lose access to some of the program’s features.

To set a default plug-in folder:

1. Choose **File menu ▸ Preferences**.

2. Choose **Imaging, Scratch Disk** from the pop-up.

3. Click **Set Directory**. A dialog appears which lets you choose a folder on your system.

4. Choose the folder you want to use.

5. Click **Select**.

Setting Application Preferences

Ray Dream Studio's Preferences let you customize many of the application's default settings. You can also set preferences for the colors of the many of the interface elements.

This section only describes the preferences that affect the entire application. Other specific preferences such as Mesh Form modeler, 3D Paint and others are covered in the related sections of this manual. You can find a specific preference by referring to the related chapter. For example, Mesh Form preferences are described in "Setting Preferences for the Mesh Form Modeler" on page 141.

To set the default unit of measure:

1. Choose **File menu▸ Preferences**.
2. Choose **General** from the pop-up.
3. Choose a measure system from the **Default 3D** pop-up. Your selection becomes the default unit of measure for all 3D objects.
4. Choose a measure system from the **Default Image Size** pop-up. Your selection becomes the default unit of measure when setting the size of rendered images.

To set interface element colors:

1. Choose **File menu▸ Preferences**.
2. Choose **Color** from the pop-up.
3. Click the color chip next to the element whose color you want to change.
4. Select a color from the color picker that appears.
5. Enable **Custom color in the Motion Path** controls if you want to pick a custom color for motion paths.
6. Enable **Custom Color in the Bounding Boxes** controls if you want to pick a custom color for object and group bounding boxes.
7. Click Ok.

Shaded Preview Preferences

The Shaded Preview display mode in Ray Dream Studio lets you see a an almost rendered preview of your image. This type of high quality preview can dramatically slow down redraw speed. However, if you have QuickDraw 3D™ or Direct3D™ acceleration on your system, you can optimize the Shaded Preview mode. This is the only mode that supports 3D acceleration, and you must "turn it on" to use it.

Ray Dream Studio also lets you set some options to optimize between performance (speed) and quality. You'll want to set these options based on your preference for working and the capabilities of your system. You'll probably want to experiment with different settings to find what's right for you.

QuickDraw 3D (Macintosh) and Direct3D (Windows) are extensions to the system architectures that improve the drawing of 3D objects onscreen. This architectures enable software and hardware developers to create 3D acceleration tools that work together.

To set Shaded Preview options:

1. Choose **File menu▸ Preferences**.
2. Choose **Shaded Preview** from the pop-up.
3. Click the **Renderer** pop-up and choose the renderer you want to use:

   Ray Dream Z Buffer This is the default renderer. It is not accelerated.

   RAVE Software This renderer uses QuickDraw 3D software acceleration.

RAVE Hardware This renderer uses QuickDraw 3D hardware acceleration. You must have specialized hardware to take advantage of this renderer.

Direct3D Software This renderer uses Direct3D software acceleration.

Direct3D Hardware This renderer uses Direct3D hardware acceleration. You must have specialized hardware to take advantage of this renderer.

Note: The onscreen results will vary slightly between the different renderers.

The RAVE and Direct3D software renderers require the associated software installed in your system. This software is installed during the Ray Dream Studio standard installation. If you do a custom install and choose not to load these items, you won't be able to use the accelerated renderers.

4 In the **Preview Quality** entry box, enable the features you want and disable those you don't want:

- Texture Mapping
- Diffuse Light
- Specular Light
- Light Cones and Colors

Note: Each feature you use increases screen rendering time. If you're not satisfied with the updating responsiveness when you move and rotate objects, disable some of these features.

5 If you want light cones to move interactively when you adjust a light, enable the **Follow light moves** option.

Light Cones and Colors must be enabled for this feature to be valid.

6 Select the **Texture resolution** you want: **Low**, **Medium** or **High**.

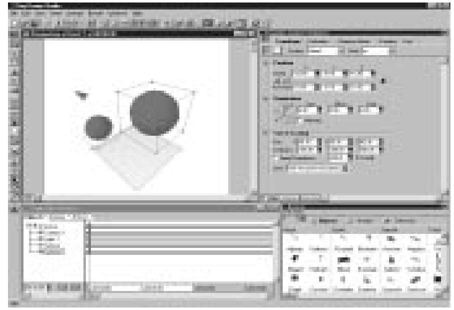
Lower resolution improves performance, but shows less detail. **Texture Mapping** must be enabled for this feature to be valid.

7 When you're finished setting options, click **OK** to close the **Preferences** dialog.

Remember, these preferences only apply when you're using the **Shaded Preview** display mode in the **Perspective** window.

Setting up your Workspace

Your Ray Dream Studio workspace refers to the layout of windows, palettes and toolbars. Most of Ray Dream Studio's windows and toolbars can be customized to suit the way you work. Ray Dream Studio also has a number of preset configurations that are especially suited for specific display sizes.



This is a sample workspace configuration for Ray Dream Studio.

To set the best workspace for your display:

Choose **Windows menu▸ Workspace▸** and select one of the workspaces that corresponds to your display resolution (1024x769, 800x600, etc.).

You can also choose **Large Font** setting for some workspaces. Large font settings take into account the extra room needed when you use your operating system's Large Font settings.

As you work you'll probably arrange Ray Dream Studio's windows and palettes to best accommodate your work style for different tasks. You may have different layouts for animating and modeling. Ray Dream Studio lets you save these workspace layouts for later use.

To save a workspace configuration:

1. Choose **Windows menu▸ Workspace▸ Save Current**. The **Save Workspace** dialog appears.
2. Enter a name for your workspace and click **OK**.

   Saved workspaces appear at the bottom of the **Windows menu▸ Workspace menu**.

To hide/display windows and palettes:

Choose **Windows menu▸** and the name of the window or palette you want to hide/ display.

A checkmark beside the window's name indicates that it's displayed.

Setting up the Working box

The working box is a three-dimensional reference tool for positioning and arranging objects.

To set the default size of the working box:

1. Choose **File menu▸ Preferences**.
2. Choose **Perspective** from the pop-up
3. Enter a value in the **Size** box. This value sets the initial size of the working box.

Setting up the Grid

The grid in Ray Dream Studio can be an invaluable tool for placing objects in 3D space.

To set up the default grid properties:

1. Choose **File menu▸ Preferences**.
2. Choose **Perspective** from the pop-up.
3. Enter a value in the **Space** box. This value sets the initial space between grid lines.

   For example a value of 4 would mean that there is 4 inches between grid lines.
4. Enter a value into the **Draw a line every** box. This value determines whether a line is drawn for every grid increment, or less frequently.

   In the example above, a value of 1 would draw a line every 4 inches.

Displaying Grid Planes

The working box in Ray Dream Studio exists in 3D. The three visible grid planes of the working box represent the XY, ZX and ZY planes. You can choose which planes to display.

To display/hide grid planes:

Click a plane in the **Display Planes** button. Visible planes have dark colored previews on the button.

Customizing Toolbars

You can also customize Ray Dream Studio's toolbars. By default, Ray Dream Studio displays a limited set of toolbars, which includes tools for working in the **Perspective** and modeling windows, buttons for setting rendering options, previewing animations and preforming basic file operations.

There are several other toolbars you can use in Ray Dream Studio which contain tools for zooming and accessing Internet Web sites.

To display or hide toolbars:

1. Choose **View menu▸ Toolbars**. The **Toolbars** dialog appears.
2. Click the name of the toolbar you want to display. A toolbar is displayed when a checkmark appears next to its name.
3. Enable the **Lock Toolbars** checkbox, if you want all the toolbars to remain locked to the main window.
4. Enable **Reset to default** to display only the default toolbars.

Toolbars can remain part of the main window, or you can have them float as separate palettes.

To undock a toolbar:

Click one of the edges of a tool and drag it towards the center of the window.

A palette containing all the tools in the toolbar appears.

To dock toolbars:

Drag the toolbar to the edge of the window. When the palette's outline switches to a toolbar layout, release the mouse button.

Creating a New Scene

Before you can create a new 3D illustration, you have to create a new document. A new document can be a blank scene or a predesigned scene you add using the Scene Wizard.

Creating an Empty Scene

When you create an empty scene in Ray Dream Studio, the **Perspective** window opens using your default workspace setup. Your scene contains only one default light and a default camera.

To create an empty scene:

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

2. Click **Create Empty Scene**. An empty **Perspective** window appears.

Using the Scene Wizard

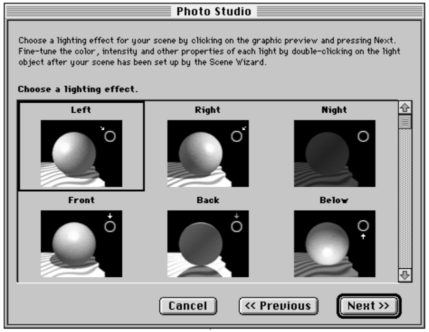
The Scene Wizard is a picture-based assistant that guides you through the steps of creating scenes. There are two ways to create scenes with the Scene Wizard, by using templates or by picking various components of your scene, step-by-step.

There are three different categories of Scene Templates: **Logo Templates**, **Indoor Templates** and **Outdoor Templates**. Each of these contains completed scenes in each of their categories. Once you've created the scene, you can edit it, just as if you'd created it from scratch.

Use the Template Scene Wizards to create a scene using preset scene elements.

There are two categories of step-by-step wizards: **Photo Studio** and **Indoor Step by Step**.

These categories create scenes by stepping you through several screens to select various components. The **Photo Studio** lets you choose lighting effects, backdrops, and props. The **Indoor step-by-step** lets you choose wall and floor combinations, and lighting effects.



Use the Photo Studio Scene Wizards to set lighting effects and backgrounds for your scene.

The **Scene Wizard** can create new scenes or you can apply the **Scene Wizard** settings to an existing file.

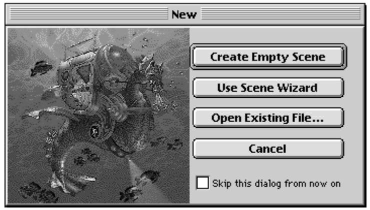
You can have the **Scene Wizard** automatically appear whenever you launch Ray Dream Studio.

To have the Scene Wizard automatically launch:

1. Choose **File menu▸ Preferences**.
2. Choose **General** from the pop-up.
3. Enable the **Use Scene Wizard on New** to have the wizard appear whenever you use the **New** command.

To create a new scene using the Scene Wizard:

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



The New dialog appears when you click the New button.

2. Click **Use Scene Wizard**.
3. Follow the on-screen instructions.
4. Click **Done** when you've reached the final screen.

To use the Scene Wizard to add to an existing file:

1. Choose **File menu▸ Apply Scene Wizard**.
2. Follow the instructions provided by the wizard. The selections you make in the **Scene Wizard** are applied to the current file.

Opening an Existing File

You can open any file you created in versions 3 or 4 of Ray Dream Studio or Designer.

To open an existing file:

1. Choose **File menu▸ New**. The **New** dialog appears.
2. Click **Open Existing File**.

   or

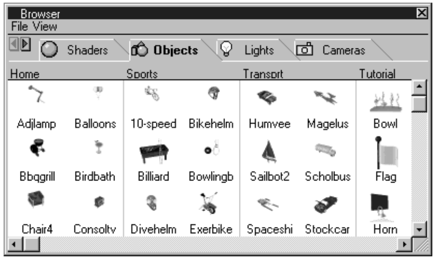
   Choose **File menu▸ Open**. The **Open** dialog appears.
3. Locate the file using the dialog controls and click **Open**.

Placing Objects in your Scene

Using the Browser Palette

The **Browser** palette helps you store and reuse items and features you've created or customized.

The **Browser** palette has eight tabs—**Shaders**, **Objects**, **Lights**, **Cameras**, **Deformers**, **Behaviors**, **Links** and **Render Filters**. Each tab category lets you organize items you save into directories.



The Browser palette is a visual catalog of all the items you can use to create 3D scenes.

When you've customized an item in one of these tab categories, you can save it to the **Browser** palette, where it will be easy to retrieve and use again later. Most operations with the **Browser** palette are the same in all categories.

Note: Objects, light sets and cameras are saved as normal Ray Dream Studio documents (.RDS files). Items in other **Browser** palette categories are saved as special **Browser** palette documents (.BRW files).

To display the Browser palette:

1. Choose **Windows menu▸ Browser**. The **Browser** palette appears.
2. Click the tab for the category you want.

   You may need to widen the window or click the tab scroll arrows to show the tab category you want.

The **Browser** palette offers three view modes for its contents—**Text**, **Small Icon** and **Large Icon**.

To change Browser palette view:

Choose **Browser palette: View menu** and select the display you want.

To change column width:

Drag the column divider to set the new column width.

When the number of columns exceeds the window width, use the scroll bar on the bottom to bring more items into view.

To set Browser palette preferences:

1. Choose **File menu▸ Preferences**.
2. Choose **Browser** from the pop-up.
3. Enable **Drop as Master Group** if you want any camera, light or object dragged from the **Browser** palette to be dropped into the **Perspective** window as a Master Group.

   Refer to "Working with Master Objects" on page 266 for more information on master groups.
4. Enable **Auto Load Selected Shader** In the **Shader Editor** to automatically update the Shader Editor whenever you click on a Shader in the **Browser** palette.
5. Click Ok.

Saving to the Browser Palette

To add an object, camera or light to the Browser palette:

1. Display the appropriate tab in the **Browser** palette.
2. In the **Time Line** window, click the name of the object, camera or light you want to add to the **Browser**.
3. Drag the item's name from the **Time Line** window to the **Browser** palette. You must drop it under one of the named directory columns.

Note: You can also add a group of items. To add the entire scene, drag the Universe name from the Time Line window to the Browser.

   Ray Dream Studio opens a dialog so that you can name the saved item.

4. Enter a name and click **OK**.

   Ray Dream Studio adds the item to the **Browser** palette in the directory column where you dropped it.

To save a scene to the Browser: Object tab:

1. Make sure the scene you want to save is open in the **Perspective** window.
2. Choose **Edit menu▸ Save As**.
3. Click **Options**.
4. Enable the **Save icon preview** option.

   You might want to disable the **Save cameras and lights** option.
5. Click Ok.
6. Use the directory tools in the **Save** dialog to locate and open a folder that's loaded into the **Browser palette: Objects tab**.

   For example, the models that are loaded by default are stored in the **Ray Dream Studio:3dclip** folder.
7. Click **Save**.
8. Click the **Browser palette: Objects tab**.
9. Select the column name for the folder where you saved your scene.
10. Choose **Browser palette: Update Selected Folder**.

To add a shader, behavior, deformer, link or render filter to the Browser palette:

1. Display the appropriate tab in the **Browser** palette.
2. Drag the item you want to add into the **Browser** palette. You must drop it under one of the named folder columns.

   - If the item you want to add is in the **Properties** palette, you may drag it from there.
   - If the item you want to add is in a **Browser** document window, you may drag it from there.
   - You may also drag the preview from the **Shader Editor**.

   Ray Dream Studio opens a dialog so that you can name the item.
3. Enter a name and click **OK**.

   Ray Dream Studio adds the item to the **Browser** palette in the directory column where you dropped it.

Behaviors and render filters are cumulative—you can apply several of them. You might create a list of behaviors or filters that you'd like to save and apply collectively. The **Browser** palette helps you do this.

To add a list of behaviors or render filters to the Browser palette:

1. Display the **Properties palette: Behaviors tab** or the **Scene Settings palette: Filters tab**.
2. Shift-click to select each behavior or filter you want to include.
3. Drag the last item into the **Browser** palette. You must drop it under one of the named directory columns.

   Ray Dream Studio opens a dialog so that you can name the list.
4. Enter a name and click **OK**.

   Ray Dream Studio adds the item to the **Browser** palette in the directory column where you dropped it.

Retrieving from the Browser Palette

To use an object, camera or light from the Browser palette:

1. Display the appropriate tab in the **Browser** palette.
2. Drag the item you want from the **Browser** palette into your scene. You can drag it into the **Perspective** window or into the **Time Line** window.

If you drag an object into the **TIme Line** window, it appears at the origin (X=0, Y=0, Z=0). If you drag it into the **Perspective** window, it appears at the point where you release the mouse button.

Note: If you double-click an object, camera or light listing in the **Browser** palette, Ray Dream Studio displays the saved **Browser** palette scene.

When you introduce objects from the **Browser** palette into a new scene, the objects carry all of their shading and arrangement characteristics with them.

To use a shader, behavior (or list), deformer or link from the Browser palette:

Drag the item you want to use from the **Browser** palette onto the object where you want to apply it. You can drag onto the object preview in the **Perspective** window or onto its listing in the **Time Line** window.

You can also drop the onto the appropriate tab on the **Properties** palette.

Note: You can also select the object, select the item in the **Browser** palette, then click **Apply** at the bottom of the **Browser** palette.

To use a render filter (or list) from the Browser palette:

Drag the render filter you want to use from the **Browser** palette into the **Perspective** window, or into the **Scene Settings palette: Filter tab**.

Editing Browser Documents

Any item that appears in the **Browser** palette is saved as a separate document. All **Browser** palette items may be opened, edited and saved.

To get information on a Browser palette item:

1. Display the appropriate tab in the **Browser** palette.
2. Select the item you want to find out about.
3. Choose **Browser palette: File menu▸ Get Info**. A dialog appears providing information on the selected item.

   You can use the **Name** entry box to change the name. Or add a comment as a reminder of how to use this particular item.

To edit a Browser palette item:

1. Display the appropriate tab in the **Browser** palette.
2. Double-click the item you want to edit.
   - For an object, camera or light, Ray Dream Studio opens it in a scene.
   - Ray Dream Studio opens all other items in a document window, which contains the tools appropriate to its type.

   For example, double-clicking a shader opens a Current Shader Editor window.

To create a new Browser palette document:

1. Display the appropriate tab in the **Browser** palette.
2. Choose **Browser palette: File menu▸ New Document.** Ray Dream Studio opens a document window of the type you selected.

To duplicate a Browser palette item:

1. Display the appropriate tab in the **Browser** palette.
2. Select the item you want to duplicate.
3. Choose **Browser palette: File menu▸ Duplicate File.**
4. Ray Dream Studio creates a duplicate of the selected item and places it in the same folder.

5. You can now open the duplicate for editing.

Managing the Browser Palette

To create a new folder in the Browser palette:

1. Display the appropriate tab in the **Browser** palette.

2. Choose **Browser palette: File menu▸ Add Folder**. Ray Dream Studio displays a dialog so you can create (or locate and open) a new folder.

3. Click **New** to create a new folder in the current location.

4. Name the folder and click **OK**.

   The folder appears as a new column in the **Browser** tab you selected.

To remove a folder from the Browser palette:

1. Display the appropriate tab in the **Browser** palette.

2. Click on the folder title you want to remove. Selected folders are highlighted.

3. Choose **Browser palette: File menu▸ Remove Selected Folder**.

   Ray Dream Studio removes the folder column from the **Browser** palette.

Removing a folder file does not delete files. It only removes them from display in the **Browser** palette.

If you change the contents of a **Browser** palette folder, you may need to force Ray Dream Studio to build a new list of the contents.

To update listings in a folder:

1. Display the appropriate tab in the **Browser** palette.

2. Click on the folder title you want to update. It will be highlighted.

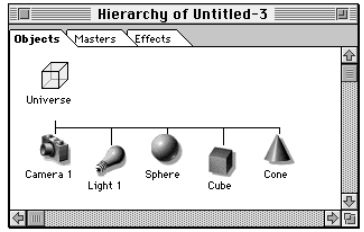
3. Choose **Browser palette: File menu▸ Update Selected Directory**.

Using the Time Line Window

As you work you'll find the **Time Line** window an invaluable tool for arranging and animating objects in your scene.

The **Time Line** window can be customized to display information specific to the type of task you're working on.

When you're modeling or arranging objects you'll need to see information on grouping and linking. For this task you can use the **Time Line** window's Hierarchy mode. The Hierarchy mode displays all objects, groups and scene elements as icons. This mode has two views: **Vertical** and **Horizontal**.



Time Line window can be displayed in Vertical Hierarchy mode (above) or Horizontal mode.

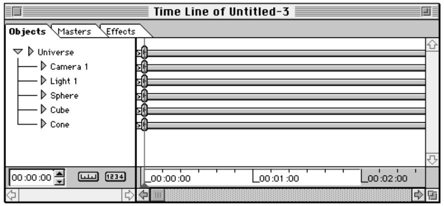
To display the Vertical/Horizontal mode of the Time Line:

1. Click the **Time Line** window to make it active.

2. Choose **View menu▸ Horizontal** or **Vertical**.

Refer to "Changing your View of the Hierarchy" on page 254 for complete instructions on using the hierarchy.

When you're creating an animation you'll need to see key events and tweeners. For this task you can use the Time Line mode of the window.



When the Time Line window is in Time Line mode you can see the key events and tweeners in your animation.

To display the Time Line view of the hierarchy:

1. Click the **Time Line** window.
2. Choose **View menu▸ Time Line**.

For complete instructions on using the **Time Line** window, refer to "The Time Line Window" on page 297.

To set the default display of the Time Line window:

1. Choose **File menu▸ Preferences**.
2. Choose **Hierarchy** from the pop-up.
3. Enable one of the display options.

Importing 3D Objects

You can import 3D objects from other applications directly into Ray Dream Studio using the **Import** command.

3D objects are not the only items you can import into Ray Dream Studio. You can also import shapes and images.

For complete instructions on importing and exporting, refer to Appendix A, "Using Ray Dream Studio with other Applications."

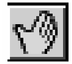
Working in a Scene

Navigating your Scene

As you create your 3D illustration or animation, your scene can quickly become rather large. You may not be able to see the entire scene in the **Perspective** window, or you may want to enlarge areas to precisely edit objects. Ray Dream Studio provides several tools for moving around your scene.

To move an area of the scene into the Perspective window:

1. Choose the **Hand** tool.

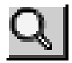


2. Drag the in the direction you want to move the view of the scene.

   You can also temporarily select the **Hand** tool by holding down the **Spacebar**.

To zoom in to an area of your scene:

1. Choose the **Zoom** tool.



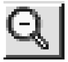
2. Click on a point in your scene. to enlarge. The scene is magnified. You can also drag a marquee around an area to magnify it.

To zoom out of an area:

1. Choose the **Zoom** tool.
2. Hold down **Option/Alt** and click an area.

   or

Choose the **Zoom Out** tool.

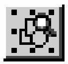


or

Click the zoom level pop-up at the bottom left corner of the **Perspective** window and choose a zoom level.

To zoom into a selection of objects:

1. If the **Zoom** toolbar is not displayed choose **View menu▸ Toolbars**. The **Toolbar** dialog appears.
2. Click **Zoom** and then click **OK**
3. Select one or more objects.
4. Click the **Zoom to selected** tool.

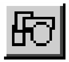


To view objects in actual size:

1. If the **Zoom** toolbar is not displayed choose **View menu▸ Toolbars**. The **Toolbar** dialog appears.
2. Click **Zoom** and then click **OK**
3. Click the **Zoom To Actual Size** tool.

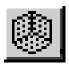
To view all objects:

1. If the **Zoom** toolbar is not displayed choose **View menu▸ Toolbars**. The **Toolbar** dialog appears.
2. Click **Zoom** and then click **OK**
3. Click the **Zoom To All Objects** tool.



To zoom to the working box:

1. If the **Zoom** toolbar is not displayed choose **View menu▸ Toolbars**. The **Toolbar** dialog appears.
2. Click **Zoom** and then click **OK**
3. Click the **Zoom To Working Box** tool.



Viewing your Scene

The default view of your scene is through the default camera. The camera can be sent to a number of default positions and oriented using the **Camera** tools. You can also add additional cameras to the scene.

To choose a camera to view you scene:

1. Choose **Windows menu▸ Camera Properties**. The Camera Properties dialog appears.
2. Choose the camera you want to use from the **Camera** pop-up.

   or

   Choose **View menu▸ Camera** and choose the camera you want.

To view your scene from a preset position:

Choose **View menu▸ Preset Position▸** and choose the position you want use.

For more information, refer to "Changing your Perspective on the Scene" on page 289.

Viewing your scene using two Perspective windows

When you have additional cameras you can view your scene from two different perspectives simultaneously.

To view your scene from two views simultaneously:

1. Choose **Windows menu ▸ New Perspective**. The **New Perspective Window** dialog appears.

2. Enable **Create New Camera** to create a new default camera for this **Perspective** window.

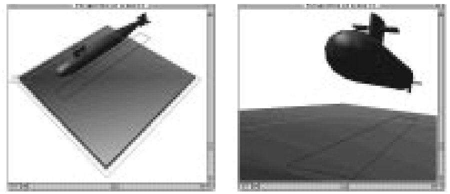
If you want to use the new **Perspective** window to view your scene from two views simultaneously, you must have at least two cameras.

3. Enter name for the camera and set its properties using the controls.

4. Choose **View menu ▸ Preset Position ▸** and select the view you want use for this **Perspective** window.

   You can also position the new camera manually. For more information, refer to Chapter 14, “Setting Lights & Cameras.”

Now, whenever you change anything in the first **Perspective** window, the second window automatically updates to show your changes.



This is the same scene viewed using two perspective windows.

Note: Each window has to be updated separately, so you will dramatically increase the redraw time of your scene by adding more **Perspective** windows. Use this feature sparingly.

Editing your Scene’s Contents

Ray Dream Studio has several of the basic operations that you’re familiar with from other applications. You can cut, copy and paste any item in the **Perspective** window using the **Edit** commands.

To copy an item in the Perspective window:

1. Select the object, light or camera.

2. Choose **Edit menu ▸ Copy**

   or

   Press **Command-C/Ctrl+C**. A copy of the item is placed on the Clipboard.

To cut an item in the Perspective window:

1. Select the object, light or camera.

2. Choose **Edit menu ▸ Cut**

   or

   Press **Command-X/Ctrl+X**. The item is removed from the scene and placed on the Clipboard.

To paste an item in the Perspective window:

1. Choose **Edit menu ▸ Paste**

   or

   Choose **Command-V/Ctrl+V**. The object appears in the **Perspective** window.

   If you have a an object selected when you paste an object, the object from the clipboard will replace the selected object.

To delete items in the Perspective window:

1. Select the item.

2 Choose **Edit menu▸ Delete**. The object is deleted from the scene.

Editing items in the **Time Line** window is far more complicated and, if not done properly, can create some unpredictable results. For detailed instructions, refer to “Arranging Objects” on page 223 and Chapter 15, “Animating.”

There are many other ways you can edit the contents of your scene. You can duplicate objects, move, rotate and resize objects. All these operations are covered in “Arranging Objects” on page 223.

Undoing Operations

You can reverse the effects of your last action by using the **Undo** command. Ray Dream Studio has multiple undo levels so that you can undo a series of operations by choosing undo several times. The number of undo levels is determined by the value you set in the Ray Dream Studio **Preferences** dialog. The maximum number of undo levels is 64.

To set Undo levels:

1 Choose **File menu▸ Preferences**.

2 Choose **General** from the pop-up

3 Enter a value in the **Multiple Undo** entry box.

To undo operations:

1 Choose **Edit menu▸ Undo**. Ray Dream Studio undoes the last operation.

2 To undo the next operation, choose **Undo** again.

There are some operations you cannot undo. In this case, the **Undo** command is replaced by **Can’t Undo**.

Redoing operations

You can repeat your last action using the **Redo** command. The command is only available after you undo an operation. You can redo multiple operations.

To repeat an operation:

1 Choose **Edit menu▸ Redo**. Ray Dream Studio repeats the last action.

Saving and Closing

Saving your file

To save your scene:

1 Choose **File menu▸ Save**.

2 Choose a location for your file.

3 Enter a name for the file in File name entry box.

4 Choose a file type from the **Format/Save as type** pop-up and click **Save**.

To save your file under a different name:

1 Choose **File menu▸ Save As**.

2 Select a location for the file.

3 Enter a new name for the file in the File name entry box and click **Save**.

Closing your File

When you’re done editing a scene file you can close it.

To close a file:

1 Choose **File menu▸ Close**.

2 If you have any changes, click **Yes** to save them or **No** to discard them.

5

Tutorial

Welcome

Welcome to the Ray Dream Studio tutorial. This tutorial is designed to introduce all the major features and functions in Ray Dream Studio 5. The main goal of the tutorial is to teach you the techniques you need to know to create 3D illustrations.

Each section of lessons is self-contained so you can start the tutorial at any point. For example, if you already know how to model an object but need assistance on shading, skip the lessons on modeling and start the tutorial at the shading section.

To help you follow along the tutorial, every lesson contains a section called “The Story so Far”, which summarizes the procedures that have been covered in the tutorial up to that point. It also tells you where you can get pre-set files to complete the lesson.

Getting Started

The first thing you need to do is start Ray Dream Studio and create an empty scene.

To open a blank scene in Ray Dream Studio:

1. Launch Ray Dream Studio. The **New** dialog appears.

2. Click the **Create Empty Scene** button.

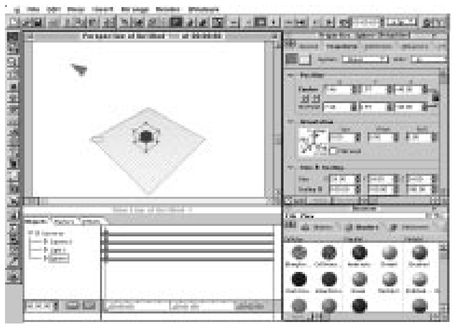
   A new document is created and four windows appear: the **Perspective** window, the **Properties** palette, the **Time Line** window and the **Browser** palette.

Before starting any project in Ray Dream Studio, you need to set up the program’s interface to help you work the most effectively. Ray Dream Studio’s interface is very flexible. You can setup menus, toolbars, and palettes.

Lesson 1: Setting up your Workspace

When you first open Ray Dream Studio, the palettes and toolbars are displayed in their default positions. If you change these positions or hide elements, Ray Dream Studio saves the new positions and use the them the next time you open the application.

The workspace configuration shown below was selected because it allows you to quick access to all the tools you’ll need during the course of the tutorial.



To begin, set up your workspace to look like this.

To setup the workspace:

Choose **Windows menu▸ Workspace▸ 800x640** (Macintosh) /**800x600** (Windows).

For more detailed instructions on workspace settings, refer to“Setting up your Workspace” on page 25.

To setup toolbars:

1. Choose **View menu▸ Toolbars**. The **Toolbars** dialog appears.

2. Click the toolbars you want to view.

   A toolbar is displayed when a checkmark appears next to its name.

The tools available in the **Tools** toolbar change depending on the window displayed.

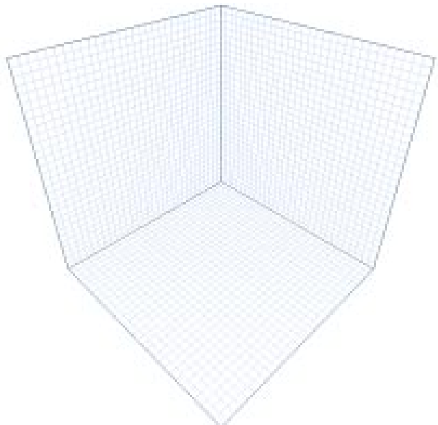
After you setup your toolbars you can set the view of the **Time Line** window. The **Time Line** window displays a textual representation of your scene. This window is where you’ll arrange groups of objects and set up the action in your animations. For more on the **Time Line** window, refer to “Using the Time Line Window” on page 32.

To setup the Time Line window:

1. Click the **Time Line** window to select it.

2. Choose **View menu▸ Horizontal**.The **Time Line** window changes to **Hierarchy** mode.

The **Perspective** window is where you’ll be arranging and positioning objects to create a scene. The window displays three grid planes called the *Working Box*. The Working Box can help you orient objects in three dimensional space. The planes in the Working Box represent each of the three axises used to define 3D space, namely X, Y, and Z.

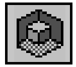


The Working Box has three grid planes for X, Y and Z.

To display planes:

1. Click the **Perspective** window to make it the active window.
2. Click each of the planes on the **Display Plane** tool icon.

   You will see the planes appear in the **Perspective** window.



Click on the Display Plane tool icon to display each plane.

When all the planes are visible, you'll notice that one of the planes is light blue, while the other two are light grey. The colored plane is called the *active plane*. When you drag an object in the **Perspective** window, it moves parallel to the active plane by default.

Displaying additional planes allows you to see the projections of all the objects in your scene.

The Working Box and the active plane are important reference tools, there are several options you can set for there tools. For more information, refer to "The Working Box" on page 225.

Arranging Objects in the Scene

A 3D illustration is made up of a number of 3D objects arranged in an order that is pleasing to eye.

Since you're working in a three dimensional space your scene can be viewed form any angle which can produce a wide variety of different illustrations. A good arrangement of objects makes your scene look good from any angle.

The lessons in this section will help you learn some of the arranging skills you'll need to create 3D illustrations.

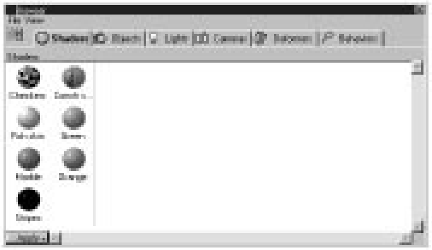
The Story so Far

Before starting this lesson you should have your workspace set up to best display all the necessary tools in the available video display.

What You'll Need

To complete this lesson you'll need some objects which you can arrange. The **Arranging Objects** folder contains all the objects you'll need. To start the lesson you will need to add this folder to the **Browser** palette.

Ray Dream Studio's **Browser** palette can be an invaluable utility when arranging objects. The **Browser** palette lets you store Light, Cameras Effects and Objects. For more information on the **Browser** palette, refer to “Using the Browser Palette” on page 28.

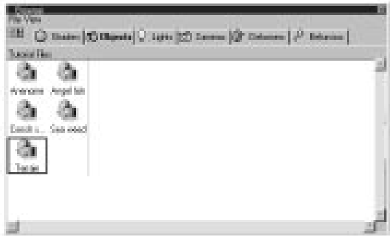


You can use the Browser palette to store scene items including object, Shaders, Deformers and Links.

To add folders to the Browser palette:

1. If the **Browser** palette is not already visible, choose **Windows menu▸ Browser**.
2. Click the **Objects** tab.
3. Choose **Browser palette: File menu▸ Add Directory/Folder**.
4. Locate the **Tutorial** folder on the Ray Dream Studio 5 CD. Open the **Arranging Objects** folder within the Tutorial folder and then click **Select Current Directory**.

The folder contains a library with pre-made objects you’ll use to create an underwater scene.



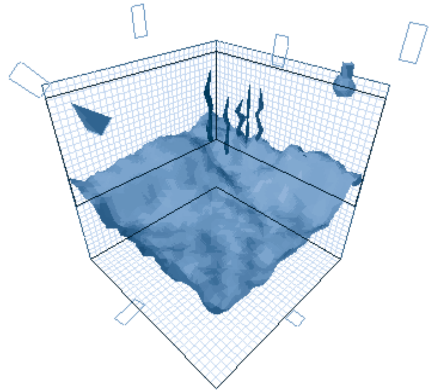
Once you add Arranging Objects, its contents appears in the Browser palette’s Objects tab.

Lesson 1: Adding Objects

The simplest way of creating an illustration is by adding existing objects from various sources and arranging them to create a scene. In fact, most complex scenes consist of a few original objects combined with stock images or library objects.

To add objects from the Browser palette:

1. Click the **Objects** tab.
2. Make sure you have the **Selection** tool chosen.Click on the **Sea Terrain** object and drag it into the **Time Line** window.

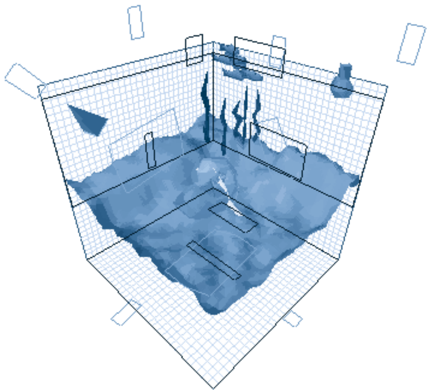


Drag the Sea Terrain object into the Time Line window.

When you drag an object into the **Time Line** window, it appears at the origin of your scene (i.e. at coordinates X=0, Y=0, Z=0.

3. Drag the objects **Shell** and **Angel Fish** into the **Time Line** window.
4. Click the object labeled **School of Fish** and drag it into the **Perspective** window.

Objects dragged directly into the **Perspective** window are positioned at the point where you release the mouse button.



Add the Shell, Angel Fish and School of Fish to your scene.

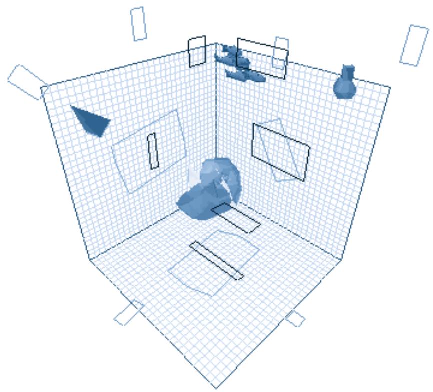
Now that all the necessary objects are in the **Perspective** window, you'll need to position them to create a scene.

You'll notice that the terrain takes up a lot of the scene. This will probably make positioning difficult. To make it easier to view the other objects you can make the terrain object invisible.

To make objects invisible:

1. Click the **Sea Terrain** object in the **Time Line** window.

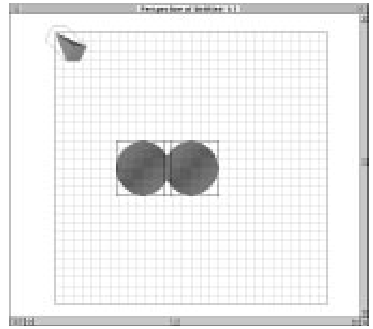
2. Choose **View menu▸ Object Invisible**.



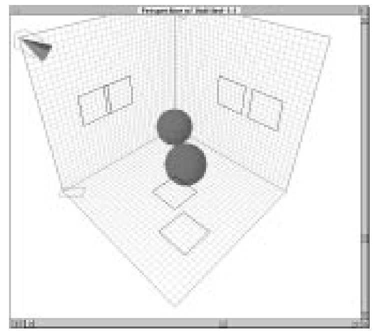
Hide the Sea Terrain to make it easier to view the other objects.

Lesson 2: Positioning Objects

When you drag objects into the **Time Line** window, they appeared at the exact center of your scene, while objects dragged directly into the **Perspective** window appear wherever you released the mouse button. This can make it difficult to tell exactly where objects are in 3D space. For example, in the front view, two spheres can appear to be adjacent. However, when you switch to **Reference** view, it becomes clear that the two objects are at completely different depths.



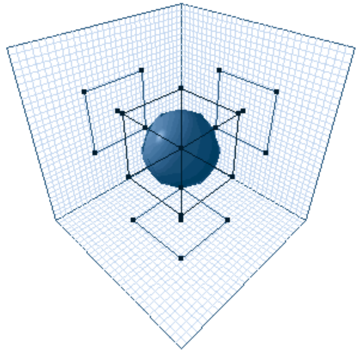
When the scene is viewed from the front view, objects can appear to be adjacent.



When the scene is viewed in Reference view, you can see that the same objects are at two different depths.

To help you position objects in 3D space, objects have projections which indicate their position in each of the planes in the Working Box.

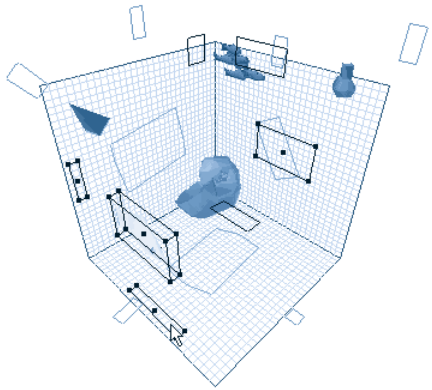
You can tell the exact position of an object in the scene by locating at least two of the object's projections. One projection indicates the object's vertical and horizontal position and the other indicates its depth in the scene.



An object's projections help you determine its position in 3D space.

To position objects manually:

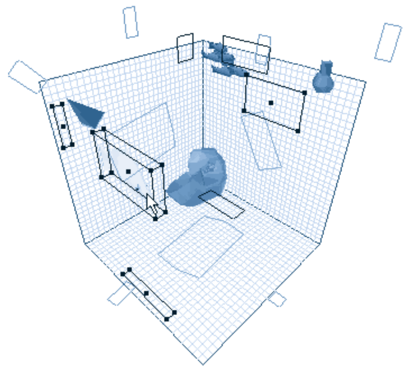
1. Click the object labeled **Angel Fish** in the **Time Line** window.
2. In the **Perspective** window click the fish's projection on the ground plane and drag it towards the left edge of the working box.



Click the Angel Fish's projection on the ground plane and drag to position it in the scene.

3. As you drag take notice of the object's projections on the other two planes only move horizontally along the X or Y axis.
4. Hold down **Option**/**Alt** and drag the fish upwards.

   Option/**Alt** constrains movement to be perpendicular to the Active plane.



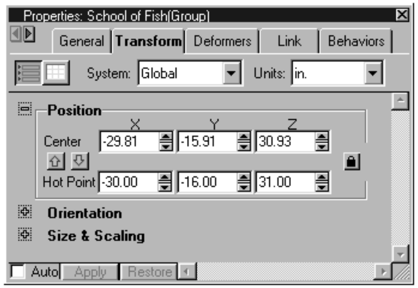
*Hold down **Option/Alt** as you drag the fish to position it vertically.*

Although you can position objects using their projections, it's not the most precise method. By entering exact values into the **Properties** palette, you can precisely position an object anywhere in your scene.

To position objects numerically:

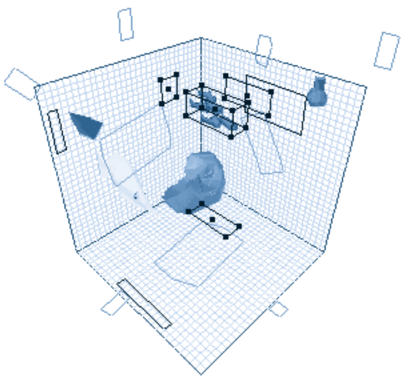
1. Click the **School of Fish** object in the **Time Line** window.
2. Choose **Windows menu▸ Properties**.
3. Click the **Transform** tab.

4 In the top row of **Position** controls, enter **X=-30**, **Y=-16**, and **Z=31**.



Enter numerical Position controls in the Properties palette's Transform tab.

5 If **Auto** is not enabled, click **Apply**.



The School of Fish are positioned numerically.

Lesson 3: Rotating Objects

Often, positioning objects vertically and horizontally is not enough. To get objects in just the right position in your scene you'll probably need to rotate them. Like positioning, you can rotate objects both manually, using the **Rotation** tools, or numerically, using the **Properties** palette.

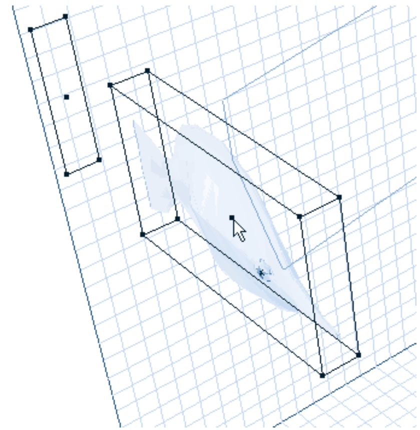
Before you begin rotating, you should adjust the object's Hot Point. When rotating, the Hot Point acts as the pivot point for the object, meaning that the object will rotate around the Hot Point.

By moving the Angel Fish's Hot Point you can rotate it around its nose.

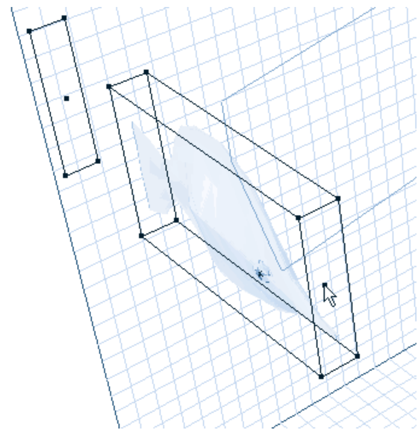
To adjust the Hot Point:

1 Using the **Selection** tool, click the **Angel Fish** object.

2 Hold down the **Shift** key and drag the black dot in the center of the object to the nose of the fish.



With the Selection tool, click the Hot Point...

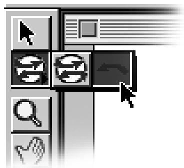


...and drag it to the nose of the fish.

Now that the Hot Point is in the correct position, you can rotate the object.

To rotate an object using the Rotation tools:

1. Press on the **Rotation** tool to pop-up and choose the **2D Rotation** tool.

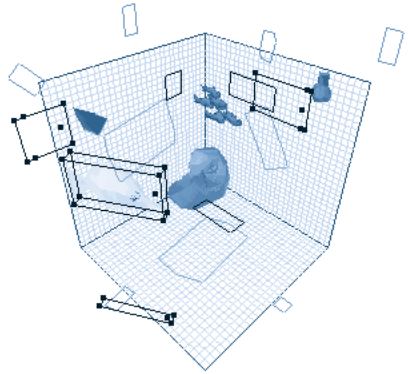


Press to pop-up and choose the 2D Rotation tool.

2. Click the Angel Fish object's projection on the ground plane.

3. Hold down the **Shift** key and drag the projection to the left until it's rotated 30 degrees. Then release the mouse button.

   Holding down the **Shift** key constraints the rotation to 30 degree increments.



Use the 2D Rotation tool to drag the fish's projection and rotate it.

Lesson 4: Aligning Objects

Another way of positioning objects is to align them to certain parts of your scene or to other object. In Ray Dream Studio, you can use the **Alignment** palette to align objects along each of the three axises (X, Y, and Z). The **Alignment** palette gives you several different methods of aligning. For more detailed information on the methods available, refer to "Aligning Duplicating Objects" on page 244.

In the scene you'll use the **Contact Sides align** option to align the Angel Fish to the Shell.

To align objects:

1. Click outside the Working Box to make sure all the objects in the **Perspective** window are deselected.

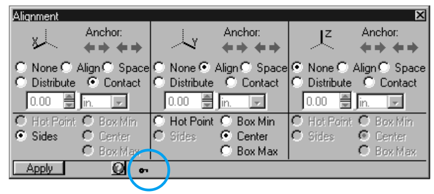
2. Click the Shell object with the **Selection** tool.

3. Hold down the **Shift** key and click the Fish object.

4. Choose **Arrange menu▸ Align Objects**. The **Alignment** dialog appears.

5. In the **X** axis panel, select the **Contact** radio button. The **Sides** radio button is automatically enabled.

6. Click the extension button (key) at the bottom right of the palette to show the **Y** and **Z** axis panels.



Click the extension button (key) to expand the palette.

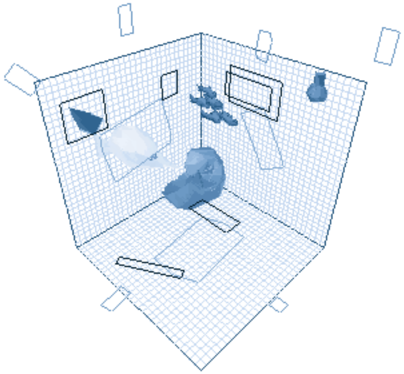
7. In the **Y** axis panel, click the **Align** radio button. The **Center** radio button is enabled by default.

8. In the **Z** axis panel, enable **None**.

9. Click **Apply**.

   The Fish moves closer to the Shell.

10. Click the **Close** box to close the **Alignment** dialog.



Once you click Apply, the Fish and Shell are aligned.

Lesson 5: Duplicating and Grouping

Duplicating is a quick way of creating a complex object from a simple one. For example by duplicating a blade of grass you can create an entire field. Duplicating creates exact copies of an object.

Although duplicating can be a great way of creating large objects, arranging many duplicates in a scene can quickly become a complex task. You can make arranging easier by combining a number of duplicates into a single group. A group can let you position and edit a number of objects all at the same time.

In the scene you're creating, you can add a bed of sea anemones by duplicating a simple object and grouping it.

To duplicate objects:

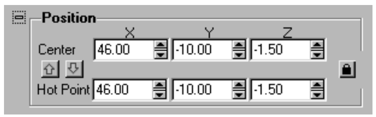
1. Click the SeaTerrain in the **Time Line** window and choose **View menu▸ Object Visible**.

2. Drag the object labeled **Anemone** out of the **Browser** palette and into the **Time Line** window.

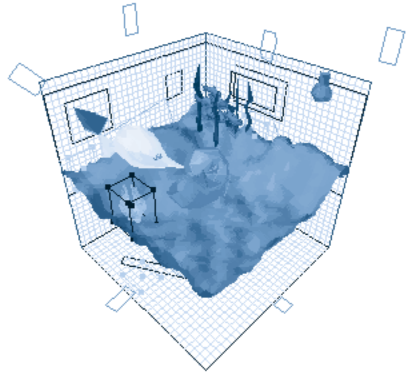
3. Choose **Windows menu▸ Properties**. The Properties palette appears.

4. Click the **Transform** tab.

5. In the **Position** controls, enter **X=46**, **Y=-10** and **Z=-1.5**.



The Position controls in the Properties palette let you numerically position objects.



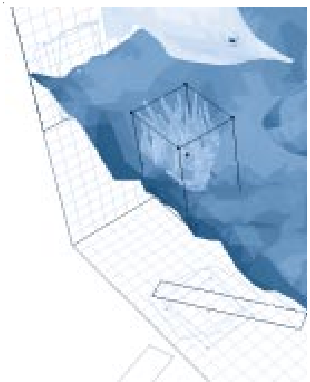
When the new position values are applied to the anemone, it moves to the edge of the terrain.

6. Click the Anemone object in the **Time Line** window.

7. Choose **Edit menu▸ Duplicate**.

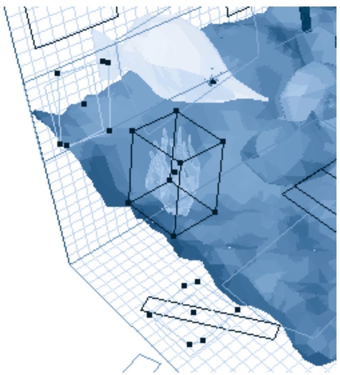
8. In the **Position** controls, enter **X= 42.75**, **Y= -13.25**, **Z= -1.5** and in the **Orientation** controls enter **Yaw= 6.5**, **Pitch= -8.85**, **Roll= 85**.

   The duplicate object is now offset and slightly rotated.



By entering values in the Properties palette you can offset and rotate the duplicate.

9. Duplicate the object again and enter **X**=**46.85**, **Y**= **-15.75**, **Z**= **-1.5** and **Yaw**= **-6.5**, **Pitch**= **8.85**, **Roll**= **95** into the **Properties** palette.



Duplicate the object again and change its position to create a series of anemones in your scene.

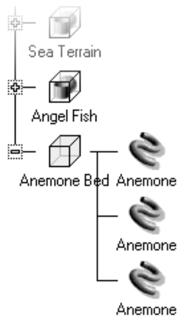
Now that you have a series of anemones, you can group them and create a bed of anemones.

To group objects:

1. In the **Time Line** window, hold down the **Shift** key and select all the objects labeled **Anemones**.

2. Choose **Arrange menu▸ Group**. A new group object is created.

3. Click the group's title and type **Anemone Bed**.



The Anemone bed appears as a new group in the Time Line window.

You can use the **minus**/**arrow** icon to open or collapse the group. When the group is collapsed you can only edit the group, when it's open you can edit the individual objects.

Moving On

Your scene is now complete. If you're happy with the way your scene looks, choose **File menu▸ Save** and save it as **ARRNG_TUT**.

You can now adjust the position of lights and cameras, then render your scene. If you want to learn how to setup your scene for rendering skip ahead to "Lesson 2: Positioning Lights" on page 70.

If you want to learn how the objects in the scene you just arranged were created, move on to the next section.

Arranging is an essential part of modeling so you may want to refer to "Arranging Objects" on page 232 for more detailed information.

Modeling Objects

Modeling refers to the process of creating three dimensional objects in Ray Dream Studio. A 3D model can be anything from a basic cube to a complex sea monster.

The lessons in this section will lead you through the different types of 3D modeling you can do in Ray Dream Studio.

The Story so Far

At the start of this section you should already know the basics of arranging objects in your scene. If you're not clear on how to align, rotate or numerically position objects, review "Arranging Objects in the Scene" on page 39, or Chapter 12, "Arranging Objects."

What You'll Need

In these next lessons you'll be creating objects from scratch so you don't need any other components. However, we have included completed versions of all the objects described in the lessons. If you have trouble, open the completed object and see how it was made. Completed objects are located in the **Tutorial: Modeling Objects** folder.

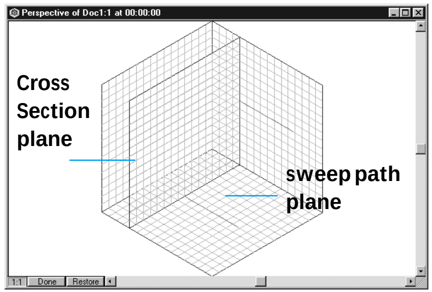
So as not to clutter the workspace, start each lesson with a blank scene.

Lesson 1: Free Form Modeling

The **Free Form** modeler lets you create 3D objects by drawing cross section shapes and extruding them along a sweep path.

The cross sections determine the basic outline of the object, while the sweep path determines its depth.

The modeler has three drawing planes which you can use to create and extrude cross sections: the cross section plane and two sweep path planes. The active plane is shown in color while inactive planes are displayed in gray. Like the **Perspective** window, you can use the **Zoom** tools to magnify areas of your object.



Use the Free Form modeler to create new 3D objects.

Refer to "Free Form Modeling" on page 109 for more on the **Free Form** modeler.

In this lesson you'll use the **Free Form** modeler to create some seaweed.

To create an oval cross section:

1. Click the **Free Form** tool and drag it into the **Time Line** window.

Drag the Free Form tool into the Time Line window to open the Free Form modeler.

The **Free Form** modeling window automatically opens.

2. Enter a name for your object and click **OK**.
3. Choose **View menu▸ Preset Position▸ Drawing Plane**.

This changes the view of the modeling window to display only the active plane.

4. Choose **View menu▸ No Preview**.

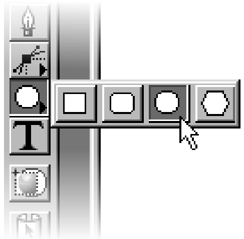
This turns off all shading, making it easier to see what you're drawing.

5. Choose **Geometry menu▸ Extrusion Method▸ Pipeline**.

This translation method lets you create a more tubular shape. For more on translation methods, refer to "Translation vs. Pipeline" on page 131.

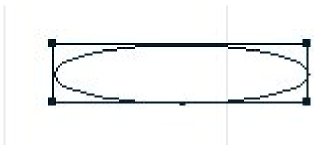
6. Click the **Zoom** tool and enlarge an area of the **Modeling** window.

7. Press on the **Square** tool to pop-up and choose the **Oval** tool



The Oval tool creates oval cross sections.

8. Click a point on the cross section plane and drag diagonally. Try to create more of a flat oval shape than a circle, this will be the cross section of the seaweed.

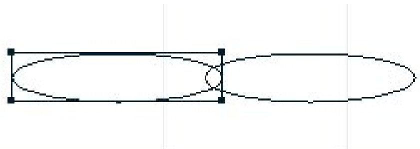


Use the Oval tool to create oval shapes as a cross section for the seaweed.

9. Press **Command-Shift-C/Ctrl+Shift+C** to center the cross section.

To use multiple shapes in a cross sections:

1. Choose the **Selection** tool and click the oval.
2. Choose **Edit menu▸ Copy**.
3. Choose **Edit menu▸ Paste**.
4. Deselect all shapes.
5. Hold down the **Shift** key and drag the oval to the right. The two ovals should be just touching as shown below.

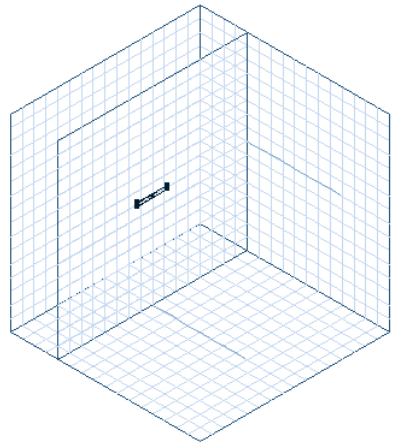


Move the pasted oval to the right so that the two ovals are touching slightly.

6. Choose **Edit menu▸ Select All** to select both shapes.
7. Choose **Arrange menu▸ Combine as Compound**.
8. Press **Command-Shift-C/Ctrl+Shift+C** to center the compound cross section.
9. Choose **View menu▸ Preset Position▸ Reference**.
10. Click the **Zoom** tool.

The Zoom tool lets you magnify your view of the scene.

11. Hold down **Option/Alt** and click the center of the scene to zoom out.



When you zoom out in Reference view you can see you new cross section in the Free Form modeling window.

Now that you have the outline of the object you'll need to adjust the sweep path and extrusion envelope to give it a more organic look.

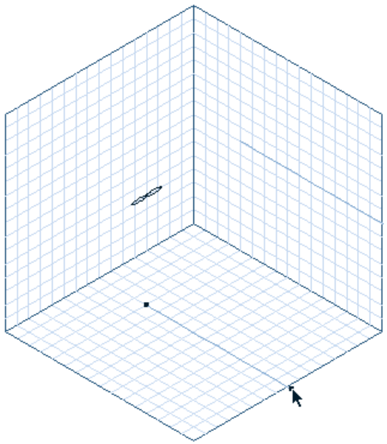
Before you can adjust the shape, you will need more points on the sweep path.

To add points to the sweep path:

1. Click the ground plane to make it active.
2. Choose **View menu▸ No Preview**.

3 Hold down the **Shift** key and click the sweep path, then extend it to the edge of the **Modeling** window.

The sweep path is displayed in red.

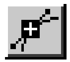


Extend the sweep path all the way to the edge of the Free Form modeling window.

4 Choose **Geometry menu▸ Extrusion Envelope▸ Symmetrical** to add an extrusion envelope.

5 Double-click the **Convert Point** tool to choose the **Add Point** tool.

Every time you click the tool on the toolbar, a new tool appears. You can cycle through all the tools by clicking on it repeatedly.

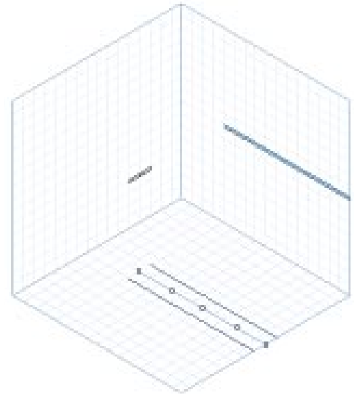


The Add Point tool lets you add control points to path.

6 Click the sweep path. A new point is added.

Each time you click the path a new point is added. You'll need the new points to create additional cross sections. Every point on the sweep path represents a point where you can place a cross section.

7 Add two more points to the sweep path.



When you're done adding points, your sweep path should look like this.

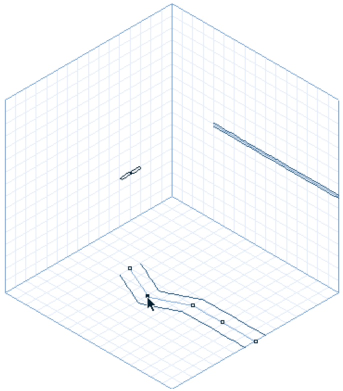
Now that you've added points, you can move them to reshape the sweep path.

To move points:

1 Choose the **Selection** tool.

2 Click the second point and drag it to the left.

Make sure you're selecting a point on the sweep path (the red line) not on the envelope (the blue lines).

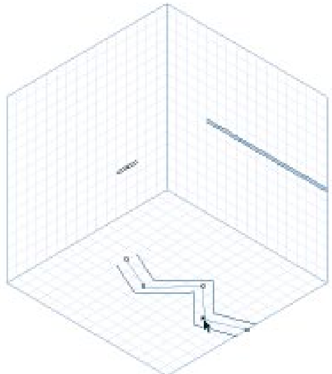


Add a second point on your sweep path and drag to the left.

Make sure all the points are deselected before going on.

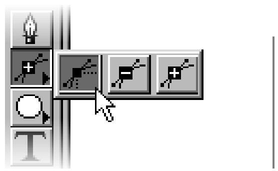
3 Click the next point and drag it to the right.

4 Click the next point and drag it to the left.



After adjusting the points along your sweep path, it should look like this.

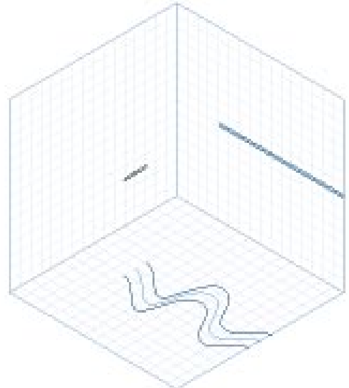
5 Press on the **Add Point** tool to pop-up and choose the **Convert Point** tool.



Choose the Convert Point tool.

6 Click each point on the sweep path and drag up.

Your sweep path should now look like a wave.



After you use the convert points to smooth the sweep path it should look like a wave.

7 Choose **View menu▸ Preset Position▸ Right**.

8 Click the **Zoom** tool and zoom in on the sweep path.

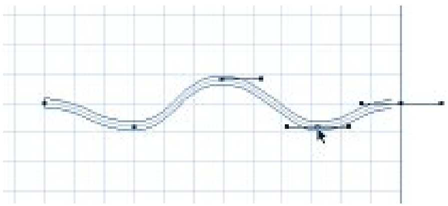
9. Click the second point on the sweep path with the **Selection** tool and move it down.

Use the Selection tool to move the second point on sweep path down.

You'll need to deselect all the points before selecting the next point.

10. Click the next point and move it up.

11. Click the next point and move it down.



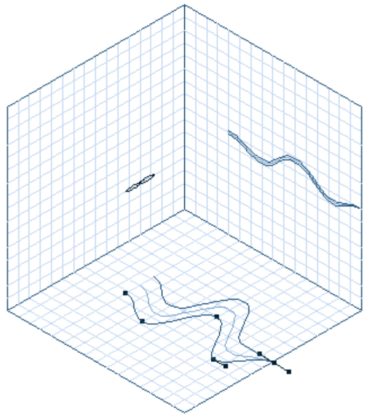
When you're done adjusting the points, your sweep path should look like a wave.

Your seaweed now waves both side to side and up and down. Next you'll adjust the extrusion envelope to add the final touches to your seaweed.

To adjust the extrusion envelope:

1. Click the final point on one of the envelope line and drag it towards the center.

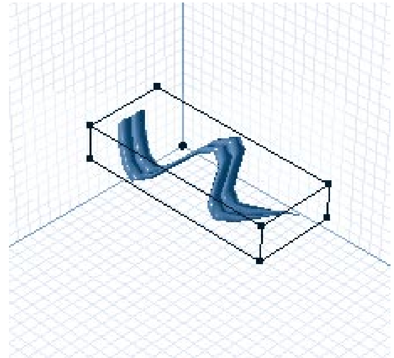
   Envelope definition lines are shown in blue.



Drag the final point to the center to "pinch off" the extrusion envelope creating the tip of the seaweed.

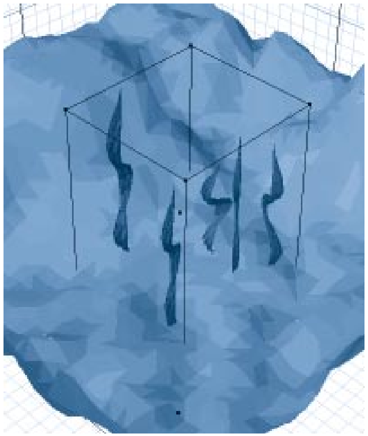
2. Choose **View menu▸ Preset Position▸ Reference**.

3. Click **Done**.



Your completed seaweed should look like this.

Your seaweed stalk is now complete. You may want to save it in a convenient location. Once the object is in the **Perspective** window, you can position and duplicate it to create a seaweed bed. For more information, refer to "Lesson 5: Duplicating and Grouping" on page 45.



You can arrange and duplicate the seaweed in the scene.

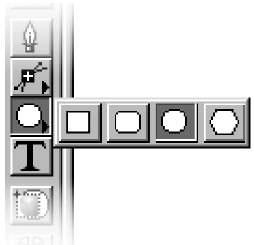
Lesson 2: Complex Free Form Modeling

Now that you know how to create simple objects using the **Free Form** modeler, you can use the skills you learned to create much more complex objects. Many objects have more detail than can be extruded using only a simple cross section and sweep path. In the next chapter you'll learn how to use multiple cross sections and shape numbering to create a sea anemone.

To create multiple cross sections:

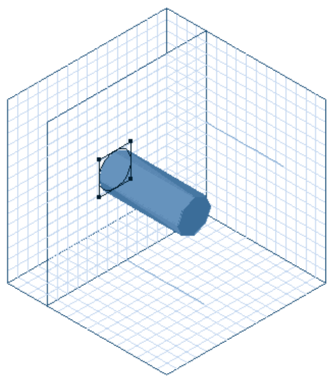
1 Open the **Free Form** modeler.

2 Press to pop-up and select the **Draw Oval** tool.



Select the Draw Oval tool to draw oval cross sections.

3 Hold down the **Shift** key and draw a circle about five grid squares in diameter.

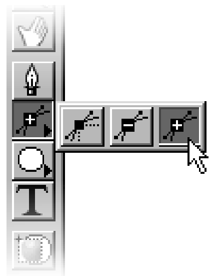


Use the Draw Oval tool to create the first cross section.

4 Press **Command-Shift-C/Ctrl+Shift+C** to center the cross section.

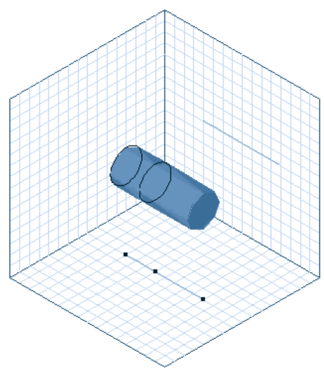
5 Choose **View menu▸ Preset Position▸ Reference**.

6 Choose the **Add Point** tool.



Use the Add Point tool to add new control points to a path.

7 Click the sweep path on the ground plane and add a point about two grid squares from the first point.



Use the Add Point tool to add a point on the sweep path two grid squares from first.

8 Choose **Sections menu▸ Create**.

9 Choose the **Selection** tool.

10 Click the new cross section and choose **View menu▸ Preset Position▸ Drawing Plane**.

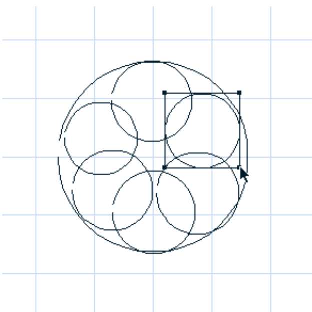
11 Choose **View menu▸ No Preview**.

12 Choose **Sections menu▸ Next**. If **Next** is not available you are already on the correct section.

13 Choose the **Oval** tool.

14 Hold down the **Shift** key and draw six smaller circles inside the larger circle.

You may need to move the circles to get them inside the larger circle.



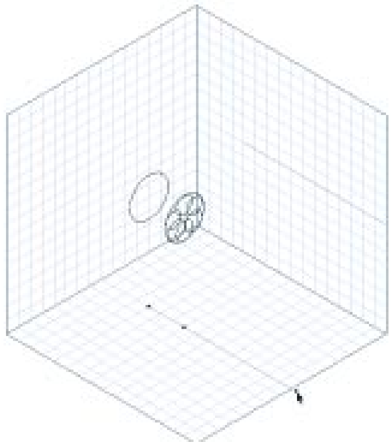
Add six smaller circles inside the larger circle with the Oval tool.

15 Choose **View menu▸ Preset Position▸ Reference**.

16 Choose the **Selection** tool.

17 On the ground plane, click the last point on the sweep path.

18 Hold down the **Shift** key and drag it to the end of the Working Box.



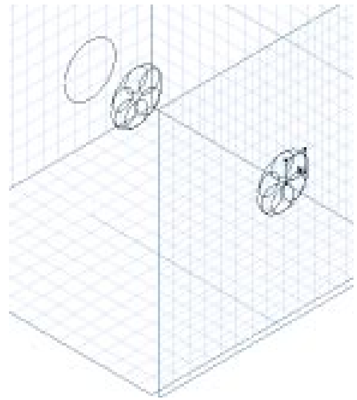
Extend the sweep path to the end of the Free Form modeling box.

19 Choose **Sections menu▸ Create**. A new cross section is added to the end of the path.

To ensure that shapes with multiple cross sections are extruded properly, you can assign numbers to shapes. Ray Dream Studio uses corresponding numbers to determine how to extrude cross sections.

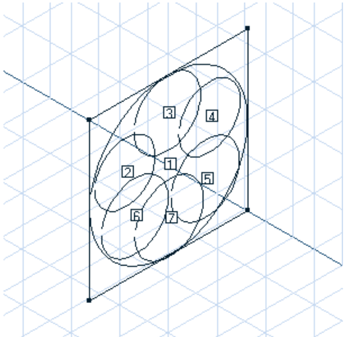
To adjust shape numbers:

1 Click the last cross section on the sweep path.



When you select the last cross section on the path, the cross section becomes the active Drawing plane.

2. Choose **Sections menu▸ Show Shape Numbers**.



You can use the cross sections shape numbers to control how multiple sections are extruded.

3. Choose **Sections menu▸ Previous**.

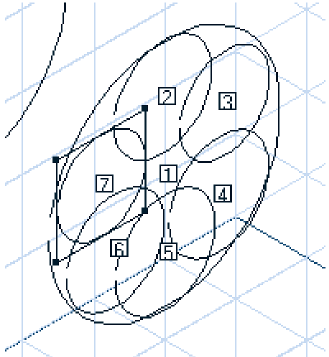
4. Choose **Sections menu▸ Previous** again. You should be on the first cross section.

   If **Previous** is not available you're already on the first cross section.

5. Choose **Sections menu▸ Next**.

6. Click a cross section number. The **Shape Number** dialog appears.This dialog lets you change the shape's number.

7. Change the number of the cross sections to match those shown below.

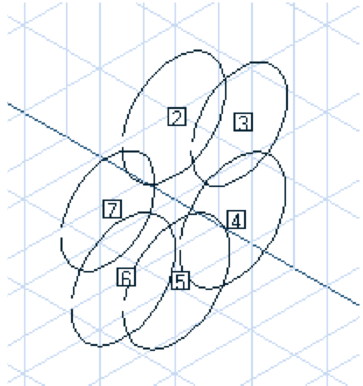


When you're done adjusting the shape numbers on your cross section, they should match these shown.

8. Choose **Sections menu▸ Next**.

9. Select shape #1 and delete it. All the numbers change.

10. Change the shape numbers to match the diagram shown below.



After you delete a shape, the number all change so you need to adjust the remaining numbers to match those shown.

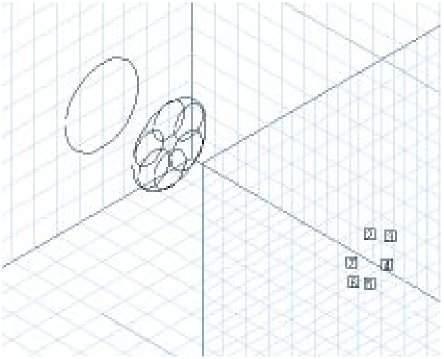
11. Click shape #2 with the **Selection** tool.

12. Choose **Windows menu▸ Properties**.

13. In the **Position** controls, enter **Width**=**0.25**, **Hieght**=**0.25**. Be sure the **Keep Proportions** box is enabled.

14. Click **Apply**.

15. Repeat steps 11 to 14 for each of the remaining shapes.

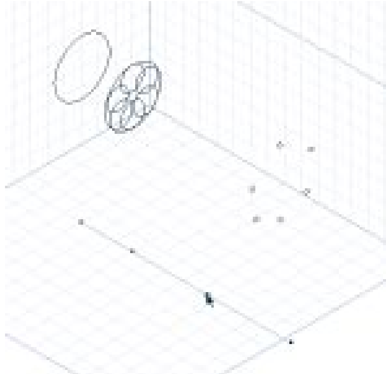


When you're done resizing the cross sections, your cross sections should look like these.

Now that the numbers are correct, you can add more sections.

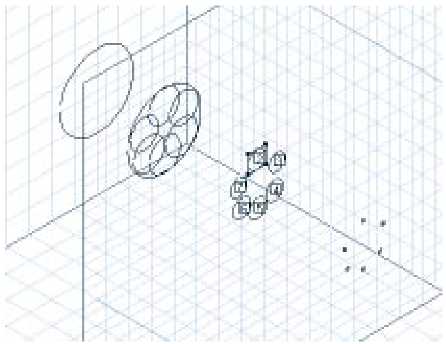
To add more sections:

1. Click the ground plane to make it active.
2. Choose the **Add Point** tool.
3. Add a point between the second and last cross sections.



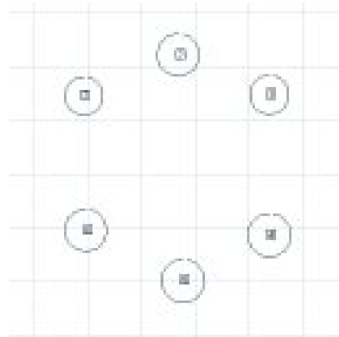
The new point determines where the cross section will be placed.

4. Choose **Sections menu▸ Create**.
5. Click the new cross section.



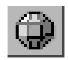
The new cross section has the same number of shapes as the previous section.

6. Choose **View menu▸ Preset Position▸ Drawing Plane**.
7. Choose **Sections menu▸ Show▸ Current**.
8. Drag the circles away from the center as shown below.



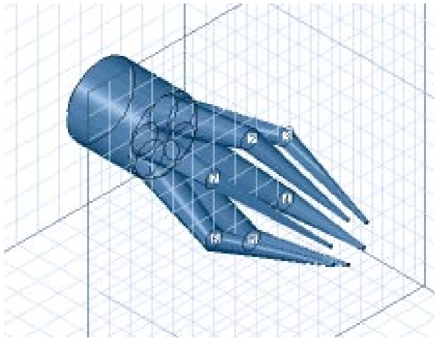
When you're done repositioning shapes, your cross section should look something like this.

9. Choose **View menu▸ Preset Position▸ Reference**.
10. Click the **Shaded Preview Quality** button.



Use the Shaded Preview Quality button to see a preview of your object with shading.

11 Choose **Sections menu▸ Show▸ All.**



Your object should look like this in Shaded Preview.

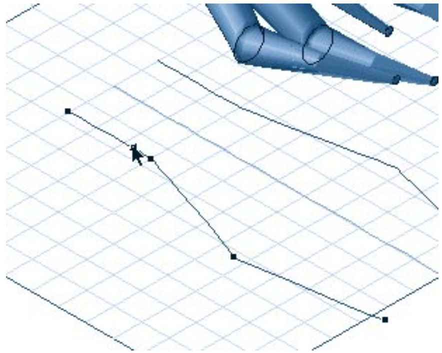
Now that you have all the necessary cross sections, you can add a extrusion envelope to reshape the anemone.

To adjust the object's envelope:

1 Choose **Geometry menu▸ Extrusion Envelope▸ Symmetrical.**

2 Choose the **Add Point** tool.

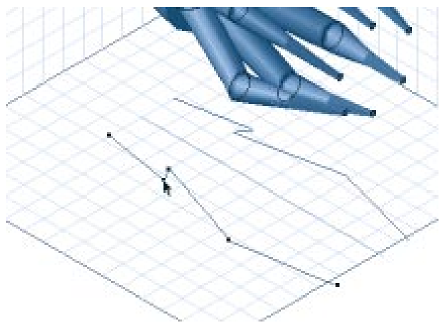
3 Add a point on the envelope as shown.



Use the Add Point tool to create a new point on the object's envelope.

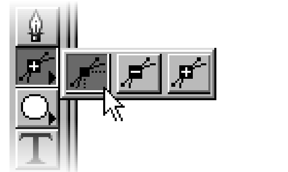
4 Choose the **Selection** tool.

5 Drag the new point down and to the left as shown.



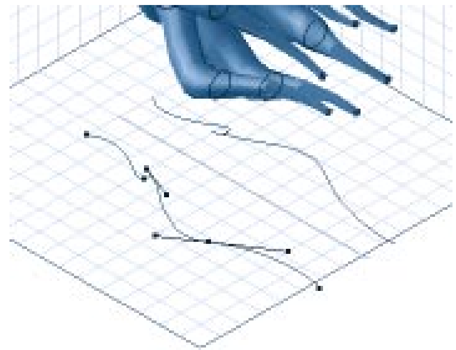
Use the Selection tool to adjust the position of the new point.

6 Choose the **Convert Point** tool.



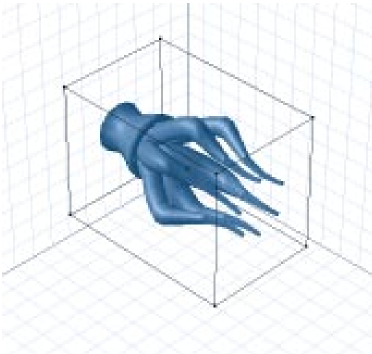
Use the Convert Point tool to convert lines to curves.

7 Smooth the points as shown.



After you adjust the points on the envelope, your object should look like this.

8. Click **Done**.



This is how your completed anemone appears in the Perspective window.

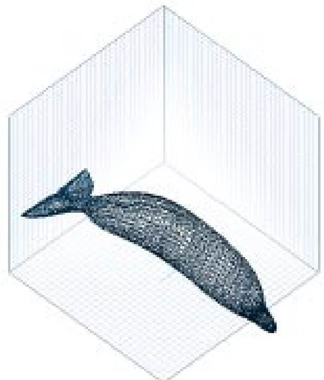
Your sea anemone is complete. You may want to save it in a convenient location. In the **Perspective** window you can duplicate the anemone to create a sea anemone bed.

Duplicate the anemone to form a bed.

Lesson 3: Mesh Form Modeling

The **Mesh Form** modeler lets you create 3D objects by adjusting the position of vertices, or points, mapped onto a shape or outline.

The **Mesh Form** modeler is a very organic way of modeling. You can think of the objects you create in the modeler as being made out of a malleable medium, like clay, that can be reshaped by pulling or pushing it's surface.



The Mesh Form modeler lets you create objects using vertices and polymeshes.

Like the **Free Form** modeler, the **Mesh Form** modeler has three drawing planes representing the X, Y, and Z axises. However, since you're not working with a sweep path there are no projections to work with. All your modeling is done directly in 3D.

The axis indicator will help you tell which plane you're working in.

The Mesh Form modeler axis indicator helps determine the plane you're working in.

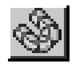
Each plane has a different color. The X axis is in green, the Y axis in blue and the Z axis is red.

Refer to "Mesh Form Modeling" on page 137 for more on the **Mesh Form** modeler.

In this next lesson you'll create a fish using a 3D primitive and the **Sphere of Attraction** tool.

To open the Mesh Form modeler:

1. Drag the **Mesh Form** tool into the **Perspective** window.



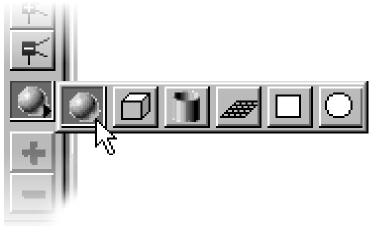
Drag the Mesh Form tool into the Perspective window to open the Mesh Form modeler.

The **Mesh Form** modeler opens.

2. Enter a name for your new object and click **OK**.

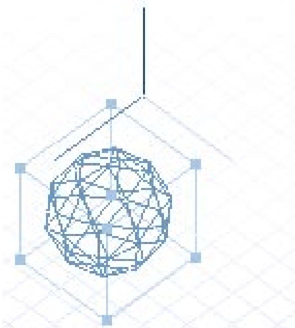
To create a 3D primitive

1. Choose the **Create Sphere** tool.



Drag with the Create Sphere tool to make a 3D sphere.

2. Drag the tool in the Mesh Form modeling window. Using the grid squares, make your object approximately 4 x 4.

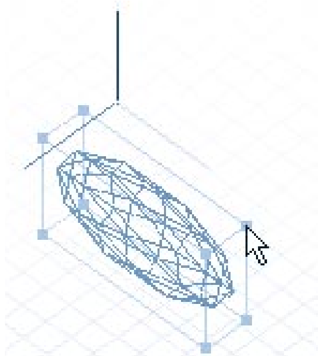


Your 3D sphere should be about four grid boxes wide and four grid boxes long.

3. Choose the **Selection** tool.

4. Click the top right point of the sphere's bounding box and drag to flatten and stretch the sphere as shown.

   The flattened sphere should be about two grid squares wide.



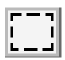
Drag the sphere's bounding box to stretch and flattened it.

Now that you have the basic shape, you can move its points (also called vertices) to reshape the sphere's outline

To edit an object's mesh:

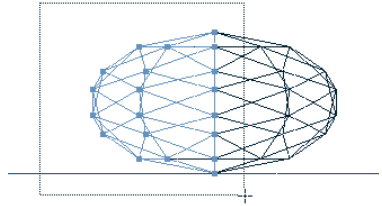
1. Choose **View menu▸ Preset Position▸ Left**.

2. Choose the **Marquee** tool.



Use the Marquee tool to select a group of vertices.

3. Drag to select the back half of the sphere.



Use the Marquee tool to selected the vertices on the back half of the object.

4. Choose **Selection menu▸ Subdivide**.

   This will double the number of points in the selected area. The more points you have, the more control you have over the shape of the object.

5. Click the **Sphere of Attraction** tool.

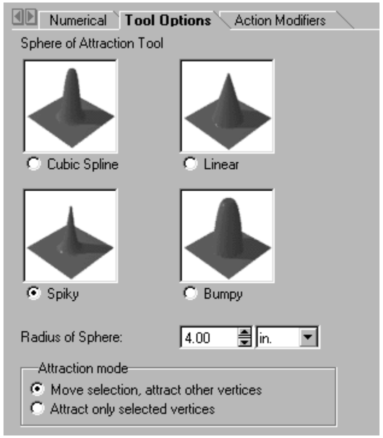
Use the Sphere of Attraction tool to move a group of vertices.

6. Choose **Windows menu▸ Properties**. The Properties palette appears.

7. Click the **Tool Options** tab.

8. Select the **Spiky** radio button.

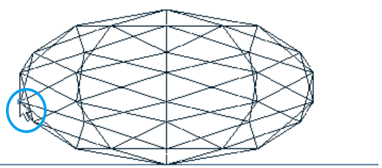
9. Set the **Radius of Sphere** to **4.00**.



Use the Sphere of Attraction options to set the radius and shape of the tool.

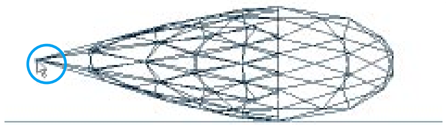
10. Click outside the sphere to deselect it.

11. Select the left-most point on the sphere and drag it left.



The left-most point on the sphere is approximately in the position shown. You may need to zoom in on the object.

Stop dragging when your shape looks like the one shown below.



Your object should look like the one shown after you drag the vertex.

To create the fish's tail:

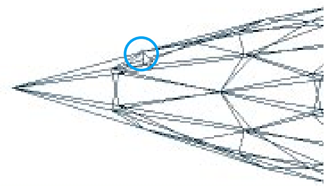
1. Click the **Zoom** tool.

2. Zoom in on the extended section.

3. Click the second point from the left on the top edge of the tail.

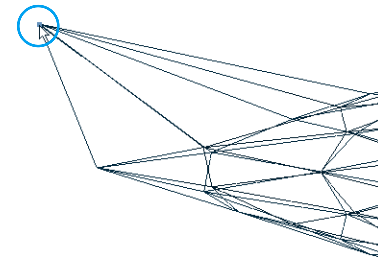
   You may need to click a few time to find the right point. Refer to the diagram below for more precise positioning.

Tip: If you accidentally click on a segment (a line with two points), click outside the object to deselect it.



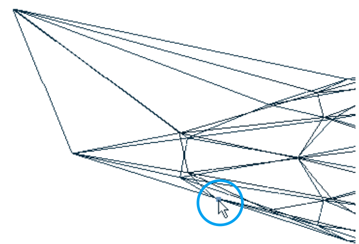
Click the vertex shown above and drag it to the left.

4. Drag the point up and towards the left as shown.



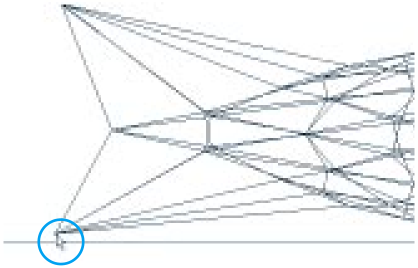
After you're finished moving the vertex your object should look like this.

5. Click the second point from the left on the bottom edge of the tail.



Click the point shown and drag it down and to the left.

6 Drag the point down and to the left.

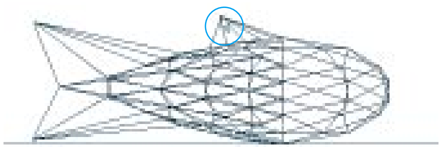


The tail should look like this when you're finished adjusting the vertex.

7 Choose the **Sphere of Attraction** tool.

8 In the **Properties palette: Tool Options tab**, enable the **Spiky** radio button and set the **Radius of Sphere** to **0.5**.

9 Click a point on the top edge of the object and drag it up and to the left.



Your dorsal fin should look like this when you're finished adjusting it with the Sphere of Attraction tool.

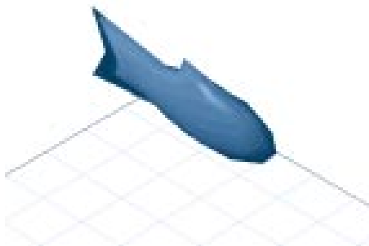
The basic shape of your fish is now complete. To finish it off you'll need to adjust the smoothness of the fish shape.

To smooth object edges:

1 Choose the **Marquee** tool and select the entire object.

2 Choose **Poly Mesh menu▸ Smooth Edges**.

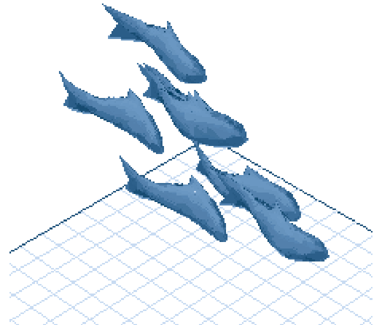
3 Click **Done**.



Your completed fish should look like this.

The fish is now complete. You may want to save it in a convenient location. The fish object you just completed was used to create the School of Fish object in the first section.

To create the school you'll need to duplicate and group the fish. For more information, refer to "Lesson 5: Duplicating and Grouping" on page 45.



When your fish is complete you can duplicate and group it to create a school of fish.

Lesson 4: Deformers

Deformers are a special set of tools that let you reshape objects or groups of objects. Using deformers you can easily create effects that would require a large amount of repositioning and editing. For example, you can explode an object by just applying a deformer instead of breaking the object apart manually and repositioning all the pieces. For more on Deformers, refer to "Deformers" on page 171.

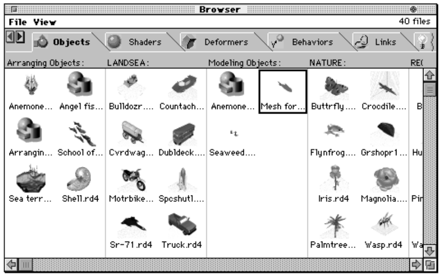
In this lesson you'll apply the **Wave** deformer to a fish object. The **Wave** deformer will give the fish object a fluid look.

Although this tutorial instructs you to use the fish from the **Browser** palette, feel free to use the fish object you created in the **Mesh Form** modeler.

To apply a deformer:

1. If you haven't done so already, add the **Modeling Objects** folder in the **Tutorial** folder to the **Browser palette: Objects tab**.

2. Drag the **Mesh Form Fish** object from the **Browser** palette to the **Perspective** window.

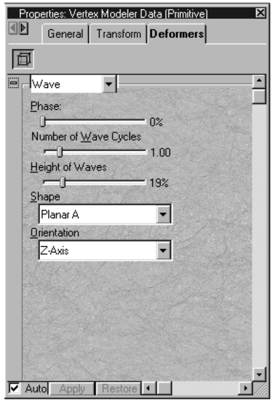


When you add the Modeling Objects folder to the Browser, you should see the Mesh Form Fish.

3. Choose **Windows menu▸ Properties**.

4. Click the **Deformers** tab.

5. Choose **Wave** from the **Defomers** pop-up.



Use the Wave Deformer controls to set the phase and shape of the wave.

6. If it is not already enabled, enable the **Auto** button at the bottom of the dialog.

   When this button is enabled, any settings you change are automatically applied to the object.

7. Set **Phase** to 0.

8. Orientation to **X Axis**.

9. Set **Number of Wave cycles=1.5**.

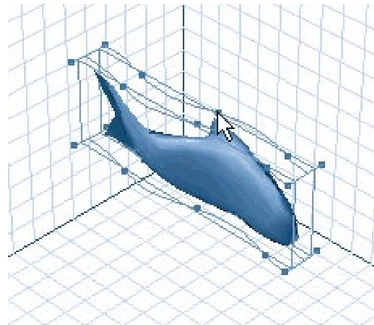
10. Set **Height of waves =08%**.

11. Click the **Direct Manipulation** button.

Click the Direct Manipulation button to display the Deformer's control handles.

   Direct manipulation lets you adjust the deformer's settings interactively in the **Perspective** window.

12. Click the center point and drag it to the left. The center points adjust the phase.



The Direct Manipulation controls let you adjust the Wave deformer's attributes in the Perspective window.

13. Close the dialog.

The fish should now look like its swimming though water. Deformers can also be applied to groups of objects. For example if you create a school of fish from the single fish object you can apply the **Wave** deformer to the entire school. All the fish will then appear to be swimming in the same direction.

Moving On

After completing the lessons in this section you should be familiar with the different types of objects you can create with Ray Dream Studio. The objects you created are just the beginning. You can create some incredibly complex objects just by combining the skills outlined in these lessons. For example, the same techniques used in Lesson 1, can be used to create leaves or plants. The techniques in Lesson 2 can be used to create an octopus or any number of tentacled creatures.

A good way to expand your modeling skill is to jump into some of the objects in the **Browser** palette. You can examine their sweep paths and cross sections to see how you might go about creating your own objects.

The next section of the tutorial will lead you through the process of creating and applying shaders to objects.

Shading Objects

Shaders are used to apply surface properties to objects. The Shader determines whether the object is shiny or dull, rough or smooth, transparent or opaque. By combining several different surface properties you can make even the simplest objects come alive.

A Shader can be saved as a file in the **Browser** palette which allows you to apply the same surface properties to several different objects.

The lessons in this section will teach you how to create, save and apply shaders.

The Story so Far

In the previous sections, you learned how to create and arrange objects. The type of shader you create will largely depend on the shape of your object, so you should be familiar with modeling concepts and procedures. For more details of modeling, refer to “Free Form Modeling” on page 109 and “Mesh Form Modeling” on page 137.

What You’ll Need

In the next lessons you’ll be creating shaders. To see the effects of the Shaders you’ll need to apply them to some objects.

To add lesson files to the Browser palette:

1. Click the **Objects** tab and choose **Browser palette: File menu▸ Add Directory/Folder**.
2. Locate and open the **Tutorial** folder on the Ray Dream Studio 5 CD-ROM. Open the **Tutorial** folder, then open the **Shading Objects** folder.
3. Click **Select Current Directory**.
4. Click the **Shaders** tab and choose **Browser palette: File menu▸ Add Directory/Folder**.
5. Locate the **Tutorial** folder on the Ray Dream Studio 5 CD-ROM. Open the **Tutorial** folder, then open the **Shading Objects: Tutorial Shaders** folder.
6. Click **Select Current Directory**.

For more instructions on opening folders in the **Browser** palette, refer to “Arranging Objects in the Scene” on page 39.

Lesson 1: Creating Shaders

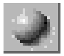
Shaders are a collection of surface properties that are saved in a special file called a shader file. You can create new shader files and edit existing ones using the **Current Shader Editor** palette.

In this lesson you'll use the **Current Shader Editor** to create a new shader and save it in the **Browser** palette.

Since you'll be applying shaders to your objects in this lesson you should adjust your preview mode to better see the affects of the shaders.

To change the preview mode:

Click the **Shaded Preview Mode** button.



Use the Shaded Preview Mode button to see the effects of shaders on an object.

In this preview mode, you will be able to see any texture maps you apply to objects.

To create new shader:

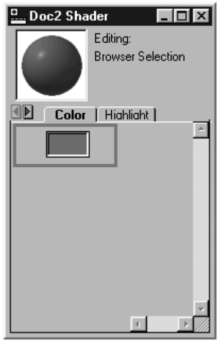
1. Drag the Shell object from the **Browser** palette to the **Perspective** window.

2. Choose the **Eyedropper** tool.

Use the Eyedropper tool to pick up the selected object's shader and display it in the Current Shader Editor palette.

3. Click the Shell.

The **Current Shader Editor** palette appears. When you create a new object, Ray Dream Studio places a default shader on it. The default shader has all the shader's channels set to 50. Each shader has eight channels which store a different surface property.



The Current Shader Editor lets you edit the shader's eight property channels.

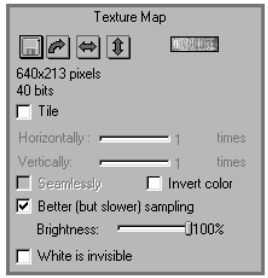
4. Click the **Color** tab.

5. Choose **Shader Editor: Insert menu▸ Texture Map**.

6. Locate the file **Tutorial: Shading Objects: SHELL_TEXTURE** on the Ray Dream Studio 5 CD-ROM.

You can import this image to use as Texture map on your object.

The **Texture map** controls appear.



The Texture Map controls let you specify the tile size and orientation of the texture map.

7. Click the **Highlight** tab.

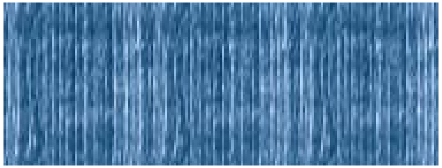
8. Set the value to **50**.

9. Click the **Shininess** tab and set the value to 50.

10. Click the **Bump** tab.

11 Choose **Shader Editor: Insert menu▸ Texture Map**.

12 Locate the file **Tutorial: Shading Objects: SHELL_BUMP** on the Ray Dream Studio 5 CD-ROM



You can also import a different image in the Bump channel to use as a Bump map.

13 Set Brightness to **30%**.

Bump channel effects can only be seen in the final rendered image.

14 Click **Apply**.

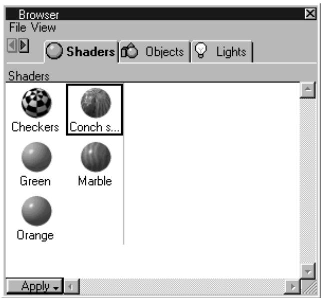
Your shader is now complete. If you want to apply the shader to other objects, you need to save it in the **Browser** palette.

When you click Apply, Ray Dream Studio applies al the attributes in all the Shader channels to the Shell.

To save a shader in the Browser palette:

1 Click the **Browser palette: Shader tab**.

2 In the **Current Shader Editor**, click the shader preview image and drag it to the **Browser** palette.



You can drag your Shader to any shader family in the Browser palette.

3 Enter a name for the shader.

Lesson 2: Applying Shaders

Ray Dream Studio lets you apply shaders in a number of different ways. You can apply the shader uniformly, or use the **3D Paint** tools to apply shaders to specific areas of an object.

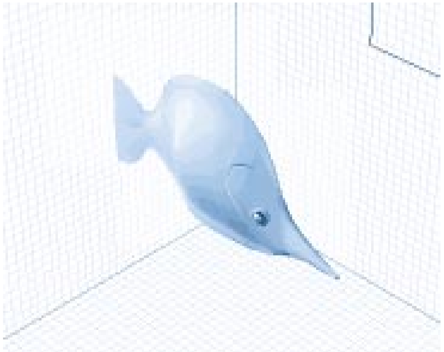
In this lesson you'll use Paint shapes to apply stripes to a fish and then use the 3D Paintbrush to fade them.

To apply a shader uniformly:

1 Drag the object labeled **Angel Fish** from the **Browser** palette to the **Time Line** window.

2 Click the **Shaders** tab.

3 Locate the drag the **Angel Fish Skin** shader from the **Browser** palette onto the **Angel Fish** object.



The fish's skin was created by applying the base shader Angel Fish Skin.

The Fish Skin shader is designed to be used as a base shader, meaning that the properties set for this shader will be carried over to any other shader you apply on top of it.

Once the fish's base color is set you can add the stripes.

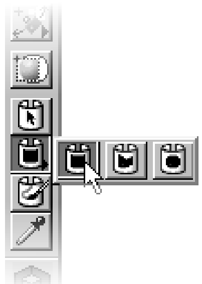
To a place a paint shape on an object:

1 Click the **Angel Fish Stripes** shader in the **Browser** palette.

The Angel Fish Stripes shader was created using a single image map of stripes. All the other channels in the shader are empty.

You can see how the Fish stripes shader was created by opening it in the Current Shader Editor.

2 Choose the **Rectangular Paint Shape** tool.

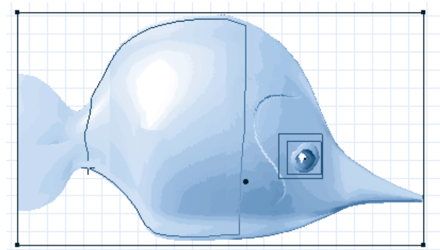


Use the Rectangular Paint Shape tool to create a rectangular paint shapes on objects.

The **Paint Shape** tools let you place image maps directly onto the surface of an object.

3 Choose **View menu▸ Preset Position▸ Left**.

4 Drag a large square over the body of the fish.



Drag the Paint Shape tool on the object's surface to size the paint shape.

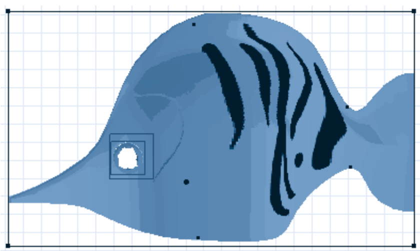
The stripes appear when you release the mouse button.

If the stripes are not in the right place, Choose the **Paint Shape Selection** tool and drag it to a different location.

When you release the mouse button the stripes appear.

5. Choose **View menu▸ Preset Position▸ Right**.

6. Draw a large square on this side as well.



Since the fish's stripes are in a shader, you apply them again to the other side of the fish.

Now that you have the stripes on the fish. You can make them appear to fade as they reach the fish's edges.

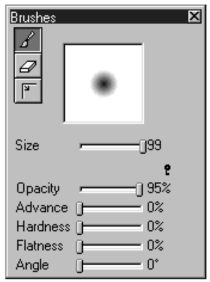
To apply a shader using the 3D Paintbrush:

1. In the **Browser** palette, click the **Fish Skin** shader.

2. Choose the **3D Paintbrush** tool.

Use the 3D Paintbrush tool to paint brush strokes onto your object.

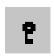
The **Brushes** palette appears.



Use the Brushes palette controls to set the size and Opacity of your 3D Paintbrush.

3. Set the **Size** value to **99**.

4. If the palette is not extended, click the **Extend** icon to extend the palette.



Use the extend icon to view more 3D Paintbrush controls.

5. Set the following:

   Opacity to **95%**

   Advance to **0%**

   Hardness to **0%**

   Angle to **0** degrees.

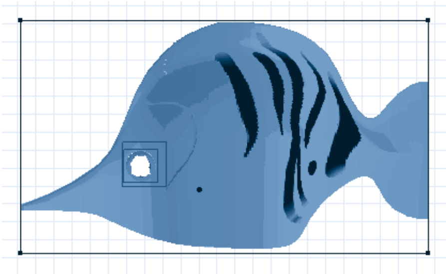
6. Choose **View menu▸ Preset Position▸ Right**.

7. Drag the brush over the top and bottom edges of the fish.

The brush you created will fade fish's stripes when you paint over them.

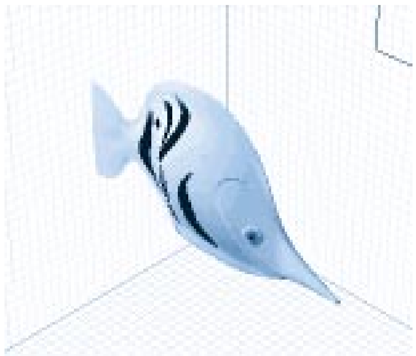
8. Choose **View menu▸ Preset Position▸ Left**.

9 Paint over the edges of the fish on this side as well. You don't have to worry about matching to the two sides as the fade will look more natural the more uneven your strokes.



Use the 3D Paintbrush to fade the other side of the fish as well.

10 Choose **View menu▸ Reference**.



When you're done painting on the fish, switch to Reference view to the see the results of your changes.

The fish is now complete. If you want to see the rendered shader use the **Render Preview** tool or skip ahead to "Rendering" on page 92.

Moving On

The lessons in this section covered most of the basics of working with Shaders, but that doesn't mean that's all there is to learn. Shaders can give you an almost infinite variety of textures and colors. There are many more complex ways of creating shaders. Refer to "Creating Shaders" on page 197 for details on all the features you can use to create complex shaders.

As with modeling objects, a good way to learn more about shaders is to take a look at how other shaders are made. Try opening some of the pre-made Shaders in the **Current Shader Editor**.

The next section of the tutorial will lead you through the process of adding lights to your scene.

Setting up Lights

The final appearance of your scene depends greatly on how you light it. In fact, many of the effects you applied to objects using shaders can only be seen if the they are lit properly. For example, you can't see the shininess of an object's surface unless you shine a light onto it.

In Ray Dream Studio, you can apply the same lighting techniques used in real photography. By adjusting the position and attributes of lights you can produce a large number of different scenes using the same set of objects.

The lessons in this section will take you through adding lights using the **Browser** palette and position them using the **Direct Manipulation** controls.

The Story So Far

This tutorial has lead you through the steps necessary to create, arrange and shade objects. If you're unclear on any of these concepts refer to earlier sections of this tutorial or see the relevant chapters.

What You'll need

To see the affects of the lights you'll need a scene. You can use the scene you arranged in the first section of the tutorial, or use the file **LIGHT_TUTOR_1**.

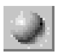
To begin setting up lights:

1. Open the scene file **Tutorial: Setting Up Lights: LIGHT_TUTOR _1** on the Ray Dream Studio 5 CD-ROM.
2. Click the **Lights** tab.
3. Choose **Browser palette: File menu▸ Add Directory/Folder**.
4. Locate **Tutorial: Setting Up Lights** folder and click **Select Current Directory**.

Like shaders, some of the lighting effects cannot be seen until you render your scene. Ray Dream Studio offers you two tools for see light effects without having to render your scene: **Shaded Preview Mode**, and the **Render Area** tool.

To switch to Shaded Preview mode:

Click the **Shaded Preview** button.



Use the Shaded Preview button to see the effects of lights on your objects.

Shaded Preview slows the redraw time dramatically so its a good idea to work in Preview mode while you're setting up lights and then switch to Shaded Preview only when you're finished.

The **Render Area** tool lets you check your lighting by rendering a small area of your scene.

To render an area of a scene:

1. Choose the **Render Area** tool.

Use the Render Area tool to render areas of your scene.

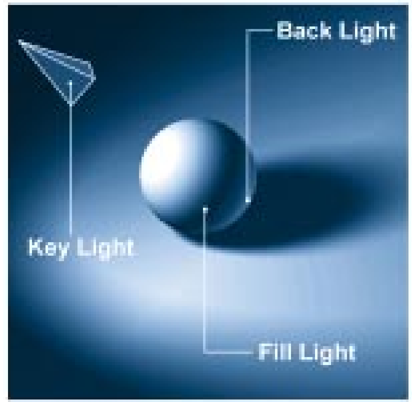
2. Drag the tool over the area you want to render.

Lesson 1: Adding Lights

There are two different types of lights you can add to your scene: ambient and specific. Ambient light acts like daylight. It has no origin and doesn't cast shadows. Specific lights like, spot lights or bulb lights, have an origin which can be positioned in your scene.

When deciding how many lights to add, you should consider the contents of your scene and your systems memory limitations. The more lights you add, the longer the rendering time.

In most cases you can adequately light your scene using only three specific lights. One light in front of the object to illuminate the scene (Key Light), one behind the scene to highlight object outlines (Back Light) and one to create shadows (Fill Light).



This basic lighting setup can be used to effectively light most scenes.

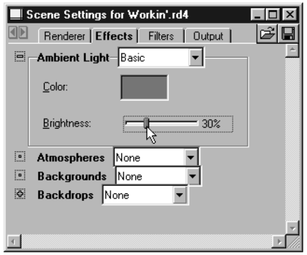
In Ray Dream Studio this basic setup can be created using a Spot light as a Key Light, Distance light as a Back Light and Ambient light as a Fill Light.

Ambient light settings depend on the environment you want to create. For an underwater scene, the ambient light should be set fairly low to create murky atmosphere.

To set ambient light:

1. Choose **Windows menu▸ Scene Settings**. The **Scene Settings** dialog appears.

2 Click the **Effects** tab.



Use the Effects tab of Render Effects palette to set the color and brightness of your ambient light.

3 Display the **Ambient Light** controls.

4 Click the color chip and choose a dark blue color from the palette.

5 Set **Brightness** to **30%**.

6 Close the palette.

Now that you've set the ambient light you can add specific lights to the scene. You can begin by adding a bulb light.

To add a light:

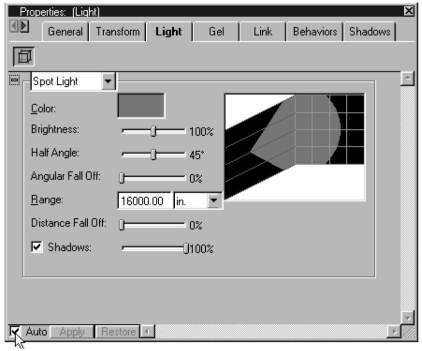
1 Drag the **Create Light** tool into the **Time Line** window.

Drag the Create Light tool into the Perspective window to create a new light.

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

3 Click **Auto**.

4 Choose **Bulb Light** from the pop-up.



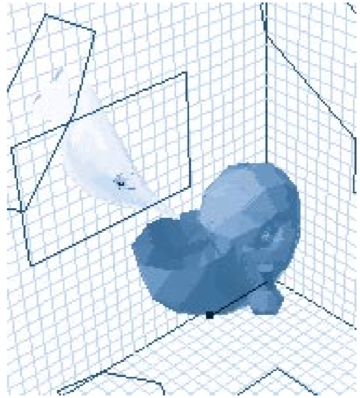
Use the Light tab of Properties dialog to choose a light type and color.

5 Disable the **Shadows** checkbox to save on rendering time.

6 Click the **Direct Manipulations** button.

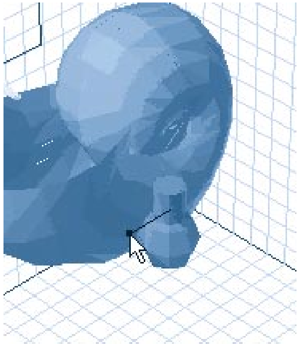
Use the Direct Manipulations button to display the light's control handles.

Two points appear on the bulb light (called control handles) in the **Perspective** window. You can adjust the light's properties by dragging its control handles.



Use the light's Direct Manipulation controls to set its properties in the Perspective window.

7. Click the control handle that extends from the light and drag it away from the light. This adjusts the **Brightness** value in the **Properties** palette.



As you drag the Bulb brightness control, the Brightness value in the Properties palette changes.

You can use the **Direct Manipulation** controls to adjust the properties any type of light. Spot lights have many more control points than bulb lights. For more details on interactive controls, refer to “Controlling a Spot Light Directly” on page 277.

You can also add lights by dragging them out of the **Browser** palette.

To add lights from the Browser palette:

1. Choose **Browser palette: Lights tab**.

Click the Light tab on the Browser palette to view any saved lights.

2. Drag the light labeled **Light Tutor** to **Time Line** window.

Your new lights appear at preset positions. You now have all the lights you’ll need to create a good lighting effect, but you still need to properly position the lights.

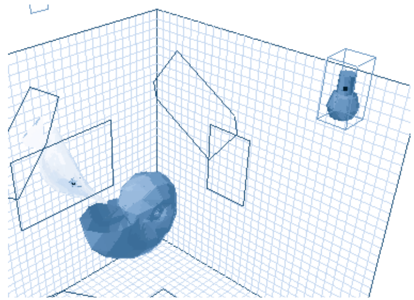
Lesson 2: Positioning Lights

There are several ways of positioning lights. Like other objects you can position lights numerically or manually. As well, you can also assign special behaviors to lights which will automatically position them.

To position lights using Transform controls:

1. Click the **Bulb** light in the **Time Line** window.
2. Choose **Windows menu▸ Properties**. The Properties palette appears.
3. Click the **Transform** tab.
4. Set **Position** values to **X=0**, **Y=65**, and **Z=80**.
5. Click **Apply.**

The light moves to the upper left corner of the Working Box.



You can enter values in the Properties palette’s Transform tab to numerically reposition the bulb light.

The remaining light can be positioned easily by applying the **Point At** behavior. The Point At behavior forces the light to always point at the object no matter what position it is in. Wherever you move the object, the lights will follow.

To add the Point At behavior to a light:

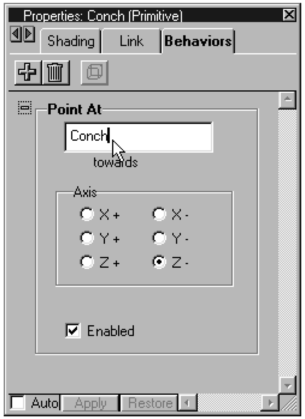
1. In the **Time Line** window, click the light labeled Key light.
2. Choose **Windows menu▸ Properties** if the **Properties** palette is not already visible.

3. Click the **Behaviors** tab.

4. Click the **Add Component** button.

Click the Add Component button to see a list of available components.

5. Choose **Point At** from the list and click **OK**.



Use the Behaviors tab to add or delete behaviors for an object.

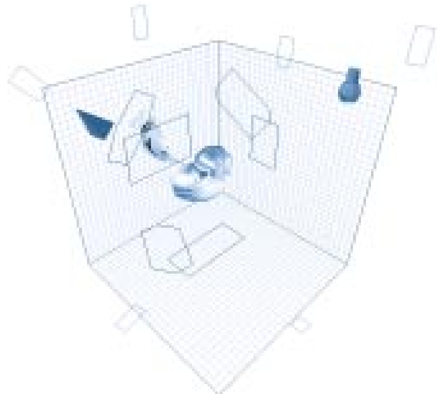
6. Type the name **Conch Shell** in the **Point At** box.

   This forces the light to point at the Conch at all times.

7. Make sure the **Enabled** checkbox is checked.

8. Click **Apply**.

9. To see the results of the pointed light, enable the **Shaded Preview** button.



In Shaded Preview you can see the results of your light settings.

Now that your lights are all in the correct position you can refine individual light properties to create special effects.

Lesson 3: Lighting Effects

Just like in a real studio, a light doesn't have to be just a simple spot light. You can adjust the light's properties to create subtle effects, or you can add gels to lights to create a special lighting effect.

Gels are images that act as transparency masks when you place them in front of a light.

To add a gel:

1. Click the light labeled **Key** light in the **Time Line** window.

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

3. Click the **Gel** tab.

Use the Gel tab in the Properties palette to load image maps as gels.

4. Choose **Map** from the pop-up.

5. Click the disk icon and choose **Open**.

6. Locate the file: **Tutorial: Setting Up Lights: WATER** on the Ray Dream Studio 5 CD-ROM and click **Open**.

7. Click **Apply**.

Your lighting setup is now complete. If you want to see the lighting effect, drag the **Render Preview** tool over the entire scene.

When you render your image you can see the effects the gel on your objects.

Moving On

The lighting setup can be quickly adapted to any scene by just changing the **Point At** object.

Many other lighting setups are available through the Scene Wizard. The Scene Wizard will lead you through he process of creating a lighting setup by answering a few questions. For more on the Scene Wizard, refer "Using the Scene Wizard" on page 27.

The next section of the tutorial will show you how to set up cameras.

Setting up Cameras

Just like in a real photo studio, the appearance of your scene can vary depending on where you view it from. That is why you strategically place cameras at specific positions. Since all your objects in Ray Dream Studio exist in a 3D space, you can position cameras to view your scene from any angle.

When you're rendering an image or animation, the view you see through a camera is used to produce the final image.

The lessons in this section will teach you how to add cameras using the **Browser** palette and position them using the **Direct Manipulation** controls.

The Story so Far

You've learned how to create, arrange, shade and light objects in your scene. Since lighting can be essential to deciding where you place cameras, you should be familiar with lighting concepts and procedures.

For more information, refer to "Lesson 1: Adding Lights" on page 68, or"Setting Lights" on page 271.

What You'll Need

To get a feel for how different camera perspectives can be used in a scene, you'll need a sample scene.

To begin setting up cameras:

1. Open the file **Tutorial: Setting Up Cameras: CAMERA TUTOR** on the Ray Dream Studio 5 CD-ROM.

   You can also use the scene you arranged in the first section of the tutorial.

2. Choose **Browser palette: Cameras tab**.

3. Choose **Browser palette: File menu▸ Add Directory/folder**.

4. Locate the **Tutorial: Setting Up Cameras** folder and click **Select Current Directory**.

Lesson 1: Adding Cameras

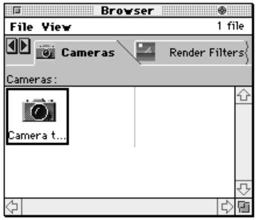
By default, your scene already has one camera. The preset positions available from the **View** menu are based on the default camera. You can add other cameras to view your scene from different perspectives. You can also add cameras to save commonly used camera angles.

The simplest way of adding a camera is to drag one out of the **Browser** palette.

To add cameras from the Browser palette:

1. If the **Browser** palette is not visible, choose **Windows menu▸ Browser**.

2. Choose the **Cameras** tab.



The Camera tab in the Browser palette contains sets of camera settings.

3. Drag the **Camera Set** camera from the **Browser** palette into the **Time Line** window.

   The new camera appears at its preset position.

You can also create new cameras and customize their attributes.

To add cameras using the Create Camera tool:

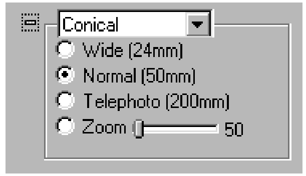
1. Choose the **Create Camera** tool and drag it into the **Time Line** window.

Drag the Create Camera tool into the Time Line window to add a new camera to your scene.

   A new camera appears at the origin. By default, the camera is named Camera 2.

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

3. Click the **Camera** tab.



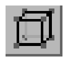
Use the Camera tab in the Properties palette to set camera type and zoom level.

4. Choose **Conical** from the pop-up.

5. Enable the **Normal** radio button.

6. Enable the **Auto** box.

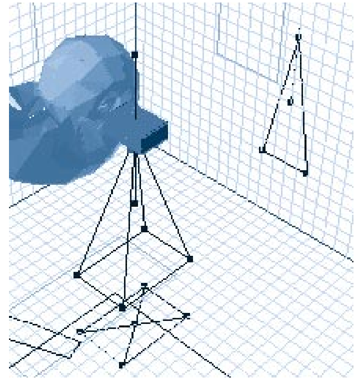
7. Click the **Direct Manipulation** button.



Use the Direct Manipulation button to display the camera's control handles.

   The camera's control handles appear in the **Perspective** window. You can set the camera's attributes by dragging these control handles.

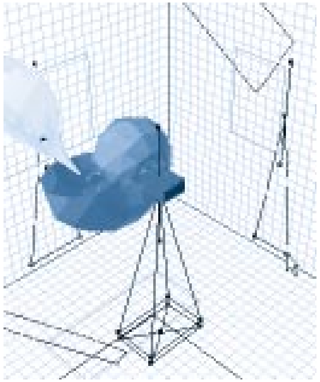
   The control handle that extends in front of the camera controls the viewpoint, the control that extends behind it controls the position of the camera in the scene. The triangle that extends out in front of the camera controls the zoom level.



Use the camera's direct manipulation controls to adjust its attributes in the Perspective window.

8. Drag the zoom controls (the triangle extending in front of the camera) towards the camera.

If you find it difficult to move the zoom control, try adjusting the zoom control on one of he camera's projections.

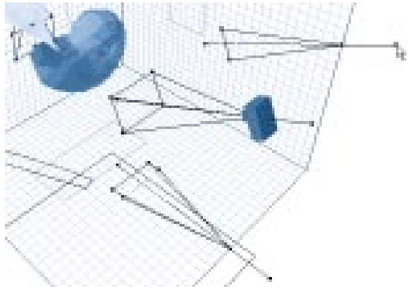


Drag the camera's zoom controls to adjust the zoom level.

When you release the mouse button, the zoom value in the **Properties** palette should read about 45.

9 Drag the control handle that extends from behind the camera to front of the workspace.

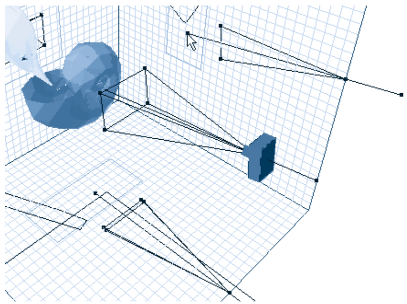
When you release the mouse button, the camera changes position.



Drag the camera position control handle to move the camera to a new position.

10 On the right plane, click the control handle that extends out in front of the camera and drag it over the center of the scene.

The camera is now pointing at the center of the scene.



Drag the viewpoint control out to the object you want the camera to point at.

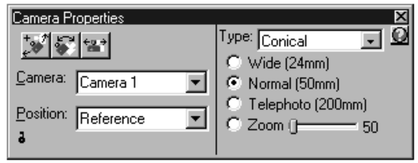
Your new camera setup is complete.

Lesson 2: Viewing your Scene from Different Cameras

Now that you have more than one camera you can choose which camera you want to use to view your scene.

To switch between cameras:

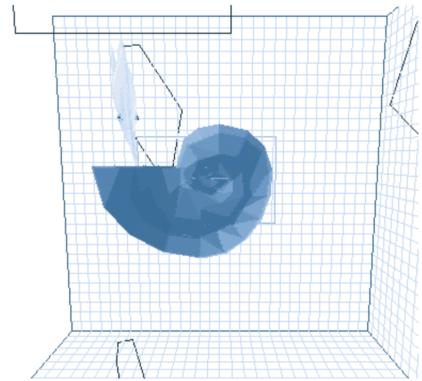
1 Choose **Windows menu▸ Camera Properties**. The **Camera Properties** palette appears.



Use the Camera Properties palette to switch between cameras.

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

The view of the scene changes.



When you change the camera in the Camera Properties palette the view of your scene changes.

3. Choose **Reference** from the **Position** pop-up. The view changes to the **Reference** view for Camera 2.

4. Choose **Camera 1** from the **Camera** pop-up. The view changes to the **Reference** view from the default camera.

   You can use the **Camera Properties** palette to switch between different cameras and to save your most commonly used positions. For more on cameras, refer to “Setting up Cameras” on page 72.

Now that you’ve added some cameras you need to position them to get the best views of your scene.

Lesson 3: Positioning Cameras

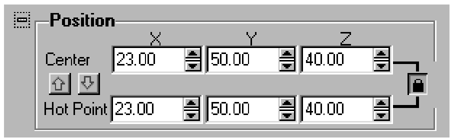
There are several ways of positioning cameras in Ray Dream Studio besides using the **Direct Manipulation** controls. You can send the camera to a specific position using the transform commands, or using the **Camera Dolly**, **Camera Pan**, or **Camera Track** tools.

To numerically position a camera:

1. Select **Camera Set** in the **Time Line** window.

2. Choose **Properties palette: Transform tab**. If the **Properties** palette is not visible, choose **Windows menu▸ Properties**.

3. In the **Position Controls** enter **X=23**, **Y=50** and **Z=40**.



Use the Position controls in the Properties palette to numerically position cameras.

4. Click **Apply**.

   The camera moves to a new position.

You can also use the camera tools to position your cameras.

To position a camera manually:

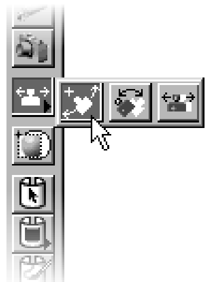
1. Choose **Windows menu▸ Camera Properties**. The **Camera Properties** palette appears.

2. Choose **Cameras menu▸ Camera Tutor**.

3. Choose **Position menu▸ Reference**.

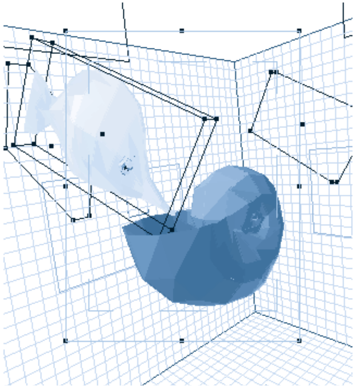
4. Click the Shell object in the **Perspective** window.

5. Choose the **Dolly** tool from the toolbar.



Use the Dolly tool to interactively adjust the position of the camera.

The production frame appears and the pointer changes to a camera. The production frame defines the area of your scene that appears in the final artwork when you render the scene.



The production frame defines the area of your scene that is used to produce a rendered image or animation.

6 Drag the pointer down and to the left. The view of the scene rotates around the selected object.

You can also use the other **Camera** tools to adjust the position. The production frame for each camera can also be adjusted separately.

To adjust the Production Frame:

1 Select the **Camera Tutor** camera in the **Perspective** window.

2 Choose **View menu▸ Production Frame**. A green frame appears around your scene.

3 **Shift-drag** one of the points on the production frame towards the center. The frame shrinks proportionately.

If you drag a point without holding down the **Shift** key, a dialog appears warning you that you're about to change the frame's aspect ratio.

To move the production frame:

Click the production frame and drag it to a new location.

Your camera setup is now complete. Using the cameras you set up in this lesson you can produce a number of different 3D illustrations using the same scene. If you want to see how your scene will look rendered from a particular angle, drag the **Render Preview** tool over the scene.

Use the Render Preview tool to see how your scene will look when it's rendered.

Moving On

The cameras you created in this section can be used in a wide variety of scenes. If you like the custom camera you created, save it in the **Browser** palette. Refer to "Using the Browser Palette" on page 28 for instructions on saving to the **Browser** palette.

Ray Dream Studio comes with a number of preset cameras which can be accessed through the Scene Wizard. The Scene Wizard will set up cameras and lighting based on your answers to a few questions. For more information, refer to "Using the Scene Wizard" on page 27.

The next section of the tutorial will lead you through the process of animating the objects in your scene.

Animating Objects

Ray Dream Studio uses a process known as *key frame* animation to animate objects. In this process, each point in time where an action begins, ends or changes is know as a key frame. All the frames in between the key frames, or action, are filled in Ray Dream Studio.

For example, if you wanted to animate a bouncing ball, you would set up a key frame showing the ball in its starting position, a frame showing it bouncing off the ground and a frame showing its final position. When the animation is rendered, Ray Dream Studio creates all the frames in between, showing the ball moving towards the floor and then away from the floor.

The lessons in this section will show you how to create key frames and apply **Tweeners** and **Behaviors** to them to create simple animations.

The Story So Far

In this tutorial you've learned how to create, arrange, and light objects and how to add cameras. In the next section you'll learn how to animate objects. Before you can animate an object you should know how to create one. For more information on modeling, refer to "Free Form Modeling" on page 109 and "Mesh Form Modeling" on page 137. Key frame animation relies heavily on changes in position and angle so it's essential that you also understand how to position objects. For more information, refer to "Arranging Objects in the Scene" on page 39 or "Arranging Objects" on page 223.

What You'll Need

In order to animate objects, you'll need a few sample objects. Since animation takes up a large amount of memory, it is recommended that you use only a few objects in you scene.The file **ANIMATE TUTOR** in the **Tutorial** folder on the CD-ROM has been designed especially for this animation section.

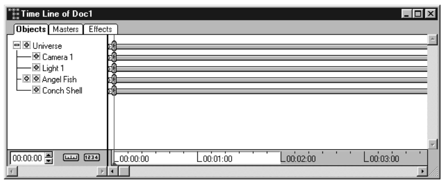
To begin animating objects:

1. Open the file **Tutorial:Animating Objects: ANIMATE TUTOR** on the Ray Dream Studio CD-ROM.
2. Choose **Browser palette: Objects tab**.
3. Choose **Browser palette: File menu▸ Add Directory/Folder**.
4. Locate the folder **Tutorial: Animating Objects** and choose **Select Current Directory**.

The first step in any animation is to set the its time limit.

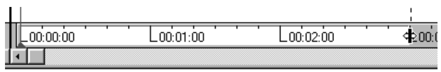
To set animation time limit:

1. Make sure the **Time Line** window is visible. If it's not, choose **Windows menu▸ Time Line of Animate Tutor**.



The Time Line window displays all the key event markers in the animation and its current length.

2. Click the **Time Axis** at **00:02:00** and drag it to **00:03:00**.



Drag the end of the Time Axis to 00:03:00 to extend the length of your animation.

Your animation will now last for three seconds.

When you're animating, you'll probably need to quickly move between frames. Ray Dream Studio's **Time Controller** tools let you jump from the beginning of an animation, to the end, or anywhere in between.

To display the Time Controller:

1. Choose **View menu▸ Toolbars**. The **Toolbars** dialog appears.
2. Enable **Time Controller**. A toolbar is visible when a checkmark appears next its name.

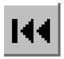
The Time Controller toolbar contains all the tools you'll need to preview your animation in the Perspective window.

Lesson 1: Creating Key Frames

In key frame animation you need to create a key frame anywhere you want action to start, stop or change. In this lesson you'll be creating a simple animation with only one action so you'll only need to create two key frames one to tell Ray Dream Studio where you want the action to begin and another to define where you want the action to stop.

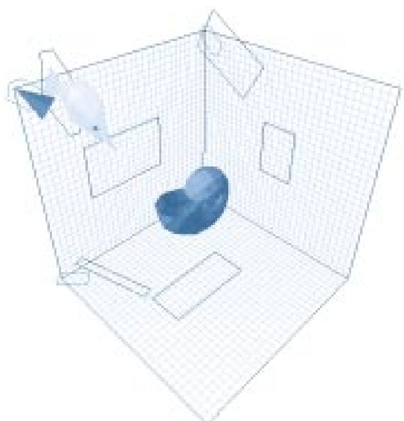
To create a key frame:

1. Make sure you're at the first frame of your animation. If you're not, click the **First Frame** button.



Click the First Frame button to jump to the first frame in your animation.

By default, Ray Dream Studio creates key frames for all the objects in the scene at the start of the time line. So, you already have the starting key frame of your animation. All you have to do now is create a key frame for the end of the animation.



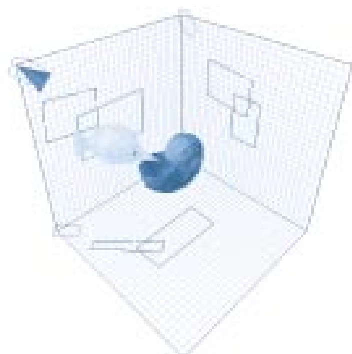
By default Ray Dream Studio creates the first key frame in your animation when you open a scene.

2. Click the **Last Frame** button on the **Time Controller**.

Click the Last Frame button to jump to the last frame in your animation.

The **Current Time** indicator jumps to the end of the animation.

3. Click the Angel Fish object in the **Time Line** window.
4. Click **Command-T**/**Ctrl+T** to display the **Object Properties** palette.
5. Click the **Transform** tab.
6. Enter the **Position** values **X**=**34**, **Y**= **-16**, **Z**=**20** and **Yaw**= 45, **Pitch**= -5 and **Roll**= -5 click **Apply**.

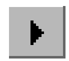


When you adjust the position of objects, Ray Dream Studio creates a new key frame.

7. Click the **First Frame** button.
8. Click the **Perspective** window to make it the active window.
9. Click the **Interactivity** button. This button should be active whenever you preview animations in the **Perspective** window.

When the Interactivity button is active you can see your objects moving between key frames.

10. Click the **Play** button to preview your animation.



Click the Play button to run your animation.

The fish appear to move towards the shell.

Lesson 2: Applying Tweeners

In the animation you created in Lesson 1 you probably noticed how quickly the fish approached the shell. In reality, the fish would probably slow down as it gets closer to the shell. This type of behavior can be controlled using **Tweeners**. A tweener lets you control how Ray Dream Studio fills in the transitions between key frames.

If you apply a Bézier tweener to the Angel fish, the fish will slow down as it approaches the shell.

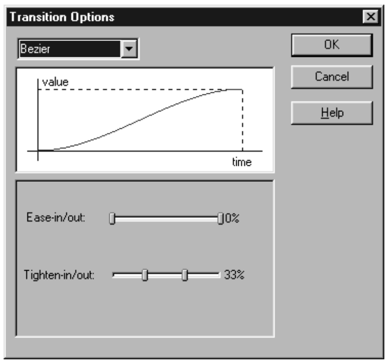
To apply a Tweener:

1. In the **Time Line** window, double-click the time track between the first and last key frames for the **Angel Fish** object.

The tweener icon appears in the space between frames when you apply a tweener to your animation.

The **Transition Options** dialog appears

2. Choose **Bézier** from the pop-up.



Use the Transitions Options dialog to select a Tweener type and set its attributes.

The Bézier tweener lets you control the acceleration of an object and its trajectory. For more on tweeners, refer to “Using Tweeners” on page 309.

3. Set the **Ease-in** /**out** values to 40% and 40%.

   These values control the speed of the object.

4. Set the **Tighten-in** /**out** values to 50% and 50%.

   These values control the trajectory of the object.

5. Click the **First Frame** button then click **Play** to preview the new animation.

The fish now appears to slow down as it approaches the Conch shell. If you’re happy with this animation, save it to a convenient location.

Lesson 3: Applying Behaviors

Using a combination of key frames and tweeners you can create some very realistic looking animations. However, by applying **Behaviors** to objects you can create realistic animations that would be very complicated to create using only key frames.

A behavior gives an object a specific set of instructions that determine or modify their actions during an animation.

In this lesson you’ll apply a special set of behaviors called *physically-based* behaviors.

Physically-based behaviors let you set up a simulation of real world physical action like gravity or velocity.

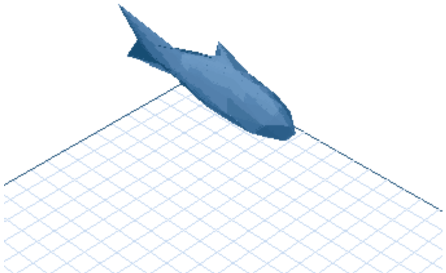
To set up a simulation you must first define which objects are to be included in the simulation and then apply some kind of force to move those objects.

For example, to simulate a collision, you would create two physical objects, then apply directional force to one of them. When rendered, one object would appear to crash into another and then rebound off it.

In this lesson you’ll apply the **Flow Force** behavior to a school of fish and then watch as they swim away in every direction

To apply physically-based behaviors:

1. Drag the Mesh Form Fish object out of the **Browser** palette and into the **Perspective** window.



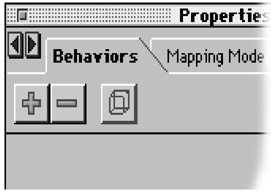
This is what the Mesh Form Fish looks like in the Perspective window

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

3. Enable the **Auto** checkbox.

   When **Auto** is enabled, any change you make to the behavior's values are automatically applied to the object.

4. Click the **Behaviors** tab. If the tab is not visible, click the arrow buttons to scroll the tabs.

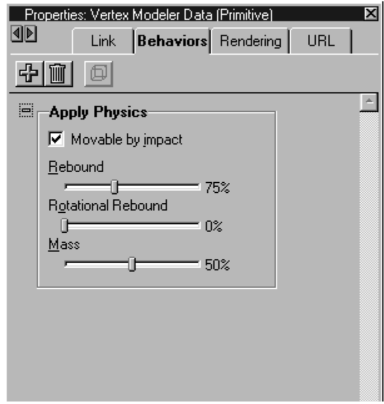


Use the scroll buttons to view Properties tabs that are not visible.

5. Click the **Add** button. The **Add** dialog appears.

Use the Add button to display a list of available behaviors.

6. Select **Apply Physical Effects** and click **OK**.



When you select a behavior from the Properties palette's Behaviors tab, controls for that behavior are displayed.

   Apply Physical Effects is the base behavior for all physical simulation. you must apply this behavior to any object you want to be included in the simulation.

   Once the behavior is applied, the other objects in the simulation will interact with it as if it were a real object.

7. Enable the **Movable by impact** checkbox.

8. Click the **Add** button again.

9. Choose **Flow Force** from the list and click **OK**. The **Flow Force** controls are added to the **Behaviors** tab.

   Flow Force simulates the force of water currents on an object.

10. Set the **Turn Density** to 70%.

11. Enable the **Rotate with flow** checkbox.

The behavior setup is now complete. If you ran the simulation at this point the little fish would appear to swim through the scene towards the camera. However, you can create a much more interesting effect by creating an entire school of fish.

To duplicate objects:

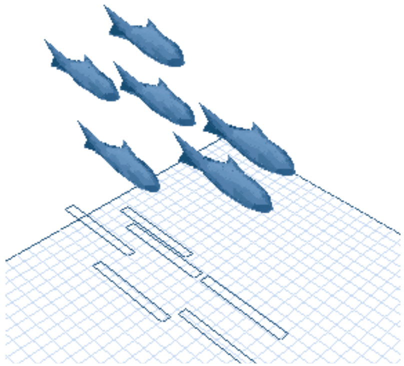
1. Select the School Fish in the **Perspective** window and press **Command-D/Ctrl+D**.

2. Drag School Fish up and to the left.

3. Press **Command-D/Ctrl+D** again. A new fish appears.

   You may need to move the fish around to get the right positions for the school.

4. Continue duplicating and repositioning the fish until you have enough to look like a school.



As you duplicate fish, each duplicate will have the same behaviors applied to it.

In order to see the full affect of the behaviors in your scene, you'll need to activate **Interactivity** and extend the time limit of the animation.

To preview behaviors:

1. Click the **Interactivity** button.

When the Interactivity button is active you can see your objects move during the animation.

2. In the **Time Line** window, drag the end of the animation in the **Time Axis** from 00:03:00 to 00:10:00.

3. Click the **First Frame** button and then click **Play**. Make sure the **Interactivity** button is enabled.

The school of fish appears to break apart an swim away in all directions.

If your not happy with the speed of the action, you can use the techniques you learned in the previous lesson to apply **Tweeners** to the fish.

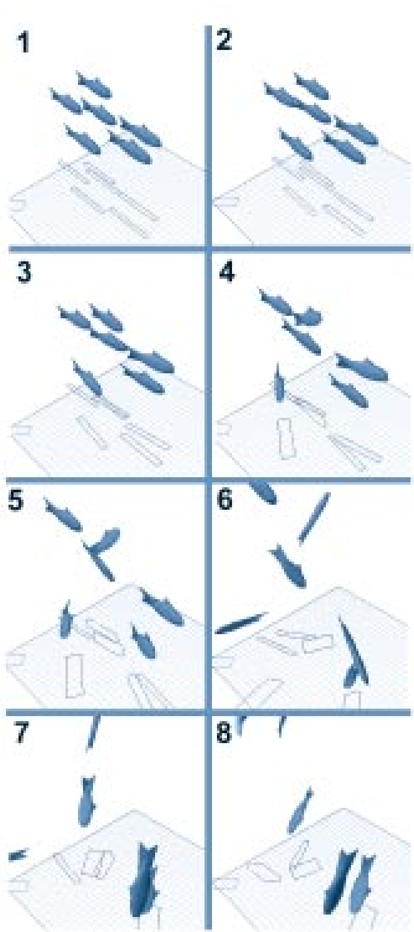
If you get an animation you're satisfied with, save it to a convenient location.

Moving On

The animations you created in this section are just the beginning. Try experimenting with different objects to create key frames or apply different tweener settings.

The Physically-based behaviors you added in this section are one example of the kinds of simulations you can create. These new behaviors open up a whole new world of possibilities in animation. Experimenting with different simulations can produce some astounding results. For a full descriptions of the Behaviors available in Ray Dream Studio, refer to "Behaviors" on page 314.

The next section of the tutorial will lead you through the process of animating objects by altering their shape.



When you play the animation, Ray Dream Studio plays the physically-based simulation.

Animating Shapes

In Ray Dream Studio there are several ways of animating objects. The previous section showed you how to animate objects by changing their position. You can also animate objects by altering their shape using either the **Free Form** or **Mesh Form** modelers or by applying a Deformer.

In this section you'll alter the shape of several objects across several key frames to produce moving objects.

The Story So Far

In this tutorial you've learned how to create, arrange, light and animate objects in a scene. Since you'll be using the object modelers and deformers to alter object shapes in this section it is essential that you understand the concepts involved in modeling objects. It would be a good idea to review the "Modeling Objects" on page 47 before beginning this section.

What You'll Need

This section of the tutorial deals with altering object shapes so you'll need some shapes to start with. If you've been following the tutorial, you can use the objects you created in the Modeling Objects section, or you can use the **Animating Shapes** folder in the **Browser** palette. This folder contains the models used as examples in this section.

To begin animating shapes:

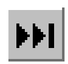
1. Make sure the **Browser** palette is visible. If it's not, choose **Windows menu▸ Browser**.
2. Click the **Objects** tab.
3. Choose **Browser palette: File menu▸ Add Directory/Folder**.
4. Locate the folder **Tutorial: Animating Shapes** and click **Select Current Directory**.

Lesson 1: Animating the Extrusion Path

You can animate the shape of a Free Form object by altering the shape of its sweep path in different key frames.

To animate an object using the sweep path:

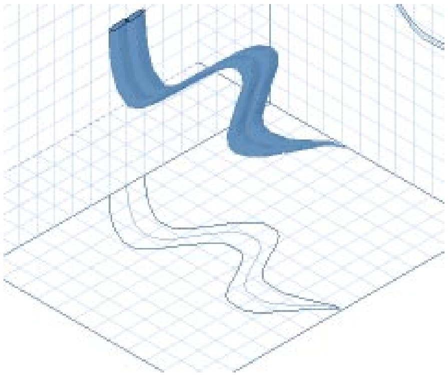
1. Drag the Seaweed object from the **Browser** palette into the **Perspective** window.
2. Click the **Last Frame** button.



Click the Last Frame button to jump to the last frame in your animation.

3. Double-click the seaweed in the **Perspective** window to open the **Free Form** modeler.

4. Select the **Zoom** tool and zoom in on the sweep path on the ground plane.

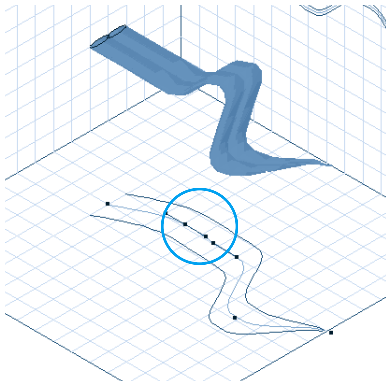


The sweep path looks like this at the beginning of your animation.

5. Choose the **Selection** tool.

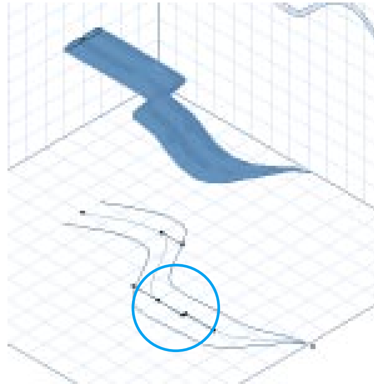
6. Click the second point on the sweep path and drag it to the right as shown.

Make sure that you're not selecting a point on the extrusion envelope (blue lines).



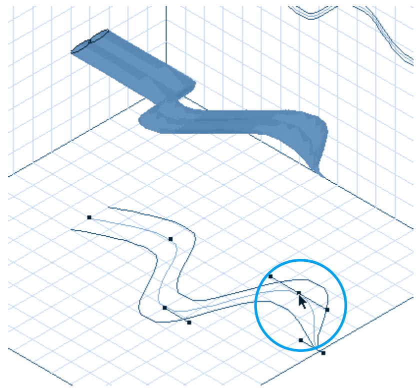
This is what you sweep path should look like after you reposition the second point.

7. Click the third point and drag it to the opposite side of the sweep path.



Your sweep path should look like this after you reposition the third point.

8. Click the fourth point and repeat step 7.

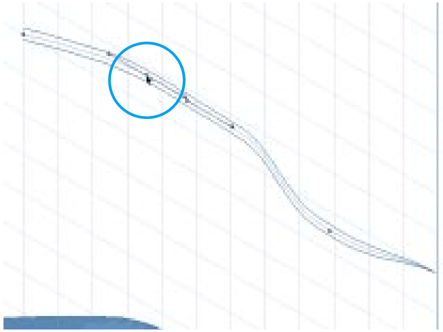


When you're done repositioning the fourth point, your sweep path should look like the one shown.

9. Choose **View menu▸ Preset Position▸ Left**.

10 Zoom in on the horizontal sweep path.

11 Click on the second point on the sweep path and drag it up.

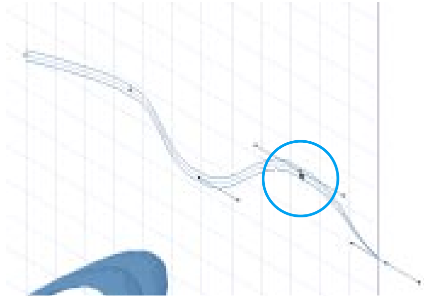


This is what you sweep path should look like after you reposition the second point.

12 Click the third point and drag it down.

Your sweep path should look like this after you reposition the third point.

13 Click the fourth point and drag it up.

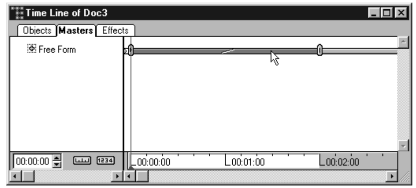


When you're done repositioning the fourth point, your sweep path should look like this.

When you play this animation the seaweed will appear to sway, but the motion will be somewhat stiff. To smooth out the motion, you can apply the **Oscillate** tweener.

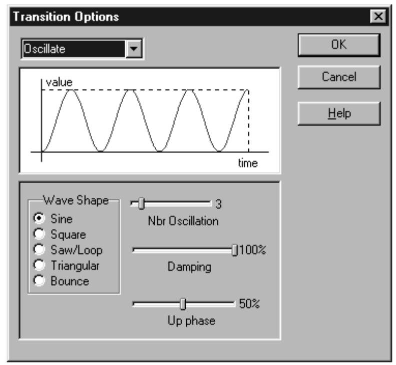
To apply the Oscillate tweener:

1 Double-click between the first and last frame of the **Seaweed** object in the **TimeLine** window. The **Transition Options** dialog appears.



Double-click the space between frames to display the Transition Options dialog.

2 Choose **Oscillate** from the **Tweener** pop-up.



The controls available in the Transition Options dialog change depending on the tweener you select.

3. Set the **Nbr Oscillation** slider to **2** and click **OK**.

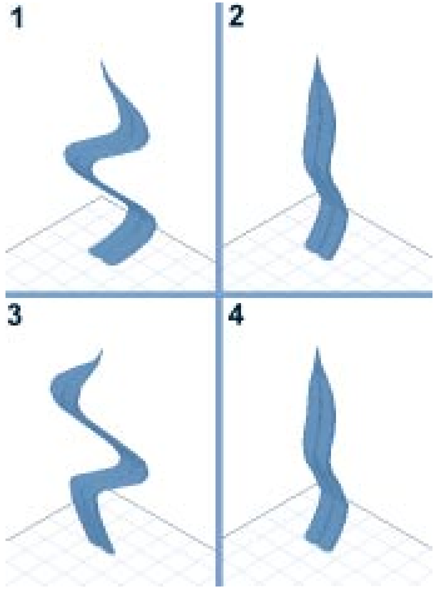
4. Click the **First Frame** button on the **Time Controller**.

Click the First Frame button to jump to the first frame in your animation.

If the **Time Controller** is not displayed, choose **View menu ▸ Toolbars** and then enable **Time Controller**.

5. Click **Play**.

The seaweed appears to sway in the current.



When you run your animation, the seaweed will appear to sway.

If you're satisfied with this animation, save it to a folder on your hard drive.

Lesson 2: Animating the Mesh Form Modeler

You can animate an object's shape in the **Mesh Form** modeler the same way you would in the **Free From** modeler, by altering the object's shape over several key frames.

To animate an object by repositioning its vertices:

1. Make sure the **Objects** tab is selected on the **Browser** palette, and drag the **Mesh Form Fish** from the **Browser** palette to the **Perspective** window.

2. Click the **First Frame** button. If the button is not available, you're already on the first frame.

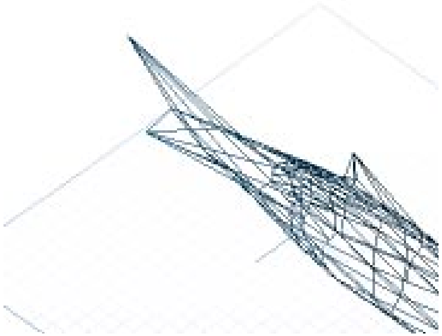
Click the First Frame button to jump to the first frame of your animation.

3. Double-click the fish to open the **Mesh Form** modeler.

4. Choose the **Zoom** tool.

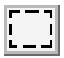
Use the Zoom tool to enlarge an area of your scene.

5 Zoom in on the fish's tail.



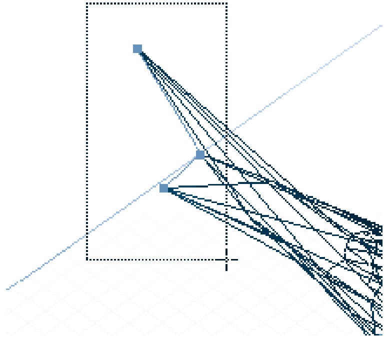
Use the Zoom tool to zoom in on the back end of the Mesh Form Fish's tail

6 Choose the **Marquee** tool.



Use the Marquee tool to select a group of vertices.

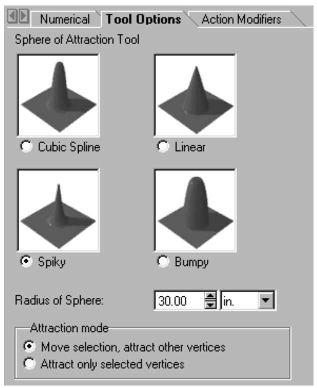
7 Select the rear of the tail.



Use the Marquee tool to select the points shown.

8 Choose the **Sphere of Attraction** tool.

9 Choose **Windows menu ▸ Properties** and then click the **Tool Options** tab in the **Properties** palette.

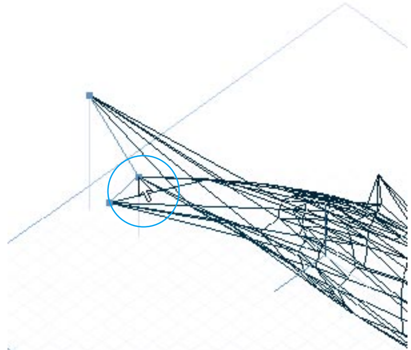


Use the Sphere of Attraction tool options to set the tool's size and shape attributes.

10 Enable **Spiky**.

11 Set the **Radius of Sphere** to **30**.

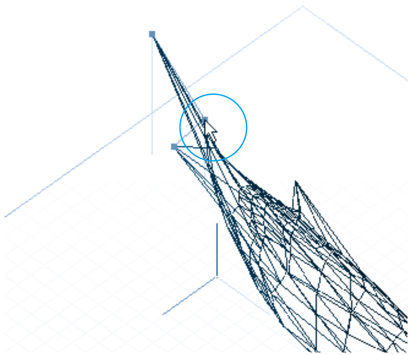
12 Click the center point of the three selected points and drag it to the left.



Select the center point in the tail and drag it to the left.

13 Click the **Last Frame** button.

14 Drag the center point to the right.



Select the same center point again and drag it to the right

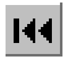
When you play this animation the tail of your fish will appear to swing from left to right. However, the movement will appear somewhat rigid. To smooth out the motion you can apply an **Oscillate** tweener.

15 In the **Time Line** window, double-click the time line between the first and last frames of the **Mesh Form Fish** and apply the **Oscillate** tweener.

For more detailed instructions on applying the **Oscillate** tweener, refer to "To apply the Oscillate tweener:" on page 84.

16 Click **Done**.

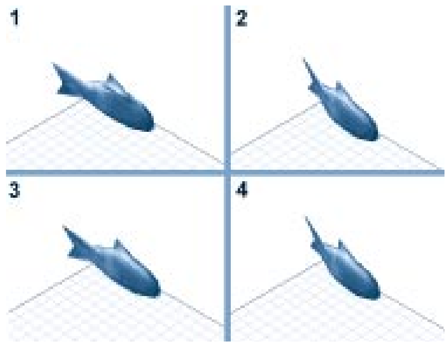
17 Click the **First Frame** button on the **Time Controller** and then click **Play**.



Click the First Frame button to jump to the first frame of your animation.

If the **Time Controller** is not displayed, choose **View menu▸ Toolbars** and then enable **Time Controller**.

Your fish now appears to swim. To create a school of fish, duplicate the **Mesh Form Fish** object.



When you run the animation, the fish's tail appears to move from left to right.

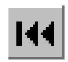
If you're happy with the animation as it is, save it to your hard drive.

Lesson 3: Animating Deformers

Deformers you applied to objects to alter their shape can also be animated. By adjusting the parameters of the **Deformer** in different key frames, you can have the objects appear to change over time. In this lesson you'll learn another way of making your fish swim--by animating the **Wave** deformer.

To animate a deformer:

1 Make sure you're on the first key frame of your animation. If you're not sure, click the **First Frame** button on the **Time Controller**.



Click the First Frame button to jump to the first frame of your animation.

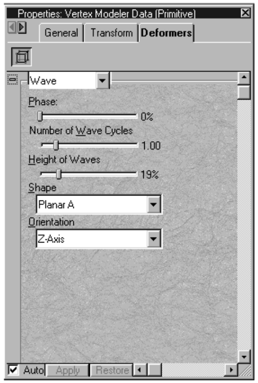
If the button is grayed out, you're already on the first frame.

2 Drag the **Mesh Form Fish** object from the **Browser** palette into the **Perspective** window.

3 Choose **Windows menu▸ Properties**. The **Properties** palette appears.

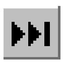
4 Click the **Deformer** tab.

The **Wave** deformer controls appear. If you want to learn how the **Wave** deformer was applied to the object refer to “Lesson 4: Deformers” on page 60.



Use the Wave deformer controls to control the phase and shape of the wave applied to your object.

5. Enable the **Auto** checkbox.
6. Make sure the **Phase** slider is set to **0%**
7. Click the **Last Frame** button. The current time indicator jumps to the last key frame.



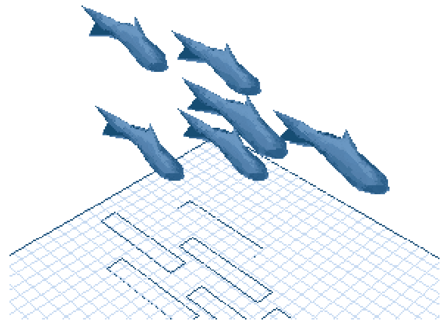
Click the Last Frame button to jump to the last frame of your animation.

8. Set the **Phase** slider to **100%**
9. Click the **First Frame** button and then click **Play** to preview you animation. Make sure the **Interactivity** button is enabled.

The little fish appear to swim. You can now duplicate the fish to create a school of swimming fish.

To duplicate the deformed fish:

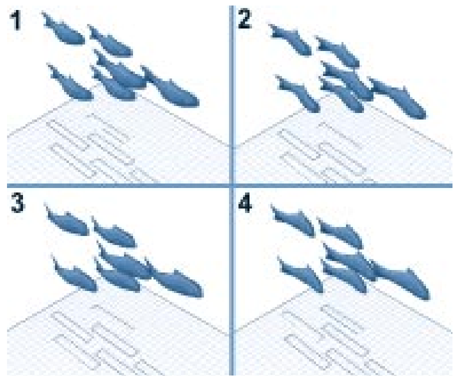
1. Click the **First Frame** button.
2. Click the **Mesh Form Fish** in the **Perspective** window.
3. Press **Command-D/Ctrl+D** to duplicate the fish.
4. Drag the **Mesh Form Fish** up and to the left.
5. Click the duplicate fish and press **Command-D/Ctrl+D** again.
6. Continue moving and duplicating fish until you have a good sized school.



When you duplicate the fish, each duplicate will have the Deformer applied to it.

7. Click the **First Frame** button and then click **Play** to preview your animation.

The school of fish appears to swim.



When you run the animation the fish appear to all be swimming in the same direction.

Moving On

The techniques you just learned can be combined with tweeners to fine tune the animation.

You may want to try these animation techniques with some of the more complex objects in the **Browser** palette. You'll quickly find out how easy it is to create some very complex effects by just adjusting a few parameters.

The techniques you learned in this tutorial are just a few of the ways you can use the modelers in animations. For more information, refer to "Free Form Modeler" on page 328 and "Mesh Form Modeler" on page 329.

The next section of the tutorial will show you how to add special effects to your animations.

Animating Effects

After you've created the main action of your animation you may feel that something is still missing. Perhaps your environment needs a little added realism, or do you want your object to change color? Using key frame animation, you can animate almost any object parameter to create subtle effects to enhance your animations.

In this section you'll learn how to add Rotoscoping to your animations and how to animate Shader settings.

The Story So Far

You've learned how to create, shade, light and animate objects. In this lesson you'll be animating Shaders and adding Rotoscoping to lights, so you should be familiar with shading and lighting concepts. You may want to review "Shading Objects" on page 62 and "Setting up Lights" on page 67, or refer to "Applying Shaders" on page 181 and "Setting Lights & Cameras" on page 269 for a detailed explanation of these concepts.

What You'll Need

To create the effects shown in this section, you'll need some lights and a shader. The file **ANI_EFF** has all the models and lights you'll ned to complete the lessons in this section.

To begin animating effects:

1. Locate the **Tutorial: Animating Effects** folder and open the file **ROTOSCOPING TUTORIAL**.
2. Choose **Browser palette: Shaders tab**.
3. Choose **Browser palette: File menu▸ Add Directory/Folder**.
4. Locate the folder **Tutorial: Animating Effects** and click **Select Current Directory**.

Lesson 1: Rotoscoping

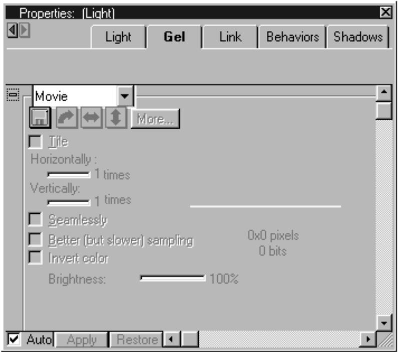
Rotoscoping lets you add a movie to your animation. You can use movies as animated textures on your objects or apply them to lights as gels.

To apply rotoscoping to a light:

1. Click the **Key Light** in the **Time Line** window to select it.
2. Click the **First Frame** button to move to the first key frame in your animation.
3. If necessary choose **Windows menu▸ Properties** to display the light's properties.
4. Click the **Gel** tab.

5. Enable the **Auto** button.

6. Choose **Movie** from the **Gels** pop-up.



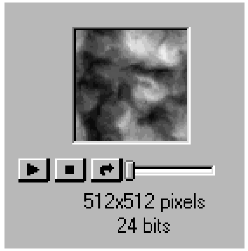
Use the Movie controls in Properties palette to load a movie as a gel.

7. Click the disk icon.

8. Use the dialog to locate the file **Tutorial:Animation:Effects:H20.MOV** or **H20.AVI** and click **Open**.

   When you add the movie, Ray Dream Studio automatically creates a key frame at the end point of the movie's. Since the movie is only 1.46 seconds long, a new key frame appears at 1.46 in the time line.

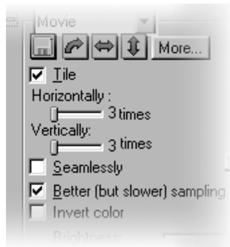
9. In the **Time Line** window drag the key frame indicator from **00:01:46** to **00:02:00**.



You can use the Movie controls to play the movie you loaded.

10. In the Properties palette, enable **Tile**.

11. Move the **Horizontal** slider to **3 times**.



Use the Tile Controls to tile the movie 3 times.

To view the rotoscoping effect you need to preview the rendered animation.

To preview a rendered animation:

Choose **Render menu▸ Best Animation Preview**.

Your scene now has a realistic underwater look to it.

When you render your animation in Best Animation Preview you'll be able to see the effects of the movie as a gel.

Lesson 2: Animating Shaders

By adjusting shader parameters, you can animate a change in color, or texture on the surface of objects.

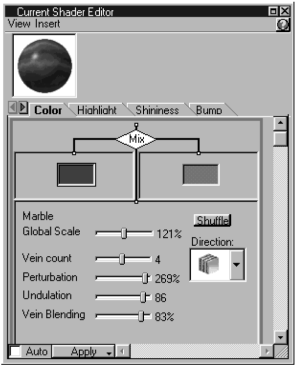
To animate a shader:

1. Click the **First Frame** button to move to the beginning of your animation.

2. Drag the **Shaded Fish** from the **Browser** palette to the **Perspective** window.

3. Choose the **Eyedropper** tool.

4. Click the Shaded Fish in the **Perspective** window. The **Current Shader Editor** appears.



When you click the fish with the Eyedropper tool, its shader appears in the Current Shader Editor.

5. Click the **Last Frame** button to move to the end of your animation.

6. In the **Current Shader Editor**, double-click the left color chip.

7. Click the **Color palette** button.

Click the Color palette button to display your system's color picker.

8. Select a green color, then click **OK**.

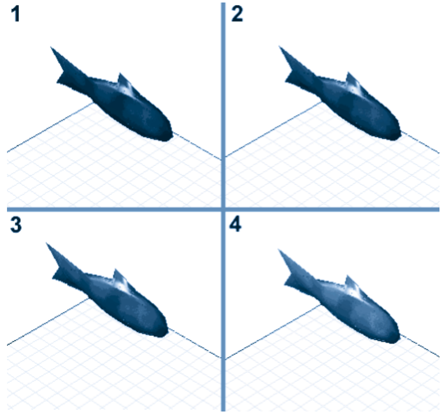
9. Double-click the right color chip, then click the **Color palette** button.

10. Choose a light gray color, then click **OK**.

11. Click **Apply**.

12. Choose **Render menu▸ Best Animation Preview**. to create a preview of your animation.

The school of fish will appear to change from silvery red to silvery green.



When you play the preview of your animation you can see the shader change color over time.

Moving On

The animation effects you learned in this section are only two of the many types of effects you can add to your animation. By changing the properties of objects across different key frames you can create a wide variety of effects. For example, you could adjust an object's size across key frames and the object would appear to grow. For more details on creating animation effects, refer to Chapter 15, "Animating."

The next section of the tutorial will show you the fundamentals of rendering your scenes and animations.

Rendering

Rendering is the process of creating a two-dimensional image or movie from a three-dimensional scene. The settings you choose for your rendering can have a large impact on the final appearance of your image. Ray Dream Studio offers you several different types of renders that you can use to achieve different effects. For detailed information on the different types of renderers available, refer to "Renderers" on page 342.

The lessons in this section will teach you how to set up a rendering session for an image and for an animation.

The Story so Far

The previous sections have shown you how to create and arrange objects, how to set up lights and camera, how to animate objects and now finally you will learn how to turn your scene into an image or an animation. Before you begin this section you should understand how to set up a scene using the arranging features as well as understanding how to set up cameras and the production frame. You may want to review "Setting up Cameras" on page 72 or "Setting Lights & Cameras" on page 269.

What You'll Need

The materials you need for this section depend on how you've been using this tutorial. If you have been following the tutorial from the beginning, you'll need the scene you arranged in "Arranging Objects in the Scene" on page 39, the lighting setup from "Setting up Lights" on page 67, and the camera setup from "Setting up Cameras" on page 72.

If you've skipped ahead to this section you can complete the lessons using the preset files provided.

To open preset files for the rendering lessons:

1. Locate the folder **Tutorial: Rendering** and open the file **RENDERING TUTORIAL**.
2. Choose **Browser palette: Cameras tab** and add the folder **Tutorial: Setting Up Cameras**.
3. Choose **Browser palette: Lights tab** and add the folder **Tutorial: Setting Up Lights**.
4. Drag the objects **Camera Tutor** and **Light Tutor** from the **Browser** to the **Perspective** window.

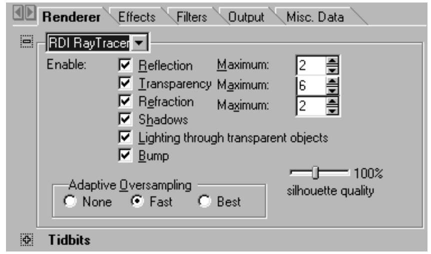
Lesson 1: Rendering an Image

The first thing you need to do to set up a rendering is to choose a renderer. A renderer converts your scene into a bitmap or movie.

In this lesson you'll be using the RDI Ray Tracer since it's one of the renderers that handle reflections and refractions.

To choose a renderer:

1. Choose **Render menu ▸ Current Scene Settings**. The **Scene Settings** palette appears.



Use the Render Settings dialog to choose a renderer and set its attributes.

2. Click the **Renderer** tab.
3. Choose **RDI Ray Tracer** from the pop-up.
4. Make sure that all the rendering options are enabled.

   If you want to speed up the rendering, disable the options you won't be using in your scene. For example, since there are no transparent objects in your scene, you can disable the **Light through transparency** option.

After you've selected a renderer, you need to set the atmosphere for your scene.

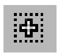
To set the atmosphere:

1. Choose **Scene Settings palette: Effects tab**.

2. Choose **Distance Fog** from the **Atmosphere** pop-up.

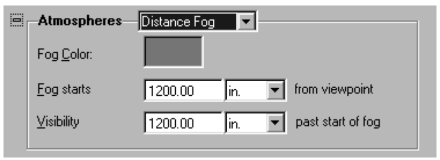
   Distance Fog makes objects appear to fade the further they move away from the camera.

3. Click the **plus/arrow** icon next to the **Atmosphere** title to display its controls.



Use the Plus icon to display more controls.

The **Distance Fog** controls appear.



The Distance Fog controls let you set the color and range of the fog.

4. Double-click the **Fog Color** chip.

5. Choose a light blue color and then click **OK**.

6. Enter **Fog starts= 120**

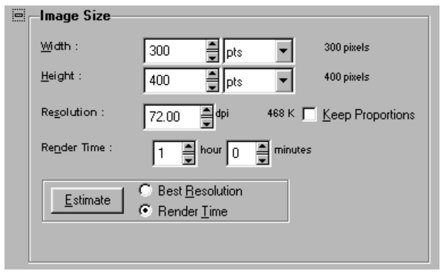
7. Enter **Visibility = 300**

The **Distance Fog** will add realistic depth to your image. If you want to add a more detailed realism, you can add a background to the scene. Now that your scene has an environment, you can set the output file options.

To set Output options:

1. Choose **Scene Settings palette: Output File tab**.

2. Click the **plus/arrow** icon next to **Image Size**. The **Image size** options appear.



Use the Image Size options to set the height, width and resolution of your rendered image.

3. Set **Width=300** and **Height=400**.

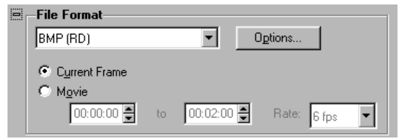
4. Set the **Resolution** to 72 dpi.

5. Click the **plus/arrow** icon next to **Camera**. The **Camera** options appear.

Use the Camera options to select a camera to use for your rendering.

6. Choose **Render Camera** from the **Rendering Camera** pop-up.

7. Click the **File Format plus/arrow** icon. The **Format** options appear.



Use the File Format options to set the output format for your rendered image.

8. Choose **BMP (RD)** from the pop-up.

9. Click the **Save** button to save your rendering setup.

Your rendering setup is now complete. Now you can use these saved settings to render your scene.

To start a rendering:

Choose **Render menu▸ Use Current Settings**.

Ray Dream Studio starts rendering your image. Depending on the complexity of your image, rendering can be a time consuming process, so it's a good idea to only render when you're happy with your scene.

The rendering options you just set can be used in any number of rendering sessions. So you can adjust the cameras and lights in your scene and then render multiple views of your scene using the same settings.

Lesson 2: Rendering an Animation

The only difference between rendering a movie and an image is the file output type. Instead of selecting an image format as the output format, you select an animation format.

To render a movie:

1. Choose **Render menu▸ Current Scene Settings**.

2. Click the **Renderer** tab and choose a renderer from the pop-up.

   If you're creating a preview of your animation, choose **Draft Z-Buffer**, otherwise choose **RDI Raytracer**.

3. Click the **Effects** tab.

4. Choose **Distance Fog** from the **Atmosphere** pop-up.

5. Expand the **Atmosphere** controls by clicking the plus/arrow icon.

6. Click the **Fog Color** chip and choose a blue color.

7. Enter **Fog starts**=**300**, **Visibility**=**200**.

8. Click the **Output** tab.

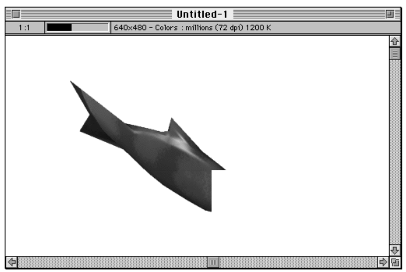
9. Choose **QuickTime**/**AVI** from the pop-up.

10. Set the frame rate to 6fps (frames per second).

    Leave the time limits as they are. By default the time limits in the **Scene Settings** palette are the same as those shown in the **Time Line** window.

11. Click **Save** to save your settings.

12. Choose **Render menu▸ Use Current Settings**. The rendering preview window appears.



Ray Dream Studio displays a preview window as it renders your animation.

When the rendering is complete you can save the file for use in other applications.

Moving On

The rendering settings you choose can have a large affect on the final artwork you produce. You should make sure that you're using the best settings for your scene. If you find that the rendering is taking too long you or you run out of memory you may want to reduce the complexity of your image. One area you should watch out for is reflection and refraction. These effects take a long time to render and require a great deal of memory. If you're having memory problems you may want to use this effect sparingly.

For complete descriptions of how to choose the right renderer for your image, refer to Chapter 17, "Rendering."

Wrapping Up

Now that you've completed the tutorial you may be asking yourself where do I go from here? Well the best way to learn Ray Dream Studio is to experiment. The techniques outlined in this tutorial are only the beginning. You can apply the skills you've learned to any project you have in mind.

If you want to learn more about modeling, open some of the models in the **Browser** palette and see how they were made. Even in the most complex models you'll be able to see the basic techniques described in this tutorial. Another great modeling resource is the **Modeling Wizard**. The **Modeling Wizard** is a picture-based assistant that guides you through the process of creating many types of objects, teaching you valuable modeling principles along the way. For instructions on accessing the Modeling Wizard, refer to "Free Form Modeling" on page 109.

If you want to learn more about arranging scenes, try using the **Scene Wizard**. This wizard leads you through the process of setting up lights and backgrounds. Refer to "Using the Scene Wizard" on page 27.

Some of the files you created in this tutorial can be the basis for your own 3D illustration cookbook. The shader you created can be the start of your own Shader library. The Shell shader can be applied to other underwater creatures such as snails and hermit crabs. Trying saving the shader in a personal shader folder and then add more shaders as you create other objects.

The lighting setup you created can be used to light almost any scene effectively. It's a great starting point for even the most complex lighting setups. The cameras you set up can also be used in other scenes.

You're now ready to explore Ray Dream Studio in more detail. The remaining chapters in this User Guide will explain in detail all the features and functions of Ray Dream Studio 5. Remember, you can use this tutorial as a reference source. If you want to brush up on a certain aspect of Ray Dream Studio, jump into the tutorial lesson that deals with the topics you want to review.

6

Creating Objects

Modeling vs. Primitives

There are two ways of creating objects in Ray Dream Studio. You can create objects by combining a number of basic 3D shapes, called *primitives*, or you can model unique shapes using the Ray Dream Studio's *Free Form* and *Mesh Form* modelers. The method you use will depend on the type of object you want to create.

The first thing you need to do when creating an object, is decide how you're going to build it in 3D space. The easiest way of doing this is to break the object down to it's basic components. If those components turn out to be all geometric shapes, you use primitives to create it. If the object's basic components are shapes that can't be created using primitives, you use the modelers.

For example, when a sub is reduced to basic components, you can see that it's made up of cylinders, cones and cubes. Therefore you would use 3D primitives to create the object.

A complex object...

...and the primitives used to make it.

Following the same example, if you reduce a jellyfish to its basic components you'll end up with objects that are not geometric shapes. In this case you'd have to use a modeler to create this object.

A complex object...

...and the shapes used to make it.

This chapter covers the different types of primitives you can create using Ray Dream Studio, as well as introducing the **Text** and **Formula** modelers. The **Free Form** modeler is covered in "Free Form Modeling" on page 109. The **Mesh Form** modeler is covered in "Mesh Form Modeling" on page 137.

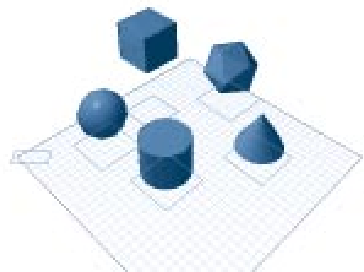
What are 3D Primitives?

Primitives are the most basic type of 3D object you can create in Ray Dream Studio.

There are two types of 3D primitives: *Geometric* and *Environmental*. Geometric primitives are 3D geometric shapes such as cones, squares or cylinders. Environmental Primitives are primitive volumetric objects like clouds or fire.

Creating Geometric Primitives

Geometric Primitive objects are the building blocks of 3D objects. When you closely examine any complex 3D object you'll notice that it can be reduced to simple primitive geometric shapes. In fact, the easiest way of creating an object is by combining a number of primitives.



Examples of geometric primitives.

When you create a Geometric Primitive object, it simply appears in your scene where you can move and resize it as necessary. Each type of object you can create has its own tool. The **Geometric Primitive** tools are located on a single pop-up tool.

All the Geometric Primitive tools can be accessed from a single pop-up.

To create a Geometric Primitive object:

1. Choose a Geometric Primitive tool from the toolbar.
2. In the **Perspective** window, click a point in the Working Box to create an object of default size, or drag to create an object of a custom size.

   or

   Drag an object creation tool from the toolbar into the **Time Line** window to create an object of default size.

Objects dropped into the **Perspective** window are placed on the active plane of the Working Box, at the point where you release the mouse. Objects dropped into the **Time Line window** are placed at the center of the Universe.

or

Choose **Insert menu▸** type of object.

The object is created at a default size and placed in the center of the Universe.

Creating Environmental Primitives

Like Geometric Primitives, Environmental Primitives can be the building blocks of scenes. They can be used to quickly add an environment to any scene.

The **Cloud**, **Fog** and **Fire** primitives are volumetric. They behave slightly differently than other Ray Dream Studio objects when you change the size of the object. With other objects, changing the size causes the object itself to change scale. Changing the size of a volumetric object changes the size of the container of the object but the contents stay at the same scale. For example, a small cloud made larger results in a larger area of cloud, but the swirls within the cloud stay the same size. A fire object made taller results in higher flames. Making the fire object wider results in a larger area of fire based on the parameters you have set.

Note: You must use either the Adaptive or Ray Tracer renderer to render **Cloud**, **Fire** and **Fog** primitives.

Each Environmental Primitive has its own tool which are located on a pop-up tool.

All the Environmental Primitive tools can be accessed from the same pop-up.

Fountain Primitive

The **Fountain** primitive is a particle primitive you can use to create objects like geysers or tornadoes. The **Fountain**'s attributes let you change the density of its particles and rate of animation.

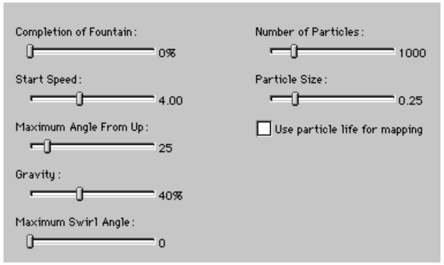
To create a Fountain object:

1. Choose the **Fountain** tool and drag it into the **Perspective** or **Hierarchy** window.

   or

   Choose **Edit menu▸ Insert▸ Fountain**.

2. Double-click the new object. The **Fountain** primitive controls appear.



Use the Fountain primitive controls to set fog attributes.

3. Adjust the value of the **Completion of Fountain** slider.

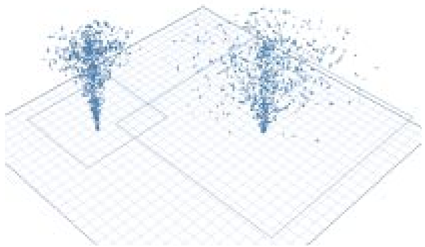
   This slider controls the fountain's animation. Set the slider to 0% at the beginning of the animation and 100% at the end.

4. Adjust the value of the **Start Speed** slider.

   This slider controls the force of the fountain. A low setting creates a fast spouting fountain while a high setting creates a slow spouting fountain.

5. Adjust the value of the **Maximum Angle From Up** slider.

   This slider controls the angle of the spray from the fountain. When the slider is set to 0 degrees the spray goes straight up, at 180 degrees it goes out in a radius all the way around the fountain.



The example above illustrates the Maximum Angle From Up control set at 0 and 180.

6. Adjust the value of the **Gravity** slider.

   This slider controls the amount of gravity applied to the fountain. When the setting is low, gravity has little effect on the fountain. When the setting is high, gravity pulls the particles down quickly.

7. Adjust the value of the **Maximum Swirl Angle** slider.

   This slider controls how much the particles rotate parallel to the ground plane as they fall. A low setting causes very little rotation while a high setting causes a particle to rotate a great distance as it falls.

8. Adjust the value of the **Number of Particles** slider.

   This slider controls the number of particles in your fountain.

9. Adjust the value of the **Particle Size** slider.

   This slider controls the size of the particles in your fountain.

10. Enable or disable the **Use particle life for mapping** check box.

    This setting determines how the shader is mapped to the fountain primitive. When it's enabled, the shader is mapped over the entire fountain, with the particles near the bottom of the fountain appearing different from those nearer the top (depending on the shader content).

    When its disabled, all the particles are mapped individually, so they all appear identical.

Cloud Primitive

The **Cloud** primitive creates a three dimensional, or volumetric, cloud. You can use this primitive to quickly add a sky to any scene.

There is no on-screen preview of the cloud except its bounding box that indicates the cloud's size and location. You won't be able to see the cloud until it's rendered.

You can place objects inside the cloud or partially within the cloud. Cloud attributes can also be animated.

Note: Changing the size of the cloud by dragging a larger or smaller bounding box does not change the scale of the clouds. It only changes the area that is covered with clouds.

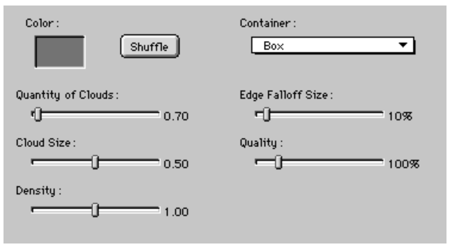
To create a Cloud object:

1. Choose the **Cloud** tool and drag it into the **Perspective** or **Hierarchy** window.

   or

   Choose **Edit menu▸ Insert▸ Cloud**.

2. Double-click the new object. The **Cloud** primitive controls appear.



Use the Cloud primitive controls to set cloud attributes.

3. Click the **Color** color chip and choose a color for the cloud.

4. Adjust the value of the **Quantity of Clouds** slider.

   This slider controls the number of clouds that are included in the bounding box.

5. Adjust the value of the **Cloud Size** slider.

   This slider controls the size of clouds that are included in the bounding box.

6. Adjust the value of the **Density** slider.

   This slider controls the density of clouds.A low setting creates almost transparent clouds while a high setting creates almost opaque clouds.

7. Adjust the value of the **Density** slider.

   This slider controls the quality of the clouds as they are rendered. The higher the Quality, the longer the render time.

8. Click the **Container** pop-up and choose a container for your cloud.

   The container determines the general shape of the cloud

The cloud primitive in Box and Sphere containers.

9. Adjust the value of the **Edge Falloff Size** slider.

   This slider controls the appearance of the edges of the clouds. A low setting results in a sudden change or little falloff while a high setting results in gradual change or longer falloff.

Use the **Shuffle** button to shuffle between different cloud patterns with the same attributes.

Fog Primitive

The **Fog** primitive creates a three dimensional, or volumetric fog. The **Fog** primitive is best for creating distinct local areas of fog, while the fog available through the **Atmosphere** controls in the **Scene Settings** dialog are best for applying fog to the whole image.

There is no on-screen preview of the fog except its bounding box that indicates the fog's size and location. You won't be able to see the fog until it's rendered.

You can place objects inside the fog or partially within the fog. You'll probably want your fog object to be fairly large so you can place a portion of your scene inside it. Fog attributes can also be animated.

Note: Changing the size of the fog by dragging a larger or smaller bounding box does not change its scale. It only changes the area that it covers.

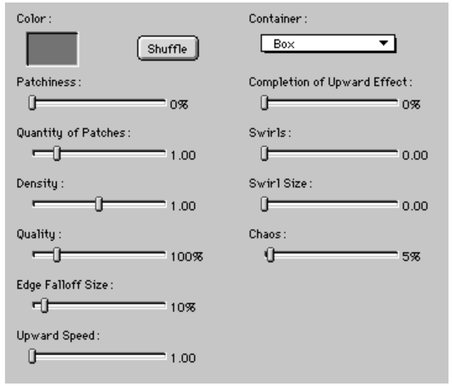
To create a Fog object:

1. Choose the **Fog** tool and drag it into the **Perspective** or **Hierarchy** window.

   or

   Choose **Edit menu▸ Insert▸ Fog**.

2. Double-click the new object. The **Fog** primitive controls appear.



Use the Fog primitive controls to create fog.

3. Click the **Color** color chip and choose a color for the fog.

4. Adjust the value of the **Patchiness** slider.

   This slider controls the regularity of the fog throughout the bounding box. A low setting creates a blanket of fog. A high setting creates patches of fog.

5. Adjust the value of the **Quantity of Patches** slider.

   This slider controls how many patches of fog are contained in the bounding box.

6. Adjust the value of the **Density** slider.

   The **Density** slider controls the amount of light that penetrates the fog.

7. Adjust the value of the **Quality** slider.

   This slider controls the quality of the fog as it is rendered.

8. Adjust the value of the **Edge Falloff Size** slider.

   This slider controls the appearance of the edges of the fog. A low setting results in a sudden change or little falloff while a high setting results in gradual change or longer falloff.

9. Adjust the value of the **Upward Speed** slider.

   The **Upward Speed** slider controls the rate at which the fog rises during an animation. Use a higher setting for longer animations.

10. Click the **Container** pop-up and choose a container for your fog.

    The container determines the general shape of the fog

11. Adjust the value of the **Completion of Upward Effect** slider.

The **Completion of Upward Effect** slider controls the animation of the fog. Set this value to 0% at the start of your animation and 100% at the end.

12. Adjust the value of the **Swirls** slider.

    This slider controls how the fog swirls or rotates as it rises.

13. Adjust the value of the **Swirl Size** slider.

    The **Swirl Size** slider controls the size of the swirls.

14. Adjust the value of the **Chaos** slider.

    This slider controls the uniformity of the fog. A low setting creates uniform fog while a high settings create random fog.

Use the Chaos slider to control the uniformity of the fog. This example uses the low (left) and high (right) settings.

Use the **Shuffle** button to shuffle between different fog patterns with the same attributes.

Fire Primitive

The **Fire** primitive creates a three dimensional or volumetric fire. You use this primitive to set your scene on fire.

There is no on screen preview of the fire except its bounding box that indicates the fire's size and location. You won't be able to see the fire until it's rendered.

You can place objects inside the fire or partially within it. Fire attributes can also be animated.

Note: Changing the size of the fire by dragging a larger or smaller bounding box does not change its scale. It only changes the area that it covers.

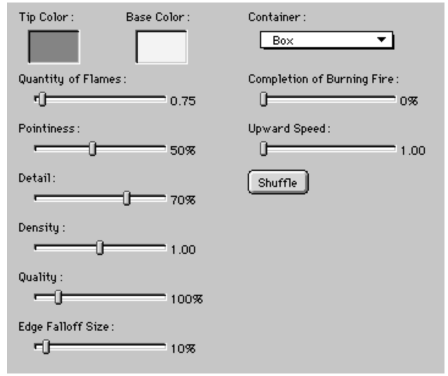
To create a Fire object:

1. Choose the **Fire** tool and drag it into the **Perspective** or **Hierarchy** window.

   or

   Choose **Edit menu▸ Insert▸ Fire**.

2. Double-click the new object. The **Fire** primitive controls appear.



Use the Fire primitive controls to create a 3D or volumetric fire.

3. Click the **Tip Color** color chip and choose a color for the tips of the flame.

4. Click the **Base Color** color chip and choose a color for the base of the flame.

5. Adjust the value of the **Quantity of Flames** slider.

   This slider controls the quantity of flames that appear in your **Fire** object.

6. Adjust the value of the **Pointiness of Flames** slider.

   The **Pointiness** slider controls the percentage of your Fire primitive that is points or tips of flames. A low setting results in fewer, less tapered points while a high setting results in many more tapered points.

7. Adjust the value of the **Detail** slider.

   This slider controls the degree of detail in the Fire primitive.

8. Adjust the value of the **Density** slider.

   This slider controls the density of the fire. A low setting creates fire that is almost transparent. A high setting creates fire that is almost opaque.

9. Adjust the value of the **Quality** slider.

   This slider controls the detail of the fire as it is rendered.

10. Adjust the value of the **Edge Falloff Size** slider.

    This slider controls the appearance of the edges of the fire. A low setting results in a sudden change or little fall off. A high setting results in gradual change or longer fall-off

11. Click the **Container** pop-up and choose a container shape for your fire.

    The container determines the general shape of the fire.

The container determines the shape of the fire. This example uses the Box and Sphere containers.

12. Adjust the value of the **Completion of Burning Fire** slider.

    This slider controls the animation of your fire. Set this slider to 0% at the start of your animation, and at 100% at the end.

13. Adjust the value of the **Upward Speed** slider.

    The **Upward Speed** slider controls the speed at which the flames appear to shoot up during an animation.

Creating Infinite Planes

An Infinite Plane is a flat primitive whose sides extend out to infinity in all directions. This type of primitive is used to create a surface for your scene such as a sky, ocean or ground.

To create an Infinite Plane:

Click the **Infinite Plane** tool and drag it into the **Time Line** or **Perspective** windows.

Use the Infinite Plane tool to create an Infinite plane.

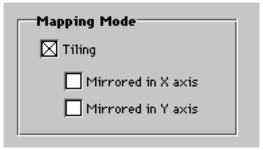
Although the plane appears finite in the **Perspective** window, it will extend out to infinity in the final rendering.

Shading an Infinite Plane

Apply shaders to an Infinite plane can be tricky since the texture or color you apply will extend out to infinity. This can be a especially tricky when using texture maps or gradients. The plane’s tiling controls can help you adjust how shaders are tiled on the plane.

To adjust shader tiling:

1. Double-click the Infinite Plane.



Use the Infinite plane tiling controls to set the attributes for tiling a shader across the plane.

2. Enable the **Tiling** option if you want your shader to be tiled across the plane.

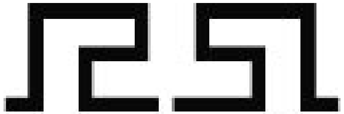
   If you don't enable tiling, the shader will be stretched to cover the entire surface of the plane.

3. Enable either the **Mirrored in X axis** or **Mirrored in Y axis** option.

   These options let you control the continuity of the pattern created by tiling the shader.

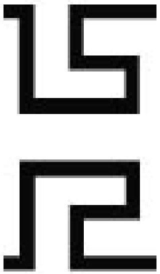
   The X and Y refer to the plane's own coordinate system, not the global coordinate system.

Mirrored in X axis mirrors the tile in the X axis as it tiles it across the plane.



Tile mirrored in X the axis.

Mirrored in Y axis mirrors the tile in the Y axis as it tiles it across the plane.



Tile mirrored in the Y axis.

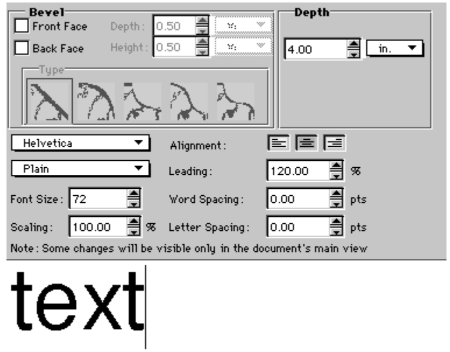
You can adjust the size of tiles by adjusting the size of the plane.

Creating Text Objects

When you create a **Text** object, Ray Dream Studio immediately opens it in the **Text Modeling** dialog, allowing you to enter the text you want, specify its depth, and add bevels.

To create Text objects:

1. Choose the **Text** tool and then drag in the **Perspective** window. The **Text Modeling** dialog appears.



Use the Text Modeling dialog to create text.

2. In the region at the bottom of the dialog (where it says "text..." in the figure above), type the text you want.

3. Choose a font from the font pop-up.

Any TrueType and Type 1 fonts you have in your system are available for creating **Text** objects.

4. Choose a font style from the style pop-up.

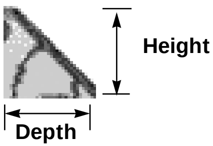
5. Enter a value in the **Font Size** entry box. Font size is measured in points. You can also use the scroll arrows to set a value.

6. Use the **Depth** controls to set the width of the text.

7. Enable the **Front Face** checkbox to add a bevel on the front face of the text object.

8. Enable the **Back Face** check box to add a bevel to the back of the **Text** object.

9. Enter values in the **Depth** and **Height** fields to specify the slope or contour of the bevel on the text.



The Depth and Height settings control the contour of the bevel on the back of your text object.

10. Click on a bevel type in the **Type** controls at the top of the dialog.

11. Click **Done**. You can also choose **Edit menu▸ Jump Out**.

    The **Text** dialog changes back to the **Perspective** window, and your text object is drawn.

To edit a Text object:

Double-click a **Text** object in the **Perspective** or **Hierarchy** window, or select a **Text** object and choose **Edit menu▸ Jump In**.

Ray Dream Studio opens the **Text** object in the **Text Modeling** dialog, where you can change its content, extrusion depth, bevels, or any of the type specifications.

The Size of Text Objects in the Universe

The size of a text object in the Universe depends on the font size you choose in the **Text Modeling** dialog. You can determine how large a **Text** object will be by multiplying its font size by 0.333. This calculation gives you the approximate height (in inches) of a capital letter; lowercase letters are proportionally smaller, of course.

For example, if you created a **Text** object using 72-point type in the **Text Modeling** window, any capital letters in the text object would be approximately 23 inches tall in the Universe. Knowing the height of the letters in your object, you can set a value in the **Extrusion Depth** field to control the relationship between height and depth.

Creating Formula Objects

Formula objects are 3D objects you create using mathematical equations. The Formula Editor lets you enter parameters, variables and operators to create unique objects.

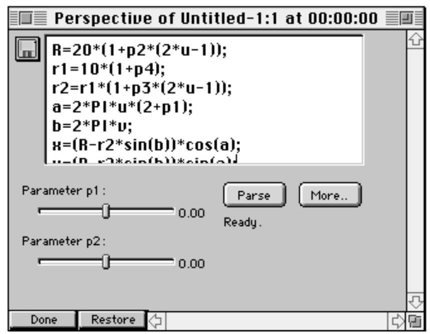
To create a Formula object:

1. Click the **Formula** tool and drag it into either the **Perspective** or **Time Line** windows.

.

Drag the Formula tool into the Perspective window to open the Formula controls

2. Double-click the object. The **Formula** controls appear.



Use the Formula controls to create unique objects.

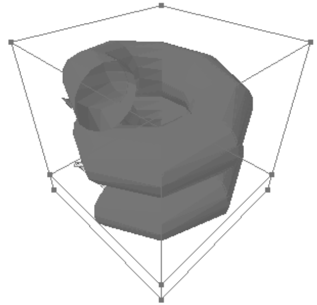
3. Enter a formula into the editor.

- You can load a formula by clicking the **Load** button.
- You can use the parameter sliders to increase/decrease the value of parameters.
- Click **More** to display the **Formula Editor**.

The Formula Editor lets you see more of the parameter sliders and has controls for adding parameters and functions.

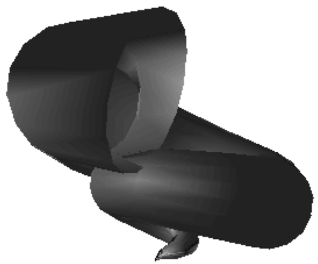
Creating objects using formulas is a highly technical endeavor. To find out more about creating Formula objects, refer to the Using Formulas in Ray Dream PDF on the CD-ROM.

4 When you're finished editing the formula, click **Done**.



When you're done creating your formula, Ray Dream creates an object and places it in the Perspective window.

When your formula object is finished you can edit it by adjusting the values of its parameters.



You can change the shape of your formula object by adjusting the values of its parameters.

Creating Objects Using the Modeling Wizard

The Modeling Wizard is a picture-based assistant that guides you through the basic steps of creating an object. After a few sessions with the Wizard you'll better understand the concepts of **Free Form** modeling.

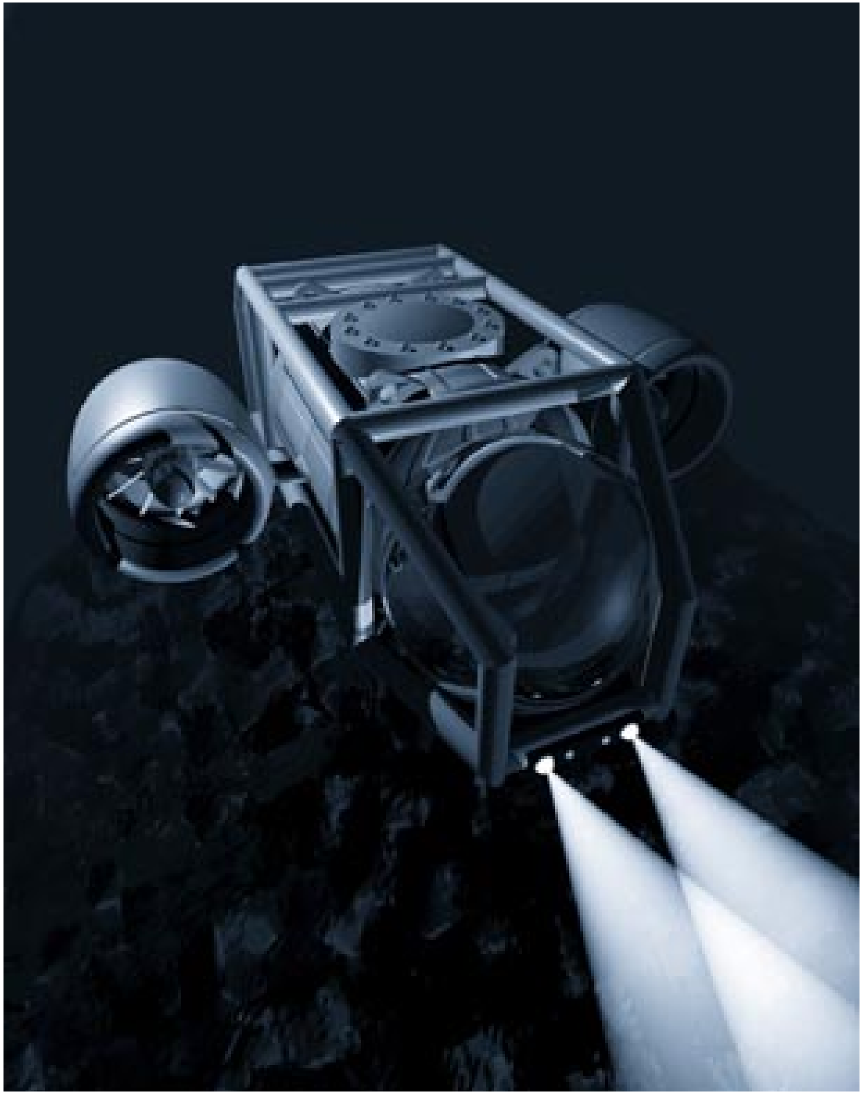
Note: The Modeling Wizard only creates **Free Form** objects.

To create an object using the Modeling Wizard:

1 Drag the **Modeling Wizard** tool into the **Perspective** or **Time Line** window.

The Modeling Wizard appears.

2 Follow the instructions provided.



7

Free Form Modeling

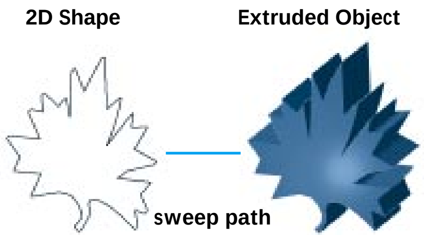
Free Form Modeling

The **Free Form** modeler lets you create by converting 2D shapes into 3D objects. The modeler tools let you draw 2D shapes called *cross sections* and then convert them to 3D object by extruding them. Once you've created a 3D object, you can refine its shape using an extrusion envelope.

This chapter covers the concepts involved in Free Form modeling and describes how to use the **Free Form** modeler.

Free Form Modeling Concepts

The **Free Form** modeler is based on a concept called extrusion. You create an object by drawing a 2D shape, then drawing a sweep path perpendicular to the shape. Ray Dream Studio sweeps the shape along the path to form a 3D object.

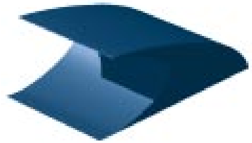


A 3D object is created by extruding a 2D shape along a sweep path.

Straight Extrusion

Straight extrusion is the most basic type of Free Form modeling. In a straight extrusion, a 2D shape is swept along a straight sweep path, creating a sort of "cookie cutter" effect.

The 2D shape doesn't have to be a single outline—it can consist of several distinct outlines. You can even extrude a compound path to create an object with a hole in it. For more on extrusions, refer to "Cross Sections and the sweep path" on page 131.



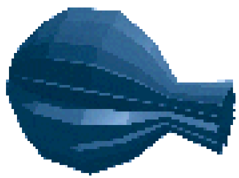
Object created using straight extrusion.

Scaling

Scaling creates objects by changing the scale of the 2D shape as it's extruded along the sweep path.

More complex objects can be created by using different sized cross sections.

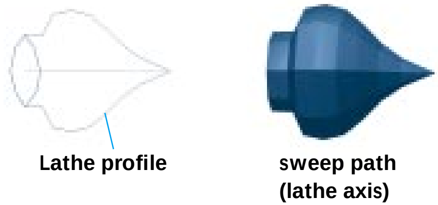
Simply changing the scale of a shape produces very basic shapes, but when combined with an extrusion or scaling envelope, you can create a much wider variety of objects. For more on scaling, refer to "Understanding the Envelope" on page 132.



The same scale object can be modeled further by using an extrusion envelope.

Lathing

You can model many symmetrical objects using a technique called lathing. Lathed objects are created by extruding the lathe profile around a sweep path. You can think of the lathe profile as the outline of the object when it's cut in half. For more on lathing, refer to "Lathing with the Extrusion Envelope" on page 135.

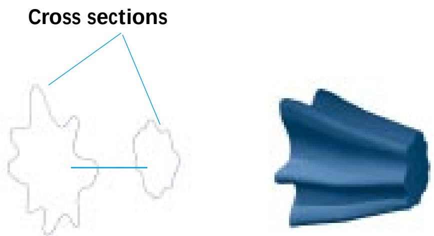


Lathed objects are created by extruding a lathe profile around a sweep path.

The more complex the lathe profile, the more complex the object.

Cross Sections

Cross sections are 2D shapes the act as the skeleton of your object. The **Free Form** modeler extrudes from each cross section to the next, basing the contours of the object's surface on the shapes in the cross sections.

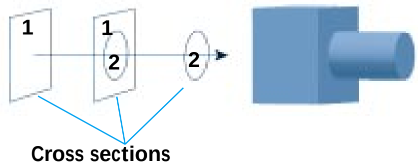


Ray Dream Studio creates an object by extruding between cross sections.

This modeling technique is sometimes referred to as skinning—the **Free Form** modeler stretches a "skin" over the various shapes in the cross sections.

A skinned object is created by stretching a "skin" over a series of cross sections.

Each cross section can have any number of 2D shapes. However, the more shapes you add, the more complicated your extrusion gets. The modeler's shape numbering feature allows you to specify which shapes should be connected from one cross section to the next. If a particular shape has no corresponding shape in the next cross section, it is simply not extruded. For more on working with cross sections, refer to "Modeling with Multiple Cross Sections" on page 125.



Ray Dream Studio uses corresponding cross section numbers to determine how to extrude a shape.

Complex sweep paths

The sweep path controls the general direction of the extruded object. A straight sweep path creates a straight object while a more complex sweep path creates objects with bends and curves.

A sweep path with curves will result in an object with bends and curves.

The **Free Form** modeler allows you to draw a true 3D sweep path, meaning that it can be adjusted in X, Y and Z axes. You can also close the sweep path, to create a continuous object like a chain link. Ray Dream Studio also provides tools for automatically creating complex sweep paths like spirals. For more on working with the sweep path, refer to "Drawing the sweep path in 3D" on page 129.

You can create complex shapes like spirals using sweep path presets.

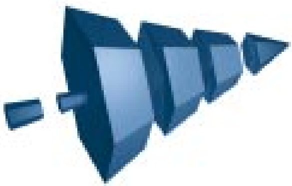
How do you Choose a Modeling Technique?

The **Free Form** modeler offers you a number of ways of creating **Free Form** objects, but you'll need to decide which technique is best suited for your object before you begin modeling.

An easy way of determining which technique you'll need is to take an imaginary knife and cut your object into several slices. The types of slices you end up with will tell you which technique you should use.

To determine which modeling technique you should use, slice an object with an imaginary knife. The size and shapes of the slices determine which modeling technique is the most appropriate.

If you get identical shapes, use straight extrusion. If you get identical shapes that only differ in size, use the scaling technique.



When you slice a tree, you can see that all the cross sections are the same. However, they have different sizes. So the easiest way to create this object is to use the scaling method.

If shapes vary dramatically in size and shape you may need to use a more complex modeling technique. Use **Lathing** if the shapes are symmetrical. If not, use the shape number and multiple cross sections technique.

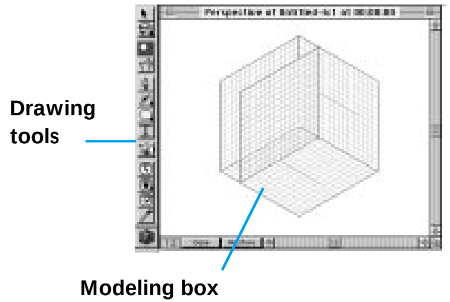
When you slice a glass you can see that the cross sections are symmetrical and vary in size so the lathe technique should be used.

The Free Form Modeling Window

The **Free Form** modeler is where you create new Free Form objects. When the **Free Form** modeling window opens it temporarily replaces your scene's **Perspective** window. New menus appear in the menu bar, and drawing tools appear in the toolbar. Your view of the scene is replaced with a close-up view of the object.

As well, the **Time Line** window automatically switches to the **Masters** tab, since changes you make in the **Free Form** modeler affect Master objects, not individual copies of objects.

For a discussion of the relationship between objects and Master objects, refer to "Working with Master Objects" on page 266.



When you're creating a free form object, the Free Form modeling window replaces the Perspective window.

You can also open the **Free Form** modeler by jumping into an existing free form object. The **Free Form** modeler opens showing you the components of the object.

To jump into an object:

Double-click the object in the **Perspective** or **Time Line** window,

or

Select the object and choose **Edit menu▸ Jump In**.

When you're finished modeling, you can jump out of the object and return to the Reference view of your scene.

To jump out of an object:

Click **Done** at the bottom of the **Modeling** window,

or

Choose **Edit menu▸ Jump Out**.

Features of the Modeling Window

The Modeling Box

The Modeling Box is the primary feature of the **Modeling** window. The box defines the drawing environment and provides you with planes for drawing sweep paths, cross sections and extrusion envelopes.

You can only work on a single plane at a time. The plane you're currently working on is called the Drawing plane. By default, it is highlighted in green.

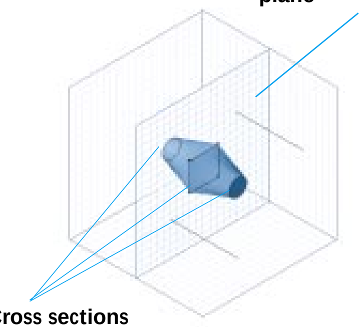
For a description of the Drawing plane environment and the Drawing tools, refer to "Working on the Drawing Plane" on page 116.

Cross Section Planes

The Cross section planes are the shapes you use to create the surface of your object. These planes act like the paper in a 2D drawing application. You can use the Drawing tools to draw and edit shapes to create cross sections.

Every time you create a cross section, you create a new Cross section plane. Since a cross section can contain any number of 2D shapes, you may have more than one shape per Cross section plane.

By default, Cross section planes are oriented according to the shape of the sweep path. As the sweep path bends or twists, the cross sections reorient themselves to remain perpendicular to it.



Each cross section has its own plane called a Cross section plane.

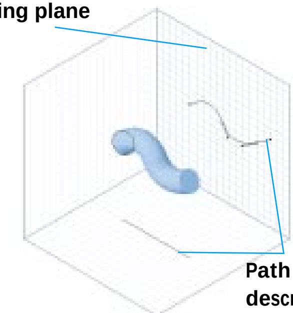
For more information, refer to "Working with Cross Sections" on page 125.

The Sweep Path

The sweep path, also known as the *Extrusion path*, is the path along which cross section shapes are extruded. The path is defined by two red lines which appear on the bottom and side walls of the Modeling Box.

You can think of these description lines as horizontal and vertical projections of the same sweep path. These two lines let you edit the sweep path in both the XY plane and YZ plane.

You can draw a sweep path of any shape or angle, including curved, straight or closed paths.



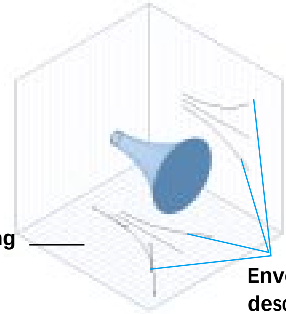
Since the sweep path exists in 3D it can be edited both horizontally and vertically using its projections.

For more information, refer to "Working with the sweep path" on page 129.

The Extrusion Envelope

The Extrusion envelope lets you control the curvature in an object's form. The envelope is not displayed when you first open the modeling window. You need to add it to an object using one of the Extrusion envelope commands in the **Geometry** menu.

The Extrusion envelope is represented by four blue Bezier curves, two on each sweep path plane. By editing these envelope description lines, you can scale an object's cross sections as they're extruded along the sweep path. You can scale cross section shapes either symmetrically or asymmetrically.



Extrusion envelope lets you adjust an object's shape.

For more information, refer to "Using the Extrusion Envelope" on page 132.

Working in the Modeling Window

Changing the Drawing Plane

The Drawing plane is the plane you're currently working on. It is used as a reference for viewing objects, such as **View menu▸ Drawing plane**, and for positioning.

To change the Drawing plane:

Click on different plane in the Modeling Box. The plane you click becomes the Drawing plane.

For more Information on moving between multiple cross sections, refer to "Modeling with Multiple Cross Sections" on page 125.

Changing Your View of the Object

Since you're working with a 3D object, you can view it from any angle. You can change your view of an object using either the **View** menu commands or the **Virtual Trackball** tool.

When you change your view of the object, your view of the Modeling Box changes as well. However, the object maintains its spatial relationship to the Modeling Box at all times.

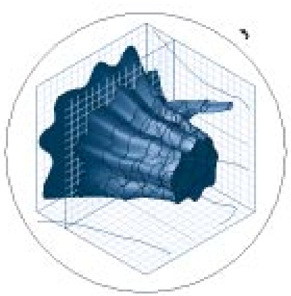
To select a different view:

Choose **View menu▸ Preset Position▸ Reference** (the default view), **Drawing Plane**, **Top**, **Bottom**, **Left**, **Right**, **Front**, or **Back**.

The **Drawing Plane** view provides a direct view of the selected Drawing plane. So you should probably use this view when you're drawing detailed shapes.

To rotate the object:

1. Choose the **Virtual Trackball** tool from within the **Free Form** modeler.
2. In the **Free Form** modeling window, drag the object in the direction you want to rotate it.



You can rotate an object in 3D space using the Virtual Trackball.

An object's orientation in the modeler has no connection to its orientation in the scene. You may rotate the object without worrying about its orientation in the scene.

Selecting an Object Preview Mode

There are four levels of object preview in the **Free Form** modeler. Listed from lowest to highest they are:

- No Preview
- Wireframe
- Preview
- Shaded Preview
- Better Preview

Higher preview modes take longer to redraw. So it's a good idea to use Wireframe or Preview mode when you're drawing.

To change the object preview:

Choose **View menu▸ No Preview**, **Wireframe**, **Preview**, **Shaded Preview** or **Better Preview**.

The mode is enabled when a checkmark appears next to the command.

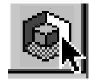
You can also click one of the preview buttons on the toolbar to change modes.

Selecting Modeling Box Display

By default, the Modeling Box appears displaying all three planes. If you find that the sweep path projections or cross section previews are too distracting, you hide their planes. You can hide or display the Modeling Box planes using the **Display Plane** tool.

To change plane display:

Click on the plane you want to hide or show on the **Display Plane** tool.



Setting Scale and Object Size

The modeling window opens at a scale consistent with the proportions of objects in the scene. If you want to work with an object at some other scale, you can reset the Modeling Box's size.

To set Modeling Box and object size:

1. Choose **View menu▸ Modeling Box Size**. The **Modeling Box Size** dialog appears.

The Modeling Box Size dialog lets you adjust the size of the Modeling Box in the Free Form modeler.

2. Enter a dimension and select the units you want.

3. Enable the **Scale object with Modeling Box** checkbox if you want to resize the object along with the Modeling Box.

4. Click **OK**.

Setting Surface Fidelity

When Ray Dream Studio is rendering, it breaks each object down into hundreds of tiny polygons. This helps the renderer understand the contents of the scene.

The number of polygons used for each object is based on the rendering resolution, the size of the object, and its distance from the camera. This calculation usually results in a smooth object.

If a particular object does not render as smoothly as you'd like, however, you can force Ray Dream Studio to break it down into a greater number of polygons. Ray Dream allows you to set a value for each object's surface fidelity.

If none of the objects in your scene renders as smoothly as you would like, you can increase the rendering Silhouette Quality instead. However this option uses more memory and increases rendering time. For more information, refer to "Renderers" on page 342.

To set surface fidelity:

1. Choose **Geometry menu▸ Surface Fidelity**. The **Surface Fidelity** dialog appears.

2. Drag the slider to increase or decrease the object's surface fidelity. The default value is 100%.

3. Click **OK**.

The surface fidelity value is resolution-independent. That is, if a particular value yields good results for a given object in a given scene at low resolution, it should yield good results at higher resolutions as well.

Working on the Drawing Plane

To create an object, you will need to draw cross section shapes and Extrusion paths on the appropriate planes in the **Free Form** modeling window. Each plane in the modeling window is a separate 2D drawing environment with a grid. At any given time, you will work on a single plane. The currently selected plane is called the Drawing plane.

This section provides general instructions for working on the Drawing plane. These instructions pertain to both the cross section and sweep path planes. For specific information on cross sections and sweep paths and how they relate, refer to "Working with Cross Sections" on page 125 and "Working with the sweep path" on page 129.

All 2D shapes and paths you draw in Ray Dream Studio are Bezier curves. A Bezier curve is an interpolated curve whose shape is determined by the relative positions of its vertices and control points. Each segment of a Bezier curve connects two vertices. The control points (handles) extending from each vertex, determine the curvature of the path segments.

Ray Dream Studio's drawing tools are similar to those found in traditional Bezier-based 2D drawing applications. The drawing tools enable you to create curves and shapes, and to edit and modify those shapes point-by-point.

Ray Dream Studio allows you to import shapes from many popular 2D graphics programs. For more information, refer to "Importing Shapes" on page 124.

Don't confuse the Drawing tools with the **3D Paint** tools, which appear below the drawing tools in the toolbar. The **3D Paint** tools are discussed in Chapter 11, "Creating Shaders."

Drawing Tools

Pen Tool

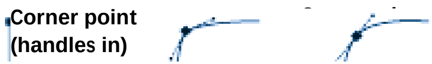
The **Pen** tool allows you to:

- Draw a new path.
- Add points to either end of an existing open path.

Drawing with the **Pen** tool is like playing connect the dots. You draw a shape by adding one point at a time. As you add points, Ray Dream Studio connects them by drawing lines called *segments*.

Depending on the state of its handles, each point can be classified as a *corner point* or a *curve point*. A curve point's handles are bound together, creating a straight tangent for the path and resulting in a smooth curve.

A corner point's handles can be moved independently of one another, or retracted completely, allowing you to create abrupt changes in the direction of the path.



Corner points have no handles, curve points have controls handles extending from the point.

To add a corner point:

1. Choose the **Pen** tool from within the **Free Form** modeler.
2. Click (do not drag) at a point on the Drawing plane.

   Hold down the **Shift** key to constrain the position of a new point in relation to the previous point. The angle between the two points is constrained to increments of 45°.

To add a curve point:

1. Choose the **Pen** tool from within the **Free Form** modeler.
2. Drag the **Pen** tool at a point on the Drawing plane.

As you drag, a pair of handles extends from the vertex. By default, each pair of handles is bound together creating a curve point—the two handles remain parallel to one another.

- Hold down the **Shift** key while dragging to constrain the angle of the handles to 45° increments.
- Hold down the **Option**/**Alt** key while dragging to break apart a pair of handles creating a corner point. You can then move each handle independently. Continue to hold the **Option**/**Alt** key down while dragging. If you release the key before releasing the mouse button, the handles snap back together.

To close a path:

1. Choose the **Pen** tool from within the **Free Form** modeler.
2. Click on the first point you added.

To draw a new path:

1. Deselect all paths and points by clicking in an empty area of the Drawing plane with the **Selection** tool.
2. Choose the **Pen** tool.

3. Click anywhere on the Drawing plane to start the new path with a corner point.

   or

   Drag to start with a curve point.

4. Click or drag to add each subsequent point. As you add each point, the segments are drawn to connect the path.

To add points to either end of an open path:

1. Select one of the endpoints of an open path with the **Selection** tool.
2. Choose the **Pen** tool.
3. Click or drag to add the next point. A segment is drawn to continue the path to the new point.
4. Continue adding points until you're satisfied with the path.

Selection Tool

In the **Free Form** modeling window, the **Selection** tool allows you to:

- View the points on the path.
- Select, deselect and move points.
- Drag handles.

The **Selection** tool is also used for scaling shapes. For additional information, refer to "Scaling Shapes" on page 124.

To view points on a path:

1. Choose the **Selection** tool from within the **Free Form** modeler.

2. Click on a path in the **Free Form** modeling window.

   All of the points on the curve become visible, but none are individually selected. A point appears white when it is deselected, and black when it is selected.

   - Hold down the **Shift** key and click on additional paths to view the points on multiple paths.
   - Hold down the **Shift** key and click on a path whose points are visible to make them invisible.
   - Click in an empty area of the Drawing plane to make all points invisible.

To select points:

1. Choose the **Selection** tool from within the **Free Form** modeler.
2. Click on a point in the **Free Form** modeling window to select it.

   The point color changes from white to black and its handles, if it has any, become visible.

   - Hold down the **Shift** key and click on additional points to increase your selection.
   - Hold down the **Option**/**Alt** key and click on a path to select all of the points on the path.
   - Hold down the **Shift** key and click on a selected point to deselect it.
   - Click in an empty area of the Drawing plane to deselect all points.

To move points:

1. Choose the **Selection** tool from within the **Free Form** modeler.
2. Drag a selected point to a new location.

   All selected points move together. As you drag, the path segments that are affected by the move are redrawn.

- Hold down the **Shift** key while you drag to constrain the movement of the points in relation to their previous positions. Their movement is restricted to angles of 45° increments.
- Select all of the points on a path and drag them to move the entire path.

To adjust a curve:

1. Choose the **Selection** tool from within the **Free Form** modeler.
2. Drag the point's handles.

   As you drag, the curve is redrawn. When you move a curve point handle, the opposite handle moves to remain parallel to the one you are moving.

   - Hold down the **Shift** key while you drag to constrain the angle of a handle's motion to 45° increments.
   - Hold down the **Option**/**Alt** key while you drag to break apart a pair of parallel handles. You can then move each handle independently.

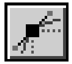
Convert Point Tool

The **Convert Point** tool lets you:

- Convert a corner point to a curve point.
- Convert a curve point to a corner point.

To convert a corner point to a curve point:

1. Choose the **Convert Point** tool from within the **Free Form** modeler.

2. Drag a point in the **Free Form** modeling window. As you drag, a pair of handles extend from the point.

   or

   Drag one of a corner point's handles.

   When you click a corner point, the two handles extending from the point will move together.

   When you click a curve handle, the handles extending from the point will move independently.

To convert a curve point to a corner point:

1. Choose the **Convert Point** tool from within the **Free Form** modeler.
2. Click on a curve point in the **Free Form** modeling window. The point's handles retract.

   or

   Drag one of a curve point's handles.

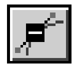
Delete Point Tool

The **Delete Point** tool allows you to:

- Delete a point.
- Delete a path segment.

To delete a point:

1. Choose the **Delete Point** tool from within the **Free Form** modeler.

2. Click on a point in the **Free Form** modeling window.

   When you delete a point in the middle of a path, the points on either side of the deleted point become connected by a new segment, changing the shape of the path.

   When you delete the endpoint of an open path, the last path segment simply disappears, leaving a new endpoint.

If you delete a point on the sweep path, any cross section associated with that point is deleted as well.

To delete a segment:

1. Choose the **Delete Point** tool from within the **Free Form** modeler.

2. Click on a path segment in the **Free Form** modeling window.

This feature applies to cross section shapes only—you cannot delete a segment from the sweep path or the Extrusion envelope.

Removing a path segment leaves adjacent path segments unchanged. When you delete a path segment from a closed path, the path simply becomes an open path.

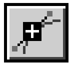
When you delete a path segment from an open path, the path is split into two separate open paths.

Add Point Tool

The **Add Point** tool lets you add a new point between two existing points on the same path.

To add a point:

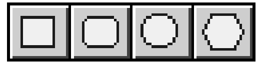
1. Choose the **Add Point** tool from within the **Free Form** modeler.



2. Click anywhere on an existing path in the **Free Form** modeling window.

Ray Dream Studio determines whether to add a corner point or a curve point, depending on the shape of the path. The new point is automatically selected so that it can be moved with the **Selection** tool.

When you add a point to the sweep path, you can simultaneously add a cross section at that point—just hold down the **Option/Alt** key as you click.



2D Primitive Tools

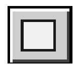
The **2D Primitive** tools allow you to easily create closed paths in a variety of shapes. These tools work only on the cross section planes.

After creating a shape with one of the **2D Primitive** tools, you will not immediately be able to edit its points—you will need to ungroup it first. For more information, refer to "Grouping Shapes" on page 123.

Rectangle Tool

To draw a rectangular cross section:

1. Choose the **Rectangle** tool from within the **Free Form** modeler.



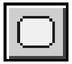
2. In the **Free Form** modeling window, drag from one corner of the rectangle to the opposite corner.

Hold down the **Shift** key while dragging to create a square.

Rounded Rectangle Tool

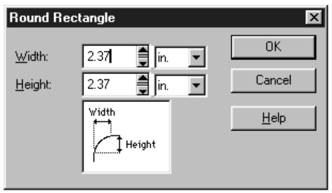
To draw a rounded rectangular cross section:

1. Choose the **Rounded Rectangle** tool from within the **Free Form** modeler.



2. In the **Free Form** modeling window, drag from one corner of the rectangle to the opposite corner. Release the mouse button when the rectangle is the desired size.

   Hold down the **Shift** key while dragging to create a square with rounded corners. The **Round Rectangle** dialog appears.



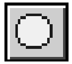
Use the Rounded Rectangle dialog to round the corners of rectangles.

3. Set the curvature on the corners.
4. Click **OK**.

Ellipse Tool

To draw an ellipse cross section:

1. Choose the **Ellipse** tool from within the **Free Form** modeler.



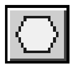
2. Drag in the **Free Form** modeling window to draw an ellipse.

   Hold down the **Shift** key while dragging to create a circle.

Polygon Tool

To draw a polygon cross section:

1. Choose the **Polygon** tool from within the **Free Form** modeler.



2. Drag the tool in the **Free Form** modeler Cross section plane. Release the mouse button when the polygon is the desired size.

   Hold down the **Shift** key while dragging to keep all angles equal. The **Number of Sides** dialog appears.

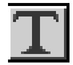
3. Set the number of sides for the polygon.
4. Click **OK**.

2D Text Tool

The **2D Text** tool allows you to create text on a cross section plane.

To draw text on the cross section plane:

1. Choose the **2D Text** tool from within the **Free Form** modeler.



2. Click in the **Free Form** modeling window to position the text. The **Text** dialog appears.
3. Enter text and specify type settings.
4. Click **OK**.

Use this tool when you want to extrude text along a curved path. Use the Text modeler when you want to extrude text along a straight path and add bevels. For more information on the Text modeler, refer to "Creating Text Objects" on page 105.

Precision Editing

The Drawing Plane Grid

You can use the Drawing Plane grid to help you precisely position lines and points as you draw.

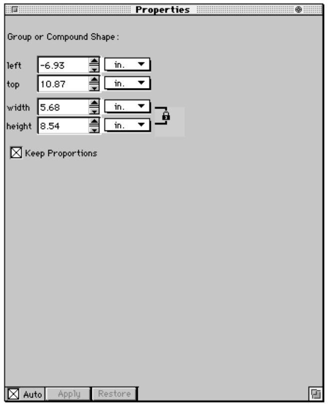
You can set the size of each grid increment, and specify whether a line should be drawn at every increment. As well as enabling the Snap To feature. When this feature is enabled any object you drag along the plane will "jump" to the nearest grid intersection.

To set up the grid:

1. Choose **View menu▸ Grid**. The **Grid** dialog appears.
2. Change the **Spacing** value to control the amount of spacing between grid lines in the box. You can also change the value using the scroll buttons.
3. Choose a unit of measure from the pop-up.
4. Change **Draw a line every** value to control how often grid lines are drawn.
5. Enable **Snap to** if you want objects to "jump" to the nearest grid line as you drag them.
6. Disable **Show** if you want to hide the grid lines.
7. Click **OK**.

The Properties Palette

The **Properties** palette displays the properties of the selected point, control handle, group or compound cross section.



The Properties palette in the Free Form modeler shows the position of points and control handles.

- When a point is selected, the X and Y coordinates are displayed.
- When a curve point is selected, the X, and Y position of its handles are displayed. When these controls are active, you can retract a control handle using the **Retract** button.
- When a group or compound cross section is selected, its top, and left coordinates are shown as well as the shape's height and width.
- No information is available for ungrouped shapes or multiple point selections.

By default, all values are shown in inches.

To change the properties of a cross section:

1. If the **Properties** palette is not visible, choose **Windows menu▸ Properties**.
2. Select a cross section group or point.
3. Adjust the position values.
   - If you selected a closed cross section, you can enable the **Keep Proportions** checkbox to maintain the shapes aspect ratio as you scale it.
   - If you selected a curve point, you can click the **Retract** button to retract the point's handles. You can also click the **Corner Point** button to convert the curve point to a corner point.

Rotating Shapes

You can use the **2D Rotation** tool to rotate the cross section freely, or the **Rotate** dialog to rotate it numerically.

Note: You can only rotate cross sections, not the sweep path.

To free rotate a cross section:

1. Select a shape on the cross section plane.

2. Choose the **2D Rotation** tool from the **Free Form** modeler.

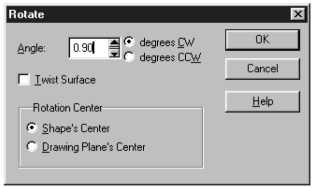
3. Drag the shape in a circular path.

A shape rotated with the **2D Rotation** tool always rotates around its center.

If the **Properties** palette is open, the cross section's position values will update as you rotate it.

To numerically rotate a cross section:

1. Select a shape, and choose **Geometry menu ▸ Rotate**. The **Rotate** dialog appears.



Use the Rotate dialog to numerically rotate an object.

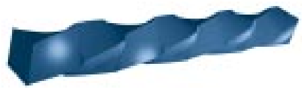
2. Select the rotation center—the shape's center, or the Drawing plane's center.

3. Enter a value for degree of rotation and select clockwise (CW) or counterclockwise (CCW).

4. Click **OK**.

Twisting An Object

When you rotate a cross section shape, you can specify that the rotation be applied to the surface of the object to give it a twisted appearance.



You can twist an object by rotating its cross sections.

To twist an object:

Hold down the **Option**/**Alt** key while rotating a cross section shape with the **2D Rotation** tool.

For precise twisting, enable the **Twist** checkbox in the **Rotation** dialog. When **Twist** is enabled, Ray Dream Studio twists the surface the specified number of degrees.

Rotation values greater than 360° make sense when twisting the object's surface—you can use them to specify multiple twists.

Grouping Shapes

You can group one or more shapes using the **Group** command. Grouping two or more shapes lets you to manipulate them all at once.

Note: Grouping is allowed only on the Cross section planes.

To group shapes:

1. Select the shape(s) you want to group.

2. Choose **Arrange menu ▸ Group**.

To ungroup:

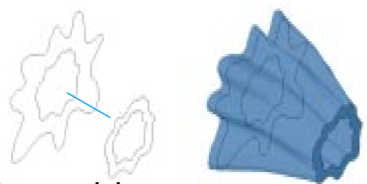
1. Select the group you want to ungroup.

2. Choose **Arrange menu ▸ Ungroup**.

Compounding Shapes

Compounding shapes is like grouping them, with one significant difference—any shape which is completely enclosed by another shape in the same compound "cuts away" from the larger shape. When a compound is extruded, the inner shapes create holes through the extrusion.

Note: Compound shapes are allowed only on Cross section planes.



Compound shape

This hollow log was created by extruding two compound cross sections.

To compound shapes:

1. Select the shapes you want to compound.
2. Choose **Arrange menu▸ Combine as Compound**.

To break apart a compound:

1. Select the compound you want to release.
2. Choose **Arrange menu▸ Break Apart Compound**.

Scaling Shapes

You can scale a shape directly by dragging its bounding box, or numerically using the **Scale** dialog.

Note: Scaling is allowed only on cross section planes.

Scaling a cross section shape directly is not always necessary. The scaling envelope, described in "Using the Extrusion Envelope" on page 132, can often accomplish the same results more simply and powerfully.

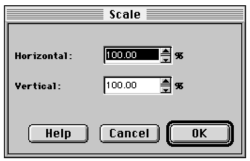
To scale shapes:

1. Group the curves or shape you want to resize.
2. Drag a corner of the shapes bounding box with the **Selection** tool to resize it. Drag towards the shape to reduce it's scale, or away from it to increase its scale.

   Hold down the **Shift** key to maintain proportions.

To scale shapes numerically:

1. Select the shape you want to resize.
2. Choose **Geometry menu▸ Scale**. The **Scale** dialog appears.



Use the Scale dialog to numerically resize objects.

3. Enter horizontal and vertical scale factors.
4. Click **OK**.

Importing Shapes

Ray Dream Studio lets you import cross section shapes, sweep paths, and envelopes from 2D drawing programs that support Bezier curves, like Adobe Illustrator or CorelDRAW!.

To import shapes to a cross section:

1. Click the cross section you want to work with.

   You can also create a blank cross section using **Sections menu▸ Create**.
2. Choose **File menu▸ Import**. The **Import** dialog appears.
3. In the dialog, select the file you want, then click **Open**.

   Ray Dream Studio places the artwork on the Drawing plane.

   The file may include one or several two-dimensional shapes. You should, however, avoid unnecessary complexity. Paint characteristics, like stroke and fill are ignored. Compound paths are preserved. Text is automatically converted to outlines.
4. Click **OK**.

To import a path as a sweep path or envelope:

1. Choose **Geometry menu ▸ Extrusion Envelope** to turn on the extrusion envelope.

Note: Importing a sweep path or envelope replaces the current sweep path and envelope.

2. Click one of the path sweep path planes to make it the Drawing plane.

3. Choose **File menu ▸ Import**. The **Import** dialog appears.

4. Select the file you want, then click **Open**.

If the file you choose contains more than one path, only the first path will be imported.

Another dialog appears, allowing you to specify whether the path should be used as the sweep path or the envelope.

5. Specify sweep path or envelope, and click **OK**.

Ray Dream Studio imports the sweep path or envelope.

Working with Cross Sections

A basic free form object, like a box, has one cross section at the start of the path. The shape on this first section is swept to the end of the Extrusion path. To create more complex forms, you can add any number of cross sections along the length of the path. Since each cross section, in turn, can contain any number of shapes, you will be able to model even very intricate objects.

The **Free Form** modeler automatically extrudes between each cross section and the next, basing the surface of the object on the shapes contained in the cross sections.

As you begin to work with the **Free Form** modeler, you will find that the sweep path and cross sections are closely tied. Although separated here for the sake of clarity and organization, these concepts go hand in hand. Be sure to read “Working with the sweep path” on page 129.

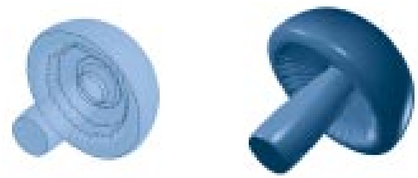
Modeling with Multiple Cross Sections

Modeling with multiple cross sections lets you increase your control over the shape of your object’s surface.

If you just use a few cross sections, Ray Dream Studio automatically extrudes a surface between the cross sections creating a flat surface.

When you only use a few cross sections to define an object, Ray Dream creates a flat surface over the entire object.

With each section you add, you reduce the amount of surface areas that is automatically calculated. You can add subtle variations in your object’s surface by placing more sections with different shapes in between cross sections.



By adding more cross sections you can vary the surface of your object.

Of course, the more cross sections you add the more complicated it becomes to work in the modeler. However, the **Free Form** modeler has a number of features to help you model with multiple cross sections. The modeler lets you:

- Add or delete cross sections.
- Move between cross sections.
- Add shape numbering to sections to control the extrusion between section shapes.
- Control whether the surface is extruded from shape to shape or point to point.

Adding and Removing Cross Sections

You can add as many cross sections as you like. Each cross section must correspond to a point on the sweep path. If you want to add a cross section where there is no point, you have to add one.

Although modeling with multiple cross sections enables you to achieve otherwise impossible effects, be careful not to add cross sections unnecessarily. Editing an object with too many cross sections can become difficult and tedious. Often, you can accomplish similar results using the scaling envelope. Refer to "Using the Extrusion Envelope" on page 132.

To create a new cross section:

1. If a sweep path point exists where you want the new cross section:
   - Select the sweep path and choose **Sections menu▸ Create**.
2. If there is no point:
   - Choose the **Add Point** tool from within the **Free Form** modeler.
   - Hold down the **Option**/**Alt** key and click on the sweep path at the point where you want to create the new cross section.

   Ray Dream Studio adds a point to the sweep path and creates a new cross section at that point.
3. If you're working on a cross section plane:
   - Choose **Sections menu▸ Create**.

   Ray Dream Studio adds a new cross section at the next vertex.

Generating Intermediate Cross Sections

You can have Ray Dream Studio create a specific number of cross sections between the current cross section and the next one

To generate intermediate cross sections:

.

1. Click on a cross section plane.
2. Choose **Sections menu▸ Create Multiple**. The **Create Multiple Cross-Sections** dialog appears.
3. Enter the number of sections you want.
4. Click **OK**.

   Ray Dream Studio creates the intermediate cross sections, spacing them evenly between the current cross section and the next one. A new point is added to the sweep path for each cross section created.

The shapes on the new cross sections are interpolated from the shapes on the existing cross sections. This process is similar to blending between two shapes in a 2D illustration program—each shape on the new cross sections is like one "step" in the blend.

To remove a cross section:

1. Click the cross section you want to remove, or select the corresponding point on the sweep path.

2. Choose **Sections menu ▸ Remove**.

To simultaneously remove a cross section and delete its corresponding sweep path vertex, use the **Delete Point** tool to delete the point from the path.

Moving the Drawing Plane Between Sections

If you have multiple cross sections, you can choose **Next** or **Previous** from the **Sections** menu to move the Drawing plane between adjacent cross sections.

To move between sections using the keyboard:

Hold down the **Command**/**Ctrl** key and press the right or left arrow key to move to the next or previous cross section, respectively.

To move to a specific section:

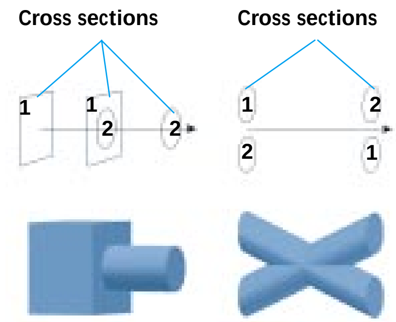
1. Choose **Sections menu ▸ Go to**. The **Go To Cross Section** dialog appears.

2. Enter the number of the section you want to go to and click **OK**.

   Cross sections are numbered from left to right.

Correspondence and Shape Numbering

Normally, there is a direct correspondence between the number of shapes in adjacent cross sections. You can, however, use a different number of shapes in adjacent sections, or change which shape sweeps to which. You control multiple shape correspondence through shape numbering.



Cross section shape numbers let you control how sections are extruded along a sweep path.

To control shape-to-shape correspondence:

1. Choose **Sections menu ▸ Show Shapes Numbers**.

   Ray Dream Studio displays a number beside each shape in the Drawing plane. A group or compound is assigned a single shape number.

   Each numbered shape is swept to the corresponding numbered shape in the next cross section.

2. Click on the number you want to change. The **Shape Number** dialog appears.

3. Type in the number for the corresponding shape.

   - If you enter the number of another shape in this plane, the program swaps the correspondence number with that shape.
   - If you enter a unique number, make sure that you assign the same number to the appropriate shape in the adjacent cross section(s).

4. Click **OK**.

Any shape that has no correspondence (i.e., its number does not match any shape number in an adjacent section) is not extruded.

Cross Section Options

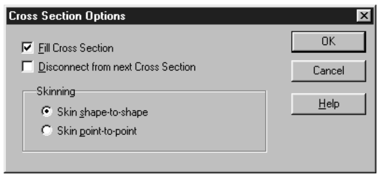
The **Cross Section Options** dialog lets you specify the following:

- Whether the cross section should be "filled."
- If the cross section should be connected to the next cross section.

- What type of “skinning” should be used between the cross section and the next cross section.

To set cross section options:

1. Click on a cross section.
2. Choose **Sections menu▸ Cross-Section Options**. The **Cross Section Options** dialog appears.



Use the Cross Section Options dialog to fill or disconnect cross sections.

3. Enable the **Fill Cross Section** checkbox if you want to fill the section. For example, a cylinder with its first and last sections not filled would be a tube that you could look through.

   An object’s first and last cross sections are often referred to as endcaps—you can turn endcaps “on” by filling them, or “off” by leaving them unfilled.

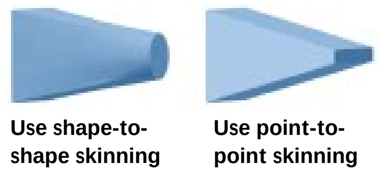
4. Enable the **Disconnect from next Cross Section** checkbox to turn off extrusion between this section and the next one. In this way, you could create an “intermittent” object.

Object created using the Disconnect from next Cross Section option.

5. Enable a **Skinning** option:

   Skin Shape-to-Shape is especially well suited for creating smooth, organic surfaces whose cross section shapes are significantly different from one another. In fact, if adjacent cross sections have different numbers of vertices, shape-to-shape skinning is the only option available.

   Skin Point-to-Point can be used when adjacent cross sections contain very similar shapes, and you want each vertex in one cross section to be connected directly to the corresponding vertex in the next cross section. This option is useful when you model an object which requires straight, sharp edges.



Two cases where you would use shape-to-shape and point-to-point skinning.

6. Click **OK**.

Centering a Cross Section

Often when you’re creating cross sections, you may end up with a number of off centered sections which can lead to unexpected results when they’re extruded. It’s usually a good idea to center sections when you’re finished drawing them.

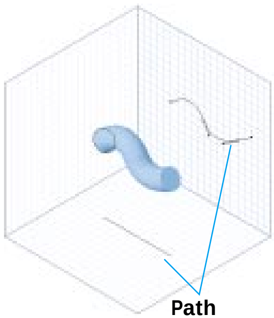
To center a cross section on the sweep path:

1. Click the section you want to center.
2. choose **Sections menu▸ Center**. The shape(s) on the cross section will be centered around the sweep path.

Tip: You can also use **Command -Shift-C/ Ctrl+Shift+C**.

Working with the sweep path

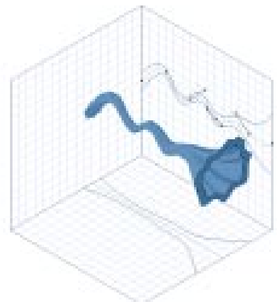
The key to working with the sweep path is understanding how the 2D path description lines define the 3D sweep path. There are two red path description lines, one on each sweep path plane. Although the path description lines appear to be two separate paths, they are actually just projections of the same path.



You can tell the exact position of the sweep path by its path description lines.

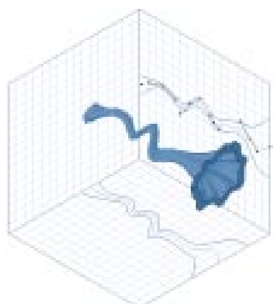
Each point on one path description line corresponds to a point on the other path description line. In fact, each pair of points represents a single 3D point on the sweep path.

The sweep path projection on the ground plane describes the sweep path's horizontal position while the projection on the side plane describes its vertical position. A sweep path that is curved on the side plane but straight on the ground plane would create an object whose's shape curves up and down but not side to side.



A sweep path curving in 2D will create an object that only curves up and down.

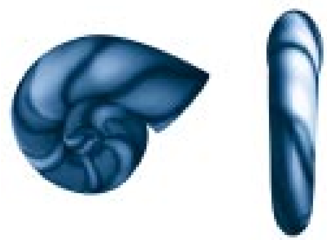
A path that curves on both planes would create an object whose shape curves in 3D.



A sweep path curving in 3D will create an object both up and down and side to side.

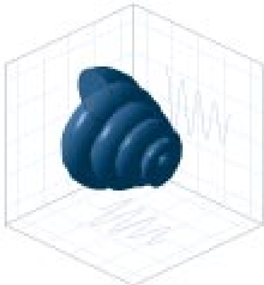
Drawing the sweep path in 3D

The best way to start drawing a sweep path is to consider how you want your object to look both from the side and from the top. An object that has a lot of curves when viewed in profile, but looks straight when viewed from the top, indicates that the sweep path will remain straight on the ground plane and curved on the right plane.



An object that has many curves when viewed in profile but appears straight when viewed from above.

Unfortunately few objects are this simple. Most objects have some variation from both the top and the profile. You can easily handle this type of sweep path by adjusting the point on the two sweep path projections.

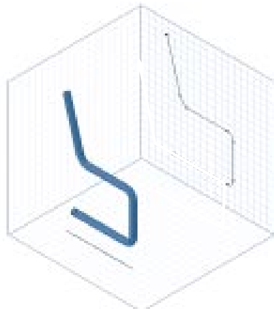


You can create more realistic objects by making the sweep path curve in 3D.

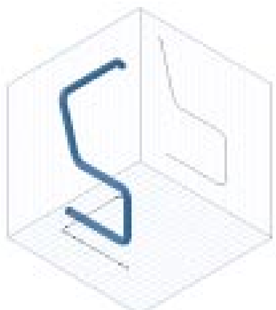
In some cases, simple adjustment may not be enough. You may want to draw the sweep path continuously from the first point to the last, switching back and forth between the two planes as you work. The chair frame shown below is modeled using this technique—the diagrams that follow illustrate the process.

To draw a sweep path in 3D:

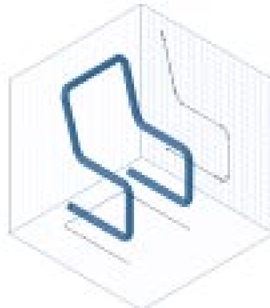
1. On the side plane, draw one side of the chair using the **Pen** tool As you draw, points are added on the ground plane, as well.



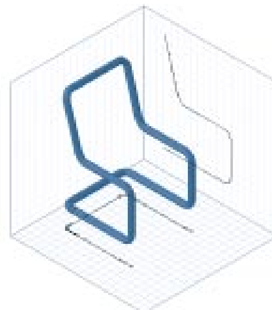
2. Switch to the ground plane and select the last point. Then continue drawing to add the chair's horizontal bar as shown.



3. Switch back to the side plane, and trace back over the path to add the other side of the chair.



4. Finally, working on the ground plane, close the path by drawing from the last point to the original point.

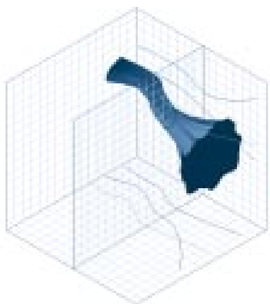


Cross Sections and the sweep path

When you're working with the sweep path it's important to understand the relationship between cross sections and the sweep path. You can think of the sweep path as an object's spine. Whenever you move a point on the sweep path, any cross section at that point will move as well.

The opposite is not true, however. When you move a cross section shape up or down, left or right along the cross section plane, the sweep path is not affected.

This allows you to create cross sections that are not centered around the sweep path.



Cross sections don't necessarily have to be centered around the sweep path. They can be off-center.

Translation vs. Pipeline

The **Free Form** modeler can extrude cross sections along the sweep path using one of two extrusion methods: the **Translation** method or the **Pipeline** method.

With the **Translation** method, each cross section remains perpendicular to the ground plane of the Modeling Box, regardless of the sweep path's curvature.

With the **Pipeline** method, the orientation of each cross section depends on the direction of the sweep path at the point where the cross section is located—all cross sections remain perpendicular to the sweep path, rather than to the ground plane.

Translation method

Pipeline method

Translation vs. Pipeline.

To choose an extrusion method:

Choose **Geometry menu▸ Extrusion Method▸ Translation** or **Pipeline**.

You can switch extrusion methods at any time, however, changing methods may reset your sweep path and extrusion envelope. In general, you should try to determine which extrusion method is appropriate before you start work on an object.

Extrusion Presets

Ray Dream Studio provides three extrusion presets, which automatically generate specific types of sweep paths. When you apply an extrusion preset, the current sweep path and envelope are replaced with the preset path.

To straighten the sweep path:

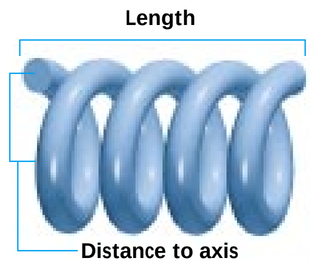
Choose **Geometry menu▸ Extrusion Preset▸ Straight**.

All of the points on the sweep path are moved into a straight line. Cross section shapes are unaffected.

Note: When you use the **Spiral** extrusion preset, only the first cross section of your existing object is kept—the remaining cross sections, sweep path, and envelope are all replaced.

To make a spiral:

1. Draw a 2D shape in the cross section plane.
2. Choose **Geometry menu▸ Extrusion Preset▸ Spiral**. The **Spiral** dialog appears.
3. Enter the **Number of turns** you want—one turn equals 360°.
4. Enter the **Length** of the spiral sweep path. The relationship between the number of turns and the length determines how “tightly” the coils of the spiral are spaced.



Relationship between length and distance.

5. Enter a value in the **Distance to axis** entry box. This value determines the size of each coil by setting the distance between the cross section shape and the spiral’s central axis.
6. Enter a percentage in the **Cross Section Scaling** entry box if you want to shrink or enlarge the cross section shape as it sweeps along the spiral path. Values less than 100% shrink the shape; values greater than 100% enlarge the shape.
7. Enter a percentage in the **Spiral Scaling** entry box if you want to decrease or increase the distance to the axis as the cross section shape sweeps along the path. Values less than 100% taper the spiral; values greater than 100% widen it.
8. Click **OK** to close the **Spiral** dialog. Ray Dream Studio creates the spiral sweep path you have specified, and automatically switches to **Pipeline** mode.

The Torus Extrusion Preset

The **Torus** extrusion preset automatically creates a perfect circular sweep path. This feature is described in “Lathing” on page 134.

Using the Extrusion Envelope

To a large extent, the contours of a Free Form object are determined by the cross sections you place along the sweep path. Wherever you change the size or shape of a cross section, the object’s surface changes accordingly.

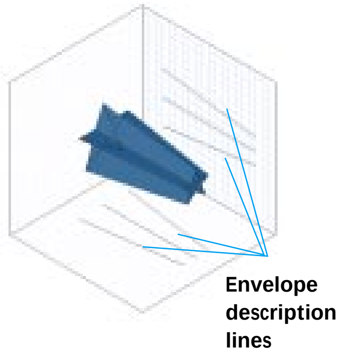
To create some complex objects you may find that you‘ll need a finer degree of control than cross sections alone can provide. The extrusion envelope lets you specify how an object’s surface should curve from one cross section to the next, giving you precise control over the object’s form.

For the best results, you should model the object as completely as possible using the sweep path and cross sections, then adjust the scaling envelope as a final step.

Understanding the Envelope

By default, the extrusion envelope is not used—Ray Dream Studio stretches the object’s surface over the cross sections as simply as possible. When you turn the envelope on, it appears as four blue Envelope description lines, two on each sweep path plane. (The red path on each sweep path plane is a path description line—refer to “Working with the sweep path” on page 129.)

Initially, the envelope conforms to the dimensions of the object's cross sections, widening and narrowing only if the cross sections vary in size.

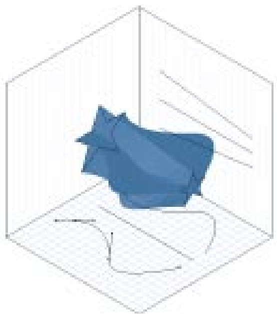


Object with envelope.

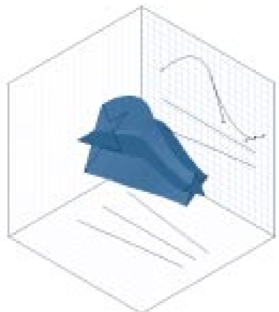
The envelope description lines are Bezier curves. By editing these curves, you can alter an object's contours. The envelope has three modes: **Symmetrical**, **Symmetrical in Plane** and **Free**.

Symmetrical envelope.

When you work with the **Symmetrical** envelope setting, all the envelope lines maintain symmetry. **Symmetrical in Plane** lets you edit the envelope description lines in pairs. **Free** lets you edit each line individually. This allows you to model asymmetrical objects.



Symmetrical in Plane.



Free Envelopes.

How the Envelope Relates to the sweep path

The envelope and the sweep path are closely related. In fact, each point on the extrusion envelope corresponds to a point on the sweep path.

Moving an envelope point perpendicular to the sweep path controls the scaling of the object at that point on the path. When you move an envelope point parallel to the sweep path, the corresponding point on the sweep path moves as well—the points are "locked" together in the direction of the sweep path.

When you are using the Pipeline extrusion method, envelope points are constrained to move only perpendicular to the sweep path.

To maintain the relationship between the sweep path and the envelope, when you add a point to the scaling envelope, a point is also added to the sweep path. Likewise, when you delete a point from the envelope, the corresponding point is deleted from the sweep path.

How the Envelope Relates to Cross Sections

Editing the Extrusion envelope may also affect an object's cross section shapes. If you edit the envelope at a point where there is no cross section, only the surface between cross sections is affected. However, if you edit the envelope at a point where a cross section exists, the shapes on the cross section are scaled accordingly. If you delete a point from the envelope, you will also delete any cross section located at that point.

When using the extrusion envelope in conjunction with multiple-shape cross sections, note that the scaling reference point is the sweep path—not the center of each shape. If you want a cross section's individual shapes to scale around their respective center points, you should resize each shape individually on the cross section plane, rather than use the scaling envelope.

Editing the Envelope

To enable the envelope or change its symmetry constraint:

Choose **Geometry menu▸ Extrusion Envelope▸** and pull right to select a symmetry constraint setting: **Symmetrical**, **Symmetrical in Plane** or **Free**.

If the envelope was not already enabled, the four blue Envelope description lines appear on the sweep path planes.

Symmetrical uses the same curve for all four envelope description lines—when you edit one line, the others update automatically.

Symmetrical in Plane the two Envelope description lines in either plane use the same curve—when you edit one line, the other in its plane updates (as a mirror image) automatically.

Free each line may have a unique curve.

To modify the extrusion envelope:

Use the drawing tools to edit the Envelope description lines.

You can add and delete points, as well as adjust existing points and control handles. As you adjust one of the Envelope description lines, the other lines are updated in real time.

For instructions, refer to "Working on the Drawing Plane" on page 116.

To reset the extrusion envelope:

Choose **Geometry menu▸ Reset Envelope**.

or

Choose **Geometry menu▸ Extrusion Envelope▸ None**.

Lathing

Lathing lets you create many types of symmetrical objects by rotating a 2D profile around a straight axis. Rotation can be circular or angular, around 360º or less.

Because your lathe object is actually a Free Form object, you can edit it in ways that traditional lathing tools do not allow. For example, you can create a symmetrical lathe object, then deform it using the Free Form modeler's other tools.

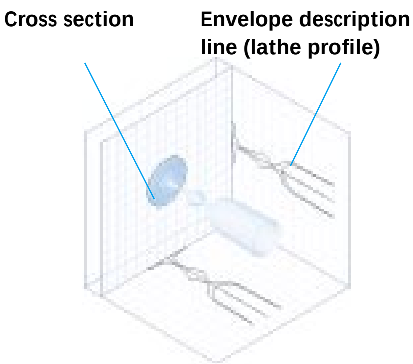
Depending on the specific object you want to create, you can choose from two different lathing methods:

- using the Extrusion envelope
- using a circular sweep path.

Lathing with the Extrusion Envelope

You can create nearly any lathe object by extruding a circle or a regular polygon and using the extrusion envelope to draw the object's lathe profile.

For more on the Extrusion envelope, refer to "Using the Extrusion Envelope" on page 132.



Lathed object using the extrusion envelope.

To create a lathe object with the extrusion envelope:

1. Click a cross section plane.

2. Draw a cross section using the **Ellipse**, **Rectangle**, or **Polygon** tool.

   Draw your circle (or polygon) at an appropriate size for the object you are creating, since the initial diameter of your object depends on the size of the cross section. For example, the size of the first circular cross section determines the diameter of the glass' base.

   Hold down the **Shift** key to create circles or squares.

3. Choose **Sections menu▸ Center** to center the cross section on the sweep path.

4. Choose **Geometry menu▸ Extrusion Method▸ Translation**.

5. Choose **Geometry menu▸ Symmetrical▸ Extrusion Envelope**.

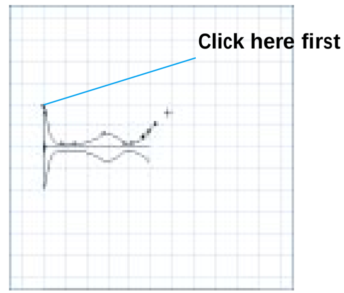
   Do not worry about trying to edit the envelope's description lines—they disappear when you start drawing your own lathe profile.

6. Click one of the sweep path planes to make it the Drawing plane.

7. Click an empty space on the plane, being careful not to select the sweep path or either of the Envelope description lines.

8. Choose **View menu▸ Preset Position▸ Drawing Plane**. This allows you to draw in the plane of the screen.

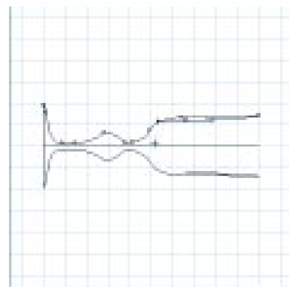
9. Using the **Pen** tool, place the second point of the lathe profile. You may need to drag the **Pen** tool to create a curve point.



As you draw the top portion of the lathe profile, the bottom portion automatically appears.

   Make sure you draw the lathe profile above the sweep path.

10. Continue drawing the lathe profile, placing additional points with the **Pen** tool.



Completed lathe profile.

You can also use the Drawing tools to edit the points you have already placed. For the best results, be careful not to cross over the sweep path as you draw the lathe profile.

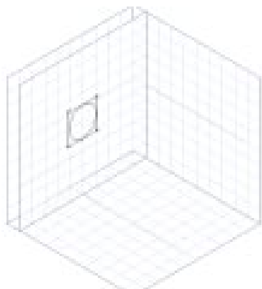
Lathing with a Circular sweep path

Some lathe objects are difficult to create with the scaling envelope. An object with a hole in the center can be particularly difficult. To create these type of objects, you can draw the lathe profile in the Cross section plane and sweep it around a circular sweep path.

The **Torus** extrusion preset, available from the **Geometry** menu, creates a precise circular path.

To create a lathe object using a circular sweep path:

1. Draw your lathe profile in the cross section plane.

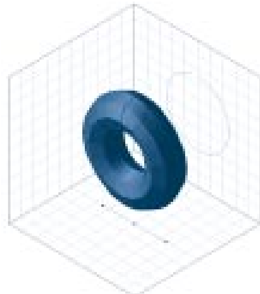


Lathe profile in cross section plane.

2. Choose **Geometry menu▸ Extrusion Preset▸ Torus**. The **Torus** dialog appears.

3. Enter a value in the **Distance to axis** entry box, and click **OK**.

   This value specifies the distance of the cross section from the torus' central axis which is the radius of the object.



Lathed object using Torus preset.

You may need to experiment with the radius of the torus to achieve the effect you want. Simply repeat steps 2 and 3, and enter a different dimension—Ray Dream Studio replaces the old Torus with the new one you have specified.

8

Mesh Form Modeling

Introducing the Mesh Form Modeler

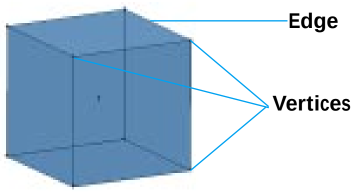
The **Mesh Form** modeler lets you sculpt three-dimensional objects by directly manipulating their surfaces.

When you use the **Mesh Form** modeler, you're not limited to creating objects that can only be modeled as extrusions, you can model objects by directly edit an object's surface.

You can start with a predefined object, such as a sphere or cube, or use the Polymesh modeling tools to generate extrusions, sweeps, lathed objects, and lofted objects. Once you've created an object, you can reshape and refine it by editing the points that define its surface.

Mesh Form Modeling Concepts

Three-dimensional objects can be described as sets of vertices, edges and polygons. A *vertex* defines a position in three-dimensional space and an *edge* is the line that connects two vertices. For example, eight vertices and twelve edges describe a cube. Each face of the cube is a filled polygon.



A Mesh Form object's surface is defined by its vertices.

A *polyline* is a selected set of connected edges. A polyline that forms a closed loop is referred to as a *closed* polyline. A closed polyline is not equivalent to a polygon—a closed polyline might encompass several polygons. However, if you fill a closed polyline that doesn't encompass any other edges or vertices, it becomes a polygon.

A collection of vertices, edges and the polygons that they form is called a *polymesh*. A polymesh can form a closed volume, such as a cube, or an open object resembling a sheet of wire mesh.

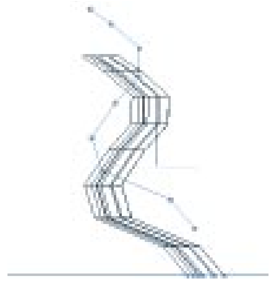
Polymesh modeling is the process of creating three-dimensional objects by directly manipulating vertices, edges and polygons. Instead of modeling all objects as extrusions, you can "sculpt" objects by changing the number and location of their vertices, edges and polygons.

By combining the modeling techniques used in the **Free Form** modeler with the ability to directly edit vertices and edges, the **Mesh Form** modeler makes it easy to create complex models. For example, you can use the **Mesh Form** modeler to create a complex cross section and extrusion path, extrude an object, and then directly edit the object's vertices and edges to refine its appearance.

The following sections explain how extruding, sweeping, lathing and lofting differ in the **Mesh Form** modeler. For an introduction to these modeling concepts, refer to "Free Form Modeling" on page 109.

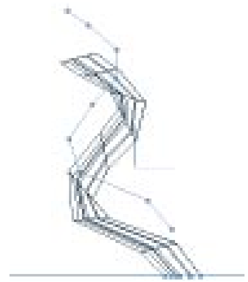
Extruding and Sweeping

When a cross section is *extruded* along a path, its orientation does not change—at every point along the path, the extrusion's cross section is parallel to the original cross section.



When an object is extruded along a path, the cross sections remain parallel to the original cross section.

In contrast, when a cross section is *swept* along a path, its orientation changes so that the cross section of the sweep is always perpendicular to the path..



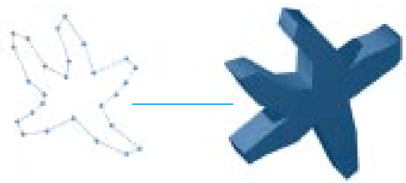
When an object is swept along a path, the cross sections remain perpendicular to the path.

With the **Mesh Form** modeler, you can:

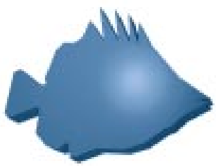
- Extrude and sweep open and closed polylines selected from existing polymesh objects.

- Extrude and sweep 3-dimensional cross sections.
- Specify complex 3D extrusion and sweep paths using polylines.
- Use selected edges of existing polymesh objects as sweep paths.

For more information about creating extrusions and sweeps with the **Mesh Form** modeler, see "Extruding and Sweeping Polygon and Polyline Cross Sections" on page 164.



Extruded polygon cross section.

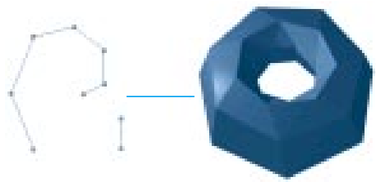


This extruded object was created with the Mesh Form modeler.

Lathing

When you lathe an object with the **Mesh Form** modeler, you specify both the lathe profile and the lathe axis. Unlike the **Free Form** modeler, you do not specify a cross section; all lathed objects created with the **Mesh Form** modeler have circular cross sections.

The **Mesh Form** modeler creates lathed objects by revolving the lathe profile around the specified lathe axis.



Polyline lathe profile and resulting object.

The **Mesh Form** modeler enables you to:

- Define 3-dimensional lathe profiles.
- Use closed polylines as lathe profiles.
- Use any edge in a polymesh object as the lathe axis.

For more information about lathing with the **Mesh Form** modeler, see "Lathing with Polygon and Polyline Profiles" on page 166.

This object was created by rotating a lathe profile around a lathe axis.

Lofting

Lofting, also known as skinning, is the process of stretching a surface over several cross sections to construct a complex object. In the **Mesh Form** modeler, you can easily:

- Create 3-dimensional cross sections.
- Use open and closed polylines selected from existing polymesh objects as cross sections.

The **Mesh Form** modeler performs a straight extrusion from one cross section to the next. Unlike the **Free Form** modeler, the **Mesh Form** modeler only supports one shape or object for each cross section. For more information about lofting with the **Mesh Form** modeler, see "Modeling with Polygon and Polyline Cross Sections" on page 166.

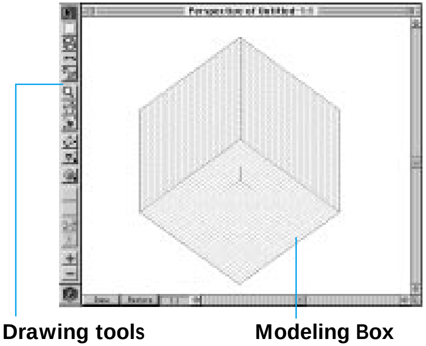
A Loft object is created by stretching a skin over a series of cross sections.

This object was created by lofting several cross sections of different sizes and shapes.

The Mesh Form Modeling Window

You work in the **Mesh Form** modeling window whenever you edit a Polymesh model. You can also open imported models and models created with other modelers in the **Mesh Form** modeler.

When you create a new Mesh Form model by dragging the **Mesh Form Modeling** tool to the scene window, the **Mesh Form** modeling window opens automatically. Your scene's **Perspective** window is temporarily replaced by the **Mesh Form** modeling window, which displays a close-up view of the objects in the model.



The Mesh Form modeling window is used to edit polymesh models.

To create a Mesh Form object:

Drag the **Mesh Form** tool into the **Perspective** or **Time Line** window.

To edit an existing mesh form model:

In the **Scene** window, double-click the model you want to edit.

The model is opened in the **Mesh Form** modeling window.

To use the Mesh Form modeler to edit an imported model or a model created in a different modeler:

1. Select the model you want to edit.
2. Choose **Edit menu▸ Jump In Another Modeler**. The **Choose another Modeler** dialog appears.
3. Select **Mesh Form modeler** from the **Available Modelers** list.
4. Specify the fidelity for the conversion using the **Fidelity** slider.

   The default, 100% divides the object's surface into the recommended number of polygons. A higher percentage generates more polygons, providing more points of control. A lower percentage generates fewer polygons. Regardless of the fidelity of the conversion, some data may be lost and the model altered.
5. Click **OK** to convert the model and open it in the **Mesh Form** modeling window.

When a model is opened in a different modeler than the one it was created in, the model is converted. This conversion can alter the object's appearance.

When the **Mesh Form** modeling window is open, special commands are enabled in the menus and a new set of modeling tools appears in the toolbar, replacing the object creation and camera manipulation tools.

The **Hierarchy** window automatically switches to the **Masters** tab when the **Mesh Form** modeling window is open. Changes you make in the **Mesh Form** modeler affect Master objects, not individual copies of objects. For more information on Master objects, refer to “Working with Master Objects” on page 266.

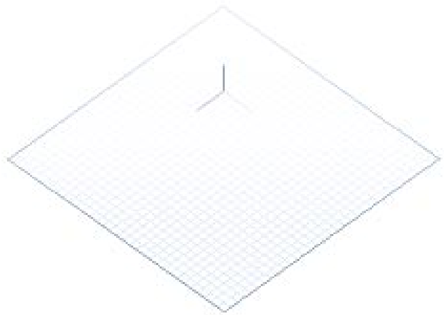
By default, opening the **Mesh Form** modeling window also opens the **Properties** palette. The tabs in the **Properties** palette provide direct access to both object and tool properties, as well as action attributes you can use to alter the effects of certain operations. For example, the **Action Modifier** tab allows you to change the number of sides in a newly created cylinder.

The **Properties** palette is not automatically displayed if the Properties checkbox has been disabled in the **Mesh Form Modeler Preferences** dialog. See “Setting Preferences for the Mesh Form Modeler” on page 141 for more information.

When you’re done editing your model, you can return to the **Scene** window by choosing **File menu▸ Jump Out** or clicking **Done** at the bottom of the **Mesh Form** modeling window. If you want to return to the **Scene** window without preserving your changes, click **Restore**.

Features of the Modeling Window

The **Mesh Form** modeling window contains the mesh form model you’re editing. The window displays the objects in the model, the Drawing plane, and a tri-color axis-indicator.



Mesh Form Drawing plane in default position with orientation axes.

The Drawing Plane

All drawing takes place on the two-dimensional Drawing plane displayed in the **Mesh Form** modeling window. Like the **Free Form** modeling window, the planes of the modeling box can be displayed, but the objects’ profiles are not projected onto the planes. By default, only the Drawing plane is displayed.

A tri-color axis indicator is located in the center of the Drawing plane when you open the **Mesh Form** modeling window. The X axis is displayed in pink, the Y axis is displayed in red, and the Z axis is displayed in blue.

This indicator shows the orientation of the model’s X, Y and Z axes and identifies its origin. All X, Y, Z coordinates for the model are relative to the origin of the axis indicator.

As you move the Drawing plane and the objects in the model, the axis indicator helps you determine the orientation of the objects and your point of view.

If you get confused about which way is up, you can always return to the initial view by choosing **View menu▸ Preset Position▸ Reference**.

Setting Preferences for the Mesh Form Modeler

In the **Mesh Form Modeler Preferences** dialog, you can set preferences for the display of the **Properties** palette, the default welding tolerance, and the grid.

By default, the **Properties** palette is always displayed when the **Mesh Form** modeler is open and Ray Dream Studio automatically switches to the appropriate tab for the current operation. You should normally leave these options enabled—the

Properties palette is integral to the operation of many polymesh modeling features.

The default tolerance value is used when you weld vertices and when vertices are welded as part of a Boolean operation. Vertices are welded if the distance between them is less than or equal to the default tolerance.

By specifying grid settings in the **Mesh Form Modeler Preferences** dialog, you can set up the grid for the **Mesh Form** modeler without affecting the grid settings used for the **Scene** window and other modelers. For more information see "Setting up the Grid" on page 150.

Working in the Mesh Form Modeling Window

The **Mesh Form** modeler lets you freely move the Drawing plane to any plane in the model. When you move the Drawing plane, you often need to change your viewpoint to get a better view of the objects you're working with.

You can use the preset viewing positions in the **View** menu to change your viewpoint, like you can in the **Free Form** modeler.

When you're viewing and editing your model, you'll also frequently want to change between the wireframe editing mode and the preview modes. The **Mesh Form** modeler provides the same preview modes as the **Free Form** modeler.

Changing the Drawing Plane

When editing your model, you can easily move and orient the Drawing plane using the **View** menu and keyboard shortcuts.

To move the Drawing plane to a preset position:

Choose **View menu▸ Send Drawing Plane To▸** and select the position you want: **Left**, **Right**, **Top**, **Bottom**, **Front** or **Back**.

These positions are relative to the Drawing plane's reference position, the position it is in when the **Mesh Form** modeling window is opened.

To align the Drawing plane with a selection:

1. Select the vertex, polygon, or group of vertices with which you want to align the Drawing plane.

2. Choose **View menu▸ Send Drawing Plane To▸ Selection.**

   If the selection is a single vertex, Ray Dream Studio centers the Drawing plane on that vertex without changing the plane's orientation.

   If the selection is a group of vertices or a polygon, Ray Dream Studio moves the Drawing plane to the plane shared by those vertices. If the vertices lie in different planes, the Drawing plane is moved so that the selected points are as near to the Drawing plane as possible.

To move the Drawing plane so that you look directly at it from the current viewpoint:

Choose **View menu▸ Send Drawing Plane To▸ Screen.**

To move the Drawing plane to a particular position:

1. Choose **View menu▸ Send Drawing Plane To▸ Position.** The **Move Drawing Plane** dialog appears.

2. Specify the X, Y, Z coordinates to which you want to move the center of the Drawing plane.

   Ray Dream Studio centers the Drawing plane on that vertex without changing the plane's orientation.

To rotate the Drawing plane:

Choose **View menu▸ Rotate Drawing Plane▸** and select the direction you want to rotate the Drawing plane: **Left**, **Right**, **Front** or **Back**.

The direction of rotation is specified in relation to the current view of the Drawing plane.

To move the Drawing plane back to its original position:

Choose **View menu▸ Reset Drawing Plane**.

The Drawing plane is returned the position it's in when the **Mesh Form** modeling window is opened.

Drawing plane in different positions around an object.

You can also move the Drawing plane by **Command-clicking/Ctrl-clicking** when the **Selection** tool or **Sphere of Attraction** tool is active.

To move the Drawing plane to a polygon:

1. Choose the **Selection** tool, **Sphere of Attraction** tool, **Trackball Rotation** tool or **2D Rotation** tool.
2. **Command-click/Ctrl+click** the polygon to which you want to move the Drawing plane.

   This moves the Drawing plane to the plane that the polygon is on. If the polygon's vertices aren't all on the same plane, the Drawing plane is moved to the plane that best represents the polygon.

To move the Drawing plane to a vertex:

1. Choose the **Selection** tool, **Sphere of Attraction** tool, **Trackball Rotation** tool or **2D Rotation** tool.
2. **Command-click/Ctrl+click** the vertex to which you want to move the Drawing plane.

   Ray Dream Studio centers the Drawing plane on that vertex without changing the plane's orientation. The current selection is not affected.

Changing your Point of View

As you edit your model, you'll frequently change your point of view. For example, when you move the Drawing plane, you often change your viewpoint so you're looking at the Drawing plane. (It can be easier to draw and rotate objects if you're looking directly at the Drawing plane.)

Without changing your point of view to examine an object from all sides, it can be difficult to determine the object's position relative to other objects in the model. When you perform a Boolean operation such as subtraction, this is particularly important—you need to be sure that the objects are actually overlapping for it to work.

To look directly at the Drawing plane:

Choose **View menu▸ Preset Position▸ Drawing Plane** or press **Command-5/ Ctrl+5**.

To move your viewpoint back to where it was when the Mesh Form modeling window was first opened:

Choose **View menu▸ Preset Position▸ Reference** or press **Command-0/Ctrl+0**.

To move your viewpoint to the Top, Bottom, Left, Right, Front or Back:

Choose **View menu▸ Preset Position▸** and select the position you want: **Top**, **Bottom**, **Left**, **Right**, **Front** or **Back**.

You can also move between these preset positions using keyboard shortcuts:

Top: **Command-8/Ctrl+8**
Bottom: **Command-2/Ctrl+2**
Left: **Command-4/Ctrl+4**
Right: **Command-6/Ctrl+6**
Front: **Command-1/Ctrl+1**
Back: **Command-3/Ctrl+3**

To return your viewpoint to the previous position:

Choose **View menu▸ Preset Position▸ Last**.

You can also change your viewpoint with the **Camera Dolly** tool. For more information, refer to “Camera Dolly Tool” on page 146.

Selecting a Preview Mode

By default, the **Mesh Form** modeler displays a Wireframe view of the objects in the model. To view the effects of operations such as emptying a polygon or sharpening edges, you must view the object in one of the preview modes.

To switch preview modes:

Choose **View menu▸** and choose a different preview mode: **Preview**, **Shaded Preview**, **Better Preview**.

Using the Window Controls

Three controls are provided at the bottom of the **Mesh Form** modeling window:

- **Done** returns to the scene window, updating the model with your changes.
- **Restore** returns to the scene window without preserving any modifications to the model.
- **Zoom level** indicates the zoom factor at which the window contents are currently displayed. To change the zoom level, choose a different scale factor from the pop-up.

Working on the Mesh Form Drawing Plane

To create objects with the **Mesh Form** modeler, you use the **Polyline** tool and the Polymesh primitive tools to draw polymeshes, cross-sections, extrusion paths and lathe axes and profiles.

Like the **Free Form** modeler, you always work on a single Drawing plane. However, you can freely move the Drawing plane to any location in the model.

In the **Mesh Form** modeler, all vertices are connected by straight lines. Unlike the **Free Form** modeler, you cannot draw Bézier curves.

This section describes the tools provided in the **Mesh Form** modeler.

Mesh Form Modeler Arranging Tools

The arranging tools provided in the **Mesh Form** modeler are designed to make it easy to manipulate your polymesh objects. In addition to the arranging tools available in the **Scene** window, the **Mesh Form** modeler provides a **Marquee Selection** tool.

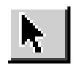
Selection Tool

Use the **Selection** tool to select and move vertices, edges, polygons and entire objects. You can also use the **Selection** tool to select and resize objects. For more information about the **Selection** tool, refer to “The Arranging Tools” on page 224.

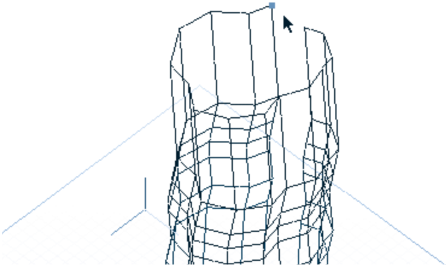
Selected vertices and edges are highlighted in red. When you select an entire object, its bounding box is displayed and all of its edges are highlighted.

To select a vertex or edge:

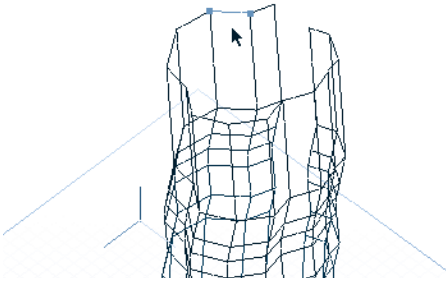
1. Choose the **Selection** tool from within the **Mesh Form** modeler.



2. Click the vertex or edge you want to select.



An object with a selected vertex.

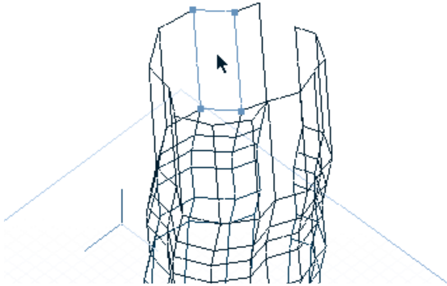


An object with a selected edge.

To select a polygon:

1. Choose the **Selection** tool from within the **Mesh Form** modeler.

2. Click in the middle of the polygon you want to select.



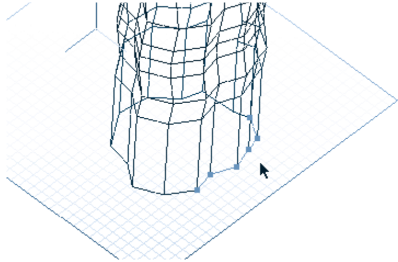
An object with a selected polygon.

To select an edge and all connected edges in the same direction:

1. Choose the **Selection** tool from within the **Mesh Form** modeler.

2. Double-click an edge of the polygon.

   An adjoining edge is considered to lie in the same direction if the angle formed between the selected edge and the adjoining edge is equal to or less than the **Angle of Selection Propagation** specified in the **Properties palette: Tool Options tab**. If the adjoining edge lies in the same direction, it is selected and the angles formed between it and any adjoining edges are evaluated. In this way, the selection propagates until there are no more adjoining edges that meet the selection criteria.



An object with all of the edges in a particular direction selected.

To select a group of objects, edges, and vertices:

1. Choose the **Selection** tool from within the **Mesh Form** modeler.

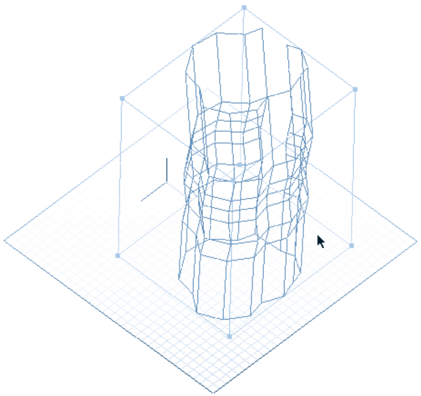
2. Drag until the marquee encloses the objects you want to select. You must begin the drag outside of the object—to select a group of edges and vertices within an object, use the **Marquee Selection** tool.

   To extend a selection, hold down the **Shift** key before selecting additional objects. To remove an object from the selection, hold down the **Shift** key and reselect the object.

To select an entire object:

1. Choose the **Selection** tool from within the **Mesh Form** modeler.

2. Double-click any vertex or polygon in the object or triple-click any edge.



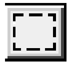
Double-click any vertex or polygon to select an entire object.

Marquee Selection Tool

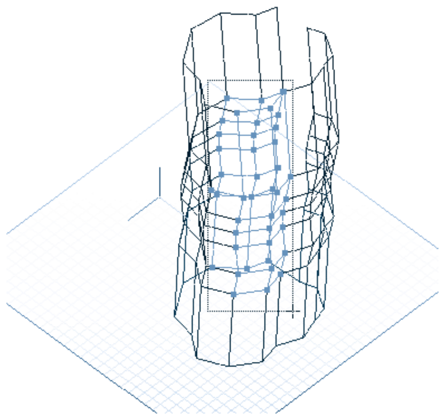
Use the **Marquee Selection** tool to select groups of objects, vertices or edges. You must use the **Marquee Selection** tool if you want to select a group of vertices or edges within an object.

To use the Marquee Selection tool to select a group of objects:

1. Choose the **Marquee Selection** tool from within the **Mesh Form** modeler.



2. Drag until the marquee surrounds the objects, edges and vertices you want to select.

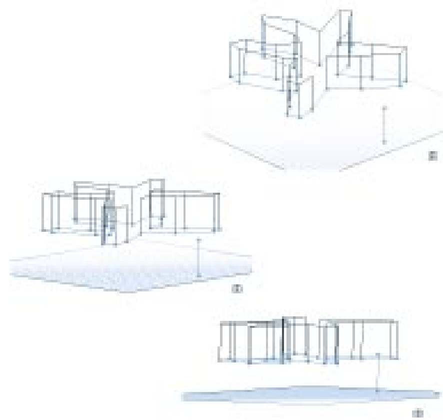


A group of vertices & edges within an object selected.

To extend the selection, hold down the **Shift** key before selecting additional vertices. To remove an object from the selection, hold down the **Option**/**Alt** key and reselect the object.

Camera Dolly Tool

Use the **Camera Dolly** tool to move your viewpoint around the model. This allows you to determine the spatial relationships between objects in the model.



A series of views of an object in the Mesh Form modeling window from different positions set with the Camera Dolly tool.

To change your view point:

1. Choose the **Camera Dolly** tool from within the **Mesh Form** modeler.

2. Drag in the **Mesh Form** modeler until you have the desired view point.

You can also dolly the camera with the numeric keypad: **8** and **2** dolly the viewpoint up and down, **4** and **2** dolly the viewpoint left and right, and **1** and **3** rotate the viewpoint around the Drawing plane axis. In Windows, **Numlock** must be on to dolly the camera with the keypad.

The **View** menu allows you to change your viewpoint to several preset positions. For more information, refer to "Changing the Drawing Plane" on page 142.

Hand Tool

Use the **Hand** tool to adjust your view of the window contents. The **Hand** tool lets you scroll your view up, down, left or right without using the scrollbars. Press the spacebar to temporarily invoke the **Hand** tool when another tool is active.

To use the Hand tool:

1. Choose the **Hand** tool from within the **Mesh Form** modeler.

2. Drag within the **Mesh Form** modeling window to move the window's contents left, right, up, or down.

Zoom Tool

Use the **Zoom** tool to magnify or reduce the window's view. You can also zoom in and out with **Command- +/Ctrl+ +** and **Command- –/Ctrl+ –**. To switch to a particular magnification level, use the **Zoom level** pop-up at the bottom of the **Mesh Form** modeling window.

To use the Zoom tool:

1. Choose the **Zoom** tool from within the **Mesh Form** modeler.

2. Click in the **Mesh Form** modeling window to zoom in.

   Option-click/Alt+click in the **Mesh Form** modeling window to zoom out.

   Drag with the **Zoom** tool to zoom in on a particular item.

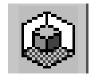
Plane Display Tool

Use the **Plane Display** tool to change the plane display in the **Mesh Form** modeling window.

When you drag an object in the **Mesh Form** modeling window, gray altitude lines show the object's position relative to the visible planes. Because of the potential complexity of **Mesh Form** models, 2D projections of the objects in the model are not displayed on the visible planes.

To use the Plane Display tool:

1. Choose the **Plane Display** tool from within the **Mesh Form** modeler.



2. Click on the representation of the plane you want to show or hide.

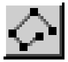
   Option-click/Alt+click on the representation of a plane in the **Plane Display** tool to select it as the Drawing plane.

Mesh Form Modeler Drawing Tools

The **Mesh Form** modeler provides several tools that you can use to create and edit objects in the **Mesh Form** modeling window:

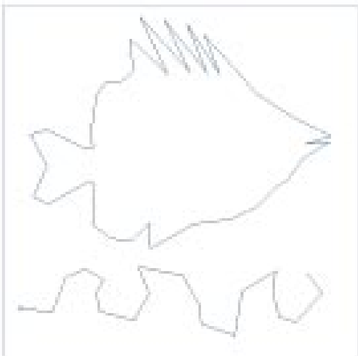
- **Polyline** tool
- **Sphere of Attraction** tool
- **Add Vertex** tool
- **Delete** tool
- **Polymesh Primitive** tool
- **Extrude** tool

- **Sweep** tool
- **Lathe** tool
- **Loft** tool
- **Increase Action Modifier**
- **Decrease Action Modifier**



Polyline Tool

Use the **Polyline** tool to draw two and three-dimensional polylines. The polylines can be open or closed.



A polygon and a polyline drawn with the Polyline tool.

Polylines can be used as cross sections, extrusion and sweep paths, and lathe profiles.

When drawing with the **Polyline** tool, you add one vertex at a time. Edges are automatically drawn between each vertex.

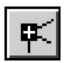
The **Polyline** tool is not a Bézier drawing tool; points in a polyline or polygon are always connected by straight lines.

Sphere of Attraction Tool

Use the **Sphere of Attraction** tool to attract a group of vertices in an object. The **Sphere of Attraction** tool behaves like a magnet, pulling the vertices and edges within its sphere away from their original locations.

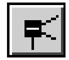
You can set properties for the **Sphere of Attraction** tool on the **Properties palette: Tool Options tab**. The tool options allow you to control:

- The shape of the attraction curve.
- The radius of the sphere of attraction.
- Whether nearby edges and vertices are attracted or only the selected vertices and edges are attracted.



Add Vertex Tool

Use the **Add Vertex** tool to add vertices to existing edges. This is useful when you need more control over the object than is provided with the existing vertices.



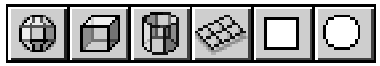
Delete Tool

Use the **Delete** tool to remove vertices and edges from an existing object. You can also use the **Delete** tool to empty a polygon.

Removing a vertex also removes any edges connected to the vertex.

Removing an edge does not affect the vertices that it connected.

Emptying a polygon doesn’t affect the vertices or edges surrounding the polygon. It simply converts the polygon to a closed polyline by removing the polygon face.



Polymesh Primitive Tools

Use the **Polymesh Primitive** tools to quickly create standard objects of any size:

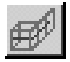
- **Sphere** tool—create a sphere.
- **Cube** tool—create a cube
- **Cylinder** tool—create a cylinder.
- **Mesh** tool—create a 2D array of vertices.
- **Rectangle** tool—create a 2D rectangle.
- **Ellipse** tool—create a 2D ellipse.

You can set properties for the **Sphere**, **Mesh**, **Cylinder** and **Ellipse** tools, on the **Properties palette: Tool Options tab**. These properties affect all subsequent objects created with the tool.

- **Mesh tool options** allows you to specify the number of vertices in new meshes. The number of vertices doesn't affect the size of the mesh.
- **Sphere tool options** allows you to specify the number of polygons in new spheres. A greater number of polygons creates a smoother sphere.
- **Cylinder tool options** allows you to specify the number of sides in new cylinders. The more sides that a cylinder has, the smoother its surface.
- **Ellipse tool options** allows you to specify the number of edges in the ellipse. The more edges an ellipse has, the smoother its circumference.

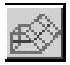
The actual number of polygons or sides in an object might differ from the value you specify in the **Tool Options** or **Action Modifiers** tab. For example, if you specify 59 as the number of polygons in a sphere and create a sphere, that sphere might actually contain 60 polygons. The **Properties palette: Numerical tab** displays the actual values for a particular object.

To change newly created objects, you can edit the options in the **Action Modifiers** tab.



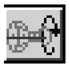
Extrude Tool

Use the **Extrude** tool to create an extrusion from a profile and an extrusion path. For more information, refer to "Extruding and Sweeping" on page 138.



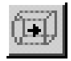
Sweep Tool

Use the **Sweep** tool to create a sweep object from a profile and a sweep path. For more information, refer to "Extruding and Sweeping" on page 138.



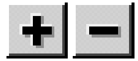
Lathe Tool

Use the **Lathe** tool to create a lathed object from a lathe profile and a lathe axis. For more information, refer to "Lathing" on page 139.



Loft Tool

Use the **Loft** tool to stretch a skin over a group of selected polylines. For more information, refer to "Lofting" on page 139.



Action Modifier Tools

Use the **Action Modifier Increase** and **Decrease** tools to modify the result of the last action. These tools provide a shortcut to the functions provided by the **Properties palette: Action Modifier tab**. They have different effects depending on what the last action was. The **+** and **–** keys have the same effect as the **Action Modifier** tools.

When an object is created with the **Sphere**, **Cylinder**, **Mesh** or **Ellipse** tool, the **Action Modifiers** can be used to smooth or sharpen the object by increasing or decreasing the number of polygons, edges or vertices defining the object.

For example, when you create a cylinder, you can select the **Increase Action Modifier** tool to add more sides to the cylinder. Similarly, you can use the **Decrease Action Modifier** tool to reduce the number of vertices in a newly created mesh.

When you create objects with the **Extrude**, **Sweep**, and **Lathe** commands, the **Action Modifiers** can be used to change which object is used as the cross section or profile.

When you use the **Boolean Operations** command, the operation defaults to the previous operation type (**Union**, **Intersection** or **Subtraction**). You can use the **Action Modifiers** to change operation types.

The **Action Modifiers** can also be used in conjunction with the **Sphere of Attraction** tool: the **Action Modifiers** increase and decrease the radius of the sphere of attraction.

For more information, refer to "Modifying the Last Action" on page 150.

Setting up the Grid

You can use the grid to precisely position objects on the Drawing plane. When **Snap To** is enabled, objects are automatically snapped to the nearest grid intersection when they are dragged. By changing the grid, you can control where objects are snapped.

You can control the grid used in the **Mesh Form** modeler independently of the grid used in the **Perspective** window and other modelers. To set up the grid for the **Mesh Form** modeler, you change the grid options in the **Mesh Form Modeler** preferences.

When you return to the **Perspective** window, the grid settings revert to the settings last specified in the **Grid** dialog.

To make global changes to the grid settings, choose **View menu▸ Grid**. For more information, refer to "Changing Grid Options and Color" on page 226.

To set up the grid for the Mesh Form modeler:

1. Choose **File menu▸ Preferences** or press **Command-Shift-P/Ctrl+Shift+P**. The **Preferences** dialog appears.
2. Choose **Mesh Form Modeler** from the pop-up.
3. In the **Grid Settings**, specify the grid spacing increment and choose a unit from the pop-up.

   The **Spacing** increment is also used for "nudging" (moving an object with an **Arrow** key).
4. Change the **Draw a Line Every** value to control how many grid lines are drawn.

   This value sets the number of increments between grid lines. When set to 1, there is one increment for every grid line and nudging an object moves it to the next grid line.
5. Change the **Number of Steps** to control the size of the grid.

   The size of the grid is the number of steps multiplied by the spacing increment. For example, if you want to multiply the grid frequency by 2, you need to double the number of steps and reduce the spacing increment by half.
6. If you want to hide the grid lines, disable **Show Grid**.

   The grid doesn't have to be displayed for **Snap to Grid** to work.
7. Enable **Snap to Grid** if you want objects to "jump" to the nearest grid increment when you drag them.

Modifying the Last Action

When you're creating new objects or performing complex actions such as **Boolean Operations**, you might not get the results you want on the first try. To make it easier to modify the results, the **Mesh Form** modeler provides a special feature for modifying the last action.

You can use the **Action Modifier** tools to step through changes, or you can enter values directly in the **Properties palette: Action Modifiers tab**. The action modifiers are not available for all operations, but do allow you to change:

- Newly created spheres, cylinders and meshes

- Newly created extrusions, sweeps, and lathed objects.
- Objects modified with the **Sphere of Attraction** tool.
- Objects created with the Boolean operations.

In most cases, the options that you can modify in the **Action Modifier** tab correspond to the Drawing tool's options.

Creating Polymesh Objects

A polymesh object is any polymesh created in the **Mesh Form** modeler, or created with another modeler and opened in the **Mesh Form** modeler.

Instead of just being able to manipulate an object's profile or cross section, you can manipulate any part of a Polymesh object's surface. You have complete control over all of the vertices and edges that describe the object.

This section describes how to create objects by drawing with the **Polyline** tool, using the **Polymesh Primitive** tools, and duplicating existing objects. For information about editing Polymesh objects, refer to "Working with Selections" on page 153, "Working with Vertices" on page 154, "Working with Polymesh Objects" on page 156 and "Transforming Polymesh Objects and Selections" on page 161.

To create more complex objects, you can generate extrusions, sweeps, lathed objects lofted objects in the **Mesh Form** modeler. For more information, refer to "Using Standard Modeling Techniques to Create Complex Polymesh Objects" on page 164. The **Mesh Form** modeler also allows you to generate complex objects by performing Boolean operations on existing objects. For more information. refer to "Using Boolean Operations to Create Complex Polymesh Objects" on page 167.

Drawing with the Polyline Tool

With the **Polyline** tool, you can draw open and closed polylines. The cursor changes to indicate when you have completed a polyline by closing it or clicking twice on its end point.

To draw an open polyline:

1. Choose the **Polyline** tool from within the **Mesh Form** modeler.
2. Click in the **Mesh Form** modeling window to add each vertex in the polyline.

   Vertices are added to the current Drawing plane. Hold down the **Option**/**Alt** key to draw vertices perpendicular to the Drawing plane.

   Edges are automatically drawn to connect the vertices. To constrain the polyline to 45° angles, hold down the **Shift** key.
3. Click the last vertex again to finish the polyline.

To draw a closed polyline:

1. Select the **Polyline** tool from within the **Mesh Form** modeler.
2. Click in the **Mesh Form** modeling window to add each vertex in the polyline.
3. Close the polyline by clicking again on the first vertex.

To create polygons, you can fill closed polylines. For more information, refer to "Creating and Filling Holes in an Object" on page 158.

Drawing with the Polymesh Primitive Tools

You can use the **Polymesh Primitive** tools to create an object that you can "sculpt" with the editing tools. The cube, sphere, or cylinder is like a block of clay that you can reshape into a finished object.

To draw an object:

1. Choose the **Sphere**, **Cube**, **Mesh**, **Rectangle** or **Ellipse** tool from within the **Mesh Form** modeler.

   These tools all share the same space on the toolbar and are considered **Polymesh Primitive** tools.

2. Click the Drawing plane to add the object. You can drag to create an object of a particular size.

   Hold down the **Shift** key to constrain a new mesh or rectangle to a square, or to constrain a new ellipse to a circle.

Duplicating Polymesh Objects

You can duplicate an object with the **Edit** menu commands **Duplicate** and **Duplicate with Symmetry**.

When you choose **Duplicate**, a second copy of the object is created at the same location as the original.

When you choose **Duplicate with Symmetry**, the copy created mirrors the original object. In the **Mesh Form** modeler, the Drawing plane is used as the mirror plane. This allows you to control where the mirrored object is placed by moving the Drawing plane in relationship to the object you're duplicating.

To duplicate an object:

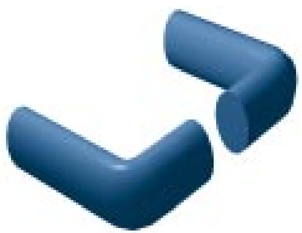
1. Select the object you want to duplicate.
2. Choose **Edit menu▸ Duplicate** or press **Command-D/Ctrl+D**.

To duplicate an object with symmetry:

1. Adjust the Drawing plane so that when used as the mirror plane, it will reflect the appropriate image.

   For example, if you have modeled the fuselage of an airplane and one wing, you can duplicate the wing and place it in the correct location if you move the drawing place so that it bisects the fuselage vertically.

2. Select the object you want to mirror.
3. Choose **Edit menu▸ Duplicate with Symmetry** or press **Command-Option-D/ Ctrl+Alt+D**.



Objects can be duplicated with symmetry.

For more information about **Duplicate** and **Duplicate with Symmetry**, refer to "Duplicating Objects" on page 247.

Specifying Object Properties

The **Properties palette: Numerical tab** displays the properties of the selected object, vertices, edge or polygon.

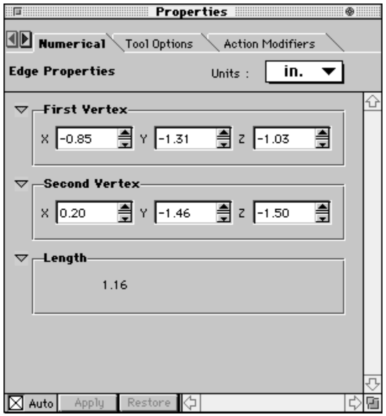
You can use the **Numerical** tab to:

- Move selected vertices to particular X, Y, Z coordinates.
- Move selected objects to particular X, Y, Z coordinates.

When one vertex is selected, the **Numerical** tab displays the X, Y and Z coordinates of the vertex.

When two discontinuous vertices are selected, the **Numerical** tab displays the distance between the vertices and the vertices' X, Y and Z coordinates.

When an edge is selected, the **Numerical** tab displays the length of the edge and the X, Y and Z coordinates of the edge's vertices. In addition, the tab displays a set of radio buttons that indicates the edge's current smooth setting. **Smooth** indicates that the Smooth command has been applied to the edge, **Automatic** indicates that the smooth setting is calculated from the crease angle, and **Sharp** indicates that the **Sharpen** command has been applied to the edge.



Properties palette with Numerical tab visible and an edge selected.

When a polygon is selected, the **Numerical** tab displays the coordinates of the polygon's center and the number of vertices in the polygon.

When one polymesh object is selected, the **Numerical** tab displays the number of vertices and edges in the object; the number of polygons or sides in the object, and the current crease angle.

When multiple objects are selected, the **Numerical** tab displays the number of selected vertices, edges, polygons and polymeshes.

To specify object properties in the Numerical Properties tab:

1. Select the object whose properties you want to change.
2. Choose **Properties palette: Numerical** tab.
3. Directly edit the displayed values.

   By default, all values are specified in inches. To change units, select the units pop-up and choose **ft**, **cm**, **m**, **mm**, or **pts**.
4. Click **Apply**.

   If **Auto** is enabled, the changes are applied automatically.

Working with Selections

To make it easier to work with complex polymesh objects, the **Mesh Form** modeler allows you to save and restore , invert , and hide selections.

Saving and Restoring Selections

When you're working with complex objects, it's often convenient to save selections of groups of objects so that you can easily reselect them.

You can only have one saved selection at a time.

To save the current selection:

Choose **Selection menu▸ Save Selection**.

To restore the saved selection:

Choose **Selection menu▸ Restore Selection**.

Inverting the Current Selection

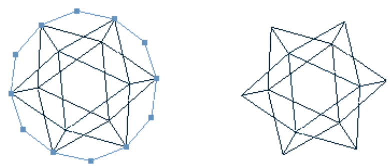
Inverting the selection selects only those items that are not part of the current selection.

To invert the current selection:

Choose **Selection menu▸ Invert**.

Hiding Selections

When you're editing a complex object, you might want to hide parts of the object to make it easier to view and select the vertices and edges you want to work with.



Selected vertices hidden using the Hide Selection command.

To hide a selection:

1. Select the vertices and edges you want to hide.

2. Choose **View menu▸ Hide Selection**.

To reveal hidden vertices in an object:

1. Select the object.

2. Choose **View menu▸ Reveal Vertices**.

Working with Vertices

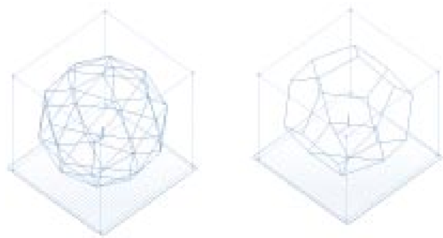
The real power of the **Mesh Form** modeler lies in the fact that you can directly edit polymesh objects. By moving vertices and edges, adding vertices, removing selected vertices and edges, and joining separate objects, you can model just about anything you can imagine.

Adding and Removing Vertices

Adding a vertex provides you with another point that you can manipulate to modify the object.

You can add and remove individual vertices with the **Add** and **Remove Vertex** tools. You can also remove selected items, including vertices, by pressing the **Delete/ Backspace** key.

Removing a vertex also removes any edges connected to that vertex.



Vertices removed using the Decimate command.

To add a vertex:

1. Select the **Add Vertex** tool from within the **Mesh Form** modeler.

2. Click an edge where you want to add the vertex. The new vertex is highlighted in red.

   You can drag with the **Add Vertex** tool to add and immediately move a new vertex.

To remove a vertex:

1. Select the **Delete** tool from within the **Mesh Form** modeler.

2. Click the vertex you want to remove. Removing a vertex also removes the edges that connected the vertex to other vertices.

Selected vertices can be removed with the **Delete/Backspace** key and the **Edit menu▸ Delete command**.

You can also remove edges with the **Remove Vertex** tool. Deleting an edge does not affect the vertices.The result is the same as selecting the edge and choosing **Selection menu▸ Unlink**.

Linking and Unlinking Vertices

You can close or extend a polyline by linking two vertices. Linking vertices creates an edge between them. Unlinking vertices removes the edge that connects them, but does not affect the vertices themselves.

Closing a polyline does not turn it into a polygon. If you want to create a polygon from a closed polyline, select it and choose **Selection menu▸ Fill Polygon**.

To link vertices:

1. Select the vertices you want to link.

2. Choose **Selection menu▸ Link**.

An edge is created to connect the vertices. If the two vertices are part of the same polygon, the polygon is divided into two smaller polygons.

To unlink vertices:

1. Select the vertices you want to unlink.
2. Choose **Selection menu▸ Unlink**.

   The edge connecting the two vertices is removed. You can also unlink two vertices by clicking the edge with the **Delete** tool.

Moving Vertices and Edges

The power of polymesh modeling lies in the ability to change an object by directly positioning its vertices and edges.

You can use the **Object Selection** tool to drag any selection to a new location. For example, you can move a polygon by clicking in its center and dragging it.

When you drag a selection in the **Mesh Form** modeling window, the selection is moved in relationship to the current Drawing plane. Gray altitude lines show the object's position relative to the visible planes.

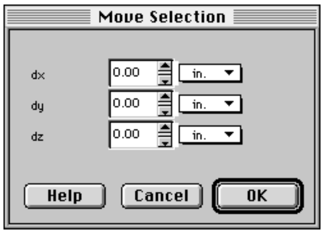
Repositioning Vertices

In the **Mesh Form** modeler, you can precisely reposition vertices by:

- Offsetting a vertex from its current location with the **Move** command.
- Changing the coordinates of a vertex with the **Properties palette: Numerical tab**.

To move vertices numerically:

1. Select the vertex or vertices you want to move.
2. Choose **Selection menu▸ Move**. The **Move** dialog appears.



Use the Move dialog to move vertices numerically.

3. Enter the amounts you want to move the vertices in the X, Y and Z directions and click **OK**.

To move a vertex to an exact location:

1. Select the vertex you want to move.
2. Choose **Properties palette: Numerical** tab.
3. Specify the X, Y, Z coordinate for the vertex and click **Apply**.

   If **Auto** is enabled in the **Properties** palette, the changes are automatically applied.

Moving Vertices with the Sphere of Attraction Tool

You can selectively move vertices in an object with the **Sphere of Attraction** tool. This tool behaves like a magnet, attracting the vertices within its sphere of influence.

The **Properties palette: Tool Options tab** allows you to change the shape of the attraction curve, adjust the radius of the tool's sphere of influence, and specify an attraction mode.

You can set the attraction curve to one of four profiles: **Cubic spline**, **Linear**, **Spiky** or **Bumpy**.

There are two attraction modes:

- Move selection, attract other vertices. Selected vertices are moved like they would be with the **Selection** tool, other vertices within the sphere of attraction are moved towards the location of the selected vertices.

- Attract only selected vertices. Selected vertices are attracted with the **Sphere of Attraction** tool, other vertices are not affected.

To move a group of vertices:

1. Choose the **Sphere of Attraction** tool from within the **Mesh Form** modeler.

2. In the **Properties palette: Tool Options tab**, select an attraction curve: **Cubic spline**, **Linear**, **Spiky** or **Bumpy**.

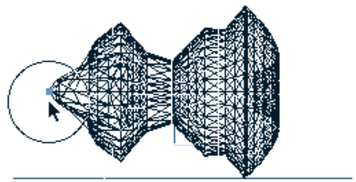
3. Specify the radius of the sphere of attraction.

4. Select an attraction mode by enabling **Move selection**, **attract other vertices** or **Attract only selected vertices**.

5. With the **Sphere of Attraction** tool, select the vertices you want to move or attract.

6. Drag the **Sphere of Attraction** tool in the direction you want to move the vertices.

   To constrain the move operation to the direction perpendicular to the Drawing plane, hold down the **Option**/**Alt** key.

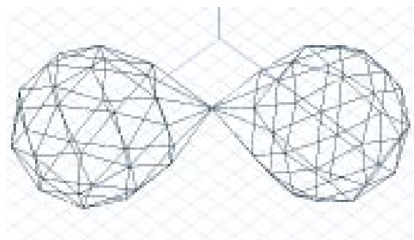


Deforming an object with the sphere of attraction tool.

Welding Vertices

You can join separate objects by welding the vertices where they meet.

Normally, if two vertices are within a specified distance from each other, they are welded when you use the **Weld** command. However, if welding the vertices would cause a single edge to be shared by more than two polygons, the vertices are not joined.



Two objects to join by welding vertices.

To weld vertices:

1. Select the vertices to be welded.

2. Choose **Selection menu▸ Weld**. The **Weld** dialog appears.

3. Indicate how close the vertices must be to be welded and click **OK**.

   Use Default Tolerance welds the vertices if the distance between them is within the default tolerance specified in the **Mesh Form Modeler** preferences.

   Use Custom Tolerance allows you to specify the maximum distance vertices can be from each other and still be welded.

   Weld every selected vertex welds the selected vertices no matter how far apart they are.

   Welded vertices are joined into a single vertex.

Working with Polymesh Objects

The **Mesh Form** modeler provides a number of ways to manipulate an object's surface without directly editing individual vertices and edges. This section describes how you can:

- Adjust the position of vertices, edges, and polygons to align two objects.
- Add depth to an object's surface to give it a visible shell.
- Create and fill holes in an object's surface.

- Smooth or sharpen an object's surface.
- Increase the number of polygons that describe an object's surface, giving you more control over its shape and appearance.

Aligning Polymesh Objects

You can adjust the alignment of two objects by aligning part of one object with part of another. Using the **Adjust** command, you can align vertices, edges, or polygons. For example, you could use **Adjust** to snap a lid on a can by selecting one vertex on the lid and the corresponding vertex on the can.

To align a vertex in one object with the vertex in another:

1. Select the two vertices you want to align.
2. Choose **Polymesh menu ▸ Adjust**. The **Adjust** dialog appears.
3. Specify which vertex is the anchor, the one that should remain in its current position.

   In the **Mesh Form** modeling window, the vertex highlighted in blue is the anchor. Click one of the blue anchor arrows in the **Adjust** dialog to select the other vertex as the anchor.
4. When you've selected the anchor, click **OK** to align the vertices.

To align an edge in one object with the edge in another:

1. Select the two edges you want to align.
2. Choose **Polymesh menu ▸ Adjust**. The **Adjust** dialog appears.
3. Use the blue Anchor arrows to specify which edge is the anchor, the one that should remain in its current position.

   In the **Mesh Form** modeling window, the edge highlighted in blue is the anchor. To select the other edge as the anchor, click one of the blue anchor arrows.
4. When you've selected the anchor, click **OK** to align the edges.

   The edge specified as the anchor isn't moved. The other edge is aligned and centered along the anchor edge.

To align a polygon in one object with the polygon in another:

1. Select the two polygons you want to align.
2. Choose **Polymesh menu ▸ Adjust**. The **Adjust** dialog appears.
3. Use the blue Anchor arrows to specify which polygon is the anchor, the one that should remain in its current position.

   In the **Mesh Form** modeling window, the polygon highlighted in blue is the anchor. To select the other polygon as the anchor, click one of the blue anchor arrows.
4. When you've selected the anchor, click **OK** to align the polygons.

   The polygon specified as the anchor isn't moved. The other polygon is centered with the anchor polygon.

Adding Thickness to an Object

To add thickness to an object, you can perform a straight extrusion on all or part of its surface. To make this easy, the **Mesh Form** modeler provides an **Add Thickness** command.

When you use this command, a straight extrusion with the specified depth is performed on each polygon in the selection.

Object with added thickness.

To add thickness to an object:

1. Select the part of the object to which you want to add thickness.
2. Choose **Selection menu▸ Add Thickness**. The **Add Thickness** dialog appears.
3. Specify how thick you want the surface to be and then click **OK**.

Creating and Filling Holes in an Object

Polymesh objects do not have to be completely solid. You can cut holes in an object by emptying polygons on the object's surface.

You can also cut away parts of an object by using the **Boolean Subtraction** operation. For more information see "Using Boolean Operations to Create Complex Polymesh Objects" on page 167.

Emptying a polygon to create a hole in an object.

To create a hole in an object:

1. Select the polygons you want to remove to create the hole.
2. Choose **Selection menu▸ Empty Polygon**.

   You can also empty polygons with the **Delete** tool.

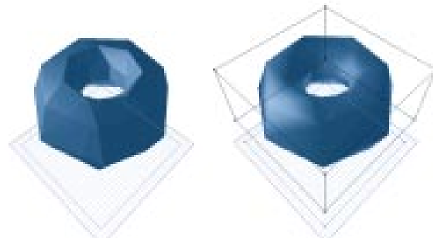
Filled and empty polygons appear the same in the **Wireframe** view. To view the hole, switch to one of the preview modes: **Preview**, **Preview Shaded**, or **Better Preview**.

To fill a hole in an object:

1. Select the closed polyline that you want to fill.
2. Choose **Selection menu▸ Fill Polygon**.

Smoothing and Sharpening Edges in an Object

When an object such as a sphere is rendered, the individual polygons are shaded to appear smooth. In some cases, you do not want smooth shading from one polygon to the next—the edge shared by the polygons might represent a crease in the object's surface.



Sharpened and smoothed edges of an object.

The **Mesh Form** modeler provides two different ways to smooth or sharpen edges on an object's surface:

- Smoothing or sharpening selected parts of an object with the **Smooth** and **Sharpen** commands.
- Smoothing or sharpening an entire object by increasing or decreasing its crease angle.

Setting the crease angle allows you to control smoothing and sharpening for an entire object. Polygons on the object's surface that meet at an angle less than the crease angle, are shaded smoothly. Edges where polygons meet at an angle greater than the crease angle, are rendered as creases in the object's surface.

To adjust the crease angle:

1. Select the object.
2. Choose **Polymesh menu▸ Set Crease Angle**. The **Crease Angle** dialog appears.
3. Enter a value in degrees for the crease **Angle**.
4. Enable the **Override edge settings** checkbox to override the effects of the **Smooth Edges** and **Sharpen Edges** commands.
5. Click **OK** to set the crease angle.

You can view the results in one of the preview modes.

To smooth edges in an object:

1. Select the edges you want to smooth.
2. Choose **Polymesh menu▸ Smooth Edges**.

You can view the results in one of the preview modes.

To sharpen edges in an object:

1. Select the edges you want to sharpen.
2. Choose **Polymesh menu▸ Sharpen Edges**.

You can view the results in one of the preview modes.

To determine an edge's smooth state:

Select the edge and check the **Properties palette: Numerical tab**.

Controlling the Number of Vertices and Edges Used to Describe an Object

The **Mesh Form** modeler provides three commands that allow you to change the number of vertices and edges used to describe an object: **Triangulate**, **Subdivide**, and **Decimate**.

When a polygon is triangulated, edges are added to divide the polygon into smaller, triangular polygons.Triangulating a polygon doesn't affect the number of vertices in the polygon. When a polygon is subdivided, it's triangulated and then vertices are added to divide each triangle into four smaller triangles. Triangulating a three-sided polygon has no effect, but you can subdivide a triangle.

Decimating an object reduces the number of vertices and edges in the object.

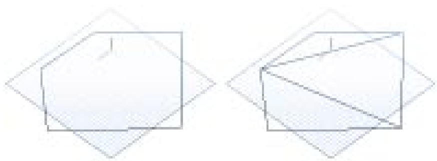
You can triangulate, subdivide, or decimate an entire object or just selected portions of the object.

An object with added vertices using the Subdivide command.

Triangulating an Object

When you edit an object, you might create some large, odd-shaped polygons. When rendered, these polygons can make the object look blocky. To create more natural looking transitions across the surface of the object, you can use triangulate to add edges that you can adjust to create a smoother shape.

Triangulate can also be used in conjunction with the **Decimate** command to produce more satisfactory results.



An odd-shaped polygon triangulated.

To triangulate selected polygons:

1. Select the polygons you want to triangulate.
2. Choose **Selection menu▸ Triangulate Polygon**.

Subdividing an Object

Subdividing an object adds vertices and edges to give you finer-grain control over an object's surface.

To subdivide selected polygons:

1. Select the polygons you want to subdivide.
2. Choose **Selection menu▸ Subdivide**.

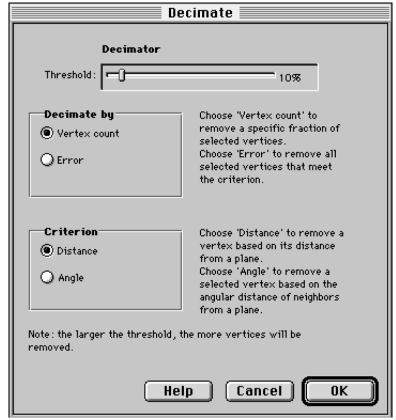
Decimating an Object

Decimating an object is an easy way to simplify imported models that contain more detail than you need. In some situations, though, decimating an object is counter-productive—you often want more control over an object's surface, not less.

To get the best results when you're decimating an object, you might want to alternate decimating the object and triangulating the object. For information about triangulating, refer to "Triangulating an Object" on page 160.

To decimate an object:

1. Select the object or portion of an object that you want to decimate.
2. Select **Selection menu▸ Decimate**. The **Decimate** dialog appears.



Use the Decimate dialog to decrease the number of vertices in your object.

3. Adjust the **Threshold** slider to specify the percentage of vertices to be removed.

   The higher the threshold, the more vertices will be removed.
4. Select the decimate technique to be used by enabling either **Vertex count** or **Decimate**.

   Vertex count removes the percentage of vertices specified in the **Threshold** slider.

Decimate removes the vertices that meet the decimate criteria, up to the threshold percentage.

5. Select the decimate criteria by enabling either **Distance** or **Angle**.

   Distance causes vertices to be removed based on their distance from the planes shared by their neighbors.

   Angle causes vertices to be removed based on the angles formed by the polygons connecting the vertices to their neighbors.

6. Click **OK** when you've finished specifying the **Decimate** options.

Transforming Polymesh Objects and Selections

The **Mesh Form** modeler provides a number of ways to move, scale and rotate polymesh objects or parts of polymesh objects.

You can transform them interactively using the **Selection** , **Trackball Rotation** or **2D Rotation** tools. You can also transform them numerically using **Selection menu▸Rotate**, **Resize**, or **Move**.

For 3-dimensional objects, you can specify exact dimensions using the **Resize** command. Similarly, you can specify the exact location of a vertex by editing its coordinates on the **Properties palette: Numerical tab**.

Moving an Object or Selection

You can move any selection simply by dragging it to a new location. For more precise positioning, use the **Move** command or the **Properties palette: Numerical tab**.

You can also use the Arrow keys to nudge objects.

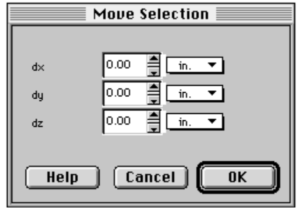
If you hold down the **Option**/**Alt** key, the object moves perpendicular to the Drawing plane when it's dragged or nudged. For more information, refer to "Positioning Objects" on page 234.

The **Mesh Form** modeler also allows you to offset selected polygons from an object's surface.

To move an object or selection numerically:

1. Select the object or portion of an object that you want to move.

2. Choose **Selection menu▸ Move**. The **Move** dialog appears.



Use the Move dialog to move an object or sections to a specific position in the Modeling window.

3. Specify the amounts you want to move the object in the X, Y and Z directions and click **OK**.

   Positive values increase the selection's distance from the origin; negative values move the selection closer to its origin. (The axis indicator identifies the origin for the model.)

   By default, the values are specified in inches. Use the units pop-up to select a different unit of measure.

To offset the surface of an object:

1. Select the polygons that you want to offset from the object.

2. Choose **Selection menu▸ Offset**. The **Offset** dialog appears.

3. Specify the amount you want to move the selected polygons.

   The surface is expanded like a balloon. Each selected polygon is moved outward, perpendicular to the plane defined by the polygon.

Flattening Selections

In some cases, you might want to move the vertices in a polygon, edge, or other selection to the same plane. This is called *flattening* the selection. The plane that the vertices are flattened to depends on the locations of the selected vertices.

To flatten a group of vertices, edges and polygons:

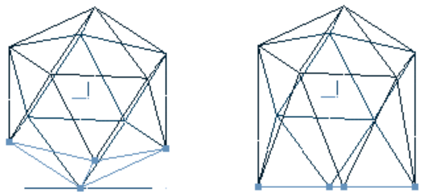
1. Select the objects you want to flatten.
2. Choose **Selection menu▸ Flatten**.

Moving Selections to the Drawing Plane

Instead of flattening selected vertices to an arbitrary plane, you might want to move them to all to the Drawing plane.

To move a group of vertices, edges or polygons to the Drawing plane:

1. Select the objects you want to move to the Drawing plane.
2. Choose **Selection menu▸ Move to Drawing Plane**.



Selected vertices sent to the Drawing plane.

Scaling an Object or Selection

You can drag the corner of an object's bounding box to scale it, scale the current selection by specifying X,Y,Z scale factors with the **Resize** command, or change an object's size by specifying new X,Y,Z dimensions with the **Set Size** command.

To scale an object:

1. Select the polymesh you want to scale.
2. With the **Selection** tool, drag one of the object's bounding box corners. Drag away from the object's center to enlarge it; drag towards the object's center to reduce it.

   To scale the object around its center, hold down the **Command/Ctrl** key. To constrain the scale operation to equal proportions, hold down the **Shift** key. To constrain the scale operation to a direction perpendicular to the Drawing plane hold down the **Option/Alt** key.

Scaling an object by dragging a corner of its bounding box.

To scale an object or selection numerically:

1. Select the object or portion of an object that you want to scale.
2. Choose **Selection menu▸ Resize**. The **Resize** dialog appears.

Use the Resize dialog to scale an object or selection numerically.

3. Enter the X, Y and Z scale factors and click **OK**.

   The scale factors are specified in percentages. For example, to reduce an object to half its original size in all dimensions, specify X, Y and Z scale factors of 50%.

To set the size of an object:

1. Select the object whose size you want to set.

   You can only set the size of 3-dimensional objects. To resize objects whose vertices all lie on the same plane, use the **Resize** command.

2. Choose **Polymesh menu▸ Set Size**. The **Set Polymesh Size** dialog appears.

3. Enter the new X, Y, and Z dimensions for the object and click **OK**.

   The object is resized so that its bounding box matches the dimensions you specify.

Rotating an Object or Selection

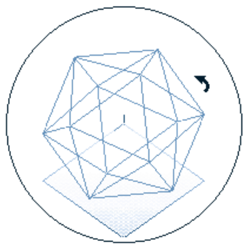
You can rotate an object freely in three dimensions, or in relationship to the Drawing plane. With the **Rotate** command, you can rotate an object a specific amount around the X, Y, or Z axis.

To free rotate an object in three dimensions:

1. Choose the **Trackball Rotation** tool from within the **Mesh Form** modeler.

2. Drag to rotate the object to a new orientation.

   The cursor must be over the object you want to rotate when you begin dragging. You can **Shift-click** other objects to rotate them at the same time.



Rotating an object with the Trackball Rotation tool.

To free rotate an object relative to the Drawing plane:

1. Choose **View menu▸ Preset Position▸ Drawing Plane**.

   Objects are rotated with respect to the current Drawing plane. It is easier to observe the effect of the rotation if you are looking directly at the Drawing plane.

2. Choose the **2D Rotation** tool from within the **Mesh Form** modeler.

3. Drag to rotate the object to a new orientation.

   The cursor must be over the object you want to rotate when you begin dragging. You can **Shift-click** other objects to rotate them at the same time. To constrain the rotation to 45° increments, hold down the **Shift** key while you drag.

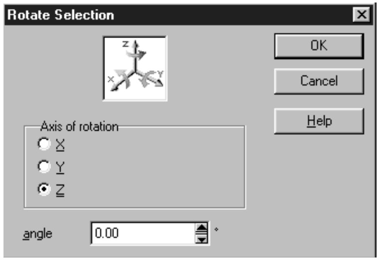
To rotate an object or selection numerically:

1. Select the object or portion of an object that you want to rotate.

2. Choose **Selection menu▸ Rotate**. The **Rotate Selection** dialog appears.

3. Select the axis of rotation.

The rotation is constrained to one axis of rotation.



Use the Rotate dialog to rotate an object or selection rotate using a specific axis and angle.

4. Specify the angle of rotation and click **OK**.

   The angle of rotation is specified in degrees. Positive values rotate the object clockwise around the axis of rotation (looking away from the origin), negative values rotate the object counterclockwise.

Using Standard Modeling Techniques to Create Complex Polymesh Objects

You can use the standard modeling techniques introduced with the **Free Form** modeler to create complex objects in the **Mesh Form** modeler. The **Mesh Form** modeler supports:

- Extrusions
- Sweeps
- Lathed objects
- Lofted objects

For general information about these techniques, refer to "Free Form Modeling" on page 109.

You should use the **Mesh Form** modeler to create these types of objects when you want to:

- Edit the surface of the resulting object.
- Create extrusions or sweeps with 3-dimensional cross sections or sweep paths.
- Use the resulting object to perform Boolean operations.

If the object you are modeling is easier to describe using Bézier curves, you can create the object in the **Free Form** modeler and then edit it in the **Mesh Form** modeler.

For more information about editing Free Form models in the **Mesh Form** modeler, refer to "Working in the Mesh Form Modeling Window" on page 142.

This section describes how to use the **Mesh Form** modeler to create extrusions, sweeps, lathed objects and lofted objects.

You cannot extrude, sweep, loft, or lathe polygons with the **Mesh Form** modeler. If you want to use a polygon in an existing polymesh object as a cross section, convert the polygon to a closed polyline by emptying it.

Extruding and Sweeping Polygon and Polyline Cross Sections

Extruding or sweeping a polygon creates an object similar to that created with the **Free Form** modeler. You can use an open or closed polyline to define the cross section of an extrusion or sweep. Using an open polyline as a cross section creates a shell with the shape of the polyline.

The cross section can be a separate polyline object, or a set of selected edges in a larger object.

The extrusion or sweep path is also defined by a polyline. The vertices of the extrusion path do not need to lie in the same plane, allowing you to easily define complex, three-dimensional extrusion paths.

Like cross sections, the extrusion path can be defined by a separate polyline object or a set of selected edges in a larger object.

When a cross section is extruded, the orientation of the cross section remains constant along the extrusion path. When a cross section is swept along a path, the orientation of the cross section changes so that it always remains perpendicular to the path.

The same cross section extruded and swept.

To create a straight extrusion:

1. Create a cross section using the **Polyline** tool or select an existing polyline to use as the cross section.
2. With the cross section selected, choose **Selection menu▸ Extrude**. The **Extrude Options** dialog appears.
3. Specify the depth of the straight extrusion and click **OK**.

To create a complex extrusion:

1. Create a cross section using the **Polyline** tool or select an existing polyline to use as the cross section.
2. Draw the extrusion path with the **Polyline** tool or select an existing polyline to use as the path.
3. Select the cross section and extrusion path.
4. Choose **Selection menu▸ Extrude**.
5. Use the blue arrows in the **Properties palette: Action Modifier tab** to change which selection is used as the extrusion path.

   In the **Mesh Form** modeling window, the object selected as the extrusion path is highlighted in blue and the cross section is highlighted in red. The starting vertex in the extrusion path is also highlighted in blue.

   To change the object selected as the extrusion path, click one of the double arrows. To change the starting point on the selected extrusion path, use the single arrows.
6. When the extrusion path is set, click **Apply** to generate the extrusion.

   If **Auto** is enabled in the **Properties** palette, the changes are automatically applied.

To create a sweep:

1. Create a cross section using the **Polyline** tool or select an existing polyline or polygon to use as the cross section.
2. Draw the sweep path with the **Polyline** tool or select an existing polyline to use as the path.
3. Select the polygon and the polyline.
4. Choose **Selection menu▸ Sweep**.
5. Use the blue arrows in the **Properties palette: Action Modifier tab** to set the extrusion path.

   In the **Mesh Form** modeling window, the object selected as the sweep path is highlighted in blue and the cross section is highlighted in red. The starting vertex in the sweep path is also highlighted in blue.

   To change the object selected as the sweep path, click one of the double arrows. To change the starting point on the selected path, use the single arrows.

6. When the sweep path is set, click **Apply** to generate the extrusion.

   If **Auto** is enabled in the **Properties** palette, changes are automatically applied.

Modeling with Polygon and Polyline Cross Sections

Lofting enables you to stretch a surface over a series of cross sections. In the **Mesh Form** modeler, these cross sections can be defined by open or closed polylines.

Like the cross sections used for extrusions and sweeps, these cross sections can be separate polyline objects or selected edges in a larger object.

You can define as many cross sections as you need, but all of the cross sections for a single lofted object must be either open polylines or closed polylines, you cannot mix them. To be lofted, the cross sections must lie on different planes.

In certain situations, not all of the cross sections you define are used. This might happen if two of the cross sections lie very close to the same plane—one of them is used and the other ignored.

Two polylines and the object that results when they're lofted.

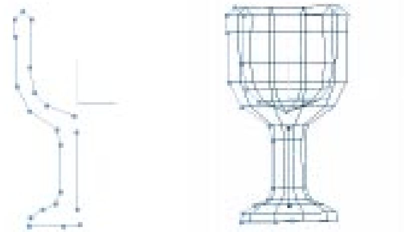
To loft an object:

1. Create the cross sections with the **Polyline** tool or choose existing polylines to use as cross sections.
2. Select the cross sections.
3. Choose **Selection menu▸ Loft**.

Lathing with Polygon and Polyline Profiles

When you lathe objects in the **Mesh Form** modeler, you control both the lathe profile and the lathe axis. The lathed object is created by revolving the profile around the specified axis. The lathe profile is always rotated a full 360 degrees around the axis.

Both polylines and polygons can be used as lathe profiles. The lathe axis can by defined by any edge.



A polyline lathe profile and the object that results from Lathing.

To lathe an object:

1. Create the lathe profile with the **Polyline** tool, or select a set of connected edges to use as the lathe profile.
2. Create a lathe axis with the **Polyline** tool or select an existing edge to use as the axis.

   The lathe axis must be a line defined by two vertices.
3. Select the lathe profile and the lathe axis.

   If you do not select a lathe axis, Ray Dream Studio revolves the selected lathe profile around the axis formed by drawing a line from the first vertex in the profile to the last vertex in the profile. In this case, the lathe profile must be an open polyline.
4. Choose **Selection menu▸ Lathe**.

5. Use the blue arrows in the **Properties palette: Action Modifier tab** to set the lathe axis.

   In the **Mesh Form** modeling window, the object selected as the lathe axis is highlighted in blue, and the lathe profile is highlighted in red.

   To change the object selected as the lathe axis, click one of the blue arrows in the **Properties palette: Action Modifiers tab**.

6. Specify the number of steps for the lathed object.

   A greater number of steps produces a smoother object.

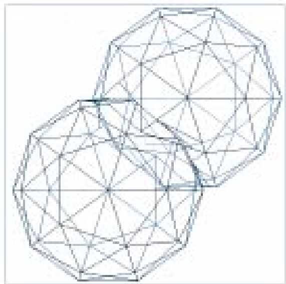
7. Click **Apply** to generate the extrusion.

   If **Auto** is enabled in the **Properties** palette, changes are automatically applied.

Using Boolean Operations to Create Complex Polymesh Objects

The Boolean operations; **Union**, **Subtraction** and **Intersection** are used to produce a complex object from two simpler objects. Boolean operations are performed on two overlapping volumes. Both volumes should be closed—holes in the surface of a volume can prevent Boolean operations from producing the desired results.

The *union* of two objects is an object whose surface encompasses the visible surfaces of both objects. For example, if you spray-paint two overlapping spheres, the painted surface represents the union of the two spheres.



Two objects joined using the Boolean Union.

If you take the *intersection* of two objects, the resulting object is the volume shared by both objects. For example, if you take the intersection of two overlapping spheres, the resulting object resembles a flying saucer.

Result of two objects joined using Boolean Intersection.

When you *subtract* object B from object A, the parts of object A that are encompassed by object B are removed. For example, if you have two overlapping spheres and subtract one from the other, the resulting object resembles a sphere with a large crater.

Boolean subtraction is similar to the concept of compounding shapes in the Free Form modeler. However, compounding shapes only enables you to create holes through extruded objects. Boolean subtraction enables you to work directly with 3D objects and remove overlapping volumes.

Results of two objects joined using Boolean Subtraction.

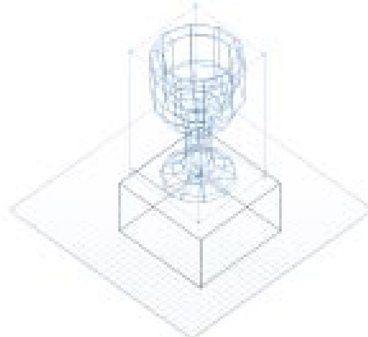
Note: When you perform a Boolean operation, you lose the UV coordinates of the original objects and surface shading can become much more complex.

Using Boolean operations enables you to quickly produce certain types of complex models. For example, suppose that you want to create a cylindrical hole through a sphere that originates on the top of the sphere and exits to the sphere's left side. Using normal modeling techniques, this would be nearly impossible, but with Boolean subtraction it's easy. You could:

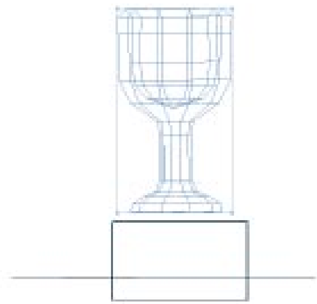
1. Extrude a circle along a path defined by a polyline to form an object that looks like a bent pipe.
2. Align the sphere and the cylinder object.
3. Subtract the cylinder object from the sphere.

The object that results when you Boolean Subtract a bent pipe from a sphere.

Before performing a Boolean operation, it is important to verify that the objects are aligned the way that you want them. You should look at the objects from a variety of viewpoints to verify that their alignment will produce the intended results. You might also want to check the **Properties palette: Numerical tab** to verify the location of particular vertices in an object.



Some objects that appear to adjacent when viewed from reference....



...may not be adjacent when viewed from another perspective.

When you use the **Boolean Operation** command, Ray Dream Studio automatically performs the last selected Boolean operation on the selected objects. You use the **Properties palette: Action**

Modifiers tab to switch between the **Union**, **Intersection**, and **Subtraction** operations.

If you enable **Auto** in the **Properties** palette, you'll be able to see the results immediately when you switch between operations.

To join two objects:

1. Align and select the objects you want to join.
2. Choose **Polymesh menu▸ Boolean Operation**.

   Ray Dream Studio automatically performs the last selected Boolean operation.
3. On the **Properties palette: Action Modifiers tab**, enable **Union**.
4. If **Auto** is not enabled in the **Properties** palette, click **Apply** to perform the union.

To create an object that is the intersection of two objects:

1. Align and select the objects.
2. Choose **Polymesh menu▸ Boolean Operations**.

   Ray Dream Studio automatically performs the last selected Boolean operation.
3. On the **Properties palette: Action Modifiers tab**, enable **Intersection**.
4. If **Auto** is not enabled in the **Properties** palette, click **Apply** to perform the intersection.

To subtract one object from another:

1. Align and select the objects.
2. Choose **Polymesh menu▸ Boolean Operations**.

   Ray Dream Studio automatically performs the last selected Boolean operation.
3. Enable **Auto** at the bottom of the **Properties** palette.

   When **Auto** is enabled, you can immediately view the difference between the two subtraction operations.
4. On the **Properties palette: Action Modifiers tab**, enable **Subtract A from B** or **Subtract B from A**.

Shading Polymesh Objects

In some situations, you need to specify the mapping mode for a model to get the results you want. The **Mesh Form** modeler provides additional control by allowing you to specify how shaders are mapped to individual objects in a model.

Specifying an Object's Mapping Mode

In addition to the three projection mapping modes supported at the scene level, the **Mesh Form** modeler supports a custom mode that allows you to specify UV coordinates for particular vertices. For more information about mapping modes, refer to "Advanced 3D Paint Topics" on page 191.

If you specify mapping modes for individual objects in the **Mesh Form** modeler, and then specify a projection mapping mode for the entire model at the scene level, the modes you specified in the **Mesh Form** modeler are overridden. To use the settings specified in the **Mesh Form** modeler, use the **Parametric Mapping** mode at the scene level.

To change an object's mapping mode:

1. Select the object.

2. Choose **Properties palette: Mapping mode tab**.

3. Choose a mapping mode from the tab pop-up: **Custom**, **Box/Face**, **Cylindrical**, or **Spherical**.

   Custom specify the technique to be used to map the UV coordinates to the selected vertex or vertices. For more information, refer to "Defining a Custom Mapping Mode for an Object" on page 170.

   Box/Face choose the face you want to map onto.

   Cylindrical or **Spherical** choose the orientation of the mapping primitive.

Defining a Custom Mapping Mode for an Object

When you choose **Custom mapping** mode in the **Properties palette: Mapping mode** tab you can specify how UV coordinates from the shader should be applied to the selected vertex or group of vertices.

There are two options for applying uv coordinates to the selection:

- **Interpolate** sets the U or V value for the selected vertex or vertices using the UV values for the nearest vertices that are specified.
- **Keep Current Value** locks the current specified U or V value.

When you enable **Wrap**, the shader is wrapped around the object from the specified U or V coordinate.

To view the UV coordinates that are set for a particular vertex:

1. Select the vertex and choose **Polymesh menu▸ Shader Mapping**.

2. In the **Properties palette: Mapping mode** tab, select **Custom**.

   The current U and V values are displayed in the **Specify** fields.

9

Deformers

Using Deformers

Deformers are a special set of tools that let you easily manipulate objects in ways that would normally require a large number of arranging and remodeling operations.

For example, using the Explode deformer, you can make an object appear to explode by setting only a few parameters. Without the Deformer, you would have to remodel the object several times to achieve the same effect.

Deformers can also be animated. So you can create complicated animation effects like morphing and dissolves by simply applying different Deformers to your objects.

Applying Deformers

You can access all the Deformer available in Ray Dream from the Deformers tab on the **Properties** palette. Each Deformer has its own settings but they're all applied in the same way.

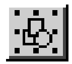
To apply a Deformer:

1. Select the object or group you want to deform.
2. Open the **Properties** palette by choosing **Windows menu▸ Properties**.
3. Click the **Deformers** tab. If the tab is not visible, use the scroll buttons at the top of the palette.
4. Select the Deformer you wish to apply from the pop-up.
5. Select the Deformer's properties parameters by adjusting the value of its sliders and enabling the relevant options.
6. Click **Apply**. The Deformer is applied to the object.

Only one Deformer can be selected at any given time, so if you want to combine the effects of multiple Deformers (a **Stretch** and a **Twist** for instance) to an object, you need to stack them up using artificial group hierarchies.

To apply multiple Deformers:

1. Apply the first Deformer.
2. Put the object in a group by itself using the **Group** button.



Use the Group button to group the selected object.

3. Apply the second Deformer to the new group.

Controlling a Deformer Directly

The **Direct Manipulation** controls let you adjust the Deformers attributes directly on the object. **Direct manipulation** controls appear as a set of wires with "handles" at certain points. The handles represent attributes you can change by dragging.

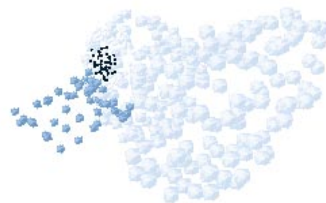
To display the Direct Manipulation controls on a Deformer:

1. Select an object.
2. Display the **Properties palette▸ Deformers tab** and apply a Deformer to the object.
3. Click **Auto**.
4. Click the **Direct Manipulation** button. The Deformers control handles appear in the **Perspective** window.

Note: Not all Deformers have **Direct Manipulation** controls.

Using the Atomize Deformer

The **Atomize** deformer replaces the surface of the selected object with small balls which are then slightly scrambled or wiggled.



When you apply the Atomize deformer to an object its surface is replaced with small balls.

To set Atomize deformer attributes:

1. On the **Properties Palette:Deformers tab**, adjust the value of the **Completion of Wiggle Effect** slider.

   The **Completion of Wiggle Effect** slider controls the amount of movement the balls display as they move. When animating this Deformer, you would set the value of this slider to 0% at the first frame and 100% at the final frame. A setting of 600% may result in the same position as a setting of 0%.

2. Adjust the value of the **Particle Density** slider.

   This slider controls the number of balls created to cover the surface of the object.

3. Adjust the value of the **Particle Size** slider.

   This slider controls the size of the balls on the object's surface.

Using the Bend and Twist Deformer

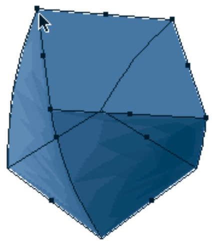
The **Bend and Twist** deformer bends and/ or twists the surface of an object. This Deformer is particularly useful for fine tuning complex models such as bent compound shapes that are otherwise tricky or impossible to achieve.

You can add bends and curves to an object by applying the Bend and Twist deformer.

The bend and bend axis respectively control the amount and direction of the bend, while the twist, twist start and twist size define the amount of twist and portion of the object on which the twist is applied.

To directly control the Bend and Twist deformer:

1. Click the **Direct Manipulation** button on the **Properties palette:Deformer tab**. A bounding box with twelve points appears around the object.



Use the Bend and Twist deformer' s direct manipulation controls to set the Deformer's attributes in the Perspective window.

2. Enable a **Twist axis** button. These buttons let you select the axis to which the twist will be applied.

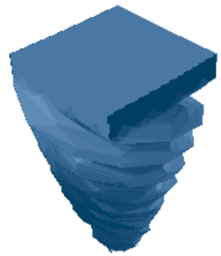
   When you select an axis the bend and twist controls on the object's bounding box move to the selected axis.

3. On the **Twist** axis, drag one of the corner points clockwise, or counter-clockwise to twist the object.

4. On the twist axis, drag one of the middle point up or down to bend the object.

Using the Black Hole Deformer

The **Black Hole** deformer creates a vortex effect, similar to the way water swirls as it is being sucked down a drain. In an animation the **Black Hole** deformer creates a whirling, circular motion that tends to form a cavity or vacuum at the center of its action.



The Black Hole deformer creates a vortex effect.

To set Black Hole attributes:

1. On the **Properties Palette:Deformers tab**, adjust the value of the **Completion of Hole Entrance** slider.

The **Completion of Hole Entrance** slider controls the state of the vortex. Set this value to 0% at the beginning of an animation, and 100% at the end.

2. Adjust the value of the **Winding** slider.

   This slider controls the rotation as the Black Hole deforms. A negative setting creates a counterclockwise rotation.

3. Adjust the value of the **Spin Speed** slider.

   The **Spin Speed** slider controls how fast the object turns as it goes down the vortex

4. Adjust the value of the **Suck Down Point Below Object** slider.

   This slider controls how far below the object the center of gravity is placed. A low setting results in little gravity pull while a high setting results in a stronger pull.

Using the Dissolve Deformer

The **Dissolve** deformer reduces the object to triangles or polygons then diminishes the object so that it gradually fades away or disintegrates. You can use this Deformer to create interesting sci-fi effects such as a transporter or a mummy dissolving before your face in a horror movie.

Use the Dissolve deformer to convert an object's surface to triangles and polygons that fade.

To set Dissolve attributes:

1. On the **Properties Palette:Deformers tab**, adjust the value of the **Completion** slider.

   This slider controls how much the object has dissolved. In an animation, set this value to 0% in the first frame and 100% in the last.

2. Adjust the value of the **Size of Pieces** slider.

   This slider controls the size of the piece the object dissolves into.

Using the Explode Deformer

The **Explode** deformer causes the object to burst apart.

Use the Explode deformer to break an object apart.

To set Explode attributes:

1. On the **Properties Palette:Deformers tab**, adjust the value of the **Completion of Explosion** slider.

   This slider controls how much the object has exploded. In an animation, set this value to 0% in the first frame and 100% in the last. If you apply gravity, the pieces gradually fall to the ground as the explosion progresses.

2. Adjust the positions of the controls in the **Size of Pieces** slider.

   This slider controls the range of sizes for the pieces created by the explosion. The slider contains two controls. The right control sets the size of the largest pieces while the left control sets the size of the smallest pieces.

Use the Size of Pieces slider to set the size of the exploded pieces.

With the left control set to the far left (0%) and the right control set to the far right (100%) you will have the greatest variety of sizes for the pieces. With the two controls set close together the difference between the largest and smallest pieces will be less dramatic.

3 Adjust the positions of the controls in the **Speed** slider.

The **Speed** slider controls the speed of the pieces as they move away from the original position of the object. The slider contains two controls. The left control sets the speed for the slowest moving particles while the right control sets the speed for the fastest moving particles

With the left control set to the far left (0%) and the right control set to the far right (100%) you will have the greatest variety of speed.

4 Adjust the value of the **Gravity** slider.

The **Gravity** slider controls how much gravity is applied to the pieces. The higher the setting, the faster the pieces fall downward.

5 Adjust the value of the **Slow Down at End** slider.

This slider controls the rate at which the pieces slow down as they get farther from the center of explosion.

6 Adjust the positions of the controls in the **Rotational Speed** slider.

The **Rotational Speed** controls the speed at which the pieces rotate as they move away from the original position of the object. The slider contains two controls. The left control sets the speed for the slowest moving pieces while the right control sets the speed for the fastest moving pieces

7 Enable the **Large Pieces Move Slower** checkbox if you want larger pieces move more slowly during the explosion.

8 Enable the **Pieces Stop At Bottom** checkbox if you want all the pieces stop falling when they reach the bottom of the original object's bounding box.

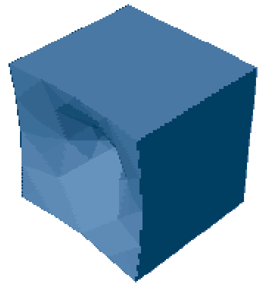
9 Enable the **Explode from Top Down** checkbox if you want the object to explode starting from the top then working down to the bottom.

Using Formula Deformers

The **Formula** deformers uses mathematical equations to deform the selected object. You can use the **Formula Editor** to input variables, operators and parameters. Formula deforming is a very technical process, for more information on using formulas refer to the "Using Formulas in Ray Dream Studio 5" PDF on the Ray Dream Studio 5 CD.

Using the Punch Deformer

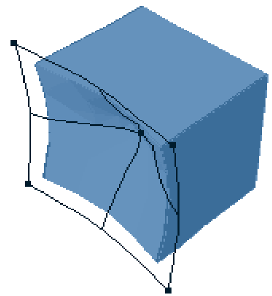
The **Punch** deformer punches a dent into an object or bulge it outward.



Use the Punch deformer to dent or bulge an object.

To directly control the Punch deformer:

1. Click the **Direct Manipulation** button. A square with five points appears in front of the object.



Use the Punch deformer's direct manipulation controls to set its attributes in the Perspective window.

2. If necessary, click the **Orientation** menu and choose an axis.

   The punch controls move to the selected axis.

3. If necessary, enable the **Punch Other Side** checkbox to place the dent on the other side of the object.

4. Drag the center point on the square towards the object to increase the strength of the Punch, or away from it to decrease the strength. Dragging away from the object creates a bulge instead of a dent.

5. Drag one of the corner handles away from the center of the square to increase the **Punch Radius**, or towards the center to decrease the radius.

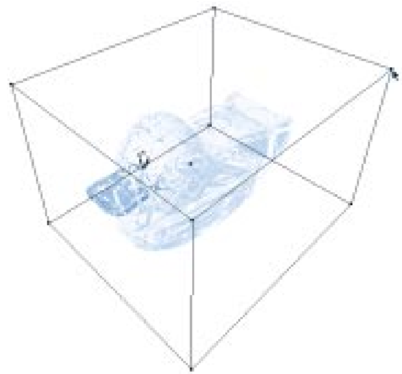
Using the Shatter Deformer

Shatter is a very simple, facet based Deformer you can use to simulate object explosions. Since the Deformer only works at the facet/patch level, it will work best on non patch based objects (for example, imported objects or objects created in the **Mesh Form** modeler). When applied to objects made with Ray Dreams's **Free Form** modeler, the shatter will only separate the patches that make up the surface of the object from each other. This results in a coarse grained shatter effect.

The Shattered deformer separates the patches that make up an object's surface.

To directly control the Shatter deformer:

1. Click the **Direct Manipulation** button. A bounding box with eight points appears around the object.

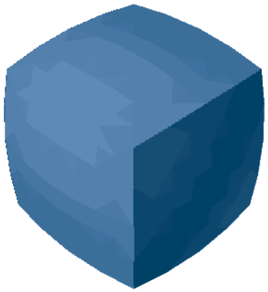


Use the Shatter deformer's direct manipulation controls to set the Deformer's attributes in the Perspective window.

2. Drag a point on the box away from the object to increase the scale of the shatter, or drag towards the object to decrease the shatter scale.

Using the Spherical Morph Deformer

The **Spherical Morph** deformer turns the selected object into a sphere.



The Spherical Morph turns any selected object into a sphere.

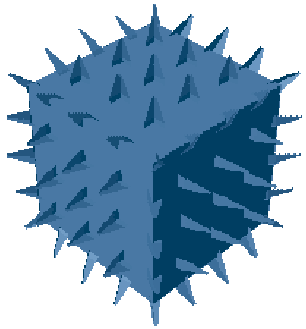
To set Spherical Morph attributes:

1. On the **Properties Palette:Deformers tab**, adjust the value of the **Completion** slider.

   This slider controls the morphing of the object into a sphere. In an animation, set this value to 0% in the first frame and 100% in the last frame.

Using the Spike Deformer

The **Spike** deformer adds needle-like pointed spikes to the selected object. Use the **Spike** deformer to add stubble to a character's chin or create a field of grass, blowing in the wind.



The Spikes deformer creates needle point shapes over the surface of an object.

To set Spike attributes:

1. On the **Properties Palette:Deformers tab**, adjust the value of the **Spike Density** slider.

   This slider sets the number of spikes applied to an object.

2. Adjust the value of the **Length** slider.

   The **Length** slider controls the length of the spikes.

3. Adjust the value of the **Radius** slider.

   This slider lets you set the radius of the spikes.

4. Adjust the value of the **Messiness** slider.

   The **Messiness** slider controls how wavy the spikes appear. A low setting results in fairly straight spikes while a high setting results in very wavy spikes.

5. Adjust the value of the **Flow** slider.

   The **Flow** slider works with **Messiness** and controls the wiggles of the spikes during animations. The higher the value, the more the spikes will appear to move.

6. Adjust the value of the **Gravity** slider.

   The **Gravity** slider controls the strength of gravity on the spikes.The higher the value, the more the spike will bend downward.

7. Enable the **Keep Original Object** checkbox if you want to keep the original object while adding the spikes around it. Disable it to replace the object with spikes.

Using the Stretch Deformer

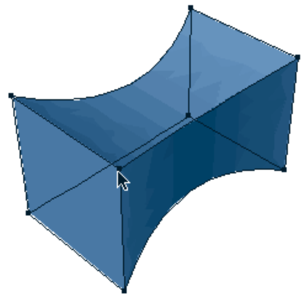
The **Stretch** deformer is particularly suitable for simulating the exaggerated, cartoon-style effects of squash and stretch motions. A squashed object will seem to bulge; a stretched one will elongate itself while thinning in its middle, almost like chewing-gum!

Use the Stretched deformer to elongate an object.

The stretch axis indicates the axis along which the stretch/squash will occur. Any percentage value lower than 100% will cause the object to be compressed and bulge; any value greater than 100% will elongate and thin the object or group selected.

To directly control the Stretch deformer:

1. Click the **Direct Manipulation** button. A bounding box with eight points appears around the object.



Use the Stretch deformer's direct manipulation controls to set the Deformer's attributes in the Perspective window.

2. Select an axis to stretch along.
3. Drag a point on the box away from the object to stretch it, or drag towards the object to squash it.

Using the Warp Deformer

The **Warp** deformer takes the object's surface points that are farthest from the center of the object and moves them out farther. At the same time, surface points that are nearest the center of the object move in closer to the center.

Note: The **Warp** deformer has no effect on spheres because all the surface points are the same distance from the center.

When you apply the Warped deformer the object is distorted by reversing its surface points.

To set Warp attributes:

1. On the **Properties Palette:Deformers tab**, adjust the value of the **Warp Strength** slider.

   The **Warp Strength** slider controls the amount of distortion. A negative setting moves surface points near the center away from the center and surface points far from the center in toward the center. A positive setting moves surface points far from the center farther away from the center and points near the center closer to the center.

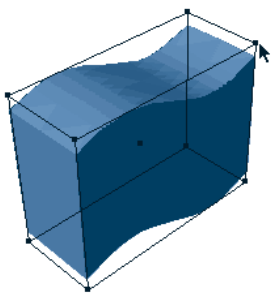
Using the Wave Deformer

The **Wave** deformer distorts the object by pulling it along an imaginary wavy sweep path. Use this Deformer to simulate air or water currents.

Apply the Waves deformer to distort an object along a wavy sweep path.

To directly control the Wave deformer:

1. Click the **Direct Manipulation** button. A bounding box with a number of control handles appears around the object.



Use the Wave deformer' s direct manipulation controls to set the Deformer's properties in the Perspective window.

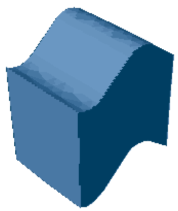
2. Click the **Properties palette▸ Deformer tab▸ Orientation menu** and choose an axis.

   The height and phase controls move to the selected axis.

3. Adjust the value of the **Number of Wave Cycles** slider to set the number of waves applied to the object.

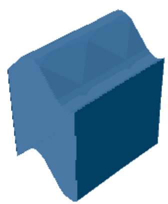
4. Click the **Properties palette▸ Deformer tab▸ Shape menu** and choose a shape for your wave.

   Planar A: Wave moves along the plane A.



An object deformed using Planar A wave.

   Planar B: Wave moves along the plane B.

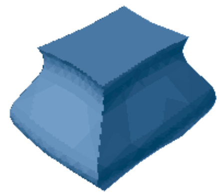


An object deformed using a Planar B wave.

   Radial: Wave moves from center point outward.

An object deformed using a Radial wave.

   Cylindrical: Wave moves around the outside of the object as if it were in a cylinder.



An object deformed using Cylindrical waves.

   The direction in which the wave is applied depends on the setting in the Orientation box.

5. Drag one of the corner handles to adjust the height of the wave. Dragging away from the object increases the wave's height.

6. Depending on the type wave you selected you can adjust the **Phase** of the waves in a number of ways:

For Planar A and B waves move the center handles left or right to adjust the phase.

For **Radial** waves you can move the handles towards or away from the objects center. As you move towards the middle of the object, its center appears to sink, as you move away, its center bulges up.

For **Conical** waves you can move the center handles up or down to adjust the phase.

10

Shading Objects

Applying Shaders

This chapter explains shading, the process of assigning surface properties to your objects. By designing and applying shaders, you can precisely control the color, texture, and finish on your objects.

Ray Dream Studio's drag and drop interface for applying shaders makes shading easy. You'll keep a collection of shaders in the **Browser** palette's **Shaders** tab and simply drop them onto your objects in the **Perspective**, **Free Form**, or **Mesh Form** modeling window.

Shading Overview

Using a process called shading, you can assign a variety of surface characteristics to each object in your scene. When Ray Dream Studio renders your final artwork, these characteristics determine whether an object appears rough or smooth, shiny or dull, transparent or opaque.

Using shaders you can create surfaces that are rough, smooth, shiny or transparent.

By adjusting the properties of a shader you can create any number of surfaces. For instance you can change the surface from shiny to wood grain.

Shading allows you to describe which objects are glass and which are wood, metal, stone, skin, painted or otherwise.

Shaders

A shader is a set of surface characteristics. Each shader may contain settings for one or more of the following attributes: **Color**, **Highlight**, **Shininess**, **Bump**, **Reflection**, **Transparency**, **Refraction**, and **Glow**.

Each shader is saved as a document. Ray Dream Studio includes dozens of pre-defined shaders, which are ready to use right out of the box. In time, you'll build your own collection by editing existing shaders and creating new ones from scratch.

Note: As you learn how to build your own shaders, you'll find the pre-defined shaders to be invaluable. Examine them closely, for they demonstrate techniques you might not immediately discover through experimentation or reading these chapters.

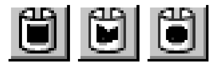
The Primer

Every object has a base shader called the primer, which covers the entire object. By applying a shader to an object's primer, you give the complete object its surface characteristics. The default shader used for new objects is a simple red color.

3D Paint

Many real-world objects have non-uniform surfaces. Variations on an object's surface might be as simple as a painted-on logo, or as complex as an intricate inlaid wood design.

To achieve effects such as these, you can use Ray Dream Studio 5's **3D Paint** tools.



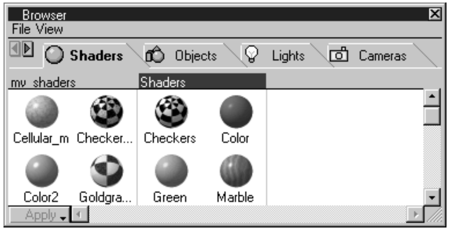
You can use the 3D Paint tools to place paint shapes on objects.

The **3D Paint** tools allow you to apply different shaders to various regions on the surface of an object. These regions, called paint shapes, may take the form of geometric shapes, or of freely brushed designs. Once created, paint shapes can be selected, moved along the surface of the object, modified (in shape, size, or shader content), layered, or deleted.

The **3D Paint** tools are discussed in "3D Paint Tools" on page 186.

The Browser Palette

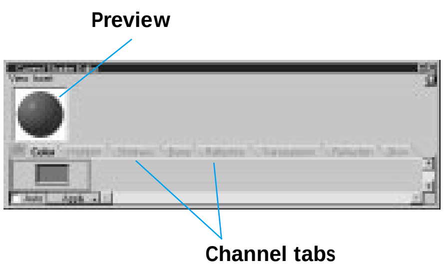
As you create shaders you want to keep, you'll save them in the **Browser palette: Shaders tab**. You can select a shader in the **Browser** palette and apply it to an object. You'll also use the **Browser** palette to create, open and edit shader documents.



Use the Browser palette to store your Shaders in your personal folders.

The Current Shader Editor

The Shader Editor gives you complete control over the appearance of your shaders. You can use the Shader Editor to edit shaders stored in the Shaders Browser or shaders you've applied to objects in your scene.



The Shader Editor, expanded.

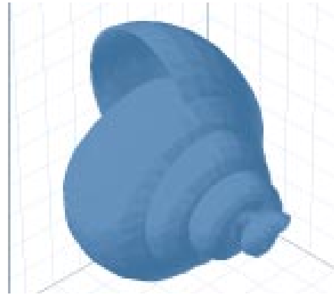
Each shader channel is on a different tab in the editor. The preview shows you how your shader will appear on the surface of an object and provides you with immediate feedback when you change shading parameters.

The Shader Editor is thoroughly discussed in "Building and Editing Shaders" on page 217.

Previewing Shading

Once you have created or edited a shader, you'll want to see how it looks when applied to a particular object.

The level of detail you're able to see in the **Perspective** window depends on the preview mode you have selected. The Box and Wireframe modes provide no preview of the shaders in your scene. The standard Preview mode displays only the average color of an object across its entire surface. Shaded Preview shows a low resolution approximation of the shaders on your objects. To see your shaders in detail, you must switch to Better Preview mode or use the **Render Preview** tool.



In the standard preview mode, you can only see the basic color of the object. When you're working on shader properties you'll need to use Better Preview mode.

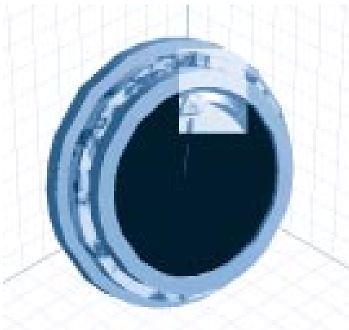
Better Preview mode accurately depicts highlights, bumps, glow, shading (but not shadows), and color variations over the surface of an object. Transparency, shadows, and reflection can be previewed only with the **Render Preview** tool, which allows you to ray trace a specific area of the **Perspective** window at screen resolution.

In Better Preview display mode, most shader properties are visible in the Perspective window.

To use the Render Preview tool:

1. Choose the **Render Preview** tool.

2. In the **Perspective** or **Modeling** window, drag a marquee across the area to be previewed. Ray Dream Studio ray traces the area you have selected.



The Render Preview tool renders areas of your object. When rendered, you can see all the shader's attributes including transparency and shadows.

To work efficiently, keep the size of your render previews small. Larger areas take longer to ray trace, and require more memory. If you want to ray trace more than a small portion of your scene, you might as well do a low resolution rendering. Refer to Chapter 17, "Rendering."

Shading an Entire Object

When you create a new object, Ray Dream Studio assigns it a default primer. To shade an entire object, you simply apply a shader to the object's primer. You can use the drag and drop technique or click **Apply** in the **Browser** palette.

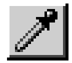
You can also edit an object's existing shader—for instructions, refer to "Building and Editing Shaders" on page 217.

To apply a shader to an object's primer (drag and drop):

Drag a shader from the **Browser palette: Shaders tab** onto an object in the **Perspective** window, or onto an object's icon in the **Hierarchy** window.

To apply a shader to an object's primer (Apply button):

1. Select one or more objects in the **Perspective** or **Hierarchy** window.
2. Select a shader in the **Browser palette: Shaders tab**, or use the **Eyedropper** tool to "grab" the shader from an object in the **Perspective** window.

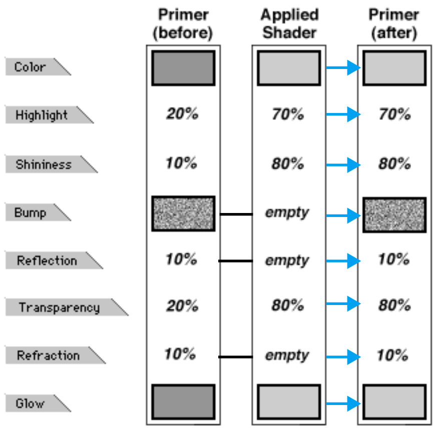


3. Click **Apply** in the **Browser** palette.

Applying Non-Empty Channels vs. Applying All Channels

An object's primer always contains settings in all eight shader channels. Although you can replace some or all of these settings by applying a shader, you can never completely remove settings from a primer channel.

A shader in the Shaders Browser, however, may have one or more empty channels. By default, Ray Dream Studio ignores these empty channels when you apply a shader to an object's primer. It applies only channels that contain settings.

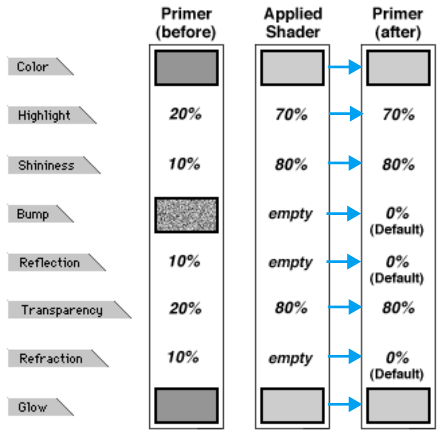


When you apply a shader with empty channels, the primer values replace those in the empty channels.

Applying only non-empty channels allows you to selectively change certain shading attributes, while leaving others intact.

Note: You might keep a catalog of frequently used colors or bump settings in the Shaders Browser, and apply them to objects via the drag and drop technique.

Sometimes, however, you'd rather completely replace an object's primer with the shader you're applying. In this case, you'll need to apply all channels, rather than just those that contain settings. The diagram below demonstrates the effects of applying all channels, using the same shader and primer used in the previous example.



When you apply all channels it overrides all the settings in the primer.

Since you wanted to replace the primer completely, applying only non-empty channels would have left unwanted settings in the Bump, Reflection, and Refraction channels. Applying all channels removes these unwanted settings and replaces them with the default settings.

For a thorough discussion of shader channels and settings, refer to "Shader Structure and Content" on page 198.

To replace an object's primer (apply all channels):

1. Select one or more objects in the **Perspective** or **Hierarchy** window.
2. Select a shader in the **Browser palette: Shaders tab**.

   You may also use the **Eyedropper** tool to "grab" the shader from an object in the **Perspective** window.
3. Pop-up the **Apply** button in the **Browser** palette and choose **Apply All Channels**.

This method also applies to the **Apply** button on the Current Shader Editor. If you prefer, you can change the **Default Apply** Mode so that the Shader Editor applies all channels by default, instead of non-empty channels only. Choose **File menu▸ Preferences**. Choose **Current Shader Editor** from the pop-up in the **Preferences** dialog. Set your choice for the Default Apply Mode.

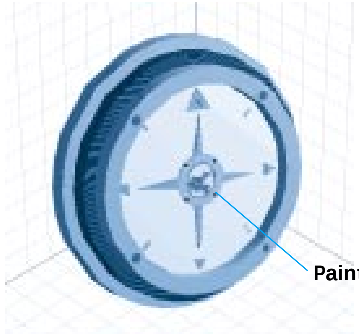
3D Paint

When you want to apply a shader to a limited region on the surface of an object, you'll use Ray Dream Studio's **3D Paint** tools. The **3D Paint** tools allow you to create paint shapes directly on the surface of an object in the **Perspective** or **Modeling** window. A paint shape may be rectangular, elliptical, polygonal, or freely brushed.

Because the **3D Paint** tools work with the shaders in the **Browser palette: Shaders tab**, you're not limited to painting with color. You can load your brush with gold, marble, or concrete and apply not only color, but bump, reflection, transparency, and the other shading attributes as well.

Once you've created paint shapes, you can move them, resize them, layer them, and delete them. You may create any number of paint shapes on the surface of an object.

This section introduces the **3D Paint** tools and explains how to use them. It also explains how layered paint shapes relate to each other and to the object's primer. Finally, it discusses advanced topics such as mapping modes, and the Master and Object shading layers.



Using the 3D Paint Brush you can use a shader like a paint color and paint shader properties onto objects like brush strokes.

3D Paint Tools

Ray Dream Studio's **3D Paint** tools allow you to paint directly on your 3D objects. Each tool provides visual feedback as you paint to show you how your paint shape appears on the surface of your object.

The **3D Paint** tools work best on objects created in Ray Dream Studio. You can paint on an object imported from another application, but you may need to change the object's mapping mode to achieve satisfactory results. For more information, refer to "Advanced 3D Paint Topics" on page 191.

With the exception of the **Brush** tool, all of the **3D Paint** tools work in Preview, Shaded Preview and Better Preview display modes. In Preview mode, you'll see only the outlines of your paint shapes, not the shaders they contain. The **Brush** tool works only in **Better Preview** mode.

To use a 3D Paint tool:

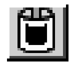
1. Select the shader you want to use.

   Click on a shader in the **Browser** palette, or use the **Eyedropper** tool to "grab" the shader from another object.

2. Choose a **3D Paint** tool. The behavior of each tool is described below.

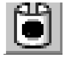
3. Paint on the surface of an object in the **Perspective** or **Modeling** window.

   It's not necessary to select the object.



Rectangle Tool

Drag to create a rectangle. As you drag, a "rubber band" preview is drawn in real time to show you the boundaries of the rectangle. If you're working in **Shaded Preview** or **Better Preview** mode, the paint shape is shaded when you release the mouse button.



Ellipse Tool

Drag to create an ellipse. As you drag, a "rubber band" preview is drawn in real time to show you the perimeter of the ellipse.

When you draw with the **Rectangle** or **Ellipse** tool, your first mouse click positions one corner of your paint shape's bounding rectangle, then you drag to position the opposite corner. Ray Dream Studio normally uses the shortest path to connect these opposite corners—that is, the paint shape will not wrap all the way around the object. If you want the shape to wrap "the other way" around your object, hold down the **Option/Alt** key as you drag.

Polygon Tool

Click once to position each vertex of your polygonal paint shape. As you position vertices, the line segments connecting the vertices are drawn. Double-click at the last vertex to automatically close the shape.

Although you can later resize or "stretch" a polygonal paint shape, you won't be able to re-edit its vertices. Refer to "Working with Paint Shapes" on page 190.

Brush Tool

The **Brush** tool has several features and options. The next section explains them in detail.

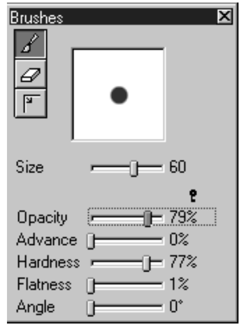
The Brush Tool

The **Brush** tool is the most versatile **3D Paint** tool. It allows you to paint free form designs on the surface of an object. Paint shapes you create with the **Brush** tool are called "brushed shapes."

Like other paint shapes, a brushed shape may contain only one shader. If you choose a new shader while painting with the **Brush** tool, Ray Dream Studio automatically creates a new brushed shape. You can create any number of brushed shapes on an object.

Brush Options

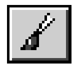
When you choose the **Brush** tool, Ray Dream Studio opens the **Brush** palette, where you can choose a brush and set its options.



Use the Brush Options dialog to set the 3D Brush tool's size, opacity and other attributes.

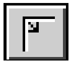
The **Paint Brush** tool has three brush types represented by icons at the top of the palette:

- The **Paint Brush** allows you to paint new brushed shapes and add to existing brushed shapes.



- The **Eraser** modifies an existing brushed shape by "cutting away" from it.

- The **Imported Shape Brush** lets you import a 2D image to use as a brushed shape. This brush is described in a separate section below.



To set brush options (Paint Brush or Eraser):

1. Click the icon for the brush type you want: **Paint Brush** or **Eraser**.

2. Drag the **Size** slider to make the brush smaller or larger.

3. Adjust the **Advance** slider to set the frequency at which the brush shape is drawn along the path of the moving mouse.

   A low **Advance** setting produces a continuous brush stroke. A high **Advance** setting produces a discontinuous brush stroke, giving the impression that the brush has “skipped” across the surface being painted.

4. Drag the **Hardness** slider to adjust the edge of the brush stroke.

   The hardest setting shades at 100% opacity all the way to the edge of the brush. Lighter settings fade out the shader effect toward the edge of the brush.

5. Drag the **Flatness** slider to adjust the width of the brush.

   Low **Flatness** produces a round brush. High **Flatness** produces a narrow brush.

6. Drag the **Angle** slider to adjust the angle of the brush.

Use Angle and Flatness together to create a calligraphic effect.

Painting with the Brush Tool

Like the other **3D Paint** tools, the **Brush** tool provides real time feedback as you work on the surface of an object. When you position the **Brush** tool cursor over an object in the **Perspective** or **Modeling** window, a preview outline of the size, angle and shape of the brush appears on the object.

To start painting, drag the brush across the object. As you drag, the path of your stroke is previewed in real time. In a couple of seconds, Ray Dream Studio draws the fully shaded brush stroke.

You can use the 3D Brush tool to apply a shader to only areas of your object. The spots on this crab were created using the Brush tool.

Because 3D objects can be rendered at any resolution, you rarely need to concern yourself with the resolution of your final output until it’s time to render your image. Because brushed shapes are pixel-based, however, they are of a fixed resolution. You can think of the surface of your object as a blank image whose greater dimension (which may be either its height or its width) has a default resolution of 1,024 pixels. The resolution of an individual brushed shape depends on how much of the object’s surface it covers. If you plan to render your final image at high resolution, you may wish to increase the default paint shape size. You can set this value in the 3D Paint section of the **Preferences** dialog.

To paint with the Brush tool:

1. Select the shader you want to use.
2. Choose the **Brush** tool from the toolbar. The **Brush** palette appears.
3. Choose a brush and set the brush options (see above).
4. Drag the brush cursor over the surface of an object to apply a brush stroke. Drag again to apply additional brush strokes. A brushed shape may contain any number of brush strokes, but only one shader.

   You can also add to or subtract from an existing paint shape.

To add to a brushed shape:

1. Using the **Paint Shape Selection** tool, choose a brushed shape.
2. Using the **Eyedropper** tool, grab the shader from the selected brush shape, or select the same shader from the **Browser palette▸ Shaders tab**.

   When you add to a brushed shape, you must use the same shader.
3. Start your first stroke within the boundary of the selected brushed shape.
4. Continue in this fashion to add brush strokes.

To erase part of a brushed shape:

1. Use the **Paint Shape Selection** tool to select a brushed shape.
2. Choose the **Brush** tool from the toolbar. The **Brush** palette appears.
3. Select the **Eraser** icon.
4. Drag the eraser across the portions of the brushed shape you wish to remove.

You can convert any other paint shape to a brushed shape, which you may then edit with the Brush tool. Refer to "Advanced 3D Paint Topics" on page 191 for more information.

Importing a Brushed Shape

The Imported Shape brush allows you to import a a 2D image file and use it as a brushed shape. The image you import creates a brushed shape region that's then filled with the current shader.

When you import a brushed shape from a 2D image file, Ray Dream Studio ignores any color information in the file—only the brightness of each pixel is used to describe the shape. Therefore, bitmap (1 bit black and white) and 8-bit grayscale images are best suited for use as imported brushed shapes.

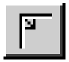
If the image you import is a bitmap, the black regions enable (turn on) the shader, and the white regions disable it. A bitmap image is an easy way to create intricately patterned, irregular, or non-contiguous paint shapes.

If you use an 8-bit image, the brightness of each pixel determines how the shader in the brushed shape blends with the primer or the shader of the paint shape below. For each black pixel in the image, the paint shape's shader is applied at 100% opacity to the corresponding point on the object. For each white pixel in the image, the shader is not applied at all. Intermediate shades of gray blend the paint shape's shader with the shader below.

To import a brushed shape:

1. Using a 2D art program, prepare the image you want to import. Save it in a convenient folder in one of the formats Ray Dream Studio supports.
2. Select a shader from the **Browser palette: Shaders tab**.
3. Choose the **Brush** tool from the toolbar. The **Brush** palette appears.

4. Select the **Imported Shape Brush** icon.



5. Drag a marquee across the surface of your object to define the limits of your imported brushed shape.

   Ray Dream Studio displays a dialog so you can select your 2D image file.

6. Use the file system tools to select and open your image.

   Ray Dream Studio closes the dialog and maps the image onto the object as a paint shape. Its proportions are determined by the marquee you have drawn. Ray Dream Studio fills the shape with the current shader.

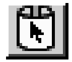
If you're not happy with the proportions of your brushed shape, you can resize it to the proportions you desire—see the next section.

Working with Paint Shapes

Once you've created paint shapes, you can move, resize, layer and delete them.

To select a paint shape:

1. Choose the **Paint Shape Selection** tool.
2. Click on the paint shape you want to edit.



   Ray Dream Studio show the paint shape within a bounding rectangle. The rectangle has four handles, one at each corner.

To move a paint shape:

With the **Paint Shape Selection** tool, drag the shape along the surface of the object.

Note: You may also use the **Properties palette: Shaders tab** to reposition a paint shape. Refer to "Editing Shading in the Properties Palette" on page 191.

To delete a paint shape:

1. Select the shape.
2. Choose **Edit menu▸ Clear** or press the **Delete**/**Backspace** key.

Note: You may also use the **Properties palette: Shaders tab** to delete a paint shape. Refer to "Editing Shading in the Properties Palette" on page 191.

To resize a paint shape:

With the **Paint Shape Selection** tool, drag one of the corner handles on the shape's bounding rectangle.

Drag toward the center of the shape to shrink it. Drag outward to stretch it.

Note: You may also use the **Properties palette: Shaders tab** to resize a paint shape. Refer to "Editing Shading in the Properties Palette" on page 191.

To crop a paint shape:

With the **Paint Shape** tool, drag a corner while holding down the **Command**/**Ctrl** key.

Layering: How Primer and Paint Shapes Interact

When you create a paint shape on the surface of an object, the paint shape's shader overrides the shading characteristics of the object's primer. Likewise, when several paint shapes overlap, the topmost paint shape's shader overrides those below.

There is one important corollary to this rule, however. When a paint shape's shader has one or more empty channels, it inherits the settings for these channels from the paint shape immediately below it (or from the primer, if there is no paint shape below).

For example, if you paint on an object with a bumpy primer, any paint shape you create will also be bumpy unless the shader you're painting with specifies different bump settings. To create a smooth paint shape on a bumpy object, you would use a shader with a constant value in the Bump channel.

The **Properties palette: Shading tab** allows you to control the opacity of an object's paint shapes. Unlike a shader's Transparency setting, paint shape opacity does not affect an object's translucence; rather it controls how paint shapes interact. If a paint shape's opacity is less than 100%, its shader does not fully override the shaders of the primer and paint shapes below; rather, the shaders effects are mixed. Refer to "Advanced 3D Paint Topics" on page 191.

To change the layering order of paint shapes:

1. Select one of the shapes you want to re-order.
2. Choose **Arrange menu▸ Paint Shape Order▸** and select **To Front** or **To Back**.

Note: You may also use the **Properties palette: Shading tab** to change layering. This is covered in the next section.

Advanced 3D Paint Topics

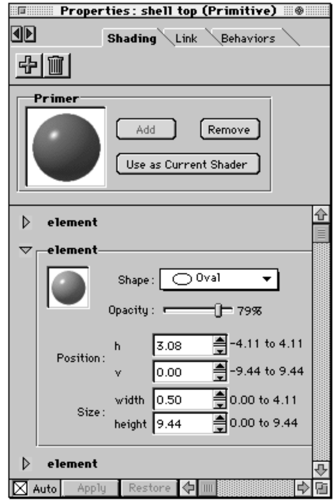
Editing Shading in the Properties Palette

The **Shading** tab of the **Properties** palette allows you to edit the position and size of an object's 3D Paint shapes with numerical precision. You can also add and delete paint shapes, change layering, specify a paint shape's opacity, convert a paint shape from one type to another, remove an object's primer, and change an object's mapping mode. For more information, refer to "Mapping Modes" on page 193.

To display the Shading tab in the Properties palette:

1. Select an object.
2. Choose **Windows menu▸ Properties**.
3. Click the **Shading** tab.

You may need to advance through the tabs using the arrow buttons at the top of the palette to display the **Shading** tab.



Use the Shading tab on the Properties palette to edit the attributes of the paint shapes on an object.

The **Shading** tab displays the primer and each applied paint shape ("element").

To remove an object's primer:

Click **Remove** from within the **Properties palette: Shading tab**.

Note: If you have not changed an object's primer since you created the object, this option is not available.

When you apply a primer to an object in the **Perspective** window, it is applied over the primer of the corresponding Master object. Removing an object's primer simply reveals the Master object's primer. For more information, refer to "Master and Object Shading Layers" on page 194.

To change the layering order of an object's paint shapes:

Drag the element listings into the order you want from within the **Properties palette: Shading tab**.

In a moment, the object preview updates to your changes.

To create a new paint shape:

Click the **Plus** icon from within the **Properties palette: Shading tab**.

Ray Dream Studio creates a new paint shape on the surface of the object. The new shape has the default size, position, and shader—all of which you can change.

To delete a paint shape:

1. Select an **element** on the **Shading** tab.
2. Click the **Minus** icon.

To set paint shape options:

1. Click the **triangle** (Macintosh) or **plus** sign (Windows) to display the controls for the paint shape element you wish to edit.
2. Adjust the **Opacity** slider to set a value between zero and 100%.

The opacity of a paint shape is not related to the transparency value you set in the Shader Editor. Whereas a shader's transparency setting determines the degree to which light passes through a surface, the opacity setting simply determines the extent to which a particular paint shape hides or shows the paint shapes below it.

3. Edit the **Position** (h and v) values to move the shape on the object surface.

   The **Position** values determine the position of the paint shape's upper left corner on the surface of the object.

   The numbers just to the right describe the range of possible values

4. Edit the **Size** (Height and Width) values to alter the size of the shape.

   The **Size** values determine the size of the paint shape's bounding rectangle.

   The numbers just to the right describe the range of possible values

5. If you want, you can change the paint shape to a different type. Choose the type you want from the **Shape** pop-up.
6. Click **Apply**.

3D Paint Preferences

The **Preferences** dialog includes a panel for **3D Paint** options. Most of these let you choose between "higher quality" and "better efficiency."

To set 3D Paint preferences:

1. Choose **File menu ▸ Preferences**.
2. Click the popup menu and choose 3D Paint.
3. Enable a **Shape/Stroke Redraw** option:
   - Wait for end of stroke to refresh
   - Refresh as stroke is drawn.
4. Enable the **Show Transparency/ Reflection** option if you want this information as you paint. (Not recommended on slower systems.)
5. Adjust the **Paint Brush Shape** resolution slider for the number of pixels used in a brush shape.

Higher values offer better quality, but are more demanding on the system.

6. Enable the **Beep on creation** option if you want Ray Dream Studio to alert you when you create a new brush shape.

   This might be important if you had intended to extend an existing shape, not create a new one.

7. In the **Advice** box, enable the alert dialogs that you want to skip:

   Preview mode Ray Dream Studio presents this alert when you try to use the 3D Paint Brush in any mode other than Better Preview.

   When you “skip” this alert, Ray Dream Studio switches to **Better Preview** automatically.

   Wrong Layer Ray Dream Studio will beep the first and second time you attempt to manipulate a master layer paint shape while working on an object instance. The third time, Ray Dream Studio presents this alert, informing you why your attempt fails.

   When you “skip” this alert, Ray Dream Studio beeps each time you attempt to manipulate a master layer paint shape while working on an object instance.

8. Adjust the **Rubber Band Fidelity** slider. Higher settings create smoother edges on oval paint shapes.

Mapping Modes

Most shader content is two-dimensional. Texture maps, for example, are nothing more than 2D images. Many procedural shader functions—including Ray Dream Studio’s checkers and wires—also produce two-dimensional image data. Ray Dream Studio uses a process called mapping to apply this 2D shading information to the surface of a 3D object.

Ray Dream Studio’s 3D Paint interface allows you to shade objects without worrying about the internal “nuts and bolts” of mapping. Most of the time, you can simply paint on objects with the **3D Paint** tools and let Ray Dream Studio take care of the details. Occasionally, however, you may find that changing an object’s mapping mode makes it easier for you to achieve the results you want.

When you change an object’s mapping mode, Ray Dream Studio changes the method it uses to map 2D shapes and images to the object’s surface. As a result, the **3D Paint** tools behave differently on the object. Depending on the shape of your object and the mapping mode you choose, the difference may be subtle or quite dramatic.

Ray Dream Studio’s default mapping mode is called parametric mapping. Parametric mapping is like applying a decal to an object’s surface—each pixel in your image maps directly to a specific point on the surface of your object. This straightforward approach minimizes distortion and loss of image quality. You’ll want to use parametric mapping for most objects you create in Ray Dream Studio.

Because objects imported from other applications contain limited information, parametric mapping generally cannot be used on these objects. When you shade an imported object, you’ll need to choose one of Ray Dream Studio’s projection mapping modes: **Box/Face Mapping**, **Spherical Mapping**, or **Cylindrical** mapping.

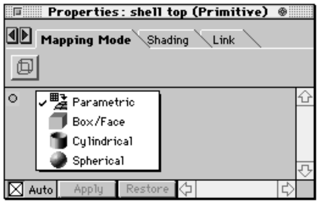
In the various projection mapping modes, Ray Dream Studio maps the image onto an invisible primitive—a box, a sphere, or a cylinder which encloses the object. The image is then projected from the primitive onto the object itself.

For the best results, you should choose the primitive which best resembles the object you are mapping. For example, spherical mapping would be appropriate for a basketball, and cylindrical mapping would be right for a soup can.

When you choose box mapping, you can specify which face of the box primitive you want to map onto. When you choose cylindrical or spherical mapping, you can specify the orientation of the primitive in relation to the object.

To change an object's mapping mode:

1. Select an object.
2. Display the **Properties** palette (**Windows menu▸ Properties**).
3. Choose the **Mapping Mode** tab.



Use the Mapping Mode tab lets you select a mapping mode option for a selected object.

4. Use the pop-up to choose a mapping mode—**Parametric**, **Box/Face**, **Cylindrical** or **Spherical**.

   Ray Dream Studio displays the options appropriate for the selected mode. (Parametric mapping has no options.)
5. Set your options (described below).
6. Apply your changes.

To set Box/Face options:

1. Display the **Properties palette: Mapping Mode tab**.
2. Choose **Box/Face** from the pop-up.
3. Click the icon for the mapping you want—**Full Box** or one of the **Single Faces**.
   - **Full Box** wraps the 2D image onto a box much like you'd wrap a package.
   - The **Single Face** mappings project the image on one side of the object. The projection continues through to the other side of the object.

   By default, the image is aligned with the object's bounding box axes. If you need to, you can change the orientation of the image on the object.
4. To change the orientation, select **Custom**.
5. Enter values in the **Yaw**, **Pitch**, **Roll** fields to change the orientation of the image.
6. Click **Apply**.

To set Cylindrical or Spherical options:

1. Display the **Properties palette: Mapping Mode tab**.
2. Choose **Cylindrical** or **Spherical** from the pop-up.
3. Click the icon to choose the alignment you want—X, Y or Z axis. You may also design your own orientation:
   - Click the **Custom** icon.
   - Enter values in the **Yaw**, **Pitch**, **Roll** fields to change the orientation of the image.
4. Click **Apply**.

Master and Object Shading Layers

If your scene contains several objects based on the same Master object, you can use the Master object to specify a set of shading characteristics to be shared between all of these objects. You can also assign specific shading characteristics to each individual object.

For example, you might create a bottle and shade it with a green glass shader in the **Modeling** window. You could then duplicate the bottle so that three copies appear in the scene, and use the **3D Paint** tools to apply a unique label to each copy. Suppose you decided later that you wanted marble, rather than glass bottles—you could reopen the Master object in the **Free Form** modeling window and apply a marble shader, affecting all three bottles while leaving the individual labels intact.

When you create multiple copies of an object, each copy has two distinct shading layers: the Master layer and the object layer. Any shading you apply to the Master layer affects all copies of the object in the scene. The shading on the object layer, however, is unique to each copy. The two shading layers may each contain both a primer and paint shapes, and the two layers need not share the same mapping mode.

Because the object layer is on top of the Master layer, paint shapes on the object layer always appear to be in front of paint shapes on the Master layer. Moreover, if you apply a primer to the object layer, it obscures the entire Master layer (both primer and paint shapes).

When you shade an object in the **Perspective** window, you're working on its object layer. To work on the Master layer, you simply shade the Master object in the **Modeling** window.

For more information on the relationship between objects and Master objects, refer to "Working with Master Objects" on page 266.

To work on the Master shading layer:

1. Click the **Masters** tab in the **Hierarchy** window. A list of all the Master objects in the scene appears in the window.
2. Double-click the icon for the Master object you want to shade. The object is opened for editing in the **Modeling** window.
3. Shade the Master object in the **Modeling** window. You can edit the primer and/or work with the **3D Paint** tools there.
4. Click **Done** to return to the **Perspective** window. The shading you have applied appears on all copies of the Master object.

To edit the Master shading layer in the Properties palette:

1. Click the **Masters** tab in the **Hierarchy** window. A list of all the Master objects in the scene appears in the window.
2. Select the Master object whose shading you want to edit.
3. Display the **Properties palette: Shading tab**.

   The **Shading** tab controls now let you work with the master object shading.

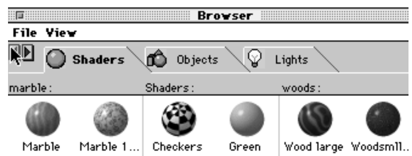
Managing your Shaders

The particular shaders used on your objects are saved with the scene file. These shaders will not necessarily appear in the **Browser** palette. The **Browser** palette displays only shaders that you've saved there.

Don't overload the **Browser** palette with shaders. Each shader thumbnail requires some memory. Too many shaders loaded into the **Browser** palette may impact your performance. It's a good idea to limit the directories listed at any given time.

You might want to organize your shader directories as logical categories. For example, a list of directories might read **Wood, Rocks, Plastic, Glass, Marble**.

For information on adding, moving and removing items and folders in the **Browser** palette, refer to "Using the Browser Palette" on page 28.



You can use the Browser palette to organize and store your personal shader library.

A Note on External Texture Maps

If any of the shaders in your shader files contain Texture Map components that reference external image files, you need to maintain the relative path from the shader files to the image files.

If either the shader files or the image files are moved to a different folder, Ray Dream Studio prompts you to locate the missing image files when it loads the shader files into the **Browser** palette.

11

Creating Shaders

Why Create a Shader?

Shaders are a powerful way of bringing your 3D objects to life. You can use Ray Dream Studio's extensive libraries of shaders to add life to your objects, but since there is no limit to the types of objects you can create, you may need to build a unique shader to suit each object you create.

Ray Dream Studio's shader structure makes it possible to create your own custom shaders. Much like mixing your own colors for painting on an artist's palette, you'll use the Shader Tree to create an infinite number of different textures, colors and surfaces.

This chapters explains the Shader Tree and guides you through the process of creating your own shaders.

Shader Structure and Content

This section and the two that follow—"Shader Components" on page 201 and "Shader Channels" on page 213—explain the central concepts of defining shaders. After reading these three sections, you should understand how to define a shader by building a shader tree from Ray Dream Studio's various shader components.

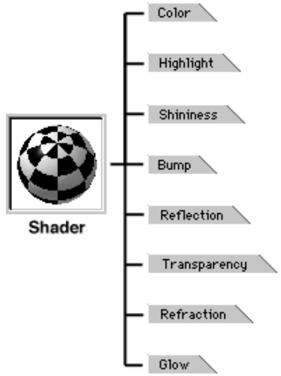
When you're ready to start designing your own shaders, read the step-by-step instructions for using the Shader Editor in "Building and Editing Shaders" on page 217.

What is a Shader Tree

A *shader* is a set of surface properties that you can assign to an object or to a paint shape on the surface of an object. Ray Dream Studio features a modular structure for defining shaders: the *shader tree*. The shader tree's modular nature allows for great flexibility in shader content.

Understanding Shader Channels

A shader tree contains all of the settings for a single shader. The shader itself is at the root of the tree. Immediately beneath the root, the tree has eight branches, one for each of the shader channels: **Color**, **Highlight**, **Shininess**, **Bump**, **Reflection**, **Transparency**, **Refraction**, and **Glow**.



The shader tree contains the eight surface properties, called shader channels, that define an object's surface in Ray Dream Studio.

To specify shader settings, you add components to the shader tree in one or more of the channels. The components beneath a particular channel represent that channel's settings.

Depending on the components you use, the settings in each channel may be simple or complex. The **Color** channel might specify either a plain color or a multi-color pattern. Likewise, the **Reflection** channel might specify uniform or varying levels of reflectiveness across the surface of an object.

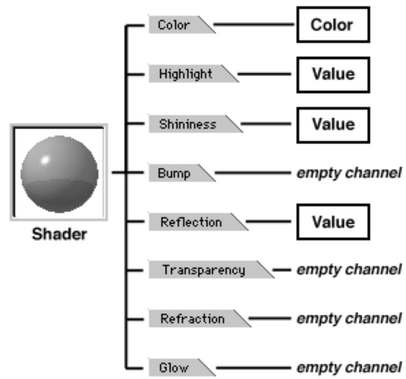
A shader need not contain settings in all eight channels. If you don't want to define a particular shading attribute, you can simply leave that channel empty.

Understanding Shader Components

There are three types of components: basic components, operators, and functions.

Basic Components

Basic components are the fundamental building blocks of shaders. Colors, values, and texture maps are examples of basic components. The diagram below shows a shader tree built entirely with basic components. Notice the structural simplicity of the tree—no branching occurs below the level of the channels.



You can adjust the contents of a shader's channels by placing different components in each channel.

For more information on specific basic components, refer to "Basic Components" on page 201.

Operator Components

To create more complex and varied shading effects, you can use operators to combine the effects of two basic components within a shader channel. The arithmetic operators (Add, Subtract, and Multiply) combine components mathematically. An additional operator, the versatile **Mix** operator, uses functions to combine components in a variety of ways.

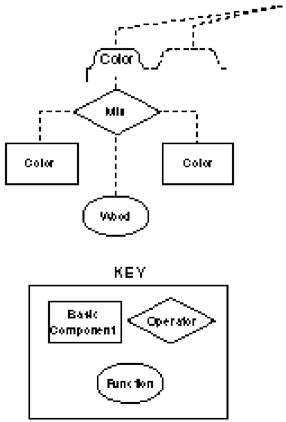
For more information on specific operators, refer to "Operators" on page 206.

Function Components

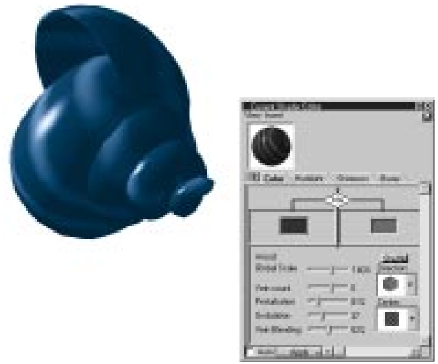
By choosing which function to use, you control how the Mix operator combines a pair of components. Ray Dream Studio ships with several functions, including **Cellular**, **Checkers**, **Wires**, **Wood**, **Spots**, **Gradient**, **Psychedelic** and **Marble**. You can also define your own function with a formula.

For more information on specific functions, refer to "Functions" on page 207.

The diagram below demonstrates the use of an operator. In this particular example, the Mix operator is used in conjunction with the Wood function to mix two colors in a wood grain pattern. Notice that placing an operator in the shader tree causes the tree to branch.



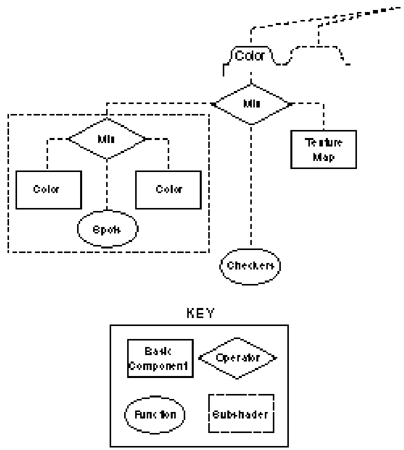
Placing the Mix operator in the shader tree creates three branches. One for the mixing function and one for each of the components you're mixing.



The wood grain applied to this object was created by using the Mix operator with two colors and a wood grain function.

When a component such as the Mix operator has branches extending below it, the component and all of the branches below are referred to as a *subshader*. Subshaders allow you to create truly complex effects—anywhere you can place a component on the shader tree, you can place a subshader instead.

The shader in the example below uses the Mix operator with the checkers function to create a complex checkerboard pattern in the Color channel. Half of the squares in the checkerboard are spotted—the spot pattern is produced by a second Mix operator, nested as a subshader within the first. The appearance of the remaining squares is determined by a texture map, loaded into Ray Dream Studio from a 2D image file. This image file might contain a multi-color gradient or fractal pattern, for example.



Using two mix operators in the shader tree lets you create a subshader.

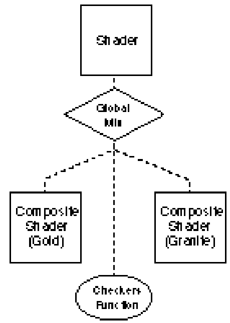
Composite Shaders vs. Global Mix Shaders

The shaders in all of the preceding examples are called *Composite* shaders, because they are simply collections of individual channel settings. The settings within the different channels combine to determine the shader's overall appearance, but settings in one channel have no effect on the settings in the other channels.

In the last example, the Mix operator was used to create a complex pattern in a shader's Color channel. Suppose you wanted to create a shader which mixed

The checkerboard pattern applied to this object contains a second mix operator which produces spots in one half of the squares in the checker pattern.

attributes in all of the shader channels at once. For example, you might want to create a checkerboard pattern with alternating squares of shiny, reflective gold and rough granite. To accomplish this with a Composite shader, you would need to apply the same mix function to each channel. Fortunately, Ray Dream Studio provides another type of tree structure, the *Global Mix*, which makes it easier to achieve effects like this. The diagram below illustrates how a Global Mix shader works.



Any component placed under the Global Mix affects all the shader channels.

The checker pattern applied to this object has alternating squares of gold and granite. It was created using the Global Mix shader.

The top level of a Global Mix shader tree has only one branch, which affects all eight shader channels. The Global Mix operator always appears on that branch. The Global Mix operator functions identically to the Mix operator, except that it mixes complete shaders rather than individual shader components. These complete shaders may be Composite shaders, as in the example above, or other Global Mix shaders. You can achieve some very complex shading effects by nesting Global Mix shaders.

Instructions for creating and editing both Composite and Global Mix shaders appear in “Building and Editing Shaders” on page 217.

Shader Components

This section describes Ray Dream Studio’s various shader components. It explains what each component does, and how to set each component’s unique parameters. Within this section, the components are divided by type into three groups: basic components, operators, and functions.

“Building and Editing Shaders” on page 217 explains how to use the Shader Editor to place shader components on the shader tree.

You may have received other shader components, in addition to those described here. Ray Dream Studio’s open architecture allows developers to program their own shader components in the form of plug-ins. These third-party extensions join seamlessly with Ray Dream Studio’s built-in shading tools.

Basic Components

Color

The *Color* component allows you to specify any color. Although you can place the Color component anywhere on the shader tree, it’s best suited for use in the **Color**, **Highlight**, **Reflection**, **Transparency**, and **Glow** channels, which are designed for color input.

For a description of how colors affect the each channel, refer to “Shader Channels” on page 213.

- In the Bump channel, the Color component produces no effect because it gives a constant value across the surface of an object. To create the illusion of bumpiness, the Bump channel requires variation across an object’s surface.

For a thorough discussion of the Bump channel, refer to “Bump” on page 214.

- In a non-color channel—Shininess or Refraction—colors are converted to values. Dark colors convert to low values, light colors to high values.

When you place the Color component on the shader tree, it appears as a color chip.

In the shader tree, a Color component appears as a Color chip.

To set a color:

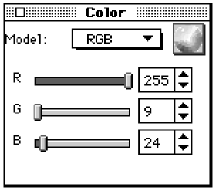
1. In the **Current Shader Editor**, click a channel tab.

2. Choose **Insert menu ▸Color**.

   You can open the editor by clicking an object with the **Eyedropper** tool.

3. Double-click a color chip to edit the color. The color picker appears.

4. You can switch between the **RGB** and **CMYK** color models using the **Model** pop-up.



The Ray Dream Studio color editor.

5. Drag the **RGB** or **CMYK** sliders to set the color you want.

   You can also enter specific values into the text boxes. The valid range for RGB values is from zero to 255. The valid range for CMYK values is from zero to 100%.

Your choice of a color model is for your convenience only—it has no effect on the content of your final rendered image. Like other rendering applications, Ray Dream Studio always renders RGB images. You can use an image processing application to convert rendered images to CMYK for separation.

To use the system color picker:

You might prefer to use the system color picker.

1. In the Ray Dream Studio color editor, click the color wheel in the upper right corner of the RBB/CMYK color picker.

Note: You can use the system color picker as the default. Choose **File menu▸ Preferences**. Choose **Shader Editor** from the pop-up. Enable the **Use system color picker** option.

Value

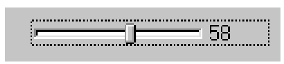
The *Value* component allows you to set a value between zero and 100%. You'll use the Value component frequently in every channel but the Color channel.

- If you use it by itself, it specifies a constant level for a particular attribute across the surface of an object or paint shape.

  For example, a 30% value in the Transparency channel means that the shader will make an object 30% transparent.

- If you place it beneath the Color channel, its value is converted to a shade of gray. Zero converts to black, 100 to white.

When you place the Value component on the shader tree, it appears as a slider.



In the shader tree, a Value component appears as a slider.

To set a value:

Drag the pointer along the **Value** slider. The far left side of the slider represents zero, the far right 100. The number to the right of the slider displays the current value.

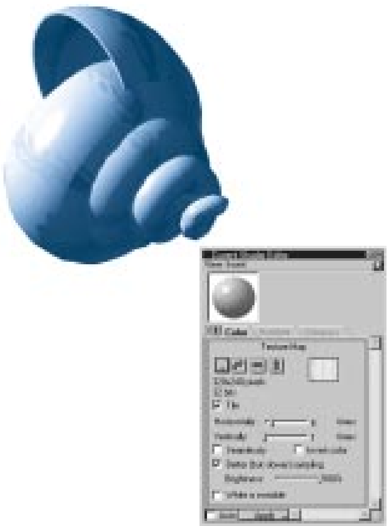
Texture Map

The *Texture Map* component allows you to use a 2D image, such as a scanned photograph or paint-type illustration, in your shader. Used effectively, texture maps can lend your shaders unparalleled realism. Many complex real-world surfaces are nearly impossible to simulate through other means.

To assist you in creating texture maps, Fractal Design has developed Detailer—a dedicated program for preparing texture map images. Detailer and Ray Dream Studio work together and help you achieve superior results.

Using Color Images as Texture Maps

Texture maps using color images are extremely useful in the Color channel. You might import an actual product logo as a texture map and apply it like a decal to a 3D package model. Or to mimic an extremely detailed natural surface, you could import a small photographic sample of the surface and tile it—duplicate it a specified number of times—to cover your entire object.



The conch shell surface of this object was created by placing a texture map in the color channel.

Color texture maps are also appropriate in the **Highlight**, **Reflection**, **Transparency** and **Glow** channels.

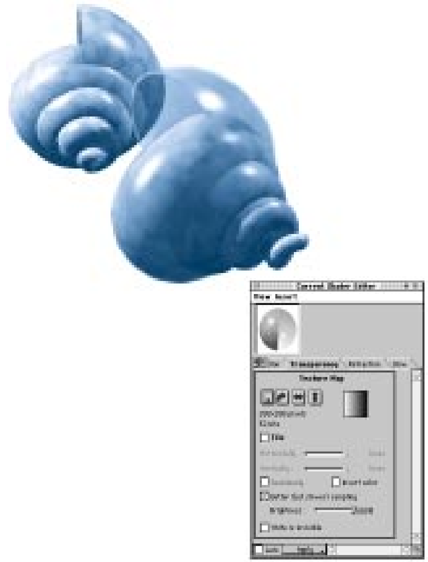
If you use a color image in a non-color channel, Ray Dream Studio internally converts it to grayscale.

You can use an image of any color depth as a texture map. In most cases, an 8-bit (256 color) image with a custom color palette provides excellent results, while requiring substantially less memory and disk space than a 32-bit image. Ray Dream Studio cannot use CMYK images as texture maps. If you want to use a CMYK image, you must convert it to RGB before importing it.

Black & White and Grayscale Images as Texture Maps

You can use a black and white or grayscale texture map in any channel (besides Color) to specify varying levels of a particular shading attribute. The shade of each pixel in the image determines the level of the attribute for the corresponding point on the object or paint shape.

If you use a black and white image, each black pixel turns the attribute on—sets it to 100%—while each white pixel turns the attribute off. An 8-bit grayscale image allows subtler effects, with 256 possible shades for each pixel. For example, a grayscale blend from white to black in the Transparency channel would make an object or paint shape fade smoothly from opaque to transparent.



The fade in on this object was created by using a texture map in the Transparency channel.

You can also use a black and white or grayscale texture map with the Mix operator, in place of a function. For more information, refer to "Using Other Components as Functions" on page 213.

Storing Maps Internally vs. Externally

By default, Ray Dream Studio saves copies of all texture maps internally. You can also have Ray Dream Studio save only a reference to an external file.

There are advantages and disadvantages to each option. Storing maps internally avoids organizational hassles, since you don't need to keep track of any external files. However, internally saved maps greatly increase the size of a file, which can result in slower loading and saving. With an external map, you can modify it with another program, and you don't need to reload the map.

In general, you can store maps internally unless your file contains particularly large texture maps (or many smaller maps).

If you move an externally referenced image on your hard drive, Ray Dream Studio prompts you to locate the image file the next time you open your scene file or shader Browser document.

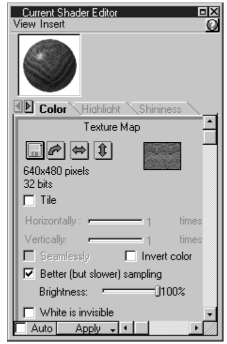
Choosing an Image

When you place a Texture Map component on the shader tree, Ray Dream Studio displays the standard **Open** dialog, prompting you to choose an image.

To choose an image:

1. Select an image file from the file list in the **Open** dialog.
2. To specify whether you want a copy of the image saved within your Ray Dream Studio file, click the **Options** button in the **Open** dialog. The **Texture Map Options** dialog appears.
3. Select **Internal** or **External**.
4. Click **OK** to close the **Options** dialog.
5. Click the **Open** button in the **Open** dialog, or press **Return**/**Enter**. The texture map controls appear, displaying the image you have chosen.

Depending on the current display setting in the Shader Editor and the location of your Texture map component on the shader tree, you may not be prompted immediately to choose an image—in this case, a preview sphere appears in place of the texture map controls. To open the controls and choose an image, simply double-click on the preview sphere. A discussion of the Shader Editor's display options and instructions for navigating the shader tree appear in "Building and Editing Shaders" on page 217.



You can use an image as a component in shader tree using the Shader Editor's texture map controls.

A thumbnail preview of the image appears in the upper right corner of the Texture map controls. Immediately to the left of the preview, Ray Dream Studio displays the image's dimensions in pixels, and its color depth.

To flip or rotate the image:

Click the appropriate button to the left of the preview.

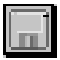
To tile the image:

1. Click the **Tile** check box to turn tiling on. Ray Dream Studio enables the tiling sliders.
2. Use the sliders to set the number of repetitions in each direction.

If you want Ray Dream Studio to rotate and flip neighboring tiles to maximize continuity, click the **Seamlessly** check box. If your image is specifically designed for seamless tiling, you don't need to enable this option.

To filter the image:

1. Click the disk icon in the **Texture Map** controls.



2. Choose **Filter** from the pop-up which appears. A dialog listing available Adobe Photoshop™-compatible filters appears.

3. Select a filter and click **OK**.

If you have Adobe Photoshop-compatible filters on your hard drive, but none appear in the Filters dialog, you need to use the Preferences dialog to set the location of your third-party plug-ins. Step-by-step instructions for this procedure appears in "Advanced Filter Techniques" on page 376.

To replace the image:

Click the disk icon in the **Texture Map** controls, and choose **Open** from the pop-up. The **Open** dialog appears, allowing you to choose a different image.

or

Click the disk icon in the **Texture Map** controls, and choose **Import** from the pop-up. A dialog appears, allowing you to choose from any Adobe Photoshop-compatible plug-ins you may have available. If you have the appropriate plug-in, you can acquire an image from a scanner or a PhotoCD, for example.

The White is invisible check box allows you to achieve a type of masking effect by instructing Ray Dream Studio to ignore any purely white pixels in the image. For example, you could use this option to place a logo with an irregular shape on the surface of an object. Simply create a map with a white background and place it in the Color channel; then apply it to an object using the 3D Paint Rectangle tool. Wherever there is a white pixel in the map, the paint shape or primer below shows through.

Movie

The Movie component allows you to use any QuickTime (Macintosh) or AVI (Windows) movie within a shader. The movie behaves just as a texture map, except that the image differs in each frame of the rendered animation.

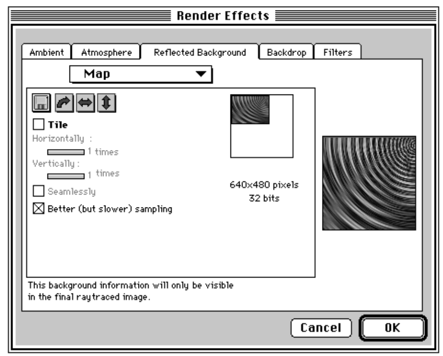
For more information on using movies as shader components, refer to "Rotoscoping" on page 334.

To select a movie in the shader component:

1. Click the disk icon. Studio displays the **Open** dialog.

2. Locate and open a movie file.

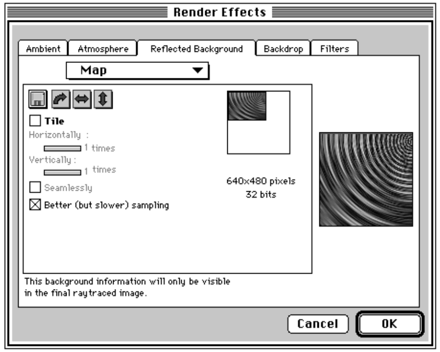
   When you've opened a movie, a preview player appears. This player lets you synchronize the movie with your animation. Refer to "Rotoscoping" on page 334.



Movie Controls

3. You can click the directional buttons to change the movie's orientation.
4. You can reduce the image's brightness with the **Brightness** slider.
5. Enable the Better (but slower) sampling to view a more precise preview.
6. Enable the **Invert Color** option if you want to invert the movie's colors.
7. If you want the frame to repeat, enable the **Tile** option.
8. Use the **Horizontally** and **Vertically** sliders to set the number of tiles in each direction.
9. Enable the **Seamlessly** option to smooth the transitions between tiles.
10. You can get more information on this movie by clicking **More**.

   Studio opens a window that provides technical information and a movie preview player.



Movie Time Selection dialog.

11. Enable the **White is Invisible** option if you want white regions of the movie to render transparent.

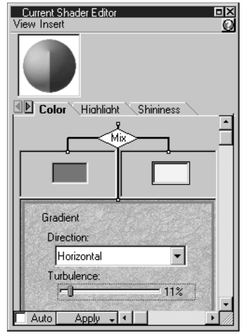
Operators

Operators allow you to create complex shading effects by combining two components or subshaders within a single shader channel.

Mix

The *Mix* operator is Ray Dream Studio's most versatile shading tool. It can produce a wide variety of results, depending on which function you choose to mix the two components.

When you place a Mix operator on the shader tree, it appears as a node with three branches below it. The left and right branches are placeholders for the two components you want to mix. The mixing function goes on the middle branch.



The mix operator mixes the other components in the shader tree.

For each point on an object or paint shape, the function generates a value between zero and 100. The Mix operator uses this value to combine the components on the left and right branches. When the value is closer to zero, more of the left component is used. When the value is closer to 100, more of the right component is used.

Some functions, like Checkers and Wires, generate a value of zero or 100 for each point. These functions result in clear divisions between the two components. Other functions, like Wood and Spots, generate a range of values between zero and 100. These functions result in gradual blends between the components.

The various functions are described in "Functions" on page 207.

Add (+)

The *Add* operator sums the values of two components. When you place the Add operator on the shader tree, it appears as a node with two branches extending below.

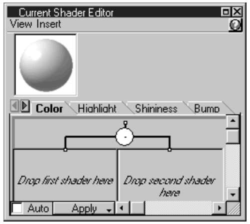
When you place the Add operator in the Shader Editor, it sums the values of the other components in the tree.

The two branches are placeholders for the components you want to combine. For each point on a paint shape or object, the Add operator sums the values of the two components.

Subtract (–)

The *Subtract* operator subtracts the value of the right component from the value of the left component.

You can use the Subtract operator to invert the value of another component. Just place the component you want to invert in the right branch and a Value component set to 100 in the left branch. Try this technique on a complex shader if you want to invert its colors.



When you place the Subtract operator in the Shader Editor, it subtracts the value of the right component from the value of the left.

Multiply (*)

The *Multiply* operator multiplies the values of the left and right components.

When you place the Multiply operator in the Shader Editor, it multiplies the values of the other components in the tree.

The Multiply Operator can be used to tint a grayscale bitmap by multiplying the bitmap shader by a color shader.

Functions

Functions are used almost exclusively with the Mix operator. They can, however, be used by themselves. A function generates a value between zero and 100 for each point on an object or paint shape.

When you place a function on the middle branch of the Mix operator, the operator uses the values generated by the function to mix the components on the left and right branches. Where the value equals zero, the left component is used; where the value equals 100, the right component is used. Intermediate values produce a blending of the two components.

When you place a function in a channel by itself, it assigns a value directly to each point on the object or paint shape. In a non-color channel, each value is used “as is.” In any of the channels designed for color input (Color, Highlight, Reflection, Transparency or Glow), each value is converted to a shade of gray, with zero translating to white and 100 to black.

2D and 3D Functions

A 2D function creates a flat image that is ten wrapped around the shaded object. Checkers and Wires are 2D functions.

A 3D function creates a three-dimensional shader that “shares space” with the object. The object’s visible shading depends on how its surfaces coincide with the variations in the 3D shading volume. Cellular, Spots, Wood, Marble and

Psychedelic are 3D functions. These functions give the appearance that the object has been carved from a solid block of material.

You'll recognize the importance of 3D shading when you consider a block of wood. If the grain runs along one surface, the perpendicular surface shows *the ends of the grain*.

Cellular

The *Cellular* function creates a surface that looks like a network of cells. Cellular is a 3D function. It can be used effectively in the Color and Bump channels. You can experiment with it in the other channels for other effects.

You can create skin-like textures by using the Cellular function in the Shader Editor.

To set Cellular options:

1. Use the **Shape** menu to select the basic shape of the cells.

2. Drag the **Intensity** slider to adjust the contrast between the two colors.

   The slider ranges from -100% to 100%. Negative settings invert the image.

3. Drag the **Scale** slider to change the size of the cell shape. The slider ranges from 1% to 200%.

4. Drag the markers on the **Upper** and **Lower Limits** slider to controls the range of values created by the function.

   The range determines the balance between the two (light and dark) components. The left marker controls the lower limit. The right marker controls the upper limit.

5. Enable the **Fractal Version** option to use fractals instead of more regular shapes for the cells.

   Using the **Fractal Version** can significantly increase the time required to redraw and to render your image.

Spots

The Spots function produces a random pattern of spots. The spots are irregular, more like leopard spots than polka dots. Spots is a 3D function.

You can create a spot pattern using the Spots function in the Shader Editor.

To set Spots options:

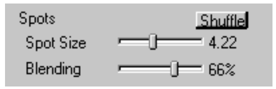
1. Adjust the **Size** slider to control the size of the spots.

2. Adjust the **Blending** slider to control how the spots blend together.

   When **Blending** is set to 0%, the function produces equal numbers of zero-value and 100-value spots, with gradual blending.

   When **Blending** is set to 50%, the function produces equal numbers of zero-value and100-value spots, with abrupt transitions.

3. Click the **Shuffle** button to randomize the spot pattern.



Use the Shuffle button to randomize the pattern of spots.

Wood

The *Wood* function produces a wood grain pattern. It assigns a value of 100 to the veins and a value of zero to the spaces between the veins. Wood is a 3D function.

You can create a variety of wood grain textures by mixing different colors with the Wood function.

To set Wood options:

1. Adjust the **Global Scale** slider to set the size of the wood grain pattern in relation to the object.

2. Adjust the **Vein count** slider to set vein spacing.

   High values produce dense vein patterns, while low values produce sparse vein patterns.

3. Adjust the **Perturbation** slider to control the size of the “waves” in the veins.

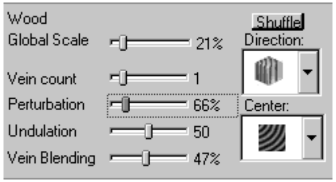
4. Adjust the **Undulation** slider to control the frequency of the waves in the grain.

5. Adjust the **Vein Blending** slider to determine whether the transitions between veins and spaces are abrupt or gradual.

6. Use the **Direction** pop-up to set the orientation of the wood grain pattern in relation to the object.

7. Use the **Center** pop-up to set whether the wood grain pattern is taken from the center of the tree, where the curvature of the veins is quite pronounced or from a point further from the center, where the curvature is more gradual. There are three settings to choose from.

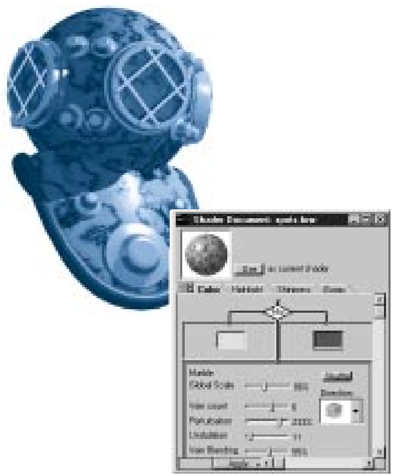
8. Click the **Shuffle** button to randomize the wood grain pattern.



Use the Shuffle button to randomize the pattern of the wood grain.

Marble

The *Marble* function produces a marble pattern. It assigns a value of 100 to the veins and a value of zero to the spaces between the veins. Like Spots and Wood, Marble is a 3D function.



You can create marble surface by using the Marble function in the shader tree.

To set Marble options:

1. Adjust the **Global Scale** slider to set the size of the marble pattern in relation to the object.

2. Adjust the **Vein count** slider to set vein spacing.

   High values produce dense vein patterns, while low values produce sparse vein patterns.

3. Adjust the **Perturbation** slider to control the size of the “waves” in the veins.

4. Adjust the **Undulation** slider to control the frequency of the waves in the pattern.

5. Adjust the **Vein Blending** slider to determine whether the transitions between veins and spaces are abrupt or gradual.

6. Use the **Direction** pop-up to set the orientation of the marble pattern in relation to the object.

7. Click the **Shuffle** button to randomize the marble pattern.

Objects shaded with 3D functions like Spots, Wood, and Marble appear to be carved or sculpted from solid blocks of material, but this appearance is only skin-deep—like all of the objects you create in Ray Dream Studio, these objects are still “hollow.” To illustrate this point, if you make a marble object partially transparent, you won’t see veins running through the inside of the object.

Checkers (and Stripes)

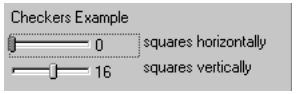
The *Checkers* function produces a checkerboard pattern. Every point is assigned a value of exactly zero or 100, so no blending occurs. Checkers is a 2D function.

The Checkers function can be used to create a checkerboard pattern on an object.

To set Checkers options:

1. Drag the **Squares horizontally** slider to set the number of horizontal squares.

2. Drag the **Squares vertically** slider to set the number of vertical squares.



Use the sliders to set the number of horizontal and vertical squares.

By setting one of the sliders to zero, you get stripes—either horizontal or vertical, depending on which slider is at zero.

Wires

The *Wires* function produces a grid of lines. Like the Checkers function, Wires assigns a value of either zero or 100 to each point on an object or paint shape. Specifically, it assigns a value of 100 to the lines of the grid, and a value of zero to the spaces. Wires is a 2D function.

You can create a lined pattern on the surface of an object using the Wires function.

To set Wires options:

1. Drag the **Horizontal count** slider to set the number of lateral wires.

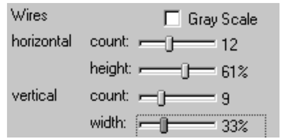
2. Drag the **Height** slider to set the size of the lateral wires.

The thickness of the horizontal/vertical wires is expressed as a percentage of the height/width of the entire object or paint shape. You can determine the thickness of a single wire by dividing the percentage by the number of wires. For example, if ten horizontal wires represent 50% of a paint shape's height, the thickness of each wire is 5% of the height.

3. Drag the **Vertical count** slider to set the number of longitudinal wires.

4. Drag the **Width** slider to set the size of the longitudinal wires.

5. Enable the **Gray Scale** option if you want to smooth the transitions between the spaces and the wires.



The grayscale option smooths the transition between wires and spaces.

This option is especially useful in the Bump channel, where gradual transitions produce more striking results.

Psychedelic

The *Psychedelic* shader function creates unusual textures, including swirls of color reminiscent of the psychedelic Pop Art of the 1960s. Psychedelic is a 3D function.

Use the Psychedelic function to create colorful swirls on an object.

To set Psychedelic options:

1. Adjust the three **Interference** sliders to control the amount of interference applied to each plane.

   The sliders range from -1.00 to 1.00. Each slider controls the stripes applied on the specific plane. A setting of 0 results in no interference on that plane. Using all three planes you can create more interesting design elements.

2. Enable the **Use Global Coordinates** check box to use the Global Coordinates for the Psychedelic function.

   By default the function uses the individual Object's coordinate system. The shading is constant as you move and rotate the object.

   When **Use Global Coordinates** is enabled, the shading remains static in global space when the object moves. The object behaves as a “window” on the shading. This is like moving your hand through the dappled shadows under a tree. Instead of shadows, though, the psychedelic shading passes across the moving object.

3. Drag the **Scaling** slider to control the size of the design elements.

4. Adjust the **Number of Stripes** slider to control the number of stripes in each element.

5. Adjust the **Density** slider to control the density of the pattern.

6. Adjust the **Phase** slider to set the current position in the psychedelic cycle.

   The **Phase** slider ranges from 0.00 to 1.00. The two extreme settings display the cycle at the same point.

   Use the flat preview to see how the shader changes when you adjust the **Phase**.

Note: Phase settings are particularly useful in animations. Set key events to animate the **Phase** from zero to one using the **Oscillate: Saw/Loop** tweener.

Gradient

The *Gradient* function produces a gradual blend from one color to another. Gradient is useful in the Color and Transparency channels. Gradient is a 2D function.

Use the Gradient function to blend two colors in the shader.

To set Gradient options:

1. Choose **Direction menu▸ Horizontal** or **Vertical** to set the direction of the blend.

2. Adjust the **Turbulence** slider to mix up the colors as they change.

   A low setting results in a uniform blend. A high setting increases irregularity in the blend.

Formula

The *Formula* function lets you design a mixing function with a mathematical formula.

For more information, refer to the PDF file "Using Formulas" contained on the Ray Dream Studio 5 CD.

Using Other Components as Functions

You can actually use any component as a function in the Mix operator. This allows you to mix components in ways not supported by Ray Dream Studio's basic functions.

When you use a component as a function, Ray Dream Studio automatically converts its output to values so that the Mix operator can use it to mix the components on the left and right branches.

Value and *Texture* map components are especially useful in place of functions.

- You can use a *Value* component to blend the components on the left and right branches of the Mix operator in a given ratio. A value of 50 blends the two components evenly. Lower values favor the left component, while higher values favor the right component.
- You can use a black and white or grayscale texture map to mix the left and right components in a custom pattern. For each white pixel in the image, the Mix operator uses the left component. For each black pixel, the Mix operator uses the right component. Intermediate shades produce a blending of the two components.

Shader Channels

Color

No shader channel has a more obvious effect on the appearance of an object or paint shape than the *Color* channel. Depending on the components you place beneath the Color channel, you can specify anything from a plain color to a complex, multi-color pattern.

- To specify a plain color, simply place a Color component.
- To specify a multi-color pattern, use a Texture Map component or combine colors with the Mix operator.

If you find that your single-color objects look unrealistic, try using the Mix operator with the Spots function to create minute color variations. Simply mix two slightly different hues in a pattern of tiny spots, with Blending set to zero for smooth blends. When viewed from a distance, these subtle color variations can give an object a more realistic appearance.

The default content of the Color channel is a Color component, set to a shade of red. Ray Dream Studio assigns the default content of each channel, as part of the default primer, to each new object you create. The default content is also used to calculate the preview of a shader in the Shader Editor, when a particular channel is empty.

Highlight and Shininess

Most objects in the real world show highlights when illuminated. These bright spots or streaks are direct reflections of light sources, like the sun glinting off a chrome bumper.

Metallic objects have small, bright highlights. Plastics have dim, but large highlights. And stones usually have no highlights, unless polished.

You can control the color, intensity and size of an object's highlights by placing shader components beneath the Highlight and Shininess channels.

The *Highlight* channel controls highlight intensity. A high value produces bright highlights, while a low value produces dim highlights.

The *Shininess* channel controls highlight size. A high value produces small highlights, while a low value produces large highlights.

Note: Typically, highlights that are extremely bright are very small, while those that are softer spread larger.

By default, highlights are white. You can specify color highlights by placing a Color component (or any component that produces color information) in the Highlight channel. Color has no effect on the Shininess channel; any color information in the Shininess channel is internally converted to values.

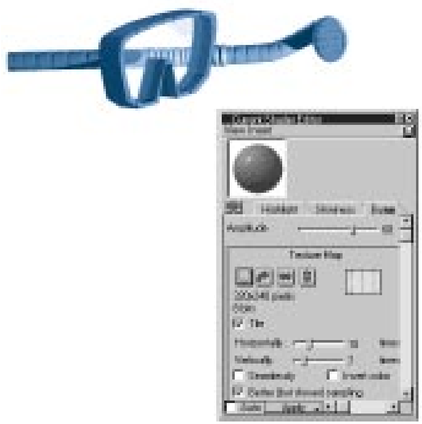
The default content of both the Highlight channel and the Shininess channel is a Value component, set to a value of 50.

If you want varying levels of highlight or shininess across the surface of an object or paint shape, you can use a texture map or a function.

Bump

Bumpy and rough surfaces are difficult to model geometrically. Imagine modeling the irregularities of the skin of an orange, point after point—the task would quickly become a nightmare. Fortunately, Ray Dream Studio allows you to use a shader to simulate variations on the surface of an object.

By placing shader components in the Bump channel, you can “perturb” a smooth surface to produce irregularities. This technique is known as bump mapping. Bump mapping can produce subtle effects like the bumps and pits on the surface of an orange, or more pronounced effects like the seams on a baseball.



The indents on the snorkel were created by placing a texture map in the Bump channel

Bump mapping does not change the actual topography of an object—no points are displaced. Rather, it changes the angle at which light rays reflect off the surface at certain points. This technique tricks the eye into perceiving texture. Because the bumpiness is just an illusion created by the renderer, the edge of the object remains smooth. In most cases, this is not a problem. However, if you require true surface variations to appear on the silhouette of your object, you’ll need to create them in the modeler.

To simulate bumps, the components you place beneath the Bump channel must specify some variation in the colors or values of adjacent pixels. Consequently, placing a simple color or value in the Bump channel does not produce bumping.

Texture maps and functions produce the best results in the bump channel. Like the other non-color channels, the Bump channel always converts color information to grayscale.

When you use a grayscale image in the Bump channel, lighter areas appear to be raised, while darker areas appear to be lowered. When you use a function that produces values, areas with higher values appear to be raised, while areas with lower values appear to be lowered.

- For the most convincing results, you should create a smooth blend between extreme values like black and white or zero and 100.

If a grayscale image with hard edges between black and white does not produce a satisfactory bump effect, try applying a blur effect to the image in an image-editing application.

- The relative height or "steepness" of the bumps depends on how rapidly you blend between extreme values. A blend that occurs over the range of many pixels produces shallow, gradual bumping. A blend that occurs over the range of a few pixels produces steeper, more sudden bumping.

The default content of the Bump channel is a Value component, set to a value of zero. This produces no bumping, since there is no variation from pixel to pixel.

To change the amount of bump:

1. In the Bump channel tab, adjust the Amount slider.

   The Amount slider lets you strengthen or weaken the Bump effect.

2. Apply your changes to the object.

3. Use the Render Preview tool to check the results on the object.

Reflection

Many real-world surfaces are at least somewhat reflective. Most types of metal and glass are partially reflective. A mirror is so reflective that it takes nearly all of its color from the environment around it.

Ray Dream Studio allows you to specify reflectiveness by placing shader components beneath the Reflection channel.

Although a Value component works fine in the Reflection channel, both subtler and more fantastic effects can be achieved by using a Color component instead. To make a highly reflective object appear more vivid (less washed out), use a variation of the same color you have in the Color channel (if the object's color is particularly bright, you may want to use a darker tint of the same color). To give reflections an unusual tint, try using a color that is markedly different from the one in the Color channel.

- When you use color data (a Color component, a Texture Map component, or a complex subshader) in the Reflection channel, its hue affects the tint of the reflection and its brightness determines the amount of reflection. Darker colors produce less reflection; brighter colors produce more.
- Using values in the Reflection channel produces the same effect as using shades of gray. Only the amount of reflection is affected.

Of course, if you want varying levels and tints of reflection across the surface of an object or paint shape, you can use a texture map or a function.

The default content of the Reflection channel is a Value component, set to a value of zero.

Transparency

When light strikes an opaque surface, it simply bounces off. When it strikes a semitransparent surface, some light bounces off, but some passes through. As a result, you can see through a semitransparent object. Glass, water and clear plastic are examples of semitransparent materials.

You can specify transparency by placing shader components beneath the Transparency channel.

While a Value component is perfectly appropriate in the Transparency channel, a Color component provides a much broader range of possible effects. Objects made of colored glass tend to look more realistic if you use a similar color in both the Color and Transparency channels (if the object's color is bright, you may want to use a darker tint in the Transparency channel).

Try using a function or a black and white texture map in the Transparency channel to create a shader which makes transparent “holes” in an object. For example, placing the Wires function in the Transparency channel creates a wireframe effect.

- When you use color data (a Color component, a Texture Map component, or a complex subshader) in the Transparency channel, its hue affects the appearance of colors viewed through the transparent shader. Its brightness determines how transparent the shader is. Darker colors produce less transparency; brighter colors produce more.
- Using values in the Transparency channel produces the same effect as using shades of gray. Only the amount of transparency is affected.
- A 100% transparent surface may not be completely invisible—depending on the settings in the other channels, it may still refract and show highlights.

The default content of the Transparency channel is a Value component, set to a value of zero.

Refraction

When light rays pass through a semi-transparent object, their trajectories are deflected. This phenomenon is known as refraction. Glass, fluids, and other translucent materials refract light to some degree. This results in a distorted view of objects behind the refractive surface.

The distorted view of the snorkel hose was created by using refraction on the mask.

A simple refraction experiment: Stand a pencil in a glass of water. Refraction “bends” the pencil where it enters the water.

A single Value component is generally all you’ll need to place in the Refraction channel.

Note: The setting in the Refraction channel only affects a shader with some degree of transparency. Light must pass through in order to be refracted.

Shaders simulating glass should have Refraction values around 20. Shaders simulating water or ice should have values that are somewhat lower. Try experimenting with different values until you achieve the effect you want.

- Color has no effect on the Refraction channel. Any color information in the Refraction channel is internally converted to values.

The default content of the Refraction channel is a Value component, set to a value of zero.

Glow

The settings in a shader’s Glow channel determine the shader’s luminance. An object whose shader has a high degree of luminance will appear bright, even if it is not lit by ambient light or external light sources.

Glowing shaders can be used to simulate things like neon tubing, lit windows in a cityscape at night, or the LED display of a digital clock. They can also be used for the subtler purpose of brightening a particular object in a dimly lit scene. This allows you to emphasize an object without affecting the lighting and mood of your entire scene.

Objects with glowing shaders do not cast light on other objects in the scene.

Although a Value component can be used in the Glow channel, a Color or Texture Map component is more appropriate. For realistic results, try using similar colors in the Color and Glow channels.

To create unusual effects, you can place markedly different colors in these two channels. For example, you might create a shader which appears green when well lit, but glows red when covered in shadow.

- When you use color data (a Color component, a Texture Map, or a complex subshader) in the Glow channel, its hue determines the color of the glow, and its brightness determines the intensity.

For a related glow technique, refer to "Aura" on page 359.

Building and Editing Shaders

Most of the work in building and modifying a shader takes place in the *Current Shader Editor*. The **Browser palette: Shaders tab** and shader document windows are also useful.

The Current Shader Editor

The **Current Shader Editor** palette provides all of the tools for customizing a shader.

You can use the **Current Shader Editor** to design a new shader, modify a shader you've stored in the Browser, or edit a shader you've applied to an object or paint shape.

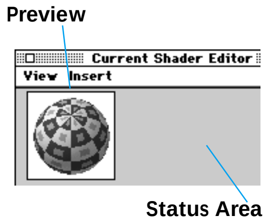
To display the Current Shader Editor:

Choose **Windows menu▸ Current Shader Editor**.

The contents of the Shader Editor depend on what type of shader you're editing: a Composite shader or a Global Mix shader.

Because a Composite shader's tree can be quite complex, the Shader Editor does not display the entire tree at once. At any given time, you'll work with only the portion of the tree beneath a single shader channel. You can use the eight channel tabs to move from one channel to another.

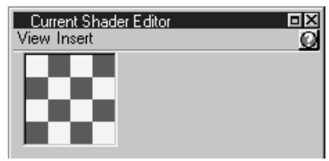
The preview in the upper left corner of the Shader Editor shows you what the shader you are editing looks like. Each time you change the shader tree, Ray Dream Studio updates the preview to show how your change affects the shader.



Ray Dream Studio's Shader Editor palette provides a preview of your shader.

You can choose a spherical preview, which shows you how your shader will look on the surface of an object, or a flat preview, which gives you an undistorted view of 2D image data like texture maps.

You can choose between a spherical shader preview...



... or a flat shader preview.

To switch between spherical and flat preview:

Choose **Current Shader Editor palette: View menu▸ Sphere Preview** or **Flat Preview**.

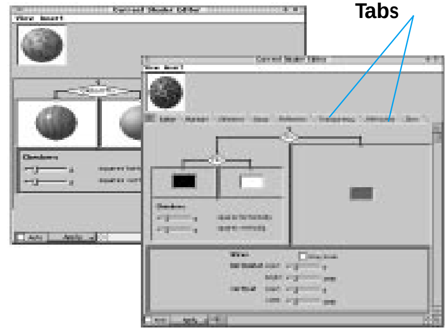
Note: This change affects only the preview of the shader you are currently editing.

To switch between shader channels:

Click the channel tab for the channel you want to edit.

The Shader Editor displays the branch of the tree beneath the channel you have chosen.

Note: The top level of a Global Mix shader's tree is fixed—it always contains a Global Mix component with three branches. The middle branch contains the mixing function, and the left and right branches contain the subshaders being mixed. Because all eight channels of the subshaders are mixed with the same function, no channel tabs appear in the Shader Editor when you are editing the top level of a Global Mix shader.



The Shader Editor.

To design a new shader:

1. Choose **Windows menu▸ Current Shader Editor**.

2. Use the **Shader Editor** tools and features to design the shader.

   - Choose a tab, select a place holder, and add a component from the **Insert** menu.

Note: Refer to the earlier portions of this chapter for information on the shader components. Instructions for navigating and editing the shader tree appear below.

- You may also drag a shader from the browser into an appropriate place holder in the Shader Editor, where it becomes a subshader.
- You may also open a shader document from the Browser and drag its components or subshaders into the Shader Editor.

Note: If you drop a shader or subshader onto a place holder where its type is inappropriate, Ray Dream Studio alerts you. For example, you can't put a Global Mix shader where a simple component is required.

3. When you're finished designing, either apply your new shader to an object or add it to the Browser.

To add the current shader to the Browser:

1. Drag the shader preview from the **Current Shader Editor** to the **Browser** palette.

Note: You must drop the shader under a directory column.

Ray Dream Studio prompts you to name the new shader.

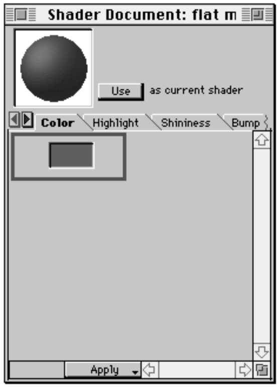
2. Enter a name and click **OK**.

To open/edit a shader from the Browser:

1. Double-click on the shader you want to edit.

Note: In the Browser, shaders are saved as documents.

Ray Dream Studio opens it in a shader document window.



Double-click on the shader to display the shader document window.

Note: If you don't see the shader document window right away, it might be hidden under one of the floating palettes—the **Current Shader Editor** or **Browser** palette.

2. Edit the shader by adjusting sliders and other settings.

You may also drag and drop components or subshaders from the Current Shader Editor or other open shader documents.

You may add or change components using the Insert menu on the main menu bar. This menu holds the same items as the Insert menu on the Current Shader Editor palette.

3. Click **Apply** to apply the modified shader to a selected object.

4. Click **Use** to move the contents of the document to the Current Shader editor.

5. You can save the modifications to the shader:

   - Make sure the shader document is the active window.
   - Choose **File menu▸ Save**.

   Ray Dream Studio saves the changes into the Browser document file.

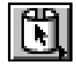
6. If you want to save the shader under a different name:

   - Drag the preview into the Browser.
   - Enter a new name.

7. Close the shader document window when you're done.

To edit an object's primer or a paint shape's shader:

1. Choose the **Paint Shape Selection** tool.



2. Display the **Current Shader Editor** palette.

3. Click an object to edit its primer—make sure you click an area where there are no paint shapes.

4. Click on a paint shape to edit its shader.

Note: If the Current Shader Editor isn't already open, double-click an object or paint shape to open the shader in the editor.

5. Edit the shader tree by adding, removing, and modifying shader components.

   Instructions for navigating and editing the shader tree appear below.

6. When you are satisfied with the changes you've made, click the **Apply** button in the Shader Editor.

Navigating the Shader Tree

A complex shader tree has many levels. Each time the tree branches, a new level is added. When you are working with a

Composite shader, you can choose to view just one level at a time, or you can expand the tree to show all of the levels beneath a particular channel.

Viewing all levels requires more space on your screen, but eliminates the need to jump from one level to another to edit components.

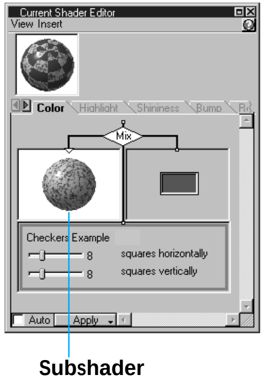
To choose a display mode:

Choose **Current Shader Editor palette: View menu▸ One** level or **All** levels.

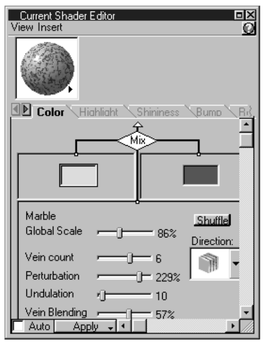
The All levels display option does not apply to Global Mix shaders. If you want to edit the subshaders on the left and right branches, you need to “jump into” them—see below.

In the following examples, the Shader Editor is set to display only one level at a time. The screen shot on the left shows the highest level of a Composite shader’s Color channel. The screen shot on the right shows a subshader on the level immediately below.

In the screen shot on the left, notice that one branch of the Mix operator contains a preview sphere, rather than a set of controls. This indicates that the branch contains a subshader and that the tree continues to branch below the current



Jumping into this subshader...



...allows you to edit its components.

level. To edit the subshader, you would need to “jump into” it—that is, jump down to the next level of the shader tree. After you finished viewing and editing the components in the subshader, you could then “jump out,” back to the level above.

When you jump into the left or right subshader of a Global Mix shader, the channel tabs appear, giving you access to the settings in each of the subshader’s channels.

To jump into a subshader:

There are two ways to jump into a subshader.

- Double-click the preview of the subshader.
- Click on the preview to select it, then choose **Current Shader Editor palette: View menu▸ Next Level**.

To jump out of a subshader:

There are two ways to jump out of a subshader.

- Choose **Current Shader Editor palette: View menu▸ Previous Level**.
- The tiny arrow in the lower right corner of the Shader Editor’s main preview indicates a pop-up. Press on it and select any higher level.

Editing the Shader Tree

You'll build a shader by placing components and subshaders on the branches of the shader tree. To edit a shader tree, you simply add, remove, and replace shader components.

Ray Dream Studio's drag and drop interface pertains not only to applying shaders, but also to building them. You can drag a component or subshader from one branch of the shader tree to another. You can also drop a shader from the Shaders Browser onto a branch of the shader tree, or drag a subshader from the tree into the Browser for storage.

This section describes how to construct a shader tree from a collection of components. For detailed descriptions of the various shader components and a discussion of how they interact, refer to "Shader Structure and Content" on page 198.

To specify a shader type—Composite or Global Mix:

Choose **Shader Editor palette: Insert menu▸ Composite** or **Global Mix**.

This replaces the current contents of the Editor with an empty Composite or Global Mix shader tree.

To place a shader component or subshader on the shader tree:

1. Display the shader channel tab where you want to work.

2. Click on the branch (component or place holder) you want to select. Ray Dream Studio outlines the selected branch in gray.

Note: The root of the channel is automatically selected.

If the component you select is the root of a subshader, the entire subshader is selected.

3. Choose the component you want to add from the **Current Shader Editor palette: Insert menu**.

Note: If you're working in a shader document, not the Editor, the Insert menu is on the main menu bar.

For complete information on the components, refer to "Shader Components" on page 201.

Note: When you add a simple component to the left or right subshader branch of a Global Mix shader, it is placed in the Color channel of the subshader. To edit its settings, you need to jump into the subshader.

To move components by dragging:

Drag a subshaders or component onto the branch of the shader tree where you want it.

- You can drag a shader from the Browser.
- You can drag a component or subshader from an open shader Browser document. This has the advantage of bringing all of its parameters with it.

  Ray Dream Studio copies the component or subshader you drag onto the branch where you drop it, replacing any contents that may have been there before.

When you drop a shader onto any branch of a Composite shader, only the contents of the applicable channel are placed on the branch. If the shader you're dropping has no components in the applicable channel, Ray Dream Studio notifies you, and nothing is added to the branch.

Note: When you drop a shader onto the left or right branch of a Global Mix shader, the entire shader you're dropping (all eight channels) is placed on the tree.

To remove the contents of a branch:

1. Select a component or subshader.

2. Choose **Edit menu▸ Clear**, or press the **Delete/Backspace** key.

   If the component you remove is the root of a subshader, Ray Dream Studio removes the entire subshader.

To copy a component or subshader to another channel:

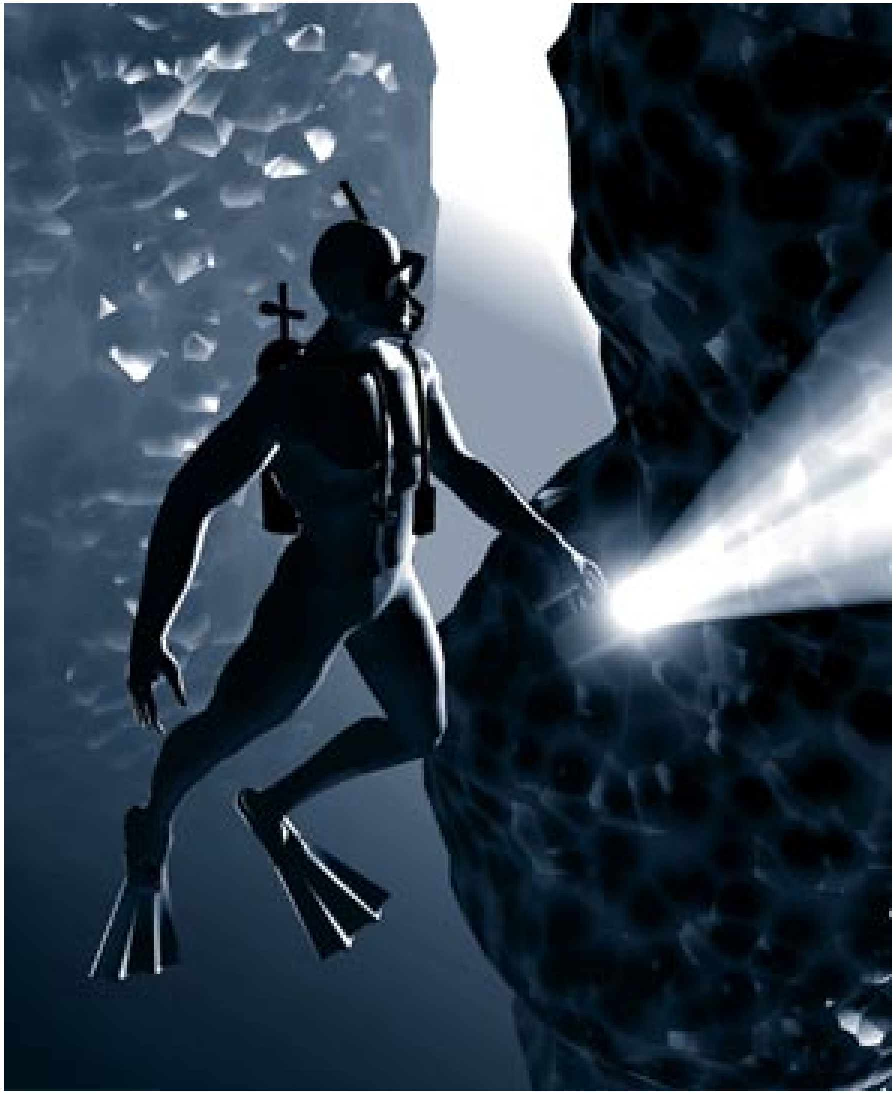
Drag a component or subshader from its branch and drop it on a different channel tab.

Ray Dream Studio replaces the entire contents of the channel with the component or subshader you drop.

or

Drag a component or subshader from its branch and hold it over any channel tab. After a moment, that tab comes forward and you can drop the shader onto any branch in that channel.

Ray Dream Studio replaces that component or subshader with what you drop.



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

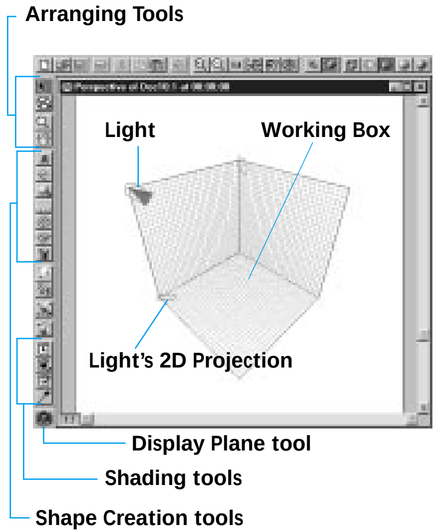
The Universe

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.



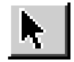
The Perspective window contains many features to allow you to display and view your images.

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.



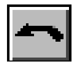
Selection Tool (Shift-T)

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.

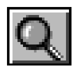


Rotation Tool (Shift-Q)

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.

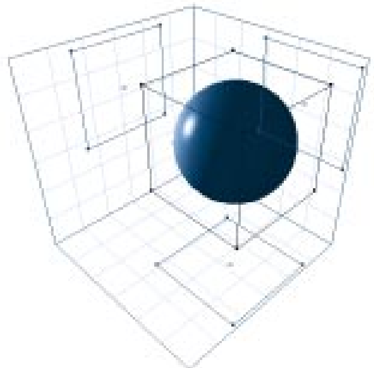
Alternatively, you may use the window scroll bars to pan the view.

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.

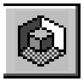
By default, the working box is centered on the origin (0, 0, 0 of the universe) and aligned with the axes of the universe. The lines where the grid planes meet show the x, y and z dimensions of the universe.

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.



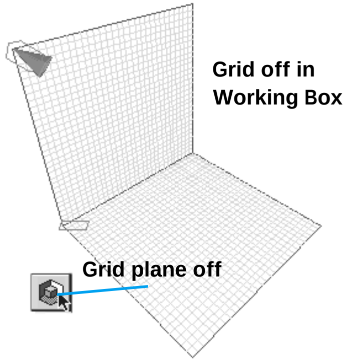
Use the Plane Display tool to toggle the grid planes on and off.

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:

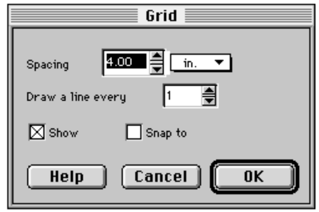
Hold down the **Option**/**Alt** key and click on the plane you want active in the **Plane Display** tool.

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.

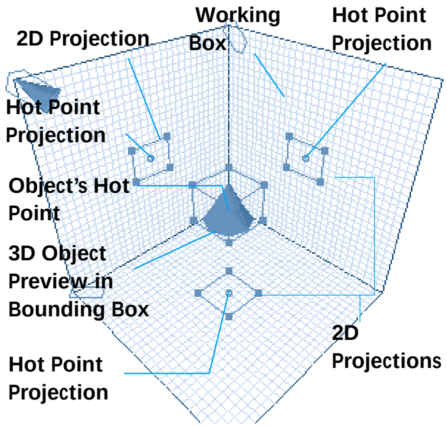
In all cases, the working box is resized to a scale appropriate to the new position.

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.

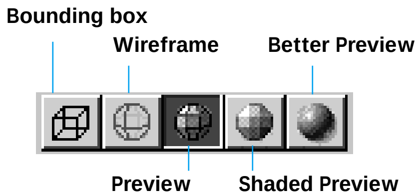
In all preview modes, objects create projections on the working box planes. And selected objects display their bounding boxes.



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.

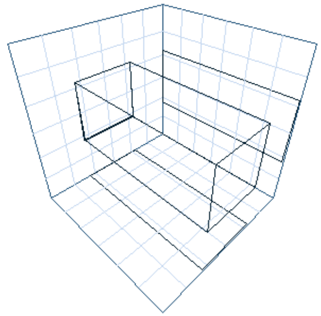


Click on one of the icons from the Rendering toolbar to change the quality of the objects in the Perspective window.

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

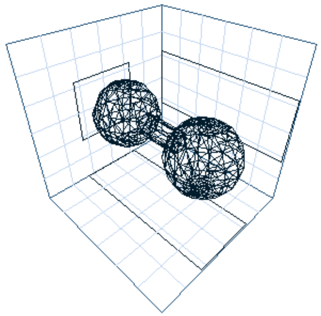
Note: There is no toolbar icon for **No Preview**.

Bounding Box displays only the bounding boxes for the objects.



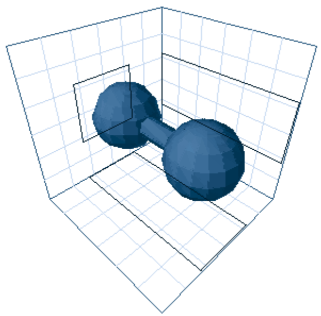
Bounding box preview example.

Wireframe displays objects as a mesh of wires.



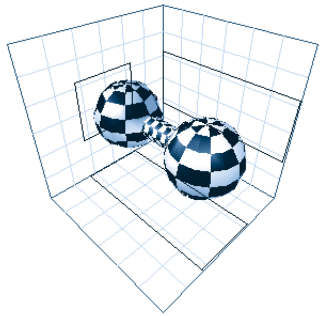
Sample object displayed in the Wireframe preview mode.

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.

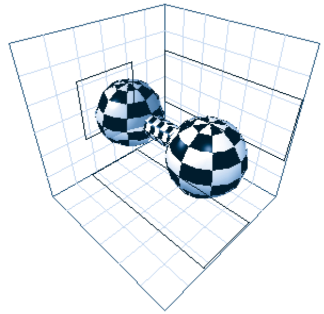
Shaded Preview displays objects using scene lighting to shade it and show its 3D shape. This display mode uses lower resolution textures and a faster shading method than Better preview.



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.

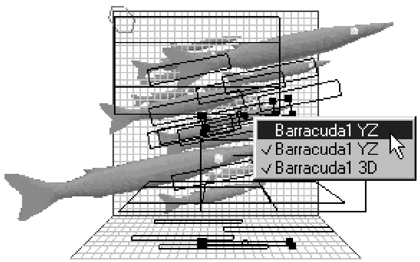
Ray Dream Studio 5 provides several ways to select objects:

- 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.

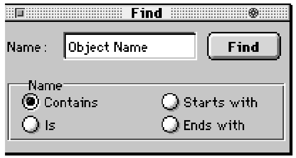
You may also drag a marquee around the objects, if you want to select several.

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.

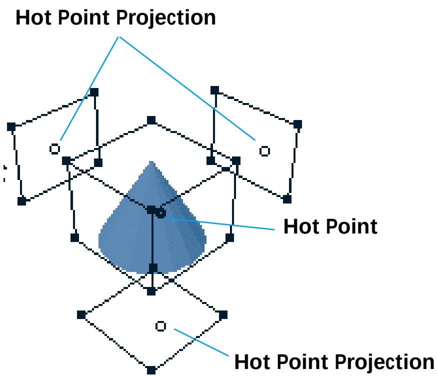
Except where noted, all of the positioning, orienting, aligning, and resizing commands work with either simple or grouped objects.

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.

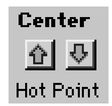
By putting on Caps Lock and holding down Command/Ctrl while dragging, you can drag an object by its hot point across a contoured surface. The object you drag maintains its distance from the surface across any contour.

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.

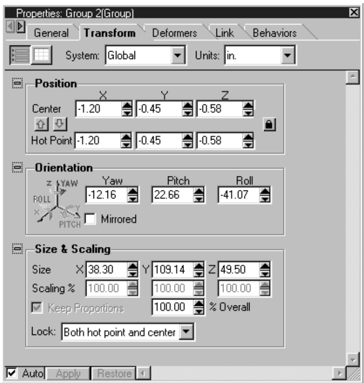
To move a hot point numerically:

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.

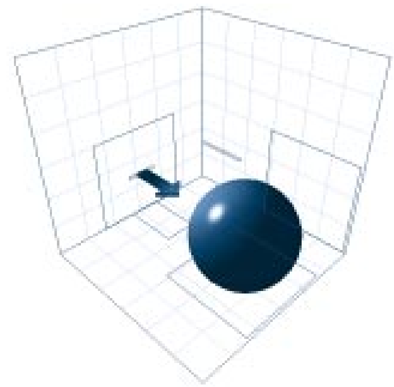
To move an object parallel to the active plane:

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.

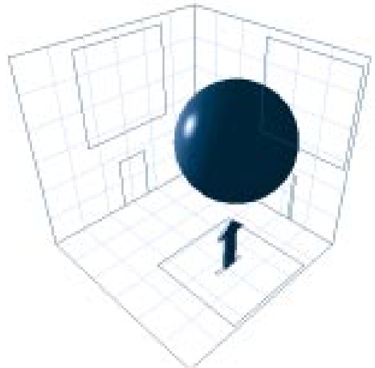


Dragging along active plane moves it parallel to that plane.

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.

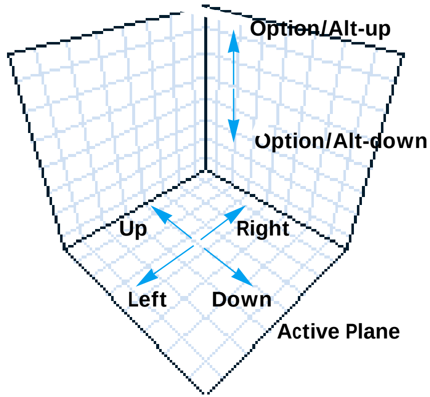
   Collision Detection is on when the button is darkened.

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.

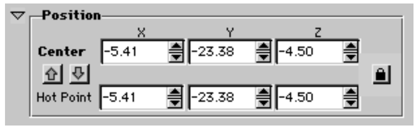
Numerically Positioning Objects

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.

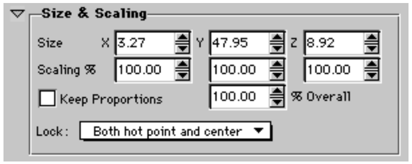
Resizing may change the relative positions of two objects. For instance, a glass on a table, if enlarged, may go through the table, and if shrunk, may seem to float over it. You can prevent this by using the plane at the bottom of the glass as the reference for resizing—that is, by dragging a corner 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

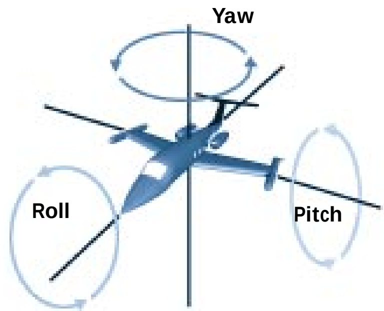
Most real-world objects have a logical "upright" and some have a logical "front." For example, airplanes and automobiles have both. In simple terms, you can think of an object's orientation as "the direction it faces."

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.

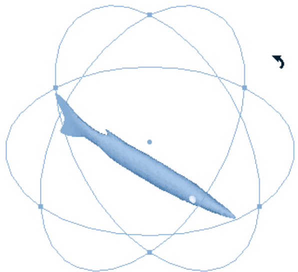
To orient an object with the Virtual Trackball:

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

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

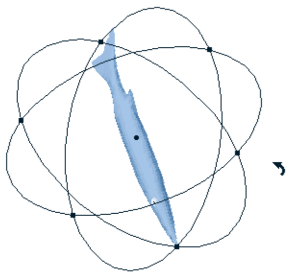
   You may select more than one object. **Shift-click** to add objects to the selection. **Shift-click** to remove selected objects.

   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.)

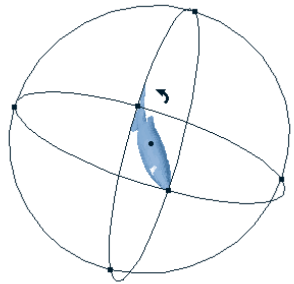


Once an object is selected, you can drag to change the orientation.

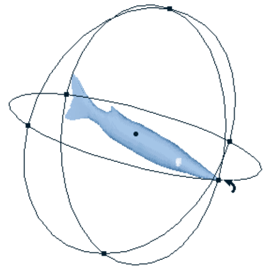
3. Drag in the perspective window to change the object orientation. The following descriptions will help you control the orientation change:



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

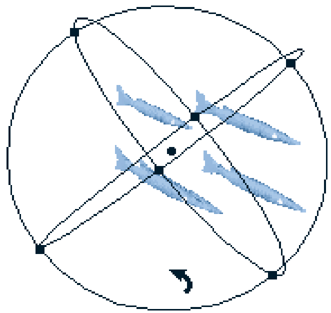


Drag within the rings to roll the object in three dimensions.



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.

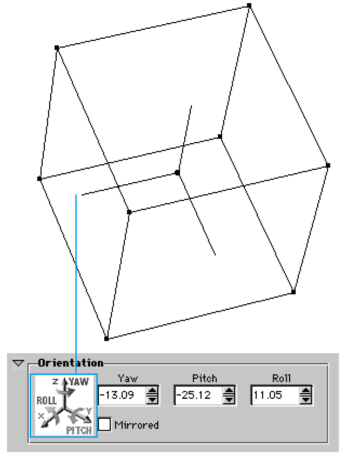
To display the axis indicators:

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**.

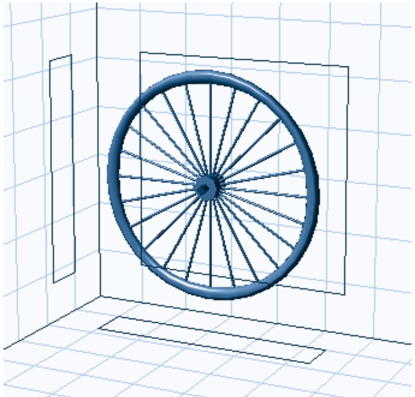
   The light or camera points at the hot point of the selected object or group.

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.

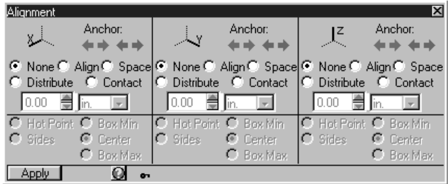


It is possible to align object in relation to other objects.

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**.

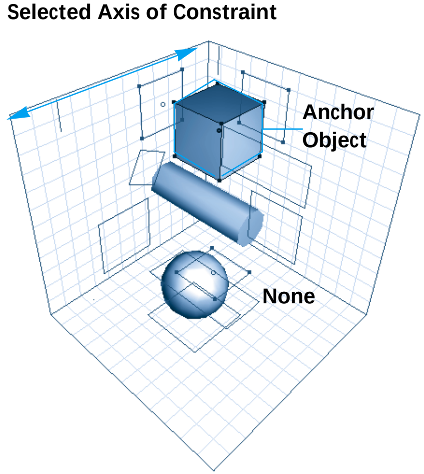
4. Choose the axis of constraint from the **Axis** pop-up.

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.



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.

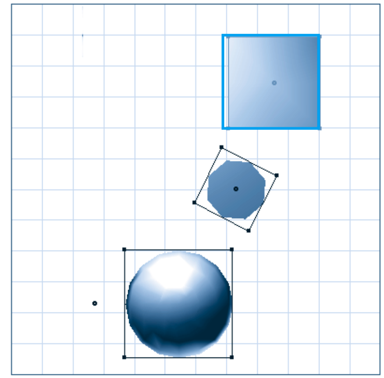
Sides specifies the sides of the object's bounding box.

8. Click **Apply**.

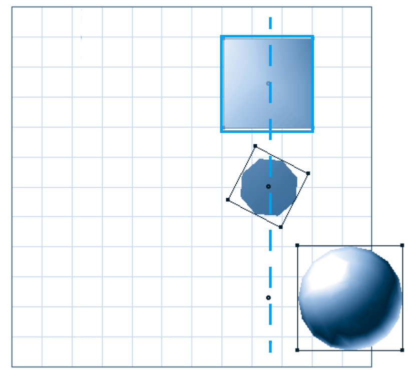
Note: The **Undo** command restores the objects to their original orientation after the last alignment operation until you change the axis of constraint, or leave the **Alignment** window, deselect the objects, and attempt another operation.

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

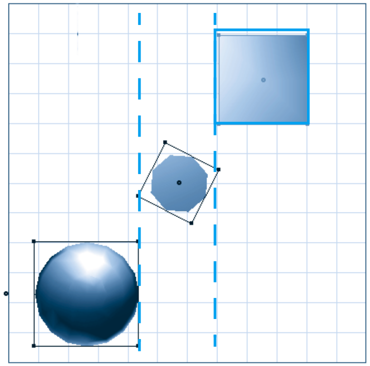
Depending on your design for this set of objects, you may use relative alignment in one, two, or all three axes of constraint.



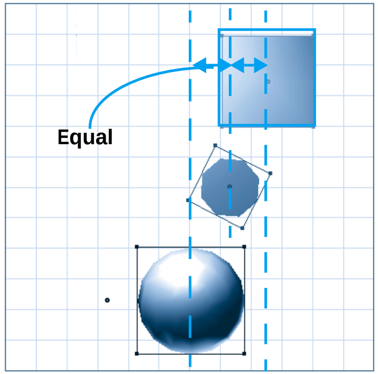
Align with None as the reference.



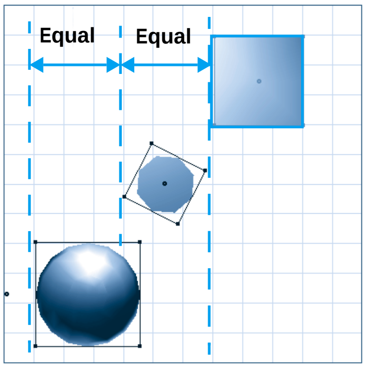
Align with Hot Point as reference.



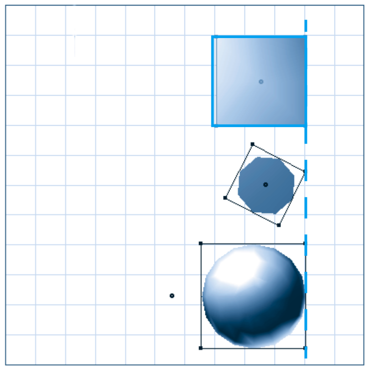
Contact with Sides as the reference.



Distribute with Center as the reference.



Space with BoxMax as the reference.



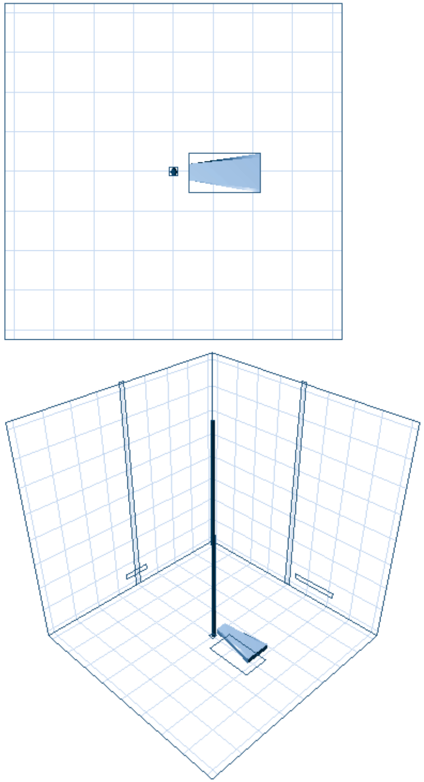
Align with BoxMin as reference

Duplicating Objects

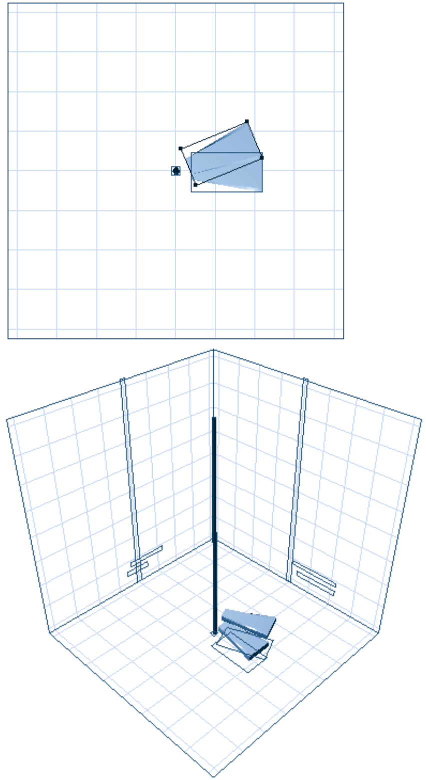
Duplication is a handy method of automatically repeating a series of position, orientation, and resize operations on a duplicate object. Duplication is an efficient way of working and has a number of practical applications.

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.

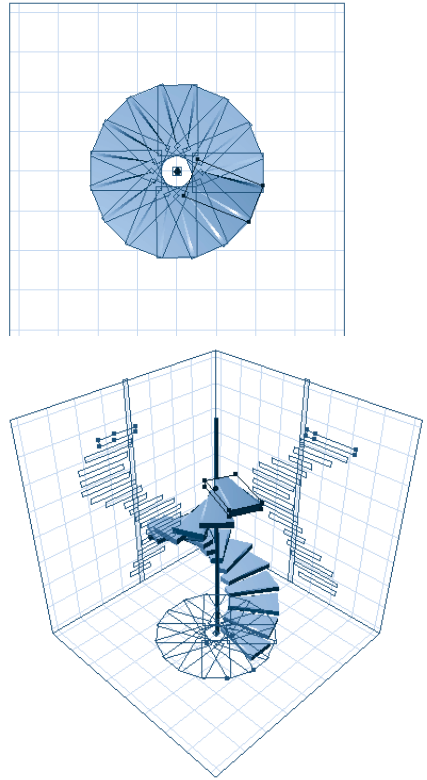
Duplicated objects are multiple instances of a single master object. For more information, refer to "Working with Master Objects" on page 266.



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.

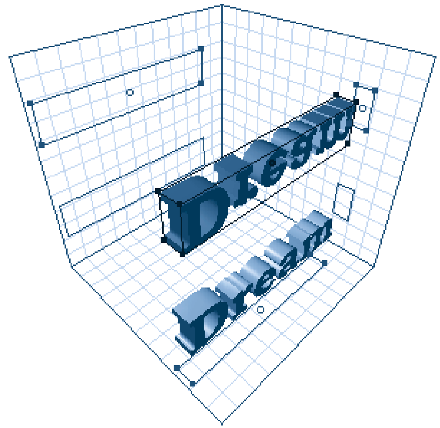
To duplicate with symmetry:

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.

13

Building a Scene

Overview

This chapter covers how you edit and manage the contents of your scene. You will learn how to add and remove objects and how to organize them in a hierarchical structure.

Building your Scene's Contents

The contents of a scene can be built by adding, deleting and replacing objects. You can also modify any object that you have created.

Adding and Deleting Objects

You can add existing objects to your scene (from other scenes or from clip art folders) in several ways: using the Objects Browser, by dragging between windows and with the **Copy** and **Paste** commands. You may even add an entire scene. In this case, the scene you add becomes a group in the new scene.

The Ray Dream Studio 5 Scene Wizard is one special way you can add an entire scene to your existing one.

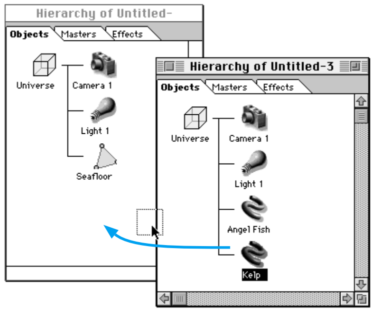
When you load an existing object, its shading, position, orientation and size characteristics are brought with it. You can, of course, change any of these to fit the new scene.

For more information on importing objects from other 3D modeling applications, refer to "Using Ray Dream Studio with other Applications" on page 379

To add an object from another scene by dragging:

1. Open both scene files.
2. Drag the icon representing the object you want from the source **Hierarchy** window to the destination **Perspective** or **Hierarchy** window.

   When you drag into the hierarchy, you can drag directly onto a group or an object. If you drag an object onto another object, the hot points are aligned, and the object you dragged is linked to the other object.



Drag the object's icon to copy the object to another scene.

To delete an object:

1. Select the object in the **Perspective** or **Hierarchy** window.
2. Choose **Edit menu ▸ Delete** or press **Delete/Backspace**.

When you select a parent object within a group, you automatically select all of its child objects. If you delete the parent, the children or the group contents are deleted as well. If you want to delete an object, but not its children, change the structure of the hierarchy to place the child or contents at some other level before proceeding.

Replacing Objects

When you replace an object, the replacement takes on the positioning, alignment and size characteristics of its predecessor.

For instructions on replacing all instances of an object class, refer to "Working with Master Objects" on page 266.

To replace a single object or group:

1. Select the object you want to use.
2. Choose **Edit menu ▸ Copy** or press **Command-C/Ctrl+C**.
3. Select the object you want to replace.

4. Choose **Edit menu ▸ Paste** or press **Command-V/Ctrl+V**.

5. If you are pasting an object (not a group), a dialog gives you a scaling option. Make your choice and click **OK**.

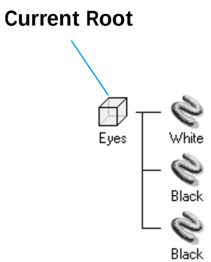
   Fit in Box scales the replacement to fit within the same bounding box.

   Keep Scaling keeps the replacement at its original scale.

Jumping into Objects

At any time, you can select an object and “jump into” it. When you jump in, Ray Dream Studio opens the object in a modeler where you can modify it.

Note: Jumping into a group is covered in “Jumping into Objects” on page 253.



Jumping into an object allows you to modify an objects shape using a modeler.

Jumping into an Object

To jump into an object:

1. Select the object.

2. Choose **Edit menu ▸ Jump In**.

   You can also double-click the object preview in the **Perspective** window or its listing in the hierarchy.

Note: If you try to jump into an instance of a class, Ray Dream Studio alerts you with a dialog. You may choose to modify the master for this class or create a new master object. For more information, refer to “Working with Master Objects” on page 266.

When you jump into a **Free Form** object, Ray Dream Studio opens it in the **Free Form** modeler.

When you jump into a **Mesh Form** object, Ray Dream Studio opens it in the **Mesh Form** modeler.

When you jump into a volumetric primitive, like **Fountain**, **Fire**, **Fog** or **clouds**, Ray Dream Studio opens the appropriate control panel.

If it’s an imported or primitive object, like the cone or sphere, Ray Dream Studio opens it in the **Minimum Modeler** window. You cannot modify the geometry of the object but you can apply shaders and paint shapes.

Jumping into an Object in a Separate Window

To jump into the object in a separate window:

1. Select the object.

2. Choose **Edit menu ▸ Jump In New Window**.

   You may have to adjust the size and position of the windows so that both are visible on your screen.

Because your modifications are updated to the object first, and then updated to the Perspective window, performance may lag slightly when you use Jump In New Window. For this reason, Jump In New Window is not recommended for systems with limited RAM.

Jumping into an Object in a Different Modeler

Normally, jumping in opens the object in the modeler where it was created or the **Minimum** modeler for primitives and imported objects. You might prefer to open the object in a different modeler.

Working with an object in a different modeler changes its type. This may limit your options for future editing. For example, you can't edit a Free Form object in the **Mesh Form** modeler, then take it back into the Free Form modeler.

To jump into the object in a different modeler:

1. Select the object.

2. Choose **Edit menu▸ Jump In Another Modeler**.

   Ray Dream Studio opens a dialog that shows your modeler options.

3. Select the modeler you want.

Note: Some modification options might not be available under other modelers.

Ray Dream Studio constructs 3D surfaces using facets and patches. Facets are triangular. Patches are polygons derived from Beziér curves. Some objects may be entirely facets, others may be a mixed set of facets and patches. When you open a primitive or Free Form modeler object in the Mesh Form modeler, all patches are converted to facets.

4. If you select the **Vertex** modeler, drag the slider or enter a value to set a fidelity level for creating facets from patches.

   More facets creates smoother surfaces, but increases the file size and memory required for the model.

5. When you have set your options, click **OK**.

   Ray Dream Studio opens the object in the selected modeler.

Building a Hierarchical Structure

The structure of a scene organizes the elements of a scene according to spatial or logical relationships. Structure simplifies arrangement operations and can save you time and trouble.

Working primarily in the hierarchy, you can structure a scene by grouping and linking objects.

The term "object" refers also to lights, cameras, and closed groups.

You'll find it's far easier to keep track of objects that you've specifically named than it is to manage generically named objects.

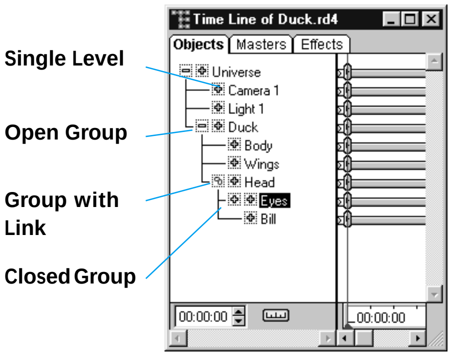
Every object in your scene appears in the hierarchy. The hierarchy is shown as a tree of elements, each represented by a listing or named icon. The hierarchy of a scene changes as you introduce objects, group them, and create links.

Elements may be objects, groups, cameras, or light sources. The highest level of the hierarchy is the root. It is represented by an icon entitled "Universe." It encompasses your entire scene. Beneath the universe, you may have any number of branches and sub-branches.

Changing your View of the Hierarchy

You can view the hierarchy in the **Time Line** window, vertically or horizontally. You may choose the display that's suitable for your working style and screen space.

Time Line view lists the contents of the hierarchy in outline form rather than with icons. This is especially useful for complex scenes or if you want to see as much of your hierarchy as possible.



The Time Line view of the object hierarchy.

To change hierarchy display:

1. Make sure the **Time Line** window is displayed.

   To display the window, choose **Windows menu▸ Hierarchy of** [**filename**] or **Time Line of** [**filename**].

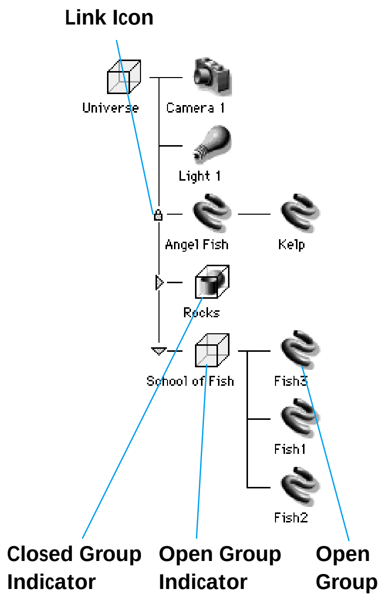
2. If necessary, click in the **Time Line** window to bring it to the front.

3. Choose **View menu▸ Vertical**, **Horizontal** or **Time Line**.

Ray Dream Studio sets the display to your choice.

Navigating the Hierarchy

You can expand and collapse the items in the hierarchy to view more or fewer elements in your scene. You may need to open a series of groups to find a particular object deep in the hierarchy.



The Hierarchical view of the object hierarchy.

To return to the outer view, close the group box at each level until only the main branch, beneath the universe root, is displayed.

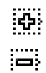
Usually, the root is the Universe. However, if you "Jump Into" a group box, the hierarchy displays the group box as the current root and the contents of that group as the only elements of the hierarchy.

A small icon appears to the left of every group.

Macintosh This icon is a small arrow. When the group is closed, the arrow faces to the right. When the group is open, it faces down.

The expand icon is a small arrow pointing to the right. The collapse icon is pointing down.

Windows The icon is a plus sign when the group is closed and a minus sign when opened.



The expand icon is a plus sign and the collapse icon is a minus sign.

To open or close a group

1. Click the arrow (Macintosh) or plus/minus sign (Windows) beside the group.

Once a group is opened, the arrow faces down and the plus sign becomes a minus sign.

To collapse the outline and close a group:

1 Click on the arrow or minus sign.

If you are in the Time Line view, a second set of arrows (Macintosh) and plus/minus signs (Windows) appears next to groups and objects. These icons located closest to the object are used to expand the hierarchical structure of the animateable attributes. Use the icons to the left of these to expand and collapse the scene hierarchy.

Changing the Structure

You can combine multiple elements of your hierarchy in two ways: grouping and linking. You can nest groups within other groups or create a chain with multiple links.

You can reorganize your groups and links by dragging them from one location in the hierarchy to another. Don't worry about making a mistake in changing the hierarchy. You can drag an element to another level at any time.

You can drag objects individually or select several and drag them at once. To select multiple items, drag a marquee around them or hold down the **Shift** key and click on additional items.

To remove a single object from a multiple selection, hold down the **Shift** key and click it.

Drawing a marquee is an easy way to select a set of objects. However, you may not select a group exclusive of its contents or a parent exclusive of its children.

Selecting elements in the hierarchy applies not only to the selected object, but, in the case of a closed group box, to its contents, and in the case of a parent object, to its children.

Groups and Links

Groups and links are similar — both let you combine multiple objects in your scene so that you can manipulate them as a single unit, but their usage is quite different.

Grouping is a way of creating collections of objects that make structuring and navigating through your scene more manageable. Groups are static, in that they don't change the relationship between the objects in the groups, they only contain them. This is similar to the group function in 2D illustration and drawing programs.

Links on the other hand, let you define an active relationship between the "parent" object and the "child" object. By applying various types of links you can "tie" them together so that moving the parent effects the child, but moving the child does not effect the parent.

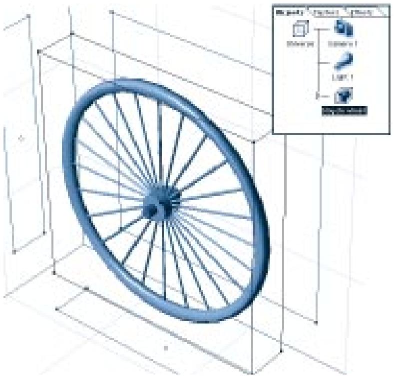
The exception to this is when applying the Inverse Kinematics behavior to a child object in a linked chain. for more information on Inverse Kinematics, refer to "Inverse Kinematics" on page 317.

Grouping Objects

As you build up your scene, you'll want to group related objects. Grouping allows you to control a set of objects as a single unit.

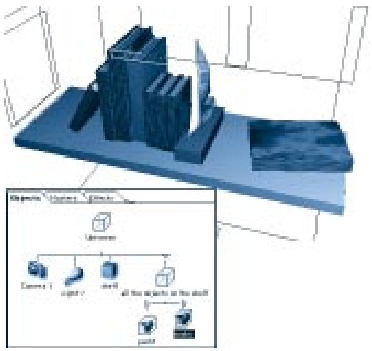
You can arrange a group just as you do a single object. During any positioning or orientation operation, the objects in a group retain their spatial relationship to one another.

How you organize your groups is up to you. You'll often create groups based on the logical context of a set of objects—for example, the "hub, axel, spokes, rim and tire." When arranged properly and grouped, the set of objects becomes a single object you could name “bicycle wheel.”



You can group all objects into a single object which can then be named.

You can also create groups based on the proximity of a set of objects—for example, “all objects on the bookshelf.”



You can also group objects based on their proximity to one another.

You can nest one group within another to as many levels as you like. As you build a complex scene, you’ll find nesting groups helps manage the multitude of elements.

Don’t worry about perfecting the shape of an object before putting it in a group. You can always open the group, then open the object for editing.

To create a new group:

1. Select the objects you want to group. You may select the objects in either the **Perspective** or **Hierarchy** window.
2. Choose **Arrange menu▸ Group**. You may also click the **Group/Ungroup** icon in the **Standard** toolbar or press **Command-G/Ctrl+G**.

   A box icon (or group listing, in **Time Line** window) appears in the **Hierarchy** window under the current root.

   By default, group boxes are named **Group x**, where **x** is a sequential number (1, 2, 3...).

Click the Group icon to group the selected objects.

To change the name of a group:

1. Click on the name of the group in the **Hierarchy** window.

   If you’re using the **Time Line** window, don’t click, but hold down the mouse button for a second or two.

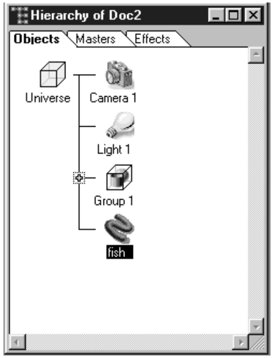
   Ray Dream Studio opens the **Edit Name** dialog.
2. Enter the new name and click **OK**.

Note: You may also change a group’s name in the **Properties palette: General tab**.

You can have Ray Dream Studio automatically prompt you to name groups you create. Choose **File menu▸ Preferences**: **Hierarchy Tab** and enable Ask for name.

To add objects to a group:

Drag the icons of the objects you wish to add onto the group box icon.



Drag the object icons into the group box.

Note: You can bring an object into the scene and immediately place it in a group. Drag the object from its source (**Browser** palette or other scene hierarchy) and drop it directly onto a group box icon.

To remove objects from a group:

Simply drag the selected objects to another point in the hierarchy. For example, you can drag onto the universe icon. This places the objects on the main branch of the hierarchy.

Opening and Closing Groups

You can open and close groups while you work. When the group is closed, you can manipulate the entire group as a single object. When a group is open, it maintains its structure in the hierarchy, but you can select and move each component object independently.

This is a great time saver and gives you maximum flexibility. You can easily adjust the objects in your groups, but maintain their structure in the hierarchy.

To open a group:

Click the right-facing arrow/plus/minus sign beside the group listing in the hierarchy.

A group box is the root of its contents. While the group box is open, indicated by the open box icon, its contents are displayed on a subbranch. .

On the Macintosh, click the left-facing arrow to open a group. Click the down arrow to close the group.

In Windows, click the plus sign to open a group. Click the minus sign to close the group.

Note: Ungrouping is different from opening a group. Ungrouping gets rid of the group; the contents appear at that level of the hierarchy.

To close a group:

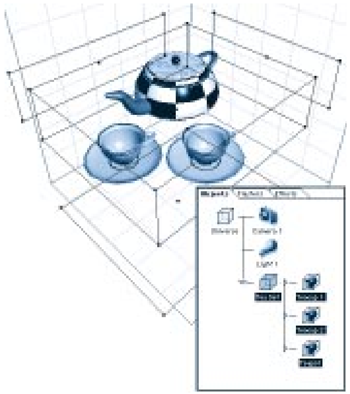
Click on the down-pointing arrow/minus sign.

The icons of the group's components collapse into the box, and the display returns to the next higher level of the hierarchy.

Group Bounding Boxes

In the **Perspective** window, the elements of a group are enclosed in a single bounding box, which is visible when the group box is closed. When you create a group, the group bounding box is set parallel to the planes of the working box.

The group bounding box is defined as "the smallest box, with the same orientation as the working box, that encloses all bounding boxes of the group's contents." If you add or remove objects from the group, the dimensions of the group bounding box may change. The orientation of the group bounding box, however, does not change as you add or remove elements.



Group bounding boxes are created parallel to the working box.

After reorienting a group, the group bounding box will no longer be parallel to the working box.

To re-calculate the group bounding box:

1. Select the group you want to recalculate.
2. Choose **Arrange menu▸ Ungroup** or press **Command-U/Ctrl+U**.
3. Choose **Arrange menu▸ Group** or press **Command-G/Ctrl+G**.

Jumping In and Out

You can jump into a group to modify the relative positions and attitudes of the objects it contains.

Within a group, a **Local Universe**, also called the Object/Group Universe, is used. This coordinate system's axes are parallel with the walls of the group's bounding box, with its origin at the center.

The Local Universe maintains the relative positions of the objects when you move or rotate the group as a whole. That is, regardless of how you manipulate the group bounding box, the content objects have the same positions in terms of the Local Universe.

To jump into a group:

1. Select the group.
2. Choose **Edit menu▸ Jump In**.

   You can also double-click the group box icon in the hierarchy to jump in right away.

Note: To open the group in a separate window (while keeping the **Perspective** window visible), use **Edit menu▸ Jump In New Window**.

When you jump into a group, the **Hierarchy** window displays the group box as the current root and its contents as the only elements of the hierarchy. Simultaneously, the **Perspective** window redraws to display only the contents of this group.

When you jump into a group, the working box is oriented parallel with the group's bounding box. This enables you to work in terms of the group's Local Root Universe. If this is not what you want, you can align the working box with the Global Universe.

To jump out of a group:

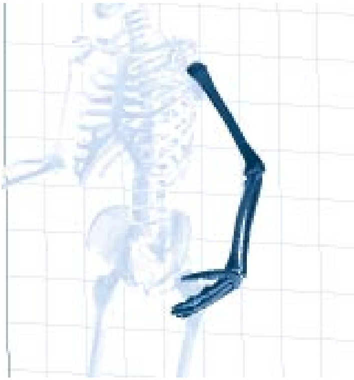
Choose **Edit menu▸ Jump Out**. You can also double-click the group box icon in the hierarchy or click the **Done** button at the bottom of the **Perspective** window.

When you jump out, the **Hierarchy** and **Perspective** windows returns to displaying the universe.

Linking Objects

Linking creates a "physical connection" between objects. In a linked pair, one object is the "parent" and the other is the "child." When you change the position or orientation of the parent, the child moves with it. However, you can still more or rotate the child independently of the parent.

Linking is used to create articulated structures, like an arm. The hand is linked to the forearm, which is linked to the upper arm, which is linked to the shoulder.

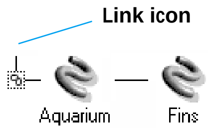


Linking is used to create articulated structures, like an arm.

For information on how to constrain the child object's movement with Link Properties, refer to "Applying Link Properties" on page 260.

To link an object to another:

1. In the **Hierarchy** window, drag the object or group's item (icon or listing) onto the item of the desired parent.



To link an object, drag the object's icon onto the parent.

The link icon appears prior to the parent object.

Note: If you duplicate a parent object, you'll also be duplicating all of its child objects.

To attach an object to a parent that is off screen in the Hierarchy window, drag the new element with the Option/Alt key held down. This automatically scrolls the window's contents to reveal additional elements.

To break a link:

Select the child object's item and drag it to another point in the hierarchy.

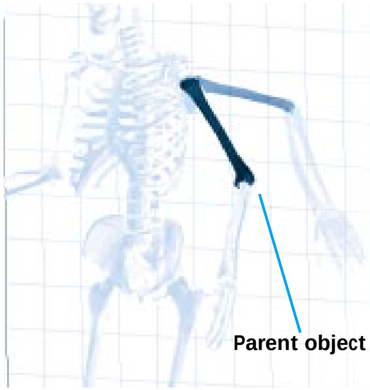
You cannot link a child object to a simple group. To do this, you must first promote the group to a master object. Then you can link the object (child) to the group (parent). See "To use a group as a master object:" on page 267.

Applying Link Properties

Linked objects have properties that constrain the child's movement relative to the parent. An excellent real world example of this is the human hand. The hand is linked to the forearm. Its range of motion (relative to the forearm) is limited—you can't bend it forward or back more than 90° or side-to-side more than 45°—anything more would break the wrist. These are just the kind of limits you can impose with link properties.

Once you have created a link, you can apply properties for setting limits.

Links become a more powerful tool for creating spatial relationships between objects when you apply a Link Property. This is especially true when setting up your scene for animation. Not only can you use links to constrain the movement of objects, but by applying the Inverse Kinematics behavior, you can create kinematic chains that allow you to manipulate the parent by moving the child.



Kinematic chains allow you to manipulate the parent by moving the child.

For more information on using Links and Inverse Kinematics in animations, refer to "Animating" on page 295.

To apply a link property:

1. Position the child object where you want it in relation to the parent.
2. Position the child object's hot point where you want it.
3. Select the child object or group.
4. Choose **Windows menu ▸ Properties**. The **Properties** palette appears.
5. Click the **Links** tab.
6. Choose the type of link you want to apply from the pop-up— **None**, **2D Plane**, **Axis**, **Ball Joint**, **Custom**, **Shaft**, **Lock** and **Slider**. Each of these is described below.
7. Choose your options for the specific **Link Property**. How to use the option controls is covered in "Setting Link Controls" on page 263."
8. When you are ready to apply your changes, click **Apply** at the bottom of the **Properties** palette.

   You may enable the **Auto** option to have your changes updated automatically.

Types of Links

There are eight link types available: **None**, **2D Plane**, **Axis**, **Ball Joint**, **Custom**, **Shaft**, **Lock** and **Slider**.

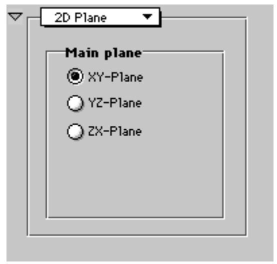
None

None is the default link property. You are free to position the child object anywhere in your scene.

2D Plane

The **2D Plane** link restricts the movement of your object to a specific plane. This plane is relative to the child object's axis, not the global universe. For example, if you rotate the object, the plane that it moves on will tilt.

Click a radio button to select the plane you want: **XY**, **ZY** or **ZX**.



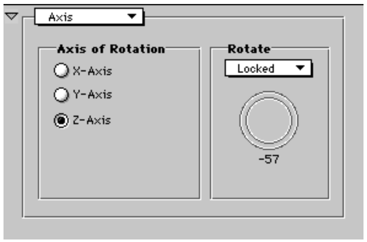
The 2D Plane controls are used to control links on a specific plane.

Axis

In the **Axis** link, a child object can be rotated around its hot point on one of the three axes. The rotation can be locked, limited, or free.

- If the rotation is locked, no movement occurs.
- If the rotation is free, the rotation is an unlimited 360° on that axis.
- If the rotation is limited, you can constrain the rotation between two points.

For more information on setting rotation controls, refer to "Setting Link Controls" on page 263.



The Axis controls are used to control links on the axis.

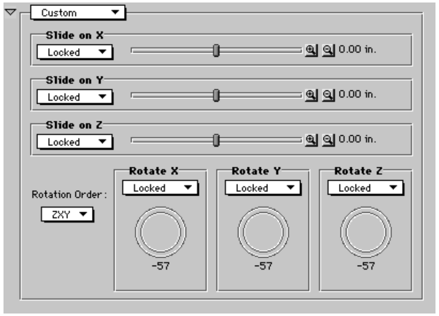
Ball Joint

The **Ball Joint** link allows you to rotate the child object 360 degrees around its own hot point. Like the 2D Plane link, the Ball Joint link is not related to the parent object, except when moving the parent. There are no constraints on any axis.

There are no options for the Ball Joint.

Custom

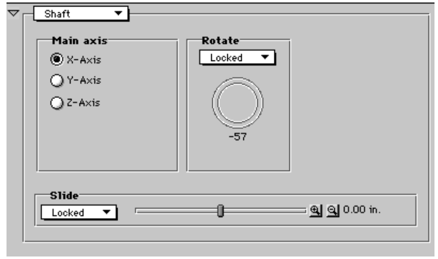
The Custom link allows you to build your own combination of constraints using sliders and axis rotation controls.



The Custom controls are used to create your own constrains.

Shaft

In the **Shaft** link, the child object can both rotate around one of its axes, while it slides up and down the same axis. Perhaps the best way to think of a shaft link is to visualize a firehouse pole. The firefighters can slide down the pole while also rotating around it.



The Shaft controls are used to rotate on one axis while sliding up and down on the axis.

Choose the main axis of rotation and set both rotation and slider controls. For information on setting these controls, refer to "Setting Link Controls" on page 263.

Lock

A **Lock** link means that the child object is locked to the parent object. You cannot select the child object and move it, but it will move in relation to the parent when the parent is moved.

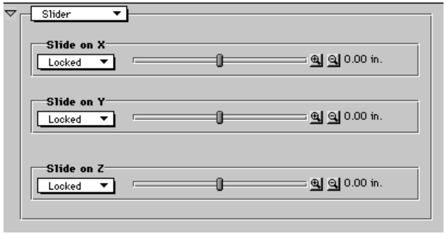
There are no options for the Lock property.

Slider

A **Slider** link sets constraints for the child object's movement along its X, Y, and Z axes. Movement on each axis can be **Locked**, **Limited**, or **Free**.

- **Locked** prevents any movement on that axis. This is the default setting.

- **Limited** allows you to place limitations on movement in both directions.
- **Free** lets the object move anywhere along that axis.



Slider Controls.

Set your options using slider controls. For information on setting slider controls, refer to “Setting Link Controls” on page 263.

Setting Link Controls

All link properties use two primary types of controls— slider and axis rotation.

To set a link slider control:

1. In the **Preferences palette: Link tab**, choose the type of constraint from the pop-up—**Locked**, **Limited** or **Free**.

   Ray Dream Studio displays the controls for the chosen constraint.

The link slider control are found in the Custom, Shaft and Slider link options.

2. Drag the slider markers to set position limits and a new position.

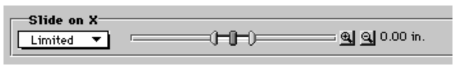
   In **Free** mode, the slider has one marker. You can drag the marker to move the object along that axis.

   You can double-click the slider to set the current position numerically.

The Free mode allows you to set limits along an axis.

   In **Limited** mode, the slider has three markers.

   - The marker on the left sets the outer constraint in the negative direction away from the object’s hot point. Drag the marker to change the limit.
   - The marker in the middle sets the current position of the object. Drag the marker to move the object along that axis between the limits.
   - The marker on the right sets the outer constraint in the positive direction away from the object’s hot point. Drag it to set a new limit.



The Limited mode allows you to set negative and positive limits along the axis.

   The text field to the right displays the position of the currently selected marker.

3. If the slider range is too large to give you precise control, click the plus magnifying glass icon to the right. Click it as many times as necessary to decrease the slider scale.

4. If the slider range is not large enough to let you set the constraint limit where you want, click on the minus magnifying glass icon. Click it as many times as necessary to increase the slider scale.

To set axis rotation controls:

1. In the **Preferences palette: Link tab**, choose the type of constraint from the pop-up—**Locked**, **Limited** or **Free**.

   Ray Dream Studio displays the controls for the chosen constraint.

The Axis rotation controls are found in the. Axis, Custom and Shaft link options.

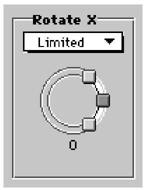
2. Drag the markers to set position limits and a new position.

In **Free** mode, your object can rotate 360° around the chosen axis. Drag the marker to rotate the object.

The Free mode allows you to set limits on the chosen axis.

In **Limited** mode, the angle ring displays three markers.

- The top marker defines the outer constraints of the rotation on the positive side of the axis. Drag the marker to change the limit.
- The middle marker sets the current position of the object. Drag the marker to rotate the object between the limits.
- The lower marker defines them for the negative side of the axis. Drag the marker to change the limit.



The Limited mode allows you to set limits for the negative and positive sides of the axis.

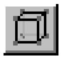
Controlling Links Directly

The Direct Manipulation option for **Link** properties provides an onscreen description and control of the objects's motion and rotation range. You can drag handles on the wires to control these properties.

To use the Direct Manipulation controls for link properties:

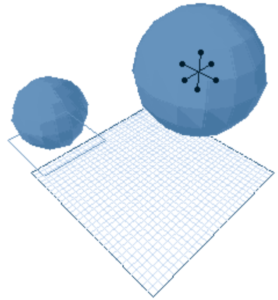
1. Follow the previous instructions to apply a Link property to an object and set link controls on it.

2. After you've chosen the constraint type, click the **Direct Manipulation** button to display the controls on the object.



Click the Direct Manipulation button to display the object controls.

The controls appear as a set of wires with "handles" at certain points. The appearance of the wires depends on the type of link and type of constraint.



The Direct Manipulation controls appear at certain points.

You won't see the control wires when the constraint type is Locked.

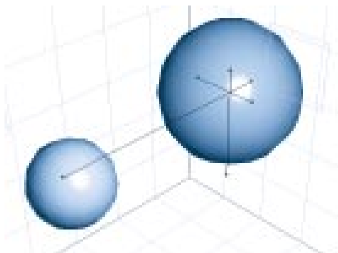
The Direct Manipulation controls require Auto Apply enabled.

For slider controls, you'll see a straight wire. When the constraint is "Limited," the handles at the ends determine the limit for sliding on that axis.

Note: If you don't see the wire, it's probably inside the object. Use the slider in the **Properties palette: Link tab** to extend the range.

To set slider options directly:

- Drag the handle at the end of the wire to change the limit in that direction.]
- Drag the object to change its position along the wire. The object's hot point slides along the wire until it reaches the end.



Drag the wire handles to change the range limits for motion on this axis.

For rotation controls, you'll see a wire arc that describes the object's angular rotation range. The line within the arc describes the current rotation.

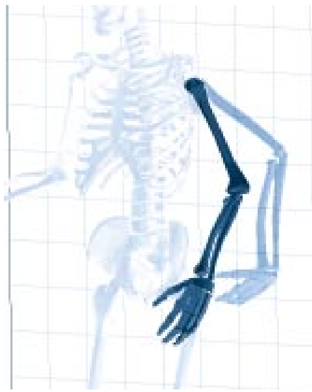
To set rotation controls:

- Drag the handle at the end of the arc to change the rotation limit.
- Drag the handle on the line within the arc to rotate the object within the range.

Building Chains of Links

The parent-child link enables you to easily manipulate multiple objects from a number of reference points by creating chains of linked objects. This feature is useful in creating articulations, especially when used in conjunction with the Inverse Kinematics feature.

For example, if you wanted to create a fully articulated arm— one that could bend at the shoulder, elbow, wrist, and each of the five finger joints—you should arrange the objects to construct the arm, then link them into a chain with the fingers at the deepest level of the hierarchy and the shoulder at the root.



A chain of links allows you to create fully articulate joints.

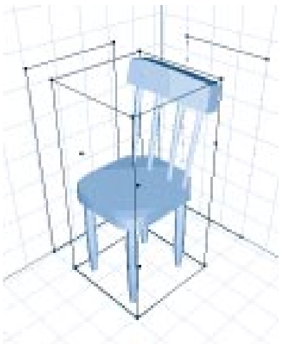
The Links Browser

The **Browser palette: Links tab** lets you save link settings that you can later apply to your objects.

The methods for saving to the **Browser** palette and using saved settings are common to the several browser categories. For complete information on using the **Browser** palette, refer to "Using the Browser Palette" on page 28.

Working with Master Objects

Most scenes use one or more duplicates of some particular object. Each duplicate is not an independent object but an Instance of the original Master object. For example, if you create a chair using four duplicate chair legs, the four legs of a chair are object instances of a master object called, “chair leg.”



Using master objects allows you to create variations of an object, but yet maintain control of the object through the master object.

The position, orientation, size, hot point location, and shading of each object instance may be unique. The shape, however, must be common.

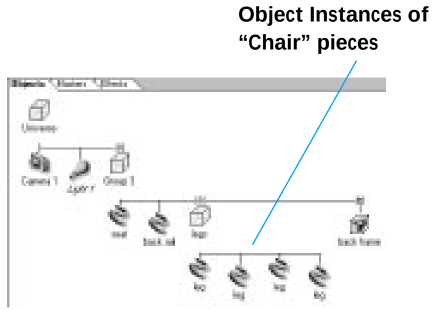
Shading of instances may be unique or common. A good example of common shading would be a dozen bottles on a shelf, all having the same label. Working at the master object level, you could change the labels on all twelve bottles in one operation. Working at the instance level, you could put a stain on one of the labels. Later, you could change all of the labels by modifying the master object without affecting the stain.

The following list describes the priority of shading layers. Items higher in the list cover those below.

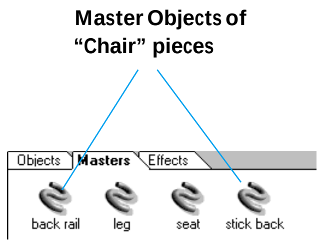
- Instance Paint Shape
- Master Paint Shape
- Instance Primer
- Master Primer

Objects and Masters Tabs in the Hierarchy

The **Hierarchy** window contains three tabs that change your view of the objects displayed in the hierarchy. The **Objects** tab displays all the objects and object instances in your scene. The **Masters** tab displays only the master objects. The **Effects** tab displays any Rendering effects you may have applied to your scene.



The Hierarchy window’s Objects tab can be used to display all objects and instances of the object.



The Hierarchy window’s Masters tab allows you to view your master objects.

Unlike the **Objects** tab, the **Masters** and **Effects** tabs do not let you structure or group objects.

To display Master objects:

1. Click the **Master** tab in the **Hierarchy** window.

   You create a new master object each time you add a new object to the scene.

Jumping into an Instance

When you jump into an instance object, Ray Dream Studio displays a dialog alerting you. In the dialog, you may choose to modify the master object of this class or create a new master from this instance.

You may have multiple instances with the same name, but you may not have two master objects with the same name. When you create a new master object by modifying an object instance, Ray Dream Studio names the new class object by appending a number to the old name.

If you modify an instance when you had intended to modify the master object, you can easily get back on track by replacing the master with your modified instance. Refer to "Master Object Operations" on page 267.

You can create new instances of the master object by duplicating an existing instance, copying and pasting, or by dragging the object from the **Master** tab into the scene.

For information on special duplicating features, refer to "Duplicating Objects" on page 247.

Master Object Operations

When you modify a master object, all object instances are automatically updated to the new form. Their individual position, orientation, scale, symmetry, and region shading remain unchanged.

To modify a master object:

1. In the **Time Line** window, click on the **Masters** tab to display all master objects.
2. Select the master object you wish to modify.
3. Choose **Edit menu▸ Jump In** to open it for editing.

   You can **Jump In New Window** if you want to modify the object in one window while viewing the scene in another.

   You may also double-click its listing in the **Master** tab to open it for editing
4. Use the modeling or shader tools to modify the object.
5. Click **Done** to jump out of the object and apply your changes.

To replace a master object:

1. Select and copy the object that will replace the existing master object.
2. In the **Time Line window: Masters tab**, select the master object you want to replace.
3. Choose **Edit menu▸ Paste** or press **Command-V/Ctrl+V**.

When you replace a master object, every instance of the class is replaced by the new object. Each object instance of the replacement uses the positioning, alignment, scale, and symmetry characteristics of its predecessor.

To use a group as a master object:

1. Select the group in the hierarchy.
2. Drag the group over the **Masters** tab, then down to drop it where you want it.

   A master group operates under the same rules as a master object. If you jump into one instance of the master group and modify its contents in any way — the number of elements, their relative positions or orientations — you separate this group instance from its master, thus creating a new master group.

The Objects Browser

The **Browser palette**: **Object tab** lets you save objects, groups and full scenes that you can use later.

The methods for saving to the **Browser** palette and using saved settings are common to the several Browser categories. For complete information on using the **Browser** palette, refer to “Using the Browser Palette” on page 28.

14

Setting Lights & Cameras

Introduction

This chapter covers how to create and use lights and cameras. It includes descriptions of the different types of lighting and how you set the options for each. This chapter also describes the different camera types and settings and how to manipulate them to achieve dramatic camera angles.

Lighting & Cameras

Lighting

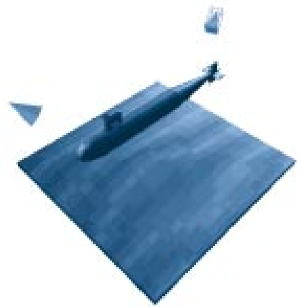
The appearance of objects in the Ray Dream Studio universe is determined greatly by the light in which they are viewed.

A good set of lighting conditions is an important step toward creating high quality artwork. The same scene rendered under different light can provide strikingly different results. For example, rendering with all lighting at zero brightness is like taking a photograph—without a flash—in the bottom of a coal mine. Conversely, too much lighting washes out subtle effects.

Ray Dream Studio also lets you create visible light spheres and cones. The visible light cone effect is like a searchlight cutting through the fog. These are rendering effects, for more information, refer to "Render Filters" on page 349.

Where Lighting Effects Are Visible

In the default **Preview Quality** display mode, lighting effects specific to your scene are not visible. Instead, the appearance of objects is determined by an arbitrary, fixed light source not visible in the **Perspective** window. This ensures that you'll see the objects you manipulate clearly—even if you are working on a dark scene. This also helps make the **Preview** mode significantly faster than the **Better Preview** mode.



A scene in Preview Quality display mode.

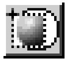
The **Shaded Preview** and **Better Preview** modes use ambient light and your scene's specific light sources to show color, highlights, gel effects and depth shading. No other lighting effects (shadows or reflections) appear. If ambient light is your only source of light, you won't see the depth shading effect on objects.

A scene in Better Preview display mode.

When modeling in the **Mesh Form** or **Free Form** modeler view, the Shaded Preview and Better Preview use an arbitrary, fixed light source. This allows you to see details of the object's textures and geometry clearly, regardless of the scene's actual light settings.

When you render your scene using the Adaptive renderer or the Ray Tracer, that rendering will show color, shading, and all of the complex lighting effects selected in the renderer. These may include visible light and camera effects, reflection and refraction, shadows and transparencies.

Before launching the rendering process, use the **Render Preview** tool in the Standard toolbar to preview lighting and shading effects.



Use the Render Preview tool to preview lighting and shading effects.

For more information on rendering features, settings and procedures, refer to "Rendering" on page 339.

Cameras

Cameras provide viewpoints for the **Perspective** window and for renderings. As you build your scene, the cameras can be positioned to get the best view for working. You can place several cameras and switch among them to get alternate perspectives of your scene. You can even create a second **Perspective** window to view your scene from two different angles at once.

When you're ready to render, you can select a camera as the viewpoint. The camera's position and settings combined with the **Production Frame** position and rendering format to determine the scale and framing of the scene.

Ray Dream Studio also lets you create camera effects, like lens flare and depth of field. These effects help you achieve results you'd expect from photography. For more information on this and other rendering effects, refer to "Render Effects" on page 344.

Setting Lights

Ray Dream Studio supports two categories of lighting—ambient and specific. There is one ambient light setting, but there are several types of specific light sources.

The lighting you set up in your scene has a big effect on the look of your rendered illustration. All the different lighting controls combine to result in dramatically different effects. Experiment with different light settings to create the effects that you want in your 3D illustration.

Ambient Light

Ambient light is uniform through the scene. It has no specific origin and casts no shadows. It is the equivalent of daylight in a real world scene. It radiates in every direction, has no position and no origin point.

To set ambient light:

1. Choose **Windows menu▸ Scene Settings**. The **Scene Settings** window appears.
2. Click the **Effects** tab.

Use the Effects tab to set the ambient light controls.

3. Click the **Ambient Light** color swatch and use the color picker to set the color for the ambient light.
4. Use the **Brightness** slider to set the amount of ambient light.
5. To view your changes, choose **View menu▸ Better Preview** or **Shaded Preview**.

Note: You may also use the **Render Preview** tool in the **Standard** toolbar.

For deeper shadows and high contrast with lit areas, use a lower ambient light setting. As you increase the brightness of ambient light, the intensity of shadows and other effects generated by your other lights decreases. This “flattens” the image. To rely exclusively on your other lights, set ambient light at zero. For example, to create the dramatic effect of a spotlight on a theatre stage, use no ambient light.

Creating a New Light Source

You may create several types of specific lights. The standard lights are distant, bulb, and spot.

You may add as many lights as you like, but as the number increases, so does the time it takes to render your final 3D illustration. Most scenes can be lit with one, two, or at most three well placed lights.

By default spot light and bulb light previews are displayed in red. If you want, you may change the color of light objects in the Perspective window. Choose **File menu▸ Preferences**: **Color** and set your preference.

To create a new light source:

Drag the **Create Light** tool from the **Tools** toolbar into the **Perspective** or **Hierarchy** window.

Drag the Create Light tool into the Perspective or Hierarchy window to create a new light.

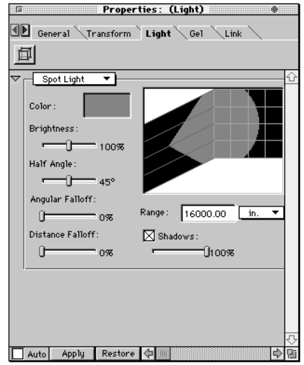
You can also choose **Edit menu▸ Insert▸ Light** to add a light at the center of the Universe (0,0,0).

If you want to create a light with the same settings as an existing light, you can select the existing light then **Copy** and **Paste**, or use the **Duplicate** command.

After creating a light, you can change its properties.

Setting Light Properties

Once you have created a new light, specify which type it is (distant, bulb, or spot) then, set its options on the **Properties palette: Light tab**. You can use these controls at any time and adjust the settings of a selected light.



Use the Light tab in the Properties palette to set the light properties.

To set a light’s properties:

1. Select the light.
2. Display the **Properties palette: Light tab**.
3. Choose the type of light you want from the pop-up: **Bulb Light**, **Distant Light** or **Spot Light**.

   A **Distant Light** is outside of the scene universe . The light rays from a distant source are parallel as they enter your scene. An example of this is the way the sun lights the earth.

A **Bulb Light** radiates light in all directions.

A **Spot Light** casts light in a specific direction. The light rays of a spot light diverge based on parameters that you set, such as the **Half Angle** and **Distance Fall Off**.

When you change light type, the tab displays the parameters appropriate to that type.

Setting Common Light Characteristics

The characteristics of color, brightness, and shadow control are common to distant, bulb, and spot lights. You adjust these settings in the **Properties palette: Light tab**.

To set the color:

Click the color chip and use the color picker to choose a color.

To set the brightness:

Drag the slider to set the brightness.

To control shadow strength:

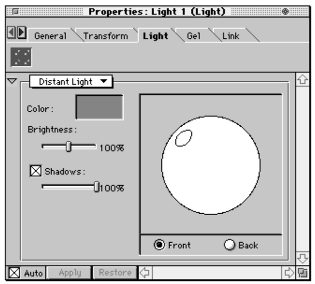
By default, all lights (except ambient) cast shadows. If you want to minimize the shadows from a particular light, drag the **Shadows** slider to a lower setting.

Use the **Render Preview** tool or render the image to view the changes. Shadows appear only in renderings.

For more control over shadows, refer to “Shadow Options” on page 279.

Setting Distant Light Direction

The direction of a distant light source is set indirectly—by moving the highlight on the surface of the sphere in the distant light’s **Properties palette: Light tab**.



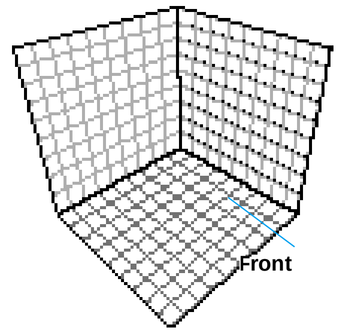
Use the Distance Light controls to set the direction of the lights.

To set the direction of a distant light source:

To set the position of the light, imagine the distance light sphere as a glass ball surrounding your scene. The highlight shows where the distant light shines through the glass, toward the center of your scene.

1. Drag the highlight on the surface of the sphere to position the light source.
2. To shine the light from behind, click the **Back** radio button.

 The Front of the scene refers to the direction shown in the following figure when the working box is in its initial position, the Reference view.

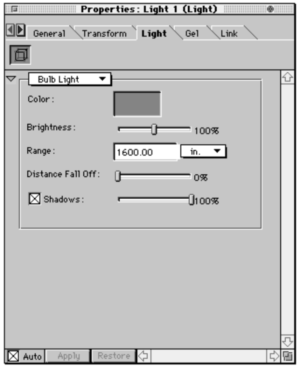


The Distant Light uses this convention for reference in the Perspective window.

As with ambient light, you can use a distant light to soften the shadows cast by your other light source. Position a distant light above your scene, then experiment with light settings to diffuse the shadows from your other lights.

Setting Bulb Light Characteristics

Bulb lights appear in the **Perspective** window. You can move them anywhere in the 3D workspace with any of the positioning features, including the **Selection** tool, **Virtual Trackball**, and **Properties palette: Transform tab: Position** controls. Because bulb lights shine equally in all directions, you do not need to aim them.

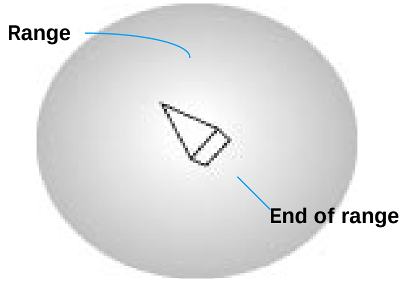


Use the Bulb light controls to set the range of the light source.

To set the range of the light source:

Enter a value. Use the pop-up to select your units.

The range is the distance from the light itself to the point where the light has no effect.



The bulb light range is the distance from the light to the point where the light has no effect.

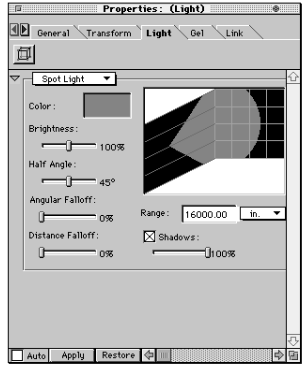
To set the distance fall-off:

Drag the **Distance Fall-off** slider.

The distance fall-off setting determines how the brightness of the light diminishes toward the edge of its range. A fall off of 10% means that the light has full intensity from the source through 90% of its range, then decreases linearly to the end of the range.

Setting Spot Light Characteristics

Your brightness, half angle and angular fall-off settings are previewed in real time in the diagram in the right side of the spot light controls.



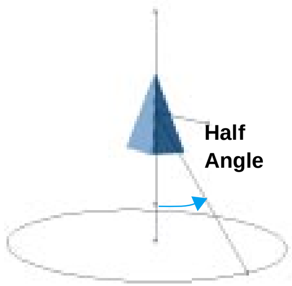
Use the Spot light controls to set the brightness, half angle and angular fall off settings.

To set the half angle of the light cone:

Drag the **Half Angle** slider.

Note: You may also use the **Direct Manipulation** controls to set this feature. Refer to "Controlling a Spot Light Directly" on page 277.

The half angle is the angle of the radius of the cone. A narrow angle creates a beam like that of a spotlight. A wide angle creates a beam like that of a flood light. (See the following diagram.)



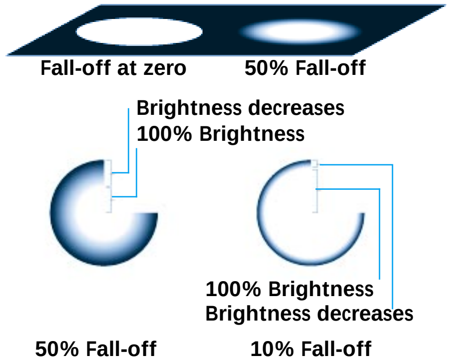
The spot light half-angle changes the diameter of the light cone.

To set the angular fall-off:

Drag the **Angular Fall-off** slider.

Note: You may also use the **Direct Manipulation** controls to set this feature. Refer to "Controlling a Spot Light Directly" on page 277.

Fall-off is how the brightness of the light diminishes toward the edge of the light cone. A fall off of 10% means that the light has full intensity from the center to 90% of the radius of the light cone, then decreases linearly to the edge of the cone.

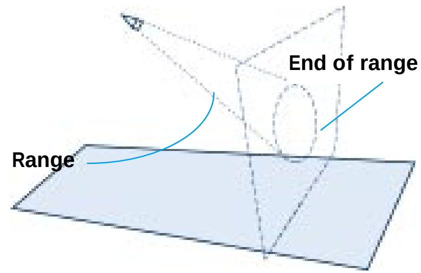


As you increase the fall-off percentage, you decrease the area that is 100% bright.

To set the range of the light source:

Enter a value. Use the pop-up to select your units.

The range is the distance from the light itself to the point where the light has no effect.



The range of the spotlight is distance between the light's point of origin and the point where the light has no effect.

To set the distance fall-off:

Drag the **Distance Fall-off** slider.

The distance fall-off setting determines how the brightness of the light diminishes toward the edge of its range. A fall off of 10% means that the light has full intensity from the source through 90% of its range, then decreases linearly to the end of the range.

The spot light parameters interact with each other. For example, using a light colored light with a low brightness setting may generate a similar result as a darker colored light with a higher brightness setting. Experiment with various settings until you achieve the lighting you want.

Positioning and Aiming Spot Lights

Spot lights appear in the **Perspective** window. You can move them anywhere in the 3D workspace and change their direction with any of the positioning and orientation features, including the **Selection** tool, **Virtual Trackball**, and the **Properties palette: Transform tab** controls.

Ray Dream Studio offers several other methods of aiming lights, including the **Point At** command, the **Point At** behavior, and the **Direct Manipulation** controls.

Pointing a Light at an Object

The **Point At** command lets you point a light directly at an object.

To point a spot light at an object:

1. Hold down **Shift** and select the light and the object you want to point it at.

   You may select multiple lights, but only one object.

2. Choose **Arrange menu▸ Point At** or press **Command-M/Ctrl+M**.

   Ray Dream Studio reorients the light to point at the hot point of the selected object.

The **Point At** command does not link the light to the object selected. That is, if you move either element, the light no longer points at the object. If you want to maintain the relationship between a light and the object it points at, place them together in a group. For more information, refer to "Grouping Objects" on page 256. If you want the light to follow the object, apply the **Point At** behavior, described below.

To direct a light to a particular area in your scene, you can create a temporary object for the light to point at, then delete the object. Remember that the light points at the hot point of the object selected.

You can check where the light is cast by actually viewing your scene through the light. Use the Position pop-up in the Camera Properties dialog to select the light source from which you will view the scene.

The Point At Behavior

The **Point At** behavior sets a light to aim at an object. If the object moves, the light automatically reorients itself to point at the object in its new position.

To have a light follow an object:

1. Select the spot light you want to use.
2. Display the **Properties palette: Behavior tab**.
3. Click the **Plus sign** icon.
4. Select **Point At** from the dialog and click **OK**.
5. Enter the name of the target object—the one you want the light to follow.
6. Leave the axis option as it is. The axis option sets which axis of the object should point at the target. For a light, you only want to use the axis that emits the light.
7. Click **Apply** to send your changes to the light.

   From now on, whenever you move the target object, this light reorients to point at it.

Controlling a Spot Light Directly

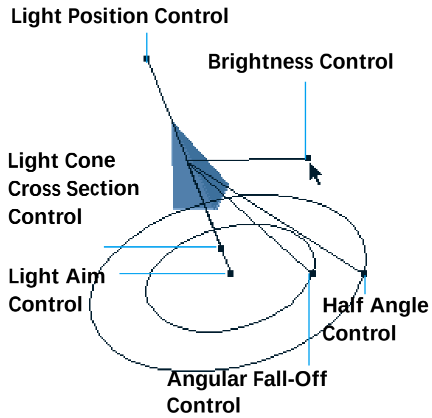
The Direct Manipulation controls for a light provide an on-screen description of the light's aim and properties. You can drag a light's control handles to change light properties.

To display the Direct Manipulation controls on a spotlight:

1. Select a spot light.
2. Make sure this light is visible in the **Perspective** window. For best results, you'll want all planes visible so you can work with the projections.
3. Display the **Properties palette: Light tab**.
4. Click the **Direct Manipulation** button to display the control handles on the selected light.

   The controls appear as a set of wires with "handles" at certain points. Each handle represents a control you can drag to set properties.

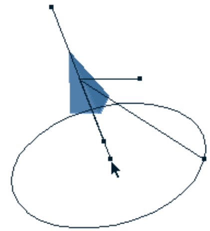
Note: The **Direct Manipulation** controls require **Auto Apply** enabled.



Drag the control handles to aim the spot light and set its properties.

To aim the light:

Drag the control handle in front of the light cone. The handle will move parallel to the active plane. Hold down the **Option**/**Alt** key to drag the handle perpendicular to the active plane.



Drag the Light Aim control to set the point where the light aims at.

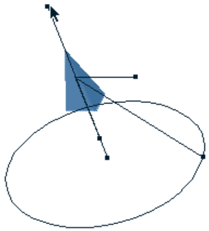
You can drag the handle out, extending it all the way to the point you want to aim at. The wire shows the angle of the light beam.

You may also aim the light with respect to a given plane by dragging the corresponding handle on one of the light's projections.

The light rotates to aim where you place the handle.

To move the light:

Drag the handle behind the light cone.



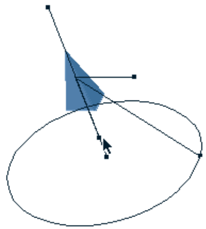
Drag the light's position control to move the light along a given plane.

You may also move the light with respect to a given plane by dragging the corresponding handle on one of the light's projections

The light moves to the new position and orients itself to point at the target.

To check the light cone diameter at a given point:

Drag the handle that's on the direction wire, centered in the ring.



Drag the Light cone cross section control to help you visualize the diameter of the light cone in the Perspective window.

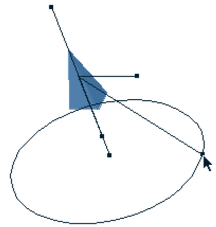
The ring around the direction wire describes the cone diameter at that point. Notice that as you drag the handle closer to the target, the ring expands.

Note: The cross section control is to help you visualize the diameter of the light cone at different ranges. It does not change any of the light's properties.

To change the cone half angle:

Drag the handle on the ring perimeter to change the light's half angle.

Hold down the **Command**/**Ctrl** key when you drag in (toward the center of the ring) to keep the Angular Fall Off and Half Angle together.

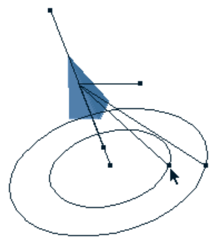


Half angle control to adjust the light's half angle.

Note: If you have the **Properties palette: Light tab** displayed, you can see the effect of your changes in the preview and settings.

To change the angular fall-off:

1. Drag in (toward the center of the ring) on the ring handle to separate the angular fall off ring from the half angle ring. (The fall off ring is always on the inside.)



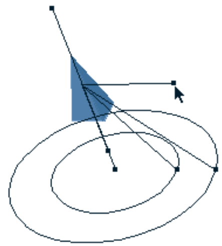
Drag the Angular fall-off control to set the light's angular fall-off.

2. Drag the fall-off ring handle to set the fall off you want. The gap between the two rings describes the fall-off.

Note: If you have the **Properties palette: Light tab** displayed, you can see the effect of your changes in the preview and settings.

To change the light's brightness:

Drag the handle on the wire that extends from the light perpendicular to the direction wire.



Drag the Brightness control to set the light's brightness.

Drag away from the light to increase the brightness, or towards the light to decrease brightness.

Note: If you have the **Properties palette: Light tab** displayed, you can see the effect of your changes in the preview and settings.

Note: On a bulb light, brightness is the only control available with Direct Manipulation.

Shadow Options

Objects block light and, therefore, cast shadows on other surfaces. For each light, you can choose between two shadow types—Ray Traced Shadows and Soft DRT Shadows.

To set shadow options for a light:

1. Select the light you want to set.
2. Display the **Properties palette: Shadows tab**.
3. Use the pop-up to choose the type of shadow you want for this light.

   Ray-Traced Shadows is the default. The edges of the shadows end abruptly. The transition from complete shadow to full light is immediate. Ray-traced shadows are considered "hard shadows."

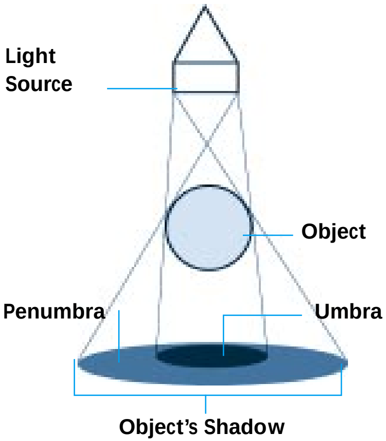
   Soft RTD Shadows let you create a penumbra at the shadow edge. The shadow has a soft transition between complete shadow and full light. Soft shadow options are described below.

Note: Distant Lights are restricted to Hard shadows.

Setting Soft RTD shadow options:

1. Enter a value in the **Diameter** field to set the size of the light source.

A larger light source creates a wider penumbra.



The penumbra width depends on the diameter of the light source and the proximity of the source, object and shadow surface. The behavior follows what you'll experience in the real world, so you can experiment with a light source (lamp), object (your hand) and surface (wall or desk) to see the penumbra-umbra transition in action.

2 Drag the **Quality** slider to set the number of samples.

The range is from 16 to 128. Higher values improve shadow quality, but increase render time.

Each sample represents a point on the light source that is used as the origin for ray tracing rays. The points are spaced evenly around the perimeter and across the surface of the light.

3 Enable the **Optimize** option if you want to speed up a rendering.

- When **Optimize** is disabled, the system will check every sample of the Quality setting.
- When **Optimize** is enabled, Ray Dream Studio checks the condition of the first seven samples.

If all seven samples are "in the umbra," Ray Dream Studio assumes that the remainder (up to the Quality setting) are also and skips them.

If all seven samples are "in full light," the system assumes that the remainder (up to the Quality setting) are also and skips them to save time.

If the first seven samples have any combination of umbra and light, Ray Dream Studio recognizes that this pixel is in the penumbra and finishes checking all samples of the Quality setting to ensure shadow quality.

Note: Using the **Optimize** option may produce erroneous results with a light source of large diameter and objects that are small and relatively close to either the light or the shadow surface.

Using Gels

You may place an image as a mask or transparency in front of a light to project complex patterns and images on your scene. The image you place in front of the light is called a gel.

If the gel is a 1-bit image, it becomes a mask. White regions of the mask transmit the light and black regions block it. Bitmap gels can create intricate effects, such as the shadow of a chain-link fence, or the dappled shade under a tree.

Grayscale or color images create transparencies when used as a gel. Their image is projected into your scene, just as a slide projector sends an image across the room. With a color image, you can achieve many effects, like sunlight filtering through a stained glass window. An 8-bit gel will probably provide all the color you need.

Two gels types—**Blinds** and **Gradient**—are built-in gels. You may also load a texture map or movie to use as a gel.

As you adjust the settings for these gels, a preview displays to the right. Specific blend controls are described later in this chapter.

To place a gel on a light:

1. Select a light.

   Gels are generally used on distant or spot lights. Your choice depends on the effect you want.

2. Display the **Properties palette: Gel tab**.

3. Choose the type of gel from the pop-up.

   None is the default. The light has no gel.

   Blinds creates horizontal or vertical stripes—venetian blinds, prison bars, etc.

   Gradient uses a blend of two colors as a gel. A gradient gel can be vertical or circular.

   Map uses a bit-mapped image file as the gel. This is the best choice when you want specific imagery in the gel.

   Formula uses a mathematical formula to create colors and patterns in the gel. You can devise your own formula to create a new pattern.

   Movie uses a sequence of images in the gel. This option only makes sense when you are creating an animation.

Blinds Controls

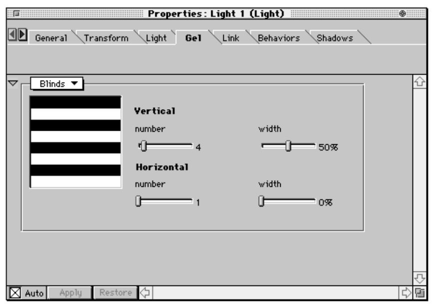
Use the Blinds controls to create a gel that projects stripes onto an object.

To set blinds options:

1. Select a light.

2. Choose **Windows menu▸ Properties palette: Gel tab**.

3. Choose **Blinds** from the pop-up.The blind controls appear in the **Gel** tab.



Choose Blinds from the Gel tab pop-up to use Blinds.

4. Drag the **Vertical number** slider to set the number of vertical slats.

5. Drag the **Vertical width** slider to set the width of the vertical slats. The width is expressed as a percentage of the gel frame.

6. Drag the **Horizontal number** slider to set the number of horizontal slats.

7. Drag the **Horizontal width** slider to set the width of the horizontal slats. The width is expressed as a percentage of the gel frame.

8. Click **Apply** to apply your selections.

Formula Controls

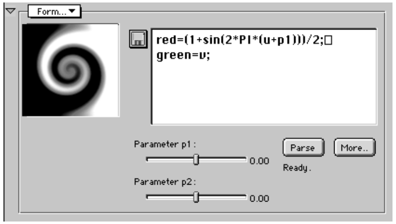
Use the Formula controls to create a gel that projects a pattern onto an object.

To select a formula for the gel:

1. Select a light.

2. Choose **Windows menu▸ Properties palette: Gel tab**.

3 Choose **Formula** from the pop-up. The formula controls appear in the **Gel** tab.



The preview displays the result of the current formula.

4 If the current formula uses the **Parameter** sliders, you can adjust them to change the formula result.

5 To load a new formula, click the **Disk** icon and choose **Open** from the pop-up.

Use the **Open** dialog to locate and open an appropriate formula. Look in the Ray Dream Studio CD: Samples: Formulas directory for some samples to get you started.

6 If you want to edit the formula or create your own, click **More** to open the **Formula Editor**.

Ray Dream Studio uses the **Formula Editor** in several places. Use of the editor is common, but the type of formula you're creating determines the valid input and output variables. Refer to the "Using Formulas in Ray Dream Studio 5 PDF" on the Ray Dream Studio 5 CD for details on using the **Formula Editor**.

Formula editing becomes technical quickly. You can learn a lot by loading the sample files.

7 When you're done with the **Formula Editor**, click **OK**.

8 To save a formula, click the **Disk** icon and choose **Save As** from the pop-up.

Use the **Save** dialog to name the file and select a disk location.

9 Click **Apply** to apply the selections.

Gradient Controls

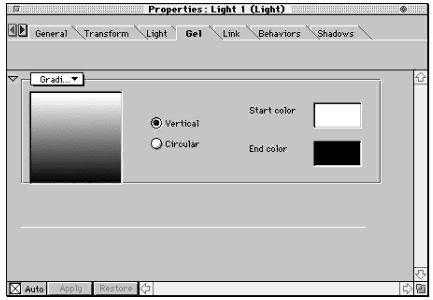
Use the Gradient controls to create a gel that projects a pattern containing color transitions onto an object.

To set gradient options:

1 Select a light.

2 Choose **Windows menu ▸ Properties palette: Gel tab**.

3 Choose **Gradient** from the pop-up.The gradient controls appear in the **Gel** tab.



Choose Gradient from the Gel tab pop-up to set the gradient options.

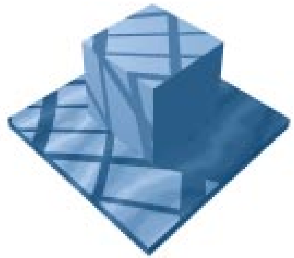
4 Select a **Vertical** or **Circular** gradient pattern.

5 Click the **Start color** chip and select a color from the color picker.

6 Click the **End color** chip and select a color from the color picker.

7 Click **Apply** to apply the selections.

Map Controls



Use the Map controls to create a gel that projects an image onto an object.

The **Map** option lets you load an image to use as a gel.

To create a map image:

1. Use any 2D art program to create an image for the gel.

   You might scan a photograph and use filters to accentuate or nominalize some aspects of the image.

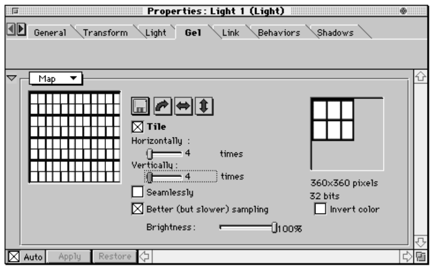
   The gel does not need to be high resolution. If you intend to use this gel on a bulb light, create the image at an aspect ratio of 2:1. If you are going to use this gel on a spot or distant light, use an aspect ratio of 1:1.

2. Save the image file in a format that Ray Dream Studio supports and in a convenient folder.

For a list of the image file types that Ray Dream Studio supports, see the section on software support for your system in Chapter 1, "Installation."

To load the map image as a gel:

1. Select a light.
2. Choose **Windows menu▸ Properties palette: Gel tab**.
3. Choose **Map** from the pop-up.The map controls appear in the **Gel** tab.



Choose Map from the Gel tab pop-up to set the map options.

4. Click the **Disk** icon and choose **Open** from the pop-up.
5. Use the **Open** dialog to locate and open the map image you saved.

To set map controls:

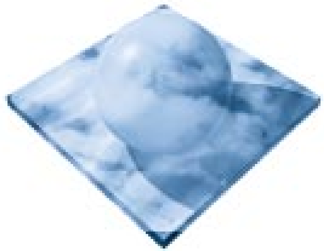
1. Click the directional buttons next to the **Disk** icon to change the image's orientation.
2. Drag the **Brightness** slider to adjust the image's brightness.
3. Enable the **Better (but slower) sampling** option to view a more precise preview.
4. Enable the **Invert Color** option if you want to invert the image's colors.
5. If you want the image to repeat, enable the **Tile** option.

   Use the **Horizontally** and **Vertically** sliders to set the number of tiles in each direction.

   Enable the **Seamlessly** option to smooth the transitions between tiles.

6. Click **Apply** to apply the selections.

Movie Controls



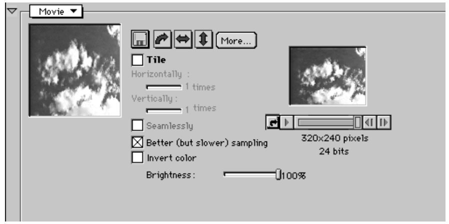
Use the Movie controls to create a gel that projects a movie image onto your object.

Movies create sophisticated gels for your animations. For example, you might capture some video of a tree blowing in the wind. With a little preparation, you can load it as a gel to create a moving shadows in your scene.

A gel movie frame for a bulb light should have an aspect ratio of 2:1. A gel movie frame for a spot or distant light should have an aspect ratio of 1:1.

To select a movie for the gel:

1. Select a light.
2. Choose **Windows menu▸ Properties palette: Gel tab.**
3. Choose **Movie** from the pop-up.The movie controls appear in the **Gel** tab.



Choose Movie from the Gel tab pop-up to set the movie options.

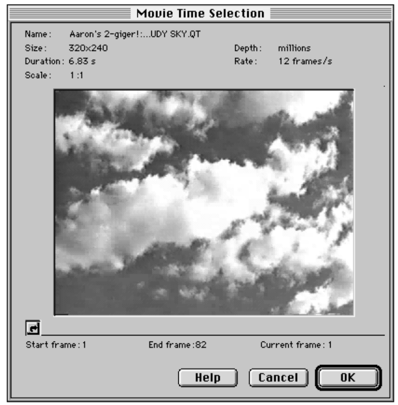
4. Click the **Disk** icon. Ray Dream Studio displays the **Open** dialog.
5. Locate and open a movie file.

   When you've opened a movie, a preview player appears. This is the control that lets you synchronize the gel movie with the animation. See "Synchronizing Movie Frames with the Animation and Looping" on page 335 for more information.
6. Click the directional buttons next to the **Disk** icon to change the movie's orientation.
7. Drag the **Brightness** slider to adjust the movie's brightness.
8. Enable the **Better (but slower) sampling** option to view a more precise preview.
9. Enable the **Invert Color** option if you want to invert the movie's colors.
10. If you want the frame to repeat, enable the **Tile** option. The tiled movie appears in the right preview.

    Use the **Horizontally** and **Vertically** sliders to set the number of tiles in each direction.

    Enable the **Seamlessly** option to smooth the transitions between tiles.
11. You can get more information on this movie by clicking **More**.

    Ray Dream Studio opens a window that provides technical information and a movie preview player.



Use the More movie controls to get more detailed information about your movie.

12. When you're done with the **Movie Time Selection** window, click **OK**.

13 Click **Apply** to apply the selections.

To preview a movie in the Gel tab:

1. Click **Play** at the bottom of the dialog.
2. Click **Stop** when you want to stop the movie.

   You can also click **Loop** to have the movie play continuously.

Using Cameras

Just as a photographer strategically places cameras for different views, you will set up various cameras for viewing your scene. After the scene is finished, you can frame the view of your scene that you want to render. Framing a scene is similar to looking through a camera's viewfinder.

The position and orientation of a camera is called a viewpoint. When you select a preset view, such as a top view of your scene, your active camera (the current camera) is moved directly to that viewpoint: over your scene and pointed downward in the case of a top view.

You may create multiple cameras, positioned anywhere in your scene, and shift the view to any of them. Using multiple viewpoints can be quite useful.

What you see in the **Perspective** window is the projection of the scene through the lens of the current camera. At any given time, only one camera is selected as the viewpoint for the **Perspective** window. If you open more than one **Perspective** window, each has its own current camera.

The Camera's Field of View

A camera's settings and position determine its field of view. The field of view of the current camera does not necessarily equal what you see in the **Perspective** window. The display in the **Perspective** window is also determined by the size of the window and its level of magnification. You can use the scroll bars or hand tool to adjust the region of the field of view that the **Perspective** window currently displays.

The camera's field of view is not affected by zooming (the **Zoom** tool) or panning (with the **Hand** tool or the scroll bars).

The portion of the camera's field of view that is used for the rendering is identified by the Production Frame. The Production Frame is similar to a real-world camera's viewfinder. By default, the production frame appears as a green rectangle on top of your perspective view.

The inner, dashed line rectangle is called the Safe Frame Margin. It's an "out of bounds warning" for objects that approach the edge of the frame. This reference can be particularly useful for animators who are developing for video output. Because the edges of the video frame are often cut off, the Safe Frame Margin can help in keeping objects fully within the visible area when the animation is displayed on video.

You can adjust the margin by choosing File> Preferences: Perspective and adjusting the Safe Frame Margin percentage. You'll probably need to experiment a few times to find the setting that's right for your video output system.

For more information on the Production Frame and Render Settings, refer to "Rendering" on page 339.

Creating a New Camera

To create a new camera:

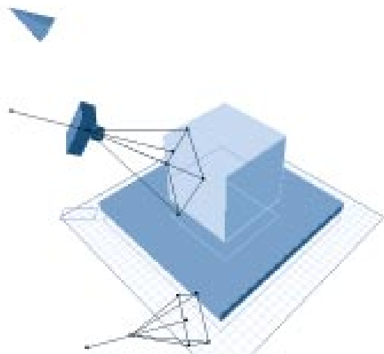
Drag the **Create Camera** tool from the **Tools** toolbar to the area of the **Perspective** window where you want it placed. You may also drag it into the **Hierarchy** window to add the camera at the center of the Universe.

You may also choose **Edit menu▸ Insert▸ Camera** to add the camera at the center of the Universe.

Note: If you choose **Windows menu▸ New Perspective** to create another view of your scene, Ray Dream Studio gives you the option of creating a new camera to provide that view.

About the New Camera

The new camera appears in your scene as a blue 35 mm camera that faces downward. The camera is an object that has projections.



New cameras appear in your scene as a blue camera.

You can move the camera as you would any other object. You'll learn about special features for moving and orienting cameras later in "Positioning and Aiming Cameras in the Scene" on page 287.

If you want, you may change the color of camera objects in the Perspective window. Choose **File menu▸ Preferences: Color** and set your preference.

In the Hierarchy, cameras are represented by numbered camera icons. You can, of course, rename a camera just like any object.

Note: The current camera is not visible in the **Perspective** window. Because you are viewing the scene through it, it is not visible within the scene.

If you set up several cameras, you might want to name them according to their viewpoints. This makes it easy to select the view you want.

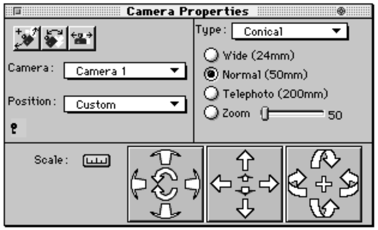
Setting the Camera Lens

You can change the properties of the current camera using the controls on the Camera Properties palette.

To change a camera's lens:

1. Select the camera you want to change.

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



Use the Camera Properties palette to change the characteristics of the selected camera.

Note: For convenience, the camera lens controls are also provided on the **Properties palette: Camera tab**.

3. Use the **Type** menu to select the camera you want: **Conical**, **Isometric** or **IVRM Spherical**.

   The **Conical** camera has four settings: **Normal**, **Wide**, **Telephoto** and **Zoom**.

   If you select **Zoom**, the slider lets you set a focal length between 6 and 500 mm.

The Ray Dream Studio perspective camera is patterned after the standard 35mm SLR camera.

The **Isometric** camera provides a view in which object size is not related to distance from the camera (that is, there is no vanishing point.)

The **Zoom** slider adjusts the field of view.

Note: With an isometric camera, use a Backdrop not a Background.

The **IVRM Spherical** camera creates a spherical rendering to be used with a virtual reality viewer, like the RealSpace Traveler. For instructions on creating your scene, using the IVRM Spherical Camera and using the viewer, refer to "Using the RealSpace Spherical Camera" on page 292.

Positioning and Aiming Cameras in the Scene

Cameras (other than the current camera) appear in the **Perspective** window as an object.

You can move them anywhere in the 3D workspace and change their angle with any of the standard positioning and orientation features.

Pointing a Camera at an Object

The **Point At** command is usually the easiest way to aim a camera in the general direction of an object. Then, you can make precise adjustments to the camera's position and aim using the navigating tools.

To point a camera at an object:

1. If you want to aim the current camera, select the object you want to point at. You'll probably find it is easiest to select it in the **Hierarchy** window.

   If you want to aim a camera other than the current one, select the camera and the object you want to aim it at.

Note: You cannot point a camera at a light.

2. Choose **Arrange menu▸ Point At**.

The **Point At** command does not link the camera to the object selected. That is, if you move either element, the camera no longer points at the object.

To direct a camera to a particular area in your scene, you can create a temporary object for the camera to point at, then delete the object. Remember that the camera points at the hot point of the object.

The Point At Behavior

If you want the camera to follow an object, apply the **Point At** behavior.

To have a camera follow an object:

The Point At behavior sets a camera to aim at an object. If the object moves, the camera automatically reorients itself to point at the object in its new position.

1. Select the camera you want to use.
2. Display the **Properties palette: Behavior tab**.
3. Click the **Plus sign** icon.
4. Select **Point At** from the dialog and click **OK**.
5. Enter the name of the target object—the one you want the light to follow.
6. Leave the axis option as it is. The axis option sets which axis of the object should point at the target. For a camera, you only want to use the axis with the viewing lens.
7. Click **Apply** to send your changes to the camera.

   From now on, whenever you move the target object, this camera reorients to point at it.

Controlling a Camera Directly

The Direct Manipulation controls for a camera provides an on-screen description of the camera's aim. You can drag control handles to change the camera's properties.

Note: These features are not available for the current camera. You must view the camera as an object to control it directly.

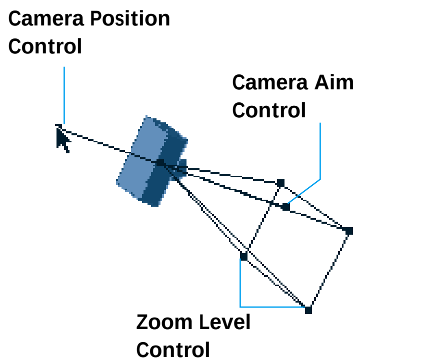
To display the Direct Manipulation controls on a camera:

1. Select a camera.
2. Make sure this camera is visible in the **Perspective** window. For more control, you'll want all working box planes visible so you can work with the projections.
3. Display the **Properties palette: Camera tab**.
4. Click the **Direct Manipulation** button to display the controls on the selected camera.

Use the Direct Manipulation button to display controls for the selected camera.

The controls appear as a set of wires with "handles" at certain points. Each handle represents a control you can drag to set properties.

Note: The **Direct Manipulation** controls require **Auto Apply** enabled.



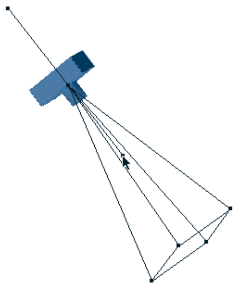
Drag the wireframe and projection "handles" to aim the camera and set its properties.

Tip: You might want to aim the camera with the Direct Manipulation controls while simultaneously seeing the result in that camera's view. You can do this by opening a second Perspective window and arranging them side-by-side.

To aim the camera:

Drag the handle in front of the camera. The target handle will move parallel to the active plane. Hold down the **Option/Alt** key to drag the target perpendicular to the active plane.

You can drag it out, extending the wire all the way to the point you want to aim at. The wire shows the angle of the camera's aim.



As you drag the Camera Aim control, the camera rotates around the Camera Position control.

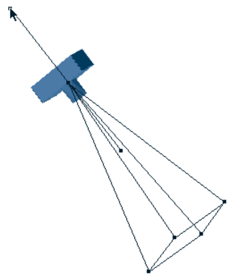
- You can also aim the camera with respect to a given plane by dragging the corresponding handle on one of the camera's projections.

The camera rotates to aim where you place the handle.

To move the camera:

Drag the handle behind the camera preview.

You may also move the camera with respect to a given plane by dragging the corresponding handle on one of the camera's projections.



As you drag the Camera Position control, the camera rotates around the Camera Aim control.

The camera moves to the new position and orients itself to point at the target.

To change the zoom:

Drag a corner of the rectangle in front of the camera to change the zoom. Drag toward the target object to zoom in.

The Rectangle in front of the camera represents the Production Frame.

Drag the Zoom control to adjust the camera's zoom level.

Note: You can change the zoom level for the Conical or Isometric cameras.

Changing your Perspective on the Scene

You may choose to work with one camera or several. If you are working with one, you can move it to another position whenever you want a different viewpoint on your scene.

If you're working with several cameras, you can simply switch the viewpoint of the **Perspective** window to a different camera by selecting from your available cameras using the **Camera Properties** dialog.

Moving the Current Camera to a Preset Position

You can choose **View menu** ▸ **Preset** to change the current camera's view to the top, bottom, left, right, front or back. To return to the original view of your **Perspective** window, select the Reference position.

If you have saved your own position presets, they're also available from this menu. See "Saving Position Presets" on page 292 for more information.

To choose a preset position:

Choose **View menu▸ Preset Position▸** and select the position you want.

You can also use the **Camera Properties palette: Position pop-up**.

Whenever the camera position and orientation is not at one of the presets, the **Camera Properties palette: Position pop-up** displays **Custom**.

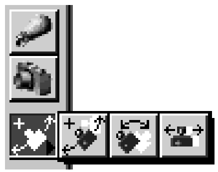
When you Jump Into an object or group using any of the default preset positions, the camera goes with you—that is, it establishes the preset position and orientation relative to the local universe you've jumped into. A custom position, on the other hand, is kept "as is" when you Jump In. This could result in an empty window when you Jump Into a group. Choose a default preset or select an object and Point At it to see the contents of the group.

Navigating the Current Camera

Ray Dream Studio allows you to directly manipulate the current camera using the Dolly, Pan, and Track tools and with the Navigation panel on the Camera Properties palette.

Note: You may also select the current camera in the hierarchy and use the **Properties palette: Transform tab: Position** and **Orientation** controls to move and aim the camera numerically.

The navigation tool icons share a space on the **Tools** toolbar. Press on whichever one is visible to "pop-up" the others and choose the one you want.



Use the camera navigation tools to interactively adjust the position of a camera.

Whenever one of these navigation tools is selected, a green rectangle, the production frame, automatically appears in the **Perspective** window.

The production frame acts as a viewfinder to help you frame your scene properly. It automatically disappears once you switch back to any non-navigation tool. If the production frame is not visible at first sight, reduce your magnification level in the **Perspective** window to the standard (1:1) ratio.

To rotate around an object:

1. Select the object you want to rotate around. If you deselect all objects, the current camera will rotate around the origin of the Universe.

2. Click the **Dolly** tool. The Dolly tool moves the camera while keeping it pointed at the same spot in the scene.

   The camera changes position and orientation.

3. Drag in the **Perspective** window to dolly the camera.

   The behavior is similar to the **Virtual Trackball**, except in this case, it's the camera that moves.

To pan the camera:

1. Click the Pan tool. The Pan tool rotates the camera on its own axis.

2. Drag in the **Perspective** window to pan the camera.

   Hold down the **Shift** key to constrain panning to the vertical or horizontal.

   The camera changes orientation only.

   To visualize panning, imagine standing in place and looking through your camera's viewfinder. Turn side-to-side and tilt up and down.

Note: If you pan the camera, then decide you want to level its view, you can use **Arrange menu▸ Align on Gravity**.

To track the camera:

Click the Track tool. The Track tool moves the camera up, down, left, or right in the plane parallel to the monitor screen.

The camera changes position only.

The tracking directions are in relation to the camera's current attitude—not to the axes of the Global Universe or working box

To track in or out:

- When using any of the three navigation tools, hold down the **Command/Ctrl** key and drag upward to move the camera forward.
- Hold down the **Command/Ctrl** key and drag downward to move the camera back from your subject.

  The camera changes position only.

Unlike zooming using the Magnifying glass, tracking in and out actually moves the camera toward or away from your subject, effectively changing your field of view and perspective if you are using a non- isometric camera.

Using the Navigational Panel

The **Camera Properties palette: Navigation panel** lets you click buttons to incrementally dolly, pan, and track the camera.

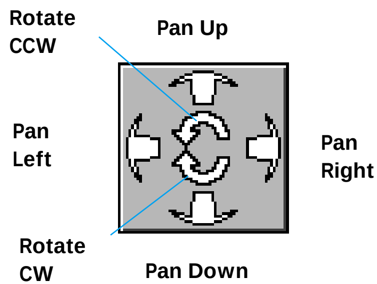
To use the Camera Properties palette's Navigation panel:

1. Choose **Windows menu▸ Camera Properties**. The **Camera Properties** palette appears.
2. If necessary, click the **Key** icon to expand the palette and show the **Navigation** panel.
3. Click the buttons to move or rotate the camera incrementally.

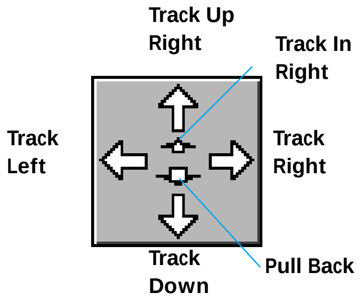
   The following diagrams describe the function of each button. Refer to the tool descriptions for more information on dolly, pan and track.
4. If you like, you can change the distance or rotation amount for each click.
5. Click the **Scale** icon to open the **Increments** dialog.

Click the Scale icon to edit the camera's position

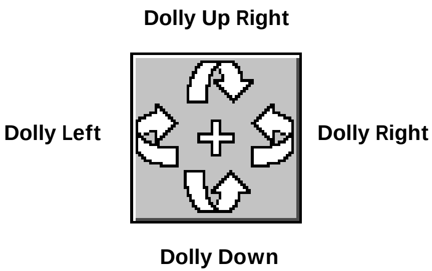
6. In the dialog, set the amount and units for position controls. Set the degrees for rotation controls.



The Pan controls



The Track controls.



The Dolly controls.

Saving Position Presets

If you set a camera position that you particularly like, you may add it to the presets. Your saved position will be available on the **View menu▸ Preset Position** sub-menu in all of your scene files.

To save a position as a preset:

1. Select the camera with the position and orientation you like.
2. Display the **Camera Properties** palette.
3. Choose **Position pop-up▸ Save Position**.
4. Select whether to save just the **Position and Orientation**, the **Type and Parameters** or **All** aspects of this camera.
5. Type a name for this camera position and click **OK**.

To remove a preset from the list:

1. Choose **Position pop-up▸ Delete Position**.
2. Select the position you wish to remove, and click **OK**.

Working with Multiple Cameras

Multiple cameras can help you arrange your objects by providing different views of your scene that you can switch between or use simultaneously. When you are ready to create a rendering, you'll select one of the cameras as the viewpoint to render from.

To switch the view between cameras:

Choose **View menu▸ Camera** and select the camera you want to use.

To view your scene from two cameras at once:

1. Open a second **Perspective** window.
2. Choose **Windows menu▸ New Perspective**. The **New Perspective Window** dialog appears.
3. Select the camera you want or create a new one.

Each Perspective window you open increases demand on your computer, its RAM, and the hard disk—especially when the level of display detail is high (that is, in Preview, Shaded Preview or Better Preview mode). This might slow you down. For better efficiency, use fewer windows or switch several of them to fast preview modes (bounding box or wireframe).

4. Click **OK**.

Using the RealSpace Spherical Camera

The IVRM spherical camera produces a rendering that includes every viewpoint radiating from its position—a "spherical image." The image is actually rectangular, but a special viewer program will wrap it onto the inside of a sphere, where you can look at it and turn to see every angle of your scene.

The RealSpace Traveler viewer is provided with Ray Dream Studio, so you can create and view these virtual reality views of your Ray Dream Studio scenes.

Scene viewed using the IVRM Camera.

To use the IVRM Spherical camera:

1. Create a scene, centered at the origin of the Universe. Don’t forget to account for lighting in all directions.

   For best results, you should create objects on all sides, above and below.

2. Drag the **Create Camera** tool into the **Hierarchy** window to add a camera at the origin (0, 0, 0) of the Universe.

3. Choose **Windows menu ▸ Camera Properties** or press **Command-E/ Ctrl+E**. The **Camera Properties** palette appears.

4. Choose **Type pop-up ▸ IVRM Spherical**.

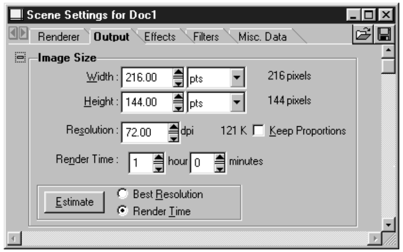
   You’re now ready to set rendering options.

To set output options IVRM spherical camera rendering:

1. Choose **Windows menu ▸ Scene Settings**. The **Scene Settings** window appears.

2. Click the **Output** tab.

3. Click the triangle next to **Image Size**. The image size controls appear.

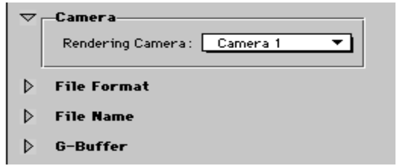


Click on the triangle/plus sign next to Image Size to display the options.

4. Define the aspect ratio. The aspect ratio of the rendering must be 2:1, but you may use whatever resolution you like—for example, 1000 pixels wide by 500 high.

Although a higher resolution rendering may produce better results, it will also require more RAM to view successfully.

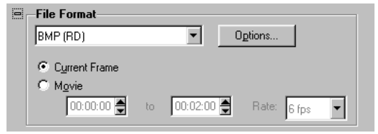
5. Click the triangle next to **Camera**. The the camera controls appear.



Click on the triangle/plus sign next to Camera to display the options.

6. Choose the IVRM Spherical camera from the list of cameras in the scene.

7. Click the triangle next to **File Format**. The **File Format** controls appear.



Click on the triangle/plus sign next to File Format to display the options.

8. Choose **JPEG** as the file format from the pop-up.

9. Click the **Options** button and use the dialog to set your choice for JPEG compression quality.

10. Save the scene file and close the document.

To render with the IVRM spherical camera:

1. Choose **Render menu▸ Batch Queue**.

   Ray Dream Studio displays the **Batch Queue** window. For complete information on using the Batch Queue, refer to “Rendering” on page 339.

2. Click **Add**.
3. Use the dialog to locate and select the scene you want to render.
4. Click **Open** to add it to the queue.
5. Click **Done** to close the dialog.
6. In the **Batch Queue** window, click **Launch**.

   When Ray Dream Studio finishes rendering, you’ll find two new files in the folder with your scene: a JPEG file and a VRML file. Use the VRML file with the Traveler viewer.

15

Animating

Key Event Animation

In Ray Dream Studio, you create an animation by moving to different points in time and making changes in the scene to define the state of the action at that moment. These changes are called *key events*. Ray Dream Studio automatically fills in the *transitions* between key events to create the illusion of motion.

Most features in a Ray Dream Studio scene can be animated in this way:

- The motion of objects, lights, and the camera
- Object size, shape, and shading attributes
- Object deformer and behavior settings
- Camera and light parameters

- Ambient lighting, background, backdrop, and atmospheric effects

There is one important exception to key event animation. The physical force behaviors define object motion based on a real-world physical behaviors. Objects that have physics applied may not be animated with position or orientation key events. For more information on the physical behaviors, refer to “Behaviors” on page 314.

Time-Based Animation

In Ray Dream Studio5, key events are tied to real-world time increments—minutes and seconds—rather than to individual animation frames. This means you can create key events at specific points in time without worrying about the number of frames in your final rendered animation.

You might work at a low *frame rate* (6 frames per second is the default) to preview your animation on screen. Then increase the frame rate to render your final animation.

Once you have defined a key event, you can remove it, copy it, or move it along the time line to fine-tune the timing of your animation.

Animatable Properties

Each characteristic of an object or effect that can be animated is called a *property*. A typical object or effect has many animatable properties. Some properties, like those that define position and orientation, are common to all objects. Other properties are specific to certain types of objects.

Lights have special properties like brightness, fall off and sometimes gels.

Rendering Effects like backgrounds, backdrops and atmospheres have their own special properties.

The properties of an individual object depend on several factors, including what type of object it is, and what types of components are used in its shader.

Environmental primitives (like Fountain, Cloud and Fire) have special properties that determine their shape.

And when you apply a deformer or behavior to an object, you add the special animatable properties that define its effect.

This overview points out the differences in animatable properties for various objects. You can find out the specific properties of an object by expanding its listing in the hierarchy.

Properties in the Hierarchy

So that you can keep track of all of a scene’s animatable properties, the hierarchy can be expanded to show all of the properties you can animate.

You can also control the hierarchy to limit which properties are displayed.

For a complete discussion of the hierarchy area, refer to “The Time Line Window” on page 297.

The Hierarchy Expanded to Show some of an Object’s Properties (Macintosh version).

To change animatable property display in the Time Line window:

1. Bring the **Time Line** window to the front. You can either click in it or choose **Windows menu ▸ Time Line of filename** .

2. Choose **View menu ▸ Preset Views ▸** and select the view option you want:

Hide still properties sets the hierarchy to display only animatable properties that have key events. (This exclude animatable properties that are constant throughout the animation.)

Hide non-transformation properties limits the hierarchy to display only transformation properties.

Hide non-existent properties sets the hierarchy to exclude animatable properties that have not been applied to the object.

Hide empty property groups sets the hierarchy to exclude properties that cannot be animated.

The Fixed Animation Hierarchy

Ray Dream Studio uses the hierarchy to manage an animation internally. For this reason, the hierarchy is fixed–*it cannot change during the course of an animation.* You cannot add or remove objects at specific points in time. Nor can you change groups or links.

You can Cloak (hide) or Uncloak (show) an object at any point during the animation. This allows an object to “exit” or “enter” during the course of the animation without changing the hierarchy. For more information, refer to “Cloaking an Object” on page 334.

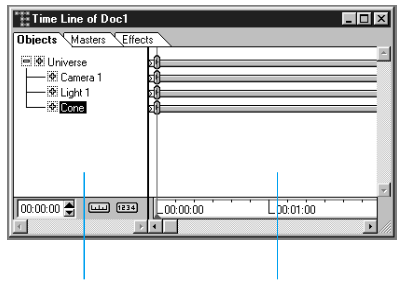
The values of the properties may change over time, but *the properties themselves must be constant.* For example, a spot light cannot become a distant light over time; a bitmap background cannot become a bi-gradient.

Most of the effects you might hope to achieve by changing the hierarchy over time can be achieved using other techniques. See “Animating Techniques” on page 327 for some examples.

The Time Line Window

This section describes the **Time Line** window, the heart of the animation interface. The window provides tools for several basic tasks:

- Viewing the animation hierarchy
- Changing the current time
- Setting the frame rate
- Specifying the render range (the start and end times of your animation)



Hierarchy Area **Time Line Area**

The Time Line window allows you to control your animations.

The **Time Line** window provides a visual representation of the key events that make up an animation. It allows you to manipulate key events and move then to different points in time. The **Time Line** window consists of three areas:

The **Hierarchy area** located on the left side of the window displays the scene's hierarchical structure.

The **Time Line** area to the right of the hierarchy area displays a time *track* for each item (object, effect, or property) currently shown in the hierarchy area. *Key event markers* on these tracks represent key events in the animation.

The **Time Axis** extending across the bottom of the window acts as a time ruler, with marks indicating time increments (minutes, seconds, and frames).

Hierarchy Area

All of the grouping, linking and organization tools of the Hierarchy are the same for producing a 3D illustration or an animation. Refer to "Building a Hierarchical Structure" on page 254 for more information on these features of the Hierarchy area.

Objects, Masters, and Effects Tabs

The contents of the hierarchy area (and therefore the tracks shown in the time line area) change depending on which tab is displayed.

The three tabs in the hierarchy area of the Time Line window s store hierarchies of the objects, master objects and render effects used in your scene.

- Click the **Objects** tab to show a hierarchical outline representation of all of the objects, lights, and cameras in the scene, with the Universe at the root.

For a discussion of organizing objects hierarchically, refer to "Building a Scene" on page 251.

- Click the **Masters** tab to show a list of the scene's master objects. Refer to "Working with Master Objects" on page 266 for information on working with master objects.

  Because the modelers operate on master objects, key events modifying a an object's shape appear on the time track of the corresponding master object. The Masters tab is useful for viewing these key events.

- Click the **Effects** tab to show a hierarchical representation of the scene's render effects. The general category **Render Effects** is at the root.

Expanding and Collapsing the Hierarchy

Expanding and collapsing the hierarchy allows you to control which time tracks appear in the **Time Line** window. This is useful when you are editing key events on the time line.

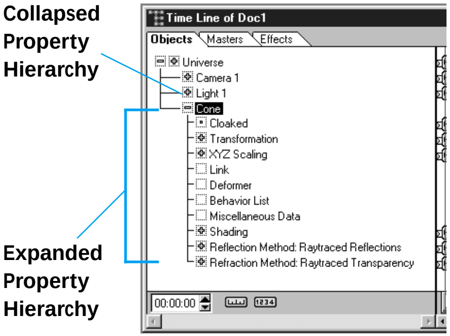
Expanding and Collapsing Property Hierarchies

You can expand individual objects, master objects, and effects to view their animatable properties.

To view the animatable properties of an item:

1. Click the **Time Line** window.
2. Click the green arrow (Macintosh) or green **plus**/**minus** sign (Windows) immediately to the left of its name.

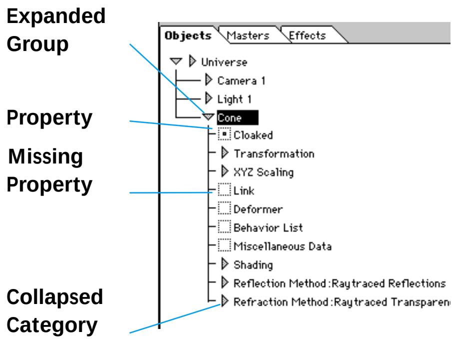
   A time track appears for each property. This allows you to edit the key events modifying individual properties. By expanding and collapsing the hierarchy, you can work with as little or as much detail as you like in the **Time Line** window.



The Hierarchy area of the Time Line window allows you to collapse and expand individual objects. This is the WIndows version.

Within the property hierarchy, related properties are grouped logically into categories, some of which may also include sub-categories. For example, **Transformation** is a category of properties which includes the sub-category **Position** and the individual properties **Hot Point**, **Scaling** and **Orientation**. The Position sub-category has three individual properties: **X**, **Y**, and **Z**, which together define the object's position in 3D space.

You can expand and collapse the categories and sub-categories within the property hierarchy by clicking their respective arrows (Macintosh) or plus/minus signs (Windows). Individual properties are represented by small green squares rather than arrows or plus/minus signs, indicating that they cannot be expanded any further.



Green squares in the Hierarchy area of the Time Line window indicate that the object cannot be expanded any further (Macintosh version).

Some items in the property hierarchy have no iconic representation, and no associated time track. This indicates that the item is not a property of the parent object or effect. In the figure above, the Cube has no Link property because no link has been assigned to it.

Scrolling and Resizing the Hierarchy Area

When you expand the hierarchy to show several levels, there may not be enough space horizontally to display all of the names. You can either scroll the view or widen the hierarchy portion of the window.

To scroll the hierarchy area:

1. Click the **Time Line** window.
2. Use the horizontal scroll bar to scroll the view of the hierarchy area.

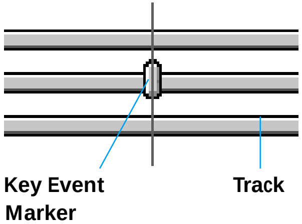
To change the size of the hierarchy area in relation to the time line area:

1. Position the cursor over the dividing line between the hierarchy area and the time line area. The cursor changes to indicate that you are over the divider.
2. Drag the divider to widen or shrink the hierarchy area. Release the mouse button when the size is right.

Time Line Area

The time Line area of the **Time Line** window displays a time *track* for each element (group, object, effect, property category, or individual property) currently shown in the hierarchy.

An animation's key events are represented by *key event markers* on the tracks of the time line. A *marker* may represent a single key event or several coincident key events, each relating to different properties of the same object. For more information, refer to "Key Event Markers on Collapsed Time Line Tracks" on page 300.



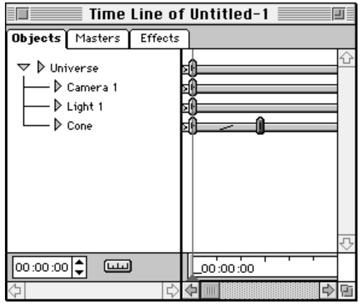
The Key Event marker in the Time Line Area indicates the position of a key frame in the animation time line.

The key event marker appears on the track for the object or effect it relates to. The location of a key event marker along its track indicates the time at which the key event occurs.

Key Event Markers on Collapsed Time Line Tracks

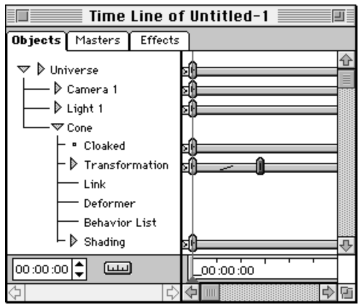
The term *key event* refers to the modification of a single property. Key event markers higher in the hierarchy—on the tracks of groups, objects, effects, and property categories—actually represent key events that modify the individual properties at the bottom of the hierarchy.

To illustrate, consider the specific example of an object that has been moved to a new position along the XY plane. A key event marker appears on its time track (a).



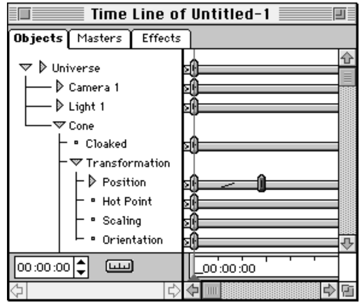
(a) A key event marker appears on its time track.

Expanding the object's property hierarchy shows a key event marker on the Transformation track (b).



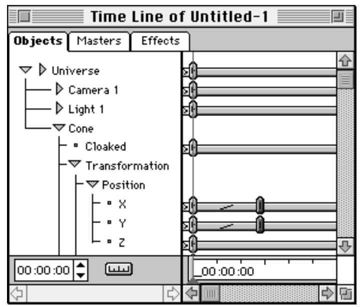
(b) Expand the objects hierarchy to display the event marker.

One level further down, a key event marker appears on the Position track (c).



(c) A key event marker appears on the Position track.

Finally, we see that key event markers appear on the X and Y tracks under the Position category (d). These markers represent two simultaneous key events: a change to the object's X coordinate, and a change to its Y coordinate.



(d) The key event markers appear on the X and Y tracks.

Whenever two or more coincident key events modify properties of the same object or effect, they are represented on higher levels by a single key event marker. So, when you move, copy, or delete a key event marker that represents several coincident key events, all of the key events beneath it are affected.

To manipulate the key events separately you need to expand the hierarchy to the individual property level, where the two key events are represented by different key event markers on separate tracks.

Step-by-step instructions for editing key events appear in "Editing the Time Line" on page 306.

Overlapping Key Event Markers

Sometimes two or more key event markers appear on the same time track at nearly, but not exactly the same time (they may represent key events modifying the same property, or key events modifying different properties of the same object or effect).

Depending on the current *time scale* (how closely you have zoomed in on the view of the time line area), these markers may overlap. In this case, the tiny vertical mark on the top key event changes to a plus sign, indicating that there are two or more closely spaced key event markers present.

This is what two overlapping key event markers look like on the time line.

Zooming in usually makes it easier to distinguish between overlapping key events. You can zoom in with the **Magnifying Glass** tool, or click the **Time Scale** button and change the settings in the **Set Time Axis** dialog. For instructions, refer to "Time Scale and Frame Rate" on page 301.

Time Axis

The **Time Axis** extends across the bottom of the **Time Line** window. It serves as a time ruler, with marks indicating time increments (minutes, seconds and frames).

The Time Axis shows the time increments used to measure your animation.

The **Time Axis** and its related interface items—the **Current Time Bar**, **Time Edit Controller**, **Render Range**, and **Time Scale** button—serve several important purposes:

Time Axis provides a temporal reference for the key event markers in the time line area.

Render Range (the white area of the Time Axis) indicates the beginning and end of the animation for the purposes of previewing and rendering.

Time Scale button allows you to change an animation's frame rate and the size of the time increments on the Time Axis.

Current Time Bar and the **Time Edit Controller** indicate the *current time*—the point in the animation currently displayed and edited in the **Perspective** window.

Time Scale and Frame Rate

The time scale describes the amount of time between each mark on the Time Axis. You can change the scale of the axis to see more time in a shorter distance, or less time in a longer distance.

The frame rate describes the number of frames displayed in each second. This applies to previews and renderings.

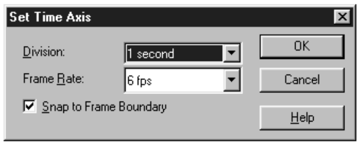
Note: The frame rate also determines the number of tics between major time divisions on the Time Axis.

You can set both these options in the **Set Time Axis** dialog.

To change the time unit divisions (scale) on the Time Axis:

1. Click the **Time Scale** button at the bottom of the **Time Line** window.

The **Set Time Axis** dialog appears.



Use the Set Time Axis dialog to change the unit divisions on the Time Axis in the Time Line window.

2. Choose a time scale from the **Division** pop-up.

Time scales range from 1/3 second to 2 minutes.

To set the Frame Rate for the animation (using the Set Time Axis dialog):

1. Click the **Time Scale** button at the bottom of the **Time Line** window.

2. Choose one of the frame rates from the **Frame Rate** pop-up.

The options range between 1 and 60 frames per second (fps). Typical frame rates are 15 or 18 fps for multimedia (CD-ROM), 24 fps for film, and 30 fps for NTSC video. You'll probably want to use a lower frame rate for previewing, then increase the rate for final rendering.

Note: The **Frame Rate** pop-up in the **Set Axis** dialog is synchronized with the frame rate menus in the **Time Controller** toolbar and the **Render Settings** dialog.

With snapping is turned on, the Current Time bar and key event markers will snap to individual frame boundaries when you drag them.

To control snapping to frame boundaries:

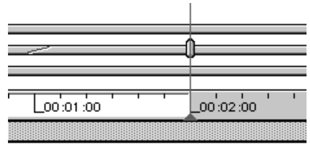
1. Click the **Time Scale** button at the bottom of the **Time Line** window.

2. Enable the **Snap** option.

The Current Time Bar

The **Current Time** bar is a vertical red slider with an arrow that points to the *current time* on the Time Axis.

The content of the **Perspective** window reflects the state of the scene at the current time. The title bar of the **Perspective** window also indicates the current time.



The Current Time Bar in the Time Line window indicates the current time in the Time Axis.

By default, when you drag the Current Time Bar it snaps to each tick (frame boundary) along the Time Axis. This allows you to set the current time precisely. You can turn snapping off by clicking the **Time Scale** button and disabling the **Snap** option in the **Set Time Axis** dialog. Refer to "Time Scale and Frame Rate" on page 301.

To change the current time with the time bar:

1. In the Time Line window, drag the **Current Time** bar to a different point along the **Time Axis**.

You can also click a point on the **Time Axis**.

If you drag the **Current Time** bar slowly, the contents of the **Perspective** Window updates interactively as you drag.

The Time Edit Controller

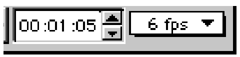
The **Time Edit Controller**, located to the left of the Time Axis and beneath the hierarchy area, displays the current time numerically in minutes, seconds, and frames (mm:ss:ff). For example, a reading of 00:08:23 refers to the moment that is eight seconds, 23 frames into the animation.

Note: The **Time Edit Controller** is synchronized with the Current Time Bar and the **Time Controller** toolbar (described "The Time Controller Toolbar" on page 303.

To change the current time (using the Time Controller toolbar):

1. Make sure the Time Controller toolbar is displayed.

2. Type a new value, or use the arrows to scroll buttons to change the current time value.

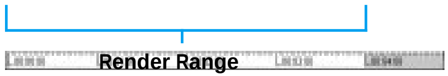


Use the current time fields in the Time Controller toolbar to adjust the position of the Current Time Bar.

The Render Range

The **Render Range** describes which time segment will be previewed or rendered. The **Render Range** is shown in white on the Time Axis.

Note: The **Render Range** is synchronized with the **Scene Settings window: Output tab: File Format: Movie controls**. For more information, refer to "File Format" on page 362.



Render Range on the Time Axis indicates the length of your animation.

The **Render Range** must extend past all key events if you want to preview or render the entire animation. The animation stops at the right boundary of the render range. If your animation does not preview or render to the end, verify that the render range extends beyond the last key event.

In theory, the maximum render range is one frame short of one hour (the entire length of the Time Axis). In practice, an animation that long would exceed the capacity of most hardware configurations. Lengthy animations should be produced in several short clips, which can then be edited together in a video-editing application.

To change the Render Range start and end times:

1. Click the **Time Line** window.

2. Drag the right edge of the Render Range to set the end time.

3. Drag the left edge of the render range to set the start time of the animation.

The Time Controller Toolbar

The **Time Controller** toolbar contains VCR-like buttons for previewing and moving through your animation within the **Perspective** window, moving forward or back one frame, and moving to the beginning or end of the render range.

The render range is the white area of the Time Axis, which determines the starting and ending points for previewing or rendering an animation. Instructions for setting the render range appear in "The Time Line Window" on page 297.

Use the Time Controller toolbar to controls the preview your animation.

To display the Time Controller toolbar:

1. Choose **View menu▸ Toolbars**. The **Toolbars** dialog appears.

2. Click the **Time Controller** item to enable its display.

   When the item has a check beside it, Ray Dream Studio displays that toolbar.

Note: Like all of Ray Dream Studio's toolbars, you can use the **Time Controller** as a floating palette or dock it on any side of the screen.

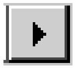
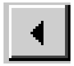
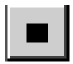
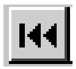
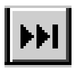
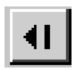
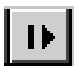
Previewing an Animation

You can use the **Time Controller** toolbar to preview your animation at any time. The animation will play in the **Perspective** window at the current display quality. Better Preview quality is not recommended for previewing animations.

When you preview an animation in a **Perspective** window, Ray Dream Studio won't skip any frames. If it can't draw frames fast enough to maintain the current frame rate, the preview will take longer to play.

Reducing the frame rate will produce choppier motion, but the preview will play closer to "real time." Lowering the current display quality to wireframe or box will speed up the preview without sacrificing smoothness of motion.

The **Time Controller** can also be used to change the current time. You can advance or back up one frame, or move to the beginning or end of the render range. You can also change the frame rate.

	Play	Click to preview the animation forward from the current time.
	Reverse Play	Click to preview the animation backward from the current time.
	Stop	Click to halt play.
	Loop	Click to loop when you play. Click again to disable looping.
	Rewind	Click to jump directly to the first frame of the render range.
	Fast Forward	Click to jump directly to the last frame of the render range.
	Previous Frame	Click to step back one frame.
	Next Frame	Click to advance one frame.

In some cases, you may want to render a low-resolution animation for preview purposes, rather than preview the animation in the **Perspective** window. For more information, refer to "Renderers" on page 342.

To change the frame rate using the Time Controller:

1. Make sure the **Time Controller** toolbar is displayed. If it's not choose **View menu ▸ Toolbars** and enable **Time Controller**.

2. Choose a frame rate from the **Frame Rate** pop-up. Values range from 1 to 60 frames per second.

Note: You can also set the frame rate using the Set Time Axis dialog or the **Scene Settings window: Output tab: File Format controls**.

If you are working with limited screen space, you can close the **Time Line** window and use the **Time Controller** toolbar to change the current time as you define key events. However, you won't be able to see the list of animatable properties, manipulate key event markers, or apply tweeners with the **Time Line** window closed.

Interactive Mode

Ray Dream Studio's Interactive Mode lets you see the objects move when you preview animations using Shaded or Better preview. When Interactive Mode is off, only projections (and bounding boxes for selected objects) move when you preview animations in **Preview**, **Shaded Preview** or **Better Preview Quality**.

To enable or disable Interactive Mode:

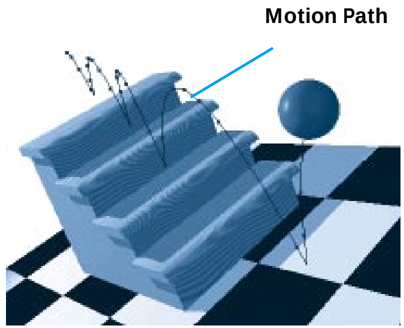
1. If necessary, display the **Rendering** toolbar, by choosing **View menu ▸ Toolbars** and enabling the **Rendering** option.
2. In the **Rendering** toolbar, click the **Interactive Mode** button.

   Interactive Mode is on when the button is darkened.

Enable the Interactive Mode button if you want to see your objects move in the Perspective window when you play an animation.

Viewing Motion Paths

To help you visualize the movements of your animated objects, Ray Dream Studio can display motion paths. A motion path is a line curving through space that describes where an object is located throughout the animation. Motion paths are 3D and cast projections.



Motion path let you see the path of your object in an animation.

The marks on the path describe the speed of the object through the animation. Where the marks are closer together, the object moves more slowly.

Note: The motion path is a visualization tool. You cannot change an object's trajectory by editing the path directly.

Motion paths apply to objects individually, so you can show or hide them for any particular object. The control for viewing motion paths is on the **Time Controller** toolbar.

Use the View Motion Path button to see the motion paths of your objects in the Perspective window.

To show or hide an object's motion path:

1. Select the object whose path you want to show or hide.
2. Click the **View Motion Path** icon on the **Time Controller** toolbar.
3. Ray Dream Studio toggles display of the object's motion path.

Note: Remember that motion paths are available for objects individually. You must select an object before clicking the icon to change its motion path display state.

To set Motion Path preferences:

1. Choose **File menu▸ Preferences**.
2. Choose **Motion Paths** from the pop-up.
3. Enable the **Display Frames** option if you want the path to show marks that indicate the object's position along the animation.
4. Choose a **Fidelity** level (Low, Medium or High) to set how precisely Ray Dream Studio should calculate and display the paths.

Defining Key Events

Key events are changes to the properties of objects and effects in your scene at specific points in time. You'll define *key events* to set the changes that create your animation. Ray Dream Studio automatically calculates the transitional states between key events.

After creating key events, you may want to modify the rule (tweener) Ray Dream Studio uses to calculate the transitional states between keys. For more information, see "Applying the Tweener" on page 310.

The physical force behaviors have special considerations. Their physical behaviors take precedence over arbitrary settings. Therefore, you cannot set key events for position or orientation on any object that has physics applied except on the first frame of the animation. See "Physical Forces" on page 318 for complete information on working with the physical forces.

Typically, you'll create a key event at the beginning and end of a particular action.

To define key events:

1. Click the **Time Line** window.
2. Set the current time to a time where you want to add one or more key events.

   You can drag the **Current Time Bar**, click a point on the **Time Axis**, or enter a time in the **Time Edit Controller** to set the time.
3. Use the standard Ray Dream Studio tools, editors, palettes, and dialogs to modify the properties of any object or effect you want animated.

   Ray Dream Studio places a key event marker on the appropriate track in the time line.
4. Continue creating key events for the several elements at various points along the **Time Axis**.

You can also add a key event directly to a time track in the **Time Line** window, using the Add Key Event tool. This doesn't change the existing action. It adds a key event at that point which you can then edit to change the timing of the animation. See Editing the Time Line, below.

Note: Notice that every element has a key event in frame one. That's because everything must have an initial state.

Editing the Time Line

After you've created several key events, you may want to change the timing of your entire animation, or synchronize individual events within the animation.

You can edit the time line to adjust the timing and content of your animation. You can add key event markers, delete them, or move them along the Time Axis. You can also copy and paste events between time tracks.

Selecting Key Event Markers

To select a key event marker:

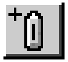
1. Choose the **Selection** tool.
2. Click on the key event marker you want to select.

   - Hold down the **Shift** key and click additional markers you want to select.
   - You may also drag a marquee around one or several markers to select them.

Adding Key Events

To add a key event:

1. Click the **Time Line** window.
2. Choose the **Add Key Event** tool from the toolbar.



3. In the **Time Line** window, click on the time track at the point where you want to add the event.

You can select the new key event marker and move it to change the timing.

Note: The transitions before and after the new key event use the tweener options for the previous key event.

Removing Key Events

To remove key events:

1. Click the **Time Line** window.
2. Select one or more key event markers.
3. Press the **Delete**/**Backspace** key.

   You may also choose **Edit menu▸ Delete**.

Changing the Timing of Key Events

To change the timing of key events, you simply move key event markers horizontally along the time tracks to different points along the Time Axis.

To move one or more selected key events:

1. Drag the key event marker along the Time Axis to the point where you want it.

   If you've selected several markers, drag one of them and they all will move. The time intervals between the selected key events remain the same.

Ray Dream Studio lets you to move a key event marker past neighboring key event markers on the same time track. If you want to restrict a key event marker to stay between the previous and next key event markers, hold down the Shift key as you drag the key event marker.

Duplicating Key Events while Dragging

You can duplicate a key event to another location on the same time track by holding down a modifier key while you drag a key event marker. This is useful when you want to return an object or effect to the same state at several points during an animation.

To duplicate key events while dragging:

1. Click **Time Line** window.
2. Hold down the **Option**/**Alt** key, and drag one or more key event markers along their time track(s).

To nudge selected key event markers:

1. Click the **Time Line** window.
2. Select one or more key event markers on the time line.
3. Press the left or right arrow key to move the marker one screen pixel to the left or right.

   Hold the **Shift** key down and press the arrow keys to move one frame at a time.

When you duplicate an object (**Command-D/Ctrl+D**), or Copy and Paste an object, you duplicate all of its animatable properties. Likewise, when you copy and paste objects into other scenes, they carry their key events.

Stretching a Series of Key Events over Time

You can stretch a series of key events over time, while maintaining the proportional timing between the events. This is useful when you're satisfied with the relative animation of a particular sequence, but you want the entire sequence to be sped up or slowed down.

To compress or expand the timing between a series of key events:

1. Click the **Time Line** window.
2. Select three or more key event markers.
3. Hold down the **Command/Ctrl** key and drag one of the selected key event markers.

   The entire series of key events will be stretched or compressed, retaining the proportional timing between the key events.

Copying and Pasting Key Events

You can copy key events from one time track to another. The key events you are copying must modify properties that pertain to the destination track. For example, you can paste key events modifying an object's position to another object's track, but not to a render effect's track—render effects don't have positions.

When you paste key events, they keep both the timing and the property state.

To copy key events:

1. [Click the **Time Line** window.
2. Select one or more key event markers.
3. Choose **Edit menu▸ Copy**.

To paste key events:

1. In the Hierarchy area of the **Time Line** window, select the name of the object, group, effect, or property whose time track you want to paste onto.
2. Choose **Edit menu▸ Paste**.

   The key events (from the clipboard) are added to the destination track. If some of the key events copied do not pertain to the destination track, they cannot be pasted.

XYZ Key Event Mode

Ray Dream Studio offers two "recording" modes for when you create a key event by translating an object (change its position):

- Mark XYZ Together.
- Only Mark Changed.

The two modes produce different results when you create and play the animation.

You'll need to set the mode you want to use before translating the object to create key events.

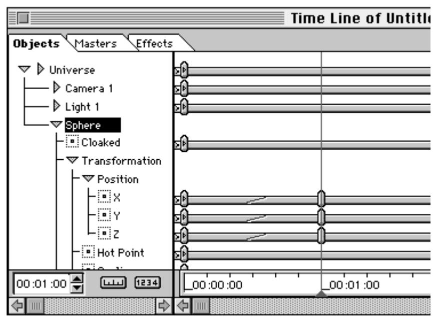
To choose the XYZ Key Event Mode:

Choose **Arrange menu▸ XYZ Key Event Mode▸** and select the mode you want—**Mark XYZ Together** or **Only Mark Changed**.

Mark XYZ Together

In this mode, Ray Dream Studio creates a key event on each of the separate X, Y, Z position tracks—even if you've changed the position in only one dimension. For example, if you raise the object (change Z position), Ray Dream Studio places a key event marker on the object's Transformation: Position: X, Y and Z time tracks.

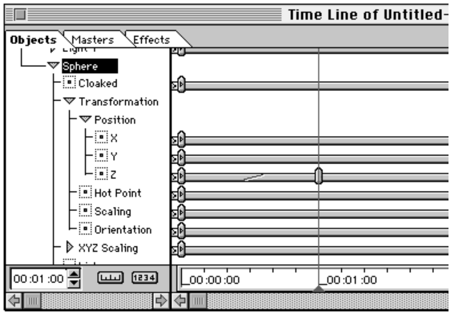
Mark XYZ Together is the default mode.



In Mark XYZ Together mode any change in position creates a key event on all position tracks.

Only Mark Changed

In this mode, Ray Dream Studio creates a key event only on the necessary X, Y, Z position tracks. For example, if you raise the object, Ray Dream Studio places a key event marker on the object's Transformation: Position: Z time track. Because you didn't change X or Y, there's no event on these tracks.



In Only Mark Changed mode, a key frame is only added to the position track where change occurs.

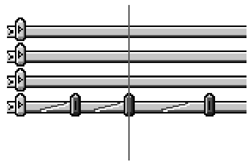
Key Event Actions

Ray Dream Studio provides some special features for duplicating and modifying a series of key events. You can reverse, repeat or mirror a key event sequence. You can also adjust the positioning of the events so that they coincide with the start of the next frame.

To use a Key Event Action:

1. Choose the **Selection** tool.
2. In the **Time Line** window, adjust the display to show the sequence of key events you want to work with.

   You may need to change the time scale or expand the properties of an object.
3. Select each marker in the sequence. You may drag a marquee or **Shift-click**.



Select a sequence of key events.

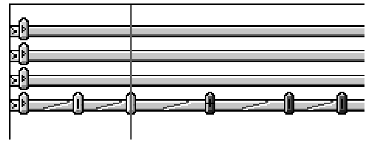
4. Choose **Arrange menu▸ Key Event Action▸** and select the action you want:

   Reverse flips the order of the events so that the last becomes first and vice versa.

   Repeat Sequence duplicates the sequence and places the duplicate immediately after the selected sequence.

   Mirror Sequence duplicates the sequence, reverses the duplicate, and places it immediately after the selected sequence.

   Snap to time adjusts the positioning of the selected events so that they coincide with the start of the next frame



This sequence was mirrored. [more descriptive]

Using Tweeners

Tweeners make it easy to create more interesting and subtle changes in the transitions between key events. Tweeners will save you time by automatically creating movements and changes that would be extremely difficult with key events alone. Tweeners make your animation motions and other changes more natural and sophisticated.

About Tweeners

The time period between any two key events is considered a transition. In the Time Line, you'll see the transition as the "gap" between key event markers. Ray Dream Studio uses a formula (the "tweener") to create the transitional states so that the object or effect changes smoothly between the two key events.

You won't always want a smooth, linear transition. Sometimes you'll want an abrupt change of state. Other times you'll want a transition that starts slowly and accelerates to finish in a rush. You might even want a transition that quickly alternates between the before and after states, like a florescent light flickering on.

All of these transitions are possible by setting your options for the tweener used between each pair of key frames.

A tweener requires a beginning and an ending key event, although you can place the ending key event far out in time.

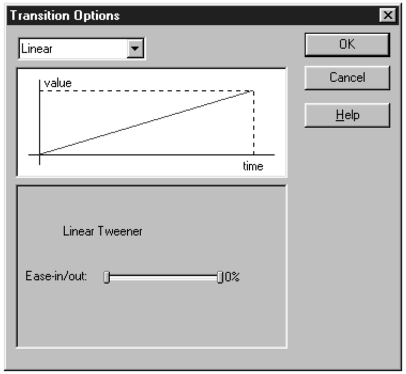
Note: The term tweener is derived from "in-between."

Applying the Tweener

Every "gap" between key events on the time track must have a tweener. The default tweener is **Linear**, which produces an even rate of change between the two states. You can achieve a different sort of transition by applying a different tweener.

To apply a Tweener:

1. Click the **Time Line** window.
2. Set up beginning and ending key events.
3. Double-click the time track segment between the two key event markers. The **Transition Options** dialog appears.

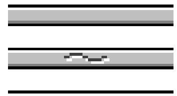


Use the Transition Options dialog to select a type of tweener to apply to your animation.

4. Select a tweener type from the pop-up.
5. Set the appropriate controls for the tweener. The controls for each type of tweener are described in the sections that follow.

   As you move the handles on a slider, the graph reflects the new settings.
6. Click **OK** to close the dialog.

Note: Notice the small graphic on each segment of the time track. This graphic indicates the kind of tweener that is applied.



When there's a tweener applied to a time track, the Tweener indicator appears.

Linear Tweener

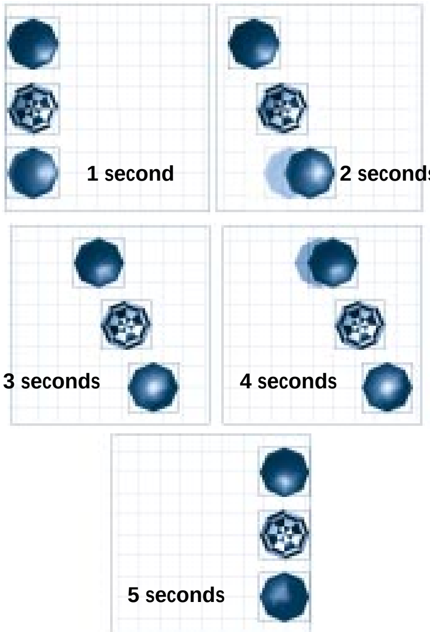
The **Linear** tweener creates gradual, direct transitions between actions.

When the graph line is straight, from the bottom left to the top right corner, the transition proceeds at an even rate from start to finish. This is the default, but you can change it.

To set Linear tweener options:

1. Click the **Time Line** window.
2. Double-click the time track segment between the two key event markers. The **Transition Options** dialog appears.
3. Select a **Linear** from the pop-up.
4. Adjust the two handles on the **Ease-In/Ease-Out** slider on the **Linear** tweener to modify the rate of change at the beginning and end of the transition.

- Drag the left handle to the right to start slowly.
- Drag the right handle to the left to finish slowly.



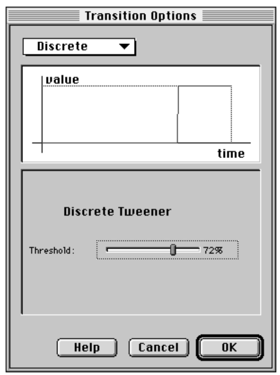
You can see how different Ease-In and Ease-Out settings affect your animation. Some objects move faster at the beginning of the animation while others move faster at the end of the animation.

Discrete Tweener

The **Discrete** tweener maintains the values from the key event that begins the transition until a specific time in the transition is reached. Then the values abruptly change to those of the key event that ends the transition. Use the **Discrete** tweener when you want a property to change immediately, like switching on a light.

To set discrete tweener options:

1. Click the **Time Line** window.
2. Double-click the time track segment between the two key event markers. The **Transition Options** dialog appears.
3. Select a **Discrete** from the pop-up.



Use the Discrete Tweener options dialog to set the tweeners options.

4. Adjust the **Threshold** slider to specify the exact point during the transition where you want the change to occur.

   The threshold value is a percentage of the transition's entire duration. For example, if you want the discrete change to occur halfway between the key events, set the threshold to 50%. If you want the change to occur at the time of the first or last key event, set the threshold to 0% or 100%, respectively.

Bézier Tweener

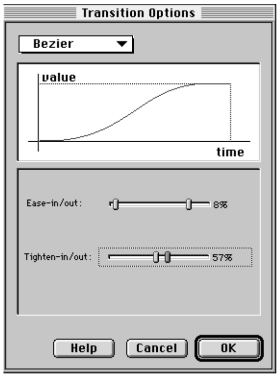
The **Bézier** tweener is designed especially for creating smooth motion paths. For best results, use it on an object's transformation track.

The **Bézier** tweener has two controls that you can adjust—**Ease-In/Out** and **Tighten-In/Out**.

To set Bézier tweener options:

1. Click the **Time Line** window.
2. Double-click the time track segment between the two key event markers. The **Transition Options** dialog appears.
3. Select a **Bezier** from the pop-up.

The Bezier tweener controls appear. The two handles on the **Ease-In/Ease-Out** slider on the **Linear** tweener to modify the rate of change at the beginning and end of the transition.



Use the Bezier Tweener options dialog to adjust the curve of the tweener.

4. Drag the left handle to the right to start slowly.

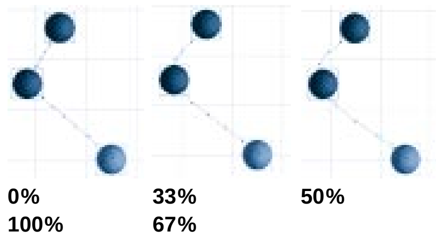
5. Drag the right handle to the left to finish slowly.

   The **Tighten In/Out** slider allows you to adjust the trajectory of the transition—the “path” the values take as they change from one key event to the next.

6. Drag the left handle to change the initial trajectory.

7. Drag the right handle to change the finishing trajectory.

   Values near the extremes (0% and 100%) result in tighter trajectories (closer to linear). Values near 50% result in looser (less direct) trajectories. The default settings (33% in and 67% out) are optimized for natural, smooth motion.



Extreme Tighten In/Out settings result in tighter trajectories. Values closer to 50% result in smoother trajectories.

Oscillate Tweener

The **Oscillate** tweener switches back and forth between the start and end values several times during the transition You can choose between several wave forms to describe the alternation.

To set Oscillate tweener options:

1. Click the **Time Line** window.

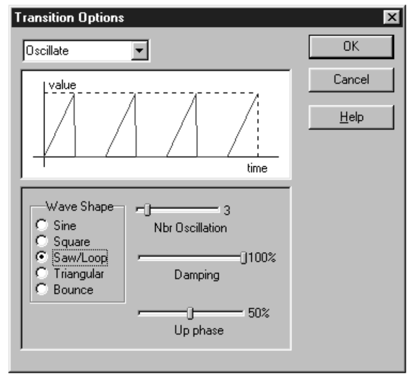
2. Double-click the time track segment between the two key event markers. The **Transition Options** dialog appears.

3. Select a **Oscillate** from the pop-up.

4. Click one of the **Wave Shape** radio buttons to choose the wave shape you want.

   The graph of the wave shape shows how the switch occurs between up and down phases.

   - The **Sine** wave uses a sine curve to alternate the before and after values.
   - The **Square** wave alternates back and forth between the first and last key events with no interpolation.

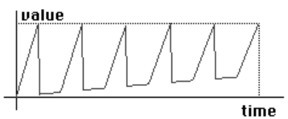


Use the Oscillate Tweener options dialog to set the shape of the oscillate wave and other attributes.

One way to make a light blink at one second intervals is to turn the light on and off by setting key events every second on the light's time track. A more efficient way is to turn a light on at Event A and then turn it off, perhaps ten seconds later, at Event B. Afterwards, apply the **Oscillate** tweener, and specify ten oscillations (using the Square wave so that the switches are abrupt). The **Oscillate** tweener switches the light on and off ten times during the ten-second interval, using only two key events and a single tweener.

- The **Saw/Loop** wave interpolates linearly from its beginning value to its ending value, then snaps back abruptly to the beginning value in each oscillation.

  You can use this option to replicate an action, such as hitting a gong. The character's arm is first placed in a drawn back position, moves to strike the gong, and then snaps back. You can also use Saw/Loop to play a movie from start to end in a loop.



This is what the Saw/Loop Wave Shape looks like when you apply Damping

- The **Triangular** wave shape causes the transition to alternate back and forth abruptly.
- The **Bounce** wave shape causes the transition to alternate, with abrupt change in and out of the second position and gradual change in and out of the first position. This works well when the first position is a ball at height, and the second position is the ball on the floor.

5. Adjust the **Nbr Oscillation** slider to set the number of times the values should alternate.
6. Adjust the **Damping** slider to progressively diminish the amplitude of the oscillations.

   After each oscillation, the amplitude diminishes by the damping factor percentage.
7. Adjust the **Up Phase** slider to control how much of each oscillation is dedicated to the "up phase."

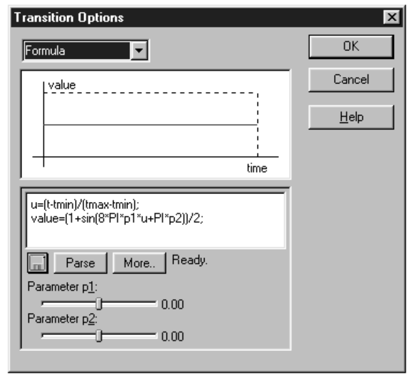
   For example, if you set the Up Phase value to 90%, the object spends 90% of the oscillation changing from A to B and only 10% changing from B to A.

Formula Tweener

Formula creates a transition curve or pattern from a formula. You can devise your own formula to create a custom tweener.

To use a formula for the tweener:

1. Click the **Time Line** window.
2. Double-click the time track segment between the two key event markers. The **Transition Options** dialog appears.
3. Select a **Formula** from the pop-up. The **Formula** controls appear.]



The preview displays the result of the current formula.

4. If the current formula uses the **Parameter** sliders, you can adjust them to change the formula result.

The graph describes the result.

5. To load a new formula, click the disk icon.

   Use the **Open** dialog to locate and open an appropriate formula. Sample formulas can be found in the **Samples: Formulas** folder on your Ray Dream Studio CD.

6. If you want to edit the formula or create your own, click **More** to open the Formula Editor.

   Ray Dream Studio uses the **Formula Editor** in several places. Use of the editor is common, but the type of formula you're creating determines the valid input and output variables. Refer to the "Using Formulas in Ray Dream Studio 5 PDF" for details on using the Formula Editor.

   Formula editing becomes technical quickly. You can learn a lot by loading the sample files.

7. When you're done with the **Formula Editor**, click **OK**.

8. To save a formula, click the disk icon and choose **Save As** from the pop-up.

   Use the **Save** dialog to name the file and choose a disk location.

Behaviors

Behaviors allow you to give objects sets of instructions that give them an "activity" during the animation. Behaviors reduce the number of key events you need to create and allow you to create actions that are not otherwise possible.

Some behaviors, such as Bounce and Spin, automatically assign complex actions to an object. greatly reducing the number of key events you need to create. Others, such as Point At and Track, define or modify the motion of one object based on the location or motion of another object.

Inverse kinematics is a specialized behavior that ensures that complex, linked models move realistically.

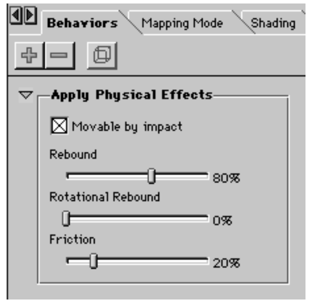
The physical force behaviors allow objects to move and interact as though they obeyed the laws of physics. The physical forces have special characteristics. See "Physical Forces" on page 318 for complete information.

Applying Behaviors

You can apply multiple behaviors to an object or group; however, some may override the others.

For example, you can apply both a bounce and a spin to an object. However, some behaviors are exclusive—they cannot be used together. It wouldn't make sense to assign the **Point At** behavior to an object and also give the object Spin—these behaviors would produce contradictory results.

When you apply a behavior, it remains in the object's behavior list for the duration of the animation. However, most behaviors can be turned on an off at different points along the time line.



Use the Behaviors tab in Properties palette to add or delete behaviors from an object.

To apply a behavior:

1. Select an object.
2. Display the **Properties palette: Behaviors tab**.
3. Click the **Plus** icon. A dialog appears with a list of the available behaviors.

4. Choose the behavior you want to apply. Click **OK**.

5. Set other options for the behavior.

   The options for **Spin**, **Bounce**, **Point At**, **Track** and **Inverse Kinematics** are described below. The options and use of the physical forces—**Apply Physical Effects**, **Initial Velocity**, **Directional Force**, **Point Force**, **Rotational Force**, **Flow Force** and **Damping Force**—are covered separately. Refer to “Physical Forces” on page 318.

6. Click **Apply** to send your changes to the object.

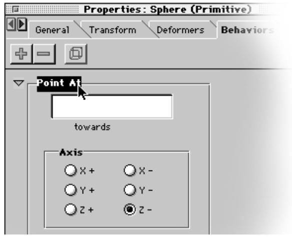
The basic behaviors (excluding the physical forces) are applied in the order that they appear in the list. Where two or more applied behaviors conflict, those further down the list override those above. After you add behaviors, you can drag them up or down to change the order.

To remove a behavior from the list:

1. Select the object or group that carries the behavior.

2. Display the **Properties palette: Behaviors tab**.

3. On the tab, click the title of the behavior you want to remove to select it.



Click the Behavior’s name on the Behavior’s tab to select it.

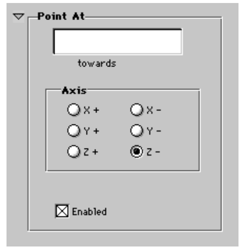
4. Click the **Minus** icon in the **Behaviors** tab.

Point At

The Point At behavior instructs an object to orient itself “toward” another object (hot point) through all or part of the animation.

You can use the Point At behavior to get a camera or light to follow a particular object or group. You can also use it to animate an object that always faces or points at another, such as a satellite dish as it tracks a satellite, or a sunflower as it follows the path of the sun.

Arrange menu▸ Point At differs from the **Point At** behavior in two respects. First, **Arrange menu▸ Point At** only operates on cameras and lights. Second, it only makes the change “right now,” so it’s not an animation tool.



Use the Point At Tab to select an object to point at.

To set point at options:

1. Apply the **Point At** behavior to an object. The **Point At** controls appear on the **Properties palette: Behaviors tab**.

   See “To apply a behavior:” on page 314 for instructions on applying behaviors.

2. Type the name of the object to be pointed at in the text box. Type the name exactly as it appears in the Hierarchy area. (The text box is case sensitive).

3. Use the radio buttons in the Axis area to select which face of the object should point at the target object.

   For objects other than camera or light, you'll need to specify which face of the object should be oriented toward the target. For example, if you're working with a "pointing finger" object, select the axis that describes the direction the finger points.

   This step is not necessary with a camera or light. By default, the face with the light beam or the camera lens is selected. Any other setting would point the light beam or camera lens at 90° or 180° to the target.

You can display the **Properties palette: Transform tab: Position controls** to show the axes. For a reference on the object itself, enable the **File menu: Preferences dialog: Perspective: Hot Point: Show Axis Information option**.

4. You can use the Enable checkbox to turn the behavior on and off at specific points in the animation.

   A key event is created each time you turn the behavior on or off.

5. Remember to click **Apply** to update your changes to the object.

The Point At behavior was applied to the rocket so that it continues to point at the dinosaur no matter where it moves.

Bounce

The Bounce behavior instructs an object to bounce up and down along the global z-axis. You can set the upper and lower limits for the bounce, and specify the number of bounces per second.

Note: The bounce behavior does not control an object's lateral movement (along the x and y planes).

The Bounce behavior is useful when you have a very specific effect in mind and wish to specify Bounce parameters (like height and frequency) by hand. However, natural bouncing is much easier to create using the physical forces. See "Physical Forces" on page 318.

To set bounce options:

1. Apply the **Bounce** behavior to an object. The **Bounce** controls appear on the **Properties palette: Behaviors tab**.

   See "To apply a behavior:" on page 314 for instructions on applying behaviors.

2. In the **Floor** entry box, enter the lower limit of the bounce. The value describes the distance from the global universe Z=0 plane that is the lower limit of bouncing.

3. In the **Height** entry box, enter the height of the bounce. The value describes the distance above the floor level that is the upper limit of bouncing.

4. In the **Bounces per Second** entry box, enter the number of bounces per second.

5. Enter values in the **Start Time** and **End Time** entry box to limit the bounce to a particular range in time.

6. Remember to click **Apply** to update your changes to the object.

Spin

The **Spin** behavior instructs an object to rotate on one of its axes. You can set the number of cycles of the spin per second.

You can also spin an object using the physical forces. see “Physical Forces” on page 318.

To set spin options:

1. Apply the **Spin** behavior to an object. The **Spin** controls appear on the **Properties palette: Behaviors tab**.

   See “To apply a behavior:” on page 314 for instructions on applying behaviors.

2. Select the axis of rotation.
3. In the **Cycles per second** entry box, enter the number of cycles per second for the spin. (A cycle is one complete 360° rotation.)
4. Enter values in the **Start Time** and **End Time** entry boxes to limit the spin to a particular range in time.
5. Remember to click **Apply** to update your changes to the object.

Track

The **Track** behavior instructs an object to “shadow” another as its moves through the universe.

To set track options:

1. Apply the **Track** behavior to an object. The **Track** controls appear on the **Properties palette: Behaviors tab**.

   See “To apply a behavior:” on page 314 for instructions on applying behaviors.

2. Type the name of the object to be tracked in the text box. Type the name exactly as it appears in the Hierarchy area. (The text box is case sensitive.)
3. Enable the checkboxes for each axis you want to track in.
4. Enable Track Rotation if you wan the object to track the rotation as well as position.
5. Use the Enable checkbox to toggle the behavior on and off at specific points in the animation.
6. A key event is created each time you turn the behavior on or off.
7. Remember to click **Apply** to update your changes to the object.

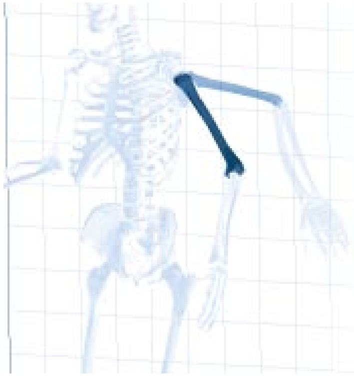
Inverse Kinematics

Inverse Kinematics is a specialized behavior that is applied to linked objects. Inverse Kinematics provides the versatility of child-to-parent control. It reduces the time it takes to create realistic animations.

Normally, movement is transmitted downward from parent to child in the hierarchy. When you link a child to a parent object and apply inverse kinematics, movement can also propagate up the hierarchy—from the child to the parent. This means that when you move a child object, the parent follows. Motion cannot propagate from a linked child to its parent without Inverse Kinematics.

The movement is affected by the type of link property and constraint you apply, for example, a Lock, Slider, or 2D link can constrain the movement of the child object in relation to the parent. Refer to “Linking Objects” on page 259 for information on link properties and constraints.

If you use an arm as an example, linking the objects that make up the arm in a hierarchical structure and placing the hot points at the joints, you can rotate the arm at the shoulder or elbow, and everything below that joint (toward the hand) moves accordingly.

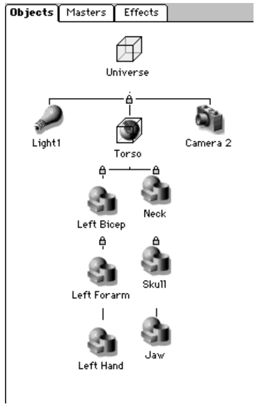


You can easily animate the natural motion of an arm using Inverse Kinematics

With Inverse Kinematics, you can move the hand, which in turn forces the forearm and upper arm to rotate and move to accommodate.

Before applying the **Inverse Kinematics** behavior to an articulated object, you must link the objects that make up the model and define properties and constraints for the movement of each child in relation to its parent. These constraints should describe the desired range of motion for each part.

Refer to "Linking Objects" on page 259 for information on linking one object to another. Refer to "Applying Link Properties" on page 260 for information on setting link properties and constraints.



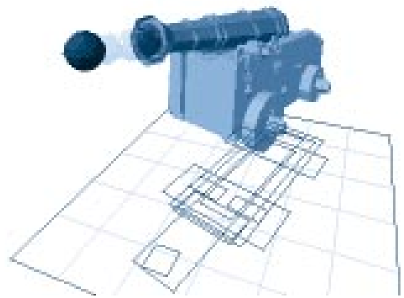
This is what the Arm with links looks like in hierarchy mode.

You must apply Inverse Kinematics to the last child object in the link chain. You may also apply it to other children higher up the link chain. Then if you start a movement farther up the chain, objects higher up the chain can move as well.

Physical Forces

The physical forces are a special form of behavior. These forces allow your objects to accelerate, move and interact in ways consistent with the laws of physics.

These physical force behaviors enable you to create realistic animations that would be virtually impossible with key framing. You can get objects to slide down a slope, bump into each other and bounce away, and other useful motions.



This cannon ball was animated using the Initial Velocity behavior

While the physical forces do an excellent job of simulating many physical events, it is not a complete model. Some types of interaction are not supported. These include true momentum exchange, perfect rolling, and some types of tumbling. This means you'll have trouble shooting billiard balls into pockets, knocking over bowling pins and tumbling dominoes one after the other.

The physics behaviors are as follows: **Apply Physical Effects**, **Initial Velocity**, **Directional Force**, **Point Force**, **Rotational Force**, **Flow Force** and **Damping Force**. Each of these is described in detail later in this section.

Note: You can learn a lot about the physical forces and how to use them be viewing the sample animations and demonstration files in the **Ray Dream Studio 5 CD: Samples: Sample Physics** folder.

The physical forces are exclusive of most other behaviors, and they may not work with some of the link property constraints and deformers.

Tip: You cannot use physics on an object for a while, then turn it off to allow some other type of event. What you can do is create a second copy of the object that does not use physics. Then cloak and de-cloak the objects to switch between them at the right moments.

Physics and Key Events

Physical forces preclude arbitrary settings in key events. For example, if you apply directional force to get an object to fall, you can't also set it's position above the floor. The object must either obey physics (and fall) or be "above the floor."

When you apply a physical force to an object, Ray Dream Studio removes all key events (not including the starting key in frame 1) that would arbitrarily set position or orientation on the object. Its other properties, like scale and shading, remain animatable with key frames.

You can't set position or orientation key events for objects that use physics. You can, however, set key events for the property values in the physical forces themselves. For example, you can accelerate an object, then apply damping to stop it, then accelerate it in a different direction. You'll learn more about this later in this section.

Note: Initial Velocity describes the object's inertia in frame 1. Therefore, this force cannot be changed with a key event.

You might want an object to respect physics, but still be animated with key events. The primary application of this is to create an object that can move with key events while having objects responding to physical forces will bounce off of it.

You can create this type of action by using the **Properties palette: Miscellaneous tab** to add the **Physical Effects Solid** property to the object you want to animate using key events.

Another possibility is to develop the animation using physical effects, then translate the result into key events with the **Record Behaviors** command. This feature is described in "Record Behaviors" on page 326.

Using Physics

To apply physical effects:

1. Rewind your animation to frame 1.
2. Select the object you want to apply physics to.
3. Display the **Properties palette: Behaviors tab**.
4. Click the **Plus** icon.
5. In the dialog, choose **Apply Physical Effects**.

   Ray Dream Studio loads the basic settings that tell this object to obey physics. For complete information on **Apply Physical Effects**, see below.
6. You can click the **Plus** icon again and load one of the specific physical forces, described below. You can apply any number of forces. The order you add them doesn't matter.
7. Adjust the settings for the forces you've loaded.
8. Click **Apply**.
9. Preview the animation to see how the forces influence object motion. You might want to extend the Render Range to see more action.

Refer to “Previewing an Animation” on page 304 for complete information on using the animation preview controls. Refer to “The Time Line Window” on page 297 for on using the time line.

Important: After previewing, remember to rewind to frame 1. If you make changes without rewinding, you'll be setting a key event at this later moment of the animation.

Note: Ray Dream Studio allows you to disable physical effects. Disabling the physics prevents Ray Dream Studio from recalculating the effect when you make changes. This is more efficient if your changes don't directly relate to the physical effects. For more information, refer to “Physical Effects Preferences” on page 325.

Apply Physical Effects

Apply Physical Effects is required for all objects that take part in physics. It tells the object to obey physics and to interact with other objects that obey physics.

If you use physics to accelerate one object into another, the resulting collision depends on whether the target object respects physics. If it does not, the missile object will simply pass through the target and continue on its way. If the target does respect physics, the two objects will bounce apart.

Note: You can get an object to respect physics for collisions by going to its **Properties palette: Miscellaneous tab** and adding the **Physical Effects Solid** property.

Apply Physical Effects is required for any object that uses one of the physical forces.

To set Apply Physical Effects options:

1. Apply the **Apply Physical Effects** behavior.

   See “To apply physical effects:” on page 319 for instructions on applying behaviors. The **Apply Physical Effects** controls appear on the **Behaviors** tab.

2. Disable the **Moveable by impact** option if you want the object to stay in one place.

   For example, if you drop a ball onto a table, you want the ball to bounce and the table to stay where it is. If both objects are “Moveable by impact”, the collision will send them in opposing directions. Disable the **Moveable by impact** option for the table to keep it stationary.

3. Adjust the **Rebound** slider to control this object's tendency to rebound.

   For example, a rubber ball will rebound better than a stone, so you should set the **Rebound** slider to describe the object's material.

   Objects don't have actual mass, but you can simulate relative mass by giving colliding objects different rebound strengths.

4. Adjust the **Rotational Rebound** slider to control this object's tendency to rotate when it rebounds.

   The direction of rotation depends on the angle of incident.

5. Adjust the **Friction** slider to control this object's resistance to sliding along a surface.

   For example, if you want an object to slide down a slope, set its Friction very small and give it downward (-Z) Directional Force (see below).

6. Click **Apply** to send your changes to the object.

Initial Velocity

Initial Velocity applies directional or rotational motion to an object in frame 1. If no other force influences the object, it will maintain its initial velocity indefinitely.

To set Initial Velocity options:

1. Apply the **Initial Velocity** behavior.

   See "To apply physical effects:" on page 319 for instructions on applying behaviors The **Initial Velocity** controls appear on the **Behaviors** tab.

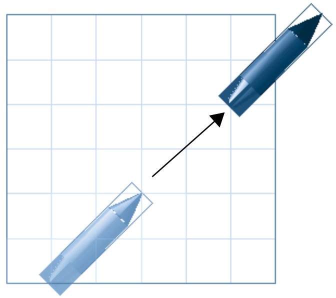
2. Enter values for velocity in the X, Y and Z dimensions.

   Use a negative value to set velocity opposite to the arrow in the xyz axis graphic.

3. Enter values for rotational velocity in terms of **Yaw**, **Pitch** and **Roll**.

   Use a negative value to set rotation counter to the arrow in the xyz/yaw pitch roll graphic.

4. Click **Apply** to send your changes to the object.



Initial Velocity takes care of the lateral movement on this rocket.

The **Initial Velocity** behavior's **Direct Manipulation Control** lets you see a wire reference of the Initial Velocity directional vector. You can drag the handle on the wire to change the vector and velocity.

To use the Direct Manipulation Controls with Initial Velocity:

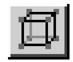
1. Apply the **Initial Velocity** behavior to an object.

   See "To apply physical effects:" on page 319 for instructions on applying behaviors

2. In the **Properties palette: Behaviors tab**, click once in the Initial Velocity panel (or on its title) to select it.

   Ray Dream Studio activates the **Direct Manipulation Controls** icon.

3. Click the **Direct Manipulation Controls** icon.

   In the **Perspective** window, Ray Dream Studio displays a wire reference that shows the Initial Velocity vector. Rotational velocity is not shown.

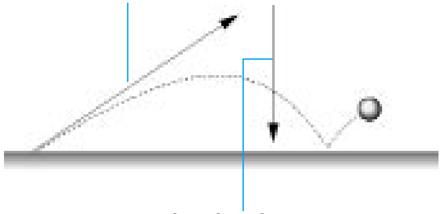
4. Drag the handle at the end of the wire (or one of the projections) to change the vector and velocity. Increasing the length of the wire increases the initial velocity.

   Ray Dream Studio updates the Initial Velocity X, Y, Z values as you drag.

Directional Force

Directional force accelerates an object in one direction.

You can use directional force to produce the effect of gravity—falling objects.



Without direction force, the ball would continue along its original trajectory indefinitely.

To set directional force options:

1. Apply the **Directional Force** behavior.

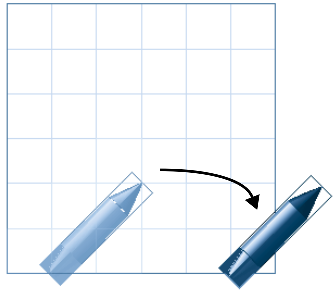
   See "To apply physical effects:" on page 319 for instructions on applying behaviors The **Directional Force** controls appear on the **Behaviors** tab.

2. Enter values to describe the force in the X, Y and Z dimensions. (These are in terms of the Universe.)

   Use a negative value to apply force opposite to the arrow in the xyz axis graphic.

Note: Units of force are arbitrary.

3. Click **Apply** to send your changes to the object.



This ballistic trajectory is accomplished with an initial velocity and a -Z directional force.

Note: Directional force applies a force to an object. It does not set velocity.

The **Directional Force** behavior's **Direct Manipulation Control** lets you see a wire reference of the **Directional Force** vector. You can drag the handle on the wire to change the vector and amount of force.

To use the Direct Manipulation Controls with Directional Force:

1. Apply the **Directional Force** behavior to an object.

   See "To apply physical effects:" on page 319 for instructions on applying behaviors

2. In the **Properties palette: Behaviors tab**, click once in the **Directional Force** panel (or on its title) to select it.

   Ray Dream Studio activates the **Direct Manipulation Controls** icon.

3. Click the **Direct Manipulation Controls** icon.

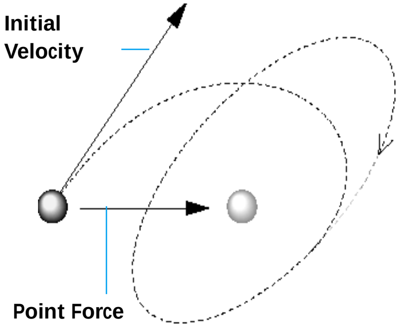
   In the **Perspective** window, Ray Dream Studio puts a wire reference that shows the Directional Force vector. Rotational velocity is not shown.

4. Drag the handle at the end of the wire (or one of the projections) to change the vector and force amount. Increasing the length of the wire increases the amount of force.

   Ray Dream Studio updates the **Directional Force X**, **Y** and **Z** values as you drag.

Point Force

Point Force accelerates an object toward another object. You can use point force to "shoot" one object at another. You may also invert the force to repulse one object from another.



When you use Initial velocity with Point Force you can create an object that orbits another.

To set Point Force options:

1. Apply the **Point Force** behavior.

   See "To apply physical effects:" on page 319 for instructions on applying behaviors The **Point Force** controls appear on the **Behaviors** tab.

2. Click in the **Point to object named** field and type the name of the object you want as the target.

3. Use the **Strength** slider to describe the amount of attraction (or repulsion).

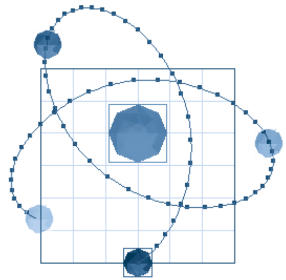
   Strength relates to the maximum acceleration.

4. Use the **Field Decay Rate** slider to describe the range (between the objects) where the attraction field begins to decay.

   At a low setting, the object accelerates toward the target slowly. At a high setting, the object accelerates quickly.

5. Enable the **Repulse** option if you want the object to move away from the target instead of toward it.

6. Click **Apply** to send your changes to the object.



You can use Point Force to place an object in orbit around another.

Rotational Force

Rotational Force accelerates an object to rotate around its hot point. You can use **Rotational Force** to spin an object.

To set Rotational Force options:

1. Apply the **Rotational Force** behavior.

   See "To apply physical effects:" on page 319 for instructions on applying behaviors The **Rotational Force** controls appear on the **Behaviors** tab.

2. Enter values for rotational force in terms of **Yaw**, **Pitch** and **Roll**.

   Use a negative value to set rotation counter to the arrow in the xyz/yaw pitch roll graphic.

3. Click **Apply** to send your changes to the object.

Flow Force

Flow Force creates randomized directional motions. You can use Flow Force to create engine vibrations or to give motion to Autumn leaves swept up by the wind.

You can use Flow Force to shoot a fleet of rockets out in every direction.

To set Flow Force options:

1. Apply the **Flow Force** behavior.

   See "To apply physical effects:" on page 319 for instructions on applying behaviors The **Flow Force** controls appear on the **Behaviors** tab.

2. Enter values for the amount of **Flow Force** in the **X**, **Y** and **Z** dimensions.

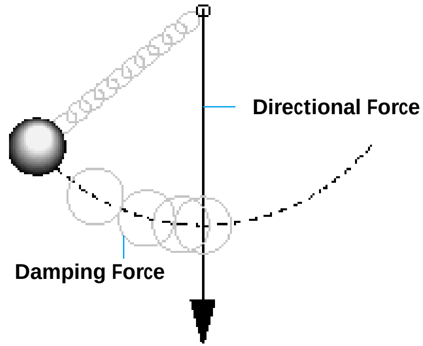
   For certain effects, you might want to set the force in one dimension to zero. This will constrain the action of the force to the plane defined by the other two dimensions.

3. Use the **Turn Density** slider to set the frequency of direction changes.

4. If you want the object to rotate with the flow, enable the **Rotate with flow** option.

Damping Force

Damping Force counters any other forces working on the object. Regardless of what inertia an object has or what force is applied, damping "slows it down."



Damping Force counters any force applied to an object.

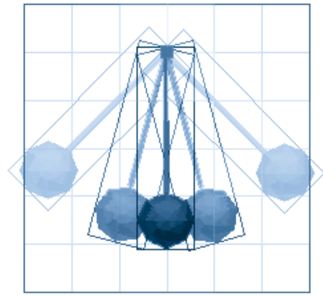
To set Damping Force options:

1. Apply the **Damping Force** behavior.

   See "To apply physical effects:" on page 319 for instructions on applying behaviors The **Damping Force** controls appear on the **Behaviors** tab.

2. Drag the slider to set the amount of damping.

Damping is not immediate. It's like applying the brakes in a car. Even at maximum braking, the car takes a few feet to slow down and stop.



When you apply Damping Force to a pendulum in your scene, it slowly brings it to rest.

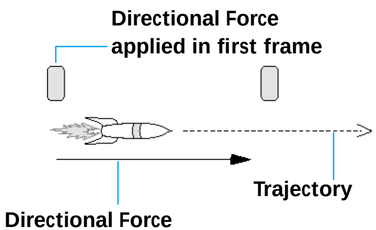
About Key Events in Physical Forces

You can change the physical force settings to create key events. Before you try this, you need to understand that the forces describe acceleration, not velocity. (**Initial Velocity** does set velocity, but it is only the initial state. It cannot be used for a key event.)

For example, you can start an object moving with a Directional Force that's X=10. A couple of seconds into the animation, you change the Directional Force values so that X=0 to create a key event.

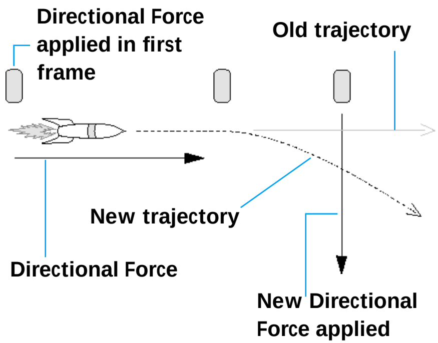
When you play the animation, the object will not stop at the moment of the key event. It will continue moving in X until it encounters a physical object (and rebounds) or some other force acts on it.

This follows the behavior of a rocket in space because Ray Dream Studio doesn't take into account friction or gravity. **Applying Directional Force** is equivalent to an engine burn. Shut off the engines and the rocket coasts along on its trajectory. Without friction to slow it down or gravity to pull it aside, the rocket continues on this vector at this velocity indefinitely.



In the first frame Directional Force was set at X=10. In the second frame Directional Force is set to X=0. Since no change in direction occurs, velocity and trajectory remain unchanged.

Next, the rocket rotates 90° and does another engine burn (this is the same as adding a new perpendicular Directional Force). The new trajectory is the combined effect of the initial acceleration and the secondary, perpendicular acceleration. The new velocity is the product of the old velocity and the new force (acceleration).



When the direction is changed in the third frame, trajectory changes, but velocity remains constant.

Note: If you want to exert more control over transitions, you can use a **Discrete** tweener or use **Damping Force** in key events just prior to a change of acceleration.

For more information, refer to "Defining Key Events" on page 306.

Physical Effects Preferences

When objects that use physics collide, they bounce away and spin. You can set a preference for how accurately Ray Dream Studio calculates the result from such interaction.

You can also disable physical effects completely. You might want to do this while you're working, and you don't want Ray Dream Studio to recalculate the effect each time you make changes.

To set physics accuracy:

1. Display the **Scene Settings window: Misc. Data tab**.

2. Click the radio button for the physics simulation accuracy you want.

   High is better than medium only when objects interact at an exceedingly rapid rate.

To disable/enable physical effects:

1. Display the **Scene Settings window: Misc. Data tab**.

2. Enable the **Enable Physical Effects** checkbox.

   When the box is empty, physics is turned off. Remember to turn it back on when you need it.

Record Behaviors

When you apply a behavior, Ray Dream Studio automatically calculates the position and orientation of objects over the course of the animation. The objects move to positions and orientations not explicitly defined by key events.

This is particularly noticeable with the Physical Force behaviors, which can create a complete animation segment without a single key event (excluding the initial state in frame 1).

You might decide that you want to control the position or orientation that's determined by a behavior. Ray Dream Studio lets you do this by converting the behavior action to a series of key events. After creating the key events, you can adjust them individually.

To convert behaviors to key events:

1. Set up the behavior to animate the object. See "To apply physical effects:" on page 319 for instructions on applying behaviors

2. Choose the frame rate you want for this project.

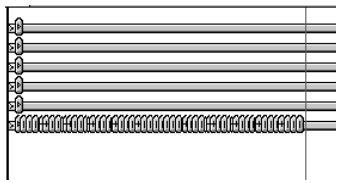
   Ray Dream Studio creates a key event marker for each frame, so it's important to set the frame rate first.

3. Set the render range to extend as far as necessary for this segment.

   Ray Dream Studio creates key event markers through the end of the render range, so it's important that the range extend to the end of this object's behavior.

4. Select the object whose behavior you want to convert.

5. Choose **Arrange menu▸ Record Behavior**.



This is what the Flow Force behavior looks like when it's converted to key frames.

16

Animating Techniques

Animation Techniques

Ray Dream Studio has a number of features for developing animations. Most of them can be used in more than one way. This chapter covers some techniques that will save you time and trouble and help you develop more interesting, natural and dynamic animations.

In this chapter you'll learn about animating object shapes using the modelers. You'll learn about animating with Deformers, how to get smooth motion paths, and use cloaking to hide and show an object at different points. You'll also learn about the many uses of rotoscoping and how to animate in shaders.

Animating Object Shape

You can change the shape of an object over time. This is as easy as jumping into the object and changing its shape to create a key event. Ray Dream Studio creates the transitions necessary to "tween" the original into the modified shape.

The type of object determines which modeler you'll use when you jump in and, therefore, what modifications you can make. For example, with the **Free Form** modeler, you can edit the cross sections, sweep path and scaling envelope. But with the volumetric primitives, like Fire and Cloud, you'll use sliders to change the character of the object.

Animating a Deformer is another way to change an object's appearance over time. Refer to "Animating with Deformers" on page 332.

Free Form Modeler

Ray Dream Studio 5 allows you to change the shape of a free form object during animation using the **Free Form** modeler.

There are some limitations in the kinds of changes you can make in your models, but generally you can edit all existing cross sections and points on an extrusion path or scaling envelope.

You *cannot* add or delete cross sections or points, or change the basic structure of the object. For instructions on modeling with extrusion paths and cross sections, refer to "Cross Sections and the sweep path" on page 131.

To create free form models whose shapes you want to animate:

1. Create all of the control points for the extrusion path.

   You cannot add or delete points during the animation, so you must create all you'll need at the outset.

2. Create all of the cross sections, with all of the control points.

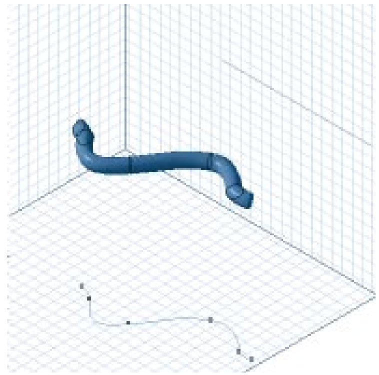
   Start with the most complex shape your object will have during the entire animation. You can pull the control points close together at first, and then pull them apart as the object changes shape.

To animate the free form shape:

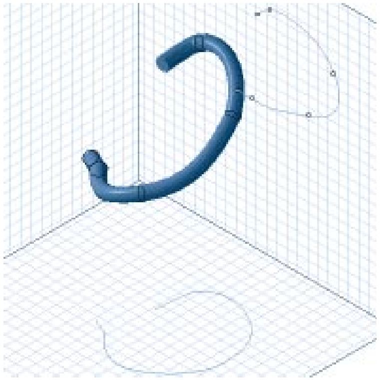
1. Set the current time bar to the point where you want the key event to occur.
2. Display the Hierarchy **Masters** tab.
3. In the **Masters** tab, double-click the name of the object whose shape you are animating.

   You may also select it, then choose **Edit menu▸ Jump In**.

4. In the **Free Form** modeler, adjust the points and curves of any cross section, extrusion path or envelope line.



To animate a free form object's shape, first create a an object in the Free Form modeler using cross sections and a sweep path...

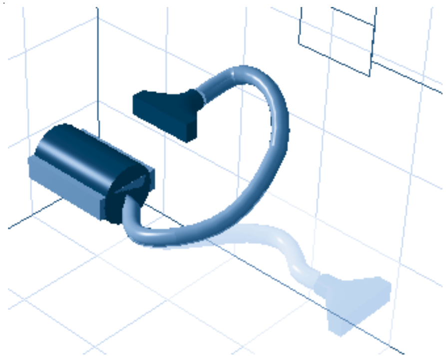


...then adjust the shapes in a different frame.

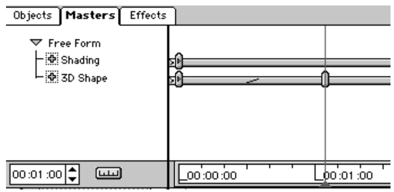
You may not add or delete points or add a cross section shape.

5. When you are finished changing the object shape, click **Done**. You may also choose **Edit menu▸ Jump Out**.

Ray Dream Studio adds a key event marker to the free form object's time track in the **Masters** tab of the hierarchy.



When you run the animation, Ray Dream Studio fills in the action between the two shapes to show the change of shape or movement.



A new key frame appears on the Master time track to indicate the change of shape.

You can now change the tweener between the two event marker s and set the transition method

Mesh Form Modeler

In Ray Dream Studio 5 you can change the shape of a mesh form object during animation using the **Mesh Form** modeler.

When you're using the **Mesh Form** modeler to animate, you're only animating movement and position. You cannot preform any operations on an object that will add, or remove vertices. Since commands like **Loft**, **Extrude** and **Sweep** all add vertices, you cannot use any of them during an animation.

For instructions on modeling with vertices and polymeshes, refer to "Creating Polymesh Objects" on page 151.

To create mesh form models whose shapes you want to animate:

1. Create all of the vertices for the object.

   You cannot add or delete vertices during the animation, so you must create all you'll need at the outset.

2. Shape the object into the desired form using any of the modelers features.

   Since you can adjust the position of vertices during the animation, the object you create at the onset doesn't have to be the final form. You can move vertices to deform the object over time.

To animate the mesh form shape:

1. Set the current time bar to the point where you want the key event to occur.

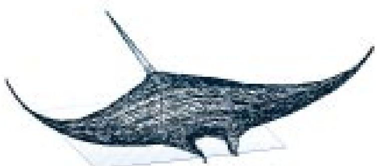
2. Click the **Masters** tab in the **Time Line** window.

3. In the **Masters** tab, double-click the name of the object whose shape you're animating.

   You can also select it, then choose **Edit menu▸ Jump In**.

4. In the **Mesh Form** modeler, adjust the position of the object's vertices.

To begin an animation, first create a an object in the Mesh Form modeler using vertices...

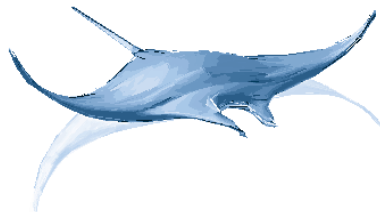


...then adjust the position on the vertices in a different frame.

   You may not add or delete vertices.

5. When you're finished changing the object shape, click **Done**. You can also choose **Edit menu▸ Jump Out**.

   Ray Dream Studio adds a key event marker to the mesh form object's time track in the **Masters** tab of the **Time Line** window.



When you run the animation, Ray Dream Studio adds key frames to simulate movement.

You can now change the tweener between the two event markers and set the transition method.

Particle and Volumetric Primitives

Fountain is a particle-based primitive. The volumetric primitives include Fire, Clouds, and Fog. Each of these primitives has its own modeling dialog, but the technique for animating them is the same.

Note: Animations of Fountain or the volumetric primitives won't be visible when previewing. You'll need to do a test render to see the results.

To animate the volumetric primitive shape:

1. Create the volumetric primitive and adjust its attributes at the start of the animation.

   The **Completion of ________** slider sets the current moment of the animation. In most cases, the slider should be at zero at the start of the animation.

The completion fountain sets the current movement of the primitive.

Note: Fog rises, Fire burns and the Fountain spews. The Cloud, however, is static. Therefore, the Cloud modeling dialog does not have a **Completion** slider.

For descriptions of the attributes for each environmental primitive, refer to "Creating Environmental Primitives" on page 99.

2. When you're finished setting the attributes, click **Done** to close the volume modeler.

3. Set the current time bar to the point where you want the key event to occur.

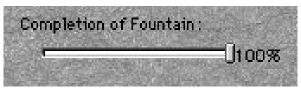
4. Display the hierarchy **Masters** tab.

5. In the **Masters** tab, double-click the name of the object.

   You may also select it, then choose **Edit menu▸ Jump In**.

6. In the **Attribute** dialog, adjust the **Completion of ________** slider to the percentage that describes how much of the object's animation should be accomplished at this point.

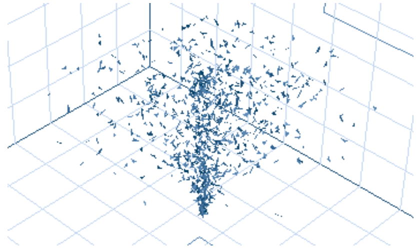
   Assuming that this is the end of the animation, set it to 100%.



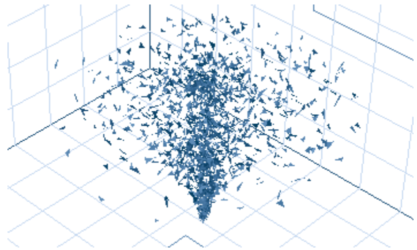
The completion fountain sets the current movement of the primitive.

7. You can adjust other attributes to change the characteristics of the object.

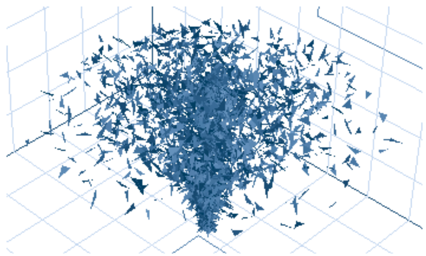
   For example, you might want the Fire to change the quantity of flames or its upward speed.



Fountain primitive with completion at 0%.



Fountain primitive with completion as 50%.



Fountain primitive with completion as 100%.

8. When you are finished changing the object shape, click **Done**. You may also choose **Edit menu▸ Jump Out**.

   Ray Dream Studio adds a key event marker to the free form object's time track in the **Masters** tab of the hierarchy.

You can now change the tweener between this event marker and the previous one to set the transition method. For example, to get flickering flames, you can use the Oscillate tweener.

Animating with Deformers

Deformers allow you to dynamically alter the shape of an object. Deformers like Stretch, Bend and Twist, Explode, Dissolve and Shatter produce interesting animated effects that cannot be achieved by other means.

Deformers are especially useful in animation because they can be used to animate the shape of entire groups, which cannot be edited directly in a modeler.

A group animated with Bend and Twist deformer.

Only one deformer can be applied to a single object or group. Since the deformer you apply becomes part of the object's property hierarchy (which remains fixed throughout the animation), it cannot be replaced with another deformer during the animation. These limitations prevent you from applying two or more Deformer (either simultaneously or sequentially) to the same object during an animation.

You can overcome this limitation by nesting objects hierarchically within groups and applying a deformer to each group as well as to the object itself. This allows you to apply multiple Deformer to the same object—either simultaneously or successively.

Bend and Twist, and Stretch Deformers applied to a text object.

To animate with a Deformer:

1. Apply the Deformer to the object. For instructions on applying a Deformer, refer to "Applying Deformers" on page 172.
2. Set the **Deformer** options you want in frame 1.

   For complete descriptions of the Deformers and their options, refer to Chapter 9, "Deformers.".

   Deformers that apply a dynamic effect, like **Explode** or **Dissolve**, have a **Completion** slider which sets the current moment of the animation. In most cases, the slider should be at zero at the start of the animation.
3. Set the current time bar to the point where you want the deformation to peak or finish.
4. Use the options in the **Properties palette: Deformer tab** to change the state of deformation at that point.
5. If the Deformer has a **Completion** slider, set it to the percentage that describes how much of the deformation should be accomplished at this point.

Note: Remember to apply your changes.

You can now change the tweener between this event marker and the previous one to set the transition method.

Animating Motion

Translate versus Rotate

Complex motion is generally animated by moving (translating) an object to various positions along the desired motion path and creating key events at each position.

The Bézier tweener can then be applied to smooth the motion. When animating along simple, curved paths, however, it is often easier to offset an object's ***hot point*** and animate its motion using rotation rather than translation.

An object always rotates around its hot point. By default, an object or group's hot point is at the center of its bounding box; however, you can move the hot point anywhere, even some distance from the object.

For example, you can point a camera at an object and move the camera's hot point to the center of the object. You could then rotate the camera around its own hot point to animate a "fly-around" of the object. This approach generally requires fewer key events than creating a similar motion path in the usual way, and produces equal or better results.

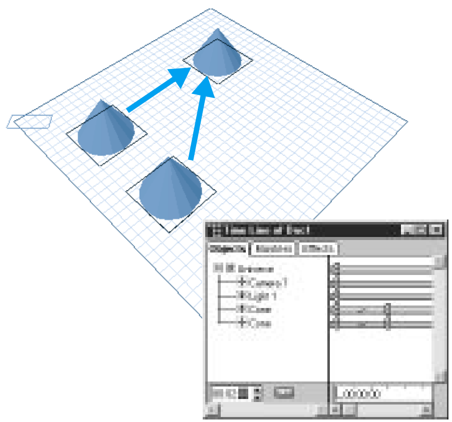
For instructions on working with hot points, refer to "The Hot Point" on page 233.

Duplicating Relative Motion with Groups

Duplicating an object or effect also duplicates its animation data (its key events and tweeners).

When key events are duplicated in this fashion, the values of the original object's properties are copied exactly to the duplicate. In the case of motion, this does not always produce the desired results.

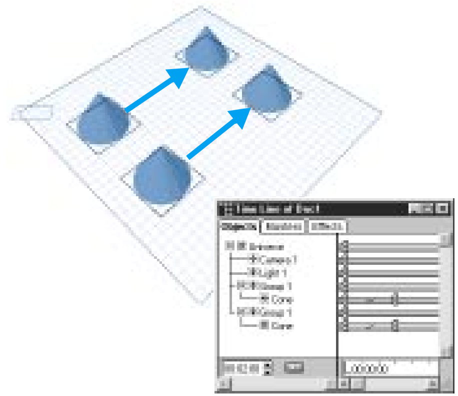
Suppose you have animated an object, and you decide you want to create a flock of identical objects, all moving in the same way. Figure 9-2 illustrates what happens when you duplicate your object and offset the duplicate from the original.



An animated object, duplicated and offset.

Since the numerical coordinates of the original object at the second key event were copied exactly to the duplicate object, the two objects end up in the same location.

This problem can be avoided by nesting the original object within a group before duplicating. When an object is animated within a group, its position is animated relative to the group, not relative to the global coordinate system. Therefore, when the group is duplicated and offset, the animated object in the duplicate group moves along its own motion path, within the group.



A group containing an animated object, duplicated and offset.

Cloaking an Object

When you want to have an object enter or exit (appear or disappear) during the course of your animation, you'll use a technique called *cloaking.*

Cloaked objects are visible and can be manipulated in the **Perspective** window; they simply are not included in the rendering of your animation.

You can take advantage of cloaking to switch one version of an object for another version of the same object. This is advantageous when the two versions have contradictory properties, which you need at different times of the animation. As long as the two objects look the same, occupy the same space, and cloak and uncloak in the same frame, the exchange from the one to the other will be seamless.

To cloak or uncloak an object at a specific point in time:

1. Select the object.
2. Display the **Properties palette: General tab**.
3. Enable or disable the **Cloak** checkbox.

Rotoscoping

Rotoscoping is a general term that describes using video selectively inside another movie. You can add live action or moving textures to your scene by rotoscoping with animations or digitized videos (movies) in your animation. Rotoscoping adds realism and visual excitement to your animations.

You can use any QuickTime (Macintosh) or Microsoft Video (AVI) file for rotoscoping. You can use movies in any of the following places:

- Texture map or paint shape on an object—including in non-color channels, like Bump.
- Background or backdrop.
- Light gel.

Using rotoscoping, you can create a scene where both the background and the objects move.

A movie is saved as a separate file. Its pathname is relative to the animation file it's used in. When you move a file with rotoscoping, be sure to maintain the relative path to the movie file.

Rotoscoping is visible on objects in Better Preview mode, but is not displayed on backgrounds, backdrops and in gels until you render the animation.

Synchronizing Movie Frames with the Animation and Looping

When you apply a movie, Ray Dream Studio creates two key events—one at the start and one at the end of the movie. You'll see the markers on the time track.

The ending event marker is placed according to the duration of the movie—not the number of frames it has. This means that the frame rate of the movie should be compatible with the rate of the animation.

It isn't necessary that the movie begin at frame 1. You can start at a later frame by synchronizing the movie to the animation.

To synchronize a movie with the animation:

1. Set the current time bar to the moment (frame) where you want to synchronize the animation.
2. Select the object or light that has the movie rotoscoped onto it. (This isn't necessary for a background or backdrop.)
3. Display the tab or window containing the rotoscope movie controls.
   - For a texture map, display the **Current Shader Editor**.
   - For a light, display the **Properties palette: Gel tab**.
   - For the background or backdrop, display the **Scene Settings window: Effects tab: Background** or Backdrop **controls**.
4. Use the preview controls to advance to the movie frame you want synchronized with the current frame of the animation.
5. Apply the change.

To loop a movie:

1. Apply the movie at the start of the animation.
2. Drag the end-of-movie key event marker out as far as you want the movie to continue.
3. Double-click the track between the two movie key event markers.
4. Choose the **Oscillate** tweener.
5. Select the **Saw/Loop Wave Shape**.
6. Set the **Up Phase** slider to 100%. This rewinds the movie instantly after each cycle.
7. Adjust the **Number of Oscillations** slider to set the number of times the movie should repeat.

   Each up slope in the graph represents one time playing the movie.
8. Close the **Transition Options** dialog.

For precise work, you'll want to calculate the correct number of oscillations based on the number of frames in the movie and the duration of the animation. You can adjust the end-of-movie marker, if necessary.

Animating Shaders

This section assumes that you have read the chapters on shading and that you have an understanding of the Current Shader Editor and its various components. For background information and step-by-step instructions on using the Current Shader Editor, refer to Chapter 10, "Shading Objects" and Chapter 11, "Creating Shaders."

Animating shaders opens a wide range of possibilities. You can animate virtually any type of change to a shader that you can imagine, from a simple color change to a shifting geometric pattern. You can even make an object appear to change from bricks to glass, or from marble to metal.

The only limitation is that you cannot replace one shader component with another during the course of an animation. You cannot, for example, replace a Wood function with a Spots function at a particular point along the time line. Thanks to the flexible, modular nature of the Shader Editor, this turns out to be only a minor limitation. "Animating Shaders with the Global Mix and Mix Components" on page 336.

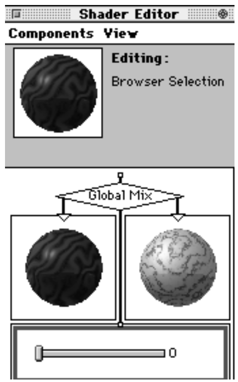
Animating simple changes to shaders is straightforward. You just use the Shader Editor to adjust the parameters of individual shader components at specific points along the time line. Examples of parameters you can adjust include:

- Colors
- Values for attributes like transparency, shininess, etc.
- Procedural function parameters, like the number of squares in a checker pattern, or the undulation of the veins in a wood pattern

Animating Shaders with the Global Mix and Mix Components

The **Global Mix** option in the **Shader Editor** allows you to animate more drastic changes to an object's shader. In the following example, a Global Mix is used to create a shader which animates gradually from wood to marble.

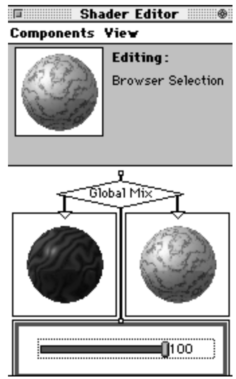
To build this animatable shader, a wood shader and a marble shader were first created separately and stored in the **Browser palette: Shaders tab**. A new shader was then created.



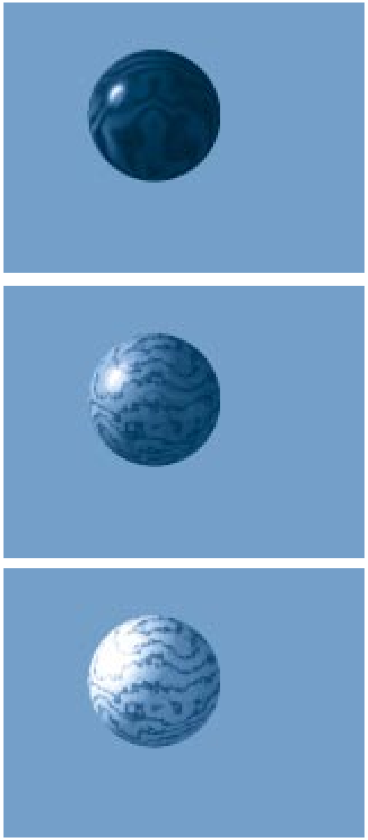
When the Global Mix is set to 0% the wood shader contributes 100% of the surface properties to the shader.

- The **Global Mix** option was chosen from the **Current Shader Editor: Insert menu**. A Global Mix mixes all shader channels at once, so the individual channel tabs disappear when **Global Mix** is selected.
- The original wood and marble shaders were dropped into the left and right branches of the tree, respectively.
- A Value component was placed in the lower branch, to be used as the mix function.

The value set in this Value component determines the contribution of each original shader to the mix. When the value is zero, the wood shader contributes 100%. When the value is 100, the marble shader contributes 100%. When the value is 50, the two shaders are mixed equally.



When the Global Mix is set 100% the marble shader contributes 100% of the surface properties.



Using the Global Mix you can adjust the values of two subshaders and have the texture of an object completely change over time.

To animate this shader, only the value component needs to be altered over time. To animate gradually from wood to glass, you would set the value to zero at one key event and to 100 at the next.

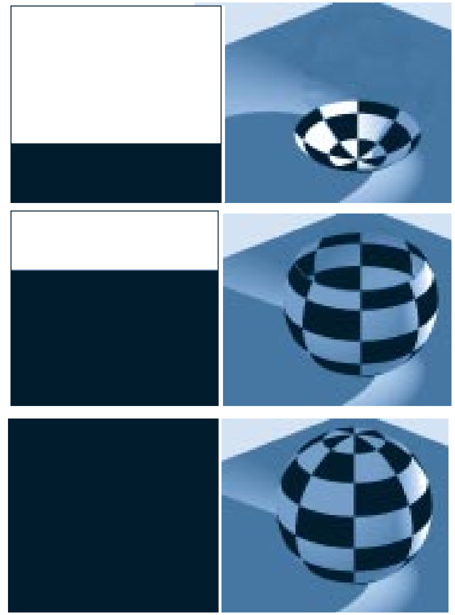
The same technique can be used to animate between different types of components within a single shader channel, except that you would use a Mix component instead of a Global Mix. This technique also allows you to animate a cross-fade between two bitmap images or movies. Just put the two bitmaps or movies in the left and right branches of the Mix.

Rotoscoping in Non-Color Shader Channels

The most common use of rotoscoping is in a shader's Color channel, where it allows a movie to be played on the surface of an object. However, rotoscoping can also be used in other shader channels to create stunning visual effects.

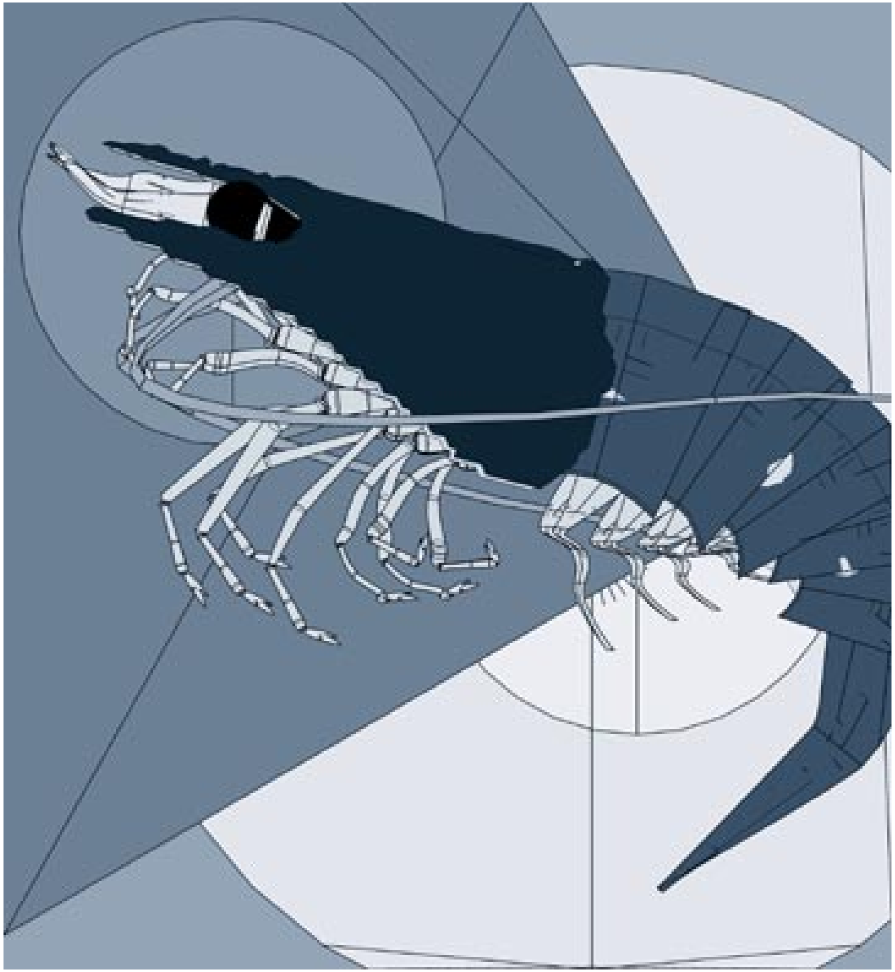
The example below illustrates the use of a movie in an object's Transparency channel.

The three animation frames in the right column show a sphere materializing from the floor up. This effect was achieved by playing an 8-bit grayscale movie in the sphere's Transparency channel.



An animation using rotoscoping in the Transparency channel.

The three corresponding frames from that movie are shown in the left column. The white region in each frame represents the portion of the sphere that is transparent. The black region represents the portion that is opaque.



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Rendering

About Rendering

Rendering is the process of capturing a view of your three-dimensional scene and saving it as a 2D image. An image has to be rendered before you can print it or open it in an image editing or page-layout program.

Ray Dream's rendering process can create photo-realistic images because it considers all of the objects in a scene simultaneously and calculates not just forms, color, and texture, but the interaction of lights and surfaces within the scene.

Since your scene exists in three dimensional space you can take any number of renderings of it—from different angles and even with different lighting conditions. If you created an object in a 2D drawing program and wanted to look at it from another side, you would have to redraw the object. In Ray Dream Studio 5, you simply move the camera to another view and re-render the scene.

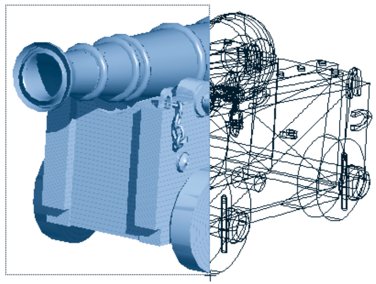
A rendering is a separate file and is stored on disk in a different format. Ray Dream Studio lets you save renderings in many popular image formats: PICT and EPS (Macintosh only), Windows Bitmap (BMP), TIFF, Adobe PhotoShop, and others. You can print your renderings, open them in an image-editing program, or place them into virtually any application.

The G-Buffer is a special feature of Ray Dream Studio 5 that allows you to include special information in data channels that are saved with the rendered image. These channels can be manipulated in an image editing program to create special effects.

The Rendering Procedure

When you've built a scene, set lights, and chosen a viewpoint, you are ready for rendering. You'll probably render your scene several times—the first couple of renderings will be low resolution proofs, so you can check your work.

You can also use the **Render Preview** tool to marquee an area of your scene and ray trace it directly in the **Perspective** window.



Use the Render Area tool to see how areas of object will appear rendered.

At each proof stage, you may want to change your Rendering Settings, depending on the image aspects you want to check. For example, if you just want to look at the objects, you might use the Draft Z-Buffer. Or if you're concerned only with shading and shadows, you might turn off the other ray-tracing options, like reflections and transparency, which add to rendering time.

Then, after correcting anything that didn't turn out as expected, you can generate the final, high resolution rendering.

An Overview

Before you produce a rendered image, you'll need to complete the following steps:

1. Arrange the objects in the scene. Refer to "Arranging Objects" on page 223 and "Building a Scene" on page 251 for additional information. Apply shaders to give the objects interesting surfaces. Refer to "Shading Objects" on page 181 for more on shading.

2. In the **Perspective** window, add lights to illuminate the scene. Refer to "Setting Lights" on page 271.

3. Set your rendering options using the tabs in **Scene Settings** window. Options include a choice of renderers, rendered image size, file format, and post-render filters for special effects. These features are described later in this chapter.

4. Display the production frame and adjust the position and settings of the camera to frame the view of the scene you want rendered. Refer to "Framing Your Scene" on page 361.

5. Adjust Ambient Light, Background, and Atmospheric settings. See "Ambient Light" on page 271 for setting ambient

light. See “Backgrounds and Backdrops” on page 345 for background and atmosphere.

Note: These options do not apply to the Natural Media renderer.

6. Once you have verified that all settings are correct, you can start the rendering with one of the **Render** commands.

Setting up to Render

Ray Dream Studio offers a number of options and settings for controlling rendering. To get the rendering results you want, you'll need to make several choices and adjustments.

Your choices will be based on your expectations—whether you're creating a draft rendering to check the objects, rendering final artwork, or rendering an animation.

Rendering Preferences for Individual Objects

Each object has two preferences that instruct the ray tracer (and Adaptive renderer) how to deal with it. These preferences concern reflection and refraction, and you'll only need to change them if you want the renderer to deal with a particular object differently.

To set an object's rendering preferences:

1. Select an object.
2. Display the **Properties palette: Rendering tab**.
3. Use the **Reflection Feature** pop-up to set whether or not this object is reflective—**No Reflections** or **Ray-traced Reflections**.
4. If this object does show reflections, set the **Reflection Feature controls: Maximum depth** value to limit the number of ray reflections.

   If two reflective surfaces face each other, the rays would bounce back and forth between them indefinitely. The Maximum depth value sets the number of bounces before the renderer stops.
5. Use the **Refraction Feature** pop-up to set whether or not this object is refractive—**No Refractions** or **Ray-traced Refractions**.
6. If this object does refract, set the **Refraction Feature controls: Maximum depth value** to limit the number of refractions.

   If multiple refractive objects align, the rays would bend from one to the next, through all objects. This would take an exceedingly long time to render and wouldn't contribute to image quality. The Maximum depth value sets the number of refractions before the renderer stops.

Render Preferences

You can select certain rendering options as defaults so they will be set in every new scene.

To set rendering default preferences:

1. Choose **File menu▸ Preferences**.
2. Choose **Render Features** from the main pop-up.
3. Use the pop-ups to choose default settings for **Shadows**, **Reflections** and **Transparency**.

Scene Settings

The **Scene Settings** window provides four tabs for controlling rendering: **Renderer**, **Effects**, **Filters** and **Output**.

After you have made all of your selections in this dialog, click **OK** to save these settings with your scene.

To display the Scene settings window:

Choose **Windows menu▸ Scene Settings** for *filename*. Where *filename* is the name of your scene.

The following sections describe the features of the **Renderer**, **Effects**, **Filters** and **Output** tabs.

Renderers

Ray Dream Studio offers four rendering engines to choose from: **Adaptive**, **Draft Z-Buffer**, **Ray Tracer** and **Natural Media**. Each has an advantage when you're looking for a particular result.

- The Draft Z-Buffer is an excellent choice for fast proofing. The quality it produces is similar to that of Better Preview mode in the **Perspective** window.
- The Ray Tracer calculates the effects of light rays from your light sources as they encounter the objects in your scene. Ray tracing shows most of the "real world" lighting effects, including transparency, shadow, reflection, and bump maps.
- The Adaptive renderer adapts the rendering method for different regions of the scene. It uses ray tracing where it's required for bump maps, reflections, shadows, etc. And it switches to an accelerated A-Buffer renderer for other regions. The Adaptive renderer produces anti-aliased edges on objects.
- The Natural-Media renderer, based on technology licensed from ThinkFish Productions Inc., produces interesting, stylistic renderings of the scene. In general, the renderings produced by the Natural Media renderer have a more hand-drawn style than typical 3D images.

To choose the renderer you want to use:

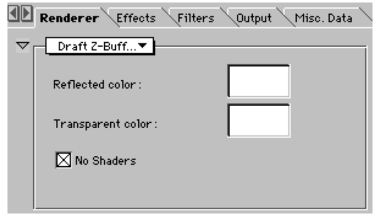
1. Display the **Scene Settings window: Renderer tab**.
2. Choose the renderer you want from the pop-up.

   The panel updates to show the options for this rendering engine.

To set Draft Z-Buffer options:

1. Click on the **Reflected color** chip to select the reflection color.

   The reflected color appears in all areas that would show reflections in ray tracing.



Use the Draft Z Buffer to create fast renderings of your scene.

2. Click on the **Transparent color** chip to select a transparency color.

   The Transparent color appears in all areas that would show transparency in ray tracing.

3. Enable the **No shaders** option if you want to see the objects without their applied shaders. A solid-colored approximation of the object is used instead, which greatly reduces rendering time.

To set Adaptive renderer options:

1. Enable the **Shadows** option to render shadows.
2. Enable the **Reflections** option to render reflections on reflective surfaces.

3. Enable the **Bump** option to render bump effects on objects.

4. Enable the **Transparency** option to render transparent objects.

5. Enable the **Refracted transparency** option to render refraction effects through transparent objects.

6. Enable the **Light through transparency** option to render lighting effects through transparent objects.

7. Click a radio button to choose the level of **Anti-aliasing** you want—**None**, **Edges** or **Better**. **Edges** anti-aliases the edges of objects only. **Better** anti-aliases the entire image.

8. Adjust the **Silhouette Quality** slider to set the accuracy for the edges of objects.

Note: Increasing **Silhouette Quality** increases RAM requirements.

9. Adjust the **Maximum Ray Depth** slider to set a limit on the number of interactions allowed for rays that reflect or refract.

Note: You can limit ray depth for individual objects. For details, refer to "Rendering Preferences for Individual Objects" on page 341.

To set Ray Tracer options:

1. Enable the **Shadows** option to render shadows.

2. Enable the **Reflections** option to render reflections on reflective surfaces.

3. Enable the **Bump** option to render bump effects on objects.

4. Enable the **Transparency** option to render transparent objects.

5. Enable the **Refracted transparency** option to render refraction effects through transparent objects.

Reflectiveness, transparency, refraction and bump are shader characteristics. You'll apply shaders to develop these effects on particular objects. refer to Appendix 10, "Shading Objects".

6. Enable the **Light through transparency** option to render lighting effects through transparent objects.

7. Click a radio button to choose the level of **Adaptive Oversampling** you want—**None**, **Fast** or **Better**.

   Adaptive oversampling renders at a higher resolution, then resamples the picture to produce a smoother, anti-aliased image.

8. Adjust the **Silhouette Quality** slider to set the accuracy for the edges of objects.

Note: Increasing **Silhouette Quality** increases rendering time and RAM requirements.

9. Adjust the **Maximum Ray Depth** slider to set a limit on the number of interactions allowed for rays that reflect or refract.

Note: You can limit ray depth for individual objects. For details, refer to "Rendering Preferences for Individual Objects" on page 341.

The Natural-Media Renderer

The Natural-Media renderer uses the LiveStyles technology from ThinkFish Productions Inc. Ray Dream includes several LiveStyles for you to choose from. You can find out more about LiveStyles and purchase additional LiveStyles from ThinkFish at http:\\www.thinkfish.com

To set Natural Media renderer options:

1. Use the pop-up to choose the rendering style you want.

2. Adjust the sliders and set your other options to control the effect.

3. When you've changed object position or geometry in the scene, click the **Update Geometry** button.

   Ray Dream Studio rebuilds the preview with the new scene data.

Miscellaneous Renderer Settings

The **Scene Settings window: Renderer tab: Miscellaneous** control has two advanced options.

- Enable the **Enable SMP** option if you have a multi-processor computer and you want to use multi-processing for rendering.

  If your computer has only one processor, this option is not available.

- Enable the **Enable Field Rendering** option if you are rendering an animation for video and you want to render the interlaced fields separately.

Note: If you use field rendering, you should choose 60 fps (NTSC) for the rendering frame rate.

Render Effects

Ray Dream Studio 5 provides some environment options to help complete the appearance of your scene in renderings. These options include **Ambient Light**, **Atmospheres**, **Backgrounds** and **Backdrops**.

For setting ambient light, refer to "Ambient Light" on page 271.

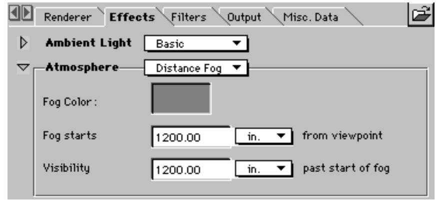
Atmosphere

Ray Dream Studio 5 offers two types of fog effects: **Distance Fog** and **Cloudy Fog**.

- **Distance Fog** produces an effect like a haze, which is more apparent across greater distances. This fog has uniform density.
- **Cloudy Fog** produces an effect that simulates the irregular "clumping" of clouds.

Atmospheric effects are only visible in the final rendered image.

To use the Distance Fog:

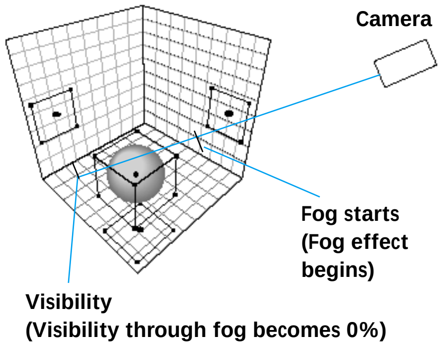


You can use the Distance Fog to add depth to your rendered scene.

1. Display the **Scene Settings** window. Choose **Windows menu▸ Scene Settings** for filename.
2. Display the **Scene Settings: Effects tab**.
3. Choose **Atmosphere pop-up: Distance Fog**.

   Ray Dream Studio displays the **Distance Fog** controls.
4. Click the **Fog Color** chip to set its color. Ray Dream Studio opens the system color picker so you can choose a color.
5. Enter the **Fog Starts** distance.

This is the distance from the camera where the fog begins.



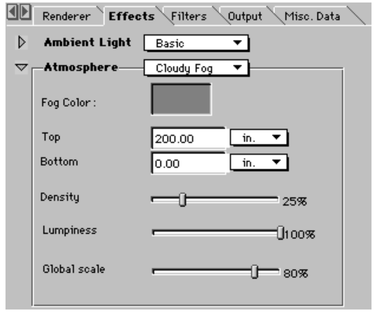
Distance fog range is set in relation to the position of the camera.

6 Enter the **visibility** distance.

This is the distance beyond the start of the fog where it becomes so thick that visibility becomes zero.

The results of these settings will be visible in the final rendering. You may return to these settings, make changes, and render again.

To use Cloudy Fog:



Use Cloudy Fog to create clumps of clouds in your scene.

1 Display the **Scene Settings** window. Choose **Windows menu▸ Scene Settings** for *filename*. Where *filename* is the name of your scene.

2 Display the **Scene Settings: Effects tab**.

3 Choose **Atmosphere pop-up: Cloudy Fog**.

4 Click the **Fog Color** chip to set its color. Ray Dream Studio opens the system color picker so you can choose a color.

5 Enter values for **Top** and **Bottom**.

These values define the vertical range (along the Z axis), where fog appears. When you're setting this option keep in mind that altitude Z=0 runs through the center of the **Working Box** when the **Working Box** is in its default position.

6 Set the **Density** slider.

Density determines fog thickness.

7 Set the **Lumpiness** slider.

Lumpiness determines how much the fog clumps together.

8 Set the **Global Scale** slider.

Global Scale determines the spacing between the wisps of fog.

The results of these settings will be visible in the final rendering or when you render an area with the Render Preview tool. You can return to these settings, make changes, and render again.

Backgrounds and Backdrops

When you render your scene, regions where there are no objects are considered background areas. By default, these areas appear white in the renderings. Ray Dream Studio offers two features for filling in the space between objects—background and backdrop.

Background

The background gives you control over the scene environment. The background is sometimes called an environment map.

During rendering, the background is projected on the inside surface of a giant sphere that surrounds your scene. Any region of a rendering not occupied by an object will show the background. The background is also the environment reflected by reflective objects.

Note: See the next section on the backdrop for another method of filling areas not occupied by objects.

You may choose the type of background you want: **Image**, **movie**, **color**, or **bi-gradient**. The background is only visible in your final image.

An isometric camera cannot record a Background. If you are using an isometric camera for your final rendering, you must use a Backdrop instead.

To use a Reflected Background:

1. Display the **Scene Settings** window. Choose **Windows menu ▸ Scene Settings** for *filename*. Where *filename* is the name of your scene.
2. Display the **Scene Settings: Effects tab**.
3. Choose the type of background you want from the **Background** pop-up.

None creates no background in the scene. The background areas appear white in the final rendered image.

Bi-gradient creates a paired gradation for the background. This is an easy way to create a sky and horizon. Bi-gradient controls are covered in "Bi-Gradient Controls" on page 347.

Map uses a bit-mapped image file as the background. This is the best choice when you want specific imagery in reflections. How to load an image as a map and map controls are covered in "Map Controls" on page 348.

Color sets a solid color as the background. Open the controls and click the color chip to choose a color.

Formula creates a color pattern from a formula. You can devise your own formula to create a new pattern. For more information on **Formula** controls, refer to "Formula Controls" on page 347.

Movie uses a sequence of images in the background. This option only makes sense when you are creating an animation. How to load a movie and movie controls are covered in "Movie Controls" on page 349.

Backdrop

The backdrop is a 2D image placed behind your scene. The backdrop appears in regions of the rendering where there are no objects.

The backdrop does not appear in reflections or interact with the lighting.

You might want to use both a backdrop and a background. In this case, Ray Dream Studio uses the background for the reflection environment and places the backdrop behind the objects.

To use a backdrop:

1. Display the **Scene Settings** window. Choose **Windows menu ▸ Scene Settings** for filename.
2. Display the **Scene Settings: Effects tab**.
3. Choose the type of backdrop you want from the **Backdrop** pop-up.

   None creates no backdrop in the scene.

   Bi-Gradient creates a paired gradation for the backdrop. **Bi-Gradient** controls are covered later in this chapter.

   Map uses a bit-mapped image file as the backdrop. This is the best choice when you want specific imagery behind your objects. How to load an image as a map and map controls are covered later in this chapter.

Color sets a solid color as the backdrop. Open the controls and click the color chip to choose a color.

Formula creates a color pattern from a formula. You can devise your own formula to create a new pattern. For more information on **Formula** controls, refer to "Formula Controls" on page 347.

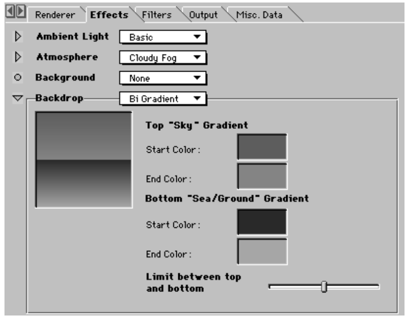
Movie uses a sequence of images in the Backdrop. This option only makes sense when you are creating an animation. How to load a movie and movie controls are covered later in this chapter.

Bi-Gradient Controls

To use a bi-gradient for the background or backdrop:

1. Choose **Bi-Gradient** from the pop-up where you want to use it—**Background** or **Backdrop**.

2. Click the **plus/arrow** icon to display the **Bi-Gradient** controls.



Use the Bi-Gradient controls to set up a simple two color backdrop.

3. Select colors for the **Top** ("Sky") and **Bottom** ("Sea/Ground") **Start** and **End** colors.

   Click the color chip and use the system color picker to select a color.

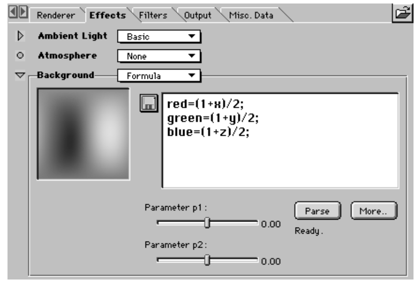
4. Adjust the **Limit between top and bottom** slider to control the height of the horizon.

Formula Controls

To select a formula for the background or backdrop:

1. Choose **Formula** from the pop-up where you want to use it—**Background** or **Backdrop**.

2. Click the **plus/arrow** icon to display the **Formula** controls.



The Formula controls let you create a backdrop mathematically.

3. If the current formula uses the **Parameter** sliders, you can adjust them to change the formula result.

4. To load a new formula, click the disk icon.

   Use the **Open** dialog to locate and open an appropriate formula. You can find sample formulas in the **Ray Dream Studio CD: Samples: Formulas** folder.

The formulas for a Background or Backdrop differ. Remember the Background is projected onto a sphere, so it uses a 3D system. The Backdrop is rectangular, so it uses a 2D system.

5. If you want to edit the formula or create your own, click **More** to open the **Formula Editor**.

   Ray Dream Studio uses the **Formula Editor** in several places. Use of the editor is common, but the type of formula you're creating determines the valid input and output variables. Refer to the *Using Formulas in Ray Dream Studio 5 PDF* for details on using the **Formula Editor**.

   Formula editing becomes technical quickly. You can learn a lot by loading the sample files.

6. When you're done with the **Formula Editor**, click **OK**.

7. To save a formula, press on the disk icon and choose **Save As** from the pop-up.

8. Use the **Save** dialog to name the file and select a disk location.

Map Controls

The tools and methods for using a map are the same for the background or backdrop.

Ideally, images for the background should have an aspect ratio of 2:1 (twice as wide as they are tall).

Images for the backdrop should have the same aspect ratio as the final rendering and be equal or greater in resolution. You can set the final rendering image size in the **Scene Settings window: Output tab: Image Size** control.

To select a map for the background or backdrop:

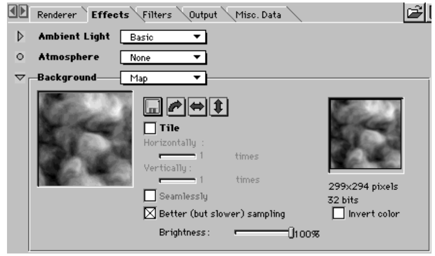
1. Choose **Map** from the pop-up where you want to use it—**Background** or **Backdrop**.

2. Click the **plus/arrow** icon to display the **Map** controls.

3. Click the disk icon. Ray Dream Studio displays the **Open** dialog.

4. Locate and open a bitmapped image file.

When you've opened an image, a preview appears in the left panel.



The Map controls let you use an imported image as backdrop.

5. You can click the directional buttons to change the image's orientation.

6. You can reduce the image's brightness with the **Brightness** slider.

7. Enable the **Better (but slower) sampling** option to get cleaner results in your rendering.

8. Enable the **Invert Color** option if you want to invert the image's colors.

9. If you want the image to repeat, enable the **Tile** option. The tiled image appears in the right preview.

10. Use the **Horizontally** and **Vertically** sliders to set the number of tiles in each direction.

11 Enable the **Seamlessly** option to tile the image without visible seams between tiles. Ray Dream flips adjacent tiles vertically and/or horizontally as necessary to avoid seams.

You can apply a filter to the map. For more information, refer to Chapter 18, “Post Production.”

Movie Controls

To select a movie for the background or backdrop:

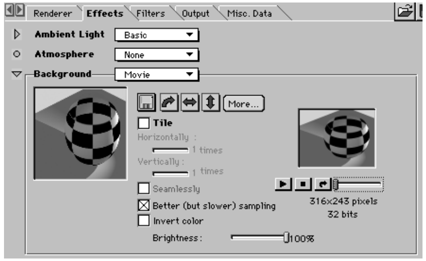
1 Choose **Movie** from the pop-up where you want to use it—**Background** or **Backdrop**.

2 Click the **plus/arrow** icon to display the **Movie** controls.

3 Click the disk icon. Ray Dream Studio displays the **Open** dialog.

4 Locate and open a movie file.

When you’ve opened a movie, a preview appears in the left panel, and a preview player appears in the right.



Use the Movie Controls to import a movie as a backdrop.

5 You can click the directional buttons to change the movie’s orientation.

6 You can reduce the image’s brightness with the **Brightness** slider.

7 Enable the **Better (but slower) sampling** option to get cleaner results in your rendering.

8 Enable the **Invert color** option if you want to invert the movie’s colors.

9 If you want the movie to be tiled, enable the **Tile** option. The tiled movie appears in the right preview.

10 Use the **Horizontally** and **Vertically** sliders to set the number of tiles in each direction.

11 Enable the **Seamlessly** option tile the image without visible seams between tiles. Ray Dream flips adjacent tiles vertically and/or horizontally as necessary to avoid seams.

12 You can get more information on this movie by clicking More.

Ray Dream Studio opens a window that provides technical information and a larger movie preview player.

Use the Movie Time Selection dialog to review additional information about your movie.

Render Filters

The render filters create special effects in the image after it has been rendered. Actually, they’re post-render filters.

The filters include lens effects that simulate the results obtained from photographic cameras and special lighting effects.

To apply a render filter:

1. Display the **Windows menu▸ Scene Settings window: Filters tab**.
2. Click the **Plus** button.

Ray Dream Studio displays a dialog with a list of the available post-render filters.

3. Select the filter you want to apply. Click **OK**.
4. In the **Filters tab**, set the options for the filter.

The options for each filter are described in the next section.

The Visible Light and Lens Effect filters can be enabled or disabled on a light-by-light basis. So you can turn the filters on/off for specific lights.

To apply a render filter on a light-by-light basis:

1. Display the **Windows menu▸ Properties palette: Miscellaneous tab**.
2. Click the **Plus** button.

Ray Dream Studio displays a dialog with a list of the available post-render filters.

3. Select either **VL LIght Control** or **PLP Light Control** and click **OK**.
   - Use **VL Light Control** enable/disable the Visible Light render filters: LIght Cone and Light Sphere.
   - Use **PLP Light Control** to enable/disable the Lens Effect render filters: Depth of Field, Lens Flare, CrossScreen, Glow, Nebula, Pulsator, Stars, VariCross.
4. In the **Miscellaneous tab**, use the popup to enable or disable the effect.

Note: Although you can enable/disable filters on a light-by-light basis, the settings you specify for the render filter are global for any given scene. All lights for which a given filter is enabled will use the same settings.

Animating Filters

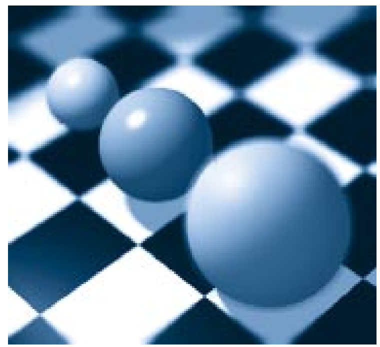
All of the filters have settings that you can change to create key events. The results of animating filters can be dramatic. For example, by animating the Depth of Field filter, you can have the camera focus on the foreground, then gradually move its focus to a background object over the course of the animation.

To do this, you need to set the Depth of Field focus (on the foreground) in the first frame, then move later in time and set the Depth of Field focus (on the background) to create a key event. You can change the tweener to modify the focus transition—have it accelerate, for example.

All of the effects can be animated in this way. Most of them have several settings you can animate.

Depth of Field

The Depth Of Field filter simulates the lens of a real life camera. The Depth Of Field filter post-process-es the rendered picture by blurring the objects according to their distance from the rendering camera.



Depth of Field filter simulates the type blur you'd see on objects that are not in focus.

Depth of Field is a post-render filter. It does not change the rendering camera itself.

Note: Normally, every object appears in focus regardless of its distance from the camera.

You can also select or design your own lens to change the depth of field range from macrophoto to telephoto.

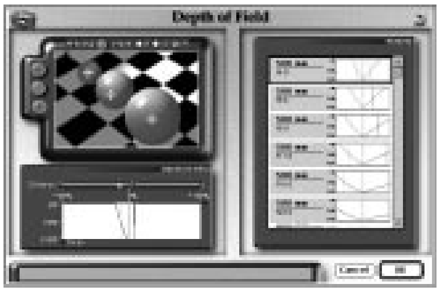
To set Depth of Field options:

1. Click one of the radio buttons to chose the preview quality:

   x1 high quality (slower)

   x2 normal quality

   x4 low quality (faster)



Use the Depth of Field controls to set the focus object and the range of the effect.

2. Click **Preview** to generate a preview of your scene.

   This takes a few moments.

3. Click the red cross button to select the tool for setting the plane of focus.

4. Click in the preview on the object that you want to be in focus.

   Ray Dream Studio puts a red cross on the point where you click and sets this distance as the plane of focus.

5. Set the range for the depth of field. You have three options to do this:

   - By using the blue and green crosses and clicking in the preview
   - By dragging sliders on the blue and green **Distance** sliders on the graph
   - By choosing a preset

To use the click tools:

1. Click the green cross button to select the tool for setting the foreground out-of-focus plane.

2. Click in the preview on the foreground object that you want to be 50% out-of-focus.

Note: You cannot select a foreground object that is behind the in-focus object.

   Ray Dream Studio puts a green cross on the point where you click, sets this distance as the plane of 50% out-of-focus, and updates the Depth Of Field curve.

3. Click the blue cross button to select the tool for setting the background out-of-focus plane.

4. Click in the preview on the background object that you want to be 50% out-of-focus.

Note: You cannot select a background object that is in front of the in-focus object.

   Ray Dream Studio puts a blue cross on the point where you click, and sets this distance as the plane of 50% out-of-focus, and updates the Depth Of Field curve.

To use the Distance sliders:

Note: You must set the plane of focus with the red cross when using the sliders.

1. Drag the blue slider on the **Distance** bar to set the distance of the 50% out-of-focus background plane.

   If you want background objects to stay in focus, move the blue slider all the way to the right.

2. Drag the green slider on the **Distance** bar to set the distance of the 50% out-of-focus foreground plane.

If you want foreground objects to stay in focus, move the green slider all the way to the left.

To use a Depth of Field preset:

You must set the plane of focus with the red cross when using a preset curve.

1. On the right side of the panel, click the graph describing the **Depth of Field** you want.

2. Use the scroll bar to view more choices.

Dots Per Inch (DPI) and Depth Of Field

In natural photography, depth of field is closely connected to film resolution and size. The smaller the film the more the out-of-focus objects are blurred. The Depth Of Field filter works the same way: if you increase the size of the rendered picture the depth of field effect will appear weaker. Keep this in mind when working with your small previews.

To give you control over the strength of the effect, the **Depth Of Field** filter uses the DPI settings as the film resolution. When increasing DPI the picture size and film resolution are increased, hence the depth of field effect remains the same.

Example:

1. Render a preview at 216 x 144 pixels and 72 dpi with the Depth of Field filter applied.

2. When you are satisfied with the preview, render your final image at full resolution (for example: 600 x 400). You have two options:

Option 1:
In the **Image Size** control of the **Scene Settings window: Output tab**, change the render size directly by typing 600 and 400.

The image is now 600 x 400 at 72 dpi. The Depth Of Field filter renders the image as if you have increased the size of your film and you get a weaker blur.

Option 2:
In the **Image Size** control of the **Scene Settings window: Output tab**, change the dpi to 200. The picture is also at 600 x 400, but this time at a resolution of 200 dpi.

The **Depth Of Field** filter renders the image as if you have increased the resolution of your film. The result is the same blur in your final image that you saw in the preview.

Note: To achieve realistic results use 72 dpi. For the opposite effect (to render very blurry images) increase the dpi while maintaining image size.

Note: You can get a stronger depth of field effect by increasing the dpi and decreasing the picture size by the same amount. For example, if you want an effect that is twice your current effect, halve the picture width and height and double the dpi.

Lens Flare

Lens flares are reflections of a strong light source on the various components of the lens. Flare color and size depend on the kind of glass and shape of each lens component.

Lens Flare simulates the reflections produced by a very strong light source.

The Lens Flare filter lets you add lens flares to one or more light source in your final rendered image, according to their respective positions, colors and intensities.

To get a lens flare effect, a light source must be visible to the rendering camera The light source must be within the production frame and not hidden behind or inside another object—even if it is a transparent object. A spot light must be aiming toward the rendering camera to produce a lens flare. (The camera must be within the light cone.)

To set Lens Flare options:

1. Apply the **Lens Flare** filter.

   See “To apply a render filter:” on page 350 for instructions on applying filters. The Lens Flare controls appear on the **Scene Settings window: Filters tab**.

2. You have two options for previewing the lens flare effect. To switch between preview modes, click the radio button for the mode you want.

   Display selected lens flare shows an arbitrary light source on a black background to create the lens flare.

   You can drag in the preview to change the relationship between the light source and lens. This doesn’t effect your final lens flare effect.

   Show preview uses a rendered preview of your scene. You must first generate a preview to use this option.

Note: If you’re rendering with a white background, you won’t see the result of the lens fare effect. Select a dark color for the background.

Use the Lens Flare Controls to set the light source attributes.

3. If you want to generate a preview of your scene, click one of the radio buttons to chose the preview quality: **x1** (high quality (slower)), **x2** (normal quality) or **x4** (low quality (faster)).

- Click the **Preview** button to generate a preview of your scene.

  This takes a few moments.

4. On the right side of the panel, click the image describing the lens flare you want.

5. Drag the **Intensity** slider to change lens flare strength.

The Lens Flare effect uses three parameters to render the effect: **Light source color**, **Light source intensity** and **Lens Flare intensity**.

To get brighter Lens Flares use brighter light sources. It also helps to lower the ambient light and use darker backdrops.

Glow

Glow simulates a photographic filter by adding a glow around every visible light source. The effect of the glow depends on the light’s position, color and intensity.

The light source must be visible from the camera to produce a glow. It must be within the production frame and not hidden behind or inside an object.

Glow created a visible glow around light sources.

To set Glow options:

1. Apply the **Glow** filter.

See “To apply a render filter:” on page 350 for instructions on applying filters. The Glow controls appear on the **Scene Settings window: Filters tab**.

2. Adjust the **Glow Size** slider to change the diameter of the glow.

3. Adjust the **Glow Intensity** slider to change the strength of the glow.

Nebula

The Nebula filter adds multicolored streaks around every visible light source.

The light source must be visible from the camera to produce a nebula effect. It must be within the production frame and not hidden behind or inside an object.

Use the Nebula filter to simulate the light streaks produced by a bright light pointed at the camera.

To set Nebula options:

1. Apply the **Nebula** filter.

   See “To apply a render filter:” on page 350 for instructions on applying filters. The **Nebula** controls appear on the **Scene Settings window: Filters tab**.

2. Drag the 1st radius to set the streak’s starting radius.

3. Drag the 2nd radius to set the streak’s ending radius.

4. Drag the **Angle** slider to rotate the streaks around the light source center.

5. Use the **Branch number** pop-up to choose the number of streaks.

6. Enable the **Thick** option to makes the streaks thicker.

7. Drag the **Intensity** slider to set the streak intensity.

Note: You’ll need to render on a dark background to see the effect.

Pulsator

Pulsator adds dotted streaks around every visible light source.

Use the Pulsator filter to simulate the dotted streaks of light produced by a flashing light.

The light source must be visible from the camera to produce a pulsator effect. It must be within the production frame and not hidden behind or inside an object.

To set Pulsator options:

1. Apply the **Pulsator** filter.

   See “To apply a render filter:” on page 350 for instructions on applying filters. The Pulsator controls appear on the **Scene Settings window: Filters tab**.

2. Drag the **Thickness** slider to set the streak thicker.

3. Drag the **Size** slider to set the streak radius.

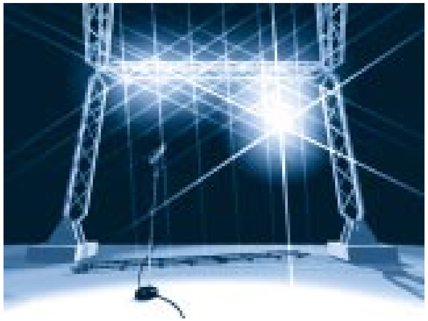
4. Drag the **Angle** slider to rotate the streaks around the light source center.

5. Drag the **Intensity** slider to set the streak intensity.

Note: You'll need to render on a dark background to see the effect.

Stars

Stars adds a star around every visible light source.



Use the star filter to add starry streaks around objects.

The light source must be visible from the camera to produce a stars effect. It must be within the production frame and not hidden behind or inside an object.

To set Stars options:

1. Apply the **Stars** filter.

   See "To apply a render filter:" on page 350 for instructions on applying filters. The Stars controls appear on the **Scene Settings window: Filters tab**.

2. Drag the **Thickness** slider to set the star thicker.

3. Drag the **Size** slider to set the star radius.

4. Drag the **Angle** slider to rotate the stars around the light source center.

5. Use the **Branch number** pop-up to choose the number of rays.

6. Enable the **Diffraction** option to split the stars into rainbow colors.

7. Drag the **Intensity** slider to set the star intensity.

Note: You'll need to render on a dark background to see the effect.

VariCross

The VariCross filter adds two streaks around every visible light source.

Use the VariCross filter to simulate the light streaks produced by distant bright lights.

The light source must be visible from the camera to produce a varicross effect. It must be within the production frame and not hidden behind or inside an object.

To set VariCross options:

1. Apply the **VariCross** filter.

   See "To apply a render filter:" on page 350 for instructions on applying filters. The VariCross controls appear on the **Scene Settings window: Filters tab**.

2. Drag the **Thickness** slider to set the streak thicker.

3. Drag the **Size** slider to set the streak radius.
4. Drag the **1st Angle** slider to rotate the first streak around the light source center.
5. Drag the **2nd Angle** slider to rotate the second streak around the light source center.
6. Enable the **Diffraction** option to split the streaks into rainbow colors.
7. Drag the **Intensity** slider to set the streak intensity.

Note: You'll need to render on a dark background to see the effect.

CrossScreen

The CrossScreen filter adds a glow and large branches to every visible light source.

Use the CrossScreen filter to simulate the light effect produced by stars.

The light source must be visible from the camera to produce an effect. It must be within the production frame and not hidden behind or inside an object.

To set CrossScreen options:

1. Apply the **CrossScreen** filter.

   See "To apply a render filter:" on page 350 for instructions on applying filters. The CrossScreen controls appear on the **Scene Settings window: Filters tab**.

2. Adjust the **Glow Size** slider to change the diameter of the glow.
3. Drag the **Star Size** slider to set the star radius.
4. Drag the **Angle** slider to rotate the stars around the light source center.
5. Drag the **Branch** number slider to set the number of rays.
6. Drag the **Intensity** slider to set the effect intensity.

3D Light Cone

The 3D Light Cone simulates the interaction between light from a Spot light and smoke, fog, and dust.

The 3D Light Cone effect post-processes the rendered picture to adding visible light beams from Spot lights. The visible light beams accurately describe the half angle of each Spot light in the scene.

Use the 3D Light Cone filter to produce visible cones of light in your scene.

Note: In the natural world, light rays are visible when the atmosphere contains small particles of dust or vapor which diffuse light.

About the Warnings

Some of the **3D Light Cone** options lead require more memory and extend rendering time.

The warning box at the bottom left of the panel tells you when the current settings demand a large amount of memory and require more rendering time.

The bottom right box indicates the amount of RAM required to render the scene with the current settings.

To set 3D Light Cone options:

1. Apply the **3D Light Cone** filter.

   See "To apply a render filter:" on page 350 for instructions on applying filters. The 3D Light Cone controls appear on the **Scene Settings window: Filters tab**.

2. To change the color of the fog, click on the color chip at the left of the Fog panel.

   Ray Dream Studio opens the system color picker so you can choose a color.

Note: The color of the visible light cone results from the interaction of the light's color and the fog color. Yellow light in a white fog produces a yellowish light cone. In a blue fog, yellow light produces a green cone.

3. Drag the **Intensity** slider to change the strength of the light cone effect. The range is from 25% to 200%.

4. Enter a value in the **Range** entry box to set the length of the light cones.

   The **Range** describes the number of inches before the light cone fades out.

5. Enable the **Use gel** option if you want to use any gel on the lights in the light cone effect.

   Use this option only if you've applied gels to your Spot lights.

6. Drag the **Gel Buffer Size** slider to set the quality of the gel effect in the light cone.

   Move the slider to the right to increase quality of the gel in the light cone.

   Caution: To render textured light rays, the filter pre-processes and stores buffers for each Spot light in your scene. High buffer values produce better results, but can be costly in rendering time and memory requirements. Don't try values higher than 200 unless you have a powerful computer and are working on high resolution pictures. Always start with a small value.

7. Enable the **Add Turbulence** option if you want swirls in the fog medium.

8. Drag the **Turbulence size** slider to set the mean size, in inches, of the wreath of smoke. This slider ranges from 0.01 inches to 489 inches.

9. Drag the **Turbulence lumpiness** slider to set the contrast level in the wreath of smoke.

10. Drag the **Turbulence sampling** slider to set the number of samples per pixel.

    The typical value is 10. Don't change this value unless you are working on high resolution pictures (over 1024 x 1024). High sampling values significantly slow down the rendering.

11. Enable the **Animated** option if you want the fog medium to move (change over time).

    This option slows down the rendering. Use it only when doing animations.

12. Enable the **3D Shadow** option if you want objects in the light cone to cast shadows in the fog.

13. Drag the **Shadow Buffer Size** slider to set the quality of the 3D shadow effect in the light cone.

Caution: 3D Shadows is a powerful but costly effect. The filter must pre-process and store buffers for each Spot light in your scene. High values can are costly in rendering time and memory requirements. Do not try values higher than 200 unless you have a powerful computer and you are working on high resolution pictures. Always start with a small value.

Note: You'll need to render on a dark background to see the visible light cones.

3D Light Sphere

The 3D Light Sphere simulates the interaction between light from a Bulb light and smoke, fog, and dust.

3D Light Sphere filter post-processes the rendered picture by adding a light sphere around each Bulb light.

Use the 3D light Sphere to add a ball of light in your scene.

About the Warnings

Some of the **3D Light Sphere** options lead require more memory and extend rendering time.

The warning box at the bottom left of the panel tells you when the current settings demand a large amount of memory and require more rendering time.

The bottom right box indicates the amount of RAM required to render the scene with the current settings.

To set 3D Light Sphere options:

1. Apply the **3D Light Sphere** filter.

   See "To apply a render filter:" on page 350 for instructions on applying filters. The 3D Light Sphere controls appear on the **Scene Settings window: Filters tab**.

2. To change the color of the fog, click on the color chip at the left of the Fog panel.

   Ray Dream Studio opens the system color picker so you can choose a color.

Note: The color of the visible light sphere results from the interaction of the light's color and the fog color. Yellow light in a white fog produces a yellowish light sphere. In a blue fog, yellow light produces a green sphere.

3. Drag the **Intensity** slider to change the strength of the light sphere effect. The range is from 25% to 200%.

4. Enter a value in the **Range** entry box to set the radius of the light sphere.

   The **Range** describes the number of inches before the light sphere fades out.

5. Enable the **Add Turbulence** option if you want swirls in the fog medium.

6. Drag the **Turbulence size** slider to set the mean size, in inches, of the wreath of smoke. This slider ranges from 0.01 inches to 489 inches.

7. Drag the **Turbulence lumpiness** slider to set the contrast level in the wreath of smoke.

8. Drag the **Turbulence sampling** slider to set the number of samples per pixel.

   The typical value is 10. Don't change this value unless you are working on high resolution pictures (over 1024 x 1024). High sampling values significantly slow down the rendering.

9. Enable the **Animated** option if you want the fog medium to move (change over time).

   This option slows down the rendering. Use it only when doing animations.

Aura

Aura let you render true glowing objects with an outside aura. The light emitted from the glowing objects can interact with fog or turbulent smoke.

Use the Aura filter to create glowing objects.

Aura automatically detects which objects have a glow shader, letting you create impressive effects like laser beams, neon signs and LEDs.

Aura uses the shader glow channel to know which object are glowing and which are not. Only objects that have some degree of luminance in the glow channel receive an aura.

To identify which objects should have an aura:

1. Select an object that should have an aura.
2. Display the **Current Shader Editor palette: Glow tab**.
3. Set the glow color.

   Higher luminance values result in a brighter glow and, therefore, a stronger aura.
4. Repeat steps 1 through 3 for each object that should have an aura.

To set Aura options:

1. To change the color of the aura, click on the color chip at the left of the Aura panel.

   Ray Dream Studio opens the system color picker so you can choose a color.

Note: The color of the final aura effect results from the interaction of the object's glow color and the aura color.

2. Enable the **Test Z** option if you want Ray Dream Studio to check the depth of the different objects in the scene before applying the aura effect.

   When Test Z is off, the Aura might produce an unexpected result when the aura object is partially obscured by a non-aura object.

   For example, you set up two spheres—one in the foreground without glow and the second with glow behind the first. With Test Z off, the Aura around the background sphere may cover a part of the foreground sphere. With Test Z on, the Aura filter knows which object is in front, and the foreground sphere will correctly obscure the background aura.
3. Drag the **Intensity** slider to change the strength of the aura effect.
4. Drag the **Range** slider to set the radius of the aura.

   The **Range** describes the number of inches before the aura fades out.
5. Enable the **Add Turbulence** option if you want swirls in the aura medium (smoke wreaths).
6. Drag the **Turbulence size** slider to set the mean size, in inches, of the wreath of smoke. This slider ranges from 0.01 inches to 489 inches.
7. Drag the **Turbulence lumpiness** slider to set the contrast level in the wreath of smoke.
8. Drag the **Turbulence sampling** slider to set the number of samples per pixel.

   Leave this value at the default unless you are working on high resolution pictures (over 1024 x 1024). High sampling values significantly slow down the rendering.
9. Enable the **Animated** option if you want the medium to move (change over time).

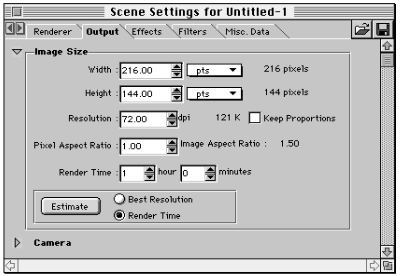
This option slows down the rendering. Use it only when doing animations.

Output

The **Scene Settings window: Output tab** provides a set of controls for the images the renderer creates.

Image Size Controls

The **Image Size** controls lets you describe the dimensions and resolution of the image to be rendered.



The image size controls let you specify the size and resolution of the final rendered image.

The resolution of a device, such as a monitor, printer, scanner, or image setter, is described as the number of pixels it can create for each inch of image area: pixels (or dots) per inch (ppi or dpi).

For example, the screen of an Apple color monitor has 72 dots per inch (dpi). Each dot is a pixel, so an image that is 72 x 72 pixels would be one inch square on the screen of that monitor. VGA monitors have slightly higher resolutions. Many color printers are capable of 300 dpi, and some image setters can produce more than 2500 dpi.

This discrepancy in device resolution creates a slight problem—pixels are different sizes on different devices, so an image displays or prints at a different size on devices of different resolution. For example, the 72 x 72 image that appears one inch square on the screen would be less than one-quarter inch when printed on a 300 dpi printer. (72 pixels drawn at 300 dots per inch: 72/300=0.24 inches.)

The solution is to set the rendering parameters according to the size of the image you want from a particular output device.

To set the image size and resolution:

1. In the **Width** and **Height** entry boxes of the **Rendering Settings** dialog, enter the dimensions you want for the picture.

   Set the size according to your final output. You can use the pop-ups to the right to choose the units.

2. In the **Resolution** entry box, enter the resolution (dots per inch) of the expected output device.

A six-inch square image at 600 dpi may occupy as much as 100 MB on disk! (The size varies depending on file format and image content.)

3. Enable the **Keep Proportions** option if you want to keep the same aspect ratio (ratio of width-to-height) when you change either the width or height.

To check how long this rendering will take:

1. Set image dimensions and resolution as described above.

2. Click **Estimate**.

   In a moment, the Render time display shows approximately how long rendering will take at the current settings.

To limit rendering time:

If time is more important than quality, you can give Ray Dream Studio a time limit and ask for the best rendering in that time frame. This would be a good choice, for example, if you wanted the rendering done by the time you got back from lunch.

1. In the **Render Time** entry boxes, enter the amount of time you want Ray Dream Studio to work on the rendering.
2. Click **Estimate**.

   In a moment, the Resolution (and number of pixels in each dimension) changes to the best resolution possible in the time allotted settings. You can now start the rendering to get this result.

Framing Your Scene

The image dimensions are closely related to the production frame, which specifies the area of the scene (as seen by the camera) that's rendered in the final artwork. You can think of the production frame as the camera's view finder.

After setting the image size in the Image Size panel of the **Render Settings** dialog, turn on the Production Frame display and check the framing of your scene.

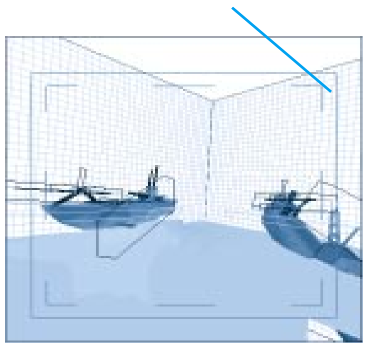
To display the Production Frame:

Choose **View menu▸ Production Frame**.

The production frame appears as a colored rectangle (green, by default) in the **Perspective** window.

The rectangle's dimensions are determined by the width and height settings in the Image Size panel.

The area of the scene the frame encloses represents the area of your rendering. You can think of the rectangle as "defining the print area" of your scene.



The Production Frame defines the area of the Perspective window will be used to produce the rendered image.

To move the Production Frame:

1. Choose the **Selection** tool.
2. Click on the outer rectangle to select it.

   You'll notice "handles" appear on each corner and side.
3. Move the cursor inside the frame and drag it where you want it.

Note: To change the viewpoint of your scene, you'll need to work with the camera. For information om moving the camera, refer to Chapter 14, "Setting Lights & Cameras."

To resize the Production Frame:

1. Choose the **Selection** tool.
2. Click on the outer rectangle to select it.

   You'll notice "handles" appear on each corner and side.
3. Drag a corner handle to resize in two dimensions. Hold down the **Shift** key while you drag to constrain proportions (maintain the aspect ratio).
4. Drag a side handle to resize in one dimension.

When you resize the production frame, Ray Dream Studio updates the height and width values in the **Scene Settings window: Image Size** controls. The resolution (dpi) stays the same.

Note: The camera position does not change when you move or adjust the Production Frame. What you are doing is cropping the camera's view.

The **Zoom** tool and the scroll bars change the display in the **Perspective** window—not the camera view. If you can't see all of the production frame, use the scroll bars and/or Zoom tool (to zoom out) until you do.

Camera

If you use one of the **Render** commands, by default you'll be rendering from the current camera.

To render from some other camera or if you are going to use the Batch Queue, you can identify which camera to use.

The Camera controls let you specify a camera to use for the rendering.

To select the camera to render from:

1. Display the **Scene Settings window: Output tab: Camera** controls.
2. Use the **Rendering Camera** pop-up to choose the camera you want to render from. The pop-up lists all cameras in your scene.
3. Save your scene.

Note: If you want to render one scene several times from different cameras, use the Batch Queue. This feature is described in "Using the Batch Queue" on page 368.

File Name

The **File Name** controls let you set the name and disk location for rendered files.

To set a file name for rendering this scene:

1. Display the **Scene Settings window: Output tab: File Name** controls.
2. Click the **In Named File** radio button.
3. Click **Set**.

   Ray Dream Studio displays a dialog that lets you enter a name for renderings from this scene and choose a disk location.
4. When you've finished with the dialog, click **Save**.

   Ray Dream Studio displays the disk location and name to the right of the **Set** button.

Use the file name controls to choose between a default file name and a specific name.

File Format

The **File Format** controls let you choose the type of file saved to disk and set options for it. The **File Format** controls also let you specify the frame range and rate for rendering animations.

To set file format options for rendering the current frame:

1. Display the **Scene Settings window: Output tab: File Format** controls.
2. If necessary, click the radio button for **Current Frame** (still image).

Movies have additional settings and considerations. See the next section For information on choosing movie file formats, refer to "Choosing Compression Settings" on page 363.

3. Choose the file format you want from the pop-up.

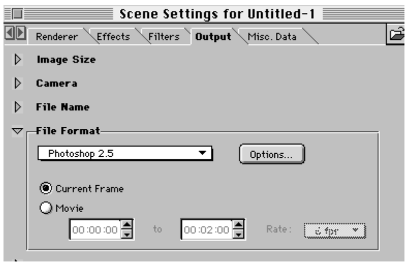
   Windows Bitmap, PICT (Macintosh), TIFF, EPSF (Macintosh), GIF, JPEG, Painter RIFF, Targa (Windows), Corel Photo Paint, and Adobe PhotoShop.

   You may have other formats added as PhotoShop compatible plug-ins.

4. Click **Options**.

   Ray Dream Studio displays a dialog that lets you set features for this file format.

5. When you're finished setting options, close the options dialog.



Use the File Format controls to select a specific format for the final rendered image.

To choose a movie file format:

1. Click the radio button for **Movie** (animation).

2. Choose the movie file format you want from the pop-up.

   Movie formats include QuickTime Movie (Macintosh), AVI Movie (Windows), and a variety of sequenced image formats.

   The "Movie" formats (QuickTime and AVI) generate a single file that includes all of the frames.

   The "sequenced" formats generate a single file for each frame. The files are numbered 000, 001, 002, and so forth, to keep them in sequence. Sequenced files are often used for transferring the animation to other programs, such as Adobe Premiere™

3. Set the start and end points of the render range. For more information on the render range, "The Render Range" on page 303.

4. Choose a frame rate from the **Rate** pop-up.

5. Click **Options**.

   Ray Dream Studio displays a dialog that lets you set features for this file format.

Choosing Compression Settings

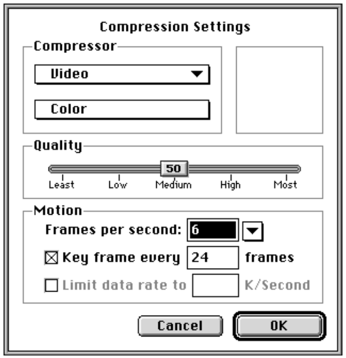
Rendering animation requires significant amount of hard disk space. If you have disk space limitations, you will want to compress the movie that you render. If you have plenty of disk space, you may want to render without compression. This way you won't invest rendering time only to find out that you used too much compression. You can then re-open the movie file in Ray Dream Studio and save it with compression.

The software compression and decompression algorithms (called codecs) that you can select in the **Compression Settings** dialog are provided with QuickTime (Macintosh) or AVI (Windows). Codecs compress data when you render an animation and decompress the data when you play the movie. Any Macintosh or Windows system with QuickTime or AVI software can play back a compressed movie.

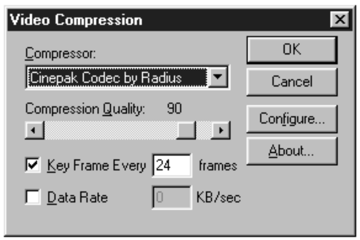
If you are using hardware for MPEG compression, see the instructions that accompanied your board for a description of available compression options.

To select a movie compression option:

1. Click **Options** n the Scene **Settings window: Output tab: File Format** controls. The **Compression Settings** dialog appears.



On Macintosh you can set compression options for Quicktime movies.



In Windows you set compression options for AVI movies.

2. Select one of the compressor options from the **Compressor** pop-up.

Note: Your actual compression may vary, depending on the version of QuickTime or Video for Windows you have installed. For additional information refer to your Apple or Microsoft documentation.

Macintosh Compression Options

- ***None***. This is a lossless form of compression with a 2 to 1 (or less) compression ratio. This codec converts an image's pixel depth from 32-bit to 24-bit image format with no loss in quality by combining the alpha channel byte. None is a good option for raw animation if you have plenty of hard disk space. You may want to use this as an intermediate step if you plan to edit your animation in Adobe Premiere because Premiere re-compresses the movie (you should avoid compressing twice). None is better for reachieving when the highest image quality is important.

- ***Animation***. This codec works best for 8-bit animation and computer-generated screen images (as opposed to videotape images). It's often used for 3D animation. The image quality (especially at higher quality settings) is acceptable for informal movies. With this codec, you can create movies up to full-screen at any color depth. The Animation codec saves the first image and then saves only changes from one frame to the next. It also cuts out the alpha channel, resulting in increased speed and smaller files.

- ***Cinepak***. This is a cross-platform codec for QuickTime and AVI movies that is best suited for video and CD-ROM playback. Movies take a long time to compress, but they decompress quickly at playback. Cinepak is best for 16- and 24-bit animations. Cinepak has better compression ratio, image quality, and faster playback than Apple's Video codec.

- ***Component Video***. This is best suited for the archival or interim storage of digitized video compression. At a compression ratio of 2 to 1, Component Video requires lots of disk space. Use this codec when image quality is more import than compression ratio or real-time playback.

- ***Graphic***. This is recommended for 8-bit still images. Useful for compressing pre-dithered animations in which decompression performance is not as important as the compression ratio.

- ***Photo-JPEG***. This is recommended for compression of still images with continuous tones such as photographs. It works too slowly for animation, and discards some data (it's a lossy compression method). Photo-JPEG is recommended for archiving 16- and 24-bit source clips. This codec saves the image in JPEG format, which results in high quality images with a high amount of compression.

Note: You may have other JPEG options available.

- ***Video***. Video is Apple's QuickTime video compressor. It is best for high-quality video clips that play in real time on faster Macintosh machines. Its only option is color. Video is appropriate for rotoscoping. This codec can play back regular animations, but the image quality not as high as when the Animator compressor is used.

AVI Compression Options

- ***Microsoft Video 1***. This codec compresses each frame of a clip (and is used for analog video (8 and 16-bit). Some data is discarded (the codec is lossy).
- ***Full Frames (Uncompressed).*** This option is best for capturing full frames of analog video. No compression is applied, so use of this codec requires lots of disk space.
- ***Cinepak Codec (Radius™).*** This is a cross-platform codec for QuickTime and AVI. Movies take a long time to compress, but decompress quickly at playback. Cinepak is optimized for 16- and 24-bit animations. Cinepak has a better compression ratio, image quality, and playback than the Microsoft Video 1 codec.
- ***Intel Indeo Video R3.2.*** This codec uses higher compression ratios, and results in better image quality and faster playback than Microsoft Video 1.
- ***Microsoft RLE***. Use this option for compressing animation and computer-synthesized 8-bit images.
- ***Intel Indeo Video Raw***. Use this compression method for capturing uncompressed video. You will obtain superior image quality because no compression is applied.

Compression tip: For optimal compression, use the right frame size: 160 x 120 for Apple Video compressor and 240 x 180 for Cinepak. When using Cinepak, frame dimensions need to be multiples of four for best performance.

To set compressor options for the QuickTime format:

1. Choose a color depth from the **Color** pop-up. The depths available depend on the selected codec.
2. Use the **Quality** slider to set the level of compression.

   The compression ratio is inversely proportional to image quality. The **Quality** slider allows you to set an optimum between the amount of compression and image quality.
3. For a codec that uses key framing, enter a **Key Frame rate**.

   The key frame is used in temporal compression methods. Each key frame is stored in its entirety. The next set of frames—up to the next key—are saved only as changes.
4. For a codec that supports the feature, you can use the **Limit Data Rate** option.

   This allows you to set a maximum size for any frame. QuickTime automatically adapts the compression quality to maintain this rate. This feature is available for only a few codecs.

G-Buffer

Ray Dream Studio 5 can calculate and save more than a dozen separate channels of geometric and lighting information in addition to your full color rendered image.

These additional channels appear as grayscale images, where the gray values represent information. The data in each of these channels describes the point in your 3D scene that each pixel in the image represents. For example, if the scene shows a drinking glass on a wooden table, each pixel in the rendered image corresponds to a point—on the glass or on the table—in your 3D scene.

Not all file formats are capable of storing all of the channels possible. Because Painter 5 RIFF and Adobe Photoshop 2.5 and higher support multiple channels, rendered images saved in these format can contain all G-Buffer channels.

There are many versions of the TIFF format. The TIFF format used in the Windows version of Ray Dream Studio 5 can also contain all G-Buffer channels.

To select G-Buffer channels:

1. Display the **Scene Settings window: Output tab: G-Buffer** controls.

2. Enable the checkbox or each feature you want.

   Do not enable channels that you don't need. Each channel adds to the file size considerably.

   Pixel color The pixel color is determined by shading and lighting effects. For example, looking through a drinking glass, you can see the wooden table behind. The color of a specific pixel in the glass appears as the color of the wood after it has filtered through the translucent glass. Pixel color occupies channels #1, #2 and #3 for red, green and blue.

   Mask A mask is a "shadow" image of your scene. It describes where objects are, versus where they are not. The mask is used as a selection of your image when you paste onto a background in an image-editing program. Pasting a foreground image onto a background is called compositing.

Refer to your image-editing application's documentation for instructions on selections, masks and compositing.

Ray Dream Studio 5 puts the mask data in channel #4, the Alpha channel, which is where masks are usually kept in applications like Painter and Adobe Photoshop.

Distance The distance channel describes the distance of each point from the camera, or viewpoint. Lighter pixels are closest to the camera, while dark colors represent areas of the rendering that are farthest from the camera. You can use the distance channel information in Painter 5 with the **Effects menu ▸ Focus menu▸ Depth of Field** effect to blur areas that are farther from the camera.

Object index The object index relates each pixel in the image to the object its corresponding point belongs to. With an object index loaded in Adobe Photoshop, you can easily select individual objects with the Magic Wand, regardless of color. This works as long as the objects do not overlap.

Normal vector The normal vector creates three channels describing the direction that each surface of the object faces. This information can be used after rendering to simulate additional light sources. For example, it's possible to add directional lighting or glows in Photoshop by loading the normal channel to select all the surfaces that face in a given direction, complete with information about how those facings fall off.

Position The position describes the coordinate of each point in the image. 3D position uses three channels, one for the x value, one for the y value, and one for z. An example of how you could use this information is to position low hanging clouds, making use of the Z, or height, channel.

Surface coordinate The surface coordinate describes the location of the point on the object in relation to the object's surface coordinate system. This is two-dimensional information which allows adding, replacing, or repositioning texture maps on 3D objects in an image editing program.

Preset Render Settings

Ray Dream Studio 5 allows you to save frequently used render settings. Your saved settings will appear as presets on the **Render** menu, where you can use them directly

To create a new render preset:

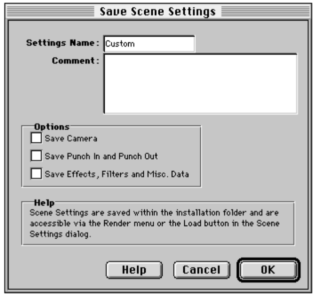
1. Set all rendering options to your liking. The presets include the controls in the **Scene Settings: Render tab** and **Output tab**.

2. Choose **Render menu▸ Save Current Settings**.

3. Ray Dream Studio displays a dialog that lets you name the preset, add a comment and set three other options.

4. Enable the **Save Camera** option if you wan to include the choice of rendering camera.

5. Enable **Save Punch In and Punch Out** if you want to include the rendering range.



You can save a specific set of render settings using the Save Render Settings dialog

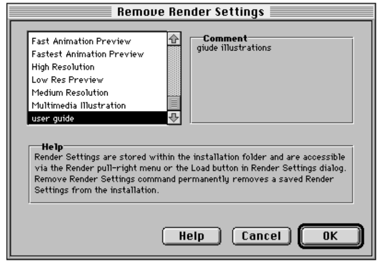
6. Enable **Save Effects, Filters, and Misc** data if you want these features to be included with the saved settings.

7. Click **OK** to close the dialog and create the preset on the **Render** menu.

To remove preset render settings:

1. Choose **Render menu▸ Remove Settings**.

   The **Remove Render Settings** dialog appears.



You can remove a saved settings from the list of settings by using the Remove Render Settings dialog

2. Select the render setting to be removed in the left window.

3. Click **OK**.

Starting a Rendering Job

When you have set your options and framed your scene, you can start a rendering.

To start rendering using the current settings:

Choose **Render menu▸ Using Current Settings**.

You may also use the key shortcut **Command-R/Ctrl+R**.

An **Image** window opens and rendering begins. The progress bar advances as rendering proceeds.

When you start a rendering, Ray Dream Studio displays a window showing the rendering's progress

To render with a preset:

Choose **Render menu▸ Preset Name**.

For example **Render menu▸ Fast Animation Preview** starts a draft movie rendering.

Rendering is computationally intensive, and depending on the render settings, jobs may take several hours to complete. Rendering can run in the background. You can go on working with Ray Dream Studio and even launch other applications—if memory permits.

Because rendering is time consuming, Ray Dream Studio provides a feature that helps you fit heavy rendering jobs into your schedule: the batch queue.

When using applications such as word processors or 2D drawing programs, the CPU is not using maximum capability and spends a lot of time idling. Ray Dream Studio 5 takes advantage of this by taking control of the CPU and performing its calculations in the background. The computational load between Ray Dream Studio's ray tracer and other programs has been set up so that you can type in your favorite word processor without perceptible slowdown.

Using the Batch Queue

Ray Dream Studio 5 allows you to batch several rendering jobs in a queue for deferred, unsupervised processing. By default, batched files are rendered using the render settings saved in the file. However, batch queue rendering parameters can be set to use specific settings for the entire batch or to use particular settings for each file in the batch queue.

During rendering, Ray Dream Studio 5 displays and processes all scenes one at a time. You can add to or remove files from the batch queue at any time.

To add files to the batch queue:

1. Set up each scene you wish to include in the batch:

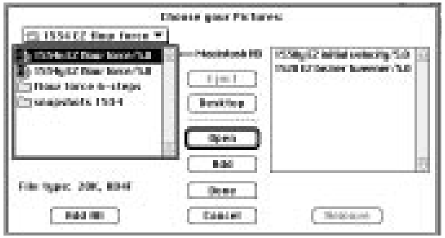
   - Remember to set the render settings, the production format, the framing, and the default camera.
   - Save and close these files.

2. Choose **Render menu▸ Batch Queue**.

3. Click **Add**.

   Ray Dream Studio displays a dialog so you can locate and add one or more scene files.

Readable files (scenes) in the current folder are on the left. Files you're adding appear on the right.



You can renderer a number of scenes at a later time using a Batch Queue.

4. Select a file, then click **Add**. You may also double-click a file to add it.

   To include all files in the current folder, click **Add All**.

   If you want to remove a file from the queue, select it and click **Delete**/**Backspace**.

5. Repeat step 4 until you've added all files you want in this batch.

6. Click **Close**/**Done**.

   At this point, you can launch the batch process or check and change the settings for any particular file.

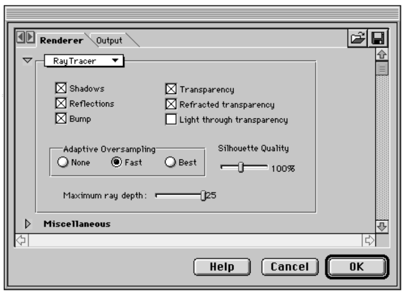
   If you think you'll want to use this same list of files in the batch queue at a later date, you can save the list. Click **Save List**. Ray Dream Studio displays a dialog so you can name the list and choose a disk location. Later, when you want these same files in the batch queue again, click **Load List**. Use the dialog to locate and open the saved batch queue list.

To change settings on a file in the queue:

1. In the **Batch Queue** list, select the file or set of files you wish to change.

2. Click **Settings**.

   The **Render Settings** dialog appears, where you can view and change the image size, file format and other options.



Use the Render Settings dialog to view the scene's rendering options.

- Page to the different tabs and change settings individually.
- Click **Load** to select one of the saved presets.
- Click **Save** to add the current settings to the presets. For more information, refer to "Preset Render Settings" on page 367.

Note: Changing the settings for a file in the batch queue only affects this batch process. The settings saved in the file itself are unchanged.

3. When you're finished with the **Render Settings** dialog, click **OK**.

To start the batch process:

To start batch processing, click **Launch**.

- While the batch is running, you can click **Abort** to stop it.
- Click **Pause** to temporarily halt the process. Click Resume to start the process again.
- Use the **Rendering Progress** and **Scene Statistics** items in the top panel to get information on the scene currently being rendered or on a scene you select in the lower panel. Use the **Information** pop-up to choose which.
- If you want to save the information, click **Save Text**. Use the dialog to name the file and choose a disk location.

To render a scene more than once from different cameras:

1. Choose **Render menu▸ Batch Queue**.
2. Click **Add** to add the scene to the Batch Queue.
3. Without exiting the Batch Queue dialog, click **Add** again. Keep clicking as many times as you need.

   A duplicate of your scene will appear in the Batch Queue list.
4. Click **Close/Done.**
5. In the Batch Queue dialog, select an instance of your scene in the list, then click **Settings**.

   The **Render Settings** dialog appears.
6. Click the **Output** tab.
7. Expand the **File Name** controls, and choose a new filename for your scene.

Note: If you don't choose a different name for when you render this scene, it will overwrite the original scene.

8. Expand the **Camera** controls, and choose a new render camera.

   Cameras aren't the only thing you can change. You can change any scene setting.
9. When your done adjusting the render settings click **Ok**.
10. Repeat steps 6-9 for each copy of the file in the list.
11. Click **Launch** to start the batch queue.

Speeding up Rendering

There are several techniques that you can use to reduce your rendering time. These techniques are especially useful when rendering animations that may have hundreds, or even thousands, of individual images to be rendered.

Use an image editing program to reduce your texture maps to 8-bit depth. Very few images actually use millions of colors, and many image editing programs discard insignificant information while maintaining the quality of the image. (Some textures even look good in 4-bit depth, or 16 colors.)

Reduce all texture maps to be used in non-color channels like the bump channel to 8-bit and grayscale before importing them. The color file wastes space and time while Ray Dream Studio converts it to gray.

If an object is distant from the camera, open it in the **Free Form** modeler and lower its surface fidelity to the minimum. This results in the minimum amount of RAM being used for its geometry.

When an object leaves the frame, and isn't reflected in any surface that you can see in the rendering, activate its Cloak property. This won't save memory, but it does save rendering time. Objects that pass behind solid objects can be cloaked to save time, too. Be careful that you do not lose a cast shadow where one is needed.

You can speed up rendering by applying these techniques:

- Use the **Draft Z-Buffer** to preview your object positions and movement.
- Work with smaller image (frame) sizes. The standard for CD-ROM-based QuickTime movies is half-screen size, or 320 by 240 pixels, although satisfying results can be achieved at 240 by 180. (You can then scale up to full-screen size for VHS output, although pixilation may be apparent when you scale up.)
- Limit the number of frames per second to 15, which is adequate for QuickTime movies. (Video uses 30 fps and film 24 fps.)
- Simplify objects and reduce the number of objects in the animation.
- Limit the number of lights.

- For the Ray Tracer or Adaptive renderer, disable the **Reflection**, **Transparency** and **Refraction** options.
- Keep objects near the background simple. (A complex bitmapped background does not affect rendering speed.)
- Limit the size of texture maps.
- Use 8-bit texture maps instead of 24 bit.
- Limit the number of reflective and transparent objects.
- Divide animations into smaller files and eliminate objects that won't be seen on-screen.
- Turn off anti-aliasing when previewing rendered animation.

Computer System Optimization

Ray Dream Studio 5's performance is affected by available RAM and disk space. You can never have a fast enough computer, enough RAM or disk space, a large enough monitor, or a fast enough computer. With that in mind, here are some things you can do to get the best performance out of your system.

If you have a scene that uses more RAM than you have, Ray Dream Studio uses its own virtual memory system to keep things running, spooling data back and forth to the hard disk. The greater the disparity between RAM needs and what is available, the more speed it costs you. If the scene ends up dipping into the operating system's virtual memory as well, performance can be very poor. In this case, adding RAM can improve speed, although this makes the computer run more efficiently, not any faster.

The fastest rendering takes place on a fast processor with plenty of RAM. Systems used in professional animation may 128 MB RAM or more.

Because all rendering involves some spooling to disk, you need a large hard disk with plenty of free space.

To keep your hard disk running efficiently, use disk utilities to scan for disk errors, and defragment your hard disk prior to starting a project or even a long rendering session.

Don't run other programs in the background. Some screen savers use as much CPU time as Ray Dream Studio 5.

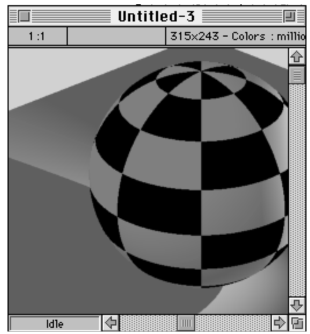
Viewing Rendered Images

When you render using **Render** menu commands, the image is displayed in a window when rendering is done. If you want to keep this rendering, you should save the file.

Renderings generated from the Batch Queue are automatically saved to disk. You can open these files in Ray Dream Studio 5 by double-clicking on the file icon. Or, you can open and view them in another graphics application.

The Ray Dream Studio 5 Image Window

When you open a rendered image, it's displayed in the window shown below.



When Ray Dream Studio is finished rendering, it displays the final image in the Image window

The program tries to load the image into RAM. If there is not enough available RAM, Ray Dream Studio spools the image from the scratch disk. For example, Ray Dream Studio 5's spooling enables you to display a 20MB image on your system with only 16MB of RAM. The penalty of spooling is slower access time. Each time you adjust the image, the computer must read/write to the disk.

The zoom ratio (scaling) appears in the top left. The ratio is "screen pixels-to-image pixels." When the ratio is 1:1, one screen dot represents one image pixel. When the ratio is 1:2, one screen dot represents two image pixels. The ratio changes as you zoom in or out with the **Zoom** tool.

The image resolution, color depth, and size of the image (in "K," for kilobytes, or "MB," for Megabytes) appear at the top.

Note: Images produced by Ray Dream Studio using **Render menu▸ Use Current Settings** and **Render menu▸ High Resolution** are rendered and stored on disk in 24-bit (millions of colors) format.

The Ray Dream Studio 5 Movie Window

When you open a rendered animation that's saved as a QuickTime or AVI movie, Ray Dream Studio displays it in the movie window, shown below.

When Ray Dream Studio is finished rendering an animation, it displays the final movie in the Movie window

The **Movie** window adds the duration and frame rate to the other statistics at the top of the window.

- Click **Play** to play the movie. During play, click **Pause** to stop.
- Click **Frame Forward** or **Frame Back** to step through one frame at a time.
- Click **Loop** to enable looping. Then click Play.
- Drag the slider to "scrub" through the movie.

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Post Production

Overview

Rendering produces a 2D, bitmapped image of your scene. Anything you do with that image is considered post production. Post production might include compositing, filtering, cropping, and retouching the image in an image-editing application.

Rendering an animation produces a movie—either a single file that contains all frames (QuickTime or AVI) or a sequence of files. Post production on a movie might include any of the still-image operations, like compositing and filtering. It might also include more advanced work, like editing clips together and adding sound effects.

Post-Production Applications

Ray Dream Studio 5 is a 3D illustration and animation tool. It does not provide comprehensive post-production features. You may use an image editing or paint application such as Fractal Design Painter®, Micrografx Picture Publisher®, Corel Photo-Paint®, or Adobe Photoshop for the best in post-production results. In some cases, you might want to use your imaging application to adjust colors or contrast, apply an effect or image filter, or paint directly onto the image.

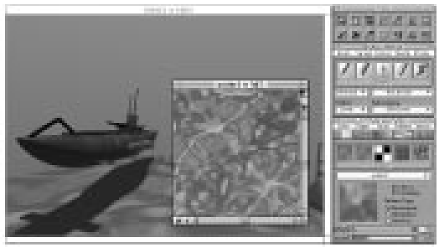
Ray Dream Studio saves renderings in file formats that are compatible with virtually any pre-press or layout application.

Compositing

Compositing is the process of pasting one image onto another. For example, if you built a sub in Ray Dream Studio 5, you could paste it onto a scanned photo of an ocean. If you're careful, the sub can appear as though it was under the ocean when the original photograph was taken.

Usually, the foreground image (what you paste) is not a rectangle, but an irregularly shaped selection of the rendered objects. This selection should be created from an auto-generated mask. (The mask is created when you request a rendering.) This ensures precise outlines on the objects you paste.

In Ray Dream Studio you can create the basic objects in your scene and then use another application to add a different background or other effects.



In an image editing application, like Painter, you can use the mask created by the rendering process to add a background to your illustration.

This final underwater scene was created by compositing a the objects created in Ray Dream Studio with an ocean texture us Fractal Design Painter.

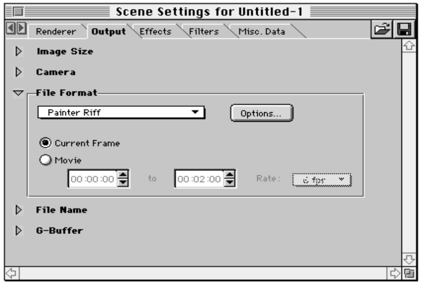
Note: You can set the background color or imagery in the **Scene Settings window: Effects tab: Background** or **Backdrop** controls.

Objects in photographs have their own perspective. If the modeled object you composite does not match the perspective of the background, it will seem unnatural and out of place. After rendering, you can't change the perspective of the objects you create. Before rendering, however, it's easy.

You want to set the perspective and the direction of lighting to match the background image before rendering.

To set up a scene to render with a mask:

1. When you're ready to render your scene, display the **Scene Settings window: Output tab: File Format** controls.



Use the file format controls to select a format that supports multiple channels.

2. Make sure the selected file format supports saving multiple channels.

   Painter (RIF), Adobe Photoshop, and TIFF are good choices.

3. Display the **Scene Settings window: Output tab: G-Buffer** controls.

4. Enable the **Mask** checkbox.

5. For best results, render with **Adaptive Oversampling/Antialiasing**.

- Display the **Scene Settings window: Renderer tab**.
- For the **Ray Tracer** renderer, enable **Adaptive Oversampling** option at **Fast** or **Best** quality.
- For the **Adaptive** renderer, enable the **Antialiasing** option with **Edges** or **Best** setting.

To composite using Fractal Design Painter:

This procedure uses Painter as the post-production application. The steps in Adobe Photoshop would be nearly identical.

1. Render the scene—either directly or through the Batch Queue.

2. If you rendered directly, save the image to a convenient location. Verify the file format before saving.

3. Open the rendered image in Fractal Design Painter (or another image-editing application).

   The mask generated during the rendering appears in the **Mask List** palette.

4. Choose **Select menu▸ Load Selection**.

5. In the dialog, make sure the mask is selected in the pop-up. Click **OK**.

   Painter selects the objects of your rendering.

6. Choose **Edit menu▸ Copy**.

   You're now done with this file.

7. Open the background image. (The image you are pasting onto.)

8. Choose **Edit menu▸ Paste**.

   The pasted selection comes into the image as an image floater.

9. Drag the floater where you want it.

Refer to the documentation that came with your image-editing application for additional information about working with masks and channels.

Filtering Images

You may have image filters for Adobe Photoshop, either from Adobe Systems or from a third-party. You may use these filters directly from Ray Dream Studio 5.

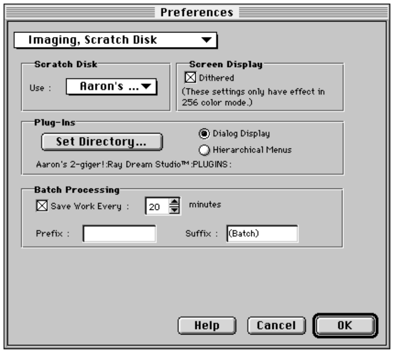
Most plug-in filters are compatible with Ray Dream Studio 5; however, filters that specifically require Adobe Photoshop are not.

To use filters you must first identify the folder containing your plug-in modules (filters). If you plan to share plug-ins between applications, make sure you move all your plug-ins into a single folder so that Ray Dream Studio 5 can find all of them.

To identify the folder containing your plug-in modules (filters):

1. Choose **File menu▸ Preferences**.

2. Choose **Imaging, Scratch Disk** from the pop-up.



Use the plug-in controls to locate and load plug-in filters.

3. Click **Set Directory**.

4. Use the dialog to locate and select the folder containing the plug-in modules.

If you add additional filters to your plug-in folder, you will need to re-identify the folder before you can use the filters.

When you have identified the plug-ins for Ray Dream Studio 5, you can use them on an image in the **Image** window, in the **Shader Editor** on texture maps, in render effects or on backgrounds and backdrops.

To use filters on the background or backdrop (before rendering):

1. Display the **Scene Settings window: Effects tab: Background** or **Backdrop** controls.

2. Pop-up the disk icon and choose **Filter** from the menu.

   Ray Dream Studio displays the list of available filters appears.

3. Select one of the filters.

To use a filter in the Shader Editor:

1. Display the Current Shader Editor.

2. Select the channel containing the texture map you want to filter.

3. Pop-up the disk icon and choose **Filter** from the menu.

   Ray Dream Studio displays the list of available filters appears.

4. Select one of the filters.

Advanced Filter Techniques

You can use the G-Buffer data as a control medium for certain types of image filters and effects.

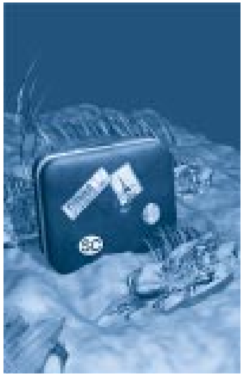
For example, the Distance G-Buffer data might be useful for developing an image that fades or blurs in the distance.

With a little imagination, you'll discover other interesting ways to use G-Buffer data in an image-editing application, like Painter or Adobe Photoshop.

In Painter, G-Buffer data appears in the mask channels. Many effects let you choose from these masks on the **Using** pop-up.

When you render an image, you can generate Distance G-Buffer data which can then be used in Painter to make your image appear to fade.

In Painter, the Distance G-Buffer data appears as a mask.



You can adjust the brightness, contrast of the mask to create depth in a flat image.

In some cases, you'll want to load the mask as a selection to control an effect.

Some G-Buffer data may be difficult to use from a mask, and you'll want to move it onto the Canvas image layer.

To convert a mask channel to an image in Painter:

1. Remove the rendered RGB image.
2. You can choose **Select menu▸ Select All** then **Edit menu▸ Cut**. (If you prefer, you can float the image, then hide the floater.)

   The canvas should be white.
3. In the **Mask List**, select the mask for the G-Buffer channel you want to use.
4. Click **Load Selection**.

   You can replace the current selection.

   You should have marching ants roughly describing the G-Buffer data. The marching ants follow a line, but the selection data is 8-bit.
5. Set the current color to black and fill the selection.

   This gives you a grayscale image derived from the G-Buffer data.

Animation Post Production

For some post-production work on animations, you'll want to use Fractal Design Painter. Painter opens either movie files or sequenced files, so you may render your Ray Dream Studio animation to either format. For the best quality, use uncompressed, sequenced files.

- You can use Painter to composite animations with background stills, video or other animations. To do this, you'll want to make sure to include a mask when you render the animation.
- You can apply image effects to an animation and add special effects with floaters.
- You can paint directly onto an animation using any of Painter's fabulous brushes.

- You can use cloning to convert the imagery to a Natural-Media style—watercolors, for example.

You'll find detailed instructions for these and other techniques in your Fractal Design Painter User Guide.

You might want to use Adobe After Effects for some animation post-production tasks. You'll need a movie-editing application, like Adobe Premiere, to edit animation clips together and synchronize sound effects.

Printing Images

You can print your rendered images directly from Ray Dream Studio 5. If you require color separations, you'll have to work with your image in a pre-press application.

To print an image from Ray Dream Studio 5:

With the **Image** window active, choose **File menu▸ Print**.

Ray Dream Studio displays the standard **Print** dialog. Refer to your system documentation for more information.

A

Using Ray Dream Studio with other Applications

Introduction to the Work Flow

In many cases, you'll use files from other programs when you develop your Ray Dream Studio scene. These files may be images used in shaders or a backdrop. They might also be models created in another program.

And when you finish your scene, you'll generate some kind of output—a rendering or animation that you'll do post production on; or maybe you'll export 3D data for use in another program.

This chapter discusses importing and exporting 2D artwork and 3D models. It suggest methods of working with other applications that will help you get the most out of Ray Dream Studio.

Working with 2D Programs

Importing Shapes from a 2D Art Program

You can import line art for cross sections, extrusion paths, and envelopes into the **Free Form** modeler.

Ray Dream Studio can import the following formats:

- **Macintosh** Adobe Illustrator 1, 88, 3, 5, 5.5.
- **Windows** Adobe Illustrator 1, 88, 3, 4; Corel DRAW 3, 4; WMF; and CGM.

You can use any program that exports artwork in Adobe Illustrator format. Fractal Design Expression and Fractal Design Painter both export in this format, and you may have other applications that support it.

After you've created the artwork and exported it in Adobe Illustrator format, you can import the file into Ray Dream Studio.

For instructions on importing paths, refer to "Importing Shapes" on page 124.

Importing Images

Ray Dream Studio can open image files in a wide range of popular formats. Additionally, Ray Dream Studio supports Adobe Photoshop-compatible plug-ins for importing, filtering, and exporting image files.

For example, with an appropriate plug-in, you could scan an image directly onto an object as a texture map.

To import image files using an Adobe Photoshop-compatible acquire plug-in:

1. Place the **Acquire Plug-ins** in your plug-ins folder and identify the plug-ins folder to Ray Dream Studio. For instructions, refer to "Filtering Images" on page 375.
2. Display the map controls where you will be using the image—**Scene Settings: Effects tab: Background/Backdrop**, **Current Shader Editor**, (Light) **Properties: Gel tab**.
3. Pop-up the disk icon and choose **Import** from the menu.
4. Select your Acquire plug-in and use it to import the image.

Note: You might prefer to scan images into your image-editing program, where you can take advantage of cropping and retouching tools.

Exporting Images

Ray Dream Studio saves rendered images in a variety of popular formats. In addition, by using Adobe Photoshop-compatible export plug-ins, you could output rendered images with an export plug-in.

To export image files using an Adobe Photoshop-compatible export plug-in:

1. Place the **Export Plug-ins** in your plug-ins folder and identify the plug-ins folder to Ray Dream Studio. Refer to "Using Plug-Ins with Ray Dream Studio" on page 23.
2. Make sure that the **Image** window containing the image that you wish to export is active.
3. Choose **File menu▸ Export**.
4. Select the **Export Plug-in** from the list.

Working with Painter

Fractal Design Painter is a full featured painting and image-editing application.

You can use Painter for developing texture maps, gels, backgrounds, backdrops and other features that use 2D bitmap images or movies.

- You can also use **Painter's Shapes** tools to design cross sections, extrusion paths, and envelopes for the Free Form modeler. Choose **File menu▸ Export▸ Adobe**

Illustrator File to create a file you can import into Ray Dream Studio for its Bézier curves.

- You can use Painter for post-production work, like image effects, retouching, or compositing a rendered scene with other material—either a single frame or in a movie.

Painter's native file format is RIFF. Ray Dream Studio supports this format, so you'll have no trouble moving images between programs. You may also use any of the other formats supported by both programs.

Painter can open either a sequenced file set (numbered frames) or movie file animation. If you are going to use Painter to do post production on an animation, you should use sequenced files, not a (compressed) movie format. You'll want to retain as much image quality as possible. Painter converts the animation to a frame stack.

When you export the animation (Save As) from Painter, you can choose either a movie file format or numbered frames.

G-Buffer Channels

Fractal Design Painter and Adobe Photoshop both support multiple channels of data. Using Ray Dream Studio's G-Buffer, you can include alpha channels and other channels of geometric or distance information with your rendered image. You can then use this data when working in your 2D program.

For more information, refer to "G-Buffer" on page 365.

Working with 3D Programs

Importing Objects

Ray Dream Studio can open Detailer native format, 3DMF, DXF and files created in previous versions of Ray Dream Studio or Designer.

To import an object/model file:

1. Choose **File menu▸ Import**. Ray Dream Studio displays an **Open** dialog which you can use to select the file.

2. If you want to narrow the list to a certain format, use the pop-up to switch from **All Readable Files** to the format you want to search for.

3. When you have located the file, click **Open**. Ray Dream Studio displays the options dialog, which depends on the file type. The options are described below.

4. After setting your options, click **OK**.

   Ray Dream Studio adds the object or model to the scene.

Detailer Files

Fractal Design Detailer's native file format is proprietary to Detailer. You'll use this format only when working with Detailer.

3DMF Files

3DMF is a 3D file format, developed by Apple, and supported by many applications. 3DMF includes UV coordinates (from most applications), so you can use Parametric mapping on the objects.

Note: Texture maps are not imported.

To set 3DMF options:

The 3DMF Options dialog can be used to set options when youimport a 3DMF object.

1. Set the scaling units and conversion factor.

Appropriate values will depend on the object and application that created it. Use trial and error to determine a good setting.

2. Enable **Ungroup as much as possible** to reduce the levels of grouping.

   This is a good idea if you want to shade or animate individual pieces of the model separately.

DXF Files

DXF is a public export text file format used by Autodesk and other CAD vendors. Because it is widely supported by animation, 3D modeling and rendering, and CAD programs, DXF may be used for importing and exporting objects between Ray Dream Studio and other applications.

When it was first created, DXF was only a 2D format. Later, it was improved to include 3D information. As a result, a DXF file can now simultaneously contain both 2D and 3D data. DXF is pure geometry. It carries no shading, lights or cameras.

It's important to realize that a perspective drawing is still a flat 2D drawing. In other words, an object drawn in perspective does not contain any 3D data. As such, the object cannot be observed from a different perspective without being redrawn from scratch. On the other hand, 3D models can be viewed from any direction.

Ray Dream Studio can import both 2D and 3D DXF data. However, since Ray Dream deals exclusively with 3D data, 2D DXF data is automatically extruded to generate 3D objects.

AutoCAD® and several other CAD software applications use layering to separate groups of objects. Unfortunately, layering is the only way for DXF to support separate groups of objects. Imagine a glass and a bottle grouped in the same layer. When writing the DXF file, AutoCAD and other CAD products will simply combine the 3D facets of both objects into one unit of information. In other words, once the file is saved, there is no way to tell the difference between the facets belonging to the glass and the facets belonging to the bottle. This is because the DXF file format does not support the higher level notion of an "object."

To work around this, models and scenes created in DXF-compatible packages should, whenever possible, be designed with separate objects in separate layers. Facets in separate layers are assumed to belong to different objects.

Since this may not always be the case, another feature is provided: 3D facets with different colors are assumed to belong to different objects. Objects in the same layer but made of different colors will be imported as separate objects.

DXF importing creates a rather flat hierarchy. Objects found in a single layer are grouped.

To set DXF options:

The DXF Options dialog can be used toset options whne you import DXF onjects.

1. Enable the **Import and extrude 2D objects** option to extrude 2D DXF files.

   This is useful to automatically build the "walls" of a floor map done in ClarisCAD™, Vellum™ or AutoCAD, and exported as a DXF file.

- Set an extrusion value. The units are based on the system that was used in the original file.

2 Enable the **Smooth Surfaces** option to have smooth shading on surfaces.

- Set a minimum smoothing angle. For example, with a 30 degree smooth angle, the surface at the junction of any two facets with less than 30 degrees of difference will be smoothed.

3 Enable the **Group all 3DFACE in a single object** option to group all imported 3D faces (3DFACE is a 3D face with 4 vertices) in one single object.

This is useful when importing 3D type, a logo or a CAD object that benefits from being treated as a single object.

4 Enable the **Separate 3DFACE by Layers and Color** option if objects need to be separated by layers and colors.

When this option is selected, 3D faces that are in the same layer and of the same color will be treated as a single object.

Import only 3DFACE entities Enable this option to exclude other information, like lines or 2D layout drawings.

Coordinate System to use Any AutoCAD coordinate system stored in the DXF file imported can be used.

If you are not familiar with AutoCAD and/ or do not want to worry about this option, leave the WORLD system selected. WORLD stands for the WCS (World Coordinate System), and CURRENT for the UCS (User Coordinate System) used when the DXF file was saved.

Not all CAD software uses both UCS and WCS. Many use only WCS. If this is the case, simply leave the WORLD coordinate system selected.

5 Use the Scaling Conversion Factor to relate the scale of the original DXF drawing to a real value.

Select the appropriate units, then enter a value in the **1 DXF unit equals____** field.

If your DXF files do not import correctly into Ray Dream Studio, verify that the DXF file contains only 3D faces, meshes, or extruded poly-lines. DXF files containing points, lines, and arcs are not supported by Ray Dream Studio. Check the documentation of the software application that created the DXF object for information about saving DXF files so that they do not contain lines, arcs, or points.

Occasionally when importing a DXF file, you will see many objects in Ray Dream Studio. If that happens, go back to the original program and select the appropriate options to save the data as 3DFace entities.

Shading Imported Objects

Parametric mapping is the standard method of mapping shaders and paint shapes onto objects created in Ray Dream Studio. Parametric mapping requires precise information on an object's structure. For this reason, parametric mapping is sometimes not available for objects imported from other applications. DXF objects do not support parametric mapping.

If parametric mapping isn't available, you can shade the imported object using one of three projection mapping modes: **Box/ Face**, **Spherical** or **Cylindrical**.

For information on selecting a projection mapping mode, refer to "Mapping Modes" on page 193.

Exporting 3D Files

To export the scene:

1. Open the scene you want to export.
2. Choose **File menu▸ Save As**. The **Save As** dialog appears.
3. In the dialog, use the menu to select the export file format.
4. Click **Options** and set options for the exported data. The options are described below.
5. When you're done with the **Options** dialog, click **OK** to close it.
6. Enter a file name, select the destination, and click **Save**.

To export objects:

1. Select the object or group you want to export.
2. Choose **File menu▸ Export**. The **Export** dialog appears.
3. Use the pop-up to select the export file format.
4. Click **Options** to set options specific to this format. The options are described below.
5. Enter a file name, select the destination, and click **Save**.

Detailer Format Options

The Detailer format is exclusively for working with Fractal Design Detailer. Refer to Appendix B in your Detailer Users Guide for complete information.

DXF Options

DXF has no options.

When exporting in DXF mode, each object is put in a separate layer, and the facets are stored as 3DFACE entities.

3DMF Options

3DMF is part of Apple's QuickDraw 3D Metafile format. Support of this format allows better exchange of objects between applications and platforms.

1. Enable Force Béziers to Polygons if you want to use polygons to approximate Bézier curves.
2. Click a radio button to select the degree of tessellation you want.

   The High setting creates the most polygons, which produces more 3D detail.
3. Enable Export UV Colormap if you want to export a surface map of the object's shading color.
4. Use the Colormap UV resolution fields to set the map's resolution (pixels) in each dimension.

Note: When writing 3DMF files, objects are written as primitives whenever possible.

Virtual Reality Modeling Language (VRML)

VRML is the language used to create 3D spaces on the World Wide Web. When you visit a site created with VRML, you have the ability to interact with that site in 3D.

Ray Dream Studio's allows you to design your own 3D web site and then export it directly to the VRML format.

Objects and other entities in VRML are referred to as "nodes." The VRML format features several types of nodes.

Ray Dream Studio's VRML export filter supports the following nodes:

Shape Nodes

- Cone (primitive)
- Cube (primitive)
- Cylinder (primitive)
- Sphere (primitive)
- **Indexed Face Sets** is used for Free Form objects, Mesh Form objects, Text objects, the Icosahedra primitive, and any primitive objects that have been deformed

With this node, you have some control over polygon count to specify the smoothness of surfaces.

- **Coordinate3** is used in conjunction with Indexed Face Set node to store geometrical information.

Shaders & Textures

- **Texture 2** represents the effects of shaders.
- **TextureCoordinate2** controls the way that textures are used to approximate procedural shaders.

Cameras & Lights

- **LOD** represents an object with a precision that depends upon the distance to the camera. This is important in order to maintain browser speeds in complex online worlds.
- **Orthographic Camera** represents an isometric camera.
- **Perspective Camera** represents a conical camera.
- **Point Light** represents bulb lights.
- **Spot Light** represents spot lights.
- **Directional Light** represents distant lights.

Miscellaneous

- **Separator** groups other nodes into a single entity.
- **WWWAnchor** links the VRML scene to another scene.
- **WWWInline** includes a VRML object that exists elsewhere on the World Wide Web.

To set URL properties:

1. Select an object.
2. Display the **Properties palette: URL tab**.
3. Type in a URL.
4. Select either **Anchor** or **Inline**.

- If an object is an anchor, then it can be a link to another URL, an HTML function, an animation, etc.
- If your object is defined as an inline object, it links back to another VRML file where the object itself is stored.

  Essentially, an inline VRML object is a place holder creating a link back to a different file. With this arrangement, you can update an object in a Virtual World without rebuilding an entire page—you simply replace the inline object.

Note: VRML does not support all features available in Ray Dream Studio. Therefore, some information may be discarded when you export in VRML.

Note: Some VRML browsers do not support all features of VRML.

To set VRML export options:

1. Use the **Maximum resolution** field to set the maximum dimension of texture maps.

Note: If a size or distance threshold (see below) is specified, the texture maps for some objects may be at a lower resolution.

2. Enable the **External** option if you want the texture maps saved as separate files. If the checkbox is not set, the image data is stored within the VRML file.

   On Windows, external texture map files will be named Image###.jpg, where ### is a decimal number starting at 000.

   On other systems the files are named BaseIm###.jpg, where Base is the name of the VRML file.

   If a file of that name exists, it will be replaced, so it is a good idea to save a VRML file to its own folder.

3. If you are saving texture maps externally, enter the URL prefix appropriate to locating the files.

   This information will be necessary for the VRML to locate (and load) the images.

4. Click a radio button to select the degree of tessellation you want for non-primitives.

   The High setting creates the most polygons, which produces more 3D detail. The size and distance thresholds (see below) also effect the degree of tessellation.

   VRML supports **Cones**, **Cubes**, **Cylinders** and **Spheres** as primitive objects. All other shapes are created by a collection of polygonal facets.

5. Set a **Size threshold** if you want smaller objects to use a smaller texture map or a lower degree of tessellation.

   Any objects smaller than the threshold will be represented by a coarser approximation. The coarseness is determined by the ratio of the object's size to the threshold value. For example, if the threshold is 12 inches, an object 6 inches across is likely to be represented at half the normal resolution. However, the relationship is not exact.

6. Set a **Distance threshold** if you want objects farther from the camera to have a lower resolution.

   Objects within the threshold have full resolution. Objects beyond the threshold have reduced resolution.

   Set the **Levels of detail** to describe the number of reduced resolution levels beyond the Distance threshold.

   The ranges are centered on the object, and each range is double the distance of the inner range.

   For example, if the distance threshold is 12 inches and there are four levels of detail, the four ranges are as follows:

   Range 1 0 to 12 inches (full resolution)

   Range 2 12 to 24 inches (reduced resolution)

   Range 3 24 to 48 inches (resolution reduced further)

   Range 4 48 inches and beyond (resolution reduced even further)

Note: If a VRML browser is capable of using Levels of Detail, the overall performance is likely to be better.

7. Enable the **Tessellate** option for any of the primitives you want better control of for texture mapping. See below for details.

   If the checkboxes **Cones**, **Cylinders**, **Cubes** or **Spheres** are enabled, the object is exported as a set of tessellated facets, rather than as a primitive.

8. Enable the **Remove white space** option if you want the VRML file stripped of extraneous spaces.

   Removing the spaces lowers the file size slightly.

Note: Spaces are used in the VRML file to show the hierarchical structure. This makes the file easier to read and edit in a text editor.

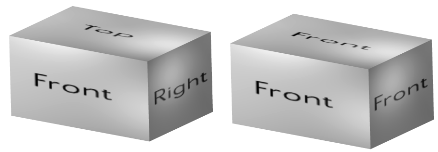
9. When you're finished setting **VRML** options, click **OK**.

About Texture Mapping in VRML

Cube

VRML 2.0 specifies that a texture map is applied individually to each face of a cube.

Ray Dream Studio applies the texture that is assigned to the 'Front' face of a Ray Dream Studio cube to each of the faces of a VRML cube.

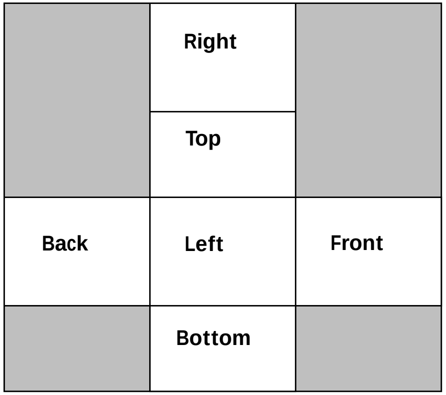


in Ray Dream **in VRML**

Parametric mapping in Ray Dream Studio(left) and what happens in VRML (right).

Only the portion of the image denoted by "Front" is used (on each face) by the VRML mapping on a cube primitive.

You can override this by enabling the **Tessellate: Cubes** option (step 7).



The image layout for parametric mapping on a cube in Ray Dream.

Cylinder

VRML 2.0 specifies that the image texture is wrapped around the curved sides of the cylinder. The texture applied to the ends of the cylinder is taken from the same image that is applied to the curved sides of the cylinder.

This is different from what Ray Dream Studio normally does. Ray Dream Studio applies the central portion of the image to the curved sides of the cylinder and uses the upper portion of the image on to the top and the lower portion on the bottom of the cylinder.

The VRML exporter ensures that the Ray Dream texture mapping on the sides of the cylinder matches that of the VRML object. However the texture of the top and bottom faces will be different.

You can override this by enabling the **Tessellate: Cylinders** option (step 7).

Cone

VRML 2.0 specifies that the image texture is wrapped around the curved sides of the cone. The texture applied to the bottom of the cone is taken from the same image that is applied to the curved sides of the cone.

This is different from what Ray Dream Studio normally does. Ray Dream Studio applies the upper portion of the image to the curved sides of the cone and uses the lower portion of the image on the bottom.

The VRML exporter ensures that the Ray Dream Studio texture mapping on the sides of the cone matches that of the VRML object. However the texture of the bottom face will be different.

You can override this by enabling the **Tessellate: Cones** option (step 7).

Sphere

Ray Dream Studio's parametric texture mapping can be directly converted to VRML 2.0.

Using Ray Dream Studio with Detailer

Fractal Design Detailer is a graphics product dedicated to developing surface maps on your objects. Detailer offers unparalleled art tools and features that will help you create extraordinary maps for color, bump, highlight, reflection and glow.

Ray Dream Studio supports the Detailer file formats, so you can take your Ray Dream Studio objects into Detailer and bring your Detailer surface maps into Ray Dream Studio.

For specific instructions on using Ray Dream Studio and Detailer together, see Appendix A of the Detailer User Guide.

Ray Dream Studio now supports the RIFF file format, used by both Painter and Detailer. (The Detailer 1.0 User Guide says that Ray Dream Studio 4.1 doesn't.)

Using Ray Dream Studio with Poser

Exporting Poser Figures for Ray Dream Studio

You can export a Poser figure in 3DMF format, then import this file into Ray Dream Studio.

When you export the figure, Poser gives you the option of exporting groups for each body part.

- If you want to keep the pose, don't enable this option. In this case, you'll be able to use one texture map to cover the entire figure.
- If you want to work with each body part separately, enable this option.

  You'll need to move each part's hot point to the joint and establish links and limits to get any sense of articulation. To do this on the entire figure would be tedious, and the results would not match what you get in Poser.

Importing a Poser Figure

In the 3DMF import options dialog, set 1 3DMF unit to equal 8 feet. This should give a reasonable size to the imported figure. You can, of course, scale the object after it's imported.

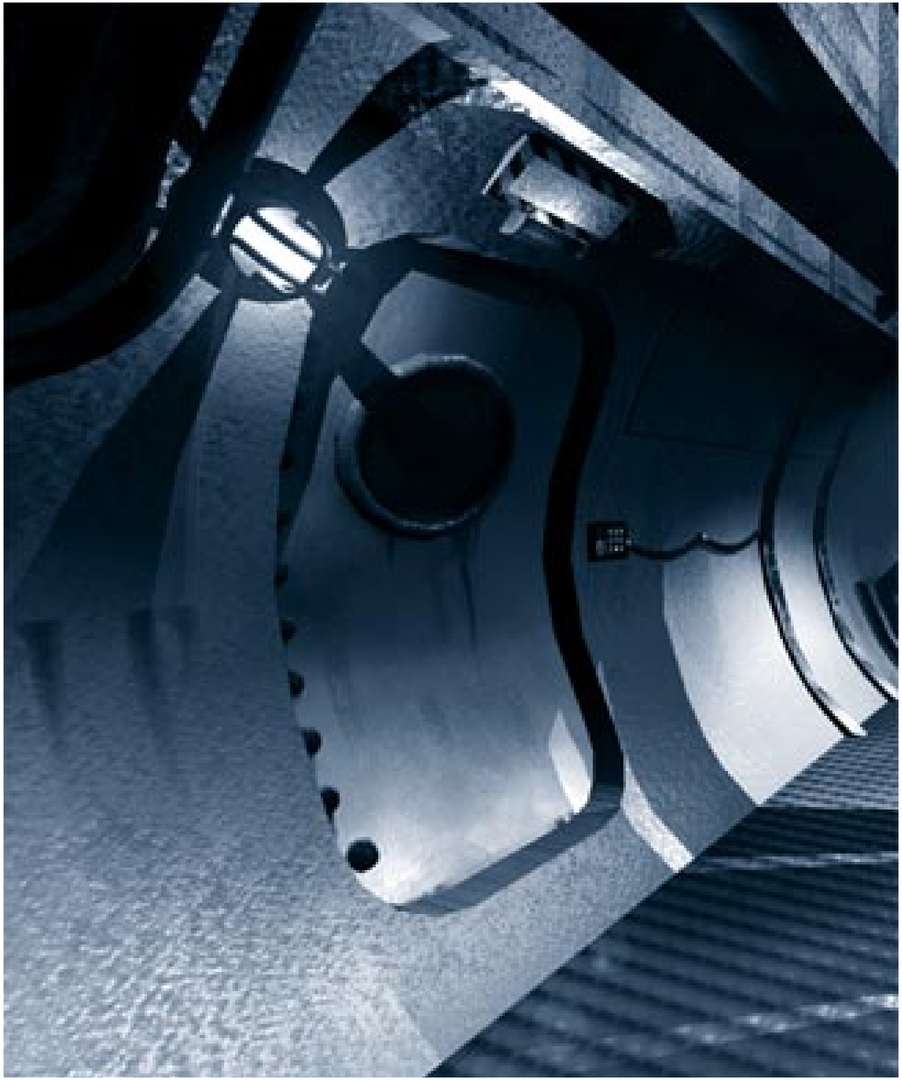
When the figure comes into Ray Dream Studio, it will be lying on its back. To stand it up, set its **Properties palette: Transform tab: Orientation: Roll to 90**.

Adjust **Properties palette: Transform tab: Orientation: Yaw** to change the direction the figure faces.

Texture Maps on Poser Figures

You can use Parametric Mapping as the mapping type on Poser figures that were imported from a 3DMF file. This mapping will offer the best results.

You can use one of Poser's default texture maps or create your own map, using one of the default maps as a template.



B

Glossary

Introduction

This Glossary provides an alphabetical listing of the special terms used in describing 3D modeling and animating.

A

Alignment, relative Setting two or more objects to some meaningful spatial relationship, such as centering them or distributing them evenly along a line.

Alignment, text Text alignment affects text objects of more than one line. The lines of text may be aligned to their left edge, their center, or to their right edge.

Alpha Channel The top byte of a 32-bit pixel that is used for data other than color. The channel may hold mask or transparency data.

Ambient Light That light responsible for the overall, diffuse lighting of a 3D scene. Similar to daylight in the real world.

Anti-aliasing Intermediate colors (or shades of gray) in the pixels between contrasting colored regions. Anti-aliasing improves the appearance of objects in renderings by removing jagged, “stair-step” edges.

Aspect Ratio The ratio of the width of an image to its height (x:y). For example, the aspect ratio of an image 640 x 480 pixels is 4:3.

Atmospheric Effects Atmospheric conditions or phenomena that affect the clarity or mood of a scene. Fog and smoke are good examples of atmospheric effects.

Attitude See *Orientation*.

Axis A hypothetical linear path. The X, Y, and Z axes (width, height, and depth, respectively) define the directions of the 3D universe. The axis along which an object is rotated is the axis of rotation. An object’s axes are parallel to its bounding box.

B

Backdrop A picture that is automatically composited behind a 3D scene. The matte paintings used in traditional movie making are a good example of backdrops.

Background, reflected Reflected backgrounds are 2D images that show up on reflective surfaces (metal, glass, etc.). Reflected backgrounds increase the realism of such surfaces. Reflected backgrounds are also knows as environment maps.

Bézier Curve A path defined by the position of four control points (at the ends of the tangents of the vertices). The length and angle of the tangents describe the deviation from a linear path that the curve follows between vertices.

Bit Depth The number of bits used to define the shade or color of each pixel in an image. A 1-bit image is black and white. An 8-bit grayscale image provides 256 shades of gray (2 to the 8th power is 256). An 8-bit color image provides 256 colors. A 24-bit image provides over 16 million colors: 8 bits are used for red, 8 are for blue, and 8 for green.

Bitmap A pixel-based image.

Boolean An object created by combining two objects using mathematical operators (Booleans). The two objects may be subtracted one from another, merged or intersected to form the Boolean object.

Bounding Box A hypothetical box drawn around an object or group of objects. A bounding box is the smallest rectangular box in which the object (or group of objects) fits completely. The bounding box is parallel to the axes of the object. The bounding box is shown (around the preview of selected objects and groups) in the **Perspective** window, and it is the bounding box—not the object itself—that “casts” the projections onto the working box grid.

C

Child An object linked to another object (its parent) in the hierarchy. When the parent is moved, the child and all “grandchildren” go with it. The parent-child link is used to enable articulation of complex objects.

Colinear Two or more objects that are in the same line.

Color, CMYK The subtractive color model, used in printing. Colors are created by assembling different densities of cyan, magenta, yellow, and black pigments on a surface. When white light strikes the surface, only specific bandwidths are reflected—depending on the density of the specific pigments. The reflected bandwidths create the perceived color. The CMYK model is called the subtractive model because the pigments subtract (by absorption) the bandwidths of white light that do not contribute to the specified color.

Color Depth See *Bit Depth*.

Color, RGB The additive color model, used in computer monitors. Colors are created by adding varying degrees of red, green, and blue light. For information on the "varying degrees," refer to Bit Depth.

Complex Object An object constructed of several simple objects that are linked or grouped. For example, a telephone—comprised of the grouped, simple objects: cord, handset, and cradle—would be considered a complex object.

Component, shader An elementary building block of a shader tree.

Concentric Having the same center.

Constrain To restrict object movement to a particular plane, axis, or angle. The working box is the primary tool for constraining an object.

Control Points The "knobs" at the ends of Bezier tangents used to adjust a Bezier curve.

Co-planar Occurring in the same plane.

Cross Section One of the planes on which two-dimensional shapes are drawn in the Free Form modeler to create a three-dimensional object. Objects have two or more cross sections.

D

Deformers Properties that can be applied to any object (or group of objects) to deform its geometry. Asymmetric scaling, bend, twist and shatter operations are examples of deformers available in Ray Dream Studio 5.

Dithering The process of approximating pixel colors when reducing the color depth of an image or mapping to a different palette. Dithering can improve transitions between colors when reducing a 24-bit image to 8-bit format.

Dolly, Pan and Track The computer equivalents of the real world camera movement commands. With Dolly, the camera moves around in 3D space as if gliding on the surface of a sphere that has the object of interest as its center. Inversely, using Pan, the camera acts as the "center of the sphere" and rotates at a fixed position in space to track an object or view a scene, much like a movie camera can rotate on a tripod to follow a moving object. Finally, Track moves the camera in a plane perpendicular to the direction in which the camera is pointing.

DXF A standard 3D file format originally developed by Autodesk, makers of AutoCAD, for the purpose of exchanging CAD data between various 3D software applications. Widely used as a poor man's exchange file format, DXF only offers support for basic geometric information (no textures).

E

Extrusion The method of creating a 3D object by moving a 2D cross section along a path (the sweep path). The Free Form modeler uses this method.

F

Face The back (first cross section shape) or front (last shape) of an extruded object.

Formula A mathematical expression that, with input, returns a meaningful set of values. Formulas may be used to create objects, define a tweener curve, or create a color pattern in a shader, gel, background or backdrop.

Free Form modeler A modeler that uses cross sections, sweep paths and scaling envelopes to create 3D objects.

G

G-Buffer (Geometry Buffer) A type of information carried on optional channels of a rendered image. The G-Buffer carries an aspect of three dimensionality with the 2D rendering. This can assist 2D filters and paint tools during retouching.

Global Mixer A shader component that mixing all channels of its two component shaders.

Global Universe The Global Universe is a Cartesian coordinate system with the origin of the X, Y, and Z axes (0, 0, 0) at the center of the universe. The Global Universe is fixed and is not affected by changes made to the working box.

Glow Channel A shading channel that holds data describing an object's luminescence or "glow."

Grayscale An image in which the pixels are defined with 8 bits, which provides 256 levels of gray.

Group A set of collected objects. Grouping enables a set of objects to behave as one.

H

Hierarchy The tree structure in the **Time Line** window that lists the objects in the scene and shows their logical relationships (links and groups). The hierarchy also includes listings for the animatable properties of each object.

Highlights Regions on an object where light reflects directly into the viewpoint. Highlights appear as bright spots on smooth/shiny objects and are almost nonexistent on rough/dull objects.

Hot Point A special, active point inside, on the surface of, or near an object or group. The hot point is used as the reference for rotation and for some positioning and alignment operations. In the **Perspective** window, the hot point appears as a small circle that is, by default, at the center of the object or group.

I-J-K

Icon A pictorial representation of a tool, object, file, or other program item. An item is selected by clicking once, or sometimes double-clicking, on its icon.

Jaggies The appearance of "stair-step," jagged edges in a pixmap image. Jaggies can be reduced with anti-aliasing.

Key Event A moment in the animation where an object's characteristics change. Key events are marked on the time track for each animatable property.

L

Leading Leading determines the vertical space between lines of text. The default leading value is 120% of the font's point size. Decreasing the percentage makes vertical spacing more compact, while increasing the percentage expands it.

Letter Spacing Letter Spacing adjusts the horizontal spacing between characters in an entire word, line, or text block. A negative value decreases spacing, while a positive value increases it.

Links A variety of child/parent relationships and constraints on relative motion to simulate traditional, real world mechanical links. Shafts, axis, and ball joints are examples of links.

M

Mask The mask is a grayscale image, stored in channel 4 of a rendering, that describes where objects are versus where they are not. In a 2D image-editing program, the mask is used to generate a selection, which helps you composite your rendered scene with other background imagery.

Master Objects A master object is the "mold" from which object instances are created. If a master object is modified, all of the objects derived from it are modified similarly.

Motion Path A curve, visible in the **Perspective** Window, that shows where an object will move during the course of an animation.

N-O

Normal Vector A ray perpendicular to an object's surface at a given point.

Object Any 3D volume or other item that appears in the universe, including cameras and lights. When objects are grouped, their group is also described as an object.

Object/Group Coordinate System Groups and individual objects have their own local coordinate systems. The origin of a group or object's coordinate system is at the center of its bounding box. The axes are parallel to the sides of the bounding box.

Operator An operator is a shader shell that combines other shaders to form a sub-shader.

Orientation The direction an object "faces" as defined by the compound effect of the object's pitch, yaw, and roll. Usually, the most important aspect of an object's orientation is its relation to other objects. An object's relation to the viewpoint can be changed by moving the current camera.

Oversampling Rendering at a higher resolution, then bringing the resolution back down to minimize artifacts like aliasing.

P

Pan See *Dolly, Pan, and Track*.

Penumbra The region of partial shadow at the edge of the full shadow. In Ray Dream Studio, you can achieve nice penumbras with the Soft DRT Shadows option for lights.

Pipeline An extrusion in which the cross section is always perpendicular to the sweep path.

Pitch The aspect of an object's attitude that describes its angular deviation along its vertical (top-to-bottom) axis.

Pixel (picture element) One dot in a 2D image. Computer images are created as an array of such dots, each having a specific color. See also *Resolution* and *Bit Depth*.

Pixmap An image formed as an array of pixels.

Plane A hypothetical, two-dimensional construct that may exist at any attitude in space. A plane can be envisioned as a flat sheet of invisible paper that stretches infinitely in two dimensions. In Ray Dream Studio, planes are used to constrain the direction of translation of an object. The working box shows the angle at which the constraint planes are set. By default, the planes of the working box are set parallel to the axes of the current local universe.

Point As a unit of measure, a point is 1/72 of an inch. Point also refers to Bézier vertex and control points.

Point of View (also viewpoint) The position and angle from which you view a scene. The point of view (POV) is always through a camera. You may add several cameras, positioned and angled differently, and switch the **Universe** window POV between them. When you render an image, you choose the POV from which the image should be taken.

Position, absolute The X, Y, Z coordinates of an object's hot point in the Global Universe.

Position, relative The placement of an object in relation to another object. For example, a book might be on top of a table.

Preview The display of an object in the **Perspective** or **Modeling** window or the color chip of a shader in the Browser. Also refers to a rendering with a low resolution setting.

Primitive An object created by definition, rather than modeling. A primitive object cannot be "dismantled" into components. The Sphere, Cube, Cylinder, Cone and Icosahedra are the basic primitives in Ray Dream Studio. The environmental primitives include Fountain, Fog, Cloud and Fire.

Production Frame The computer equivalent of the viewfinder in a regular camera. The production frame can be thought off as describing the area of the 3D scene that will be rendered into an image.

Projection The silhouette of an object's bounding box on one of the three visible planes of the grid. The hot point of the selected object or group also casts a projection. Projections are used for translation and rotation.

Properties The collection of characteristics applied to (or available for) an object. Properties for the selected object appear in the **Properties** palette.

R

Ray Tracing A procedure for generating a rendering. The ray tracer sends hypothetical rays of light from the sources in the scene and calculates the visual effects, for each pixel in the rendering, as the rays encounter and reflect from the objects in the scene.

Reference A fixed point or plane used as the starting point for some operation. The hot point, the center of the bounding box, and the corners of the bounding box are common reference points.

Reflection The phenomenon of light "bouncing off" objects.

Refraction The phenomenon of light deflecting as it passes through a translucent object, like glass or fluid.

Render The process of capturing a 2D image from a 3D scene.

Resolution For an image, resolution is given as the number of pixels in each dimension. For devices, like a printer or the monitor screen, resolution is given in dots per inch (dpi) or dots per centimeter.

Roll The aspect of an object's attitude that describes its angular deviation along its lateral (side-to-side) axis.

Root The root describes the highest level of the hierarchy, the universe. When you are "Jumped Into" a group, the group box is the highest level of the hierarchy, and therefore, the local root.

S

Scaling, object The percentage an object is resized. Each object instance may be scaled from the dimension of its master, which has a scaling of 1.

Scaling, text Scaling changes the width of characters without affecting their height. A value below 100% results in characters that are narrower than usual, while a value above 100% results in characters wider than usual.

Shape A 2D path that may be open (a line) or closed, such as an oval or a polygon. Shapes are used in cross sections when modeling. In shading, paint shapes are used to specify regions for shading.

Sweep Path The curve or line along which shapes are extruded when modeling. Called the sweep or extrusion path, the path is defined by one line on the bottom plane and one line on the back plane in the **Modeling** window. The compound curvature of these two lines defines the path itself.

T

Texture Map A 2D image used as a shader.

3D (three-dimensional) An object or volume that exists in the dimensions of width, height and depth.

TIFF (Tagged Image File Format) An image file format often used for transfer between applications or platforms. Ray Dream Studio 5 opens TIFF images in RGB format, but not in CMYK format.

Tiling The technique of repeating a small image across a larger surface to cover it.

Track See *Dolly, Pan, and Track*.

Translation Any manipulation of the position or attitude of an object. Also, an extrusion in which the cross section remains at one angle, regardless of the curvature of the sweep path.

Translucence The characteristic of an object that allows light to pass through it.

2D (two-dimensional) An image, shape, path, or plane that exists in the dimensions of width and height only.

Tweener A formula used to control the transition between two key events.

U-V

Universe The 3D workspace, shown in the **Perspective** window. The Universe is where you place and position objects. It is the root of the hierarchy, and its coordinate system is absolute (doesn't move or rotate).

URL Uniform Resource Locator is the "address" of an item on the internet.

UV A 3D coordinate mapping system. UV coordinates are used in parametric mapping to align points on the shader with points on the object.

Vertex A control point on a path. Paths begin, change angle, and end at vertices.

Viewpoint See *Point of View*.

W

Wizards, modeling and scene Visual step-by-step pictorials used to simplify a typically complex multi-stage process. The Modeling Wizard speeds the creation of 3D objects. The Scene Wizards facilitates setting up a scene with lighting and props. Wizards are great learn-by-example resources.

Word Spacing Word Spacing adjusts the horizontal spacing between words. A negative value decreases spacing, while a positive value increases it.

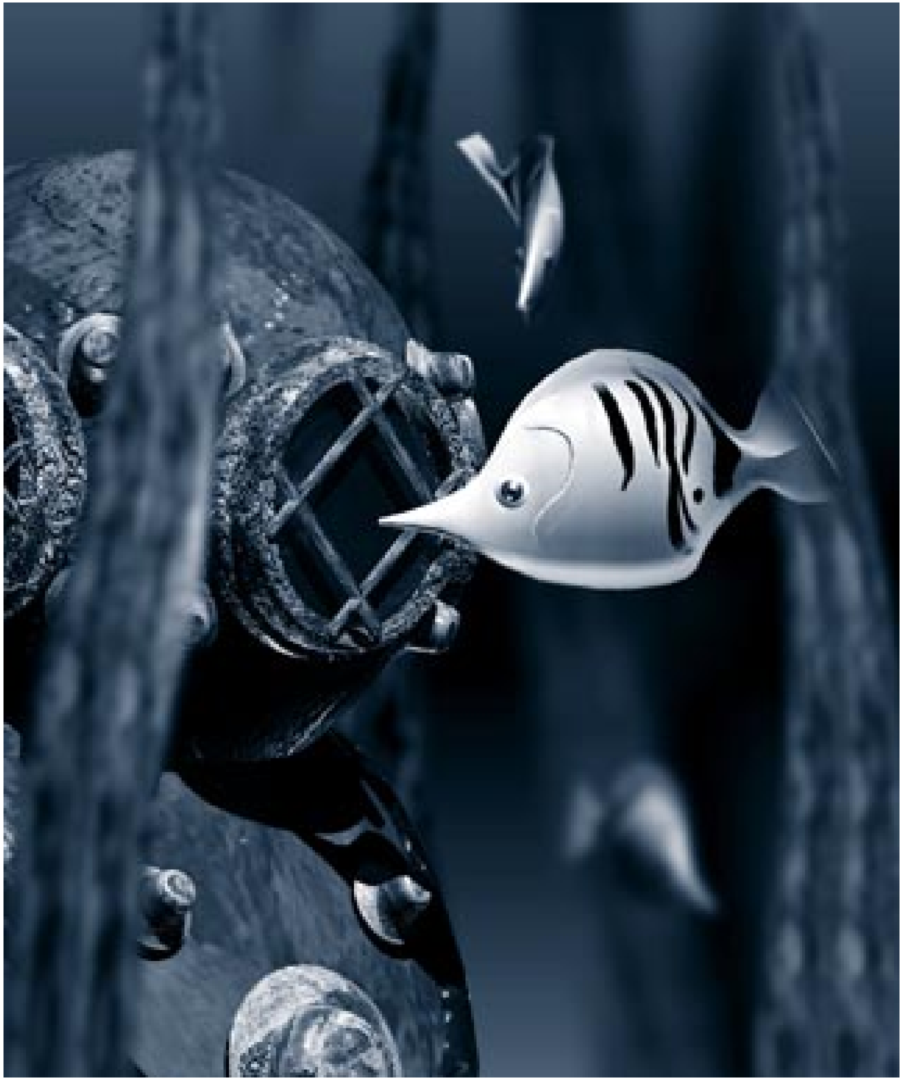
Working Box The three visible grid planes in the **Perspective** window. Called the working box because you'll move it as you work to constrain operations to certain planes.

Working Box System The working box has its own coordinate system. The attitude of its axes and the position of its origin (at the center of the working box) change as you move and re-orient the working box.

Y-Z

Yaw The aspect of an object's attitude that describes its angular deviation along its linear (front-to-back) axis.

Z-Buffer A rendering technique that uses z (depth) information in sorting object facets.



C

Technical Tips

Introduction

Fractal Design, Inc. has thoroughly tested Ray Dream Studio 5 to ensure that it runs correctly with most Macintosh and Windows software and hardware. If you experience a problem with Ray Dream Studio 5, first complete the steps given in "Before You Call Technical Support" on page 398. Then refer to the list of commonly asked questions and their answers. If you cannot resolve the problem, please refer to "Fractal Design Ray Dream Studio Troubleshooting Worksheet" on page 423 for information on how to contact Technical Support.

Before You Call Technical Support

When you first experience a problem with a software program you might be able to find the solution yourself without calling Technical Support. If you do call Fractal Design Technical Support, please have the following information available. Please fill out the Troubleshooting Worksheet included at the back of this manual.

1. Which Fractal Design product are you using?
2. Which version?

   Macintosh: Look under the **Apple** menu if the program is running or highlight the application icon and choose **File menu▸ Get Info**.

   Windows: Look under the **Help** menu.
3. What is your serial number (see the label attached on the back inside cover of this manual)?
4. What kind of computer are you using?
5. How much RAM does your computer have?
6. What kind of problem are you having?
7. Do you get an error message? If so, what message?
8. Is there anything unusual about your computer set up? Do you have a special video card or accelerator, for example.
9. Do you have a CD-ROM player? When was it last used?
10. Are you running virus protection or disk compression software, and if so, what products are you using?

Once you have answers to the above questions, call Fractal Design Technical Support at (408) 430-4200. To investigate the problem yourself, look below for instructions based on your computer platform.

Macintosh

The most common cause of problems when running Macintosh software is a conflict with Extensions.

To find out if an Extension conflict is causing a problem:

1. Restart the computer while holding down the **Shift** key.
2. When you see the message **Welcome to Macintosh. Extensions off.** release the **Shift** key.
3. Run the software to see if the problem still occurs.
4. If the problem goes away when you start the computer with Extensions off, you know that the culprit is an item in the **Extension** folder or **Control Panel**. Once identified, it is usually just a matter of getting the most current version of the product to solve the problem permanently.

To identify the item that causes the conflict:

1. **System 7.5** Choose **Apple menu▸ Control Panels▸ Extensions Manager**. If you need more instructions than what appears in this control panel, see your System 7.5 documentation. After turning off one half of your extensions, go to Step 2.

   Pre-System 7.5 Create a new folder and name it Extensions Off. Open the Extension folder and drag half of the items into the new folder.
2. Restart your computer in the usual way. See if the problem still occurs.

   If the problem still occurs you know the culprit is still active.

   Pre-System 7.5 If the problem goes away, you know the culprit is in the Extensions Off folder. Whichever folder contains the culprit, cut that group in half and restart again. Keep cutting the group in half until you zero in on the extension that causes the problem.

System 7.5 If the problem goes away, you know that the extension is turned off. Turn half of the extensions back on. If a problem still occurs, turn off half of the remaining extensions. Keep turning extensions on or off until you zero in on the extension that causes the problem.

3. If you get all the way through the Extensions folder without locating the item that causes the problem, it is possible that the culprit is in the **Control Panels** folder.

   Follow the same procedure with the **Control Panels** folder, starting by removing all items that are not included in Apple's standard system.

4. If you identify the problem as an Extension or a third-party **Control Panel** device, contact the developer of that software to verify that you have the most current version.

   If you have the most current version, contact Fractal Design Technical Support at (408) 430-4200. We will want to have the name and phone number of the developer's technician you spoke with so we can work with them to create a permanent solution.

5. If the problem is identified as an Apple **Control Panel**, contact Fractal Design Technical Support at (408) 430-4200.

Windows

If you are running Windows, sometimes there is a video driver incompatibility. The solution is easy so try this test to see if your problem is caused by a video driver.

Windows 3.1 and Windows NT

1. Close all applications except Windows.
2. In your Main directory, locate and double-click the icon labeled **Windows Setup**.
3. Write down the current Display setting so you can return to it after this test.
4. Choose **Options menu▸ Change System Setting**.
5. Where it shows Display, scroll down and select plain vanilla VGA.
6. You will need to restart Windows.
7. Run Ray Dream Studio 5 to see if the problem persists.

If the problems are gone, you know the cause was the video driver. Contact the manufacturer of your video card to get the most current video driver. Some manufacturers change drivers every few months. The new version is most likely free and can usually be downloaded from a bulletin board or online service.

Windows 95

1. Choose **Start menu▸ Settings/Control Panel**.
2. Double click **Display** and select the **Settings tab**.
3. Click **Change Display Type /Record Adapter Type**.
4. Click **Change under Monitor Type** and select **Show All Devices**.
5. Make a note of the current setting so you can return to it after this test. Scroll to **Standard Monitor Types** and select **Standard Display Adapter (VGA)**.
6. Click **OK**.

If running under VGA does not solve the problem or if the manufacturer verifies that you are running the most current driver, contact Fractal Design Technical Support at (408) 430-4200.

Set up

Q. The Ray Dream Studio 5 installer does not install Ray Dream Studio 5 on my machine. What can I do?

To install the complete Ray Dream Studio 5 including the tutorial files, you need to have 20 MB of hard drive space reserved for program files, plus 20 MB free disk space available on your hard drive.

Macintosh: If you have enough hard drive space and are still having problems, try restarting the Macintosh while holding down the **Shift** key to turn all extensions off. Then reinstall Ray Dream Studio 5.

Windows: If you have enough hard drive space and are still having problems, try rebooting the computer with the following turned off:

- Any virus protection software.
- If you are using disk compression, try installing to an uncompressed volume.
- Any TSR (Terminate and Stay Resident) application not required to run Windows.

See TSR Programs (Windows) later in this appendix for instructions on how to turn off TSR's.

Then reinstall Ray Dream Studio 5. If installation is still unsuccessful, contact Fractal Design Technical Support.

Memory

Q. Is there a limit to the size of image that Ray Dream Studio 5 can produce?

A. If there is enough RAM or scratch disk space available to open the file, Ray Dream Studio 5 renders images of up to 16,000 x 16,000 pixels.

Q. How do I select the scratch drive for Ray Dream Studio 5?

A. Choose **File menu▸ Preferences: Imaging: Scratch Drives**.

Q. How can I increase the memory allocated to Ray Dream Studio 5?

A. To change the total amount of RAM allocated to Ray Dream Studio:

Quit Ray Dream Studio 5 if it is already running.

Macintosh:

1.Select the Ray Dream Studio 5 application by clicking once on its icon.

2Choose **File menu▸ Get Info** from the **Finder** or press **Command-I**.

3. In the lower right corner of the Get Info box, type the amount of RAM you want Ray Dream Studio 5 to use in the Preferred Size box.

4.Close the Get Info box.

Recommendation: Always leave enough RAM for the System. Do not assign an application more RAM than you have available. Check **Apple menu▸ About This Macintosh** before changing RAM allocations.

Windows:

1.Close down any running applications that you really don't need.

2.Delete the contents of the clipboard.

This can be done by selecting the **Clipboard Viewer** from the **Main Group** or **Start** menu. When the **Clipboard Viewer** appears, Choose **Edit menu▸ Delete**.

3.**Windows 3.1** and **Windows NT** Release System Resources. To display the percentage of system resources available, choose **Help menu▸ About Program Manager** from the Program Manager. If the percentage of free system resources is less than 20MB, problems may occur.

Windows 95 Click **My Computer: Properties: Performance tab**.

To increase available system resources:

- Close all windows that you don't need open (do this in the Program Manager for Windows and Windows NT).
- Reduce the number of Program Groups (Windows/Windows NT).
- Close all unnecessary application windows.
- If you are running Wallpaper, turn it off.
- **Windows 95** Ensure you are using the most current version of Windows.

Q.If I upgrade my computer by adding more memory will it render faster?

A.Adding more memory might allow the computer to render some images without using the scratch disk so you may see a significant improvement in the speed, especially if your image includes texture maps. It is not actually working faster, it just doesn't have to go to the disk as often.

Q.Will adding an FPU increase Ray Dream Studio 5's speed?

A.No. Ray Dream Studio 5 does not use the FPU.

TSR Programs (Windows)

Q.What is a TSR (Terminate and Stay Resident) application?

A.A TSR or memory resident application is a program or driver that stays in memory once it is loaded and works in the background. The program normally responds only to a specific command or event (such as the deletion of a file or a specific key stroke combination).

Q.How can I turn some or all TSR's off?

A.To turn off TSR's:

Using DOS 6 and higher:

1.Reboot the computer and press the F8 key as soon as you see "Starting MS-DOS."

2.The computer prompts you before executing each line in the config.sys file and autoexec.bat file. This allows you to selectively not load TSR's that are not required to run Windows.

You must load HIMEM.SYS in order to run Windows in enhanced mode. Also, if you have a SCSI drive, make sure that you load your SCSI drivers. (You may also need the Files and Buffers and Path commands in AUTOEXEC.BAT.)

3.Once the computer restarts, start Windows then start Ray Dream Studio 5.

4.If the problem persists, even with TSR's off, contact Fractal Design Technical Support.

Q.Can TSR's cause conflicts and how can I resolve them?

A.A TSR conflict occurs when a specific TSR conflicts with another TSR, application, or a function within an application. You can resolve a possible TSR conflict by:

1.Restarting the computer with only those TSR's turned on that are required to run Windows.

2.Retry the operation. If the conflict does not recur, the problem is probably caused by a TSR conflict.

If restarting with TSR's off resolves the problem, a TSR conflict is probably the cause of the original problem. Try to identify the specific TSR or combination of TSR's that cause the problem. Once identified, verify with the manufacturer that the version is up-to-date. Then contact Fractal Design Technical Support for additional instructions.

Modeling

Q. Can I use Adobe Illustrator or Corel Draw line art to create 3D objects?

A. Yes, you can use Adobe Illustrator or Corel Draw line art as cross sections, sweep paths, and scaling envelopes. Refer to Chapter 7, "Free Form Modeling." (Macromedia FreeHand is not supported in Ray Dream Studio 5.)

Q. After I use the **Rectangle** tool to draw a square (by holding down the **Shift** key to constrain it.) I want to edit the shape. How can I convert this shape to a Bézier shape? Previous versions of Ray Dream Studio could convert to Bézier. How do I do that in this version?

A. To convert your square to Bézier curves, so you can edit the shape, choose **Arrange menu▸ Ungroup**. Then use the **Add Point or Convert Point** tool to edit the shape.

Q. How do I create an object with holes in it?

A. Draw the cross section and the hole(s). With the cross section selected hold down the **Shift** key and select the hole(s). Choose **Arrange menu▸ Combine as Compound**.

Q. The object I made using the Modeling Wizard is not exactly what I want. How do I edit it? Can I use the Modeling Wizard to modify an object made in the Modeler?

A. The Modeling Wizard is only for creating objects. Objects created with the Modeling Wizard can be edited like other free form objects. Double-click the object in the **Perspective** window to launch the Modeler. Edit the object then exit the Modeler by clicking **Done**. Remember, any Wizard object can be recreated with eight mouse clicks or fewer, so it's not too inconvenient to start over again.

Q. How can I rotate the plane of the cross section like the Modeling Wizard does when it makes the banana?

A. No magic here. Simply choose **Geometry/Extrusion Method menu▸ Pipeline** instead of **Translation**. With Translation (the default) the cross section remains parallel to the drawing plane. With Pipeline, the cross section remains perpendicular to the sweep path, so the plane of the cross section rotates as the sweep path curves.

Q. When I imported my 3D DXF file, all I got was an empty bounding box, or so many objects that I could not make any sense out of it. How can I fix this problem?

A. Ray Dream Studio 5 imports files based on the DXF standard created by AutoDesk, the manufacturer of AutoCAD. Before you export from your DXF application, ensure that objects are saved as 3D faces. Then your file should import correctly in Ray Dream Studio 5.

Shading

Q. At what resolution should I save my bitmap image in order to use it as a texture map in Ray Dream Studio 5?

A. You will get the best results if the original image is saved at the size and resolution required for the final output. So if your final image is rendered at 300 dpi and the texture map is about one inch square in the final image (300 x 300 pixels), you would want your original to have a size of 300 x 300 pixels (one inch square at 300 dpi). The closer you are to a one-to-one ratio between the original artwork and the final output, the better your texture map will look. Making the texture map larger (or higher resolution) increases the rendering time but will not increase the quality of the final image!

Q.Does Ray Dream Studio 5 support PANTONE colors?

A.Ray Dream Studio 5 supports the RGB and CYMK color models for selecting colors. PANTONE colors are not supported directly, but you can use the CMYK equivalent to select your original color. Remember that colors are manipulated in order to create a 3D image. If you start with a specified color, you don't necessarily end up with it after you have added lights, reflection and transparency, and allowed for the shading that indicates the curvature of your objects. The final artwork rendered from Ray Dream Studio 5 will always be in the RGB mode. Of course, you can do post production work in an image manipulation program, such as Adobe Photoshop, to specify PANTONE colors.

Q.What is the priority order for solid textures on objects? Say I have a transparent object with a bank of wood texture and part of the wood has a gold band "inlaid" in it. What will I see? How can I control the priority order?

A.Use the **Properties palette: Shading tab** to change the order of paint layers. Use the **Move Forward** and **Send Backward** commands to prioritize the paint layers.

Q.If I change the shape of my paint region will the texture map tile or stretch?

A.It will stretch. Remember that you can use the **Properties palette: Shading tab** to change the size of your paint region. Set the size to a size that is proportionate to your artwork to avoid distortion. If you want to increase tiling, click the paint region with the **Eyedropper** tool. Adjust the tiling in the **Shader Editor** and reapply the shader.

Q.If I have a long thin object how can I get my texture to tile correctly?

A.In the Shader Editor you can set the number of tiles you want in the vertical and horizontal planes to get the effect you are looking for.

Q.How can I make bumps show up better? I want them to appear higher or I want the indents to appear deeper.

A.Experiment with your lighting. Try not to have any light directly aimed at the bump or it will wash out. Indirect lighting shows the bump map shadows.

Q.I want to use some filters on my object but I cannot access them. Why?

A.You need to tell Ray Dream Studio 5 where to find the filters by identifying the plug-in folder in **File menu▸ Preferences: Imaging: Scratch Disk**. Remember that filters can only be applied to a 2D image. Filtering is a post-production process.

Q.Some Photoshop plug-ins look for Photoshop specific functions and cannot be used.

Printing

Q.I created a really neat 3D object but I can't figure out how to print it. Help!

A.Set up cameras and lights. Render your image. Open the rendered image and choose **File menu▸ Print**. For more information, refer to Chapter 14, "Setting Lights & Cameras."

Q.I printed my rendered image but the resolution is very poor. On screen it looks pretty good. What's going wrong?

A.It is up to you to select the size and resolution you desire for your printed image. The default is 72 dpi (screen resolution), which is very poor quality for printing but great for previewing your scene on screen. Set the resolution for your image before rendering, by using the **Scene Settings dialog: Image Size tab**.

Arranging

Q. Even using various views, I have a hard time lining things up precisely.

A. Use the **Numerical** and **Alignment** tools, described in "Positioning Objects" on page 234, to place objects precisely. You may also want to adjust the hot point on specific objects in order to get the exact placement you need.

Q. When I drag a new object into the **Perspective** window, sometimes I cannot find its projections. I have the feeling that the object is not where I think it is.

A. It does make a difference where you drop your object. Experiment with it. Generally, you should aim for the center of the Universe. However, should you really have a problem, you can always send your object to the center yourself. Select the object in the **Perspective** window, then choose **Arrange menu▸ Send To Origin**. Better yet, create your object in the center of the universe by dragging and dropping the **Free Form** tool or one of the primitive tools into the **Hierarchy** window.

Q. I've tried using Numerical and Alignment to place my objects exactly where I want them but they don't seem to align as I would expect. They don't seem to rotate correctly either.

A. Make sure the Hot Points are set correctly. To return the hot point to the default setting: Select the hot point and click **Send to Center** in the **Numerical** dialog, and click **Apply**.

Q. I really like the **Virtual Trackball** tool but sometimes I have a hard time understanding how it is rotating the object. Can you help?

A. Be sure to start your rotation with the cursor inside the circle (otherwise, rotation is constrained to one plane). If you need more control, hold down the **Shift** key and your rotation will be constrained to 15° increments. Your object rotates around its Hot Point. (If you start your rotation outside the circle, rotation is constrained to the active plane.)

Q. Why doesn't the **Hierarchy** window scroll automatically?

A. If you want to have the **Hierarchy** window scroll while you drag, hold down the **Option**/**Alt** key. Otherwise, it behaves just like a window on the Finder (Macintosh) or Program Manager (Windows) behaves.

Q. I understand how to point a light or camera at an object but what if I want the light to point at a spot where there is no object? It seems like I should be able to do that.

A. Create a dummy object and place it at the spot where you want the light (or camera) to point. Remember that it points at the Hot Point. After using the **Point At** command, select your dummy object and delete it. The **Point At** command does not link the camera or light to the object, so if you move the object and want the camera or light to continue to point at the object, you will need to aim it again.

If you have Ray Dream Studio installed, you can use the Point At behavior as a way to keep one object directed at another through all or part of the animation. The Point At behavior can be applied to objects, as well as cameras and lights.

Lights and Cameras

Q. How can I create a new camera and move it in the **Perspective** window?

A. When you create a new camera using the **Edit/Insert** command, you can set the camera's position to Reference, or to any other of the preset positions under the **View** menu; to the same as position as the current camera; or at the center of the Universe (0,0,0).

You can also select a camera in the **Hierarchy** window and choose **Windows menu▸ Numerical** or press **Command-I/Ctrl+I**) to open the **Numerical** dialog. Set the x, y and z coordinates to 0, 0, and 0. Click **Apply**. The camera now appears in the center of the universe and you can move it as you would any other object in your scene. Remember you can also move a camera using the camera tools or the controls in the **Camera Properties** palette (**Windows menu▸ Camera Properties**). Yet another way to move the camera is to select it in the **Perspective** window and drag it as you would move any other object.

Q. How can I control the intensity of shadows?

A. Double-click the light in the **Hierarchy** window and use the **Shadow Intensity** slider bar to adjust the intensity of the shadow. You can also try increasing the ambient light (just a little), but remember that ambient light affects the whole scene. (You may also want to use the Production Z-Buffer renderer, which renders soft shadows.)

Q. I set the ambient light to a nice clear white, but I am not getting the results I expected. What's wrong?

A. Ambient light refers to the light that is simply there in the room during the day. If you set the light to white it will probably wash out all the color and texture of your objects. Usually you will want to leave it set to the default neutral gray. Sometimes you may want a colored light for special effects but don't make it too bright!

Q. I set up my scene by placing the objects and adjusting the lights, but when I render the scene, everything appears to be washed out. Why is that happening?

A. Be sure you do not to set the lights too bright. If you adjusted the lights by assigning a very light yellow or white color, you are probably flooding the scene with too much light. Try rendering the scene with the lights set to a lower intensity.

Q. I added Fog to my scene but it doesn't seem to do anything. I don't see any fog.

A. Distance-based fog only shows if it is in front of something. Is your object in front of the fog? You may need to adjust the area where the fog starts or move your object into the fog. For information on how to determine where fog begins and ends, refer to "Atmosphere" on page 344.

Q. My object looks foggy now, but shouldn't fog affect the whole scene?

A. In order to see the fog in the rest of the scene, you will need to provide a background. The same is true of Ambient Light. Select a **Reflected Background** from the **Reflected Background** tab (Render/Effects), or create an object and position it behind the scene.

Rendering

Q. Can I interrupt a rendering once it has started? If so, how do I resume or do I need to start over again?

A. If you are using the Batch Queue, you can pause a rendering by clicking **Pause** in the **Batch Queue** dialog. Resume rendering by clicking **Resume** in the **Batch Queue** dialog. The contents of the Batch Queue are saved so you can resume a paused rendering later. However, once you clear the **Batch Queue** dialog, you will not be able to resume the rendering. Of course, you can abort a rendering by typing **Command-Period**/**ESC**, but an aborted rendering cannot be resumed.

Q. When using the Batch Queue, my rendering did not show the latest changes I made to my scene.

A. The Batch Queue renders the scene from the last version saved to your hard drive. (It's a good idea to save frequently!) The **Render** command renders your scene as currently shown, working from the copy held in RAM, showing the latest changes even if not yet saved to the hard drive. If you're happy with the output, remember to save it!

Q. What kind of image will I get if I choose to have the computer give me the best image possible in the time available instead of doing a full rendering? How will it relate to the Render Settings format I have set? Will it keep the dpi constant and change the size or keep the size I set and change the dpi?

A. It will keep the image size and adjust the resolution to the best quality available in the time you have specified.

Q. How long will it take to render my image?

A. Image processing time depends on a variety of factors including: computer speed, rendering resolution, scene complexity, lights, transparencies and reflections, types and complexity of textures. Generally, more complex images take longer to process than simpler images. Use the **Estimate Render Time** command in the **Scene Settings dialog: Image Size tab** for information specific to your image.

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