Using Director MX

Macromedia Director MX

Part Number ZDR90M100

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CONTENTS

INTRODUCTION
Getting Started

Macromedia Director MX is the world's foremost authoring tool for creating interactive multimedia. Developers rely on Director to create attention-grabbing business presentations, advertising kiosks, interactive entertainment, and educational products. To see some of the exciting and varied ways in which developers use Director, visit the Director showcase at www.macromedia.com/software/director/special/inspiration/. You can also see great examples of Shockwave at www.shockwave.com.

Your users can view your completed Director movie over the Internet, either in a web browser or independent of a browser,or in a stand-alone projector suitable for LANs and distribution through CD-ROM and DVD-ROM.

System requirements

The following hardware and software are the minimum required to author Director movies:

- For Microsoft Windows: An Intel Pentium II 200 processor running Windows 98, 2000, or XP; 128 MB of available RAM plus 100 MB of available disk space; a color monitor; and a CD-ROM drive
- For the Macintosh: A Power Macintosh G3 running System 10.1 or later; 128 MB of available RAM plus 100 MB of available disk space; a color monitor; and a CD-ROM drive

The following hardware and software are the minimum required to play back Director movies:

- For Microsoft Windows: An Intel Pentium II 200 processor running Windows 95/98, 2000, XP, or NT version 4.0 or later; 32 MB of installed RAM; Netscape Navigator 4.0 or later, Microsoft Internet Explorer 4.0 or later, or America Online 4.0 or later web browser; and a color monitor
- For the Macintosh OS X: A Power Macintosh G3 running System 10.1 or later; 128 MB of available RAM; Microsoft Internet Explorer 5.1 or later; and a color monitor
- For the Macintosh Classic operating system: A Power Macintosh 180 (G3 recommended) running System 8.6 or later; 32 MB of installed RAM; Netscape 4.0 or later, Microsoft Internet Explorer 4.5 or later, or America Online 4.0 or later web browser; and a color monitor

Installing Director

Follow these steps to install Director on either a Windows or a Macintosh computer.

To install Director on a Windows or a Macintosh computer:

1. Insert the Director CD into the computer's CD-ROM drive and do one of the following:

- In Windows, if the installation program doesn't start automatically, choose Run from the Windows Start menu, type **d:\setup.exe** (where **d** is your CD-ROM drive letter), and click OK.
- On the Macintosh, double-click the Director Installer icon.

2. Follow the onscreen instructions.
3. If prompted, restart your computer.

What's new in Director MX

New features in Director MX build on a proven development environment to make Director more powerful, more tightly integrated with the Macromedia MX product family, and better suited to create content that is accessible to everyone, even those with disabilities.

Developers can deliver rich multimedia content that integrates interactive audio, video, bitmaps, vectors, text, fonts, and more. Director MX lets you work more effectively with the shared Macromedia MX user interface, take advantage of unprecedented Macromedia Flash MX integration, and deliver content to a broader audience.

Integration with other Macromedia MX products

Director MX is truly a part of the Macromedia MX family; this is evident in the workspace, which matches those of other Macromedia MX products, as well as in other aspects of the application's strong integration with Macromedia Flash MX, ColdFusion MX, Flash Communications Server MX, and other Macromedia MX products.

The Macromedia MX workspace lets you organize and customize an environment that's shared among Dreamweaver MX, Fireworks MX, and Macromedia Flash MX. The familiar and flexible working environment helps you maximize productivity. Dockable panels can be grouped and collapsed or expanded as needed for a smooth workflow.

Enhanced control of Macromedia Flash media through Lingo gives you complete access to all properties and methods of Flash MX ActionScript objects. Greatly reduce your development time by directly controlling all elements within your content that were authored in Flash MX.

Access to the Flash MX launch-and-edit feature lets you simply double-click a SWF file to automatically launch Flash MX. Once you edit the file, it's automatically saved and reimported into Director MX. This roundtrip editing significantly streamlines your workflow.

Macromedia Flash Communication Server MX support allows you to use all the functional capabilities provided by Flash Communication Server MX, including the ability to access installed USB or FireWire cameras as well as installed microphones. You can combine the power of the Flash Communication Server MX with Director MX to create multiuser games, distance-learning applications, and real-time collaboration forums. Previous users of the Shockwave Multiuser Server are encouraged to use Flash Communication Server MX. However, the Shockwave Multiuser Server is available on the Director installation CD.

Macromedia Flash MX importing lets you take advantage of the power of Flash MX and its lightweight vector graphics by importing Flash files into Director MX content. Director developers can use this powerful combination to create the most effective multimedia content.

Macromedia Flash Remoting MX provides a secure, high-performance connection between Macromedia ColdFusion MX and Shockwave Player. When used with Director MX, Flash Remoting MX lets you easily pass data to ColdFusion MX and back.

Macromedia Fireworks MX integration gives Director MX developers access to the robust design and production environment of Fireworks MX, allowing developers to create graphics for presentations or Shockwave content. In addition, the tight integration between Fireworks MX and Director MX offers a roundtrip workflow between these graphic and multimedia environments. Integration features include launching and editing, Fireworks MX importing, launching and optimizing, and the Fireworks MX Import Xtra.

Accessible content

Director MX allows you to create content that meets internationally recommended guidelines and government accessibility requirements—including Section 508 guidelines. Director MX lets you add text-to-speech, captioning, and tab-navigation features to web-based Shockwave content or stand-alone applications on both Microsoft Windows and Apple Macintosh systems.

The cross-platform Speech Xtra makes Director MX applications "self-voicing"—that is, text is converted to speech without a screen reader. The user's operating system provides voices at the system level. You can create completely customizable, accessible content that doesn't rely on screen readers. Any user with Shockwave Player and an installed speech engine (which ships with current operating systems) can then use your accessible content.

Drag-and-drop accessibility behaviors in Director MX let you easily control speech and tab ordering, as well as synchronize text with spoken words, in order to repurpose existing Director applications to adhere to accessibility guidelines.

Enhanced power of Director

Director MX introduces many new features that improve on the renowned power of Director to create rich media multimedia content that can be deployed on CDs, DVDs, or corporate intranets—or to more than 300 million web users with Shockwave Player.

Advanced debugging capabilities enhance the power of Lingo, the object-oriented Director programming language. Director MX offers a streamlined professional debugging layout, with everything you need in one convenient place.

The unified Script and Debugger windows let you debug, browse, and edit scripts all in the same window. The Script window switches to debugging mode when a Lingo error or a breakpoint is encountered. You can edit scripts while in debugging mode.

New Script window buttons save you development time when you're working in Lingo. Among the buttons are a button that lets you inspect and debug code faster and realize better input responses when editing large files, a button that pinpoints debugging issues more quickly when working with others, and a button that organizes 3D Lingo commands separately from other Lingo commands for faster 3D debugging.

The Scripting Xtras window helps you organize your third-party scripting Xtra extensions more efficiently. The window detects all installed scripting Xtra extensions, gets their methods and properties, and organizes them in a convenient pop-up menu.

An Object inspector with data browser functionality lets you inspect all properties of script instances, and examine the hierarchy of elements inside 3D cast members and Flash MX sprites. The ability to quickly examine and modify all your movie components reduces both debugging and development time.

Color-coding of recently changed variables makes tracking changes quick and easy with immediate visual feedback. As you step through your code, the Debugger window displays the variables whose values have changed in red.

The split-paned Message window shows you the results of your code changes immediately. Now movies can execute and display information in the Output pane while you enter and execute Lingo commands in the Input pane.

QuickTime 6 support allows you to take advantage of QuickTime 6 features, including support for streaming MPEG4 video and MP3 audio.

Macintosh OS X support lets you create Director MX content using Mac OS X, the modern Apple operating system. You can author in Mac OS X and create Shockwave applications and executables that can be viewed on Mac OS X as well as pre–Mac OS X systems.

Resources for learning Director

The Director package contains a variety of media to help you learn the program quickly and become proficient in creating multimedia—including the printed books *Using Director MX* and *Director MX Lingo Dictionary,* both of which are also available as online help. *Using Director MX* contains two tutorials. The Director MX workspace contains tooltips and context-sensitive help, and additional help is available on the Director MX website at www.macromedia.com/support/director. The new Answers panel in the Director workspace gives you a quick and easy way to find out about the latest Director materials available on the web.

Director Help

Director Help is the comprehensive information source for all Director features. The help system includes complete conceptual overviews of all features, animated examples, descriptions of all interface elements, and a reference of all Lingo commands and elements. Topics are extensively cross-referenced and indexed to make finding information and jumping to related topics quick and easy.

You can access Director Help from the Help menu. To access context-sensitive help, select Help from the Options menu for any panel, palette, or inspector, or click the Help button in any dialog box.

Director MX tutorials

When you're ready to start working in Director, begin with Chapter 2, "Director MX Basics Tutorial," on page 53. The tutorial shows you how to create a basic movie using some of the most useful and powerful features of Director.

If you want to produce 3D content, see Chapter 3, "Director MX 3D Tutorial," on page 103.

Using Director MX manual

This printed manual contains all the information found in Director Help.

Director MX Lingo Dictionary

The *Director MX Lingo Dictionary* is a printed version of all the Lingo topics in Director Help.

Answers panel

The Answers panel provides quick access to information that helps you work effectively with Director. This includes tutorials, TechNotes, and other useful content.

You can get the latest Director information from macromedia.com by simply clicking the Update button in the Answers panel.

Tooltips

When you place the pointer over a Director tool or other workspace feature for a few seconds, a small tooltip appears that explains the function of the item.

Keyboard shortcuts

Many commands that are available from Director menus are also accessible through keyboard shortcuts. When you display a menu or submenu, the appropriate key combinations are shown next to the commands for which keyboard shortcuts are available.

The following illustration shows key board shortcuts for a variety of commands on the Control menu. (The illustration shows Director running on Windows. When Director is running on a Macintosh, the keyboard shortcuts reflect Macintosh keys.)

Director Support Center

The Director Support Center website (www.macromedia.com/support/director/) contains the latest information on Director, plus additional topics, examples, tips, and updates. Check the website often for the latest news on Director and how to get the most out of the program.

Conventions used in Director Help and printed books

The help system and printed books use the following conventions:

- The terms *Lingo* and *Director* refer to Director MX.
- Within the text and in Lingo examples, Lingo elements and parts of actual code are shown in `this` font. For example, `set answer = 2 + 2` is a sample Lingo statement.
- Quotation marks that are part of Lingo statements are shown in the text and Lingo code examples as straight quotation marks (") rather than as curly quotation marks (”).
- The continuation symbol (¬), which you enter by pressing Alt+Enter (Windows) or Option+Return (Macintosh), indicates that a long line of Lingo has been broken onto two or more lines. Lines of Lingo that are broken this way are not separate lines of code. When you see the continuation symbol in this book, type the lines as one line when you enter them in the Script window.
- Variables used to represent parameters in Lingo appear in *italics*. For example, *`whichCastMember`* is commonly used to indicate where you insert the name of a cast member in Lingo.
- Text that you should type is shown in **this** font.

CHAPTER 1
Director Basics

Macromedia Director MX is the tool of choice for legions of web and multimedia developers. With Director, you can create movies for websites, kiosks, and presentations as well as movies for education and entertainment. Movies can be as small and simple as an animated logo or as complex as an online chat room or game. Director movies can include a variety of media, such as sound, text, graphics, animation, and digital video. A Director movie can link to external media or be one of a series of movies that refer to one another.

Your users view completed Director movies in one of the following ways:

- In the Macromedia Shockwave movie format, which plays in Shockwave-enabled web browsers. Millions of web users already have the Shockwave Player on their computers, browsers, or system software. Others have downloaded Shockwave Player, which is free, from Macromedia's website at www.macromedia.com/shockwave/download/.
- In a projector, which plays on your user's computer as a stand-alone application.

Creating a new movie

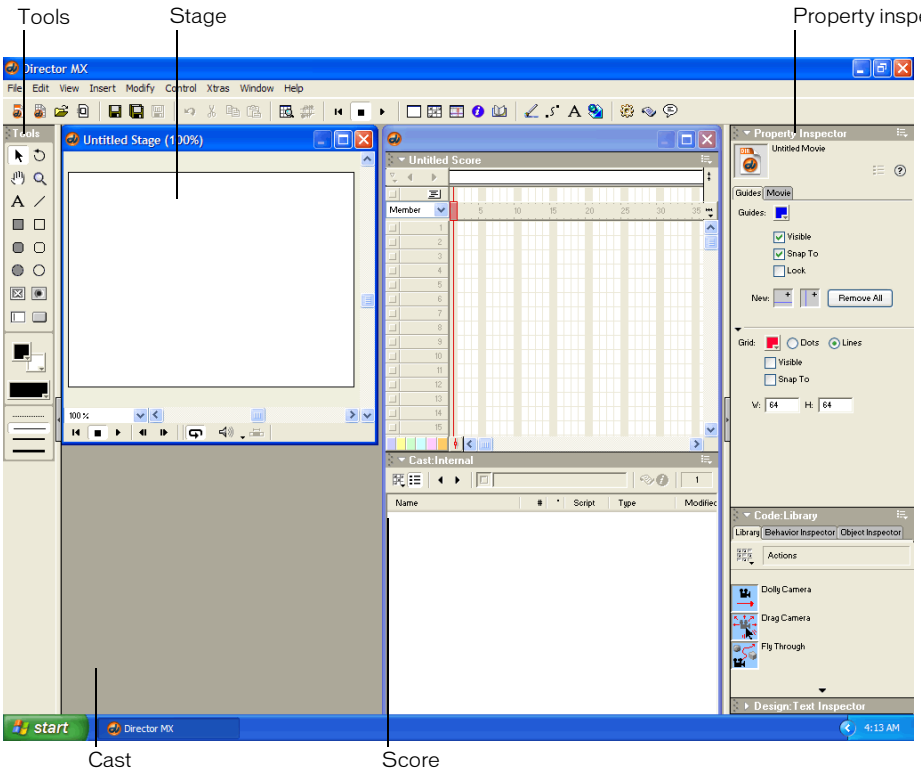
Director is organized around a movie metaphor.

To create a new movie:

- Select File > New > Movie.

Introducing the Director workspace

When you first launch Director, there are several windows in the default layout, including the Stage, the Score, the Cast, and the Property inspector.



Default Director MX window layout (Windows platform)

When creating and editing a movie, you typically work in four of these windows: the Stage, the Score, the Cast, and the Property inspector.

The Stage

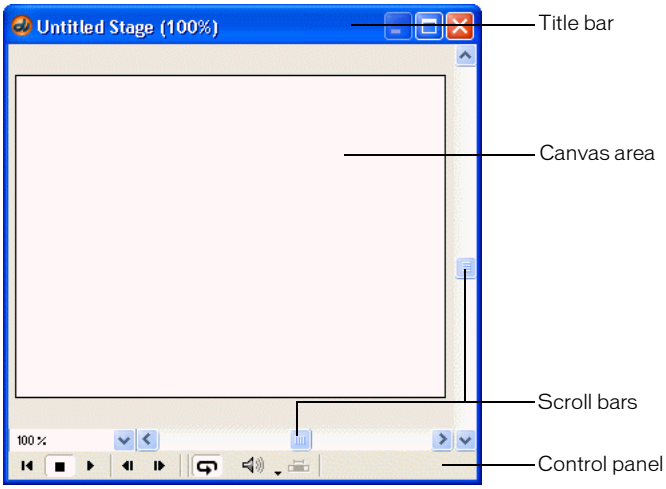
If the Stage is not open, select Window > Stage.

The Stage is the visible portion of a movie on which you determine where your media elements appear.

During authoring, you have the ability to define the properties of your Stage, such as its size and color. As you work on your movie, you can use zooming to make the Stage either larger or smaller than the original movie, while also scaling the coordinates for the Stage objects. To align objects on the Stage, you can select to display guides and grids or use the Align window.

To scroll around the Stage, do one of the following:

- Use the scroll bars. (To show or hide Stage scroll bars, select Edit > Preferences > General and select or deselect Show Stage Scrollbars.)
- Select the Hand tool from the Tool palette and drag inside the Stage to reposition the visible portion.
- Bring the Stage to the front, hold down the Spacebar to temporarily switch to the Hand tool, and then drag inside the Stage to reposition the visible portion.



The Control panel

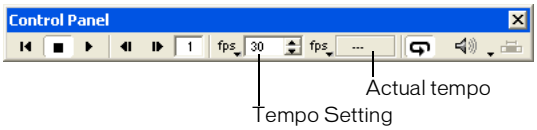
The Control panel governs how movies play back in the authoring environment. To go to a specific frame number in a movie, enter the number in the frame counter, and press Enter (Windows) or Return (Macintosh). You can also use the toolbar buttons or keyboard shortcuts to play a movie.

By default, the Control panel is attached to the bottom of the Stage. You can turn it into a floating panel by detaching it.

To detach the Control panel from the Stage, do one of the following:

- Right-click (Windows) or Control-click (Macintosh) the Control panel. In the context menu, select Detach Control Panel.
- Right-click (Windows) or Control-click (Macintosh) the Property inspector or Tool palette. In the context menu, select Detach Control Panel.

The floating (detached) Control panel displays tempo information that does not appear when the Control panel is attached to the Stage. For more information about tempo, see “About tempo” on page 267.



The floating Control panel

To close the floating Control panel, do one of the following:

- Select Window > Control Panel.
- Press Control+2 (Windows) or Command+2 (Macintosh).

Note: After you close the floating Control panel, you can use these same instructions to reopen it. However, you cannot close a Control panel when it is attached to the Stage; you can only detach it.

To reattach the floating Control panel to the Stage, do one of the following:

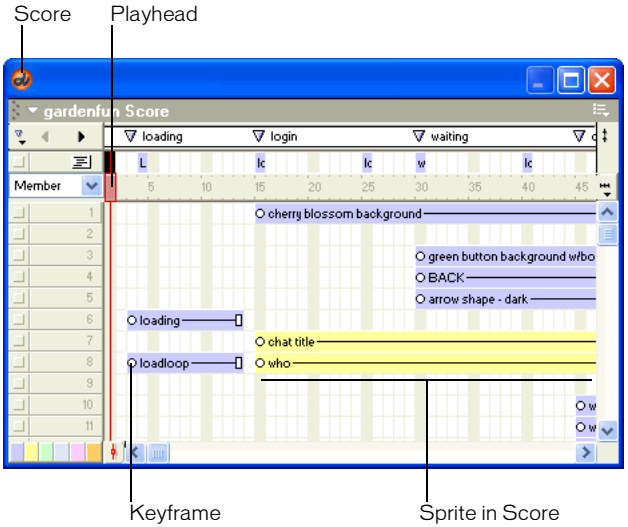
- Right-click (Windows) or Control-click (Macintosh) the Control panel. In the context menu, select Attach Control Panel.
- Right-click (Windows) or Control-click (Macintosh) the Property inspector or Tool palette. In the context menu, select Attach Control Panel.

The Score

If the Score is not visible, select Window > Score.

The Score organizes and controls a movie’s content over time in rows that contain the media, called channels. The Score includes special channels that control the movie’s tempo, sound, and color palettes. The Score also includes frames and the playhead. You use the Score to assign scripts—Lingo instructions that specify what the movie does when certain events occur in the movie.

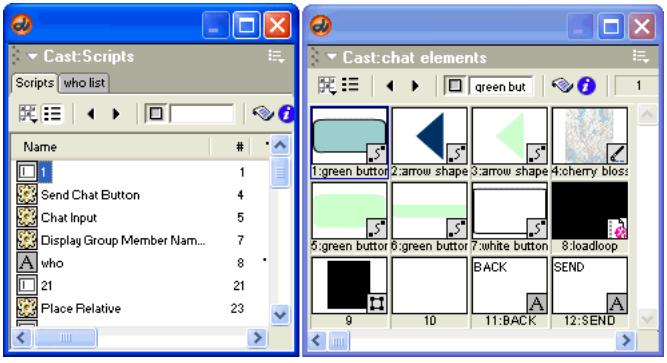
You can control the Score by zooming to reduce or magnify your view and by displaying multiple Score windows. You can also control the Score's appearance by selecting Edit > Preferences > Score.



The Cast window

If the Cast window is not visible, select Window > Cast.

In the Cast window, you can view your cast members, which are the media in your movie, such as sounds, text, graphics, and other movies. Cast members can also include assets that you use in your Score but not on the Stage, such as scripts, palettes, fonts, and transitions. You can create cast members in Director, and you can import existing media to include in your cast. The Cast window lets you view your cast members as a list or as thumbnails, depending on your preference.

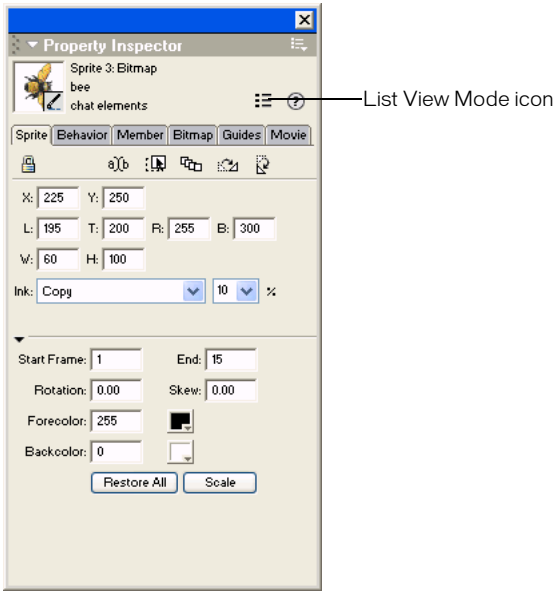


The Property inspector

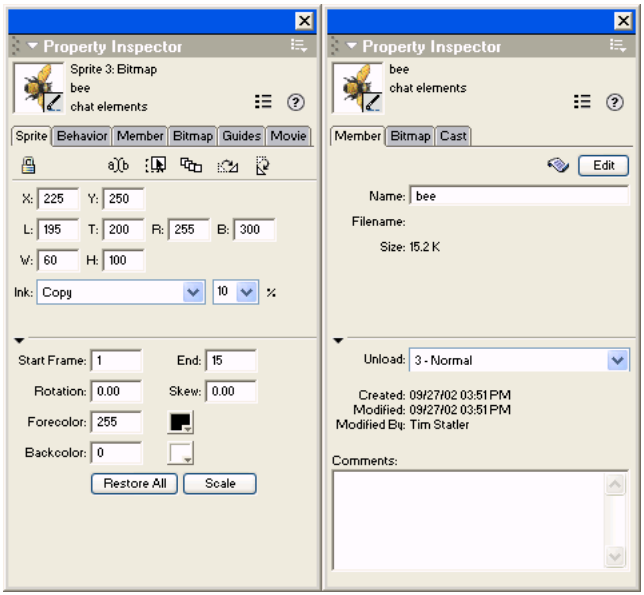
If the Property inspector is not visible, select Window > Property Inspector.

The Property inspector provides a convenient way to view and change attributes of any selected object, or multiple objects, in your movie. After you select an object, relevant category tabs and associated fields appear in the Property inspector. If you select multiple objects, only the information that is common to all the selected objects appears.

The List View Mode icon in the Property inspector lets you toggle between a List and a Graphical view.



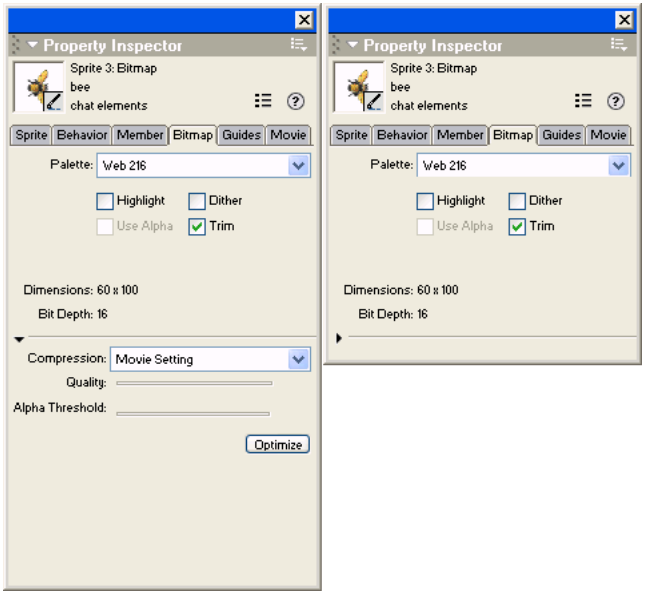
The following illustrations show different information that appears in the Property inspector, depending on what is selected. In the first illustration, a sprite is selected. In the second illustration, a cast member is selected.



To show more or less information in the Property inspector:

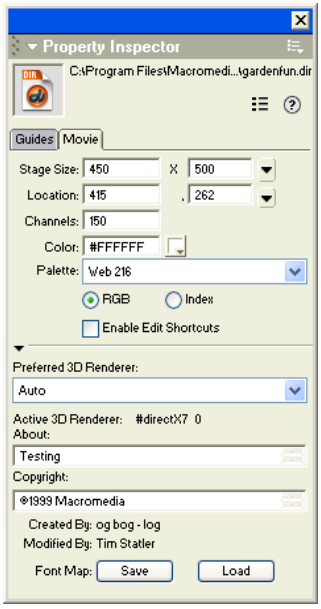
- Click the expander arrow in the Property inspector.

The following illustrations show different information appearing in the Property inspector depending on whether the expanded information is hidden or shown.



Setting Stage and movie properties

You use the Property inspector's Movie tab to specify settings that affect the entire movie, such as how colors are defined, the size and location of the Stage, the number of channels in the Score, copyright information, and font mapping. These settings apply only to the current movie, whereas the settings you select from Edit > Preferences apply to every movie.



To set Stage and movie properties:

1. Click the Movie tab in the Property inspector in Graphical view.
2. To define the size of the Stage, select a preset value from the Stage Size pop-up menu or enter values in the Width and Height fields.
3. To specify the location of the Stage during playback if the movie does not take up the full screen, select an option from the Location pop-up menu or enter values for Left and Top; these values specify the number of pixels the Stage is placed from the upper left corner of the screen, and they apply only if the Stage is smaller than the current monitor's screen size.

   Centered places the Stage window in the center of your monitor. This option is useful if you play a movie that was created for a 13-inch screen on a larger screen or if you're creating a movie on a large screen that will be seen on smaller screens.

   Upper Left places the Stage in the upper left corner of the screen.
4. To specify the number of channels in the Score, enter a value for Channels.
5. To set the color of the Stage for the movie, click the color box next to Color and select a color, or enter an RGB value in the text box on the right.

6 To select a color palette for the movie, select a palette from the Palette pop-up menu. This palette remains selected until Director encounters a different palette setting in the Palette channel.

For a complete discussion of color palettes and using color in Director, see “Controlling color” on page 255.

7 To determine how the movie assigns colors, select either RGB or Palette Index.

RGB makes the movie assign all color values as absolute RGB values.

Palette Index makes the movie assign color according to its position in the current palette.

8 To let users cut, copy, and paste editable fields while a movie is playing, select Enable Edit Shortcuts.

9 To select a default renderer used to draw 3D sprites within the movie, if that renderer is available on the client computer, select one of the following options from the Preferred 3D Renderer pop-up menu:

OpenGL specifies the openGL drivers for hardware acceleration that work with Macintosh and Windows platforms.

DirectX 7.0 specifies the DirectX 7 drivers for hardware acceleration that work only with Windows platforms.

DirectX 5.2 specifies the DirectX 5.2 drivers for hardware acceleration that work only with Windows platforms.

Software specifies Director’s built-in software renderer that works with Macintosh and Windows platforms.

Auto specifies that the most suitable renderer should be selected. This option is the default value for this property.

Note: If the preferred renderer is not available on the client computer, the movie selects the most suitable available renderer.

10 To enter copyright and other information about the movie, enter text in the About and Copyright text boxes.

This information is important if your movie will be downloaded from the Internet and saved on a user’s system.

11 To save the current font map settings in a text file named Fontmap.txt, click Save. To load the font mapping assignments specified in the selected font map file, click Load. See “Mapping fonts between platforms for field cast members” on page 284.

Increasing or decreasing your view of the Stage

You can author in Director on a zoomed Stage—one that is either larger or smaller than the normal size of the movie. Additionally, the Stage includes an offstage canvas area within the Stage window but outside of the active movie area. This canvas area is useful for assembling your media either before or after they appear on the Stage.

The offstage canvas is also useful as a way to preload media in projectors. For example, sprites in a frame, but offstage, are loaded into memory so they are ready to play in the subsequent frame.

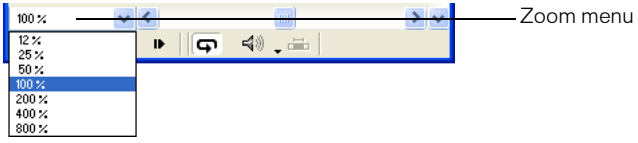
When you change the size of the Stage, any guides or grids you use to assist you with alignment will also scale to the zoomed size, and you can manipulate Stage objects in the same way that you would on a Stage that is not zoomed.

To zoom the Stage, do one of the following:

- Press Control+the Plus (+) key (Windows) or Command+the Plus (+) key (Macintosh) to zoom in and increase the Stage size. Press Control+the Minus (-) key (Windows) or Command+the Minus (-) key (Macintosh) to zoom out and decrease the Stage size. (In Windows, if you want to use the keys on the numeric keypad, NumLock must be off.)

  You can press the keys repeatedly until the Stage is the desired size.

- Select a zoom amount from the Zoom menu in the lower left corner of the Stage.



Note: If you don't see the Zoom menu, select Edit › Preferences › General, check Show Stage Scrollbars, and then click OK.

- Select View > Zoom, and select Zoom Stage In to increase the size of the Stage in increments, Zoom Stage Out to decrease Stage size, or a percentage to select a specific Stage size.
- To zoom in while selecting an area of the Stage to center within the zoomed window, select the Magnifying Glass tool from the Tool palette. Click a point on the Stage to zoom and center.
- To zoom out while selecting an area of the Stage to center within the zoomed window, select the Magnifying Glass tool from the Tool palette. Press Alt (Windows) or Option (Macintosh) while clicking a point on the Stage to zoom and center.

The Stage's title bar indicates the zoom Stage size expressed as a percentage of the normal Stage size.

About Sprites

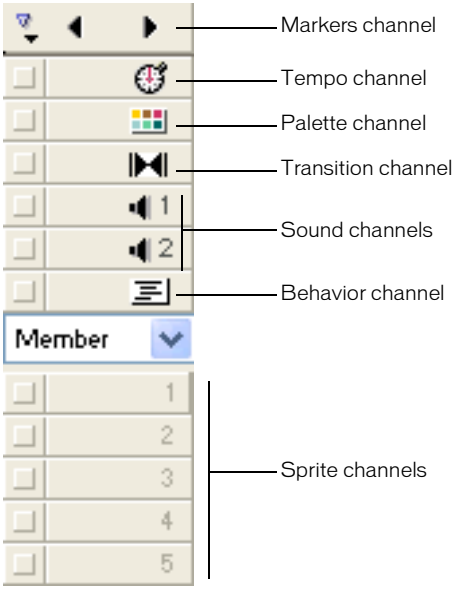
A sprite is an object that controls when, where, and how cast members appear in a movie. You create sprites by placing cast members on the Stage or in the Score. Creating a Director movie consists largely of defining sprites' properties, where they appear, when they appear in the movie, and how they behave. Different sprites can be created from a single cast member. Each sprite can have its own values for different properties, and most changes to these properties do not affect the cast member. Most changes to a cast member, however, will change the sprites created from that cast member.

For information on creating and changing sprites, see "Creating sprites" on page 157.

About channels in the Score

Channels are the rows in the Score that control your media. The Score contains sprite channels and special effects channels.

Sprite channels are numbered and contain sprites that control all visible media in the movie. Effects channels at the top of the Score contain behaviors as well as controls for the tempo, palettes, transitions, and sounds. The Score displays channels in the order shown in the following figure.



The first channel in the Score contains markers that identify places in the Score, such as the beginning of a new scene. Markers are useful for making quick jumps to specific locations in a movie. See “Using markers” on page 42.

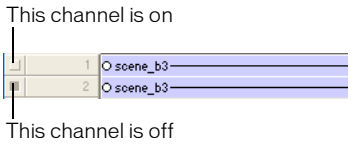
Although the Score can include as many as 1000 channels, most movies use as few channels as possible to improve performance in the authoring environment and during playback. Sprites in higher channels appear on the Stage in front of sprites in lower channels. Use the Property inspector’s Movie tab to control the number of channels in the Score for the current movie. See “Setting Stage and movie properties” on page 27.

Turning channels on and off

To hide the contents of any channel on the Stage, or to disable the contents if they are not visible sprites, you use the button to the left of the channel. When you turn off a special effects channel, the channel’s data has no effect on the movie. You should turn off Score channels when testing performance or working on complex overlapping animations. Turning off a channel has no effect on projectors or Shockwave.

To turn off a Score channel:

- Click the gray button to the left of the channel. A darkened button indicates that the channel is off.

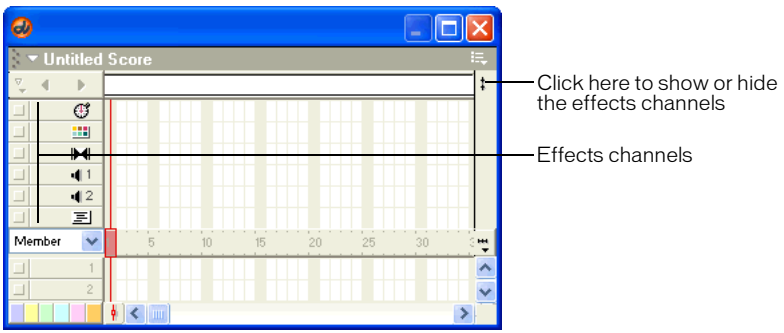


To turn multiple Score channels off and on:

- Press Alt (Windows) or Option (Macintosh), and click a channel that is on to turn all the other channels off, or click a channel that is off to turn the other channels on.

To show or hide the special effects channels:

- Click the Hide/Show Effects Channels button in the upper right corner of the Score to change the display.

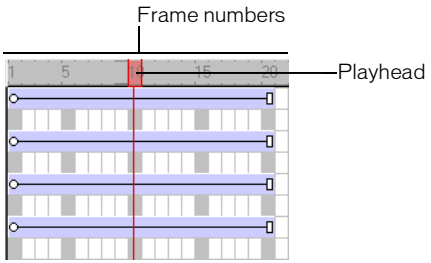


About Frames

A frame in a movie represents a single point in time, which is similar in theory to a frame in a celluloid film. Numbers are listed horizontally in the sprite and special effects channels represent frames. Setting the number of frames displayed per second sets the movie's playback speed.

About the playhead

The playhead moves through the Score to show the frame currently appearing on the Stage. As you play your movie, the playhead automatically moves through your Score. You can also click any frame in the Score to move the playhead to that frame, and you can drag the playhead backward or forward through frames.



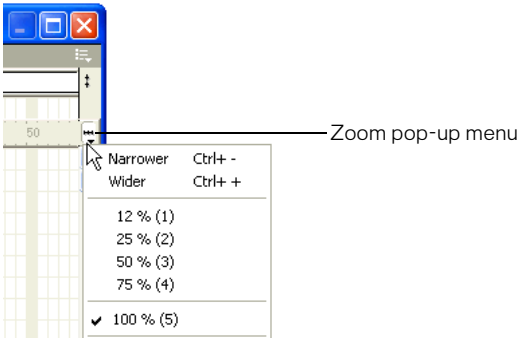
Changing your view of the Score

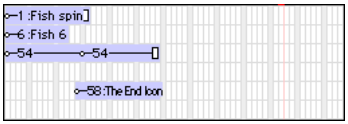
To narrow or widen the Score, you change the zoom percentage. Zooming in widens each frame, which lets you see more data in a frame. Zooming out shows more frames in less space and is useful when moving large blocks of Score data.

To change the zoom setting:

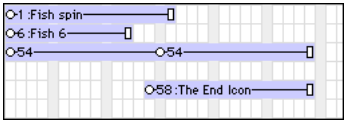
- Select View > Zoom, and then select an option.

- Select an option on the Zoom pop-up menu to the right of the Score.

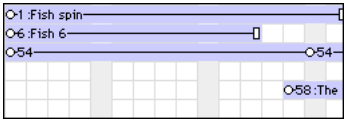




Score zoomed out to 50%



Score at 100%



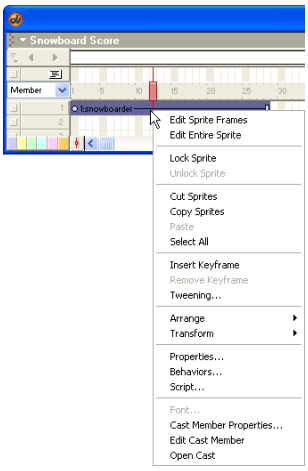
Score zoomed in to 200%

You can also display more frames in a Score without changing the zoom setting. To do so, place a sprite in the rightmost frame of the Score. Director automatically displays additional frames in the current view of the Score.

Using context menus

To let you quickly access certain commands, Director provides context menus that display commands that are relevant to a particular element. These menus are called context menus because the commands on the menu vary, depending on the context in which the menu appears.

In the following illustration, Director shows the context menu for a sprite.



To display a context menu:

- Position your mouse pointer over an element and then right-click (Windows) or Control-click (Macintosh).

Managing the workspace in Director MX

In Director MX, you can customize your workspace to maximize your productivity. You can group panels together in a tabbed view to form a panel group, expand and collapse panels and panel groups, and dock panels or panel groups to each other or to the Director application window (Windows only). You can dock panels to each other in the Macintosh and Windows versions of Director MX.

Window types

There are two types of windows in Director MX: document windows and tool windows. You typically use document windows to create or edit content, and tool windows to view or modify properties of that content. For example, the Paint window is a document window, and the Property inspector is a tool window.

The distinction between the two windows types is important for understanding panel docking and panel grouping. For more information see “Docking panels” on page 37 and “Working with panel groups”.

The following is a list of document windows in Director MX.

- Stage
- Score
- Cast
- Script
- Message
- Media editors (Paint, Vector Shape, Text, Field, QuickTime, Shockwave 3D, RealMedia, AVI Video)

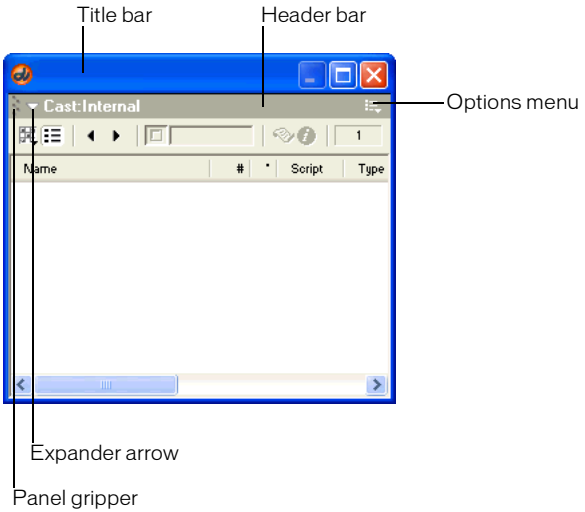
The following is a list of tool windows.

- Property inspector
- Tool palette
- Object inspector
- Library palette
- Behavior inspector
- Text inspector
- Memory inspector
- Control panel
- Onion Skin
- Align
- Color palettes
- Markers
- Tweak

Managing panels and panel groups

A panel is a window that you can group with other panels to form a panel group, dock to other panels or (Windows only) to docking channels in the application window itself, and collapse and expand panels to save work space.

Panels have the following features: a header bar that displays the name of the panel, a title bar, an expander arrow to collapse and expand panels, a panel gripper to dock and undock panels, and an Options menu for managing panels.



Note: The Stage and Control panel do not have header bars, and the Stage, Control panel and Tool palette do not have Options menus.

To open a panel or panel group, do one of the following:

- Select the window name from the Window menu.
- Use the keyboard shortcut for the window.

To close a panel or panel group, do one of the following:

- Select Close Panel Group from the panel's Options menu. For more information on using the Options menu see "Using panel Options menus" on page 40.
- Right-click (Windows) or Control-click (Macintosh) on the panel group's header bar, and select Close Panel Group.
- Select the window name from the Window menu, or use the keyboard shortcut for the window (undocked panels only).

  Docked panels will collapse rather than close if you perform this last option. For more information on docking, see "Docking panels" on page 37.

To collapse or expand a panel or panel group, do one of the following:

- Click the expander arrow or the panel's title in the header bar.
- Select the window name from the Window menu, or use the keyboard shortcut for the window (docked panels only).

  Note: Floating panels will close rather than collapse. For more information on docked and floating panels see "Docking panels" on page 37.

To hide all panels:

- Select Window > Hide Panels, or press the F4 key on your keyboard. Repeat this command to show all panels.

  Note: The Hide Panels menu command hides all floating (non-docked) tool windows and all docking channels (Windows only). Document windows (such as the Stage, Score, and Script windows) are unaffected. For more information on the difference between document and tool windows see "Window types" on page 34. For more information on docked and floating panels see "Docking panels" on page 37.

Docking panels

You can dock panels in two ways: to each other and (Windows only) to the docking channels contained by the application window. In Windows, the docking channels run along the left and right sides of the application window. The area between these docking channels is called the View Port.

To collapse or expand a docking channel:

- Click the Drawer button located in the center of the docking channel's separator bar.

  Collapsing a docking channel increases the space allocated to the View Port.

To resize a docking channel:

- Drag the docking channel's separator bar.

Panel docking is restricted by window type. On both Macintosh and Windows versions of Director MX, document windows can be docked together (for example, the Score window with the Cast window), and utility windows can be docked together (for example, the Property inspector with the Behavior inspector). A document window cannot be docked with a utility window, however.

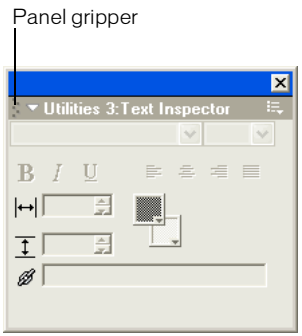
In Windows, document window types cannot be docked; utility-type windows can be docked only in the right and left docking channels. Macintosh versions of Director do not have docking channels.

Note: Both the Stage and the Tool palette are exceptions to these docking rules. Neither the Stage nor the Tool palette can be docked to any other panel, and the Stage cannot be docked to a docking channel. However, the Tool palette can dock to the left or right docking channels.

You use the panel gripper to dock panels to each other or to a docking channel.

To dock a panel or panel group:

- Drag the panel or panel group by its gripper over another panel or panel group, or (in Windows only) over a docking channel.



As you drag the panel over a docking area, a placement preview line or rectangle shows where it will be placed among the panel groups.

To undock a panel group:

- Drag the panel group by its gripper until its outline indicates that it's no longer docked.

Document windows float over the View Port when the docking channels are open. You can maximize a document window so that it completely fills the View Port (Windows only).

To fill the View Port with a floating document window, do one of the following:

- Double-click the Title bar of the document window (Windows only).
- Click the Maximize button (Windows only).

Note: To return the document window to its original state, double-click the Title bar again or click the Restore Down button (Windows only).

Working with panel groups

You can combine individual panels to form a panel group or tabbed panels. Windows that you can combine in a panel group are restricted by window type and functionality.

The following types of panel groupings are allowed:

- Casts with other casts
- Media editor windows with other media editors (for example, Vector Shape with Shockwave 3D)
- Script windows with media editors (for example, Script with Paint)
- Utility windows with other utility windows (for example, Text inspector and Memory inspector windows)

You can use a panel or panel group's Options menu to add or remove members of a panel group, rename the panel or panel group, or rearrange the order of tabs in a panel group.

You cannot group or rename the Property inspector, Tool palette, or Stage.

To group a panel with another panel or panel group:

1. Select a panel or tab within a panel group.
2. From the panel's Options menu, select Group [panel name] With, and then select a panel or panel group name from the submenu that appears.

To remove a panel (tab) from a panel group:

1. Select a tab within a panel group.
2. From the panel group's Options menu, select Group [panel name] With, and then select New Panel Group from the submenu that appears.

   The selected panel opens in its own floating panel.

   Note: The New Panel Group submenu option is dimmed if the panel group only contains a single panel.

To rename a panel group:

1. Select Rename Panel Group from the panel's Options menu.
2. In the Rename Panel Group dialog box, enter a new name for the panel in the Panel Group Name text box, and click OK.

To rearrange the order of tabs within a panel group:

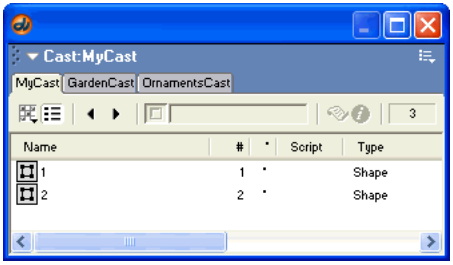
1. Select a tab within a panel group.
2. Select Group [Panel Name] With from the panel group's Options menu. Then select the name of the panel group that contains the selected panel.

   The tab is moved to the last (right-most) position in the panel group.

Note: Whenever you make changes to your panels, it's a good idea to save your panel layout. See "Saving panel layouts" on page 40.

Managing Casts

When casts are grouped with other casts, they appear as tabs in the Cast panel group.



To save the configuration of your Cast panel tabs, you must save the panel layout before closing your file. When you open the file again, restore the tab configuration by opening the panel layout you created. See "Saving panel layouts" on page 40.

For more information about Cast panel management, see Chapter 4, "Cast Members and Cast Windows," on page 127.

Using panel Options menus

Each panel and panel group has an Options menu located in its upper right corner. The Options menu contains items for grouping, closing, and renaming panels.

To use a panel's Options menu:

1. Expand the panel, if necessary, by clicking the panel's expander arrow or the title next to the expander arrow.
2. Click the Options menu control in the upper right of the panel, and select the desired menu item.

   Help launches the page in the help system that is relevant to the current panel.

   Maximize Panel Group maximizes the panel to occupy the entire height of the docking channel.

   Group [panel name] With lets you group the currently selected tab in a panel group with another panel or panel group.

   This menu item is not available for all windows. For more information on panel grouping restrictions, see "Working with panel groups" on page 38.

   Rename Panel Group opens the Rename Panel Group dialog where you can rename the panel or panel group. If the current window cannot be renamed, this item is dimmed. For more information, see "Working with panel groups" on page 38.

   Close Panel Group closes the panel group.

Saving panel layouts

You can save the current panel layout as well as open or remove a layout you have previously saved. You can save as many panel layouts as you want. You can also restore the default panel layout used by Director.

To save a panel layout:

1. Select Window > Panel Sets > Save Panel Layout.
2. Name the panel layout, and click OK.

To open a saved panel layout:

- Select Window > Panel Sets, and select a saved panel layout from the submenu.

  Select Default from the Panel Sets submenu to open the default panel layout.

To remove a panel layout:

1. Select Window > Panel Sets, and select a panel layout from the submenu.
2. In the Remove Panel Set dialog box, click Remove.

   You cannot remove the Default panel set.

Using multiple Score windows

You can view and work in different parts of a movie at the same time by opening additional Score windows. If your sprite bars occupy many frames in the Score, for example, you can open a second Score window to work on another place in the movie without scrolling. You can also drag sprites from one Score window to another.

To open a new Score window:

1. Activate the current Score window.
2. Select Window > New Score Window.

You can scroll in this window to a different location in the Score.

Changing Score settings

To control the appearance of the Score and the information that appears in numbered sprite channels, you set preferences for the Score. By doing so, you can display a script preview and cast member information.

To change Score settings:

1. Select Edit > Preferences > Score.
2. The Extended display option lets you display information within sprites in the Score. See "Displaying sprite labels in the Score" on page 165. To specify what cast member information appears in numbered sprite channels when Extended display is on, select from the following options:

   Cast Member displays the cast member number, name, or both.

   Behaviors displays the behaviors attached to the sprite.

   Ink Mode displays the type of ink applied to the sprite.

   Blend displays the blend percentage applied to the sprite.

   Location shows the sprite's *x* and *y* screen coordinates.

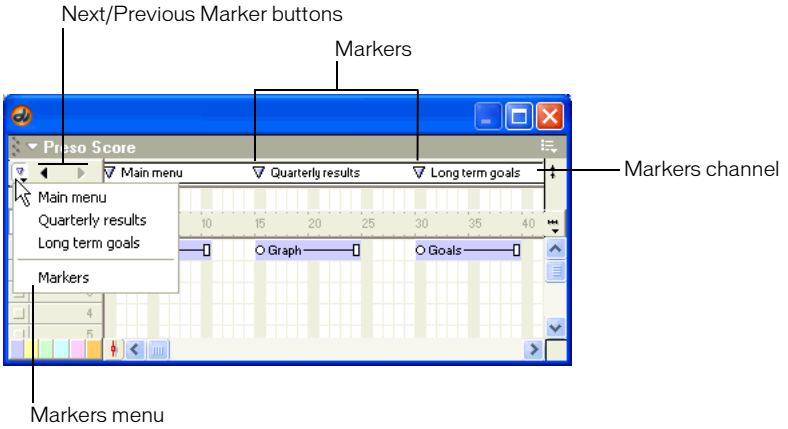
   Change in Location shows the change in *x* and *y* coordinates relative to the previous cast member in that channel.
3. To display the first few lines of the selected script in a box at the top of the Score, select Script Preview.
4. To display the cast member's name and number when the pointer is over a sprite for a few seconds, select Show Data Tips.

Using markers

Markers identify fixed locations at a particular frame in a movie. You use markers when you're defining navigation. Using Lingo or draggable behaviors, you can instantly move the playhead to any marker frame. This is useful when jumping to new scenes from a menu or looping while cast members download from the web. You can also use markers while authoring to advance quickly to the next scene.

After you mark a frame in the Score, you can use the marker name in your behaviors or scripts to refer to exact frames. Marker names remain constant, no matter how you edit the Score. They are more reliable to use as navigation references than frame numbers, which can change if you insert or delete frames in the Score.

You can use the Markers window to write comments that are associated with markers you set in the Score and to move the playhead to a particular marker.



To create a marker:

1 Click the markers channel.

A text insertion point appears to the right of the marker.

2 Type a short name for the marker.

To delete a marker:

- Drag the marker up or down and out of the markers channel.

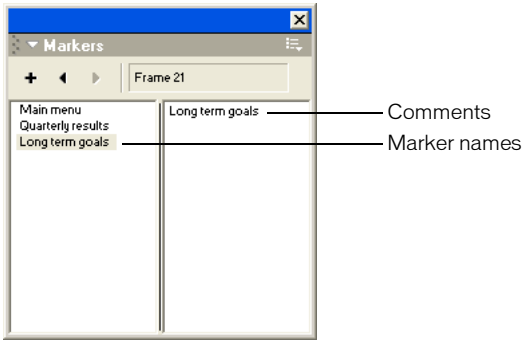
To jump to markers while authoring, do any of the following:

- Click the Next Marker and Previous Marker buttons on the left side of the markers channel.
- Press the 4 and 6 keys on the numeric keypad to cycle backward and forward through markers.
- Select the name of a marker from the Markers menu

To enter marker comments:

1 Move the playback head to a marker, and select Window > Markers.

The Markers window opens and displays comments associated with that frame.



Comments associated with markers appear in the right column. By default, the marker name appears as the first line of text in the comments column and should not be removed.

Note: Use Control+Left Arrow or Control+Right Arrow (Windows) or Command+Left Arrow or Command+Right Arrow (Macintosh) to move to the previous or next marker.

2 To enter comments, click to the right of the marker name that appears in the comments column. When the insertion point appears, click again to deselect the marker name, and press Control-Enter (Windows) or Control-Return (Macintosh) to start a new line. Then, start typing your comments.

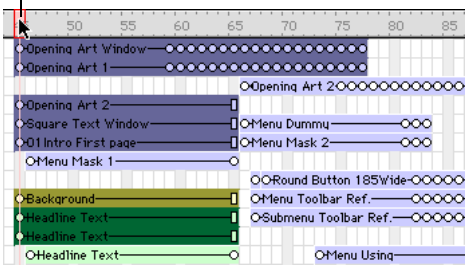
Selecting and editing frames in the Score

You can select a range of frames in the Score and then copy, delete, or paste all the contents of the selected frames.

To move, copy, or delete all the contents of a range of frames:

1 Double-click in the frame channel to select frames.

Double-click here to select all sprites in a frame, including markers, special effects, and sounds. Double-click and drag to select a range of frames.



2 If you want to move or copy frames, select Edit > Cut Sprites or Edit > Copy Sprites.

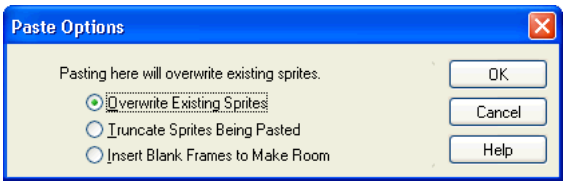
3 If you want to delete frames, select Edit > Clear Sprites, or press the Delete key on your keyboard.

If you cut, clear, or delete the selected frames, Director removes the frames and closes up the empty space.

Note: To delete a single frame, you can also select Insert › Remove Frame.

4 To paste frames that you have cut or copied, select any frame or sprite, and select Edit > Paste Sprites.

If there aren't enough empty frames available for the entire sprite to be pasted, the Paste Options dialog box appears, so you can decide how you want the frames to be pasted.



Overwrite Existing Sprites copies the entire sprite over the frames of any existing sprites

Truncate Sprites Being Pasted pastes the sprite into the number of available empty frames by shortening its frame span.

Insert Blank Frames to Make Room inserts frames into the Score so the entire sprite can fit without being truncated or overwriting other sprites

To add new frames:

1 Select a frame in the Score.

2 Select Insert > Frames.

3 Enter the number of frames to insert.

The new frames appear to the right of the selected frame. Sprites in the frames you select are extended or tweened. For more information about tweening, see Chapter 6, "Animation," on page 185.

About adding interactivity with Lingo

Lingo, the scripting language of Director, adds interactivity to a movie. Lingo can accomplish many of the same tasks—such as moving sprites on the Stage or playing sounds—that you can accomplish using the Director interface.

Much of Lingo's usefulness, however, is in the flexibility it brings to a movie. Instead of playing a series of frames exactly as the Score dictates, Lingo can control the movie in response to specific conditions and events. For example, whether a sprite moves can depend on whether the user clicks a specific button; when a sound plays can depend on how much of the sound has already streamed from the Internet.

Director includes a set of prepackaged Lingo instructions, called behaviors, that you can simply drag to sprites and frames. Behaviors let you add Lingo's interactivity without writing Lingo scripts. You can modify behaviors or create your own. For more information about the behaviors included with Director, see "Using Director Behaviors" in the Director Support Center at www.macromedia.com/support/director/lingo/d8/d8behaviors.html.

If you prefer writing scripts to using the Director interface and behaviors, Lingo provides an alternative way to implement common Director features. For example, you can use Lingo to create animation, stream movies from the web, perform navigation, format text, and respond to user actions with the keyboard and mouse.

Writing Lingo also lets you do some things that the Score alone cannot do. For example, Lingo's lists let you create and manage data arrays, and Lingo operators let you perform mathematical operations and combine strings of text.

For more general information about Lingo, see Chapter 16, "Writing Scripts with Lingo," on page 385.

Converting movies created in previous versions of Director

Director MX can convert movies from Director 7 and later. It's not necessary to update movies created in Director 8 or Director 8.5 for use in Director MX.

You can also update movies to Director MX by simply opening and saving them, but the Update Movies command is faster for converting large projects. It's also more effective for preserving links to external media. See "Processing movies with Update Movies" on page 585.

Note: Macromedia Shockwave Player 8.5 can play Shockwave movies created with Director 5, 6, 7, 8, and Director MX.

When you open a Director 7 movie in Director MX or convert it to the new format with Update Movies, the following changes occur to the movie:

- The data structure is changed to the latest file format.
- Shapes are not converted to the new Bézier shapes.
- Ink functionality is not updated unless you turn off Maintain Outdated Ink Mode Limitations in the Movie Properties dialog box.
- Old Score data, from versions of Director before Director 5, is converted to the new Score, combining adjacent frames in the old Score containing the same cast members into single sprites in the new Score. You might want to split or join sprites to make working in the Score more convenient.

Managing the Director authoring environment

While you work on a movie, you can use several optional controls and features to increase your productivity. You can change preferences for Director interface functions and Internet connection features, and you can print movies to see your work on paper. You can also monitor memory use with the Memory inspector (Windows only).

Setting general preferences

To control some of the Director default settings for the Stage and the user interface, you can use the General Preferences dialog box. These settings control the appearance of movies only in the authoring environment, not during playback.

To set Director default values:

1. Select Edit > Preferences > General.
2. To specify the default size and location of the Stage and the way it animates when deactivated, select Stage options.

   The Stage location settings affect the location of the Stage only in the authoring environment. To set the location of the Stage during playback, see "Setting Stage and movie properties" on page 27.

   Use Movie Settings sets the Stage size to the movie's Stage size and location.

   Match Current Movie opens a new movie in the Stage size of the movie that's currently open.

   Center positions the Stage in the center of the screen by default, which is useful if the Stage size is smaller than the screen size. Otherwise, the movie plays using its original Stage position.

   Reset Monitor to Movie's Color Depth (Macintosh only) automatically changes the color depth of your monitor to the color depth of a movie when it is open in the authoring environment. See "Changing the color depth of a movie" on page 256.

   Animate in Background runs animation in the background while you work with other applications. When you are running animation in the background, the Stage remains on the screen, and the active application window appears in front of the Stage.
3. To set defaults for the Director user interface, select User Interface options:

   Dialogs Appear at Mouse Position displays dialog boxes at the mouse pointer position. If this option is not selected, dialog boxes are centered on the monitor that contains the menu bar.

   Save Window Positions on Exit saves the positions of all open windows every time you quit so they reappear in the same location when you start again.

   Message Window Recompiles Scripts makes Director recompile all scripts when you press Enter (Windows) or Return (Macintosh) in the Message window. With this option off, Director recompiles scripts only when you select Control > Recompile All Scripts.

   Show Tooltips controls the definitions that appear when the pointer is over tools and buttons. Turn off this option to stop definitions from appearing.

   Show Stage Scrollbars makes scroll bars appear in the Stage window.
4. To specify the unit of measure to use in the text ruler, select inches, centimeters, or pixels from the Text Units pop-up menu. See "Formatting paragraphs" on page 278.
5. (Macintosh only) To let Director use available memory beyond its allocation, turn on Use System Temporary Memory.

Choosing Internet connection settings

Director can connect to the Internet to import cast members and retrieve data. Use settings in the Network Preferences dialog box to control how the connection works and to define a preferred browser.

To select Internet connection settings:

1. Select Edit > Preferences > Network.
2. To specify the browser to launch when a movie running in the authoring environment encounters the `gotoNetPage` Lingo command, enter the path to the browser in the Preferred Browser text box.

   To locate the browser, click the Browse button.
3. To enable or disable browser launching, select Launch When Needed.
4. To specify the amount of space that Director can use to cache data from the Internet on your hard disk, enter a value in the Disk Cache Size field.
5. To immediately empty the cache, click Clear.
6. To specify how often cached data is compared with the same data on the server, select one of the following Check Documents options:

   Once Per Session checks for data revisions only once from the time you start to the time you quit the application. This option improves performance but might not always display the most current version of a page.

   Every Time checks for changes whenever you request a page. This option slows performance but ensures you are always viewing the most current version of a page.
7. To specify the configuration of your system's proxy server, select one of the following Proxies options:

   No Proxies specifies that you have a direct connection to the Internet.

   Manual Configuration controls proxy settings for your system. Enter the HTTP or FTP URL and port number.

   Browsers usually don't require proxy servers to interact with the network services of external sources, but in some network configurations where a firewall blocks the connection between the browser software and a remote server, interaction with a proxy might be required.

   A firewall protects information in internal computer networks from external access, and in doing so, it can limit the ability to exchange information. To overcome this limitation, browser software can interact with proxy software. A proxy server interacts with the firewall and acts as a conduit, providing a specific connection for each network service protocol. If you are running browser software on an internal network from behind a firewall, you need the name and associated port number for the server running proxy software for each network service.

Printing movies

You can print movie content to review it and mark changes, to distribute edits to a team, to make handouts from a presentation, or to see your work on paper. You can print a movie while in authoring mode in several ways. You can print an image of the Stage in standard or storyboard format, the Score, the cast member number and contents of text cast members in the Cast window, all scripts or a range of scripts (movie, cast, Score, and sprite scripts), the comments in the Markers window, the Cast window artwork, or the entire Cast window.

Note: Using Cast Text on the Print pop-up menu, you can print a table of text cast members at the resolution of your printer.

You can also use Lingo to control printing. See printFrom in the *Lingo Dictionary*.

To print part of a movie:

1. Select File > Print.
2. To specify what part of the movie to print, select an option from the Print pop-up menu.

   You can print an image of the Stage, the Score, all scripts or a range of scripts (movie, cast, Score, and sprite scripts), cast text, cast art, cast thumbnails, and the comments in the Markers window.

   The Scripts, Cast Text, Cast Art, and Cast Thumbnails print options specify a range of casts and cast members—internal or external. Information that appears in the Print dialog box depends on the selection to be printed.
3. To specify which frames of your movie are printed, select one of the following Frames options:

   Current Frame prints the frame that is currently on the Stage.

   Selected Frames prints the frames that are selected in the Score.

   All prints all the frames in your movie.

   Range prints the range of frames specified in the Begin and End boxes.
4. To specify which frames in the defined range to print, select one of the following Include options:

   Every Frame is the default setting and prints every frame that is specified in Range.

   One in Every [number] Frames prints frames at the interval you specify in the text box. For example, if you enter 10, Director prints every tenth frame.

   Frames with Markers prints only the frames that have markers in the Score window.

   Frames with Artwork Changes in Channel [number] prints the frames in which cast members move or in which new cast members are introduced in the Score. Specify the channel number in the text box.

5 To determine the layout of the items to print, click Options and select from the following:

Scale provides options to print at 100%, 50%, or 25% of the original size.

Frame Borders creates a border around each frame.

Frame Numbers prints the frame number with each frame.

Registration Marks places marks on every page to align the page for reproduction.

Storyboard Format is available only when you select 50% or 25% images to print. This option places marker comments next to the frame image.

Date and Filename in Header prints a header on each page. The header consists of the name of the Director movie and the current date.

Custom Footer prints a footer on each page. Type the footer in the field.

The image at the left of the dialog box previews the layout options.

Monitoring memory use

The Memory inspector displays information about how much memory is available to Director for your movie and indicates how much memory different parts of the current movie use and the total disk space the movie occupies. It also can purge all removable items from RAM if you are about to perform a memory-intensive operation.

Note: The Memory inspector is not available on Macintosh.

To use the Memory inspector:

1 Select Window > Memory Inspector.

2 Observe the following memory use indicators:

Total Memory displays the total system memory available, including the amount of RAM installed on your computer and any available virtual memory.

Physical Memory shows the amount of actual RAM installed in the system.

Total Used indicates how much RAM is being used for a movie.

Free Memory indicates how much more memory is currently available in your system.

Other Memory indicates the amount of memory used by other applications.

Used by Program indicates the amount of memory used by Director (excluding the amount of memory used by the Director application file).

Cast and Score indicates the amount of memory used by the cast members in the Cast window and the notation in the Score window. Cast members include all the artwork in the Paint window, all the text in the Text windows, cast members that use the Matte ink in the Score, thumbnail images in the Cast window, and any sounds, palettes, buttons, digital video movies, or linked files that are imported into the cast and are currently loaded into memory.

Screen Buffer shows how much memory Director reserves for a working area while executing animation on the Stage.

3 To remove all purgeable items from RAM, including all thumbnail images in the Cast window, click Purge.

All cast members that have Unload (purge priority) set to a priority other than 0–Never (as specified in the Property inspector's Member tab) are removed from memory. This procedure is useful for gaining as much memory as possible before importing a large file. Edited cast members are not purged.

About using Xtra extensions to extend Director functionality

Xtra extensions are software components that extend Director functionality; some Xtra extensions are installed with Director and others are available through third-party developers. Xtra extensions provide capabilities such as importing filters and connecting to the Internet. You can use preexisting Xtra extensions and, if you know the C programming language, you can create custom Xtra extensions.

For information on creating Xtra extensions, download the Xtras Developer's Kit from the Director Support Center at www.macromedia.com/support/xtras/.

You must distribute any Xtra that a movie requires along with the movie. Xtra extensions can be packaged with projectors, or your user can download your required Xtra extensions from the Internet. See "Managing Xtra extensions for distributed movies" on page 574.

If your user is missing an Xtra that Director requires, an alert appears when the movie opens. For missing Xtra transition cast members, the movie performs a simple cut transition instead. For other missing Xtra cast members, Director displays a red X as a placeholder.

Types of Xtra extensions

The following types of Xtra extensions are supplied with Director:

- Cast member Xtra extensions provide new media types to Director. They create or control a wide range of objects for use as cast members.

  Some of the cast member types built into Director, such as Shockwave Flash, Vector Shape, and Animated GIF, are provided as Xtra extensions. Xtra extensions from third-party developers can include databases, 3D graphics processors, special types of graphics, and so on. Cast member Xtra extensions that are built into Director appear on the Insert > Media Element menu. Other cast member Xtra extensions might not appear on this menu and might require Lingo implementation.

  When setting properties for an Xtra cast member, use the Property inspector, which provides settings standard to all types of Xtra cast members. If there are settings that are unique to the current Xtra, you must click Option to open a second Properties dialog box that lets you change those settings.

  Some cast member Xtra extensions have separate authoring and playback components. You should include only the playback components when distributing movies.

- Importing Xtra extensions provide the code that is required to import various types of media into Director. When you link a movie to an external file, Director uses the importing Xtra to import the media every time the movie runs. To distribute a movie with external linked media, you must also include the Xtra that is required to import that type of media.

- Scripting Xtra extensions add Lingo elements to predefined Lingo scripts. The NetLingo Xtra, for example, provides special Lingo elements for controlling Internet functions.

- Transition Xtra extensions supply transitions in addition to the predefined transitions that are available in the Frame Properties: Transition dialog box.
- Tool Xtra extensions provide useful functions in the authoring environment, but they don't do anything while a movie runs. They do not have to be distributed with movies.

About installing Xtra extensions

To make custom Xtra extensions available to Director, place them in the Xtras folder located in the same folder as the Director application. You must do this before you launch Director.

An Xtra can be stored in a folder up to five folders below the Xtras folder.

When you launch Director, you can use the `openXlib` command to open Scripting Xtra extensions that are located in any folder. If you open an Xtra this way, you must use the `closeXlib` command to close it when Director finishes with it.

Copies of the same Xtra can have different filenames or have the same filename but reside in different folders. If duplicate Xtra extensions are available when Director launches, Director displays an alert. Delete any duplicate Xtra extensions.

Director automatically closes Xtra extensions when the application quits.

To make any Director movie appear on the Xtras menu and open as a movie in a window during authoring, place it in the Xtras folder.

About distributing movies

When you finish creating a movie, you have several choices about how to distribute it to users. You can distribute the movie as a Shockwave movie that plays within a web page or as a projector that downloads to the user's computer or that you distribute on a disk.

- A Shockwave movie is a compressed version of the movie data only.
- A projector is a stand-alone version of a movie. You can include several movies in a single projector. Projectors appear on the system desktop as applications.

For more information about distributing movies, see Chapter 26, "Packaging Movies for Distribution," on page 571.

Movies that are distributed from the Internet can begin playing as soon as the content for the first frame is downloaded. This process is called streaming. You can control streaming with behaviors that make the movie wait for media at certain frames, or you can specify that a movie download completely before it begins playing. See "Setting movie playback options" on page 592.

To create a Shockwave movie that can play in a web page, you use the Publish command. Director leaves your original movie in its .DIR format. Director also creates a Shockwave movie in the .DCR format.

If you use the default Publish settings, Director creates an HTML page that is completely configured with `EMBED` tags and everything else you need to run your movie in a browser. By default, Director saves all these new files in the same folder as your original Director movie. For more information about putting your Director movie on the web, see "Creating Shockwave movies" on page 576.

For information on how to distribute Xtra extensions with projectors, refer to TechNote 13965 in the Director Support Center. Although the note might refer to Director 7, the information is the same for Director MX.

Answers panel

The Answers panel provides quick access to information that helps you work effectively with Director, including TechNotes, articles, and other useful content.

To open the Answers panel:

- Select Window > Answers.

To get the latest Director information from macromedia.com:

- Click the Update button.

CHAPTER 2
Director MX Basics Tutorial

The Director Basics chapter of *Using Director* introduces you to the Macromedia Director MX user interface and basic Director concepts; you'll gain a greater understanding of the material presented in this tutorial if you've first read Chapter 1, "Director Basics," on page 19. This tutorial reiterates and expands on much of that information while it guides you through the process of creating a simple interactive movie with animation, sound, and video. The movie you'll create is designed to suggest what is possible with Director rather than simulate a fully developed Director project.

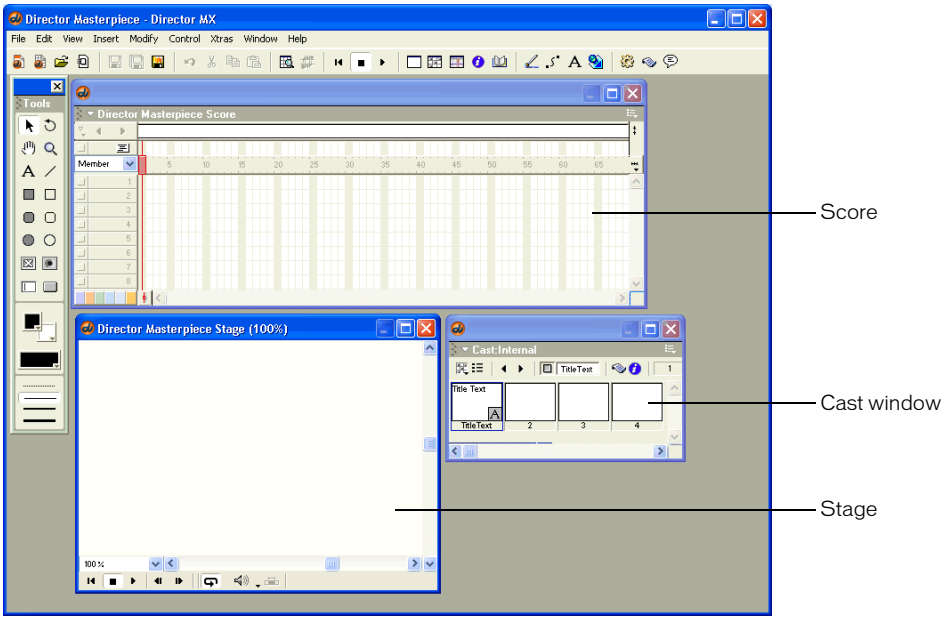
What you'll learn

This tutorial introduces you to the basic skills needed to build a Director movie. These include the following:

- Becoming familiar with Director windows
- Specifying movie properties
- Creating cast members within Director and from imported files
- Placing cast members on the Stage and in the Score to create sprites, which are copies of cast members
- Animating sprites
- Creating buttons
- Using behaviors and Lingo to create user interactivity
- Controlling digital video and audio
- Publishing the movie on the web

About the Director metaphor

The Director user interface is designed around a movie metaphor. Each project you create can be thought of as a movie, with a cast of characters, a score, a stage where the action takes place, and a director (you, the author). Each media element that appears in your movie (sound, video, images, text, buttons, and so on.) can be thought of as a member of the movie's cast. In Director, the Cast window is where you view the list of media elements that appear in your movie.



As with a real movie, each Director movie has a score. However, the score of a Director movie contains more than just music. The Score window in Director contains information about when and where each of the cast members will appear on the Stage. The Score describes the action that will happen in the movie.

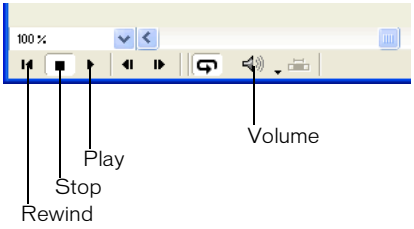
The action in a Director movie takes place in a window called the Stage. To create a Director movie, you add cast members (media elements) by creating them in Director or importing them. Next, you place them on the Stage as sprites. A *sprite* is simply a copy of a cast member that appears on the Stage. Then, you refine the actions of the sprites by editing them on the Stage or in the Score.

In this tutorial, you will practice each of these steps to create your own Director movie.

View the completed movie

You can view a completed version of the tutorial movie to become familiar with how your finished movie will appear.

1. Launch Director and select File > Open. Within your Director MX application folder, browse to Tutorials/Basics/Finished and double-click the Basic_finished.dir file.
2. If windows obscure the Stage, drag them out of the way.
3. To play the movie, click Play along the bottom of the Stage, or select Control > Play.



Note: The group of controls along the bottom of the Stage is called the Control panel. By default, the Control panel is attached to the bottom of the Stage. You can turn it into a floating panel by detaching it from the Stage. For more information about the Control panel, see "The Control panel" on page 21.

4. Use the buttons in the movie to navigate from one scene to another and control the playback of the video clip.

   The movie consists of three scenes. The first is a title scene that contains buttons for navigating to the other two scenes. The second scene is an animation of a sunset. The third scene contains a digital video and buttons that control it. Each of these scenes also contains navigation buttons.
5. When you finish viewing the movie, either click the Stop button on the Control panel, or select Control > Stop.

Open the tutorial movie

To begin the tutorial, you'll open a partially completed Director (DIR) file.

1. Select File > Open and browse to your Director MX application folder. Open the Tutorials/Basics/Start/Basic_start.dir file.

   Note: When you open this file, Director will close the Basic_finished.dir file you explored in the previous section. If you made any changes to that file, do not save them.
2. Select File > Save As and name the file My_Basic_start.dir. Save the movie in the Start folder.

   Making a copy of the file lets you or another user complete the tutorial again with the Basic_start.dir file.

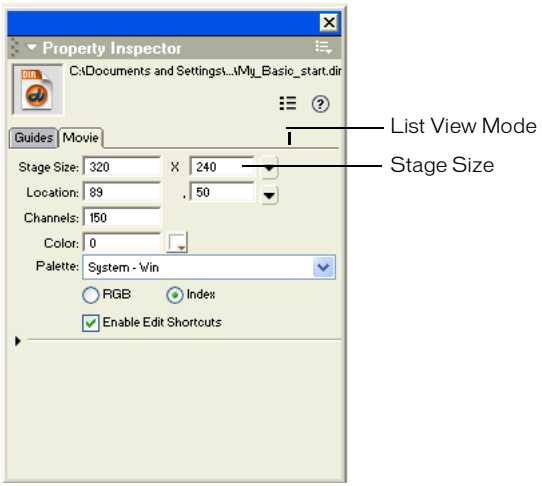
Set up the movie

You can now arrange your workspace and set properties for your movie, such as the Stage size and color, and the number of channels in your Score.

During the authoring process, you view Director movies on the Stage window. You can set up the size and color of the Stage window.

1 In the Property inspector (Window > Property Inspector), click the Movie tab.

If the Property inspector is not in graphical mode, as shown in the following illustration, click the List View Mode icon to deselect it.



The Property inspector lets you change attributes of a selected object.

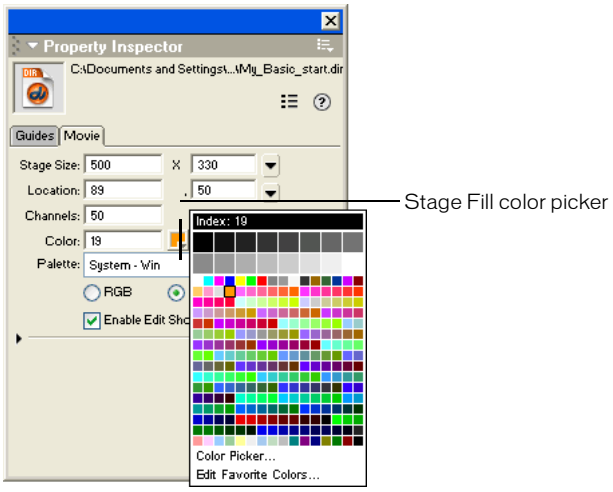
2 In the Stage Size pop-up menu, select 500 x 330.

Note: You can view tooltips for pop-up menus and text boxes by moving the pointer over the icon next to the menu.

3 If the Score is not open, select Window > Score. In the Property inspector, type **50** in the Channels text box and press Enter (Windows) or Return (Macintosh), and then click OK in the dialog box that appears.

Note: In Windows, the Enter key on the numeric keypad plays the movie. Be sure to use the Enter key on the alphanumeric section of the keyboard when entering information in Director.

4 In the Property inspector, select a dark orange color from the Stage Fill color picker.



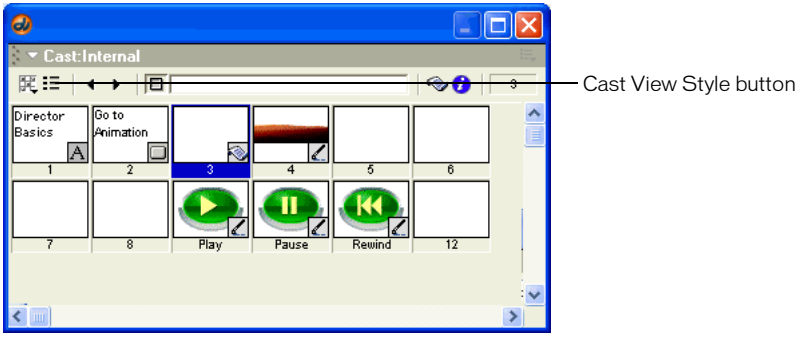
5 Save your movie by selecting File > Save or clicking the Save button in the toolbar (Window > Toolbar).

View your cast members

To create a Director movie, you need cast members. Cast members are the objects that appear on the Stage and in the Score. Some of these elements might be text, graphics, sound, video, or Lingo scripting behaviors.

The movie you create in this tutorial consists of three scenes. Some cast members appear in more than one scene, and some appear in one scene only. First, use the Cast window to view your current set of media. Next, you'll begin adding new cast members. You add cast members to a Director movie by creating them in Director or by importing files made in other applications.

1 If the Cast window is not already open, select Window > Cast.



You can view the Cast window in two modes: List view and Thumbnail. In List view, you can sort cast members by name, number, date modified, type, and other criteria. Thumbnail view lets you see a thumbnail image of each cast member. In Thumbnail view, cast members are always shown in numerical order. For this tutorial, you will use the Thumbnail view. If your Cast window is in List view, you need to switch to Thumbnail view.

2 To toggle from List view to Thumbnail view, click the Cast View Style button in the upper left corner of the Cast window.

The Cast window contains cast members that you can use in your movie. The first is a text cast member. It contains the text "Director Basics." The text cast member thumbnail image that appears in the Cast window contains a small *A* icon in the lower right corner. This is the cast member type icon and the *A* indicates that it is a text cast member.

The second cast member is a button. Button cast members have special functionality built into them, such as changing color when clicked, so that they behave in the way most users expect buttons to behave. This button contains the text "Go to Animation." Its cast member type icon is a small square button shape.

The third cast member slot is empty. You will add a cast member to that slot later. The fourth cast member is a bitmap image of mountains. Its cast member type icon is a paintbrush.

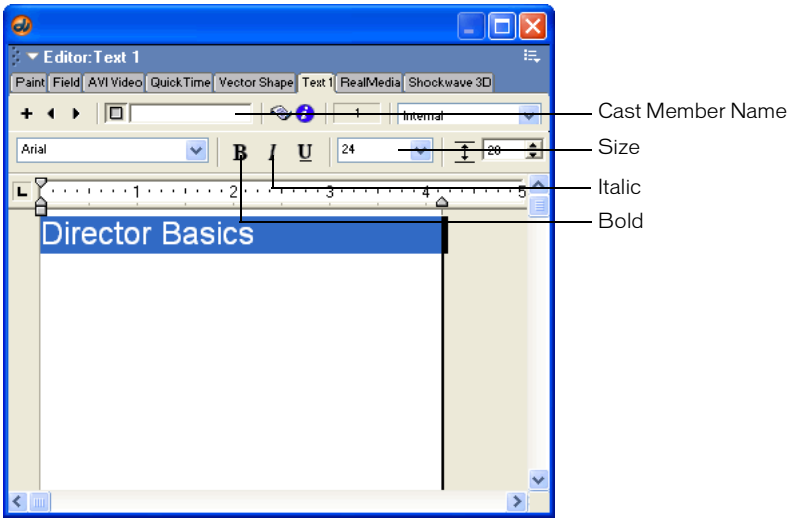
The ninth, tenth, and eleventh cast member slots contain bitmaps that you'll use as custom buttons. Using a bitmap image lets you control the appearance of the button, but it does not provide the built-in functions of the Director button cast member type. However, you can add those functions with Lingo, the Director scripting language.

Edit a text cast member

The first cast member you will use in your movie is the text cast member containing the words "Director Basics." You'll edit the text to give it a more appealing graphic design.

1 Double-click the text cast member in the first slot of the Cast window.

The Text window opens.



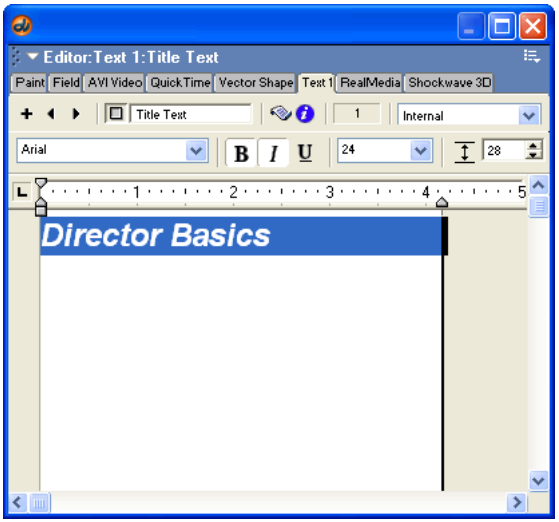
You use the Text window to edit text cast members. You'll find that most Director cast member types have associated windows that you can use to view and edit the cast member.

2 If the text is not already selected, select it, then select 36 point from the Size pop-up menu in the tool bar near the top of the window.

Note: While completing the tutorial, you might find it useful to undo a change you've made. To undo, select Edit › Undo, or press Control+Z (Windows) or Command+Z (Macintosh). Conversely, you can redo what you've undone by selecting Edit › Repeat, or pressing Control+Y (Windows) or Command+Y (Macintosh).

3 Click the Bold button and the Italic button. The style of the selected text changes from plain to bold, italic.

4 Give the text cast member a name by clicking in the Cast Member Name text box at the top of the window and typing **TitleText**. Press Enter (Windows) or Return (Macintosh).



5 Close the Text window, and save your movie.

The next section guides you through the process of building the first scene of your movie and creating a new cast member for the scene.

Build the first scene

Building a scene in Director requires creating or importing the cast members for the scene, and placing sprites on the Stage. As you learned in Chapter 1, "Director Basics," on page 19, a sprite is an object that controls when, where, and how cast members appear in a movie. You create sprites by placing cast members on the Stage or in the Score. To build the first scene of the movie, you place sprites of the TitleText cast member and two buttons on the Stage. One of the buttons is already in the cast; you'll create the other button.

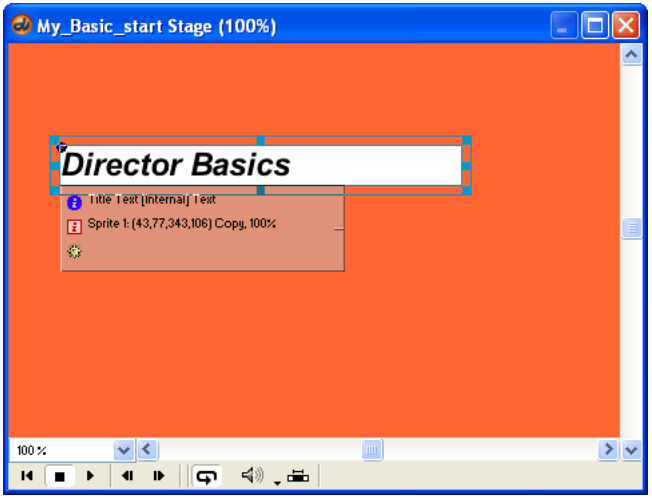
Add sprites to the Stage

To begin building the scene, you drag the TitleText and button cast members from the Cast window to the Stage. Because the first scene should occur at the beginning of the movie, you put the cast members at the beginning of the Score. The Score is discussed in detail later in this tutorial.

1 Click the Rewind button on the Control panel. This ensures that the cast members you place on the Stage are in the first frame of the Score, the beginning of your movie.

2 In the Cast window, click the TitleText cast member and drag it anywhere on the Stage to create a sprite from the TitleText cast member.

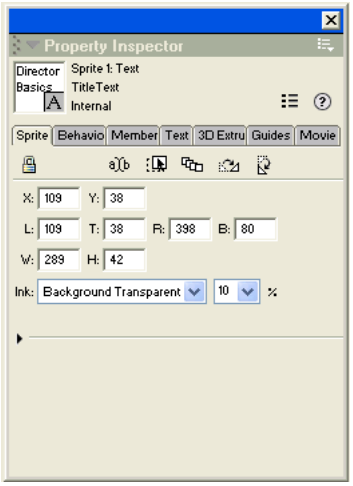
The background of the new text sprite is white.



3 Click the new text sprite on the Stage to select it. On the Sprite tab in the Property inspector, select Background Transparent from the Ink pop-up menu.

Inks control the way a sprite color appears on the Stage. Background Transparent ink makes the white background of the sprite appear transparent.

4 To place the text precisely on the Stage, in the Property inspector type **109** in the X text box and **38** in the Y text box to specify the Stage coordinates, and press Enter (Windows) or Return (Macintosh).



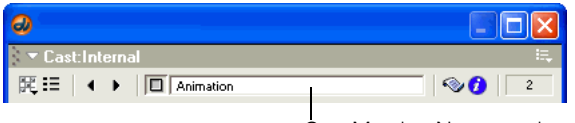
Add buttons to the Stage

In addition to the title text, the first scene of your movie will contain two buttons. You'll add the first button to the Stage, then you'll create a new button on the Stage to complete the scene.

You begin by giving the button cast member in the second slot of the Cast window a name. Earlier, you named the TitleText cast member by entering a name in the Text window. You can also give cast members names directly in the Cast window.

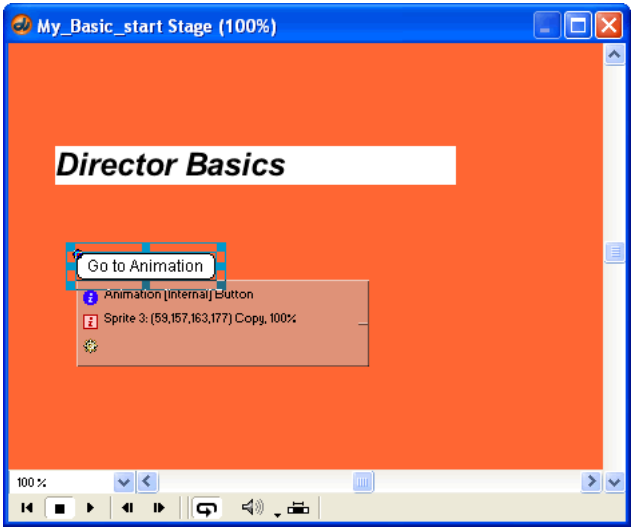
1 Click the button cast member in cast slot two.

2 Click the Cast Member Name text box at the top of the Cast window, and type **Animation**. Press Enter (Windows) or Return (Macintosh).



Cast Member Name text box

3 Drag the Animation button cast member from the Cast window to the Stage. Place it on the left side of the Stage, below the title text.



4 Select the button sprite on the Stage. In the Property inspector, type **110** in the X text box and **161** in the Y text box to position the button, and then press Enter (Windows) or Return (Macintosh).

Note: As you complete the tutorial, remember to save your work frequently.

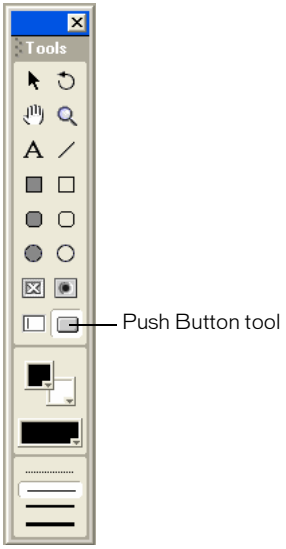
Create a new button cast member

Now you're ready to create the second button.

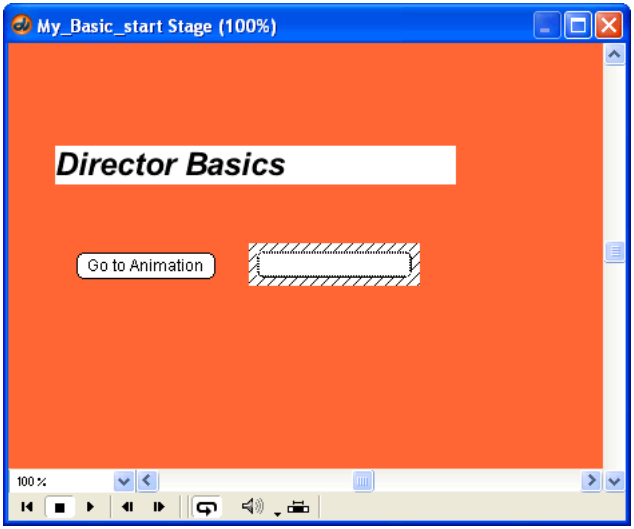
Remember that button cast members contain special functionality to automatically highlight when clicked. Creating button cast members in Director is different from creating most other cast members. Cast members are often created in separate windows and then dragged from the Cast window to the Stage. You create a button cast member directly on the Stage using the Tool palette.

You'll use the Button tool to create a new button.

1 On the Tool palette (Window > Tool Palette), click the Push Button tool.



2 Drag a horizontal rectangle toward the right side of the Stage, as shown in the following illustration:



3 When you release the mouse button, the rectangle you created becomes an editable text box in which you enter the text that you want to appear on your button. Type **Go to Sound and Video** in the text box.

4 To place the button precisely, in the Property inspector, type **242** in the X text box and type **161** in the Y text box. Press Enter (Windows) or Return (Macintosh).

5 Click the Stage outside the button.

The editable text box changes to a completed button sprite. In the Cast window, the new button cast member took the next available slot and appears in slot 3.

Note: If the text is too long for your button, you can enlarge the button. Click the button with the Arrow tool selected, and then drag the sizing handles on the right edge of the button to the right.

6 Select the new button in the Cast window, and type **SoundVideo** in the Cast Member Name text box at the top of the Cast window. Press Enter (Windows) or Return (Macintosh).

You have now created a new button cast member and added all the graphic sprites for scene 1 of your movie.

Edit sprites in the Score window

As you learned earlier in this tutorial, when you drag cast members onto the Stage, you create sprites. Sprites are instances of cast members that appear on the Stage and in the Score window. The Score window displays the sprites on the Stage in each frame of your movie. You can use the Score window to view information about sprites and edit them.

Sprites versus cast members

Several sprites can refer to the same cast member and can appear on the Stage simultaneously. To understand the difference between cast members and sprites, do the following:

1 Drag the TitleText cast member from the Cast window to the Stage a second time.

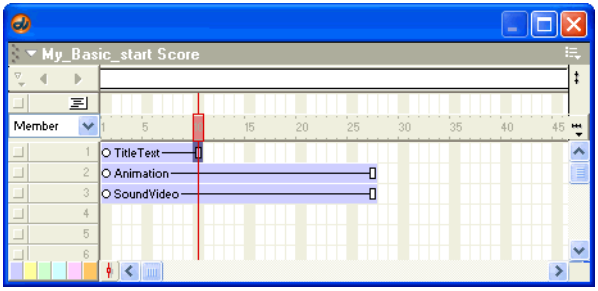
Two instances of the TitleText cast member appear on the Stage but only one TitleText cast member appears in the Cast window.

2 Click the extra TitleText sprite in the Score (the sprite span in channel 4, frames 1 to 28 of the Score) and press Backspace or Delete.

Edit sprites in scene 1

In the Score window, you should now have three sprites in frames 1 through 28. By default, each sprite that you drag onto the Stage or into the Score has a length of 28 frames. You can shorten or lengthen sprites as needed. In order to make the Score information for your entire movie easier to read on the screen without scrolling, you will shorten the sprites for scene 1.

1 In the Score window, click the end of the TitleText sprite in frame 28, and drag it to the left to frame 10.



Note: You can also lengthen sprites by dragging their end frames to the right to higher-numbered frames, and you can edit more than one sprite at the same time by selecting multiple sprite end frames.

2 Click the Animation button sprite in channel 2 of the Score.

3 Shift-click the SoundVideo sprite in channel 3.

4 Click frame 10 in the frame number bar above channel 1. The playhead moves to frame 10.

5 Select Modify > Extend Sprite.

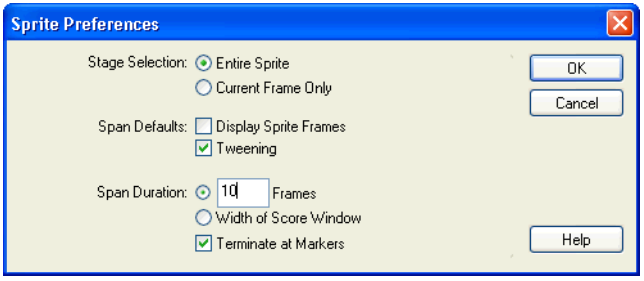
The sprites shorten in length so they occupy only frames 1 through 10. You can use the Extend Sprite command to either lengthen or shorten sprites.

Change the default length of sprites

You can change the default length of sprites that you drag to the Stage and Score by editing the Sprite Preferences. You'll now change the default sprite length to 10 frames, which makes it easier to compose a movie consisting of a series of scenes 10 frames long.

1 Select Edit > Preferences > Sprite to open the Sprite Preferences dialog box.

2 In the Span Duration text box, type **10** and click OK.



Scene 1 of your movie is almost complete. Later, you will return to this scene to add Lingo commands to the navigation buttons. Now you'll start building scene 2.

Create an animation

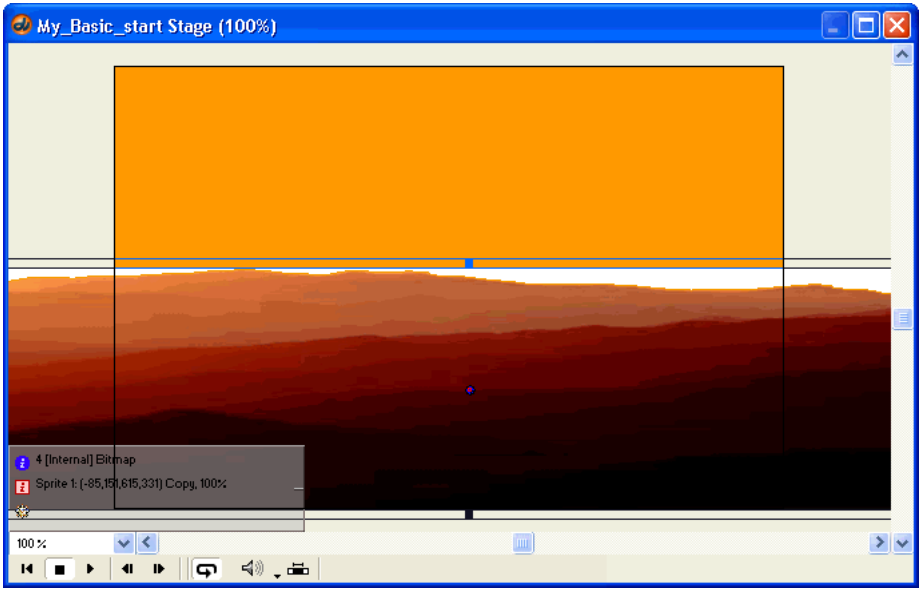
The second scene of your movie will contain a simple animation of a sunset. The sun will set behind a mountain range, and a cloud will move across the sky. You'll make three of the cast members for this scene, arrange their sprites in the Score, and create the animation of the sun. This scene will also include a new button that returns users to the first scene.

Place the mountain bitmap on the Stage

A bitmap, also known as a raster image, is comprised of colored pixels arranged to form a graphic. The fourth cast member in the cast is a bitmap of a brown-colored mountain range. This is the mountain range that the sun will set behind in your animated scene. Because the animated scene will start in frame 15, you'll place a sprite of the mountain range on the Stage in frame 15.

1. Open the Stage if it is not already open by selecting Window > Stage.
2. Open the Score if necessary, and click frame 15 in the frame number bar above channel 1.

   The playhead moves to frame 15. Because there are no sprites in frame 15, the Stage appears empty.
3. Drag the mountain cast member from slot 4 of the Cast window to the bottom of the Stage window. Place the sprite so it fills the Stage from left to right and is aligned with the bottom of the Stage. The left and right edges of the mountain range will extend beyond the Stage.



   Because you placed the playhead in frame 15 of the Score, the Mountain sprite appears in frame 15 of the Score. The end of the new sprite is in frame 24.
4. With the Mountain sprite on the Stage selected, select Background Transparent from the Ink menu on the Property inspector's Sprite tab, and save your movie.

When you place new sprites on the Stage, Director puts them into the first available channel in the Score. Because there were no other sprites in frame 15, the Mountain sprite appeared in channel 1. Later you will make changes to the order in which the sprites appear in the Score channels.

Name a cast member

The mountain cast member has not yet been named. Naming cast members makes it easier to identify the sprites in the Score.

- In the Cast window, select the mountain cast member in cast slot 4. Click the Name text box at the top of the Cast window and type **Mountain**. Press Enter (Windows) or Return (Macintosh).

Draw using the Paint window

The animation of the sunset will also include an animated cloud. You'll create the cloud in the Paint window, which you can use to create and edit bitmap graphic cast members.

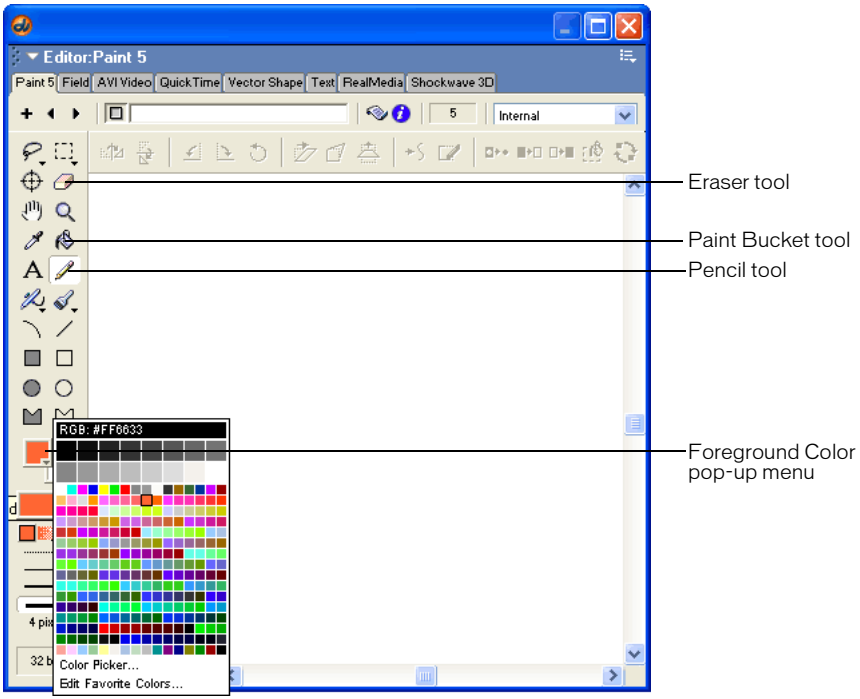
1. To open the Paint window, select Window > Paint.

   The Paint window opens with the Mountain cast member.

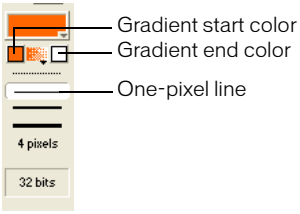
   The Paint window contains tools along the left and top edges that you use to edit graphics. To create the cloud cast member, you need to draw a cloud shape with the Pencil tool.

2. Click the New Cast member button in the upper left corner of the Paint window.

3 In the Paint window toolbar, select the Pencil tool. Select an orange color from the Foreground Color pop-up menu.



4 Select the one-pixel line width from the list of line widths at the bottom of the left-side Paint window toolbar.



5 In the Paint window, draw a small, flat cloud with the pencil tool. Be sure that the cloud has no gaps in the outline. Use the Eraser tool, if necessary, to erase lines drawn in error.

Fill the shape with color

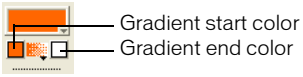
After you've drawn the cloud outline, you can fill it with color. Because this is an animation of a sunset, the cloud will have an orange gradient. A gradient is a smooth blending of one color into another.

To create the gradient, you use the Paint Bucket tool and the Gradient ink.

1. Select the Paint Bucket tool from the toolbar in the Paint window.

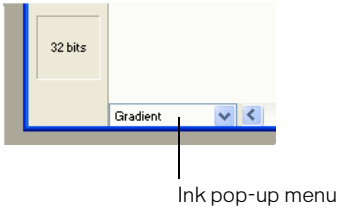
   You use this tool to fill enclosed lines.

2. Select an orange color from the Gradient Start color box. This will be the starting color of your gradient. Your cloud will look best if you select the same orange you used for the cloud outline.

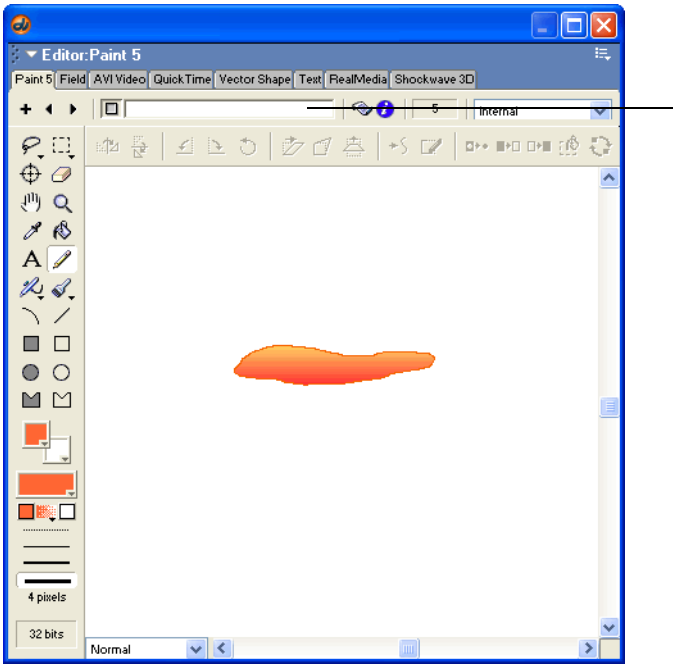


3. Select a darker orange or a red from the Gradient End color box. This will be the ending color of your gradient.

4. Select the Gradient ink from the Ink pop-up menu at the bottom of the Paint window. This causes the Paint Bucket tool to paint a gradient with the specified colors rather than simply filling the area with the current foreground color.



5 With the Paint Bucket tool still selected, click inside the outline of the cloud. The cloud fills with an orange gradient.



6 Click the Cast Member Name text box at the top of the Paint window, type **Cloud** in the text box, and then press Enter (Windows) or Return (Macintosh).

7 Close the Paint window.

Next you'll create a different kind of cast member for the Sun in your animation scene.

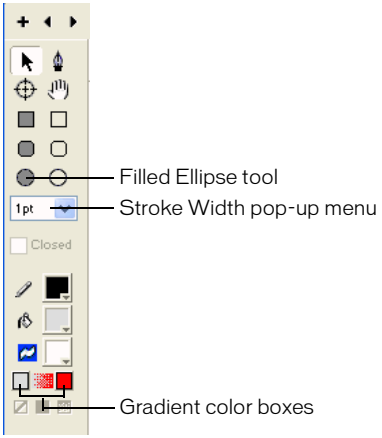
Create a vector shape cast member

Vector graphics are another kind of graphic cast member you can use. Although bitmap images contain long lists of data for each pixel in a graphic, vector cast members store graphic information as mathematical descriptions of an image. Because of this difference, vector cast members generally use less memory than comparable bitmap cast members. There are some differences in the kinds of effects you can achieve and the methods used to create various shapes and fills for each of these cast member types. By experimenting with both types of images, you can determine if your art is better suited as a vector shape or bitmap image.

For the Sun cast member in the animation scene, you'll use a vector shape. The sun is a circle, which uses little memory. You'll create it using the Vector Shape window. As with the Text and Paint windows, the Vector Shape window provides special tools for creating and editing cast members.

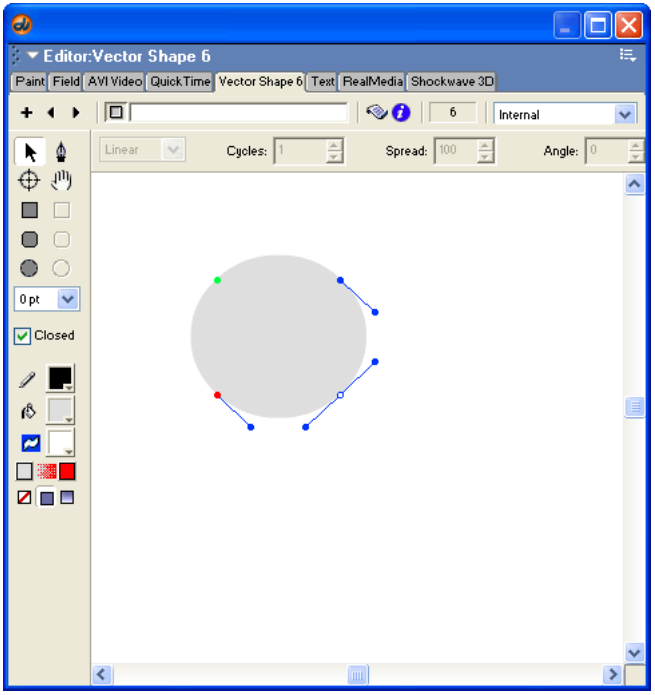
You'll create a circle for the sun and fill it with a yellow gradient.

1 Select Window > Vector Shape, and select the Filled Ellipse tool in the toolbar on the left side of the window



2 Select 0 point from the Stroke Width pop-up menu.

3 Drag the pointer in the window to make a circle.



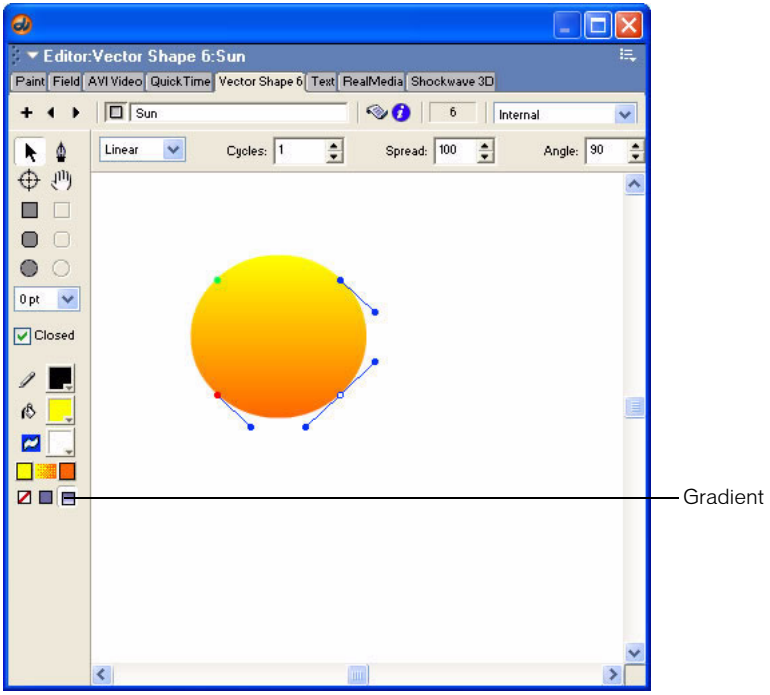
4 Click the first Gradient Color box, on the left, and select a bright shade of yellow. This will be the beginning color of the gradient on the sun.

5 Select a very light orange from the second Gradient Color box. This will be the ending color of the gradient.

6 Click Gradient, below the Gradient Color boxes.

7 The gradient fill in the circle changes color from left to right. To rotate the gradient so it changes from top to bottom, enter **90** in the Angle text box at the top of the window.

8 Click the Cast Member Name text box at the top of the window and type **Sun**. Press Enter Windows) or Return (Macintosh).

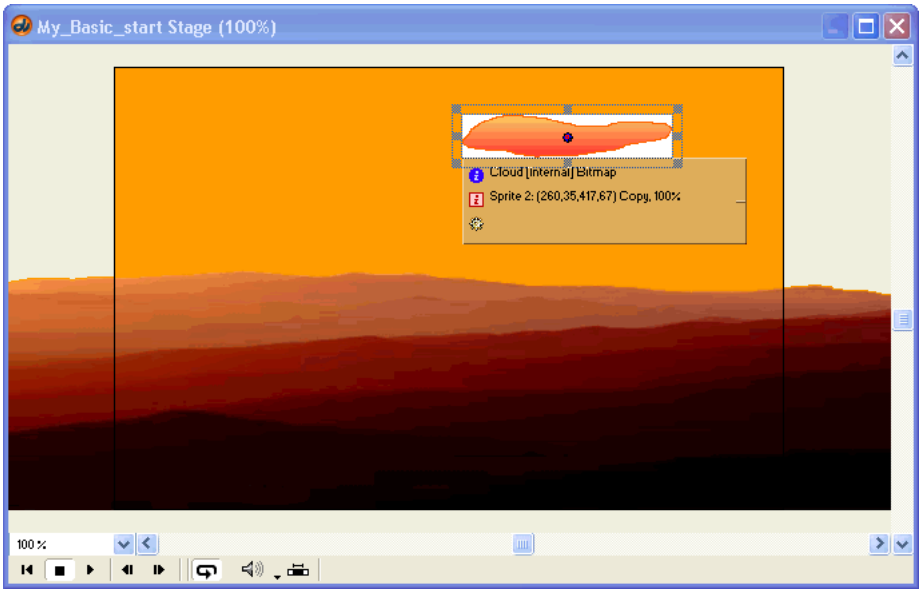


9 Save your movie, and close the Vector Shape window.

Animate the cloud

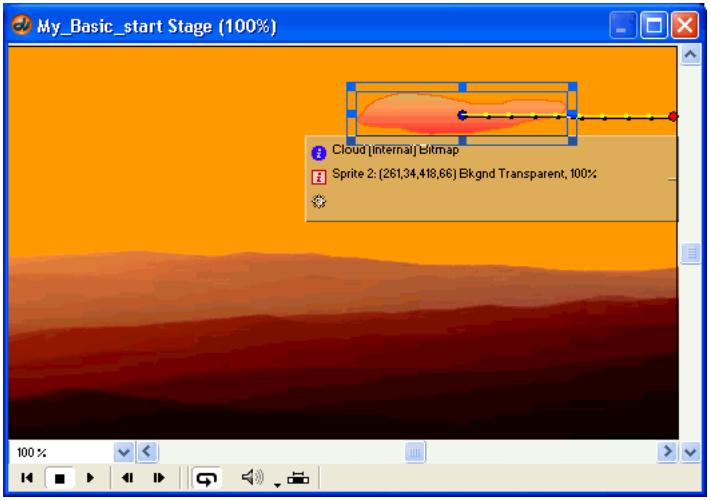
You are now ready to add the cloud to the scene and create an animation of it moving across the sky. You can do this by placing a sprite of the Cloud cast member on the Stage, and then using a technique called tweening.

1. If the playhead is not already on frame 15, the beginning of the second scene, click frame 15 in the frame number bar at the top of the Score.
2. Make sure the Cast and Stage windows are open. Drag the Cloud cast member from the Cast window to the Stage window. Place it near the top of the Stage window, slightly to the right of center.



3. Select the Cloud sprite on the Stage. In the Property inspector (Window > Property Inspector), go to the Sprite tab, and select Background Transparent from the Ink pop-up menu.

4 The new Cloud sprite has a bounding box around it and a round dot in the middle. Click and drag the round dot in the middle of the cloud to the right edge of the Stage.



A line connects the original location of the cloud to the new location of the dot. There is still a dot in the middle of the Cloud sprite, but it is a different color from the dot that you dragged.

You have performed your first tweening operation. *Tweening* is a technique in which you specify values for certain properties of a sprite at certain times and then let Director calculate the values for those properties for all the times in between. The term *tween* comes from the word *between*.

In this case, you dragged the dot on the sprite to a new location. These dots on sprites represent points in the sprite's animation path. When you first drop a sprite on the Stage, there is no animation, so there's only one dot. The line on the Stage that connects the dots represents the animation path of the Cloud. By dragging the dots, you are specifying the sprite's location on the Stage at the beginning and at the end of its sprite span in the Score. The blue dot that remains in the middle of the Cloud sprite represents its starting location. The red dot at the other end of the line represents its end location.

Scrub the playhead to view your animation

You can move the playhead to see your animation.

- Drag the playhead back and forth from frame 15 to frame 24 in the Score. This is called "scrubbing the playhead."

  The cloud moves rather quickly across the Stage. To make the animation look more realistic, you can lengthen the Cloud sprite's duration in the Score. This way, the cloud will move the same distance on the Stage during a longer period of time.

Change the tempo of an animation

To create a slower tempo for the sprite, you can extend the sprite in the Score.

1. Click the end frame of the Cloud sprite in frame 24 of the Score, and drag it to frame 50.
2. To see the slower animation this creates, drag the playhead back and forth from frame 15 to frame 50 in the Score. The cloud moves more slowly across the Stage.

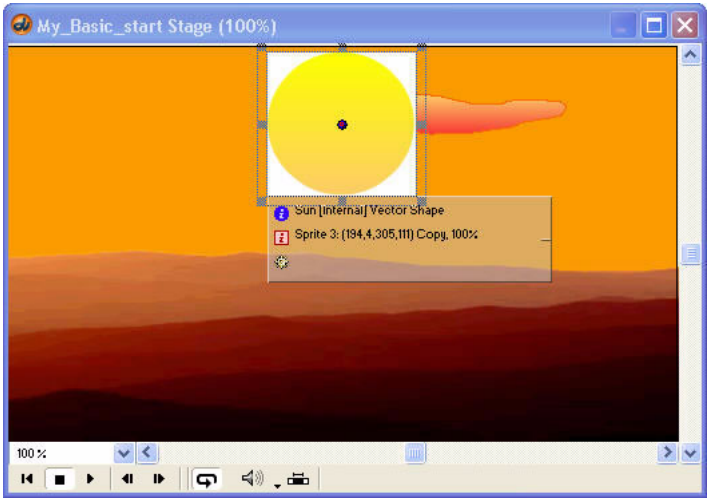
   The Mountain sprite disappears from the Stage when you drag the playhead to frames 25 through 50. This is because the Mountain sprite exists only in frames 15 to 24 of the Score. You need to lengthen the Mountain sprite to extend the duration of the entire animation scene.
3. Click the end frame of the Mountain sprite in frame 24 of the Score, and drag the end frame to frame 50.

The next step in building this scene is to add the Sun sprite and animate the sunset.

Create a sunset animation

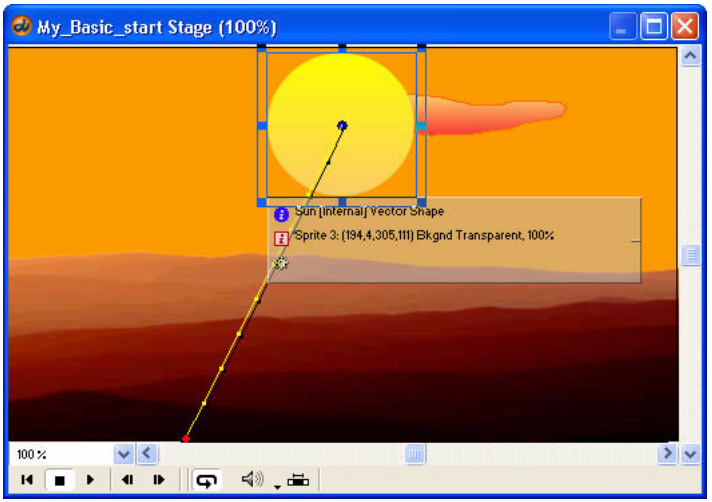
To create the sunset animation, you will use tweening animation again.

1. Click frame 15 in the frame number bar at the top of the Score to move the playhead to that frame.
2. Drag the Sun cast member from the Cast window to the Stage window. Place it near the middle and top of the Stage window, and it can overlap the Cloud sprite.



3. Click the Sun sprite on the Stage to select it. On the Sprite tab in the Property inspector, select Background Transparent from the Ink pop-up menu.

4 Drag the dot in the middle of the Sun sprite downward, in a slight diagonal toward the left, to the bottom of the Stage. A line appears, connecting the dots. This line is the sun's tweened animation path.



5 Click the end frame of the Sun sprite in frame 24 of the Score, and drag the end frame from frame 24 to frame 50.

6 Drag the playhead back and forth from frame 15 to frame 50. The sun and the cloud animate, but the animation requires modification.

Change the stacking order of sprites in the Score

In your animation, the sun appears on top of the cloud and mountains because the stacking order of sprites on the Stage is from the lowest numbered Score channel to the highest numbered channel. The sprites in lower numbered channels appear below sprites in higher numbered channels. The solution is to move the sprites in the Score so the Sun sprite is in the lowest numbered channel. This lets it appear beneath the other sprites in the scene.

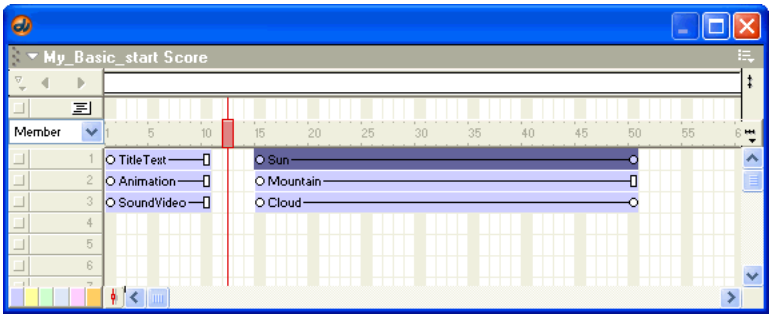
To change the stacking order of a sprite in the Score, you drag it to a new location.

1 Select the Mountain, Cloud, and Sun sprites in the Score by Shift-clicking them.

2 Drag the three sprites down in the Score so they occupy channels 2 through 4 instead of 1 through 3. Be sure the three sprites remain in frames 15 through 50.

3 Click an empty cell in the Score to deselect the three sprites.

4 Click and drag the Sun sprite from channel 4 to channel 1, but make sure it remains in frames 15 through 50.



5 Scrub or drag the playhead from frame 15 to 50 to see the modified animation.

The Sun sprite now appears behind the mountains and cloud.

Add navigation buttons to the animation scene

You've successfully completed your first animation. To complete the animation scene, you'll add navigation buttons. You'll use the Go to Sound and Video button created earlier and create a new button that returns users to the first scene. Later you'll add Lingo to these buttons to make them function.

Add an existing button

First, you add the Go to Sound and Video button that you created earlier for scene 1.

1 Click frame 15 in the frame number bar in the Score.

2 Drag the SoundVideo button cast member from the Cast window to the lower right side of the Stage window. A new sprite appears in the Score beginning in channel 4, frame 15.

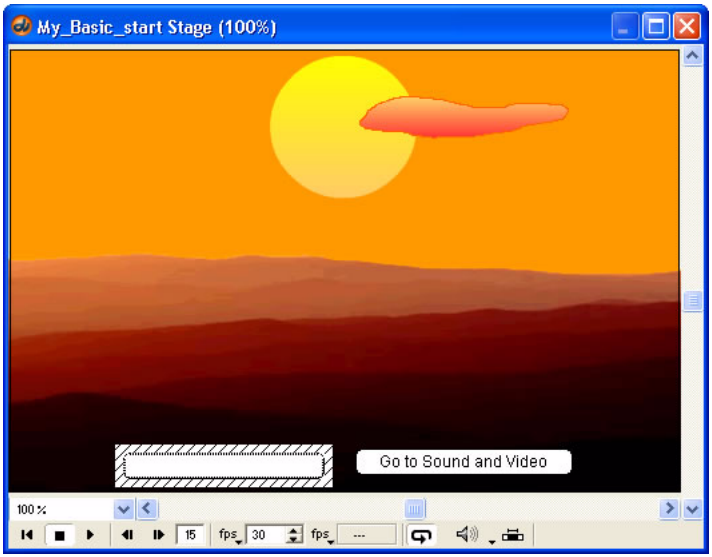
3 In the Score, click and drag the end of the new SoundVideo sprite from frame 24 to frame 50.

4 Click the SoundVideo button on the Stage. On the Sprite tab in the Property inspector, type **258** in the X text box and **298** in the Y text box, and press Enter (Windows) or Return (Macintosh) to place the button precisely.

Add a new button

Next, you create a new button that returns users to the first scene.

1. Click frame 15 in the frame number bar in the Score to move the playhead to that frame.
2. In the Tool palette (Window > Tool Palette), click the Push Button tool.
3. Drag a horizontal rectangle to the lower left area of the Stage, and release the mouse button.

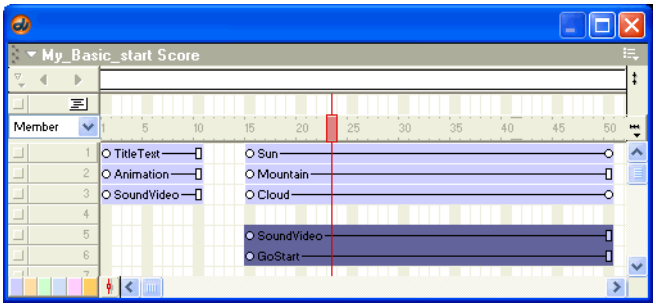


4. In the button text box, type **Go to Start**, and then click the Stage outside the button.
5. In the Cast window, select the new button cast member, and type **GoStart** in the Cast Member Name text box at the top of the Cast window. Press Enter (Windows) or Return (Macintosh).
6. Drag the end of the new button sprite in channel 5 from frame 24 to frame 50.
7. Select the GoStart button on the Stage. On the Sprite tab in the Property inspector, type **35** in the X text box and **298** in the Y text box, and press Enter (Windows) or Return (Macintosh) to place the button precisely.

Arrange sprites in the Score

To make the Score easier to read, arrange the sprites of the animation scene in the Score so there is an empty channel between the graphic sprites and the button sprites.

1. Select both the SoundVideo and GoStart sprites, which begin in frame 15, in the Score by Shift-clicking them.
2. Drag the two sprites down one channel so they occupy channels 5 and 6. Be sure not to move them left or right. The sprites should still occupy frames 15 through 50.



3. Click the Rewind button on the Control panel, and then click the Play button.

   The movie plays from beginning to end, flashing scene 1 briefly on the Stage and playing the sunset animation once before returning to frame 1 and playing again.
4. If your movie plays only once, turn on looping by clicking the Loop Playback icon on the Control panel or by selecting Control > Loop Playback.
5. When you finish viewing the movie, either click the Stop button on the Control panel or select Control > Stop.

Later in this tutorial, you'll add Lingo scripts to make the buttons function and prevent the playhead from moving from one scene to the next without navigation.

Build the sound and video scene

The sound and video scene will introduce you to importing cast members from outside Director and using sound and video in your movies. You can include sound and video with or without Lingo, depending on the complexity of the effect you want to achieve. In this scene, you'll add video to the Stage, add a sound effect, and add buttons that control the sound and video.

Import a cast digital video member

So far, all the cast members you've used have been created and stored within your Director movie file. The buttons, graphics, and text are part of the Director file. It is common to import files from outside Director, too. When you import files into Director, you can import the entire file into your Director movie file or leave it as a separate file, creating only a reference to the external file in your Director movie. If you import a file by reference, it's crucial not to move it from the location where it's referenced. If you move it, Director will not be able to find it the next time you open your Director file, and the movie will not play as intended. Advantages of importing by reference include the following:

- The file size of your Director movie is smaller when you reference, rather than fully import, your media.
- Referencing media offers greater flexibility in terms of how you manage and where you locate your media assets.

When the referenced file is edited using the Launch and Edit feature of Director, there's no need to import the edited file again.

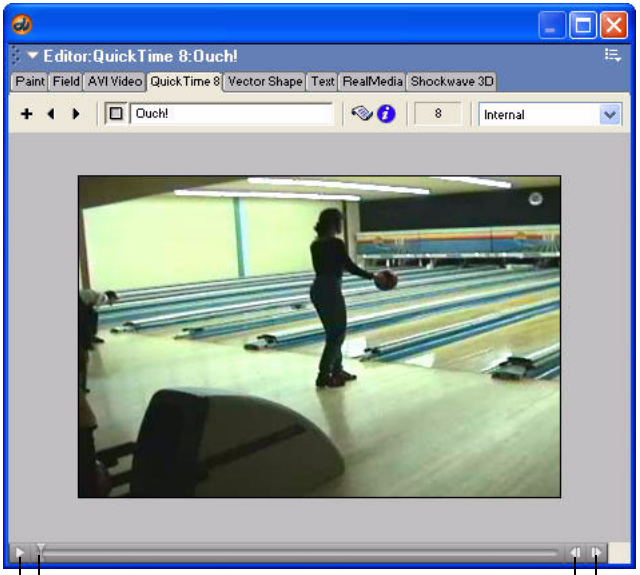
The first cast member you'll use in the sound and video scene is a QuickTime digital video file. Digital video files are always imported by reference, leaving the digital video file separate from the Director file.

1. Select File > Import. In the Import dialog box that appears, navigate within your Director MX folder to Tutorials/Basics/BasicsMedia and select the file named Ouch!.
2. Click the Import button. The new digital video cast member appears in the Cast window in slot 8. It's named after the imported file.

Play the digital video

You can view the QuickTime cast member by opening the QuickTime window. This window contains controls for playing the video file but not for editing the video; you cannot edit digital video files in Director.

1 Double-click the digital video cast member in the Cast window. The QuickTime window opens.



2 Play the video using the controls at the bottom of the QuickTime window:

- Click the Play button in the lower left corner of the window. The video begins playing, and the Play button changes to a Pause button.
- To pause the video, click the Pause button in the lower left corner of the window. The video pauses, and the Pause button reverts to a Play button.

  The QuickTime window has its own playhead that moves to the right as the video plays. You can use the playhead to jump to a specific point in the video or to scrub through the video.
- To jump to a specific point in the video, click in the bar to the right or left of the playhead. The playhead moves to the point that you clicked in the bar, and the window displays the corresponding frame of video.
- To scrub through the video, drag the playhead to the right to scrub forward and to the left to scrub in reverse.

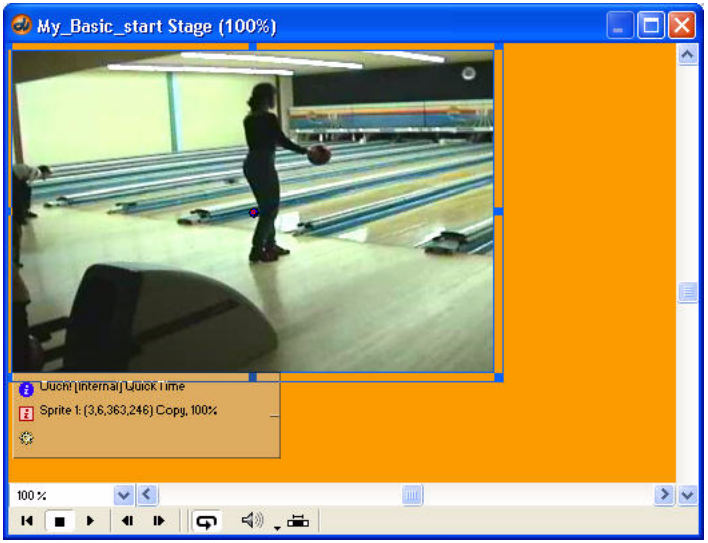
3 When you finish playing the video, close the QuickTime window.

Create a QuickTime sprite

You are now ready to place the QuickTime sprite on the Stage. The sound and video scene should start in frame 55.

1 Click frame 55 in the frame number bar in the Score. The playhead moves to frame 55.

2 Drag the Ouch! QuickTime cast member to the upper left corner of the Stage. The new sprite appears on the Stage and in the Score in channel 1, frames 55 through 64.



Specify direct-to-Stage playback

Director can play QuickTime video using the Direct to Stage option, which lets the video play at the fastest possible speed. However, when Direct to Stage is selected for digital video, the video appears in front of all other sprites, regardless of the channel that contains the sprite. To verify that Direct to Stage is selected for the Ouch! sprite, complete the following steps:

1 Select the Ouch! cast member in the Cast window (not on the Stage).

2 In the Property inspector, select the QuickTime tab, and verify that DTS (Direct to Stage) is selected.

Video, Audio, and Streaming should also be selected, by default.

Note: For additional information about QuickTime settings in the Property inspector, see "Playing digital video direct-to-Stage" on page 334.

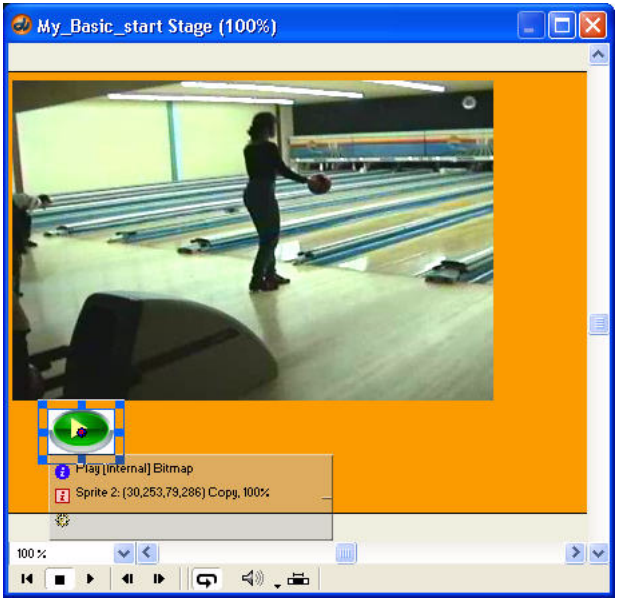
Add buttons to the Stage

Next, you'll add buttons that control playback of the QuickTime sprite. These buttons are already included in the Cast window in cast slots 9, 10, and 11. Unlike the Director Button cast members, these cast members are bitmap graphics that don't include automatic button functionality. Later you'll add Lingo to the buttons to make them control the QuickTime sprite.

You'll put the buttons near the bottom of the QuickTime sprite, allowing room on the Stage for the scene navigation buttons as well.

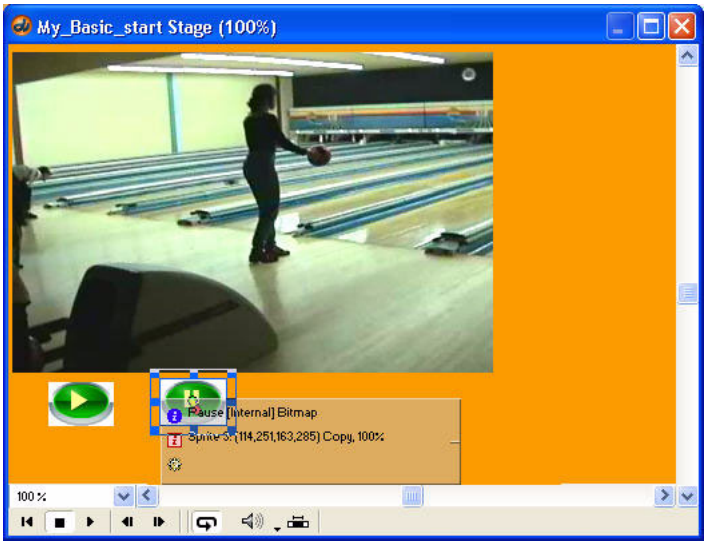
1. To place the Play button on the Stage, click frame 55 in the frame number bar in the Score if the frame is not already selected.
2. Drag the Play button from the Cast window to the left side of the Stage, directly beneath the QuickTime sprite. Because you'll align all three buttons soon, don't worry about precise placement yet.

   The Play button's sprite appears on the Stage and in channel 2, frames 55 through 64, of the Score.



3 To place the Pause button on the Stage, verify that frame 55 is selected, and drag the Pause button from the Cast window to the left side of the Stage window, directly beneath the QuickTime sprite and to the right of the Play button. Again, precise placement isn't necessary yet.

The Pause button's sprite appears on the Stage and in channel 3, frames 55 through 64, of the Score.



4 Verify that frame 55 is selected, and drag the Rewind button from the Cast window to directly beneath the QuickTime sprite and to the right of the Pause button. The Rewind button's sprite appears on the Stage and in channel 4, frames 55 through 64 of the Score.

Now all three QuickTime playback buttons are in place on the Stage. Each has a white bounding box around it. You can change the ink for all three sprites at once by selecting them all in the Score or on the Stage and selecting the new ink in the Property inspector.

5 In the Score or on the Stage, Shift-click the three buttons.

6 Select Background Transparent from the Ink pop-up menu on the Property inspector Sprite tab. The white bounding boxes of the sprites become transparent.

7 To place the buttons precisely, select a button on the Stage and use the Sprite tab of the Property inspector to give the buttons the following *x*- and *y*- coordinates:

- For the Play button, type **54** in the X text box and **269** in the Y text box, and press Enter (Windows) or Return (Macintosh).
- For the Pause button, type **142** in the X text box and **269** in the Y text box, and press Enter (Windows) or Return (Macintosh).
- For the Rewind button, type **230** in the X text box and **269** in the Y text box, and press Enter (Windows) or Return (Macintosh).

Note: As you complete the tutorial, remember to save your movie frequently.

Later in this tutorial, you'll add Lingo to the buttons to make them functional.

Import a sound

The QuickTime movie has no soundtrack. You can make the scene more interesting by adding sound to accompany the video. The easiest way to add sound to a Director movie is to import a sound cast member and place it in one of the sound channels in the Score. Whenever the playhead plays frames that include sound sprites, the sound plays. You can also play sounds by using Lingo instead of the sound channels, which you'll learn in the Lingo section of this tutorial.

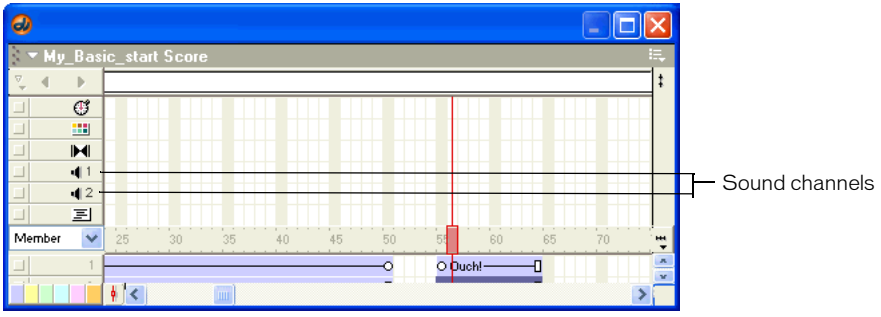
1. Select File > Import. In the Import dialog box, navigate within your Director MX application folder to Tutorials/Basics/BasicsMedia folder, and open the Sounds folder.
2. Select the sound file named drumloop, and click Add. The drumloop file appears in the file list.
3. Select Link to External File from the Media pop-up menu at the bottom of the dialog box. This tells Director to import only a reference to the file, leaving the sound file separate from the Director movie file.
4. Click Import. The sound file is imported into the Cast window.

Add a sound to the Score

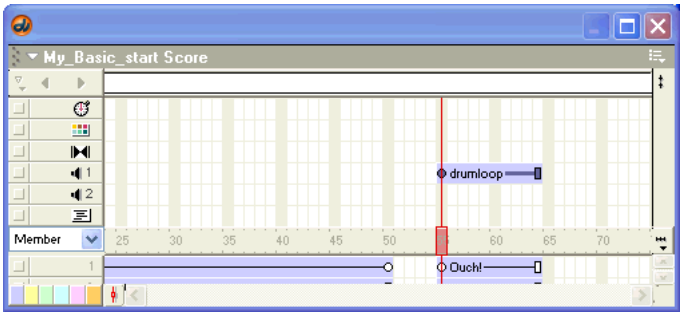
Now you can add the sound to the Score. Because sounds are heard and not seen, they do not appear on the Stage. You place sound sprites directly in the Score.

1 If the effects channels that appear above the frame number bar in the Score are not visible, click the Hide/Show Effects Channels button in the upper right corner of the Score.

The effects channels appear.



Click frame 55 in the frame number bar in the Score. With the Cast window and Score open, drag the drumloop cast member from the Cast window to frame 55 in sound channel 1.



The sound is now ready to play when frames 55 to 64 of your movie play.

2 Rewind and play your movie.

The playhead moves through all the frames of your movie quickly. Notice that there isn't enough time for the QuickTime sprite or the drumloop sound to play through before the playhead reaches frame 64. Later you'll add Lingo to solve this problem.

3 When you finish viewing the movie, either click the Stop button on the Control panel or select Control > Stop.

Add navigation buttons

The last sprites that you'll add to the sound and video scene are the navigation buttons. You'll then be ready to add simple Lingo, the Director scripting language, to all the buttons.

The sound and video scene needs a button that returns users to the start scene and a button that's linked to the animation scene. You already have each of these buttons in the Cast window and in the Score. You'll use two slightly different techniques to place these buttons in the sound and video scene.

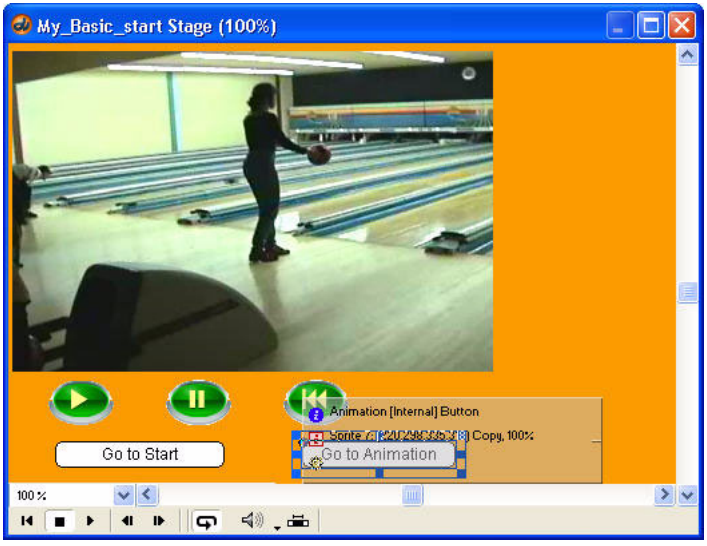
You used the GoStart button in the animation scene and placed it at the very bottom left corner of the Stage. Since it is appropriate for that button to be in the same location on the Stage in the sound and video scene, you can use the same sprite for both scenes. By simply lengthening the GoStart button sprite from the animation scene, you can extend it in the Score to the sound and video scene. When you do this, the button occupies the same space on the Stage in both scenes.

1 Drag the end frame of the GoStart button sprite in frame 50, channel 6, to frame 64, channel 6.

The sprite lengthens in the Score and appears at the lower left corner of the Stage in the sound and video scene.

Now you need to add the button that navigates to the animation scene. Because the button will occupy a different location on the Stage than it did in the start scene, you'll make a new sprite for it in the sound and video scene.

2 Click frame 55 of channel 7 in the Score and drag the Animation button cast member from the Cast window to the Stage, placing it to the right of the GoStart button.



The new Animation button sprite appears on the Stage and in frames 55 through 64 in channel 7 of the Score. Because you already selected frame 55 of channel 7, the sprite appears in that location when you drag it to the Stage. If you don't preselect a cell in the Score, the sprite appears in the first available channel of the Score in the frame where the playhead is located.

3 On the Stage, click the Animation button to select it. Use the Sprite tab in the Property inspector (Windows > Property Inspector), as you did earlier, to give the button *x*- and *y*-coordinates of **220** and **298**, respectively.

Note: As you complete the tutorial, remember to save your work frequently.

Each scene of your movie is graphically complete. You are now ready to add Lingo to the buttons, to let users navigate through the movie.

Write Lingo scripts to control movie playback

With the Lingo scripting language, you can implement almost any kind of user interaction and multimedia effect that you can imagine. You can use Lingo to make simple buttons function, as you will soon do in this tutorial. You can also use Lingo for more complex tasks, including controlling every aspect of a movie's content without using the Score.

Lingo is designed to be easy to learn, so don't be intimidated. After you know the basic concepts, you can use the extensive Lingo vocabulary to control anything in your movie. For a detailed introduction to Lingo, see Chapter 16, "Writing Scripts with Lingo," on page 385.

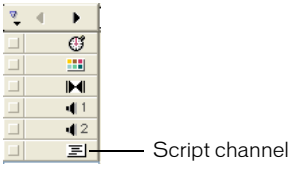
You'll now add Lingo to a special script channel in the Score and to your button sprites. You'll start with scripts that control the playhead.

Loop the playhead with Lingo

The scenes of your movie aren't much good as scenes if the playhead simply races through them without stopping to let the user absorb their content. The playhead needs to stay in one scene until the user makes a decision to go to a different scene.

To make the playhead stay in one scene, you loop it in a single frame or a series of frames. For the start scene and the sound and video scene, the playhead can loop in one frame. For the animation scene, where the animation occurs over a series of frames, the playhead should loop over the same series of frames.

To control the movement of the playhead without using buttons, you use the script channel in the Score. As with the sound channels, the script channel is one of the effects channels that appear above the frame number bar in the Score.



The start scene is the first one that needs a script to loop the playhead. Each time the playhead leaves one frame to go to the next, an event, called an `exitFrame` event, occurs. In this case, the word *event* refers to an action executed in Director. Your first script will use the `exitFrame` event as its trigger.

When you need to enter or edit scripts in Director, you use the Script window. Each script becomes a cast member the same as all the other elements that play a role in your movie. The Script window contains tools for editing scripts easily.

Each script you write is composed of handlers. A handler is a set of Lingo commands that handle a specific event, such as the `exitFrame` event. Some scripts have only one handler and some have multiple handlers. Each handler begins with the name of the triggering event, such as `exitFrame`, and ends with the word `end`.

Write a handler

In this section, you'll write a simple handler. The following discussion describes the script.

1. Open the Score (Window > Score) if it is not already open.
2. In the script channel, double-click frame 10, the last frame of the start scene. The Script window opens, and it already includes a default handler:

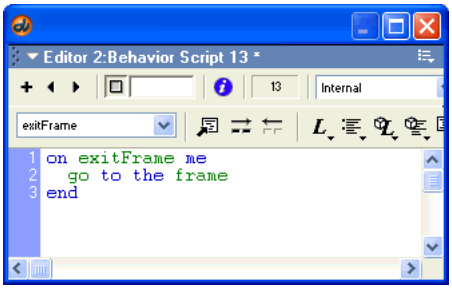
   ```
   on exitFrame me

   end
   ```

3. In between these two lines of text, enter:

   ```
   go to the frame
   ```

   The result is a handler that appears as shown in the following figure:



4. Close the Script window. The new script cast member appears in the Cast window in slot 13. A sprite for the script also appears in the script channel in frame 10.
5. In the Cast window, select the new script and type **Loop** in the Cast Member Name text box at the top of the window. Press Enter (Windows) or Return (Macintosh).
6. Rewind and play your movie. The movie plays to frame 10 and stops. The movie still plays, even though it stops at frame 10. Stop the movie.

The handler you've written has three parts. The first line, `on exitFrame me`, tells Director to run this script when the playhead leaves the frame where the script is located. This is frame 10. You don't need to worry about the word `me` that appears on this line. You'll only edit it when writing advanced Lingo scripts.

The second line contains the `go to the frame` command, which tells Director to send the playhead back to the current frame. The phrase `the frame` always refers to the frame number where the playhead is currently located. Again, this is frame 10.

The last line of any handler contains the word `end`. This simply signals to Director the end of the script. The result is that the playhead continually loops in frame 10 as it is sent back to frame 10 each time it tries to go to frame 11. This way your Director movie plays to frame 10 and loops there until the user clicks a button to go to a different scene.

Reuse the handler

You'll use the same script cast member in the last frame of your movie, frame 64.

With the Cast window and Score open, drag the Loop script from cast slot 13 to frame 64 in the script channel of the Score. A new sprite for the script appears in frame 64.

Notice that the default length of script sprites is one frame.

Now the same looping effect takes place in frame 64 so that the movie keeps playing until the user clicks a button in the sound and video scene.

In the animation scene, you constructed an animation that takes place from frame 15 to frame 50. If you loop the playhead only in frame 50, the animation does not play while the movie is waiting for the user to click a button. In this case, you should loop the playhead over the entire range of frames that contain the animation.

To do this, you can use a script that is similar to the one you just wrote and place it in the last frame of the animation scene. However, this new script will send the playhead to the first frame of the animation rather than to the frame where the script is located.

Because the first frame of the animation scene is frame 15, you can simply write a script that says:

```
go to frame 15
```

The problem with this script is that it's not too flexible. If you decide to move the animation scene to a different range of frames in the Score, the script would be incorrect. To make the script more flexible, you can place markers in the Score and send the playhead to a marker rather than a specific frame number.

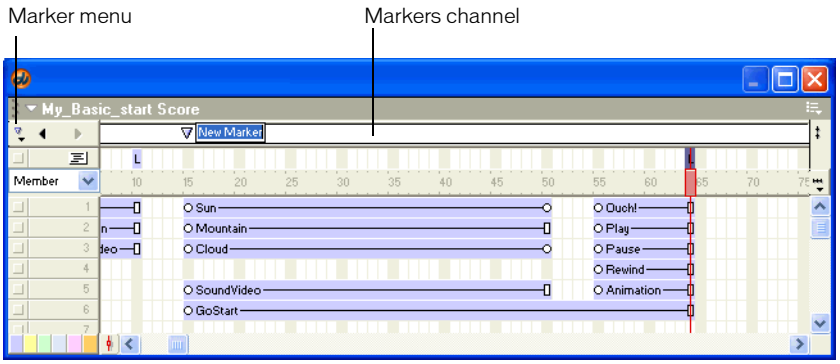
Add a marker to the Score

Markers are a way of giving a name to a specific frame in the Score. If you name the first frame of the animation scene and then decide to move the scene, you can simply move the marker in the Score along with the rest of the scene.

1 Because you won't be using the effects channels in this section, click the Hide/Show Effects Channels button in the upper right corner of the Score.

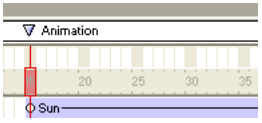
All the effects channels, except the script channel, are hidden. This makes the Score easier to read.

2 In the markers channel to the right of the marker menu in the Score, click frame 15.



A new marker appears in the marker bar in frame 15.

3 Type **Animation** in the text box next to the new marker, and press Enter (Windows) or Return (Macintosh) to name the marker.



Note: As you complete the tutorial, remember to save your work frequently.

Create navigation in Lingo using marker names

You can write a script that loops the playhead in frames 15 through 50 using the name of the marker.

1 Double-click the script channel in frame 50, the last frame of the animation scene. The script window opens with the default `on exitFrame` script already entered.

2 Inside the default script, on line 2, type the following:

```
go to frame "Animation"
```

3 In the Name text box at the top of the window, type **AnimLoop**, and close the Script window.

The new script cast member appears in slot 14 of the Cast window, and the new sprite appears in frame 50 of the script channel in the Score.

4 Click frame 15 in the frame number bar in the Score, and click the Play button on the Control panel.

The animation scene plays, and the playhead loops back to frame 15 when it reaches frame 50. The animation of the sunset repeats continuously.

5 Click the Stop button on the Control panel.

Each of the three scenes in your movie has a script that prevents the playhead from moving to a different scene. Now you'll add scripts to the navigation buttons so the user can move from scene to scene.

Add Lingo to navigation buttons

To make the navigation buttons function, you need to add scripts to the buttons. You'll write scripts attached to the button sprites, rather than to frames in the script channel. Your frame scripts respond to `exitFrame` events. Your button scripts will respond to mouse clicks.

You start by adding scripts to the buttons in the start scene.

1. In the Score, right-click (Windows) or Control-click (Macintosh) the Animation button sprite in channel 2, frames 1 through 10.
2. In the context menu, select Script. The Script window opens with a default handler entered:

```
on mouseUp me

end
```

3. On the second line of the script, type:

```
go to frame "Animation"
```

   You see the following result:

```
on mouseUp me
  go to frame "Animation"
end
```

4. In the name text box at the top of the window, type **GoAnim**, close the Script window, and save your movie.

This handler has three parts. The first line tells Director to trigger this handler when the user clicks on the button sprite to which the script is attached. Specifically, the `mouseUp` event refers to the action of releasing the mouse button after it has been pressed. This way the script is not run until the user releases the mouse button when clicking.

The second line of the handler contains the same code as the previous script you wrote. It sends the playhead to the frame that contains the marker named Animation. The difference between these two scripts is that this one performs its action based on a mouse click, not on an `exitFrame` event.

Again, the word `end` on the last line tells Director that the script is over.

Test your script

You're ready to try out your new button script.

1. If necessary, bring the Stage window to the foreground by clicking in its title bar, and then rewind and play your movie.

   The movie plays, and the start scene remains on the screen. The playhead does not move to another scene until you click your newly scripted button.

2. Click the Animation button on the Stage.

   Notice that the button automatically provides feedback by changing color when it's clicked. The playhead moves to the first frame of the animation scene, and the sunset animation plays.

3. Stop your movie.

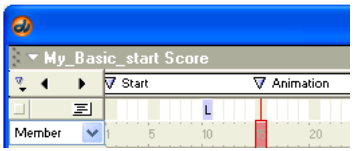
Add markers to two additional scenes

Your first button is complete. To use similar scripts on the remaining navigation buttons, you can add markers to the start scene as well as the sound and video scene.

1. In the Score, click the marker bar in frame 1, the first frame of the start scene.

   A new marker appears.

2. In the text box next to the new marker, type **Start**, and press Enter (Windows) or Return (Macintosh).



3. Click the marker bar in frame 55, the first frame of the sound and video scene, to create a new marker.

4. In the text box next to the new marker, type **SoundVideo**, and press Enter (Windows) or Return (Macintosh). Save your movie.

Write Lingo that refers to scenes

You can write scripts that refer to any of the three scenes by name. You'll now add a script to the Go to Sound and Video button in the start scene.

1. In the Score, right-click (Windows) or Control-click (Macintosh) the SoundVideo sprite in channel 3, frames 1 through 10. In the context menu, select Script.

   The Script window opens with the default `on mouseUp` handler.

2. On the second line of the handler, type:

   ```
   go to frame "SoundVideo"
   ```

3. Click the name text box at the top of the window, and type **GoSndVid**, close the Script window, and save your movie.

4. To test the script, rewind and play your movie, and then click the Go to Sound and Video button.

   The movie jumps to the sound and video scene, and the QuickTime sprite plays.

Add scripts to the animation scene

The animation scene contains two buttons: the Go to Start button and the Go to Sound and Video button. Because you've already written a script for the Go to Sound and Video button, you can reuse it. For the Go to Start button, you need to write another new script.

1. With the Cast window and the Score open, drag the GoSndVid script cast member from the Cast window onto the SoundVideo button sprite in channel 5, frames 15 through 50, of the Score.

   The script is now attached to this sprite in the same way it is attached to the SoundVideo button sprite in scene 1.

2. To write a new script for the Go to Start button, right-click (Windows) or Control-click (Macintosh) the GoStart button sprite in channel 6, frames 15 through 64, of the Score.

3. Select Script from the context menu. The Script window opens with the default `on mouseUp` handler. On the second line of the handler, type:

   ```
   go to frame "Start"
   ```

4. Click the Name text box at the top of the Script window and type **GoToStart**, then press Enter (Windows) or Return (Macintosh). Close the Script window and save your movie.

Because this Go to Start button sprite extends all the way into the sound and video scene, you don't need to do anything else to enable the button in that scene. The last step to enable all the navigation buttons is to add the GoAnim script you've already written to the Go to Animation button in the sound and video scene.

Add scripts to the sound and video scene

You've already added the navigation script to the Go to Start button in the sound and video scene. To complete the navigation buttons, you only need to add a script to the Go to Animation button. After that, you'll use Lingo commands to control the digital video sprite and play sounds.

1. With the Cast and Score windows open, drag the GoAnim script from the Cast window onto the Animation button sprite in channel 7, frames 55 through 64, of the Score to attach the script to the button. Save your movie.

   Your movie's navigation functionality is now complete. You can now move among all three scenes of your movie.

2. Rewind and play your movie.

3. Use each of the navigation buttons in all three scenes. Verify that each button sends the playhead to the correct scene.

About controlling video in Director

Although Director movies and digital video movies share some similarities, differences also exist between the two types of movies. Both Director movies and digital videos comprise a sequence of frames that display on the screen. Director plays its movies by moving the playhead through the Score and displaying each frame the playhead comes to. If the computer the movie plays on is slow and takes a long time to display each frame, the Director movie plays slowly. The way in which Director plays movies is called *frame-based* animation.

Digital video movies use a timeline instead of a Score. The timing of the video playback is tied closer to the soundtrack of the video. For example, if the video has a soundtrack, the timing of the video and sound must remain synchronized during the entire playback of the video. For this reason, digital videos will skip frames if necessary to keep up with the soundtrack. On slower computers, several frames might be skipped during video playback. This kind of animation is called *time-based*. These differences are the reason you navigate a Director movie by jumping to different frames in the movie, and you navigate a digital video by jumping to different times within the video.

Add scripts for video control

Now you're ready to add scripts to the bitmap graphic buttons for controlling the digital video playback. For these buttons, you'll use some new Lingo terms. There is a Play button, a Pause button, and a Rewind button. They will use the `movieRate` and `movieTime` properties of the QuickTime sprite. By changing the values of these properties with Lingo, you change the way the video plays on the Stage.

When the user navigates to the sound and video scene from a different scene, the digital video plays from start to finish once. To play the video again without first leaving the scene, you need to rewind it. You rewind the video by setting its `movieTime` property.

The `movieTime` property indicates the time, within the digital video, that currently appears on the screen. The `movieTime` is measured in ticks, or 60ths of a second. For example, when the movie displays the very first frame of video, the `movieTime` is 0. When 1 second of the video has played, the `movieTime` equals 60. When 3 seconds of the video has played, the `movieTime` equals 180. By setting the movieTime to a number of you select, you can make the video jump to a different frame.

Rewind the QuickTime sprite

You can rewind the QuickTime sprite by setting its `movieTime` to 0.

1. In the Score, right-click (Windows) or Control-click (Macintosh) the Rewind button sprite in channel 4, frames 55 through 64.
2. Select Script from the context menu.

   The Script window opens with a default `on mouseUp` handler already entered.
3. On the second line of the handler, type the following Lingo to rewind the QuickTime sprite:

   ```
   sprite(1).movieTime = 0
   ```
4. Press Enter (Windows) or Return (Macintosh).
5. On the third line of the handler, type the following Lingo:

   ```
   sprite(1).movieRate = 0
   ```

   The `movieRate` property indicates the speed at which the QuickTime sprite is playing. When the video is stopped, the `movieRate` is 0.

   The result looks like this:

   ```
   On mouseUp me
     sprite(1).movieTime = 0
     sprite(1).movieRate = 0
   end
   ```

6 In the name text box at the top of the script window, type **RewindScript**. Close the Script window, and save your movie.

The Lingo you typed in this handler uses a different syntax than the scripts you wrote earlier. When you write Lingo that manipulates properties of objects such as sprites or cast members, you use dot syntax. Dot syntax is a way of writing Lingo that separates properties from their objects with dots instead of words such as *the* and *of*.

By using dot syntax, you can write a short script like this:

```
sprite(1).movieTime = 0
```

Without using dot syntax, you would have to write a more verbose script like this:

```
set the movieTime of sprite 1 to 0
```

Using dot syntax is much faster when you are authoring your movie.

This example illustrates the basic requirements of dot syntax:

- You refer to sprites with the word `sprite` followed by the sprite's channel number in parentheses.
- You refer to a property of the specified sprite by separating it from the word `sprite()` with a dot or period.
- The equal sign (=) is sufficient to indicate that the property should be set to the specified value, as in `sprite(1).movieTime = 0`.

7 Close the Script window. Rewind and play your movie. Click the Go to Sound and Video button in the start scene.

The movie jumps to the sound and video scene, and the QuickTime sprite begins to play.

8 When the QuickTime sprite finishes playing, click the Rewind button. The QuickTime sprite rewinds to the beginning of the video.

Add a script that plays the QuickTime sprite

When the video is playing normally, the `movieRate` is 1. You can now add the `movieRate` property to the Play button. This time, the Lingo ensures that the QuickTime sprite plays when the user clicks the Play button.

1 In the Score, right-click (Windows) or Control-click (Macintosh) the Play button sprite in channel 2, frames 55 through 64.

2 Select Script from the context menu. On the second line of the handler in the Script window, type the following Lingo:

```
sprite(1).movieRate = 1
```

This Lingo starts the QuickTime sprite playing at normal speed.

3 In the name text box at the top of the script window, type **PlayScript**, close the Script window, and save your movie.

Add a script that pauses the QuickTime sprite

When the video is paused, the `movieRate` is 0. You can play a video at faster than normal speed by using numbers greater than 1 and at slow speed by using numbers less than 1.

1. In the Score, right-click (Windows) or Control-click (Macintosh) the Pause button sprite in channel 3, frames 55 through 64, and select Script from the context menu.
2. On the second line of the handler in the Script window, type the following Lingo:

   ```
   sprite(1).movieRate = 0
   ```

   This Lingo pauses the QuickTime sprite.
3. In the name text box at the top of the script window, type **PauseScript**, close the Script window, and save your movie.

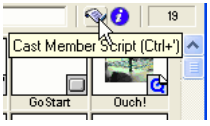
Now all your video control buttons work. Rewind and play your movie to test the buttons.

The sound and video scene plays the sound file you placed in the Score, but only the first time you go to the scene. You can add Lingo to make the music play each time you play the video. You can also add Lingo to make a short sound effect play when the video control buttons are clicked.

Control sound with Lingo

To control sound with Lingo, you use commands that are specifically intended for use with sounds. The first step is to add Lingo to play the drumloop sound when the video plays a second time. For this task, add the play command to the PlayScript Lingo you've already written.

1. In the Cast window, select the PlayScript and click the Cast Member Script button at the upper right of the window. The Script window opens with the PlayScript visible.



2. Place the insertion point at the end of the second line of the handler that reads:

   ```
   sprite(1).movieRate = 1
   ```
3. Press Enter (Windows) or Return (Macintosh), and type the following on the new line:

   ```
   sound(1).play(member("drumLoop"))
   ```

   This Lingo tells Director to play the sound cast member named drumloop in sound channel 1. In the Score, there are two sound channels. When you use Lingo, you can use as many as eight sound channels.
4. Close the Script window, and save your movie.
5. Rewind and play your movie. The drumloop sound now plays each time you press the Play button in the sound and video scene.

Modify the script for the Pause button

Now you need to modify the PauseScript Lingo so that the sound pauses when the user clicks the Pause button to pause the video.

1. In the Cast window, select the PauseScript cast member, and click the Cast Member Script button at the upper right of the window. The Script window opens with the PauseScript displayed.
2. Place the insertion point at the end of the second line of the handler that reads:

   ```
   sprite(1).movieRate = 0
   ```

3. Press Enter (Windows) or Return (Macintosh). On the new line, type the following:

   ```
   sound(1).pause()
   ```

   This Lingo tells Director to pause the sound in sound channel 1.
4. Close the Script window and save your movie.

Now when you click the Pause button in the sound and video scene, the sound and video pause at the same time. When you click the Play button again, the video will resume and the sound plays again.

Modify the script for the Rewind button

You can modify the RewindScript Lingo so that the sound stops when the user clicks the Rewind button.

1. In the Cast window, select the RewindScript cast member and click the Cast Member Script button at the upper right of the window.
2. In the Script window, place the insertion point at the end of the third line of the handler that reads as follows:

   ```
   sprite(1).movieRate = 0
   ```

3. Press Enter (Windows) or Return (Macintosh). On the new line, type the following:

   ```
   sound(1).stop()
   ```

   This Lingo tells Director to stop the sound in sound channel 1.
4. Close the Script window, and save your movie.

Now when you click the Rewind button in the sound and video scene, the video rewinds and the the sound stops playing. When you click the Play button, the video restarts and the sound plays again.

Add sounds to buttons

The final effect you'll add to your movie is to make a short sound play when users click any of the video control buttons in the sound and video scene.

Import the new sound cast member

This sound file is small; there is no compelling reason not to import the file directly into your Director file.

1. In the Cast window, select the first empty cast member slot, which should be slot 21, and select File > Import.
2. In the Import dialog box, navigate to the Sounds folder on the same level as your Director file. Select the button.wav file in the Sounds folder, and click Add.
3. Select Standard Import from the Import mode menu at the bottom of the dialog box, and click Import.

   The new sound cast member appears in the Cast window in slot 21.

Modify the video control button scripts to play the new sound

You'll add a play command to each of the scripts that are attached to the video control buttons. This command plays the new sound cast member in the second sound channel.

1. In the Cast window, select the RewindScript cast member, and click the Cast Member Script button at the upper right of the window.
2. In the Script window, create a new line after the first line of the handler that contains the word `me`.
3. On the new line, type the following Lingo:

   ```
   sound(2).play(member("button"))
   ```

   The `(2)` specifies the second sound channel.
4. Close the Script window, and save your movie.
5. Repeat steps 1 through 4 for the PlayScript and PauseScript cast members.

Play your completed Director movie

You've now completed authoring your Director movie. You can play the movie and move from scene to scene with the navigation buttons you created. You can control the playback of the digital video with the bitmap graphic buttons you added. Next, you'll publish the movie to play on the web.

Publish your movie for the web

In general, you can publish your movie for the web by simply selecting File > Publish. Using default Publish settings, Director will create a Macromedia Shockwave version of your movie, with the Director movie (DCR) extension, in the same directory as your original movie. An HTML page includes the necessary tags to embed the movie. Your browser window opens, and your Shockwave movie plays within the browser.

When you use QuickTime video, you must complete a few additional steps to ensure that your movie plays correctly. These steps involve specifying that a QuickTime Xtra downloads to your user's system, if necessary, and placing your files in a specific folder if you're publishing your movie on a local computer.

Use a QuickTime Xtra

Xtra extensions are software components that extend the functionality of Shockwave movies and projectors. A QuickTime Xtra is necessary to ensure your QuickTime movie plays correctly when published. When you imported the Ouch! QuickTime movie, Director automatically added the QT3 Asset Xtra to the Xtra extensions list for your movie. You'll now select the Xtra from the list to make it available to your users.

1 Select Modify > Movie > Xtras.

2 In the Movie Xtras dialog box, select the following Xtra, according to your operating system:

- Windows users should select QT6Asset.x32.
- Macintosh users should select QuickTime Asset.

Note: Both versions of the QuickTime Xtra are cross-platform.

3 Select Download if Needed, click OK, and save your movie.

The Xtra will now download transparently to the user's computer, from a Macromedia secure server, if the user doesn't have the Xtra. For additional information about Xtra extensions, see TechNote 14888 Using Xtras in Director: An Overview at www.macromedia.com/support/director/ts/documents/xtras.htm.

About Shockwave Player access to linked media on your local computer

The Shockwave Player plays DCRs in safe mode on your local computer to avoid security breeches, such as a movie accessing data on your hard drive. For the Shockwave Player to access the linked media in your tutorial (the QuickTime movie and drumloop.aif sound) in safe mode, the files must be in a folder named dswmedia. This is the only folder name that lets the Player access linked local files. The file naming convention applies only to DCR movies that you play on your local computer; if you upload your files to an Internet server, your linked media does not need to reside in a folder named dswmedia.

Complete the following steps to create a copy of your movie within a dswmedia folder:

1 Save your movie and exit Director (File > Exit).

2 On your desktop, create a new folder and name it dswmedia.

3 Use one of the following techniques to copy your project to the dswmedia folder:

- For Windows operating systems, within your Director MX application folder, browse to Tutorials/Basics. Right-click the Start folder, and select Copy from the context menu. Then, right-click the dswmedia folder and select Paste from the context menu. Repeat this step to copy the BasicsMedia folder, within the Basics folder, to the dswmedia folder. When you finish, you should have two folders, Start and BasicsMedia, at the same hierarchical level, copied into your dswmedia folder.
- For Macintosh operating systems, within your Director MX application folder, browse to Tutorials/Basics. Option-click the Start folder, and drag it to the dswmedia folder. Repeat this step to copy the BasicsMedia folder, within the Basics folder, to the dswmedia folder. When you finish, you should have two folders, Start and Basics/Media, at the same hierarchical level, copied into your dswmedia folder.

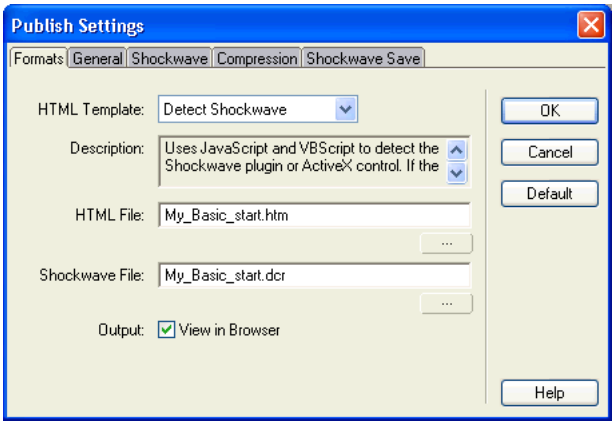
Note: The Start and BasicsMedia folders must be at the same level within the dswmedia folder for the linked media to play correctly.

Change Publish settings and publish your movie

When you use the Publish command, you can take advantage of the default Publish settings of Director, or you can modify them with the Publish Settings dialog box.

For the tutorial movie, you'll publish the movie using the Detect Shockwave HTML page which, in addition to including `OBJECT` and `EMBED` tags that are necessary to display your movie correctly in a browser, includes JavaScript that detects if your user has the correct version of Shockwave. If necessary, a message appears that advises your user to update the Shockwave installation.

1. Open the version of the My_Basic_start movie that resides on your desktop, within the dswmedia folder.
2. Select File > Publish Settings.
3. On the Formats tab of the Publish Settings dialog box, select Detect Shockwave from the HTML Template pop-up menu.
4. Verify that View in Browser is selected, and click OK.



5. Save your movie, and then select File > Publish.

   Your browser opens and plays your tutorial movie.

   When you save your movie, Director also saves any changes you've made to the Publish Settings dialog box. The next time that you want to publish your movie in the same way, you can simply select File > Publish without having to modify Publish settings.

Continue learning about Director

By completing this tutorial, you've become familiar with the basic tasks and procedures used to create Director movies. You now know how to:

- Import cast members
- Edit movie properties
- Create sprites
- Use inks
- Animate sprites
- Create bitmap graphics
- Create vector shapes
- Create button cast members
- Edit the Score
- Use sounds
- Write simple Lingo scripts
- Publish your movie for web playback

To learn more about using Lingo to create sophisticated Director movies, see Chapter 16, "Writing Scripts with Lingo," on page 385. That chapter contains information about precisely controlling sound playback and other aspects of your Director projects.

For information on how to publish Director movies as standalone applications, see "About projectors" on page 582.

For more information about the Publish command, see Chapter 26, "Packaging Movies for Distribution," on page 571.

CHAPTER 3
Director MX 3D Tutorial

Macromedia Director MX includes three-dimensional (3D) images, text, and animations with the suite of Macromedia design and development tools. 3D cast members in your Director movies allow realistic spatial rendering of graphical objects. With Director MX 3D features, you can create and view images that have depth as well as height and width.

What you'll learn

This tutorial introduces you to the use of 3D in Director MX. This version of Director includes 3D behaviors in the Library palette that enable you to build a 3D movie without using the Lingo scripting language directly. (Lingo enthusiasts can refer to "3D Lingo by Feature" in the *Lingo Dictionary* for information on Lingo syntax in Director MX.)

The tutorial takes approximately one hour to complete. It covers 3D basics, including creating 3D text and using behaviors to rotate a model, change camera perspectives, and enable navigation. Additionally, the tutorial explains 3D concepts, which you can apply when creating your own 3D Director movies.

What you should know

If you are new to Director, first complete the Director Basics Tutorial to become familiar with the Director user interface, basic Director concepts and processes, and the use of behaviors. To take the basic tutorial, see "Director MX Basics Tutorial" on page 53.

View the completed movie

You can view a completed version of the tutorial movie to become familiar with how your finished movie will appear.

1. Launch Director, and then select File > Open.
2. Browse to the Director MX application folder and open Tutorials/3D/Magic_finished.dir.
3. To play the movie, click the Play button, along the bottom of the Stage window, or select Control > Play.

   A subtle light appears to shine on the text as it rotates.
4. To get a sense of the behaviors that you'll apply in the tutorial, do the following:

- With the pointer, click the magic objects on the tables.
- Press the arrow keys.
- Press the F and B keys to move forward and backward within the scene.
- Press the Spacebar to return to the original view.

5. When you finish viewing the movie, either click Stop, along the bottom of the Stage window, or select Control > Stop.

Open the tutorial movie

To begin the tutorial, you'll open a partially completed DIR file.

1. Select File > Open.
2. Browse to the Director MX application folder and open Tutorials/3D/Magic_start.dir.

   Note: When you open this file, Director will close the Magic_finished.dir file you explored in the previous section. If you made any changes to that file, do not save them.
3. Select File > Save As and name the file **My_Magic_start.dir**. Save the movie in the same Tutorials/3D folder.

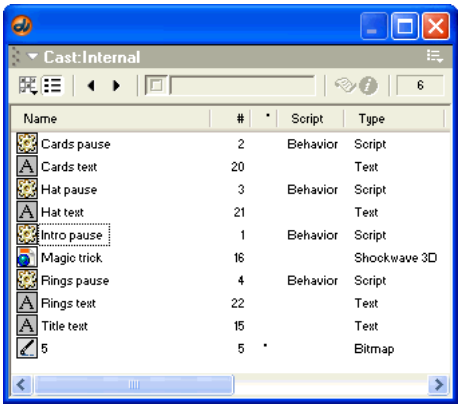
Create 3D text

Director MX lets you import and create 3D models and text. To create 3D text, you create 2D text and then use the Property inspector to give it depth. In this tutorial, you will use 2D text that has already been created.

1 If the Stage and Library are not open, select Window > Library Palette.

2 If your Internal Cast window is not open, select Window > Cast. In the Cast window, find the cast member named Title text.

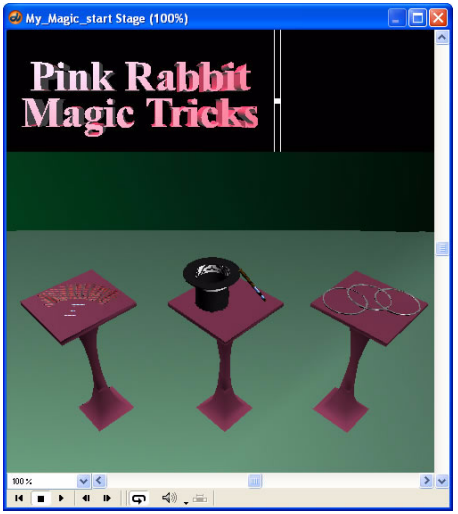
Title text is 2D text created in Director MX.



3 In the Score (Window > Score), select frame 1 in channel 3.

4 Drag the Title text cast member from the Internal Cast window to the upper left area of the Stage, as shown in the following illustration.

The placement doesn't need to be precise; you will use the Property inspector to specify placement coordinates.

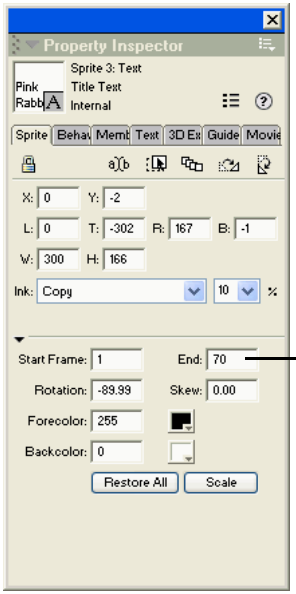


5 If the Property inspector is not open, select Window > Property Inspector.

6 If the Property inspector Sprite tab is not visible, click the Title text sprite on the Stage. On the Sprite tab, type **0** in the X text box and **0** in the Y text box. Press Enter (Windows) or Return (Macintosh).

You use the X and Y text boxes to place the sprite precisely.

7 Type **70** in the End frame text box and press Enter (Windows) or Return (Macintosh) to extend the Title text sprite to the end of the movie.

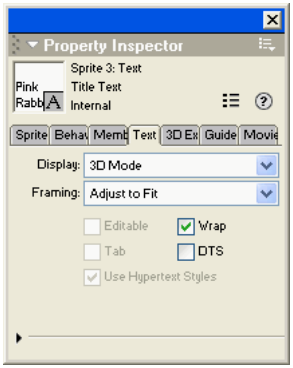


End frame text box

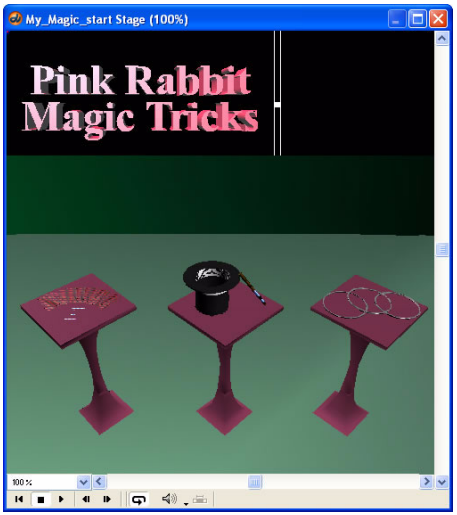
The Property inspector Text tab lets you specify 3D properties for the text.

8 With the text still selected, click the Property inspector Text tab.

9 In the Display pop-up menu, select 3D Mode.



On the Stage, the text becomes 3D.



Modify the 3D text

You can alter the appearance of the 3D text by changing settings in the Property inspector 3D Extruder tab.

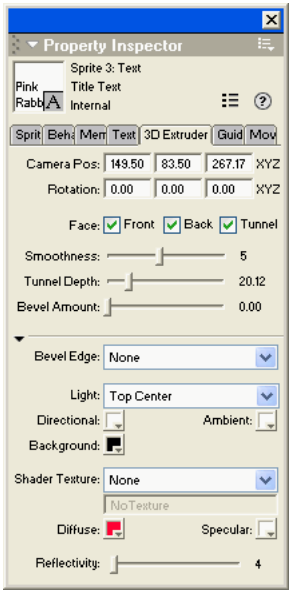
1 Click the Property inspector 3D Extruder tab.

2 Move the Tunnel Depth slider left and right to see the different effects. When you release the mouse button, the depth of the text changes.

3 When you finish experimenting with the different tunnel depths, move the slider to a value close to 20.

4 In the Light pop-up menu, select Top Center.

Three-dimensional objects in Director can use both ambient and directional lights. By specifying Top Center as the light, you're indicating where on the text it should appear as though a light is shining.



The Title text sprite changes to reflect the settings in the Property inspector.

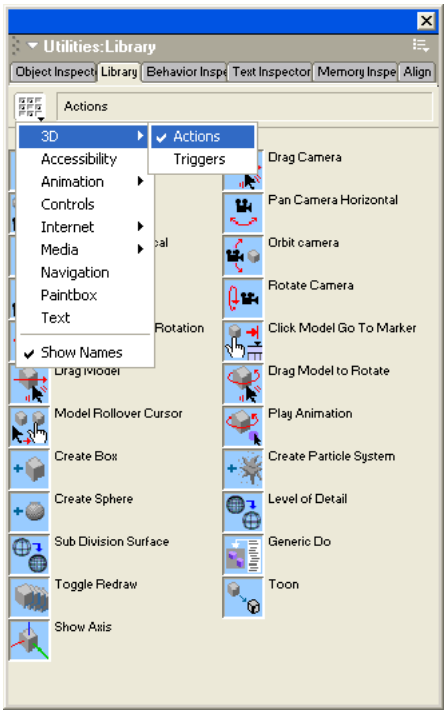
Rotate the 3D text

To rotate the text, you use a behavior from the Library palette. When the 3D text rotates, the directional light that you specified in the Property inspector appears to shine on one fixed position, lighting the text much as a spotlight would.

1 In the Library List pop-up menu, if Actions is not already selected, select 3D > Actions.

The Library includes two types of 3D behaviors: actions and triggers. Actions specify what occurs in the movie, such as a camera rotating around a model. You'll learn more about actions and triggers later in the tutorial.

2 Resize the Library palette to view all of the behaviors in the list.



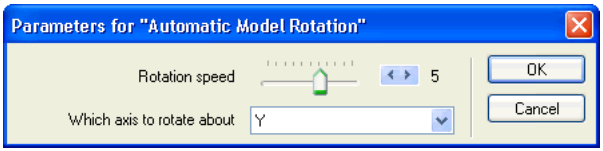
Note: If the Library palette is docked, drag it out of the docking channel to resize it. For more information about docking, see "Docking panels" on page 37.

3 Drag the Automatic Model Rotation action to the Title text sprite either on the Stage or in the Score.

4 In the Parameters for Automatic Model Rotation dialog box, move the Rotation Speed slider to 10.

5 In the Which Axis to Rotate About pop-up menu, select Y, and then click OK.

The *x*- and *y*-axes are the model's horizontal and vertical axes, respectively; the *z*-axis refers to the depth of the model.



6 To view the 3D text rotating, play your movie.

The rotation speed seems a bit fast. To avoid making your users dizzy, you'll modify the behavior parameters.

7 Stop and rewind the movie.

Note: As you complete the tutorial, remember to save your work frequently.

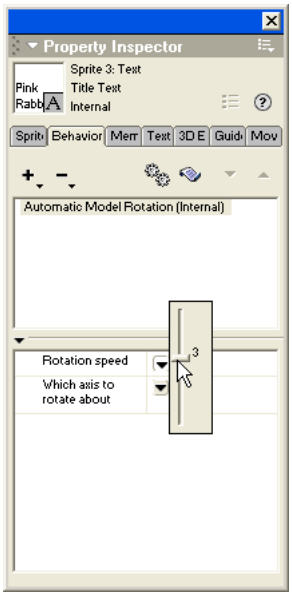
Modify behaviors

Once you've added a behavior to a sprite, you can use the Property inspector to modify the behavior.

Slow the rotation speed

To slow the rotation speed setting, complete the following steps:

1. With the Title text sprite selected, click the Property inspector Behavior tab.
2. With Automatic Model Rotation (Internal) selected in the Property inspector, click the down arrow to the right of Rotation Speed and move the Rotation Speed slider from 10 to 3.



3. Play the movie to view the text rotating at a slower speed. When you finish, stop and rewind the movie.

Note: To return to the parameters dialog box for any behavior, you can double-click the behavior listed in the upper pane of the Property inspector Behavior tab.

View a 3D world

Click the magic shop scene on the Stage. The scene is comprised of models within a single sprite named Magic trick.

The Magic trick cast member is an example of a 3D world. The 3D world contains models, which are the visible objects within the world, such as the tables. Your view of a world depends on the position of the camera.

Use the camera

The camera is the lens through which you view the world. As with a film camera, you can move the Director camera to view the world at various angles and from different distances.

Apply the Pan Camera Horizontal behavior

When you pan a movie camera, you turn the camera on its own axis, such as when a camera turns from side to side on a tripod

You use two panning behaviors in the Library palette to pan the camera up, down, left, and right. Specifying parameters for the panning behaviors gives you precise control over the camera movement.

1 Verify that 3D action behaviors are still visible in the Library.

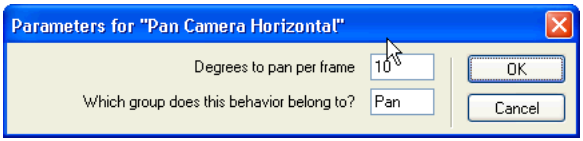
To effectively attach most 3D behaviors to a movie, you work with action and trigger pairs. (The Automatic Model Rotation behavior that you attached to the title text is an exception; it's an action that does not require a trigger.) Triggers are mouse and keyboard inputs that set actions into motion. A trigger-dependent action does not "act" unless the user completes the defined mouse or keyboard input.

2 Drag the Pan Camera Horizontal behavior from the Library palette to the Magic trick sprite on the Stage.

3 In the Parameters for Pan Camera Horizontal dialog box, specify the following:

- In the Degrees to Pan Per Frame text box, type **10**.
- In the Which Group Does This Behavior Belong To text box, type **Pan**. Then click OK.

  You are creating a group, named Pan, to which you'll add actions and triggers. An action and its trigger must be in the same group to work together. You are, in effect, grouping actions with their associated triggers.



Apply the first keyboard input trigger behavior

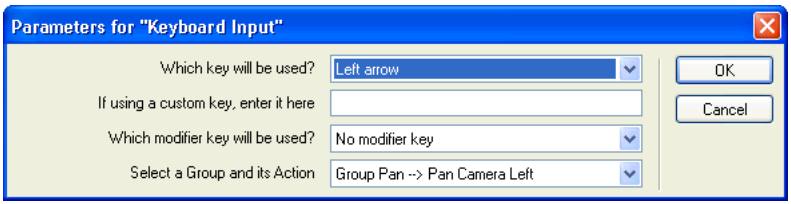
Although you've added the action for the camera to pan horizontally, you still must identify how the user activates and controls panning during movie playback. As you learned earlier, Pan Camera Horizontal is an action behavior; you apply a trigger behavior to control the action. You'll now add a trigger behavior.

1 In the Library List pop-up menu, select 3D > Triggers.

2 Drag the Keyboard Input behavior from the Library palette to the Magic trick sprite on the Stage.

3 In the Parameters for Keyboard Input dialog box, specify the following:

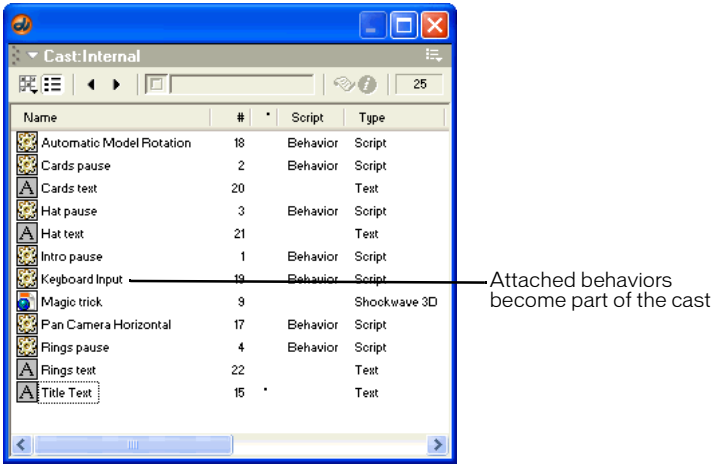
- In the Which Key Will Be Used pop-up menu, select Left Arrow.
- Verify that the second text box is blank and that No Modifier Key appears in the third text box.
- In the Select a Group and Its Action pop-up menu, confirm that Group Pan – Pan Camera Left appears. Then click OK.



Specify the panning trigger for the opposite direction

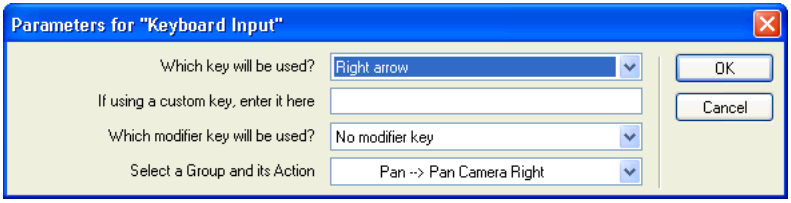
Naturally, you want to give your user the ability to pan the camera to the right as well as to the left. The procedure to add a keyboard input to pan left is similar to the keyboard input procedure you just completed.

1 You've already used the Keyboard Input behavior once, making it part of your cast. Drag the Keyboard Input behavior from the Cast window to the Magic trick sprite on the Stage.



2 In the Parameters for Keyboard Input dialog box, specify the following:

- In the Which Key Will Be Used pop-up menu, select Right Arrow.
- Verify that the second text box is blank and that No Modifier Key appears in the third text box.
- In the Select a Group and Its Action pop-up menu, select Pan – Pan Camera Right. Then click OK.



Pan the camera horizontally

To see the Pan Camera Horizontal behavior in action, do the following:

1. Play the movie and press the Left Arrow key repeatedly.

   Each time you press the key, the camera for the 3D world moves a little to the left.

2. Press the Right Arrow key to see the camera change direction.

3. When you finish viewing the panning behaviors, stop and rewind the movie.

Apply an action behavior to pan the camera vertically

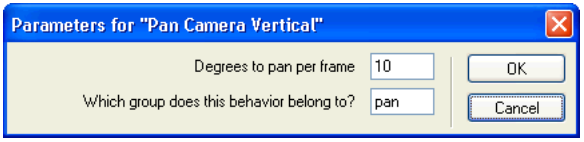
Attaching the Pan Camera Vertical behavior is similar to attaching the Pan Camera Horizontal behavior.

1. In the Library palette, select 3D > Actions from the Library List pop-up menu.

2. Drag the Pan Camera Vertical behavior from the Library palette to the Magic trick sprite on the Stage.

3. In the Parameters for Pan Camera Vertical dialog box, specify the following:

- In the Degrees to Pan Per Frame text box, type **10**.
- In the Which Group Does This Behavior Belong To text box, type **pan**. Then click OK.



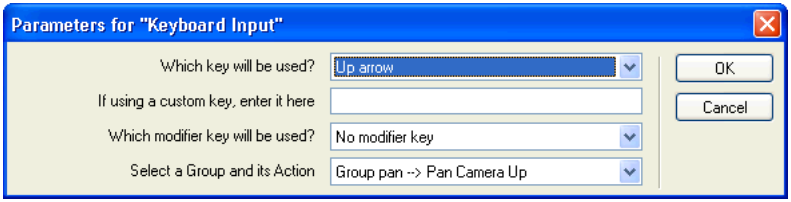
Add a trigger for the Pan Camera Vertical action

Again, you must associate triggers with the action. First, you will specify a trigger to pan the camera upward.

1 Drag the Keyboard Input behavior from the Cast window to the Magic trick sprite on the Stage.

2 In the Parameters for Keyboard Input dialog box, specify the following:

- In the Which Key Will Be Used pop-up menu, select Up Arrow.
- Verify that the second text box is blank and that No Modifier Key appears in the third text box.
- Confirm that Group Pan – Pan Camera Up appears in the Select a Group and Its Action pop-up menu. Then click OK.



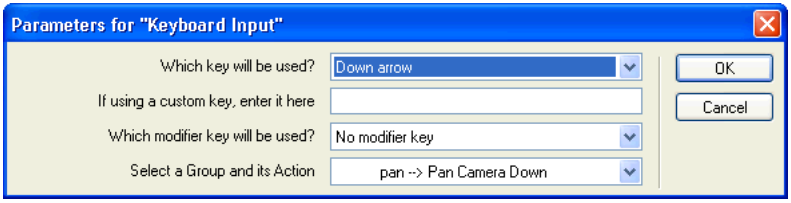
Add the panning trigger for the opposite direction

You can probably guess how to establish downward panning:

1 Again, drag the Keyboard Input behavior from the Cast window to the Magic trick sprite.

2 In the Parameters for Keyboard Input dialog box, specify the following:

- In the Which Key Will Be Used pop-up menu, select Down Arrow.
- As before, verify that the second text box is blank and that No Modifier Key appears in the third text box.
- In the Select a Group and Its Action pop-up menu, select Pan – Pan Camera Down. Then click OK.



Pan the camera vertically

Now you'll test the pan behaviors that you added.

1. Play the movie.
2. Press the Up Arrow key to see the camera tilt up, and press the Down Arrow key to see the camera tilt down.
3. When you finish moving the camera, stop and rewind the movie.

Add the Dolly Camera behavior

Another way to manipulate the view of a 3D world during movie playback is to dolly the camera. Dollying is a motion picture technique in which the camera's position changes without changing the direction of the lens itself (as if the camera were transported forward and backward, without turning, on a tripod with wheels).

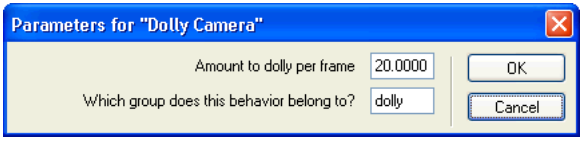
For dollying, you will drag the behavior to the Score rather than the Stage, although you could use either procedure.

1. If the Score is not open, select Window > Score.
2. In the Library palette, verify that 3D > Actions is selected.
3. Drag the Dolly Camera action from the Library palette to the Magic trick sprite in the Score. Release the mouse button when the pointer appears with a plus sign and empty rectangle.
4. In the Parameters for Dolly Camera dialog box, specify the following:

- In the Amount to Dolly Per Frame text box, type **20**.

  The Dolly Camera action moves in *world units,* which are units of measurement unique to the 3D world.

- In the Which Group Does This Behavior Belong To text box, type **dolly**. Then click OK.



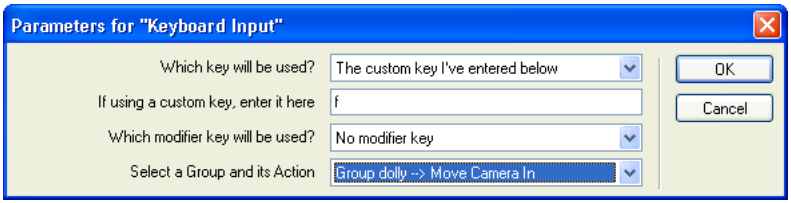
Add the triggers for the Dolly Camera behavior

You have already associated triggers with all four of the arrow keys. You'll now specify that the F and B keys trigger the forward and backward dollying action.

1 Drag the Keyboard Input behavior from the Cast window to the Magic trick sprite either on the Stage or in the Score.

2 In the Parameters for Keyboard Input dialog box, specify the following:

- In the Which Key Will Be Used pop-up menu, select The Custom Key I've Entered Below, if it's not already selected.
- In the If Using a Custom Key, Enter It Here text box, type **f**.
- Verify that No Modifier Key is selected from the Which Modifier Key Will Be Used pop-up menu.
- Verify that Group Dolly – Move Camera In is selected from the Select a Group and Its Action text box. Then click OK.

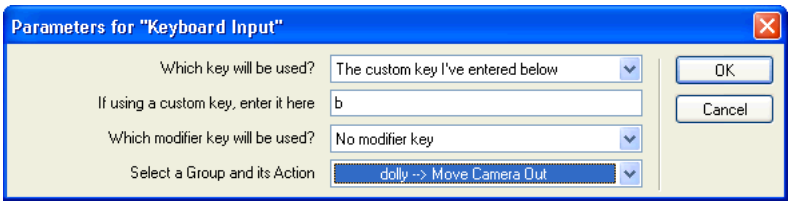


You also want to offer the user the ability to dolly the camera out. To create the Dolly Out behavior, you'll follow similar steps to configure the trigger behavior.

3 Drag the Keyboard Input behavior from the Cast window to the Magic trick sprite on the Stage.

4 In the Parameters for Keyboard Input dialog box, specify the following:

- In the Which Key Will Be Used pop-up menu, verify that The Custom Key I've Entered Below is selected.
- In the If Using a Custom Key, Enter It Here text box, type **b**.
- Verify that No Modifier Key is selected from the Which Modifier Key Will Be Used pop-up menu.
- In the Select a Group and Its Action pop-up menu, select Dolly – Move Camera Out. Then click OK.



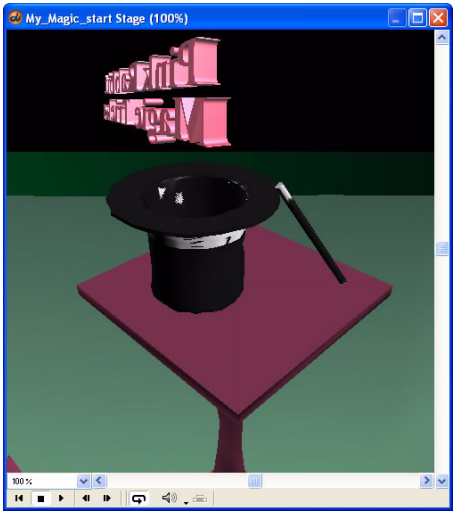
Note: Remember to save your work frequently.

Dolly the camera

1 Play the movie, and press the F key repeatedly or hold the F key down. This dollies the camera in closer to the Magic trick world.

2 Press the B repeatedly, or hold the B key down, to move the camera farther away from the Magic trick world.

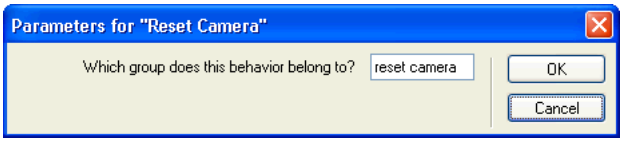
3 When you finish moving around the world, stop and rewind the movie.



Reset the camera

Once the camera starts moving around the world, it can be tricky for the user to return to the original camera position—unless you've included a way to reset the camera. Fortunately, Director MX has a Reset Camera behavior, which you'll now apply.

1. In the Library palette, verify that 3D > Actions is selected. Drag the Reset Camera behavior to the Magic trick sprite.
2. In the Parameters for Reset Camera dialog box, type **reset camera** in the Which Group Does This Behavior Belong To text box. Then click OK.

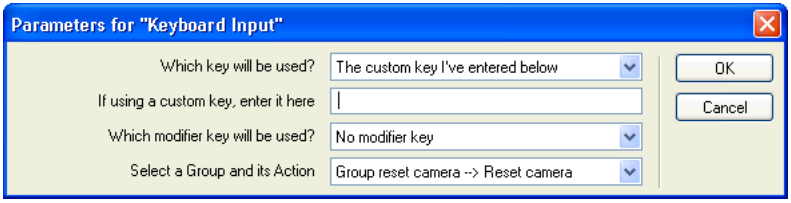


Add the Reset Camera trigger

For the trigger, you will specify that the camera resets whenever the user presses the Spacebar.

1. Drag the Keyboard Input behavior from the Cast window to the Magic trick sprite on the Stage.
2. In the Parameters for Keyboard Input dialog box, specify the following:

- In the Which Key Will Be Used pop-up menu, verify that The Custom Key I've Entered Below is selected.
- With the insertion point in the If Using a Custom Key, Enter It Here text box, press the Spacebar. The insertion point will move one space to the right.
- In the Which Modifier Key Will Be Used pop-up menu, verify that No Modifier Key is selected.
- In the Select a Group and Its Action pop-up menu, select Group Reset Camera – Reset Camera. Then click OK.



Now, when you play the movie and move the camera around the world, you can press the Spacebar to return the camera to its original position.

Set model rollover cursors

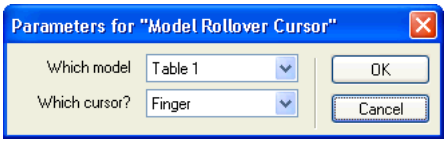
Often in interactive movies, the pointer transforms into a hand when it's over an object the user can click, such as a link or hot spot. The Model Rollover Cursor behavior lets you select a model, then specify how the pointer will appear when it's over that model.

A model can consist of a single object, or multiple objects collected together as one model.

You'll now specify the three table models, which include the objects on the table, that will cause the pointer to change into a pointing finger as it rolls over the model.

1. In the Library, with 3D > Actions selected, drag the Model Rollover Cursor behavior from the Library palette to the Magic trick sprite on the Stage.
2. In the Parameters for Model Rollover Cursor dialog box, specify the following:

- In the Which Model pop-up menu, select Table 1.
- In the Which Cursor pop-up menu, verify that Finger is selected. Then click OK.



Note: Because the Model Rollover Cursor behavior is an independent action, you do not need to assign a trigger behavior to it.

3. Again, drag the Model Rollover Cursor behavior from either the Library palette or the Cast window to the Magic trick sprite. In the Parameter for Model Rollover Cursor dialog box, this time select Table 2 from the Which Model pop-up menu.
4. In the Which Cursor pop-up menu, verify that Finger is selected.
5. Drag the Model Rollover cursor from the Cast window or Library palette to the Magic trick sprite for the third and final time. Select Table 3 in the Which Model pop-up menu and Finger in the Which Cursor pop-up menu.

   Note: Remember to save your work frequently.

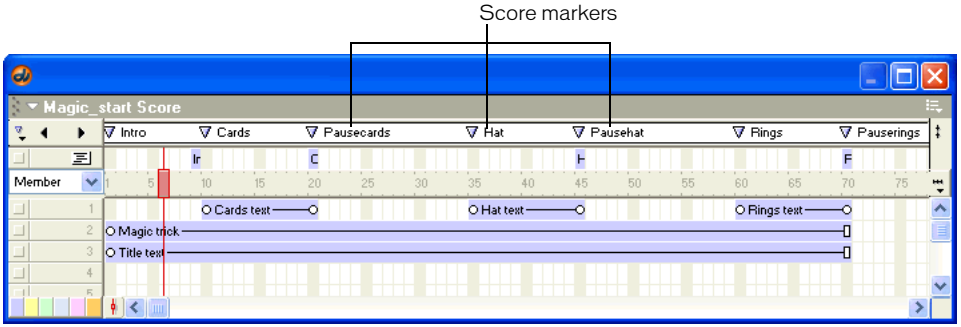
6. Play the movie and move the pointer over the tables, and the items on the tables, to see the pointer change into a pointing finger. When the pointer is not over the models to which the Model Rollover Cursor is applied, it changes back into an arrow.

7 When you finish viewing this behavior, stop and rewind the movie.

Use 3D behaviors for navigation

When a pointer changes to a pointing finger, users know that they can click and expect some sort of result. In your movie, a click of the pointing finger displays information about the merchandise on the tables.

If you look in your Score, you see that the text associated with the merchandise first appears in frame 10 of channel 1. A marker, named Cards, marks where the card text begins, just as markers indicate where the hat and rings text begin. You'll use a behavior to add navigation to your movie so that when the user sees the pointing finger and clicks, the playhead moves to the specified marker in the Score, and the associated text appears.



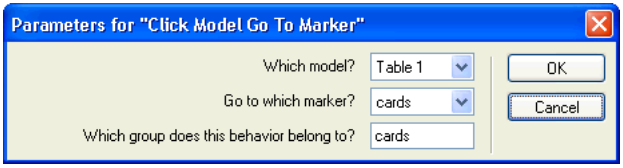
Use the Click Model Go to Marker behavior

The Click Model Go to Marker behavior lets you specify both the model in a 3D world that the user clicks and the marker that the playhead moves to when the user clicks the model.

1 In the Library, with 3D > Actions selected, drag the Click Model Go to Marker behavior from the Library palette to the Magic trick sprite.

2 In the Parameters for Click Model Go to Marker dialog box, specify the following:

- In the Which Model pop-up menu, select Table 1.
- In the Go to Which Marker pop-up menu, select Cards.
- In the Which Group Does This Behavior Belong To text box, type **cards**. Then click OK.



Add the trigger behavior

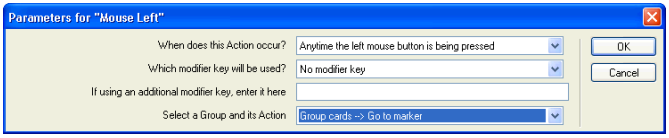
You'll now add a behavior that triggers the Click Model Go to Marker behavior when the user clicks the left mouse button.

Note: When a movie with a Mouse Left behavior is played on a Macintosh computer with a single-button mouse, simply clicking the mouse initiates the trigger effect.

1 In the Library List pop-up menu, select 3D > Triggers and drag the Mouse Left behavior to the Magic trick sprite.

2 In the Parameters for Mouse Left dialog box, specify the following:

- In the When Does This Action Occur pop-up menu, verify that Anytime the Left Mouse Button Is Being Pressed is selected.
- Verify that No Modifier Key appears in the second text box and that the third text box is blank.
- In the Select a Group and Its Action pop-up menu, confirm that Group Cards – Go to Marker appears. Then click OK.

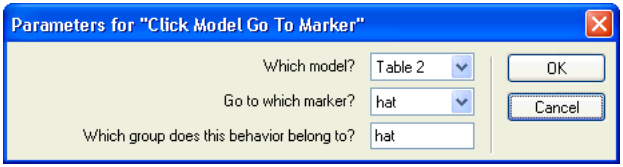


Select the action and trigger for the Hat marker

You'll repeat the procedure to add the Click Model Go to Marker action behavior and trigger behavior for the middle table.

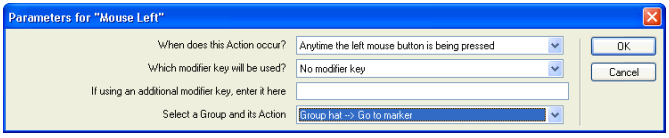
1. Drag the Click Model Go to Marker behavior from the Cast window to the Magic trick sprite.
2. In the Parameters for Click Model Go to Marker dialog box, specify the following:

- In the Which Model pop-up menu, select Table 2.
- In the Go to Which Marker pop-up menu, select Hat.
- In the Which Group Does This Behavior Belong To text box, type **hat**. Then click OK.



3. In Cast window, drag the Mouse Left behavior to the Magic trick sprite.
4. In the Parameters for Mouse Left dialog box, specify the following:

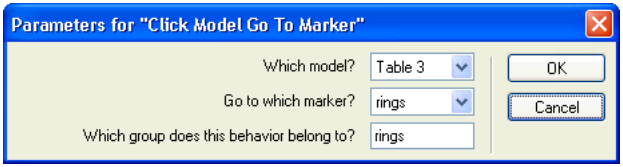
- In the When Does This Action Occur pop-up menu, verify that Anytime the Left Mouse Button Is Being Pressed is selected.
- Verify that No Modifier Key appears in the second text box and that the third text box is blank.
- In the Select a Group and Its Action pop-up menu, select Group Hat – Go to Marker. Then click OK.



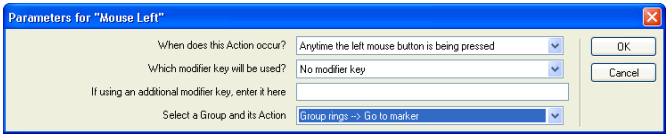
You've almost finished

By now, you should be familiar with the procedure to add the Click Model Go to Marker action and its trigger. You'll repeat the steps a final time for the remaining table.

1 Drag the Click Model Go to Marker behavior from the Cast window to the Magic trick sprite. This time, specify Table 3 in the Which Model pop-up menu and Rings in the Go to Which Marker pop-up menu. Create a new group named Rings. Then click OK.



2 Drag the Mouse Left behavior from the Cast window to the Magic trick sprite. Repeat the steps from the two previous times you've applied this behavior, except this time, in the Select a Group and Its Action pop-up menu, select Group Rings – Go to Marker. Then click OK.



3 Save your movie.

Play your completed movie

When you play your movie, you'll look at the Score to see the Click Model Go to Marker behaviors in action.

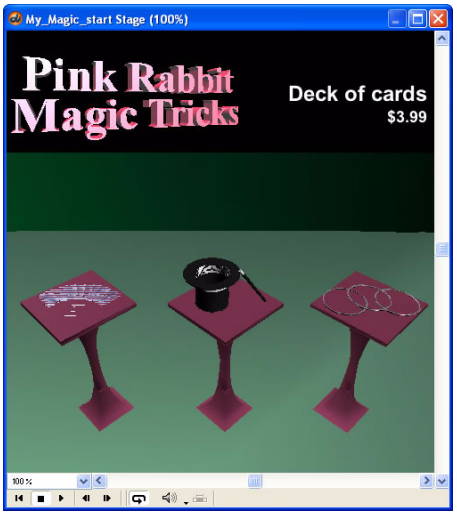
1 Arrange the Score and the Stage so that they are both visible on your screen, and play the movie.

Notice how the movie plays from frame 1 to frame 9 in the Score and then loops back to the Intro marker.

2 Move the pointer on the Stage so that it is touching the left table or the cards on top of it (the Table 1 model).

3 Use the left mouse button (Windows) to click on the Table 1 model. (Macintosh users with a single-button mouse can simply click.) Notice the following:

- The movie plays from frame 10, the frame labeled with the Cards marker, to frame 20. By clicking Table 1 during playback mode, you cause the action to jump to another marker on the Score.
- The merchandise and pricing information that appears above the 3D world comes from the text sprite in frames 10 to 20.



4 Click the other tables to see where, in the Score, the playhead jumps.

5 Use the arrow, F, and B keys to move the camera around the world. Use the Spacebar to reset the camera.

6 When you finish viewing your movie, stop and rewind it.

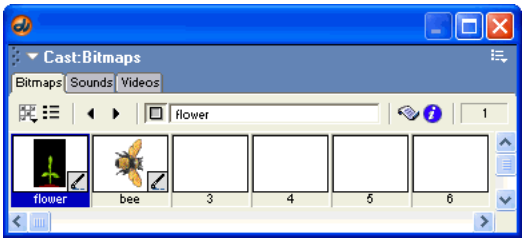
To learn more

Congratulations! You've learned how to maneuver in a 3D world, including creating and rotating 3D text, using action and trigger behaviors to change the camera perspective, and adding navigation to your 3D world. As you completed the tutorial, you also learned about 3D objects such as lights, models, and cameras, and you learned how actions and triggers rely on groups. To learn more about working within a 3D world, see Chapter 17, "3D Basics," on page 443.

CHAPTER 4
Cast Members and Cast Windows

Cast members are the media and other assets in your movie. They can be bitmaps, vector shapes, text, scripts, sounds, Macromedia Flash movies, QuickTime movies, AVI videos, and more. When you place a cast member on the Stage or in the Score, you create a sprite. For more information on sprites, see Chapter 5, "Sprites," on page 157.

You use windows called casts to group and organize your cast members. To populate casts, you import and create cast members. You can create and use multiple casts in a movie. You can also group multiple cast windows together in a tabbed panel layout:

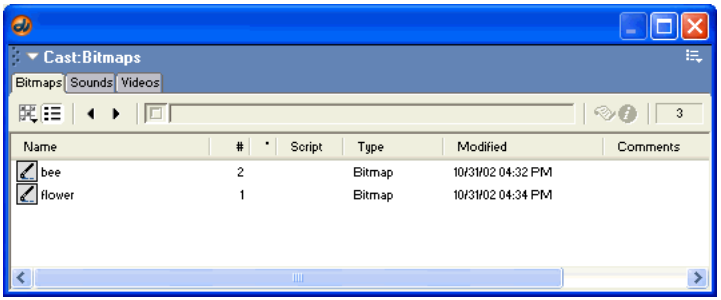


Cast window with tabs in Thumbnail view

You can create and edit cast members in Macromedia Director MX using basic tools and media editors such as the Paint and Text windows, and you can also edit cast members using external editors. In addition, you can import cast members from nearly every popular media format into a movie file. For some media types, you can link cast members as external files located on a disk or the Internet. Linked cast members can be updated dynamically.

The Property inspector contains asset management fields for cast members on the Member tab. These fields let you name your cast members, add comments about them, and view information such as creation and modification dates, and file size.

Casts can be internal—stored inside the movie file and exclusive to that movie—or external—stored outside the movie file and available for sharing with other movies. When you create a new movie, an empty internal cast is automatically created, and when you open the Cast window it is in the default List view. For more information about Cast window views, see "Switching from one Cast window view to another" on page 132.



Cast window in List view

External casts are also useful for creating groups of commonly used cast members. You can use external casts as a way of switching large groups of cast members in a single step. For example, you could switch the text cast members in your movie from English to French by simply switching the cast the movie uses, rather than each individual cast member.

Using external casts can keep the movie size small for downloading because an external cast can download separately from the movie file if or when it is needed.

Creating new casts

Before assembling a large number of cast members, it's good practice to create the casts that are necessary to keep them organized. You can sort casts by type, edit cast properties, and use external casts for storing and sharing common media elements.

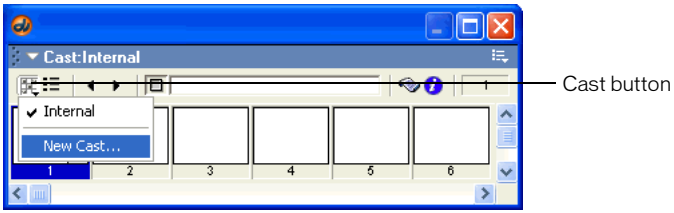
You can create as many casts as necessary; the number of casts does not affect the size of a movie for downloading.

You can include as many as 32,000 cast members in a single cast, but it's usually best to group media such as text, buttons, and images logically in a few different casts for each movie.

To create a new cast:

1 Do one of the following:

- Select File > New > Cast.
- Select Modify > Movie > Casts to open the Movie Casts dialog box, and click the New button.
- In the Cast window, click the Cast button and select New Cast from the pop-up menu. (See "Using Cast window controls" on page 134.)



2 In the New Cast dialog box, type a name for the new cast.

3 Specify how to store the cast:

Internal stores the cast within the movie file. This option makes the cast available only to the current movie.

External stores the cast in a separate file outside the movie file. This option makes the cast available for sharing with other movies. For information about internal and external casts, see "Managing external casts" on page 153.

4 If you chose External and you don't want to use the cast in the current movie, deselect the Use in Current Movie option.

Note: You can link the external cast to your movie later. See "Managing external casts" on page 153.

5 Click Create.

The cast is created and appears as a tabbed panel in the Cast window.

Note: Creating a new cast by selecting Modify › Movie › Casts does not automatically display a tabbed panel. To display the tabbed panel, click the Cast button and select the cast you created from the pop-up menu.

6 If you created an external cast, select File > Save while its Cast window is active, and then save the cast in the desired directory.

Creating cast members

You can create several types of cast members in Director. Director includes editors to create and edit common media such as text, shapes, and bitmaps. You can also define external editors to launch from within Director when you double-click a cast member, and edit almost any type of supported media. See “Launching external editors” on page 151.

You can also import cast members. See “Importing cast members” on page 146.

To create a new cast member from the Insert menu:

1 Open the Cast window for the cast member you are creating.

To place a cast member in a specific position in the Cast window, select the position in Thumbnail view. See “Using Cast Thumbnail view” on page 137. Otherwise, Director places the new cast member in the first empty position or after the current selection in the Cast window.

2 Select Insert > Media Element, and then select the type of cast member to create.

For more information on each choice, see the following sections:

- “Using the Paint window” on page 206
- “Using the Color Palettes window” on page 261
- “Streaming linked Shockwave Audio and MP3 audio files” on page 326
- “Creating text cast members” on page 275
- “Embedding fonts in movies” on page 274
- “Creating an animated color cursor cast member” on page 382
- “Using animated GIFs” on page 205
- “Drawing vector shapes” on page 245
- “Using Flash Movies” on page 293
- “Importing digital video” on page 332

3 To create a control or button, do one of the following:

- Select Insert > Control > Field to create a field cast member. Creating a field cast member also creates a sprite on the Stage. See “Working with fields” on page 282.
- Select Insert > Control > Push Button, Radio Button, or Check Box to create a button cast member and a sprite on the Stage. See “Using shapes” on page 253.
- (Windows only) Select Insert > Control >ActiveX to create an ActiveX cast member. See “Using ActiveX controls” on page 316.

To create a cast member in a media editing window:

1. Open a media editing window by selecting Window and then selecting the type of cast member you want to create (Paint, Vector Shape, Text, and so on).
2. Click the New Cast Member button to create a cast member of the corresponding type. The cast member is added to the most recently active Cast window.

New Cast Member button

To create a cast member using the Script window:

1. Open the Script window by selecting Window > Script.
2. Click the New Cast Member button to create a script cast member.

To create a cast member on the Stage:

1. Open the Tool palette, if it is not already open, by selecting Window > Tool Palette.
2. Using the tools in the Tool palette, create content directly on the Stage. Each object you create automatically becomes a cast member.

   Note: Cast members created on the Stage are automatically placed in the Score.

Using the Cast window

In the Cast window, you can view the cast in either the default List view or the Thumbnail view. (You can change the default so that the Cast window opens in Thumbnail view. See "Setting Cast window preferences" on page 140.)

The Cast window lets you do the following actions:

- Organize and display all media in a movie.
- Move groups of cast members.
- Launch editors for cast members.
- Launch the Property inspector to view, add, and change comments about your cast members and to view and modify cast member properties.
- Group multiple casts in a tabbed view using panel groups (see "Working with Cast panel groups" on page 132).

To view the Cast window:

- Select Window > Cast or press Control+3 (Windows) or Command+3 (Macintosh).

  If there is more than one cast in the movie, you can select which Cast window to open by selecting Window > Cast and then selecting a cast name from the Cast submenu.

Switching from one Cast window view to another

You can easily toggle between List and Thumbnail views of the Cast window.

To switch from one Cast window view to another, do one of the following:

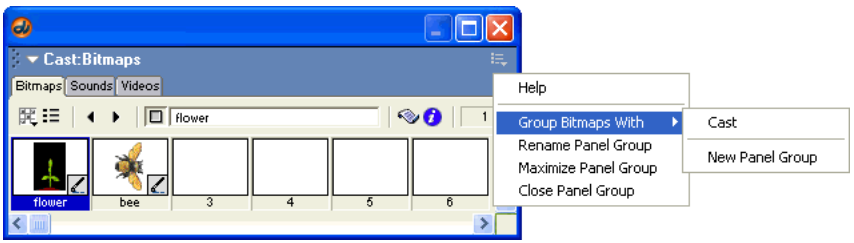
- Click the Cast View Style button on the Cast window to toggle between the two views.

Cast View Style

- With the Cast window active, select View > Cast, and select either List or Thumbnail, as desired.
- Right-click (Windows) or Control-click (Macintosh) the Cast window, and select either List or Thumbnail, as desired, from the context menu.

Working with Cast panel groups

Each Cast panel and panel group has an Options menu located in its upper right corner. The Options menu contains items for grouping, closing, and renaming panels.



To use a Cast panel Options menu:

- Click the Options menu control in the upper right of the panel, and select the desired menu item.

  Help launches the page in the help system that is relevant to the current panel.

  Group [Panel name] With lets you group the currently selected tab in a panel group with another Cast panel or panel group.

  Rename Panel Group opens the Rename Panel Group dialog box where you can rename the Cast panel group.

  Maximize Panel Group maximizes the panel group to occupy the entire height of the docking channel. (For more information about docking channels, see “Managing the workspace in Director MX” on page 34.)

  Close Panel Group closes the panel group.

To group a Cast panel with another Cast panel or Cast panel group:

1. Select a Cast panel or a tab within a Cast panel group.
2. From the panel's Options menu, select Group [Panel Name] With, then select a panel or panel group name from the submenu that appears.

To remove a panel (tab) from a Cast panel group:

1. Select a tab within a Cast panel group.
2. From the panel group's Options menu, select Group [Panel Name] With, then select New Panel Group from the submenu that appears.

   The selected panel opens in its own floating panel. The new panel assumes the name previously assigned to it.

   Note: The New Panel Group submenu option is dimmed if the panel group only contains a single panel.

To rename a Cast panel group:

1. Select Rename Panel Group from the panel's Options menu.
2. In the Rename Panel Group dialog box, type a new name for the panel group in the Panel Group Name text box, and click OK.

To rearrange the order of tabs within a Cast panel group:

1. Select a tab within the Cast panel group.
2. Select Group [Panel Name] With from the panel group's Options menu, then choose the name of the Cast panel group that contains the selected panel.

   The tab is moved to the last (rightmost) position in the panel group.

Note: Save your panel layout if you want to restore your Cast panel configuration the next time you open your file. For more information about panel layouts, see "Saving panel layouts" on page 40.

Managing casts in older Director movies

When you open a multicast movie created in a previous version of Director, only the first cast appears in the Cast window. You can display the remaining casts as tabs in a panel group, or in a new Cast window.

To open a cast as a tabbed panel:

- In the Cast window, click the Cast button and select the cast from the pop-up menu.

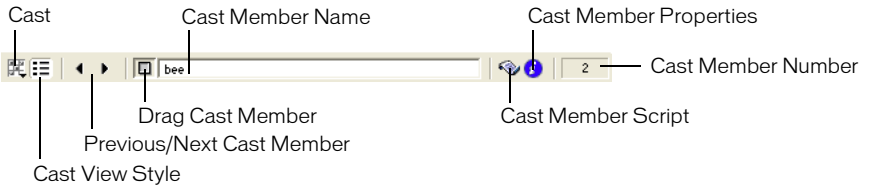
To open a cast in a new window:

- Alt+click (Windows) or Option+click (Macintosh) the Cast button and select a cast from the pop-up menu.

A dialog box reminds you to save your panel layout if you want to restore the configuration of your Cast windows the next time you open your file. For more information about panel layouts, see "Saving panel layouts" on page 40.

Using Cast window controls

The controls along the top of the Cast window are the same in both the List and Thumbnail views. You use the controls to change the cast that appears in the Cast window, the cast member selection, or the name of a cast member. You can also use them to move cast members and to open a cast member's Script window or the Property inspector.



To change the cast displayed in the current Cast window, do one of the following:

- Click the Cast button and select a cast from the pop-up menu.

  The cast is displayed as a tabbed panel in the current panel group.
- Click a tabbed panel to make it active.
- Press Control+Alt (Windows) or Command+Option (Macintosh) followed by the Right Arrow key or Left Arrow key to move from tab to tab.

To open a cast in a new Cast window:

- Alt+click (Windows) or Option+click (Macintosh) the Cast button and select a cast from the context menu.

  A dialog box reminds you to save your panel layout if you want to restore your Cast panel configuration the next time you open your file. For more information about panel layouts, see "Saving panel layouts" on page 40.

To select the previous or next cast member:

- Click the Previous Cast Member or Next Cast Member button.

To move a selected cast member to a new position in the Cast window (Thumbnail view) or to the Stage:

- Drag the Drag Cast Member button to the desired position in the Cast window or to the Stage.

  This procedure is useful when the selected cast member has scrolled out of view.

To enter a cast member name:

- Select a cast member, and enter the name in the Cast Member Name text box.

To edit a cast member script:

- Select a cast member and click the Cast Member Script button.

To view cast member properties:

1 Select a cast member.

2 Do one of the following:

- Click the Cast Member Properties button.
- Right-click (Windows) or Control-click (Macintosh), and select Cast Member Properties from the context menu.
- Select Window > Property Inspector.

See "Viewing and setting cast member properties" on page 142.

To view the cast member number:

- Refer to the Cast Member Number field in the upper right corner of the Cast window.

Selecting cast members in the Cast window

Before changing, sorting, or moving cast members, you must select them in the Cast window.

To select a single cast member, do one of the following:

- In List view, click the name or icon (Windows) or click any part of the text or icon (Macintosh).
- In Thumbnail view, click the thumbnail image.

To select multiple adjacent cast members, do one of the following:

- In List view, Shift-click or marquee-select the cast members.
- In Thumbnail view, click the first cast member in the range and then Shift-click the last cast member in the range.

To select multiple nonadjacent cast members:

- In either List or Thumbnail view, Control-click (Windows) or Command-click (Macintosh) each cast member that you want to select.

Copying cast members

You can easily create multiple versions of a cast member in a single cast. For example, you might want several cast members to be identical except for color or size. You can also copy cast members from one Cast window to another.

To copy a cast member:

1 In either List or Thumbnail view, select the cast member (or multiple cast members) that you want to copy.

2 Alt+click (Windows) or Option+click (Macintosh), and drag the cast member to a new location in Thumbnail view or to the bottom of the list in List view.

You can drag the cast member to a location in the same Cast window or to a different Cast window. Director creates a cast member with a new number, but with all of its other information identical to the original.

3 If you copied the cast member into the same Cast window, change the name of the copied cast member so that you (and Lingo scripts) can distinguish it from the original. See "Naming cast members" on page 136.

Naming cast members

To avoid problems in Lingo when referring to cast members, you should name them and refer to them by name. Naming cast members doesn't affect Director performance. The name stays the same even if the cast member number changes.

Avoid duplicating cast member names. If more than one cast member has the same name, Lingo uses the cast member with the lowest number in the cast.

To name a cast member:

1. Select the cast member in either the List or the Thumbnail view of the Cast window.
2. Do one of the following:

- Enter a name in the Cast Member Name text box at the top of the Cast window or in any of the editing windows.
- Enter a name in the Name text box on the Cast or Member tab in the Property inspector.

To name a cast member using Lingo:

- Set the `name` cast member property. See `name (cast member property)` in the *Lingo Dictionary*.

Using Cast List view

Cast List view, the default view in which the Cast window opens, provides seven columns of information by default. They are shown in the following table:

Column Title	Column Information
Name	The name of the cast member and an icon that describes the cast member type. For information on what the icons represent, see "Using Cast Thumbnail view" on page 137.
#	The number that is assigned to the cast member. This number represents the order in which this cast member appears in Thumbnail view.
*	An asterisk (*) in this column indicates the cast member has changed, but you have not yet saved those changes.
Script	The word Member in this column means the cast member contains a script. The word Movie in this column means the cast member is a movie script. The word Behavior in this column means the cast member is a Behavior. You can use the Script icon to view the script or behavior.
Type	The cast member type
Modified	The date and time the cast member was changed
Comments	Displays text entered on the Property inspector Member tab, in the Comments text box.

Four additional columns are available in the Cast Window Preferences dialog box. See "Setting Cast window preferences" on page 140. The additional columns that you can display are described in the following table:

Column Title	Column Information
Size	The size in bytes, kilobytes, or megabytes
Created	The date and time the cast member was created

Column Title	Column Information
Modified By	Who modified the cast member. This value comes from the user login name (Windows) or the Sharing setup name (Macintosh).
Filename	The full path to the cast member if it is a linked asset

Resizing columns in Cast List view

You can resize columns in Cast List view.

To resize a column:

1. Hold the pointer over the column boundary to activate the Resizing tool.
2. Drag the column to the desired size.

Sorting Cast List view columns

You can sort the Cast List view columns in ascending and descending order by clicking the column title. When you sort the Cast List window by clicking the column title, you're changing the way in which the information appears but are not changing any cast member attributes.

About cast member order in Cast List view

Unlike the way in which cast members appear in Thumbnail view, in List view the cast member order does not always correspond to the member's physical location in the cast.

When you work in List view, also keep in mind the following:

- In List view, Director places new cast members at the end of the list, and the cast member number becomes the first available number after the current selection.
- You can use Thumbnail view to reorder (and renumber) cast members by dragging them to different locations in the window; you cannot reorder cast members by dragging in List view.

Using Cast Thumbnail view

As the name suggests, the Cast Thumbnail view shows a very small (thumbnail) version of the cast member, along with an icon that represents the cast member media type, as shown in the following table:

Icon	Cast member type	Icon	Cast member type
	Animated GIF		Behavior
	Bitmap		Button
	Check box		Custom cursor
	Digital video		Field
	Film loop		Flash movie
	Font		Linked bitmap (all linked cast member icons are changed in the same way)

Icon	Cast member type	Icon	Cast member type
	Movie script		OLE
	Palette		Parent script
	PICT		QuickTime video
	Radio button		RealMedia
	Shape		Shockwave 3D
	Shockwave Audio		Sound
	Text		Transition
	Vector shape		Xtra

To turn off or on the display of cast member icons in Thumbnail view and change the Cast window display:

- Select Edit > Preferences > Cast. See “Setting Cast window preferences” on page 140.

Creating a custom cast member thumbnail

For most cast members, Director displays a scaled version as the thumbnail unless you define a custom thumbnail. Creating a custom thumbnail is useful for behaviors that you want to identify in the Library palette, because behaviors have no identifying image.

To create a custom cast member thumbnail:

1. Select the bitmap image to use as the new thumbnail, and copy it to your system’s Clipboard.

   You can copy the image from any bitmap editor, including the Paint window. The image can be any size, but smaller images look better because they require less scaling.

2. Using Thumbnail view, place the pointer over the cast member for which you are creating a custom thumbnail.

3. Right-click (Windows) or Control-click (Macintosh), and select Paste Bitmap from the context menu.

   The image from the Clipboard replaces the current cast member thumbnail.

   You can also use text as a thumbnail. Select text instead of a bitmap image in step 1, and then select Paste Text from the context menu.

Moving cast members within the Cast window

To move a cast member to a new position within the Cast window, you can use Thumbnail view to see the representation of the cast member's position.

Note: When you move a cast member to a new position, Director assigns it a new number and updates all references to the cast member in the Score, but it doesn't automatically update references to cast member numbers in Lingo scripts. The best practice is to always name cast members and refer to them by name in Lingo scripts.

To move a cast member to a new position or a different cast:

- Using Thumbnail view, drag the cast member to a new position in any open Cast window.

  In Thumbnail view, a highlight bar indicates where the cast member will be placed. If you drag the cast member over a position that already contains a cast member, Director places your selected cast member in that position and moves the existing cast member one position to the right.

  In List view, the cast member is added to the bottom of the list.

To cut, copy, and paste cast members to a new position or a different cast:

1. Select one or more cast members, then select Cut or Copy from the Edit menu.
2. Do one of the following:

- In Thumbnail view, select an empty position in any open Cast window, and then select Edit > Paste.
- In List view, deselect all cast members by clicking anywhere in the window except on a cast member name. Then select Edit > Paste.

Note: In either Thumbnail or List view, if you paste cast members while other cast members are selected, you will overwrite the selected cast members.

To move a cast member to a position that is not currently visible in Thumbnail view:

1. Select the cast member you want to move.
2. Scroll the Cast window to display the destination position.
3. Drag the Drag Cast Member button to the destination position.

Organizing cast members within the Cast window

The Sort command in the Modify menu helps clean up and organize the Cast window. Use Sort to sort cast members by their media type, name, size, or usage in the Score. You can also use Sort to remove empty positions in a Cast window.

When you use the Sort command to organize a Cast window, Director can move cast members to new positions, with new cast member numbers.

Note: If you've written scripts that refer to cast members by number, Lingo can't find moved cast members. To avoid this problem, always name your cast members and refer to them by name in your scripts.

If you want to view the cast members in a different sort order without changing cast member numbers, click a column title in Cast List view. See "Sorting Cast List view columns" on page 137.

To sort the cast using the Modify menu:

1. With the Cast window active, select the cast members to sort or select Edit > Select All.
2. Select Modify > Sort.
3. In the Sort Cast Members dialog box, select one of the following sorting methods:

   Usage in Score places selected cast members that are used in the Score at the beginning of the selection.

   Media Type groups all cast members according to their media type.

   Name groups the selection alphabetically by cast member name.

   Size arranges the selection with the largest files appearing first.

   Empty at End places all empty cast positions in the selection at the end.
4. Click Sort.

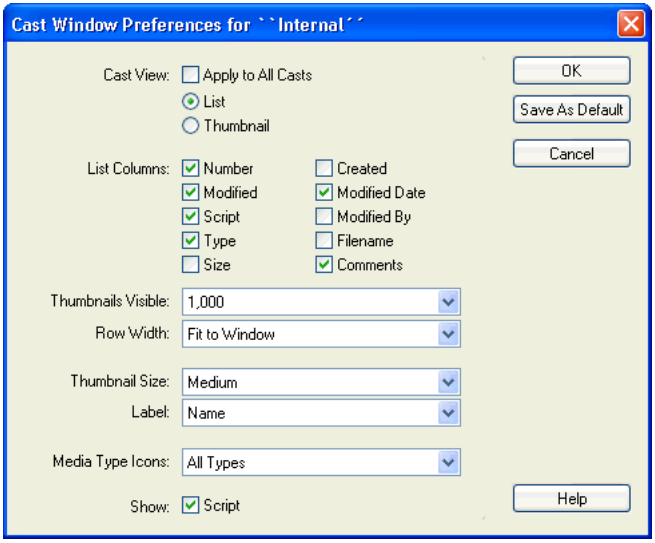
   Director reorders the cast members according to the sorting method you selected. The Score automatically adjusts to the new cast member numbers.

Setting Cast window preferences

You use the Cast window preferences settings to control the appearance of the current Cast window or, if desired, all Cast windows. You can set different preferences for each Cast window. The title bar of the dialog box displays the name of the Cast window preferences you are changing.

To set Cast window preferences:

1. Select a Cast window to change, or a click a tab within a Cast panel group.
2. Select Edit > Preferences > Cast.



3 To set the Cast window to display in either List or Thumbnail view, select the appropriate Cast View option.

4 If you want your preferences to apply to all Cast windows, select Apply to All Casts.

5 To select the columns that appear in Cast List view, select the desired List Columns options. See "Using Cast List view" on page 136.

6 To specify the maximum number of cast members to appear in the Cast window, select a value from the Thumbnails Visible pop-up menu.

This option does not limit the number of cast members that can exist in the cast. If you have a small number of cast members, you can hide the remaining unused cast positions to make better use of the vertical scroll bar. The default is 1000.

7 To specify the number of thumbnails in each row of the Cast window, select an option from the Row Width pop-up menu.

The options for 8 Thumbnails, 10 Thumbnails, and 20 Thumbnails specify fixed-row widths that are independent of the window size; if the Cast window is smaller horizontally than the width of the cast row, you must use the horizontal scroll bar to reveal the rest of the cast. The Fit to Window option automatically adjusts the number of cast members per row to fit the current width of the Cast window. In this mode, the horizontal scroll bar is disabled because the entire width of the cast is always in view. The default is Fit to Window.

8 To set the size of each cast thumbnail image that appears in the Cast window, select one of the following options from the Thumbnail Size pop-up menu:

Small 44 x 33 pixels

Medium 56 x 42 pixels (default)

Large 80 x 60 pixels

Thumbnails always maintain the standard 4:3 aspect ratio.

If the thumbnails appear fuzzy, they are probably displaying larger than their original size. To correct this, change the Cast window preferences thumbnail setting to a smaller size. Click OK when the alert message asks if thumbnails should be regenerated.

9 To select the display format of the cast member ID that appears below each cast thumbnail image in the Cast window, select one of the following options from the Label pop-up menu:

Number displays the cast number.

Name displays the cast name, if one exists; otherwise, this option displays the cast number in decimal format.

Number:Name displays the cast number in decimal format and the cast name, separated by a colon (:) (for example, 340:Dancing Potato). If no name exists, this setting displays the cast number in decimal format.

The selected format is also used in other windows, including the Score, whenever a cast ID appears.

10 To specify whether Director displays an icon in the lower right corner of each cast member that indicates the cast member's type, select one of the following from the Media Type Icons pop-up menu: All Types, All but Text and Bitmap, or None.

11 To display a script indicator icon in the lower left corner of each cast member that has a script attached, select Script.

12 To make your preference settings the default settings, click Save as Default.

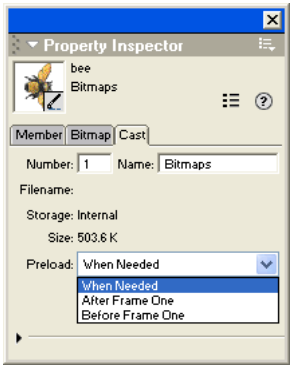
13 When you finish selecting your preferences, click OK.

Changing Cast properties

You use the Property inspector to change the name of a Cast and to define how its cast members are loaded into memory.

To change Cast window properties:

1 With the Cast window as the active window, open the Property inspector and click the Cast tab.



2 To change the name of the current cast, enter the new name in the Name text box.

3 Select one of the following Preload options to define how cast members are loaded into memory when the movie runs:

When Needed loads each cast member into memory when it is required by the movie. This setting can slow down the movie while it plays, but it makes the movie begin playing sooner. This setting is the best choice when controlling cast members loading with Lingo.

After Frame One loads all cast members (except those required for frame 1) when the movie exits frame 1. This setting can ensure that the first frame appears as quickly as possible, and it might be the best choice if the first frame of the movie is designed to remain onscreen for a number of seconds.

Before Frame One loads all cast members before the movie plays frame 1. This setting makes the movie take longer to start playing, but it provides the best playback performance if there is enough memory to hold all cast members.

Viewing and setting cast member properties

You can display and set properties for individual cast members, or for multiple cast members at once, even if the cast members are different types. In both cases, you use the Property inspector.

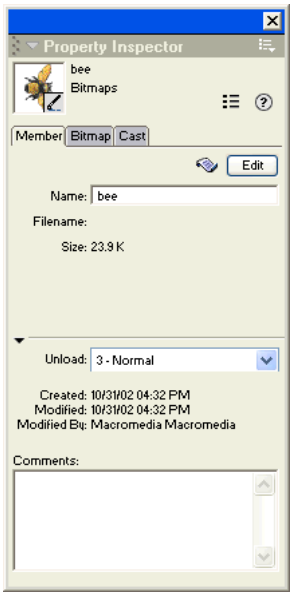
You can also set cast member properties by using Lingo (see “Setting cast member properties using Lingo” on page 154).

To view and set cast member properties:

1 Select one or more cast members.

2 Do one of the following:

- If the Property inspector is open, click the Member tab.
- If the Property inspector is not open, select Window > Property Inspector, and click the Member tab.



As with all fields in the Property inspector, if you've selected multiple cast members, the information that is common to all the selected cast members appears. Any changes you make apply to all the selected cast members.

3 Display the Graphical view on the Member tab.

The Member tab displays the following items:

- Editable fields to view or change the cast member's name (the Name text box), a Comments text box to enter text that appears in the Comments column of the Cast List window, and an Unload pop-up menu that lets you select how to remove a cast member from memory. For more information on using the Unload pop-up menu, see "Controlling cast member unloading" on page 152.
- View-only fields which indicate the cast member's size, when the cast member was created and modified, and the name of the person who modified the cast member.

  For an Xtra cast member, the information displayed in the Property inspector is determined by the developer of the Xtra. Some Xtra extensions have options in addition to those listed here. For non-Macromedia Xtra extensions, refer to documentation supplied by the developer.

For information on specific cast member properties, see the following topics:

- “Using animated GIFs” on page 205”
- “Embedding fonts in movies” on page 274
- “Using Flash Movies” on page 293
- “Setting bitmap cast member properties” on page 237
- “Setting vector shape properties” on page 252
- “Synchronizing media” on page 328
- “Setting film loop properties” on page 198
- “Setting palette cast member properties” on page 266
- “Setting PICT cast member properties” on page 238
- “To specify a shape’s fill with Lingo:” on page 254
- “Setting sound cast member properties” on page 321
- “Setting text or field cast member properties” on page 285
- “Setting transition cast member properties” on page 272
- “Setting Xtra cast member properties” on page 155
- “Creating an animated color cursor cast member” on page 382
- “Streaming linked Shockwave Audio and MP3 audio files” on page 326

Launching cast member editors

You can open any cast member in the appropriate editor directly from the Cast window. You can use the Director internal media editors, such as the Text, Paint, or Vector Shape window, or you can specify external editors for certain types of cast members. See “Launching external editors” on page 151.

To launch an editor for a cast member, do one of the following:

- Double-click a cast member in the Cast window.
- Double-click a sprite that contains the cast member in the Score or on the Stage. See “Sprites” on page 157.

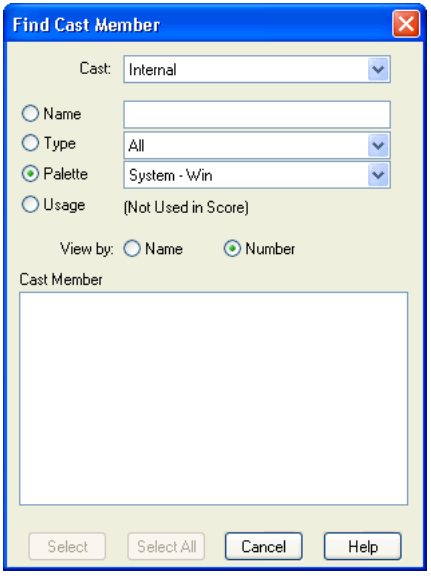
Finding cast members

You can search for cast members by name, type, and color palette. You can search for selected cast members used in the Score, such as when you are preparing a movie for distribution. You can also search for cast members not used in the Score—for example, to clean up a movie and reduce the space and memory required to save and run the movie.

Before releasing a movie, it’s a good idea to remove unused cast members to make the movie as small as possible for downloading.

To find cast members:

1 Select Edit > Find > Cast Member.



2 In the Find Cast Member dialog box, select a Cast window to search from the Cast pop-up menu.

To search every cast in the movie, select All Casts.

3 Select a search option:

- Select Name, and enter search text in the text box. For example, to search for a group of related cast members that share a common element in their names, you might enter the word `Bird` to search for cast members named Bird 1, Bird 2, and Bird 3.
- Select Type, and select an option from the pop-up menu to search for cast members by media type.
- Select Palette, and select an option from the pop-up menu. You can use this option to search for and resolve palette conflicts.
- Select Usage to locate all cast members that aren't used in the Score. Cast members that you find with this option might be used in the movie by a Lingo script.

Director displays the specified cast member.

4 Do one of the following:

- Select a cast member on the list, and click Select to close the dialog box and select the cast member in the Cast window.
- Click Select All to close the dialog box and select all listed cast members in the Cast window.

To find a cast member in the Score:

1. Select a cast member for which to search in the cast or the Score. If you select a sprite that includes multiple cast members, Director searches for the first cast member in the sprite; to select a cast member other than the first, open the sprite to select the cast member. (For information on selecting sprites, see "Selecting sprites" on page 158.)
2. Select Edit > Find > Selection, or press Control-H (Windows) or Command-H (Macintosh).

   Director searches the Score and highlights the first Score cell it finds.
3. Select Edit > Find Again to find the next occurrence of the cast member in the Score.

Importing cast members

Importing lets you create cast members from external media. You can either import data into a Director movie file or create a link to the external file and re-import the file each time the movie opens. Linked files let you display dynamic media from the Internet, such as sports scores, sounds, and weather pictures, which makes downloading movies faster. For more information about linked files, see "About linking to files" on page 149.

Director can import cast members from almost every popular media file format. See "About import file formats" on page 149.

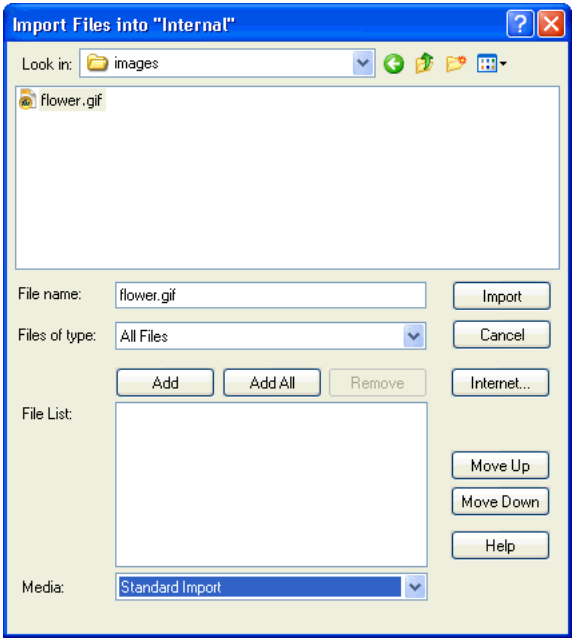
You can import files by using the Import dialog box, dragging files from the desktop to a Cast window, or using Lingo.

To import cast members and specify import options:

1. In Thumbnail view, select an empty position in a cast.

   If no cast position is selected, Director places the new cast member in the first available position in the current cast in Thumbnail view. In List view, Director places the new cast member at the end of the list.

2 Select File > Import.



3 To import a file from the Internet, click Internet and enter a URL in the Find URL text box.

4 To import local files, select the type of media to import from the Files of Type (Windows) or the Show (Macintosh) pop-up menu.

All the files in the current directory appear unless you make a selection.

5 To select a file or files to import, do one of the following:

- Double-click a file.
- Select one or more files, and click Add.
- Click Add All.

You can switch folders and import files from different folders at the same time.

6 From the Media pop-up menu at the bottom of the dialog box, select an option to specify how to treat imported media:

Standard Import imports all selected files, storing them inside the movie file but not updating them when changes are made to the source material. If you selected the option to import from the Internet in step 3, Director retrieves the file immediately from the Internet if a connection is available.

Note: AVI and QuickTime files are always linked to the original external file (see the next option, Link to External File), even if you select Standard Import.

Link to External File creates a link to the selected files and imports the data each time the movie runs. If you choose to import from a URL via the Internet, the media is dynamically updated. For more information, see "About linking to files" on page 149.

Note: Text and RTF files are always imported and stored inside the movie file (see the previous option, Standard Import), even if you select Link to External File.

Include Original Data for Editing preserves the original data in the movie file for use with an external editor.

When this option is selected, Director keeps a copy of the original cast member data and sends the original to the external editor when you edit the cast member. This option preserves all the editor's capabilities. For example, if you specify Photoshop to edit PICT images, Director maintains all the Photoshop object data. See "Launching external editors" on page 151.

- Import PICT File as PICT prevents PICT files from being converted to bitmaps.

7 If you selected a PICS or Scrapbook file to import, click Options to specify options for these files. See "Setting import options for PICS and Scrapbook files" on page 150.

8 When you finish selecting the files, click Import.

If you've imported a bitmap with a color depth or color palette that differs from the current movie, the Image Options dialog box appears, so you can enter additional information. See "Choosing import image options" on page 150.

For information on importing specific media, see the following sections:

- "About importing bitmaps" on page 204
- "Importing internal and linked sounds" on page 320
- "Using Director movies within Director movies" on page 313
- "Importing internal and linked sounds" on page 320
- "Importing text" on page 276
- "Using animated GIFs" on page 205
- "Using Flash Movies" on page 293
- "Using linked scripts" on page 416

To import files by dragging:

1 In the Explorer (Windows) or on the system desktop (Macintosh), select a file or files to import.

2 Drag the files from the desktop to the desired position in the Cast window Thumbnail view or to the Cast window List view.

If you drag the files to List view, the imported files are added at the bottom of the list.

To import files with Lingo:

- Use the `importFileInto` command to import a file. Set the `fileName` cast member property to assign a new file to a linked cast member. See `importFileInto` and `fileName (cast member property)` in the *Lingo Dictionary*.

About import file formats

Director can import files in all the formats listed in the following table. For information on additional file formats Director might support, see the Director Support Center website at www.macromedia.com/support/director.

Type of file	Supported formats
Animation and multimedia	Flash movies, animated GIF, PowerPoint presentations, Director movies, Director external cast files
Image	BMP, GIF, JPEG, LRG (xRes), Photoshop 3.0 (or later), MacPaint, PNG, TIFF, PICT, Targa
Multiple-image file	Windows only: FLC, FLI Macintosh only: PICS, Scrapbook
Sound	AIFF, WAV, MP3 audio, Shockwave Audio, Sun AU, uncompressed and IMA compressed
Video	QuickTime 2, 3, 4, and 6; AVI; RealMedia
Text	RTF, HTML, ASCII (often called Text Only), Lingo scripts
Palette	PAL, Photoshop CLUT

About linking to files

Director reimports media every time a movie runs when Link to External File is selected in the Import dialog box (select File > Import). Linking makes it easy to use bulky media such as long sounds and is especially useful for showing media from the Internet that changes frequently. Linking also makes downloading movies faster; users can choose whether to view linked files, so the files do not download unless they're needed.

When you link to an external file, Director creates a cast member that stores the name and location of the file. Saving a movie saves only the link to the linked cast member. Keep linked files in a folder that's close to the original movie file. Paths are restricted to 4096 characters by the system. URLs can be as many as 260 characters. If you store a file too many folders away from the movie or using a very long URL, it might not link correctly.

When distributing movies with linked media, use the following guidelines:

- If you distribute a movie, you also must include all linked cast member files, and they must be in their expected locations. In addition, the Xtra extensions that are used to import the media must be present when the movie runs (either on the user's computer or included in your movie). For more information, see "Setting Xtra cast member properties" on page 155.
- When you link to media on the Internet, the media must be present at the specified URL when the movie runs. Provide for link failure because you can't guarantee that an Internet transaction will be successful.
- To retrieve media from the Internet during playback, Director requires that the projector include certain Xtra extensions. To include these Xtra extensions automatically, click Add Network in the Movie Xtras dialog box. Movies playing in web browsers do not require these Xtra extensions.

Note: Select Edit › Preferences › Network to define standard network settings for the Director authoring environment; see "Choosing Internet connection settings" on page 47.

Choosing import image options

If you import a bitmap cast member with a color depth or color palette that is different from that of the Stage (the current movie), Director lets you select the image's color depth and color palette. You can choose to import the bitmap at its original color depth or at the Stage color depth. (The Stage color depth is the same as the system color depth.) You can also choose to import the image's color palette or remap the image's colors to a palette in the movie.

In many cases, it's easiest to change the image's color depth to the depth of the movie and remap the image to the color palette that is used in the rest of the movie. For more information on controlling color in Director, see Chapter 9, "Color, Tempo, and Transitions," on page 255.

If you change 16-, 24-, or 32-bit cast members to 8 or fewer bits, you must remap the cast members to an existing color palette.

To select bitmap image options for importing:

1. Import a bitmap image by selecting File > Import. (For more information on this procedure, see "Importing cast members" on page 146.)
2. If the Image Options dialog box appears while you are importing a bitmap image using File > Import, select one of the following Color Depth options:

   Image specifies the color depth and palette of the image.

   Stage specifies the color depth of the current Stage.
3. Select a Palette option to change palette settings for 2-, 4- or 8-bit images:

   Import imports the image with its color palette. The palette appears as a new cast member immediately following the bitmap cast member.

   Remap To replaces the image's colors with the most similar solid colors in the palette you select from the pop-up menu.
4. Select Image options:

   Trim White Space removes any white pixels from the edges of the image. Deselect this option to preserve the white canvas around an image.

   Dither blends the colors in the new palette in the Palette section to approximate the original colors in the graphic.
5. To apply the current settings to all the remaining files that you selected for importing, select Same Settings for Remaining Images.

Setting import options for PICS and Scrapbook files

You can import PICS and Scrapbook files several ways. These file formats are available only on the Macintosh.

To set import options for PICS and Scrapbook files:

1. Import the PICS or Scrapbook cast member by selecting File > Import. For more information on this procedure, see "Importing cast members" on page 146.

2 If the PICS/Scrapbook Options dialog box appears while you are importing an image using File > Import, specify the range of images to import:

All Frames imports as many as 512 frames in a PICS file or from a Scrapbook file. Each frame is imported as a separate cast member.

From/To selects a range of cells. The imported PICS or Scrapbook frames are added to the Score beginning at the selected cell; any existing Score data is replaced by the imported frames.

If the PICS file was created using a previous version of Director, you must enter 1 as the starting frame to import.

3 To import only the image and not the surrounding white space, select Contract White Space.

4 To place the imported artwork in the Paint window in its original position relative to the other artwork in the series, select Original Position.

5 To center each piece of imported artwork relative to the rest of the artwork in the series, click Centered.

Launching external editors

You can specify external applications to edit many types of media. All the types of media for which you can define an external editor are listed in the Editors Preferences dialog box. After you set up an external editor for a particular media type, Director launches the application when you edit a cast member of that type. When you finish editing a cast member in an external editor and then save and close the file, Director re-imports the cast member media.

You can easily edit Flash cast members using the launch-end-edit feature in Director MX. For more information, see “Editing a Flash cast member” on page 296.

If you want to use an external editor for an imported cast member, select Include Original Data for External Editing during import. For more information, see “Importing cast members” on page 146.

You cannot define an external editor for any cast member created by an Xtra, such as text, vector shapes, and custom pointers.

To define an external editor:

1 Select Edit > Preferences > Editors.

2 Select a type of media for which you want to define an external editor.

3 Click Edit.

4 Click Browse or Scan to locate the application.

You can specify any application capable of editing the selected type of media.

5 To determine which editor appears when you double-click a cast member, do one of the following:

- If you prefer to make changes inside of Director and only occasionally want to use the external editor, select Use Internal Editor.
- If you prefer to use the external editor to make changes to the cast member, select Use External Editor.

To launch an external editor:

1 Select a cast member of a media type for which you have defined an external editor, and do one of the following:

- If you specified Use External Editor when you defined the external editor for this media type, double-click the cast member.
- Select Edit > Launch External Editor.
- While the cast member is selected and the Cast window is active, right-click (Windows) or Control-click (Macintosh) and select Launch External Editor from the context menu.

Director launches or switches to the application that created the cast member, sending the original data to the external editor.

Note: If you've specified an external editor and you want to edit a cast member with the Director internal editors, select the cast member and select Edit › Edit Cast Member.

2 Edit the cast member.

If you change an image in the Paint window and then edit the image with an external editor, changes made in the Paint window, with the exception of registration points, are lost. Director warns you of this possibility.

3 Save and close the file. Director re-imports the cast member.

Controlling cast member unloading

When Director runs low on memory, it removes cast members from memory. You use the Property inspector to specify the priority with which a cast member is removed from memory. When a cast member is available in memory, it appears almost instantly. When it needs to be loaded from disk, the loading can cause a delay. Set your cast members so that frequently used cast members remain in memory as long as possible.

These settings are the same for all types of cast members.

To specify the Unload setting:

1 Select the cast members in the Cast window.

2 On the Property inspector Member tab, display the Graphical view and then select an option from the Unload pop-up menu:

3–Normal sets the selected cast members to be removed from memory after any priority 2 cast members are removed.

2–Next sets the selected cast members to be among the first removed from memory.

1–Last sets the selected cast members to be the last removed from memory.

0–Never sets the selected cast members to be retained in memory; these cast members are never unloaded.

Managing external casts

An external cast is a separate file that must be explicitly linked to a movie for the movie to use its cast members.

If you link an external cast to a movie, Director opens the cast every time it opens the movie. If you don't link an external cast to a movie, you must open and save the file separately. You can use unlinked external casts as libraries to store commonly used elements for authoring, such as scripts, buttons, and so on. See "Creating libraries" on page 154.

When you distribute a movie that uses an external cast, you must include the external cast file. For disk-based movies, the cast must be in the same relative path in your files as it was when the movie was created. For Shockwave movies on the web, the cast must be at the specified URL.

To create an external cast:

1. Select File > New > Cast.
2. Type a name for the new cast.
3. Specify that the cast be stored as an external cast.

   If you don't want to use the cast in the current movie, deselect the Use in Current Movie option.
4. Click Create.

   The cast is created, and a Cast window for the cast appears in List view. See "Using the Cast window" on page 131.
5. Select File > Save while the Cast window is active, and save the cast in the desired directory.

To link an external cast to a movie:

1. Select Modify > Movie > Casts.
2. In the Movie Casts dialog box, click Link.
3. Locate and select the external cast you want, and click Open.

   You can link to casts on your local disk or to casts that are stored at any URL. Click Internet and enter a URL (in the Find URL text box) for a linked external cast. Click OK.

To unlink a cast from a movie:

1. Select Modify > Movie > Casts.
2. In the Movie Casts dialog box, select the external cast.
3. Click Remove.

To save a movie and all open casts, linked or unlinked:

- Select File > Save All.

Note: To use a cast member from an external cast without creating a link to the external cast, first copy the cast member to an internal cast or to a (different) linked external cast.

Creating libraries

A library is a special type of unlinked external cast that appears in the Library palette. When you drag a cast member from an external cast library to the Stage or Score, Director automatically copies the cast member to one of the movie's internal casts. Libraries are useful for storing any type of commonly used cast members, especially behaviors. A library cannot be linked to a movie. See "Attaching behaviors" on page 357.

When you create a library, as explained in the following procedure, it appears in the Library List pop-up menu in the Library palette.

To create a library:

1. Create an external cast file, following the procedure under "Creating new casts" on page 128. Do not select Use in Current Movie.
2. With the Cast window for the external cast active, select File > Save, and place the external cast in the Libs folder in the Director application folder.

Setting cast member properties using Lingo

Lingo lets you control and edit cast members by setting their properties. Some properties are available for every type of cast member, and other properties are available only for specific cast member types. See entries for individual properties in the *Lingo Dictionary*.

To specify the cast member's content:

- Set the `media` cast member property.

To specify the cast member's name:

- Set the `name` cast member property. .

To set the contents of the cast member's comments field:

- Set the `comments` cast member property. You can store any text information in this field that you find useful, and access it at runtime by getting the `comments` property.

To specify the cast member's purge priority:

- Set the `purgePriority` cast member property.

To specify the content of the script that is attached to the cast member:

- Set the `scriptText` cast member property.

To specify the file that is assigned to a linked cast member:

- Set the `fileName` cast member property.

For additional cast member properties that Lingo can test and set, see the *Lingo Dictionary* sections that discuss the specific cast member type.

Setting Xtra cast member properties

Xtra cast members have the same Name and Unload properties as other cast members, but they can also contain an extra panel of options that is accessible from the Property inspector. To set cast member properties, use the Member tab and the custom tab for the type of cast member you are working with. The Member tab contains an Edit button and might contain a More Options button, depending on the type of Xtra. Use the Edit button to edit the cast member with its default editor. Use the More Options button to display the Cast Member Properties dialog box for the current cast member.

The custom tab for the type of cast member you are working with might also contain a More Options button. This button displays the Cast Member Properties dialog box for the current cast member.

The content of the Properties dialog box is determined by the developer of the Xtra. For non-Macromedia Xtra extensions, refer to any documentation that the developer supplies.

To view or change Xtra cast member properties:

1. Select an Xtra cast member.
2. Open the Property inspector, and click the Member tab.

   The Member tab displays the following information about the member:

- The cast member name
- The name of the cast that contains the cast member
- The size in kilobytes
- The creation date
- The date the cast member was last modified
- The name of the user who last modified the cast member

3. Use the Name field to view or edit the cast member name.
4. To specify how Director removes cast members from memory if memory is low, select options from the Unload pop-up menu. For information about these options, see “Controlling cast member unloading” on page 152.
5. To set special options for the current Xtra cast member, click the custom tab for the cast member you are working with. Some types of Xtra cast members also have a More Options button on this tab. You can use this button to set any properties of the cast member that are not displayed on the tab.

CHAPTER 5
Sprites

A sprite is an object that controls when, where, and how cast members appear in a Macromedia Director MX movie. Multiple sprites can use the same cast member. You can also switch the cast member assigned to a sprite as the movie plays. You use the Stage to control where a sprite appears, and you use the Score to control when it appears in your movie.

Sprites display on the Stage layered according to the channel in which they're in the Score. Sprites in higher-numbered channels appear in front of sprites in lower-numbered channels. A movie can include as many as 1000 sprite channels. Use the Movie tab of the Property inspector to control the number of channels. See "Setting Stage and movie properties" on page 27.

Sprite properties include the sprite's size and location, the cast member assigned to the sprite, and the frames in which the sprite occurs. Different properties can alter the appearance of a sprite. You can rotate, skew, flip, and change the color of sprites without affecting cast members. You can change sprite properties with the Property inspector or Lingo.

In Lingo, some properties are available only for certain types of sprites. Such properties typically are characteristics that are related to the specific sprite type. For example, Lingo has several digital video properties that determine the contents of tracks in digital video sprites.

To control the way a sprite's colors appear on the Stage, you use sprite inks. By selecting Background Transparent ink in the Property inspector, for example, you turn all white pixels transparent and remove the white border (the bounding rectangle) around bitmap images (assuming the sprite is over a white background). Other inks provide more complex and interesting effects such as reversed colors or colors that change in different ways depending on the background color.

Creating sprites

You create a sprite by dragging a cast member to either the Stage or the Score; the sprite appears in both places. New sprites, by default, span 28 frames. To change the default sprite duration, select Edit > Preferences > Sprite; see "Changing sprite preferences" on page 158.

To create a new sprite:

1. Click to select the frame in the Score where you want the sprite to begin.
2. From the Cast window, in either List or Thumbnail view, do one of the following:

- Drag a cast member to the position on the Stage where you want to place the sprite.
- Drag a cast member to the Score. Director places the new sprite in the center of the Stage.
- To create a sprite one frame long, press Alt (Windows) or Option (Macintosh) and drag a cast member to the Stage or Score.

Changing sprite preferences

You use the Sprite Preferences dialog box to control the way sprites behave and appear in the Score window and on the Stage.

To change preferences for sprites:

1. Select Edit > Preferences > Sprite.
2. To determine if selecting a sprite on the Stage selects the entire span of the sprite or only the current frame in the sprite, select one of the following Stage Selection options:

   Entire Sprite selects the sprite in all frames that it occupies.

   Current Frame Only selects only the current frame of the sprite.
3. To determine the appearance and behavior of sprites yet to be created, select the following Span Defaults options. These options do not change settings for existing sprites.

   Display Sprite Frames turns on Edit Sprite Frames for all new sprites. See "Editing sprite frames" on page 192.

   Tweening turns on tweening for all tweenable properties. This option is on by default. With this option off, sprites must be manually tweened when new frames or keyframes are added to the sprite. For additional information on tweening, see Chapter 6, "Animation," on page 185.
4. To determine the length of sprites measured in frames, select the following Span Duration options:

   Frames defines the default number of frames for sprites.

   Width of Score Window sets the sprite span to the visible width of the Score window.

   Terminate at Markers makes new sprites end at the first marker. See "Using markers" on page 42.

Selecting sprites

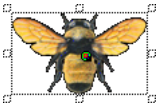
To edit or move a sprite, you must select it. You can select sprites, frames within sprites, and groups of sprites in several ways.

You use the Arrow tool on the Tool palette to select sprites before most operations. You can also select sprites with the Rotate and Skew tool to enable rotation and skewing. See "Rotating and skewing sprites" on page 176.

When selecting sprites, you often want to select a certain frame or range of frames within the sprite instead of the entire sprite. When you make certain changes to a frame within a sprite, it becomes a selectable object called a keyframe. See "Editing sprite frames" on page 192.

A selected sprite appears on the Stage with a double border. When you select a single frame within a sprite, the sprite appears on the Stage with a single border.

Entire sprite selected



Single frame within sprite selected

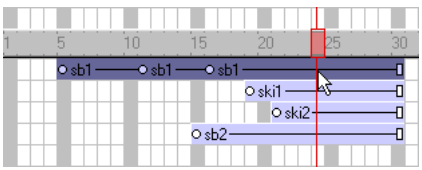
To select sprites, do one of the following:

Note: The following techniques select an entire sprite only if Edit Sprite Frames is not enabled for the sprite(s) you select.

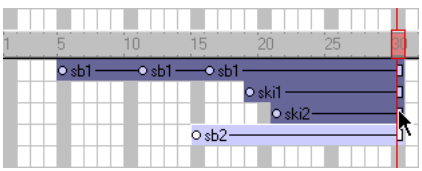
- On the Stage, click a sprite to select the entire sprite span.

  You can change sprite preferences so that selecting a sprite on the Stage selects only the current frame instead of the entire sprite. See “Changing sprite preferences” on page 158.

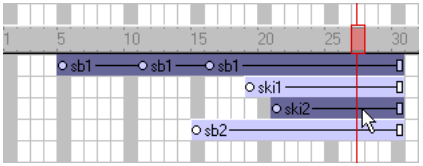
- In the Score, click the horizontal line within a sprite bar; do not click the keyframes, the start frame, or the end frame.



- To select a contiguous range of sprites either on the Stage or in the Score, select a sprite at one end of the range and then Shift-click a sprite at the other end of the range. You can also drag to select all the sprites in an area.

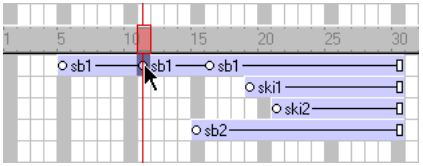


- To select discontiguous sprites, Control-click (Windows) or Command-click (Macintosh) the discontiguous sprites.

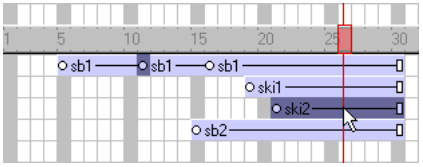


To select a keyframe, do one of the following:

- To select only a keyframe, click the keyframe indicator.

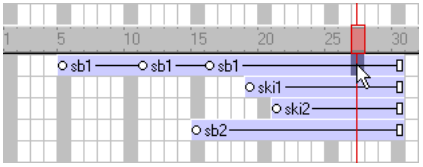


- To select a keyframe and sprites at the same time, Control-click (Windows) or Command-click (Macintosh) the keyframe and the desired sprites.



To select a frame within a sprite that isn't a keyframe, do one of the following:

- In the Score, Alt-click (Windows) or Option-click (Macintosh) the frame within the sprite.



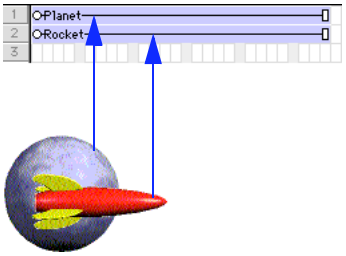
- On the Stage, Alt-click (Windows) or Option-click (Macintosh) to select only the current frame of the sprite. The sprite appears on the Stage with a single border.

To select all the sprites in a channel:

- Click the channel number at the left side of the Score.

Layering sprites

A sprite appears in front of other sprites on the Stage according to its channel. Sprites in higher-numbered channels appear in front of sprites in lower-numbered channels.



The rocket in channel 2 appears in front of the planet in channel 1.

To change a sprite's layer on the Stage:

1. Select the sprite. To select the contents of an entire channel, click the channel number at the left side of the Score.
2. Do one of the following:

- Select Modify > Arrange, and select a command from the submenu to change the order of sprites.
- Drag the sprite in the Score from one channel to another.
- If you selected a channel, drag its contents to another channel.

Displaying and editing sprite properties

As you work with sprites in your movie, you'll want to monitor and possibly modify sprite properties. Director offers several methods of accomplishing this using one or more of the following:

- The Property inspector
- The Sprite toolbar, which includes a subset of Sprite fields found in the Property inspector
- The Sprite Overlay, which displays, directly on the Stage, the most commonly used properties for selected sprites
- Sprite labels, which appear within the sprite bars in the Score and let you view important sprite properties
- Lingo

Displaying and editing sprite properties in the Property inspector

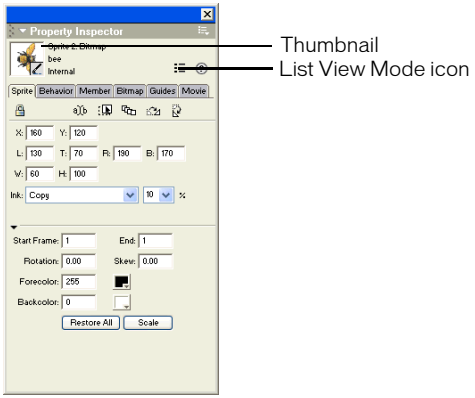
Depending on your preference, you can use either the Sprite toolbar or the Property inspector to perform many of the same procedures.

To display and edit sprite properties in the Property inspector:

1. Select one or more sprites on either the Stage or the Score.
2. If the Property inspector is not open, select Window > Property Inspector.

   The Property inspector opens with focus on the Sprite tab. The Graphical view is the default view. You can toggle to the List view by clicking the List View Mode icon.

   The Property inspector displays settings for the current sprite. If you select more than one sprite, the Property inspector displays only their common settings.



   A thumbnail image of the sprite's cast member appears in the upper left corner of the Property inspector.

   Note: To open a window in which you can edit the sprite's cast member, you can double-click the thumbnail image.

3 Edit any of the following sprite settings in the Property inspector:

Lock changes the sprite to a locked sprite so you or other users cannot change it. For additional information on locked sprites, see "Locking and unlocking sprites" on page 167.

Editable applies only to text sprites and lets you edit the selected text sprite on the Stage during playback. See "Selecting and editing text on the Stage" on page 277.

Moveable lets you position the selected sprite on the Stage during playback. See "Visually positioning sprites on the Stage" on page 168.

Trails makes the selected sprite remain on the Stage, leaving a trail of images along its path as the movie plays. If Trails is not selected, the selected sprite is erased from previous frames as the movie plays.

Flip Horizontal and **Flip Vertical** reverse the sprite horizontally or vertically to form an inverted image. See "Flipping sprites" on page 178.

Reg Point Horizontal (X) and **Vertical (Y)** display the location of the registration point in pixels from the upper left corner of the Stage. See "Editing sprite properties with Lingo" on page 166.

Left (L), Top (T), Right (R), and **Bottom (B)** show the location of the edges of the sprite's bounding rectangle.

Width (W) and **Height (H)** show the size of the sprite's bounding rectangle in pixels.

The Ink pop-up menu displays the ink of the current sprite and lets you select a new ink color. See "Using sprite inks" on page 180.

Blend determines the blend percentage of the selected sprites. See "Setting blends" on page 180.

Start Frame and **End Frame** display the start and end frame numbers of the sprite. Enter new values to adjust how long the sprite plays. See "Changing the duration of a sprite on the Stage" on page 173.

Rotation rotates the sprite by the number of degrees you enter. See "Rotating and skewing sprites" on page 176.

Skew slants the sprite by the number of degrees you enter. See "Rotating and skewing sprites" on page 176.

Forecolor and **Backcolor** color boxes determine the colors of the selected sprite. See "Changing the color of a sprite" on page 179.

Restore All reverts the height and width to that of the cast member.

Scale opens the Scale Sprite dialog box, where you can resize the selected sprite. See "Resizing and scaling sprites" on page 175.

Displaying sprite properties in the Sprite toolbar

The Sprite toolbar displays a subset of the same information and fields found on the Sprite tab in the Property inspector. You can use either the Sprite toolbar or the Property inspector, depending on your preference, to perform many of the same procedures.

To show or hide the Sprite toolbar in the Score:

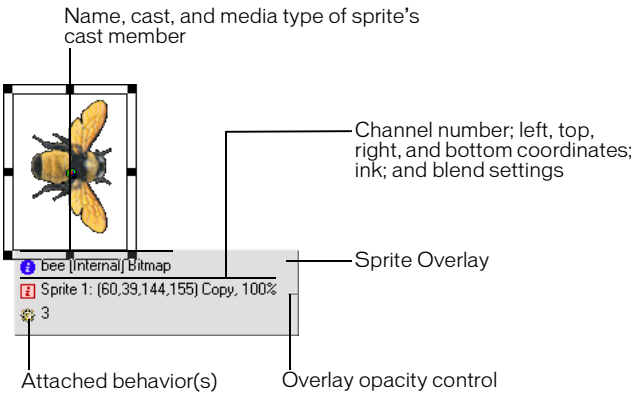
- While the Score is active, select View > Sprite Toolbar.

Using the Sprite Overlay

The Sprite Overlay displays important sprite properties directly on the Stage. You can open editors, inspectors, and dialog boxes to change sprite properties by clicking the corresponding icons in the Sprite Overlay.

To display the Sprite Overlay when a sprite is selected:

- Select View > Sprite Overlay > Show Info.



To use Sprite Overlay options to change how the overlay appears:

1. Click the Sprite on the Stage to select it.
2. In the Sprite Overlay, click the icon that represents the data you want to edit:

- To edit the Sprite's cast member, click this icon to open the tab in the Property inspector that applies to this type of sprite. For example, clicking this icon displays the Vector tab for a vector sprite, the Text tab for a text sprite, and so on.

- To open the Sprite tab in the Property inspector, click this icon.

- To open the Behavior tab in the Property inspector, click this icon. See Chapter 14, "Behaviors," on page 357.

To change the Sprite Overlay's appearance to suit your preferences:

1. Select View > Sprite Overlay > Settings.
2. Select a Display option to determine when sprite properties are visible and active:

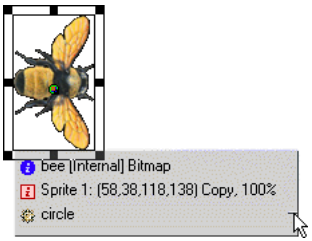
   Roll Over displays sprite properties only when the pointer is over a single sprite.

   Selection displays sprite properties when you select a sprite.

   All Sprites displays sprite properties for all sprites on the Stage.
3. Use the Text Color box to select the color for text that appears in the Sprite Overlay.

To change the opacity of the Sprite Overlay:

- Drag up or down the small thin line that appears on the right edge of the Sprite Overlay.



Displaying sprite labels in the Score

Sprite labels appear in the Score's sprite bars and display key information about the sprite in relation to the movie. For example, if you detect a strange blip caused by an ink effect, you can turn on Ink display and quickly locate the problem in a sprite label. You can change the information that appears in labels; for example, you can use the Extended display option to display the precise location of a sprite in every frame.

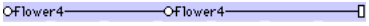
To display sprite labels:

1 With the Score as the active window, do one of the following:

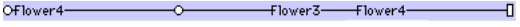
- Select View > Sprite Labels.
- Right-click (Windows) or Control-click (Macintosh) on any Score channel, and select Sprite Labels.

2 Select from the following options:

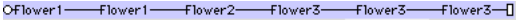
- Keyframes



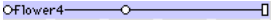
- Changes Only (shown at 800%)



- Every frame (shown at 800%)



- First frame

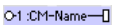


Many options are useful only when the Score is zoomed to 400% or 800%.

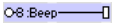
To change sprite label options:

- Select a display option from the Display pop-up menu in the Score or from the View > Display menu.

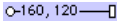
  Cast Member displays the name and number of the sprite's cast member.

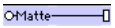
  Behavior displays the behavior that is assigned to the sprite.

  Location displays the *x* and *y* coordinates of the sprite's registration point.

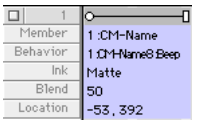
  Ink displays the ink effect that is applied to each sprite.

  Blend displays the blend percentage.

  Extended displays any combination of display options; select options by selecting Edit > Preferences > Score.

Editing sprite properties with Lingo

You can use Lingo to check and edit sprite properties with scripts as the movie plays.

To check a property value:

- Use the `put` command or check in the Watcher window. See `put` in the *Lingo Dictionary*.

To edit a property:

- Use the equals (=) operator or the `set` command to assign a new value to the property. See `=-(equals)` and `set...to, set...=` in the *Lingo Dictionary*.

Locking and unlocking sprites

During authoring, you can lock sprites to avoid inadvertent changes to the sprite, either by you or by someone else working on the same project. When you lock a sprite, you can no longer change its settings, although you still see it represented on the Stage and in the Score. While preserving the settings of your locked sprites, you can continue to create and edit unlocked sprites.

Locking sprites is not supported during playback.

Note: If you try to perform an operation on a group of locked and unlocked sprites, a message appears that indicates the operation will affect only the unlocked sprites.

To lock a sprite:

In the Stage or the Score, select one or more sprites to lock, and do one of the following:

- Select Modify > Lock Sprite.
- On the Sprite tab of the Property inspector, click the padlock icon.
- Right-click (Windows) or Option-click (Macintosh), and select Lock Sprite from the context menu.

In the Score, a locked sprite appears with a padlock in front of its name. On the Stage, a locked sprite appears with a padlock in its upper right corner.

To select a locked sprite on the Stage:

- Hold down the L key while selecting the sprite.

To unlock a sprite:

1. In the Score or on the Stage, select one or more sprites to unlock.
2. Do one of the following:

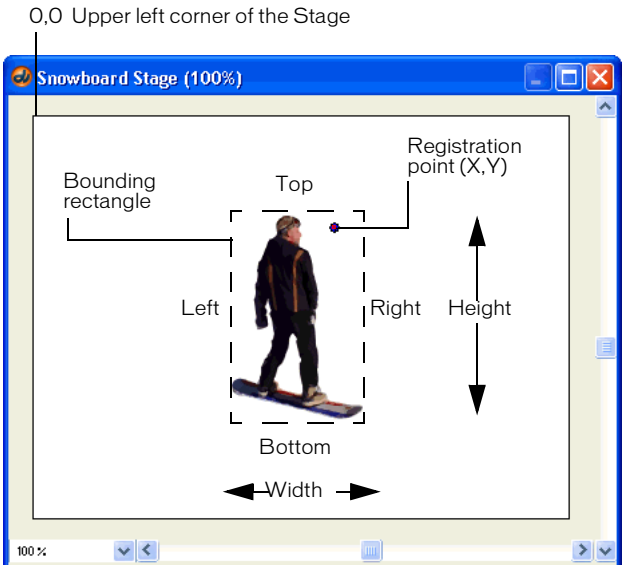
- Select Modify > Unlock Sprite.
- On the Sprite tab in the Property inspector, click the padlock icon.
- Right-click (Windows) or Option-click (Macintosh), and select Unlock Sprite from the context menu.

Positioning sprites

The easiest way to position a sprite is to simply drag the sprite into place on the Stage. To position a sprite more precisely, you can do any of the following:

- Set a sprite's position on the Stage by entering coordinates in the Property inspector.
- Use the Tweak window.
- Use guides or the grid.
- Use the Align window.
- Set the sprite's coordinates in Lingo.

The following diagram shows all the sprite coordinates you can specify.



Director places the image of a cast member on the Stage by specifying the location of its registration point. For many cast members, such as bitmap or vector shapes, the registration point is in the center of the bounding rectangle by default. For other types of cast members, the registration point is at the upper left corner. (For instructions on changing the location of the registration point of bitmap cast members, see “Changing registration points” on page 219. For instructions on changing a vector shape cast member’s registration point, see “Editing vector shapes” on page 249.)

Visually positioning sprites on the Stage

You can position sprites on the Stage by dragging them or by using the arrow keys.

To visually position a sprite on the Stage:

1. Select Window > Stage to display the Stage.
2. Do one of the following on the Stage:

- Drag a sprite to a new position. Hold down Shift to limit the movement to horizontal or vertical straight lines.
- Select a sprite and use the arrow keys to move the selected sprite 1 pixel at a time. Hold down Shift as you press an arrow key to move the selection 10 pixels at a time.

To visually position a sprite on the Stage during playback:

1. Select a sprite that you want to position during playback.
2. On the Sprite tab in the Property inspector, click Moveable. See "Displaying and editing sprite properties in the Property inspector" on page 162.
3. Begin playing back the movie.
4. On the Stage, drag the sprite to the new position.

Positioning sprites with the Property inspector

You can use the Property inspector to specify the exact coordinates of a sprite.

To set sprite coordinates in the Property inspector:

1. With the Property inspector open and in Graphical view, select a sprite to reposition.
2. On the Sprite tab in the Property inspector, specify the sprite coordinates in pixels, with 0,0 at the upper left corner of the Stage, as follows:

- Specify attributes in the X and Y text boxes to change the horizontal and vertical coordinates of the registration point.
- Specify coordinates in the W and H text boxes to change the width and height of the sprite.
- Specify values in the L, T, R, and B text boxes to change the left, top, right, and bottom edges of the sprite's bounding rectangle.

  To move the sprite without resizing it, adjust only the *x* and *y* coordinates.

Positioning sprites with the Tweak window

You can use the Tweak window when you want to move sprites by a certain number of pixels.

To position sprites with the Tweak window:

1. Select Modify > Tweak.
2. Select the sprite or sprites you want to move, as described in "Selecting sprites" on page 158.
3. In the Tweak window, drag the point on the left side of the window or enter the number of pixels in the fields for horizontal and vertical change, and then click Tweak.
4. If you want to repeat the move, click Tweak again.

Positioning sprites using guides, the grid, or the Align window

On the Stage, you can align sprites using guides, the grid, or the Align window.

The grid consists of cell rows and columns of a specified height and width that you use to assist you in visually placing sprites on the Stage. The grid is always available.

Guides are horizontal or vertical lines you can either drag around the Stage or lock in place to assist you with sprite placement. You must create guides before they become available.

Moving a sprite with the Snap to Grid or Snap to Guides feature selected lets you snap the sprite's edges and registration point to the nearest grid or guide line. When you're not using the guides or the grid, you can hide them.

Guides and the grid are visible only during authoring.

You can create and modify the guides and the grid from the Property inspector or by using menu commands.

To add and configure guides:

1 With the Property inspector open, click the Guides tab.

The top half of the tab contains settings for Guides.

2 To change the guide color, click the Guide Color box and select a different color.

3 Select the desired options to make the guides visible, to lock them, and to make the sprites snap to the guides.

4 To add a guide, move the cursor over the new horizontal or vertical guide, and then drag the guide to the Stage. Numbers in the guide tooltip indicate the distance, in pixels, the guide is located from the top or left edge of the Stage.

5 To reposition a guide, move the pointer over the guide. When the sizing handle appears, drag the guide to its new position.

6 To remove a guide, drag it off the Stage.

7 To remove all guides, click Remove All on the Guides tab in the Property inspector.

To display guides and align sprites:

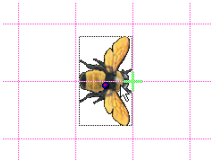
1 If guides do not appear on the Stage, select View > Guides and Grid > Show Guides.

2 If Snap to Guides is not selected, select View > Guides and Grid > Snap to Guides.

3 Move a sprite on the Stage near a guide line to make the sprite snap to that exact location.

To display a grid and align sprites:

1 If grid lines do not appear on the Stage, select View > Guides and Grid > Show Grid.



2 If Snap to Grid is not selected, select View > Guides and Grid > Snap to Grid.

3 Move a sprite on the Stage near a grid line to make the sprite snap to that exact location.

Note: Press the G key while moving or resizing a sprite to temporarily turn Snap to Grid off or on.

To configure the grid:

1 With the Property inspector open, click the Guides tab.

The bottom half of the Guides tab contains Grid settings.

2 To change the grid color, click the Grid Color box and select a different color.

3 Select the desired options to make the grid visible and to make the sprites snap to the grid.

4 To change the width and height of the grid, enter values in the W and H text boxes.

5 Select the desired options to display the grid as dots or lines.

To align sprites using the Align window:

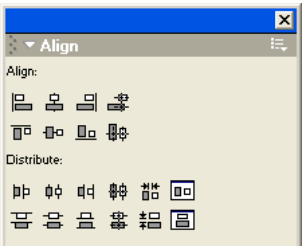
1 On the Stage or in the Score, select the sprites to align.

Select entire sprites, keyframes, or frames within sprites in as many different frames or channels as you need. All of the elements will align to the last sprite or frame selected.

2 Select Window > Align to open the Align panel.

3 Select alignment buttons to modify the selected objects:

- For Align, select Align Left Edge, Align Horizontal Center, Align Right Edge, Align Horizontal Registration Point, Align Top Edge, Align Vertical Center, Align Bottom Edge, or Align Vertical Registration Point.
- For Distribute, select Distribute Left Edge, Distribute Horizontal Center, Distribute Right Edge, Distribute Horizontal Registration Point, Distribute Width, Distribute Horizontally Across Stage, Distribute Top Edge, Distribute Vertical Center, Distribute Bottom Edge, Distribute Vertical Registration Point, Distribute Height, or Distribute Vertically Across Stage.



Positioning sprites with Lingo

Lingo lets you control a sprite's position by setting the sprite's coordinates on the Stage. You can also test a sprite's coordinates to determine a sprite's current position and whether two sprites overlap.

To check the location of a sprite's registration point or bounding rectangle on the Stage:

- Test the `bottom`, `left`, `loc`, `locH`, `locV`, `right`, or `top` sprite property.

The `bottom`, `left`, `right`, and `top` sprite properties determine the location of the sprite's individual edges. See `bottom`, `left`, `right`, and `top` in the *Lingo Dictionary*.

To place a sprite at a specific location:

- Set one of the following properties (see the *Lingo Dictionary* for entries on each property):

  The loc sprite property sets the horizontal and vertical distance from the upper left corner of the Stage to the sprite's registration point. The value is given as a point.

  The locV sprite property sets the number of pixels from the top of the Stage to a sprite's registration point.

  The locH sprite property sets the number of pixels from the left of the Stage to a sprite's registration point.

  The rect sprite property sets the location of the sprite's bounding rectangle on the Stage.

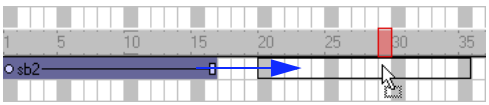
  The quad sprite property sets the location of the sprite's bounding rectangle on the Stage. You can specify any four points; the points do not have to form a rectangle. The `quad` sprite property can set the sprite's coordinates as precise floating-point numbers.

To determine whether two sprites overlap:

- Use the `sprite...intersects` operator to determine whether a sprite's bounding rectangle touches the bounding rectangle of a second sprite. Use the `sprite...within` operator to determine whether a sprite is entirely within a second sprite. See `sprite...intersects` and `sprite...within` in the *Lingo Dictionary*.

Changing when a sprite appears on the Stage

A sprite controls where and when media appears on the Stage. You change when a sprite appears on the Stage by moving the sprite to different frames in the Score and by changing the number of frames the sprite spans. You can either drag sprites to new frames or copy and paste them. Copying and pasting is easier when moving sprites more than one screen-width in the Score. You can also copy and paste to move sprites from one movie to another.



Moving a sprite in the Score

To change when a sprite appears on the Stage:

1. Select Window > Score to display the Score.
2. Select a sprite or sprites, as described in "Selecting sprites" on page 158.
3. Drag the sprite to a different frame.

   To move a sprite without spreading it over additional frames, hold down the Spacebar and drag. This technique is also useful for moving any sprite that consists mostly (or entirely) of keyframes.

To copy or move sprites between frames:

1. Select a sprite or sprites, as described in "Selecting sprites" on page 158.
2. Select Edit > Cut Sprites or Edit > Copy Sprites.
3. Position the pointer where you want to paste the sprite, and select Edit > Paste Sprites.

   If the pasting will overwrite existing sprites, select one of the following Paste options in the Paste Options dialog box:

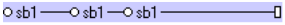
   Overwrite Existing Sprites replaces the sprites with the content of the Clipboard.

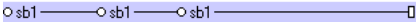
   Truncate Sprites Being Pasted pastes the Clipboard contents in the space available without replacing existing sprites.

   Insert Blank Frames to Make Room adds new frames for the contents of the Clipboard.

Changing the duration of a sprite on the Stage

By default, Director assigns each new sprite a duration of 28 frames. You can change the duration of a sprite—that is, the amount of time the sprite appears in a movie—by adjusting its length, changing the number of frames in which it appears, or using the Extend command.





Director maintains the spacing proportions of keyframes when a sprite is lengthened. For a description of keyframes, see Chapter 6, "Animation," on page 185.

To extend or shorten a sprite:

1. Select Window > Score to display the Score.
2. Do one of the following:

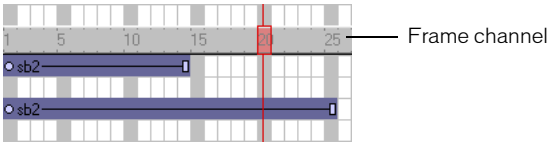
- Drag the start or end frames.To extend a one-frame sprite, Alt-drag (Windows) or Option-drag (Macintosh).
- To extend a sprite and leave the last keyframe in place, Alt-drag (Windows) or Option-drag (Macintosh) a keyframe at the end of the sprite.
- To extend a sprite and leave all keyframes in place, Control-drag (Windows) or Command-drag (Macintosh) the end frame.
- Enter new values in the Start and End text boxes on the Sprite tab in the Property inspector to change the start and end frames.

To extend a sprite to the current location of the playhead:

1 Select the sprite or sprites to extend.

2 Click the frame channel to move the playhead:

- To extend the sprite, move the playhead past the right edge of the sprite.



- To shorten the sprite, move the playhead to the left of the sprite's right edge, inside the sprite.
- To move the sprite's start frame, place the playhead to the left of the sprite.

3 Select Modify > Extend Sprite.

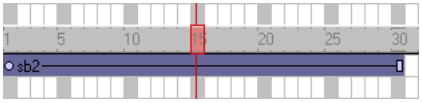
Splitting and joining sprites

You might need to split an existing sprite into two separate sprites or join separate sprites. If, for example, you created a complex animation as separate sprites and now want to move the entire sequence in the Score, you would join the sprites. Splitting and joining also lets you update movies created with older versions of Director that might have several fragmented sprites.

To split an existing sprite:

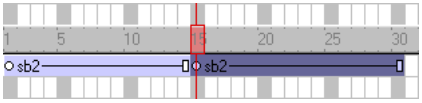
1 In the Score, click the frame within a sprite where you want the split to occur.

The playhead moves to the selected frame.



2 Select Modify > Split Sprite.

Director splits the sprite into two new ones.



To join separate sprites into a single sprite:

1 Select the sprites you want to join, as described in "Selecting sprites" on page 158.

Director fills the gaps between the selected sprites. You can also select sprites in several channels. Director joins selected sprites in each individual channel.

2 Select Modify > Join Sprites.

Changing the appearance of sprites

You can change the appearance of sprites on the Stage without affecting the cast member assigned to the sprite. You can resize, rotate, skew, flip, and apply new foreground and background colors to sprites. Applying these changes allows you to reuse the same cast member to create several different versions of an image. For example, you can create a flipped and rotated sprite with a new color. Since each cast member adds to downloading time, reusing cast members in this way reduces the number of cast members in your movie and makes it download faster.

Resizing and scaling sprites

You can resize sprites directly on the Stage by dragging their handles. To resize the sprite precisely, you can enter coordinates or scale sprites by a specified percentage on the Sprite tab in the Property inspector. You can also set the sprite's size with Lingo.

Changing a sprite's size on the Stage doesn't change the size of the cast member that is assigned to the sprite, nor is the size of the sprite affected if you resize its cast member.

In some cases, resizing bitmap sprites can cause noticeable delays. If a bitmap sprite must be a particular size, make the cast members that appear in the sprite the proper size. You can do this with Modify > Transform Bitmap or in any image-editing program. Scaling and resizing sprites works best with vector shapes.

Note: The procedure for resizing a rotated or skewed sprite is different from the following procedures. See "Rotating and skewing sprites" on page 176.

To resize a sprite by dragging its handles:

1. Select the sprite.
2. On the Stage, drag any of the sprite's resize handles. Hold down Shift while dragging to maintain the sprite's proportions.

To scale a sprite by pixels or by an exact percentage:

1. Select the sprite you want to scale and click the Sprite tab of the Property inspector (Graphical view).
2. Click the Scale button.

   The Scale Sprite dialog box appears.
3. Enter new values to scale the sprite by doing one of the following:

- Specify a pixel size in the Width or Height text boxes. If Maintain Proportions is selected, all the updatable fields adjust to reflect the new scaled size. If Maintain Proportions is not selected, you can specify new proportions in the Width and Height text boxes.
- Enter a percentage in the Scale text box.

4. Click OK.

   The sprite is scaled relative to its current size not to the size of its parent cast member.

To restore a sprite to its original dimensions, do one of the following:

- On the Sprite tab in the Property inspector (Graphical view), click Restore All.
- Select Modify > Transform > Reset Width and Height or Reset All.

To resize a sprite's bounding rectangle with Lingo:

- Set the sprite's `quad` or `rect` sprite property. See `quad` or `rect (sprite)` in the *Lingo Dictionary*.

  The `rect` sprite property determines the coordinates of a sprite's bounding rectangle. The coordinates are given as a `rect` value, which is a list of the left, top, right, and bottom coordinates.

To change a sprite's height or width with Lingo:

- Set the `height` or `width` sprite property. See `height` and `width` in the *Lingo Dictionary*.

Rotating and skewing sprites

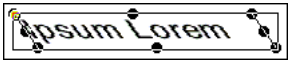
You can rotate and skew sprites to turn and distort images and to create dramatic animated effects. You rotate and skew sprites on the Stage by dragging. To rotate and skew sprites more precisely, use Lingo or the Property inspector to enter degrees of rotation or skew. The Property inspector is also useful for rotating and skewing several sprites at once by the same angle.

Director can rotate and skew bitmaps, text, vector shapes, Flash movies, QuickTime videos, and animated GIFs.

Director rotates a sprite around its registration point, which is a marker that appears on a sprite when you select it with your mouse. By default, Director assigns a registration point in the center of all bitmaps. You can change the location of the registration point using the Paint window. See "Changing registration points" on page 219.

Rotation changes the angle of the sprite. Skewing changes the corner angles of the sprite's rectangle.

Rotated sprite



Skewed sprite

After a sprite is rotated or skewed, you can still resize it.

Director can automatically change rotation and skew from frame to frame to create animation. See "Tweening other sprite properties" on page 188.

To rotate or skew a sprite on the Stage:

1 Select a sprite on the Stage.

2 Select Window > Tool Palette to display the Tool palette.

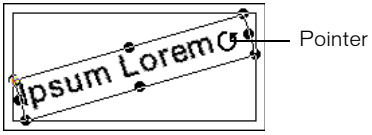
3 Click the Rotate tool in the Tool palette.

You can also press Tab while the Stage window is active to select the Rotate tool.

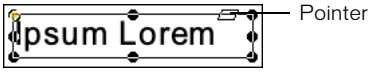
The handles around the sprite change to indicate the new mode.

4 Do either of the following:

- To rotate the sprite, move the pointer inside the sprite and drag in the direction you want to rotate.



- To skew the sprite, move the pointer to the edge of the sprite until it changes to the skew pointer and then drag in the direction you want to skew.

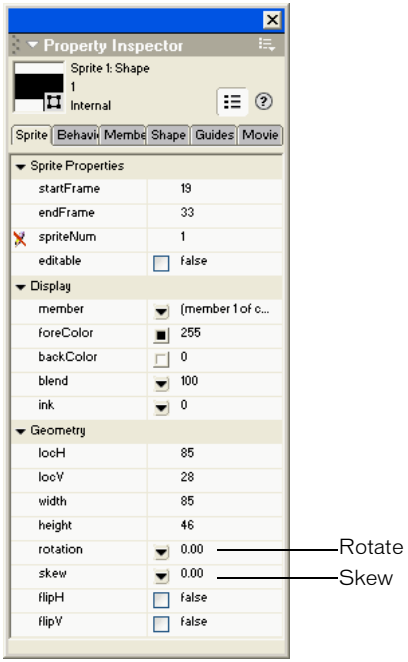


To rotate or skew a sprite with the Property inspector:

1 Select the sprite you want to rotate or skew and click the Sprite tab in the Property inspector (List view).

2 To rotate the selected sprite, enter the number of degrees in the Rotation text box.

3 To skew the selected sprite, enter the number of degrees in the Skew text box.



To resize a rotated or skewed sprite, do one of the following:

- Click the Rotate or Skew tool and drag any of the sprite's handles. Use Alt-drag (Windows) or Option-drag (Macintosh) to maintain the sprite's proportions as you resize.
- Enter new values on the Sprite tab in the Property inspector.

  Director resizes the sprite at the current skew or rotation angle.

To restore a skewed or rotated sprite to its original orientation:

- Select Modify > Transform > Reset Rotation and Skew or Reset All.

To skew a sprite with Lingo:

- Set the `skew` sprite property. See `skew` in the *Lingo Dictionary*.

Flipping sprites

Flipping a sprite creates a horizontally or vertically inverted image of the original sprite.

To flip a sprite:

1 Select a sprite.

2 Do any of the following:

- Click the Flip Vertical or Flip Horizontal button on the Sprite tab in the Property inspector to flip the sprite without moving the registration point or changing the current skew or rotation angles.

- Select Modify > Transform > Flip Horizontal in Place or Flip Vertical in Place to flip the sprite so that its bounding rectangle stays in place and the registration point is moved, if necessary.
- Select Modify > Transform > Mirror Horizontal or Mirror Vertical to flip the sprite without moving the registration point but inverting the skew and rotation angles.

Changing the color of a sprite

You can tint or color sprites by selecting new foreground and background colors from the Property inspector or with Lingo. Selecting a new foreground color changes black pixels within the sprite to the selected color and blends dark colors with the new color. Selecting a new background color changes white pixels within the sprite to the selected color and blends light colors with the new color.

Director can animate foreground and background color changes in sprites, shifting gradually between the colors you specify in the start and end frames of a sprite. See "Tweening other sprite properties" on page 188.

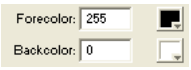
To reverse the colors of an image, change the foreground color to white and the background color to black.

To change the color of a sprite:

1 Select a sprite.

2 Do one of the following:

- Select colors from the Forecolor and Backcolor boxes on the Sprite tab in the Property inspector.



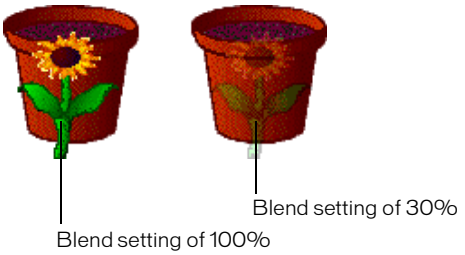
- Enter RGB values (hexadecimal) or palette index values (0-255) for the foreground and background colors on the Sprite tab in the Property inspector.

To change the color of a sprite with Lingo, set the appropriate sprite property:

- The `color` sprite property sets the sprite's foreground color. The value is an RGB value. See `color (sprite property)` in the *Lingo Dictionary*.
- The `bgColor` sprite property sets the sprite's background color. The value is an RGB value. See `bgColor` in the *Lingo Dictionary*.

Setting blends

You can use blending to make sprites transparent. To change a sprite's blend setting, use the Sprite tab in the Property inspector.



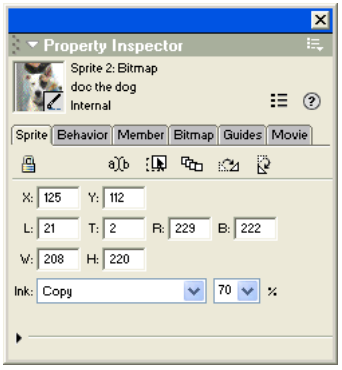
Director can gradually change blend settings to make sprites fade in or out. See "Tweening other sprite properties" on page 188.

The Blend percentage value affects only Copy, Background Transparent, Matte, Mask, and Blend inks.

To set blending for a sprite:

1 Select the sprite.

2 Select a percentage from the Blend pop-up menu in the Property inspector, or enter a blend percentage between 0 and 100.



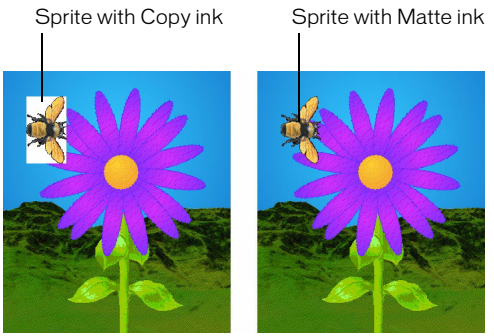
To set blending with Lingo:

- Set the `blend` sprite property. See `blend` in the *Lingo Dictionary*.

Using sprite inks

You can change a sprite's appearance on the Stage by applying inks. Sprite inks change the display of a sprite's colors. Inks are most useful to hide white bounding rectangles around images, but they can also create many compelling and useful color effects. Inks can reverse and alter colors, make sprites change colors depending on the background, and create masks that obscure or reveal portions of a background.

You change the ink for a sprite in the Property inspector or with Lingo.



To achieve the fastest animation rendering on the screen, use Copy ink; other ink types might have a slight effect on performance.

To change a sprite's ink with the Property inspector:

1. Select the sprite.
2. Select the desired type of ink from the Ink pop-up menu on the Sprite tab in the Property inspector.

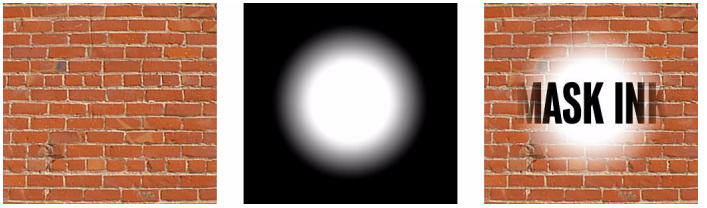
To change a sprite's ink with Lingo:

- Set the sprite's `ink` sprite property. See `ink` in the *Lingo Dictionary*.

  Note: If Background Transparent and Matte inks don't seem to work, the background of the image might not be true white. Also, if the edges of the image have been blended or are fuzzy, applying these inks might create a halo effect. Use the Paint window or an image-editing program to change the background to true white and harden the edges. You can also re-create the image with an alpha channel (transparency) and reimport the image.

Using Mask ink to create transparency effects

To reveal or tint certain parts of a sprite, you use Mask ink. Mask ink lets you define a mask cast member, which controls the degree of transparency for parts of a sprite.



The original cast member, its mask, and the sprite with Mask ink applied.

Black areas of a mask cast member make the sprite completely opaque in those areas, and white areas make it completely transparent (invisible). Colors between black and white are more or less transparent; darker colors are more opaque.

When creating a bitmap mask for a sprite, use a grayscale palette if the mask cast member is an 8-bit (or less) image. An 8-bit mask affects only the transparency of the sprite and does not affect the color. Director ignores the palette of mask cast members that are less than 32-bit images; using a grayscale palette lets you view the mask in a meaningful way. If your mask cast member is a 32-bit image, the colors of the mask tint the sprite's colors.

If you do not need variable levels of opacity, use a 1-bit mask cast member to conserve memory and disk space.

There are many ways to use Mask ink, but the following procedure explains the most basic method.

To use Mask ink:

1. Decide which cast member you want to mask.

   The cast member can be a bitmap of any depth.

2. In the next position in the same cast, create a duplicate of the cast member to serve as the mask.

   The mask cast member can actually be any image, but a duplicate of the original is usually the most useful.

3. Edit the mask cast member in the Paint window or any image editor.

   Black areas of the mask make the sprite completely opaque in those areas, and white areas make it completely transparent (invisible).

4. Drag the original cast member to the Stage or Score to create a sprite.

5. Make sure the new sprite is selected, and select Mask ink from the Ink pop-up menu on the Sprite tab in the Property inspector.

   Only the parts of the sprite that are revealed by the mask are visible on the Stage.

About Darken and Lighten inks

Darken and Lighten inks provide a great control over a sprite's RGB properties. You use them to create color effects in sprites varying from subtle to surreal.

Darken and Lighten each change how Director applies the foreground and background color properties of a sprite. Darken makes the background color equivalent to a color filter through which the sprite is viewed on the Stage. Lighten tints the colors in a sprite lighter as the background color gets darker. For both inks, the foreground color is added to the image to the degree allowed by the other color control. Neither ink has any effect on a sprite until you change the foreground or background color from the default settings of black and white.

Darken and Lighten are especially useful for animating unusual color effects. Because the Foreground and Background color properties of the sprite control the effects, you can animate color shifts to create dazzling effects without having to manually edit colors in a cast member. See "Tweening other sprite properties" on page 188.

Ink definitions

The following definitions describe all available ink types.

Copy displays all the original colors in a sprite. All colors, including white, are opaque unless the image contains alpha channel effects (transparency). Copy is the default ink and is useful for backgrounds or for sprites that do not appear in front of other artwork. If the cast member is not rectangular, a white box appears around the sprite when it passes in front of another sprite or appears on a nonwhite background. Sprites with the Copy ink animate faster than sprites with any other ink.

Matte removes the white bounding rectangle around a sprite. Artwork within the boundaries is opaque. Matte functions much like the Lasso tool in the Paint window in that the artwork is outlined rather than enclosed in a rectangle. Matte, like Mask, uses more RAM than the other inks, and sprites with this ink animate more slowly than other sprites.

Background Transparent makes all the pixels in the background color of the selected sprite appear transparent and permits the background to be seen.

Transparent makes all light colors transparent so you can see lighter objects beneath the sprite.

Reverse reverses overlapping colors. When applied to the foreground sprite, where colors overlap, the upper color changes to the chromatic opposite (based on the color palette currently in use) of the color beneath it. Pixels that were originally white become transparent and let the background show through unchanged. Reverse is good for creating custom masks.

Ghost, like Reverse, reverses overlapping colors, except nonoverlapping colors are transparent. The sprite is not visible unless it is overlapping another sprite.

Not Copy reverses all the colors in an image to create a chromatic negative of the original.

Not Transparent, Not Reverse, and **Not Ghost** are all variations of other effects. The foreground image is first reversed, then the Copy, Transparent, Reverse, or Ghost ink is applied. These inks are good for creating odd effects.

Mask determines the exact transparent or opaque parts of a sprite. For Mask ink to work, you must place a mask cast member in the Cast window position immediately following the cast member to be masked. The black areas of the mask make the sprite opaque, and white areas are transparent. Colors between black and white are more or less transparent; darker colors are more opaque. See “Using Mask ink to create transparency effects” on page 181.

Blend ensures that the sprite uses the color blend percentage that is specified on the Sprite tab in the Property inspector. See “Setting blends” on page 180.

Darkest compares RGB pixel colors in the foreground and background and uses the darkest pixel color.

Lightest compares RGB pixel colors in the foreground and background and uses the lightest pixel color.

Add creates a new color that is the result of adding the RGB color value of the foreground sprite to the color value of the background sprite. If the value of the two colors exceeds the maximum RGB color value (255), Director subtracts 256 from the remaining value so the result is between 0 and 255.

Add Pin is similar to Add. The foreground sprite's RGB color value is added to the background sprite's RGB color value, but the color value is not allowed to exceed 255. If the value of the new color exceeds 255, the value is reduced to 255.

Subtract subtracts the RGB color value of the foreground sprite's color from the RGB value of the background sprite's color to determine the new color. If the color value of the new color is less than 0, Director adds 256 so the remaining value is between 0 and 255.

Subtract Pin subtracts the RGB color value of pixels in the foreground sprite from the value of the background sprite. The value of the new color is not allowed to be less than 0. If the value of the new color is negative, the value is set to 0.

Darken changes the effect of the Foreground and Background color properties of a sprite to create dramatic color effects that generally darken and tint a sprite. Darken ink makes the background color equivalent to a color filter through which the sprite is viewed on the Stage. White provides no filtering; black darkens all color to pure black. The foreground color is then added to the filtered image, which creates an effect that is similar to shining light of that color onto the image. Selecting Darken ink has no effect on a sprite until you select nondefault foreground and background colors. See "About Darken and Lighten inks" on page 182.

Lighten changes the effect of the Foreground and Background color properties of a sprite so that it is easy to create dramatic color effects that generally lighten an image. Lighten ink makes the colors in a sprite lighter as the background color gets darker. The foreground color tints the image to the degree allowed by the lightening. See "About Darken and Lighten inks" on page 182.

Note: Mask and Matte use more memory than other inks because Director must duplicate the mask of the artwork.

Assigning a cast member to a sprite with Lingo

Several Lingo properties specify the cast member that is assigned to a sprite. You can use these properties to determine a sprite's cast member and switch the sprite's cast members as the movie plays.

To specify the cast member, including its cast:

- Set the `member` sprite property. See `member (sprite property)` in the *Lingo Dictionary*.

  Setting this property is the most reliable way to specify a sprite's cast member. You can also set the `memberNum` sprite property, but this is reliable only when the new cast member is in the same cast as the current cast member.

To determine which cast contains the cast member assigned to a sprite:

- Test the `castLibNum` sprite property. See `castLibNum` in the *Lingo Dictionary*.

  This procedure is useful for updating movies that serve as templates.

CHAPTER 6
Animation

Animation is the appearance of an image changing over time. The most common types of animation in Macromedia Director MX involve moving a sprite on the Stage (tweening animation) and using a series of cast members in the same sprite (frame-by-frame animation).

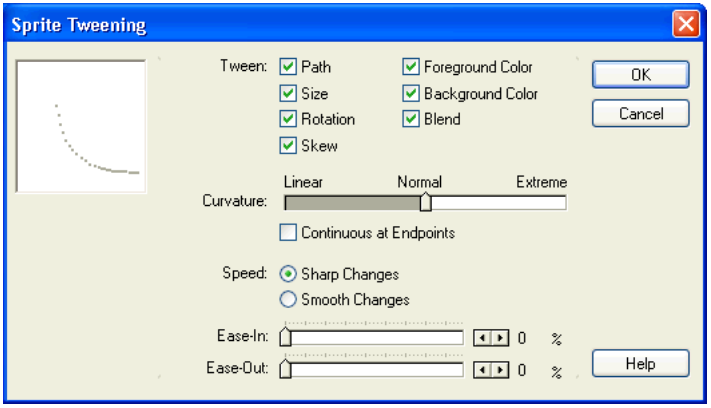
- *Tweening* is a traditional animation term that describes the process in which a lead animator draws the animation frames where major changes take place, called keyframes. Assistants draw the frames in between.
- Frame-by-frame animation involves manually creating every frame in an animation, whether that involves switching cast members for a sprite or manually changing settings for sprites on the Stage.

Other forms of animation include making a sprite change size, rotate, change colors, or fade in and out.

To specify tweening properties for a sprite, you use the Sprite Tweening dialog box.

To open the Sprite Tweening dialog box:

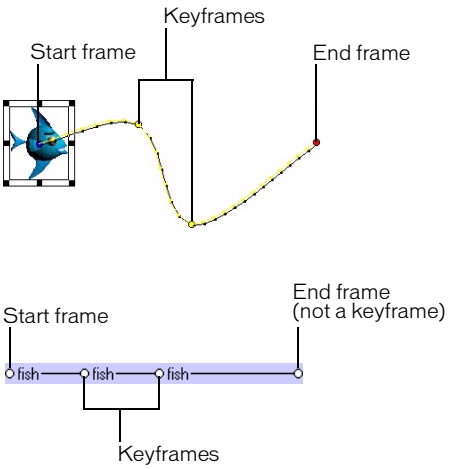
- Select a sprite, then select Modify > Sprite > Tweening.



About tweening in Director

To use tweening in Director, you define properties for a sprite in frames called keyframes and let Director change the properties in the frames in between. Tweening is very efficient for adding animation to movies for websites, since no additional data needs to download when a single cast member changes.

A keyframe usually indicates a change in sprite properties. Properties that can be tweened are position, size, rotation, skew, blend, and foreground and background color. Each keyframe defines a value for all of these properties, even if you only explicitly define one.



Tweening the path of a sprite

Sprite paths are the lines Director displays on the Stage to show the movement of a sprite. Sprite paths are controlled by the Sprite Overlay Settings dialog box. You can change settings to make the paths appear for all sprites, for selected sprites, or only when the pointer rolls over a sprite. See "Using the Sprite Overlay" on page 164.

You can tween a sprite directly on the Stage by editing the sprite's path. Director displays the path of the selected sprite directly on the Stage. You can adjust the path by dragging keyframe indicators.

To tween the path of a sprite:

1. Place a sprite on the Stage where you want the path to start. If the sprite is already on the Stage, select it.

   This places the start frame of the sprite in the proper location. The start frame is also the first keyframe of the sprite.

2. If necessary, select View > Sprite Overlay > Show Paths.

   The Show Paths option is on by default. With this option turned on, Director displays the paths of moving sprites on the Stage. Keyframes appear as hollow circles. Small tick marks show the sprite's position in tweened frames.

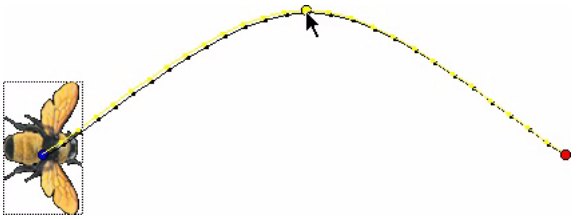
3. Insert keyframes in any additional frames where you want the sprite's animation path to change.

4 Drag the red handle within the sprite to the place on the Stage where you want the sprite's path to end.

The red handle represents the sprite's location in the end frame. For bitmaps, the red handle is usually in the center of the image. For vector shapes and other media types, the handle is often in the upper left corner.

5 Director displays the path the sprite will follow. The tick marks along the path show the sprite location in each frame in between.

6 To make the sprite's path curve between more points, hold down the Alt key (Windows) or Option key (Macintosh) and move the pointer on the Stage over a tick mark. When the pointer changes color, drag the tick mark to a new location.



This creates a new keyframe and records the new location. Repeat this step to create additional keyframes.

7 To make the property changes defined by a keyframe occur at a different time, drag the keyframe in the Score to a new frame within the sprite.

8 To change the degree of curvature between keyframes, select Modify > Sprite > Tweening and adjust the Curvature slider. To make the sprite move in the same direction at the beginning and end, select Continuous at Endpoints in the Sprite Tweening dialog box. This creates a circular motion. See "Changing tweening settings" on page 190.

Accelerating and decelerating sprites

To create more natural motion in tweened sprites, use the following settings in the Sprite Tweening dialog box:

- Ease-In and Ease-Out control how a sprite moves from its start frame to its end frame, no matter how many keyframes are in between. Ease-In makes a sprite move more slowly in the beginning frames; Ease-Out makes the sprite slow down in the ending frames. This setting makes the sprite move more like an object in the real world.
- The Speed settings control how Director moves a sprite between each keyframe. The Sharp Changes option is the default setting. Using this option, Director calculates how to move the sprite between each pair of keyframes separately. If a sprite's keyframes are separated by unequal numbers of frames in the Score, or by different amounts of space on the Stage, abrupt changes in speed may occur as the sprite moves between keyframe locations. Smooth out these speed changes by choosing the Smooth Changes option.

Sprite with modified ease-in and ease-out settings

To change the acceleration or deceleration of a sprite:

1. Use one of the tweening methods to create a moving sprite.
2. Turn on View > Sprite Overlay > Show Paths to see how far the sprite moves between each frame.
3. Select the sprite and select Modify > Sprite > Tweening.
4. Use the Ease-In and Ease-Out sliders to specify the percentage of the sprite's path through which the sprite should accelerate or decelerate.
5. Select one of the following speed settings:

   Sharp Changes moves the sprite between keyframe locations without adjusting the speed.

   Smooth Changes adjusts the sprite's speed gradually as it moves between keyframes.

Tweening other sprite properties

In addition to tweening a sprite's path, Director can tween the size, rotation, skew, blend, and foreground and background color of a sprite. Tweening size works best for vector-based cast members created in the Vector Shape window or in Macromedia Flash (bitmaps can become distorted when resized). Director can tween all of these properties at once.

To make a sprite fade in or out, you can tween blend settings. To make sprites spin or tilt, use rotation. To create gradual shifts in color, you can tween color settings.

Note: To prevent Director from tweening a certain sprite property, select Modify › Sprite › Tweening and turn off any of the tweening options.

To tween sprite properties:

1. If the Score isn't open, select Window > Score.
2. Position a sprite on the Stage and make sure it spans all the frames in which you want the sprite to change.
3. Select the start frame of the sprite in the Score.
4. To tween size, scale the sprite or resize the sprite on the Stage. See "Resizing and scaling sprites" on page 175.
5. To define the beginning property settings, click the Sprite tab of the Property inspector and do any of the following:

- To make the sprite fade in or out, enter a blend setting in the Property inspector (in List view). Enter 0 to make the sprite fade in or 100 to make it fade out. For more information, see "Setting blends" on page 180.
- To tween rotation or skew, manually rotate or skew the sprite to the beginning position on the Stage or enter an angle in the Property inspector. See "Rotating and skewing sprites" on page 176.
- To tween color, use the color boxes in the Property inspector to open the color palette for foreground and background color, or enter the RGB values for a new color in the boxes at the right (List view) or left (Graphical view).

6. In the Score, select the end frame of the sprite and select Insert > Keyframe.

   The end frame is not a keyframe unless you create one there.
7. Make sure only the keyframe is selected (not the entire sprite), and then enter the ending values of the sprite properties you are tweening.

   For example, if you entered a blend setting of 0 in the first frame, you could enter a blend setting of 100 in this frame.
8. If necessary, create additional keyframes in the sprite and enter new values for the tweened properties.
9. To make the property changes defined by a keyframe occur at a different time, drag a keyframe in the Score to a new frame within the sprite.
10. To view the tweening, rewind and play the movie. Director gradually changes the value of the tweened property in the frames between the keyframes.

Suggestions and shortcuts for tweening

Follow the suggestions listed here to improve results and productivity while tweening sprites.

- For smoother movements, tween across more frames, increasing the tempo if necessary.
- To achieve some types of motion, you may need to split the sprite and tween the sprites separately. See "Accelerating and decelerating sprites" on page 188.
- To quickly make duplicates, Alt-drag (Windows) or Option-drag (Macintosh) keyframes. This technique is useful when you want the start and end frames to have the same settings. This shortcut also provides a quick way to create a complex path. Insert a single keyframe, drag several duplicates to the proper frames, and then select the various keyframes and set positions on the Stage.
- To extend the sprite and leave the last keyframe in place, Alt-drag (Windows) or Option-drag (Macintosh) a keyframe at the end of a sprite.
- To move many keyframe positions at once, Control-click (Windows) or Command-click (Macintosh) multiple keyframes to select them and then move the sprite on the Stage.
- To make the animation look smoother, use an image editor to blur the edges of bitmaps.
- When tweening sprites that have a series of cast members, consider using a film loop instead. For more information, see "Using film loops" on page 197.
- To make a sprite jump instantly between settings in different keyframes, turn off all tweening options.

Changing tweening settings

To change tweening properties for sprites, you use the Sprite Tweening dialog box. You can turn tweening on and off for certain properties and control the curve of a tweening path and the way the speed changes as a sprite moves. For information on creating tweened animation, see "Tweening the path of a sprite" on page 186.

To change tweening settings:

1. Select a tweened sprite on the Stage or in the Score.
2. Select Modify > Sprite > Tweening to open the Sprite Tweening dialog box:

   The diagram in the upper left corner of the Sprite Tweening dialog box shows the sprite's path as specified by the Curvature, Speed, Ease-In, and Ease-Out settings. This does not show the actual path of the sprite, just the type of curve it will follow.

   If the start and end points of the sprite are the same, the diagram is circular, indicating that the sprite travels in a circle when tweened. If the start and end points are not the same, the diagram describes a curved path, indicating that the sprite ends at a point different from the starting point.
3. To change which properties of the sprite are tweened, change the values for Tween.

   A check mark indicates that the property will be tweened. The available properties are Path, Size, Rotation, Skew, Foreground Color, Background Color, and Blend.

4 To change how the sprite curves between positions defined by keyframes, adjust the Curvature slider.

Linear makes the sprite move in a straight line between the keyframe positions.

Normal makes the sprite follow a curved path inside the keyframe positions.

Extreme makes the sprite follow a curved path outside the keyframe positions.

5 To make the sprite move smoothly through start and end frames when it moves in a closed path, select Continuous at Endpoints.

6 To define how the tweened sprite positions change between keyframes, select an option for Speed. See "Accelerating and decelerating sprites" on page 188.

Sharp Changes makes the changes in position occur abruptly.

Smooth Changes makes the changes in position occur gradually.

7 To define how tweened sprite positions change over the whole length of the sprite, use the sliders to change the values for Ease-In and Ease-Out.

Ease-In defines the percentage of the sprite span through which the sprite accelerates.

Ease-Out defines the percentage of the sprite span through which the sprite decelerates.

Switching a sprite's cast members

To show different content while maintaining all other sprite properties, you exchange the cast member assigned to a sprite. This technique is useful when you've tweened a sprite and you decide to use a different cast member. When you exchange the cast member, the tweening path stays the same.

To exchange cast members in the Score:

1 To change a cast member in every frame, select an entire sprite. To change a cast member only in certain frames, select part of a sprite.

To select part of a sprite, press Alt and click the first frame that you want to select. Then press Control-Alt (Windows) or Option-Alt (Macintosh) and click each additional frame that you want to select.

2 Open the Cast window and select the cast member you want to use next in the animation.

3 Do one of the following:

- Select Edit > Exchange Cast Members.
-  Click the Exchange Cast Members button on the Director toolbar (Window > Toolbar).

If you selected an entire sprite, Director replaces the cast member for the entire sprite.

Before cast members are exchanged, the sprite moves like this.

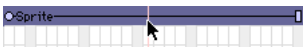
After cast members are exchanged, the sprite still moves in the same way, but it displays a different cast member.

You can also use Lingo to switch the cast member assigned to a sprite. See "Assigning a cast member to a sprite with Lingo" on page 184.

Editing sprite frames

To change how a sprite is selected and how keyframes are created, you use the Edit Sprite Frames option. Use this option with sprites that have animation you need to adjust frequently; it's especially useful for cell animation in which each frame contains a different cast member in a different position.

Ordinarily, clicking a sprite on the Stage or in the Score selects the entire sprite.



When Edit Sprite Frames is turned on for a certain sprite, clicking the sprite selects a single frame. Any change you make to a tweenable property, such as moving a sprite on the Stage, defines a new keyframe.

To use Edit Sprite Frames, do one of the following:

- Select a sprite or sprites and select Edit > Edit Sprite Frame.
- Alt-double-click (Windows) or Option-double-click (Macintosh) a frame within the sprite.

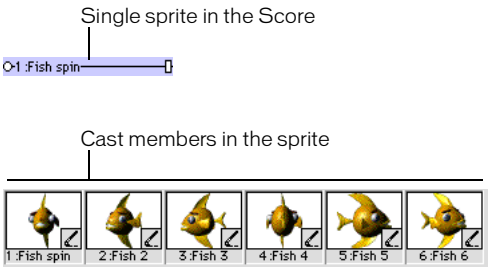
To return sprites to their normal state, do one of the following:

- Select sprites and select Edit > Edit Entire Sprite.
- Alt-double-click (Windows) or Option-double-click (Macintosh) a frame within the sprite.

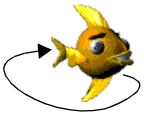
Frame-by-frame animation

To create animation that is more complex than is possible with simple tweening, you can use a series of cast members in frame-by-frame animation. Sprites usually refer to only one cast member, but they can refer to different cast members at different times during the life of the sprite.

For example, an animation of a man walking may display several cast members showing the man in different positions. By placing all the images in a sequence within a single sprite, you can work with the animation as if it were a single object.



A single sprite can display several cast members.



Sprite animating

Use this approach sparingly for movies that will be downloaded from the Internet, because all cast members must be downloaded before the animation can run. As an alternative to this type of animation, consider using vector shapes, rotation and skewing on bitmap cast members, or a Flash movie (see Chapter 11, “Using Flash and Other Interactive Media Types,” on page 293).

You can create multiple-cast-member animations in a variety of ways in Director. The following procedure explains a basic approach. The Cast to Time command provides an effective shortcut; see “Shortcuts for animating with multiple cast members” on page 195.

Note: The best way to prepare cast members for use in multiple-cast-member animation is with onion skinning in the Paint window. For more information, see “Using onion skinning” on page 234.

To animate a sprite with multiple cast members:

1. Create a sprite by placing the first cast member in the animation on the Stage in the appropriate frame.
2. Change the length of the sprite as needed.

   Drag the start or end frame in the Score, or enter a new start or end frame number in the Sprite Inspector.
3. Select View > Display > Cast Member.

   This setting displays the name of the cast member on each sprite. For more information, see "Displaying sprite labels in the Score" on page 165.
4. Select View > Sprite Labels > Changes Only.

   This setting changes the view of the Score to show the name of each sprite's cast member when it changes. This makes it easy to identify frames where the cast member changes. For more information, see "Displaying sprite labels in the Score" on page 165. You may also want to zoom the score to 800% so the frames are wide enough to display the cast member information.
5. Select Edit > Edit Sprite Frames.

   Edit Sprite Frames makes it easier to select frames within a sprite. See "Editing sprite frames" on page 192.
6. Select the frames in the sprite where you want a different cast member to appear.
7. Open the Cast window and select the cast member you want to use next in the animation.
8. Select Edit > Exchange Cast Members.

   Director replaces the cast member in the selected frame with the cast member selected in the Cast window.
9. Repeat steps 6-8 to complete the animation. Select Edit > Edit Entire Sprite when you're done.

Sometimes a series of cast members placed in the Score jumps unexpectedly when you play the movie. This occurs because the cast members' registration points aren't aligned properly. When you exchange cast members, Director places the new cast member's registration point precisely where the previous cast member's registration point was. By default, Director places registration points in the center of a bitmap cast member's bounding rectangle.

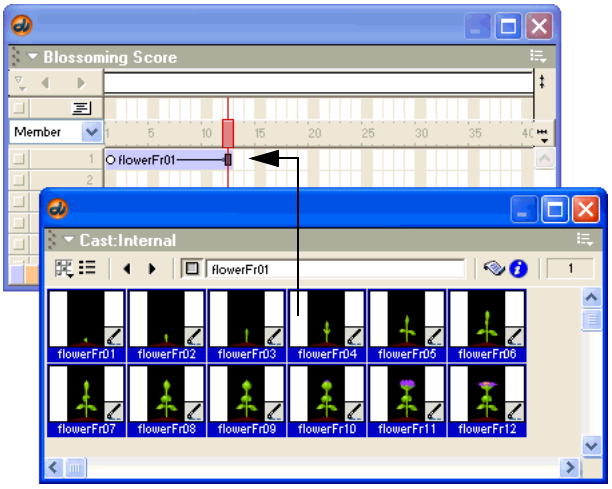
For information about aligning registration points, see "Changing registration points" on page 219. You can also align sprites relative to their bounding rectangles. See "Positioning sprites using guides, the grid, or the Align window" on page 169.

Shortcuts for animating with multiple cast members

The Cast to Time and Space to Time commands are both useful shortcuts for animating with multiple cast members.

Using the Cast to Time command

To move a series of cast members to the Score as a single sprite, you use the Cast to Time command (Modify > Cast to Time), which is one of the most useful methods for creating animation with multiple cast members. Typically, you create a series of images and then use Cast to Time to quickly place them in the Score as a single sprite. The Director onion skinning feature is also useful for creating and aligning a series of images for use in animation. For more information, see “Using onion skinning” on page 234.



Cast to Time places selected cast members in the Score as a single sprite.

To create a sprite from a sequence of cast members:

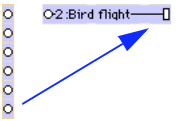
1. Select the frame in the Score where you want to place the new sprite.
2. Make the Cast window active.
3. Select the series of cast members to be placed in the new sprite.
4. Select Modify > Cast to Time, or hold down Alt (Windows) or Option (Macintosh) and drag the cast members to the Stage.

   The selected series of cast members becomes a single sprite.

Using the Space to Time command

To move sprites from adjacent channels to a single sprite, you use the Space to Time command (Modify > Space to Time). This method is convenient when you want to arrange several images on the Stage in one frame and then convert them to a single sprite.

Arrange sprites on the Stage in a single frame.



Space to Time converts sprites from adjacent channels to a single sprite.

Onion skinning provides a benefit in the Paint window similar to that provided by Space to Time on the Stage. For more information, see "Using onion skinning" on page 234.

To use the Space to Time command:

1. Select Edit > Preferences > Sprite and set Span Duration to 1 frame.

   Set the span duration to any setting you like, but Space to Time works best with shorter sprites.

2. Select an empty frame in the Score.

   This is usually at the end of the Score.

3. Drag cast members onto the Stage to create sprites where you want them to appear in the animation.

   As you position the sprites on the Stage, Director places each sprite in a separate channel. Make sure all the sprites are in consecutive channels.

4. Select all the sprites that are part of the sequence in the Score or on the Stage.

5. Select Modify > Space to Time.

   The Space to Time dialog box appears.

6. Enter the number of frames you want between each cast member in the Separation text box

   Director rearranges the sprites so that instead of being arranged from top to bottom in a single frame, they're arranged in sequence from left to right in a single sprite.

Note: Space to Time is a fast way to set up keyframes for a sprite to move along a curve. Arrange the cast members in one frame, select Modify › Space to Time, and add 10 to 20 cells between each cast member to produce a smooth curve.

Using film loops

A film loop is an animated sequence that you can use like a single cast member. For example, to create an animation of a bird flying across the Stage, you can create a film loop of the sequence of cast members that shows the bird flapping its wings. Instead of using the frame-by-frame technique, you create a sprite containing only the film loop and then animate it across as many frames as you need. When you run the animation, the bird flaps its wings and at the same time moves across the Stage.

You can also use film loops to consolidate Score data. Film loops are especially helpful when you want to reduce the number of sprite channels you're using. You can combine several Score channels into a film loop in a single channel.

To determine if a film loop is cropped or scaled within a sprite's bounding rectangle and to make the film loop repeat or mute its sounds, you use the Film Loop Cast Member properties. See "Setting film loop properties" on page 198.

Film loops are useful for animating repetitive motions and combining sprites to use fewer channels.

To create a film loop:

1. In the Score, select the sprites you want to turn into a film loop.

   Use sprites in as many channels as you need in film loops—even in the sound channel. Select sequences in all the channels you want to be part of the film loop. You can select sprite fragments if you first select a sprite and select Edit > Edit Sprite Frames. Control-click (Windows) or Command-click (Macintosh) to select sequences that aren't in adjacent channels.

2. Select Insert > Film Loop.

   A dialog box appears asking you to name the film loop.

3. Enter a name for the film loop.

   Director stores all the Score data and cast member references as a new film loop cast member.

Note: You can drag a selection from the Score to the Cast window to quickly create a film loop cast member in that position.

A film loop behaves just like any other cast member, with a few exceptions:

- When you step through an animation that contains a film loop (either by using Step Forward or Step Backward or by dragging the playhead in the Score), the film loop doesn't animate. Animation occurs only when the movie is running.
- You can't apply ink effects to a film loop. If you want to use ink effects with a film loop, you need to apply them to the sprites that make up the animation before you turn the animation into a film loop.
- Lengthening or shortening a sprite that contains a film loop doesn't affect how fast the film loop plays. It changes the number of times the film loop cycles.

Director provides three other ways of incorporating a completed animation into a movie as a discrete element: you can export it as a digital video (QuickTime or AVI), save and import it as a linked Director movie, or play it in a window in another Director movie.

Note: If you need to edit a film loop and you've deleted the original Score data it was based on, it's possible to restore the Score data for editing. Copy the film loop cast member to the Clipboard, select a cell in the Score, and then paste. Director pastes the original Score data instead of the film loop.

Setting film loop properties

To determine if a film loop is cropped or scaled within a sprite's bounding rectangle and to make the film loop repeat or mute its sounds, you set properties for the film loop cast member.

To set film loop properties:

1. Select a film loop cast member.
2. To display the Property inspector, select Modify > Cast Member > Properties, or Window > Property Inspector.
3. If necessary, click the Member tab and display the Graphical view.

   The following noneditable settings are displayed:

- The cast member size in kilobytes
- The cast member creation and edit dates
- The name of the last person who modified the cast member

4. To view or edit the cast member name, use the Name field.
5. To add comments about the cast member, use the Comments field.
6. To specify how Director removes the cast member from memory if memory is low, select one of the following options from the Unload pop-up menu:

   3–Normal sets the selected cast members to be removed from memory after all priority 2 cast members have been removed.

   2–Next sets the selected cast members to be among the first removed from memory.

   1–Last sets the selected cast members to be the last removed from memory.

   0–Never sets the selected cast members to be retained in memory; these cast members are never unloaded.

7. Click the Film Loop tab and display the Graphical view.
8. To determine how the film loop appears within the sprite bounding rectangle, select Framing options:

   Crop makes the movie image appear at its default size. Any portions that extend beyond the sprite's rectangle are not visible.

   Center is available only if Crop is selected. It determines whether transformations occur with the cast member centered within the sprite or with the cast member's upper left corner aligned with the sprite's upper left corner.

   Scale fits the movie inside the bounding rectangle.

9 To determine how the film loop plays back, use the following settings:

Audio plays the sound portion of the film loop. Turn this option off to mute sounds.

Loop replays the film loop continuously from the beginning to the end and back to the beginning.

Step-recording animation

Step recording is a process of animating one frame at time. You record the position of a sprite in a frame, step forward to the next frame, move the sprite to its new position, step forward to the next frame, and so on until you've completed the animation. This method is useful for creating sprites that follow irregular paths.

To step-record animation:

1 Place sprites on the Stage where you want the animation to begin.

2 Select all the sprites you want to animate.

3 In the Score, click the frame where you want animation to begin.

4 Select Control > Step Recording.

The step-recording indicator appears next to the channel numbers for the sprites being recorded, and the selection border widens.

5 Press 3 on the numeric keypad (make sure Number Lock is off) or click the Step Forward button in the Control panel.

Note: You can display the Control panel at the bottom of the Stage or in a floating panel. For more information about using the Control panel, see "The Control panel" on page 21.

The movie advances to the next frame. If you reach the last frame of a sprite, Director extends the sprites being recorded into the new frame.

Note: As soon as you move the animation in any way other than stepping—such as using Rewind, Play, or Back—recording stops.

6 Drag the sprite to reposition it.

You can also stretch the sprite, exchange cast members, or change any property.

7 Repeat steps 5 and 6 until you've completed the sequence you want to record.

8 Select Control > Step Recording again to stop recording.

You can also rewind the movie to stop recording.

Real-time recording animation

You can create animation by recording the movement of a sprite as you drag it across the Stage. The real-time recording technique is especially useful for simulating the movement of a pointer or for quickly creating a complex motion for later refinement.

For better control when you're recording in real time, use the Tempo control in the Control panel to record at a speed that's slower than normal.

Note: The Control panel attached to the bottom of the Stage does not include tempo settings. Tempo settings are available only from the floating panel version of the Control panel. For more information about the Control panel, see "Introducing the Director workspace" on page 20.

To use real-time recording:

1. Select one or more sprites on the Stage or in the Score.

   Recording will begin at the playhead. It's best to select a sprite in a channel that contains no other sprites later in the movie.

   To record in a specific range of frames, select the frames, and then click the Selected Frames Only button in the Control panel.

2. Select Control > Real-Time Recording.

   The real-time recording indicator appears next to the channel numbers for the sprite being recorded, and a red and white selection frame appears around the sprite. Recording begins as soon as you drag the sprite on the Stage, so be prepared to move the mouse.

3. Drag the sprite on the Stage to record a path for the sprite.

   Director records the path.

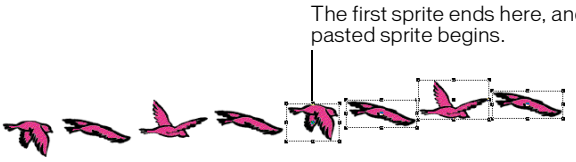
4. Release the mouse button to stop recording.

   The movie continues to play until you stop it.

Note: If you select Trails for the sprite, you can also use real-time recording to simulate handwriting.

Linking a sequence with Paste Relative

Paste Relative automatically aligns the start frame of one sprite with the end frame of the preceding sprite. It's useful for extending animations across the Stage.



To paste one sequence relative to another:

1. Select a sprite in the Score
2. Select Edit > Copy Sprites.
3. Select the cell immediately after the last cell in the sprite.
4. Select Edit > Paste Special > Relative.

   Director positions the beginning of the pasted sprite where the previous sprite ends.

Repeat the process as many times as you need to create one continuous animation across the Stage.

Animating sprites with Lingo

Lingo can create animation regardless of the settings in the Score. This lets you create or modify animation depending on movie conditions.

To move a sprite on the Stage, you use Lingo that controls the sprite's location. See `bottom`, `left`, `right`, and `top` in the *Lingo Dictionary*.

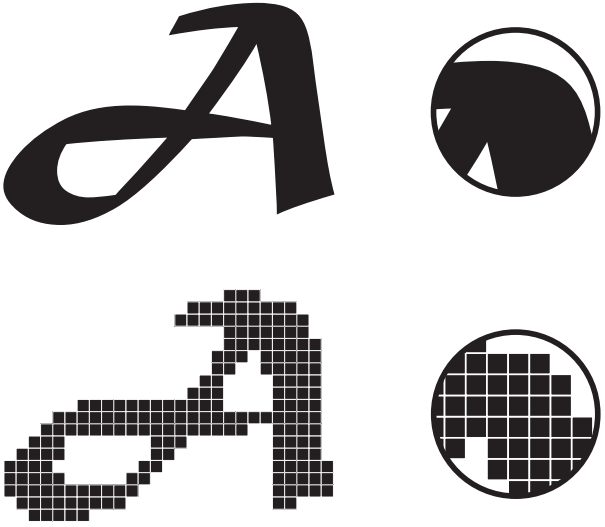
To animate a sprite by switching the sprite's cast members, change the sprite's `member` property. See `member (sprite property)` in the *Lingo Dictionary*.

CHAPTER 7
Bitmaps

Bitmaps and vector shapes are the two main types of graphics used with Macromedia Director MX. A bitmap defines an image as a grid of colored pixels, and it stores the color for each pixel in the image. A vector shape is a mathematical description of a geometric form that includes the thickness of the line, the fill color, and additional features of the line that can be expressed mathematically.

Bitmaps are suited for continuous tone images such as photographs. You can easily make minute changes to a bitmap by editing single pixels, but resizing the image can cause distortion as pixels are redistributed. Anti-aliasing is a Director feature that blends the bitmap's colors with background colors around the edges to make the edge appear smooth instead of jagged.

A vector shape is most appropriate for a simple, smooth, clean-looking image. It typically includes less detail than a bitmap, but you can resize it without distortion.



Vector image (top) and bitmap image (bottom)

A bitmap typically requires more RAM and disk space than a comparable vector shape. If not compressed, bitmaps take longer than vector shapes to download from the Internet. Fortunately, Director offers compression control to reduce the size of bitmaps in movies that you package to play on the web. For more information about bitmap compression, see "Compressing bitmaps" on page 239.

For more information about vector shapes, see Chapter 8, "Vector Shapes," on page 245.

You can create bitmaps in the Paint window or import them from any of the popular image editors in most of the popular formats, including GIF and JPEG. Director can also import bitmaps with alpha channel (transparency) data and animated GIFs. The Paint window includes a variety of tools for editing and applying effects to bitmaps.

About importing bitmaps

Importing bitmaps is similar to importing other types of media. If you import a bitmap with a color palette or depth different from that of the current movie, the Image Options dialog box appears. You must choose to import the bitmap at its original color depth or at the current system color depth. If you are importing an 8-bit image, you have the choice of importing the image's color palette or remapping the image to a palette that is already in Director. See"Choosing import image options" on page 150.

Director can import images with alpha channel (transparency) effects, which are 32 bits. If you reduce the image to a lower color depth, Director removes all the alpha channel data.

When importing bitmaps, you should always consider that they will display on the screen at your monitor's resolution (generally 72 to 96 dots per inch). Higher-resolution images that you place on the Stage in Director might appear much larger than you expect. Other applications, particularly those focused on creating images for print, let you work on the screen with high-resolution images at reduced sizes. Within Director, you can scale high-resolution images to the right size, but this might reduce the quality of the image. Also, high-resolution images use extra memory and storage space, even after they've been scaled.

If you are working with a high-resolution image, convert it to between 72 and 96 dots per inch with your image-editing program before you import it into Director.

Director supports JPEG compression at runtime for internal cast members that are imported through the Standard or Include Original Data for Editing import options. A JPEG file that is imported with either of these options contains both the original compressed bits and decompressed bits. After it's imported, the JPEG file decompresses in the authoring environment. The cast member size displays the member's size in RAM after it's decompressed. The amount of RAM required to display a JPEG file is larger than its size on disk, so don't be surprised that your cast member size is larger than its original size on disk in the Cast Properties window.

Director takes advantage of compressed JPEG data at runtime. The original compressed data bits are saved in a Macromedia Shockwave movie or a projector (if the Shockwave compression option is on). If you edit the member within Director in the Paint window, the compressed data will be lost. An alert appears before the data is overwritten.

If the Shockwave compression option is on, Director also compresses bitmaps into the JPEG format. For more information about bitmap compression, see "Compressing bitmaps" on page 239.

Using animated GIFs

You can import an animated GIF into Director with File > Import, similar to the way in which you import any other bitmap cast member. The only difference is that when the Select Format dialog box appears, you select Animated GIF.

Director supports both the GIF89a and GIF87 formats. GIFs must have a global color table to be imported. You can import an animated GIF within a movie file or link to an external file. You also have the choice of importing the first frame of an animated GIF as a still image. As with an ordinary bitmap, you place an animated GIF in the Score in a sprite channel and extend it through all the frames in which you want it to appear. An animated GIF can play at the same frame rate as the Director movie, at a different rate that you specify, or at its original rate.

Director does not support the following inks for animated GIFs: Background Transparent, Reverse, Not Reverse, Darkest, Lightest, Add, Add Pin, Subtract, and Subtract Pin.

You can make an animated GIF play direct-to-Stage, meaning that it immediately appears on the Stage instead of being first composed in an offscreen buffer with other sprites. A direct-to-Stage GIF takes less time to load, but you cannot place other sprites in front of it or use any ink effect.

To set properties for an animated GIF:

1. To specify how Director removes the cast member from memory if memory is low, select an option from the Unload pop-up menu on the Member tab of the Property inspector (Graphical view). See "Controlling cast member unloading" on page 152.
2. To achieve the fastest playback rate, click the Animated GIF tab and select DTS (Direct to Stage).

   When Direct to Stage is on, you can use only Copy ink and you cannot place any sprites on top of the animated GIF sprite.
3. Select an option, described in the following list, from the Rate pop-up menu:

   Normal plays at the GIF's original rate, which is independent of the Director movie. The GIF cannot exceed the Director frame rate.

   Fixed plays at the frame rate you enter in the FPS text box.

   Lock-Step plays at the same rate as the Director movie.
4. To set additional animated GIF settings, click More.

- To change the file of a linked external cast member, enter a new pathname in the Import text box or click Browse to select a new file.
- To import a file from the Internet, click Internet and enter a new URL in the File URL text box.

Using the Paint window

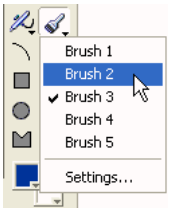
The Paint window has a complete set of paint tools and inks for creating and changing bitmap cast members for movies. Anything you draw in the Paint window becomes a cast member. When you make a change to a cast member in the Paint window, the image in the Cast window is instantly updated—as is the cast member wherever it appears on the Stage.

To open the Paint window, do any of the following:

- Select Window > Paint.
- Click the Paint window icon on the toolbar.
- Press Control-5 (Windows) or Command-5 (Macintosh).
- Double-click a bitmap sprite on the Stage or in the Score, or double-click the sprite's cast member in the Cast window.

Using Paint window tools and controls

If you see an arrow in the lower right corner of a tool, click it and hold down the mouse button to display a pop-up menu of options for that tool.



To select an irregular area, do one of the following:

- Click the Lasso tool in the Paint window, and drag to enclose the pixels you want to select.

  The Lasso selects only those pixels of a color that are different from the color the Lasso was on when you first started dragging it.
- Press Alt (Windows) or Option (Macintosh) while dragging to create a polygon selection. Every time you click, you create a new angle in the selection polygon.
- Click the Lasso tool, and hold down the mouse button to select new settings from the pop-up menu.

  See "Using the Lasso tool" on page 211.

To select a rectangular area, do one of the following:

- Click and drag the Marquee tool in the Paint window.
- Double-click the Marquee tool to select the entire bitmap.
- Click the Marquee tool, and hold down the mouse button to select new settings from the pop-up menu.

  See "Using the Marquee tool" on page 211.

To change the location of the registration point, do one of the following:

- Click the Registration Point tool, and click the spot where you want to set the registration point.
- Double-click the Registration Point tool to set the registration point in the center of the image.

See "Changing registration points" on page 219.

To erase, do one of the following:

- Click and drag the Eraser tool to erase pixels.
- Double-click the Eraser tool to erase the cast member.

To move the view of the Paint window, do one of the following:

- Click and drag the Hand tool to move the visible portion of the image within the Paint window.
- Shift-drag to move straight horizontally or vertically.

Press the Spacebar to temporarily activate this tool while using other paint tools.

To zoom in or out on an area:

- Click the Magnifying Glass tool, and click in the Paint window to zoom in. Shift-click to zoom out.

See "Zooming in and out in the Paint window" on page 214.

To select a color in a cast member:

1. Click the Eyedropper tool.
2. Do one of the following:

- Click a color to select it as the foreground color.
- Shift-click a color to select it as the background color.
- Alt-click (Windows) or Option-click (Macintosh) to select the destination color for a gradient.

Press the D key to temporarily activate the Eyedropper tool while using other paint tools.

To fill all adjacent pixels of the same color with the foreground color:

- Click the Bucket tool, and click the area you want to fill.
- To open the Gradient Settings dialog box, double-click the Bucket tool.

To enter bitmap text, do one of the following:

- Click the Text tool, then click in the Paint window, and begin typing.
- Select character formatting with the Modify > Font command.

Bitmap text is an image. Before you click outside the text box, you can edit text you've typed by using the Backspace key (Windows) or Delete key (Macintosh). After you click outside the text box, you cannot edit or reformat bitmap text.

To draw a 1-pixel line in the current foreground:

- Click the Pencil tool, and drag it in the Paint window. To constrain the line to horizontal or vertical, Shift-Click and drag.

  If the foreground color is the same as the color underneath the pointer, the Pencil tool draws with the background color.

To spray variable dots of the foreground color:

- Click the Airbrush tool, and drag it in the Paint window.
- Click the Airbrush tool, and hold down the mouse button to select a new brush type from the pop-up menu. Select Settings to change the selected brush.

See "Using the Airbrush tool" on page 212.

To brush strokes of the foreground color:

- Click the Brush tool, and drag it in the Paint window. To constrain the stroke to horizontal or vertical, Shift-click and drag.

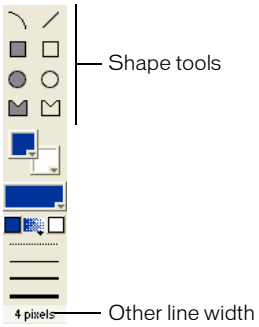
To select a new brush type:

- Click the Brush tool, and hold down the mouse button to select a new brush type from the pop-up menu. Select Settings to change the selected brush.

  See "Using the Brush tool" on page 213.

To paint shapes or lines:

- Click and drag the shape tools. To constrain lines to horizontal or vertical, ovals to circles, and rectangles to squares, Shift-click and drag.



The filled tools create shapes that are filled with the foreground color and the current pattern. The thickness of lines is determined by the line-width selector.

To select a foreground and destination color for color-shifting inks:

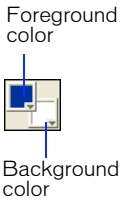
- Click the color box on the left to select a foreground color; click the color box on the right to select a destination color.

These colors affect the Gradient, Cycle, and Switch inks. Each of these inks uses a range of colors that shifts between the foreground color and the destination color.

See “Using gradients” on page 224 and “Using Paint window inks” on page 229.

To select the foreground and background colors:

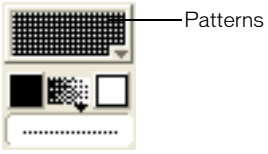
- Use the Foreground Color pop-up menu to select the primary fill color (used when the pattern is solid and the ink is Normal).



- Use the Background Color pop-up menu to select the secondary color (the background color in a pattern or text).

To select a pattern for the foreground color, do one of the following:

- To change the pattern palette, select Pattern Settings at the bottom of the Patterns pop-up menu.



- To define a tile—a pattern that is based on a rectangular section of an existing cast member—select Tile Settings from the Patterns pop-up menu.

See “Editing patterns” on page 228 and “Creating a custom tile” on page 229.

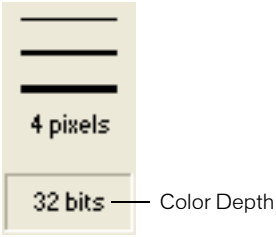
To select a line thickness, do one of the following:

- Click the None, One-, Two-, or Three-Pixel Line button.

- Double-click the Other Line Width button to open the Paint Window Preferences dialog box, and assign a width to the line.

To change the color depth of the current cast member:

- Double-click the Color Depth button to open the Transform Bitmap dialog box.

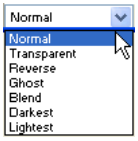


The button displays the color depth of the current cast member.

See “Changing size, color depth, and color palette for bitmaps” on page 220.

To select a Paint window ink:

- Select the type of ink from the Ink pop-up menu at the lower left of the window.



See “Using Paint window inks” on page 229.

Using the Lasso tool

You use the Lasso tool to select irregular areas or polygons. After you select artwork, it can be dragged, cut, copied, cleared, or modified with the effects on the Paint toolbar. The Lasso tool selects only those pixels of a color that are different from the color the Lasso tool was on when you first started dragging it. You use the Lasso pop-up menu to change settings.

To select an irregular area with the Lasso tool:

- Drag with the Lasso tool to enclose the pixels you want to select.

To select a polygon area with the Lasso tool:

1. Press Alt (Windows) or Option (Macintosh) while clicking the first point.
2. Click the remaining points.
3. Double-click the last point.

To change Lasso tool settings:

1. Hold down the mouse button while the pointer is on the Lasso tool.
2. Select one of the following options from the Lasso pop-up menu:

   Shrink causes the lasso to tighten around the selected object so that only the object is selected.

   No shrink lets you select the entire area you drag around. The lasso selects whatever is inside the selected area.

   See Thru Lasso causes your selection to become transparent, as if the Transparent ink effect were applied.

Using the Marquee tool

The Marquee tool selects artwork in the Paint window. After you select artwork, it can be dragged, cut, copied, cleared, or modified with the commands on the Paint toolbar. Use the Marquee pop-up menu to change settings.

To select with the Marquee tool:

- Drag to select a rectangular area.

To select the entire bitmap:

- Double-click the Marquee tool.

To stretch or compress art that is selected with the Marquee tool:

- Hold down Control (Windows) or Command (Macintosh) while dragging a border of the selected area. Hold down Shift at the same time to maintain proportions.

To move a selection, do any of the following:

- Click and drag the selection.
- Shift-drag to limit the movement to horizontal or vertical.
- Use the arrow keys to move the selection one pixel at a time.

To make a copy of artwork that is selected with the Marquee tool:

- Hold down Alt (Windows) or Option (Macintosh) while dragging the selection.

To change marquee settings:

- Click the Marquee tool, hold down the mouse button, and select from the following options:

  Shrink causes the rectangle to shrink around the selected artwork.

  No Shrink lets you select everything within the marquee.

  Lasso tightens the marquee around the object in the same way as the Lasso tool and selects the pixels according to the color of the pixel beneath the cross hair when you started the drag.

  See Thru Lasso modifies the selection function so that pixels with the same color as the first pixel selected are not included in the selection.

Using the Airbrush tool

The Airbrush tool sprays the currently selected color, ink, and fill pattern. To modify the spray, you select the ink effects from the Ink pop-up menu in the Paint window. The longer you hold the Airbrush tool in one spot, the more it fills in the area.

If you hold down the mouse button when the pointer is positioned on the Airbrush tool, the Airbrush pop-up menu appears. Each of the five settings in the pop-up menu can be defined so you can have several types of spray available without opening the Airbrush Settings dialog box.

To use the Airbrush tool:

- Click the Airbrush tool, and drag it in the Paint window.

To define airbrush settings:

1. Click the Airbrush tool, and hold down the mouse button.
2. Select the menu item for which you want to define settings.
3. Open the menu again, and select Settings from the Airbrush pop-up menu. Enter values for the options in the Airbrush Settings dialog box.

   You can also double-click the Airbrush tool to open the Airbrush Settings dialog box.
4. Use the Flow Rate slider to control how quickly the airbrush covers an area with paint. To change the flow, drag the Flow Speed slider.
5. Use the Spray Area slider to set the size of the airbrush's spray area.
6. Use the Dot Size slider to set the size of the dots that the airbrush sprays.
7. Use the following Dot Options to specify how dots spray from the airbrush:

   Uniform Spray causes the airbrush to spray drops of uniform size.

   Random Sizes sprays randomly sized drops.

   Current Brush sprays drops shaped the same as the current airbrush.

Using the Brush tool

You use the Brush tool to brush strokes with the current color, ink, and fill pattern. To select a different size and brush shape, you use the Brush Settings dialog box. The selections you make in the Brush Settings dialog box are assigned to the menu item in the pop-up menu and remain in effect until you change them. Each of the five settings in the pop-up menu can be defined so you can have several types of spray available without opening the Brush Settings dialog box.

To use the Brush tool:

- Click the Brush tool, and drag it in the Paint window.

To change brush settings:

1. Click the Brush tool, and hold down the mouse button.
2. Select the menu item for which you want to define settings.
3. Open the menu again, and select Settings from the Brush pop-up menu. Enter values for the options in the Brush Settings dialog box.

   You can also double-click the Brush tool to open the Brush Settings dialog box.
4. To select from the default brush shapes, select Standard from the pop-up menu, and click a brush shape in the chart below the pop-up menu.
5. To create a new brush shape, select Custom from the pop-up menu, and select the brush shape you want to modify from the chart below the pop-up menu.
6. Edit the current brush shape by clicking the magnified image of the brush shape. Clicking a blank pixel fills it, and clicking a filled pixel makes it blank. Clicking outside the Brush Shapes dialog box places the pixels on the screen at the point you click. Use the following editing controls to change the brush shape:

   The right and left arrows move the brush shape one pixel to the right or left.

   The up and down arrows move the brush shape up or down one pixel.

   The black and white square reverses the colors of the brush shape (for example, black becomes white and white becomes black).

   Copy copies the brush shape to the Clipboard.

   Paste pastes the brush into the custom set of brush shapes.

Using rulers in the Paint window

The Paint window has vertical and horizontal rulers to help you align and size your artwork.

To hide or show the rulers in the Paint window:

- Select View > Rulers.

To change the location of the zero point, do one of the following:

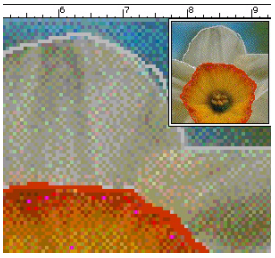
- Drag along the ruler at the top or side of the window.
- Drag into the window to align the zero point with a specific point in the cast member.

Zooming in and out in the Paint window

You can use the Magnify tool or the Zoom commands on the View menu to zoom in or out at four levels of magnification.

To zoom in or out, do one of the following:

- Click the Magnify tool, and click the image. Click again to increase the magnification. Shift-click to zoom out.
- Select Zoom In or Zoom Out from the Paint window's Options menu.
- Select View > Zoom, and select the level of magnification.
- Press Control + the Plus (+) key (Windows) or Command + the Plus (+) key (Macintosh) to zoom in, or Control + the Minus (-) key (Windows) or Command + the Minus (-) key (Macintosh) to zoom out.
- Control-click (Windows) or Command-click (Macintosh) the image to zoom in on a particular place.



To return to normal view, do one of the following:

- Click the normal-sized image in the upper right corner.
- Select View > Zoom > 100%.

Changing selected areas of a bitmap

After you select part of an image in the Paint window with the Lasso or Marquee tool, you can change the selected area.

To reposition the selected area:

1. Move the cross hair inside the selected area (the cross hair becomes an arrow pointer).
2. Drag the selected area.

To affect how the selected area behaves when you drag it, use the following key combinations:

- To make a copy of the selected area as you drag, Alt-drag (Windows) or Option-drag (Macintosh) the selection.
- To stretch the selection (Marquee tool only), Control-drag (Windows) or Command-drag (Macintosh) the selection.
- To stretch the selection proportionally (Marquee tool only), Control-Shift-drag (Windows) or Command-Shift-drag (Macintosh) the selection.

- To copy and stretch the selection (Marquee tool only), Control-Alt-drag (Windows) or Command-Option-drag (Macintosh) the selection.
- To constrain the movement of the selection to horizontal or vertical, Shift-drag the selection.
- To move the selection one pixel at a time, use the arrow keys.

Flipping, rotating, and applying effects to bitmaps

The toolbar at the top of the Paint window contains buttons to apply effects to bitmaps. Before using any of these options, you must select part of the bitmap with the Lasso or Marquee tool. Effects that change the shape of the selection work only when the selection is made with the Marquee tool. Effects that change colors within the selection work with the Marquee and the Lasso tools.

Lingo flips and rotates bitmaps by flipping and rotating bitmap sprites. See “Rotating and skewing sprites” on page 176 and “Flipping sprites” on page 178.

Note: To repeat any of these effects after using them, press Control+Y (Windows) or Command+Y (Macintosh).

To flip, rotate, skew, or apply effects to part of a bitmap:

1. Select part of a bitmap in the Paint window with the Marquee tool.
2. Use any of the following effects:

- To flip the selection, click the Flip Horizontal button to flip right to left, or click the Flip Vertical button to flip top to bottom.

- To rotate the selection 90º counterclockwise or 90º clockwise, click the Rotate Left or Rotate Right buttons, respectively.

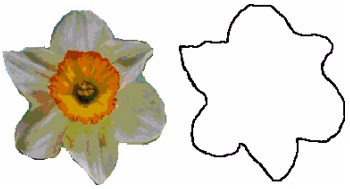
- To rotate the selection by any amount in either direction, click the Free Rotate button, and drag the rotate handles in any direction. (You can rotate a sprite that contains a bitmap instead of the bitmap. See “Rotating and skewing sprites” on page 176.)

- To skew the selection, click the Skew button, and drag any of the skew handles.

- To warp the shape of the selected area, click the Warp button, and drag any handle in any direction.

- To create a perspective effect, click the Perspective button, and drag one or more handles to create the effect you want.

- To create an outline around the edges of the selected artwork, click the Trace Edges button.



To apply color effects to a selected area:

1 Select an area within a bitmap cast member using either the Marquee or the Lasso tool.

2 Use any of the following effects:

- To soften the edges of the selected artwork, click the Smooth button. This effect works only with 8-bit cast members.

- To reverse the colors of the selected area, click the Invert button.

- To increase or reduce the brightness of the selected area, click the Lighten Color or Darken Color button. This effect works on 8-bit (256 color) images only.

- To fill the selected area with the current foreground color and pattern, click the Fill button.

- To change all pixels of the foreground color within the selection to the currently selected destination color, click the Switch Colors button.

Using Auto Distort

You can use Auto Distort to create animations that show bitmap cast members gradually changing from frame to frame. Auto Distort generates intermediate cast members for any cast member that is free-rotated, made into a perspective, slanted, distorted, or skewed.

Cast members created with Auto Distort after using the perspective effect.

To use Auto Distort:

1. Select the portion of a bitmap cast member you want to change.
2. Use the Free Rotate, Perspective, Skew, Distort, or Stretch button to change the image.
3. Without deselecting the changed image, select Xtras > Auto Distort.

4 In the Auto Distort dialog box, enter the number of cast members to create and click the Begin button.

Director generates new cast members with an intermediate amount of change applied to each one. The new cast members appear in the first available cast positions.

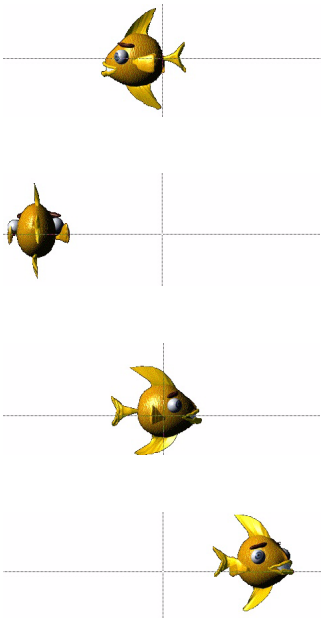
Changing registration points

A registration point is a marker that appears on a sprite when you select it with your mouse. (Registration points do not appear on unselected sprites or when a movie is playing.) Registration points provide a fixed reference point within an image, thereby helping you align sprites and control them from Lingo. Registration points are crucial to precisely placing vector shapes, bitmaps, and all cast members that appear on the Stage.

By default, Director assigns a registration point in the center of all bitmaps, but for many types of animation, you might want to move the registration point. To do this, you can use the Registration Point tool.

You can edit a bitmap's registration point in the Paint window or using Lingo.

Moving the registration point is useful for preparing a series of images for animation. When you use Cast to Time or exchange cast members, Director places a new cast member's registration point precisely where the previous one was located. By placing the registration point in the different locations, you can make a series of images move around a fixed position without having to manually place the sprites on the Stage. Use onion skinning to set registration points when images are placed in relation to each other. See "Using onion skinning" on page 234.



With the registration points set as shown, the series of fish swim in a circle without any tweening or manual placement of sprites.

To set a registration point:

1 Display the cast member you want to change in the Paint window.

2 Click the Registration Point tool.

The dotted lines in the Paint window intersect at the registration point. The default registration point is the center of the cast member.

The pointer changes to a cross hair when you move it to the Paint window.

3 Click a location in the Paint window to set the registration point.

You can also drag the dotted lines around the window to reposition the registration point.

Note: To reset the default registration point at the center of the cast member, double-click the Registration Point tool.

To set a bitmap's registration point with Lingo:

Set the `regPoint` cast member property. Set the `centerRegPoint` property to specify whether Director automatically centers the registration point if the bitmap is edited. See `centerRegPoint` and `regPoint` in the *Lingo Dictionary*.

Changing size, color depth, and color palette for bitmaps

You can use Transform Bitmap to change the size, color depth, and palette of selected cast members. Any change you make to a cast member's color depth or palette affects the cast member itself—not only its appearance on the Stage. You can't undo changes to the color depth and palette. If you want to keep a cast member's original bitmap unchanged but temporarily apply a different palette, use the Member tab in the cast member's Property inspector. To change the size of only the sprite on the Stage, use the Sprite tab in the sprite's Property inspector.

You can also remap images to new palettes with an image-editing program such as Macromedia Fireworks.

The Transform Bitmap dialog box displays values for the current selection. If you select more than one cast member, a blank value indicates that cast members in the selection have different values. To maintain a cast member's original value, leave that value blank in the dialog box.

To use Transform Bitmap:

1 Select the bitmap cast members to change.

2 Select Modify > Transform Bitmap.

3 To change the size of the bitmap, do one of the following:

If multiple cast members are selected, you can resize all the cast members to the dimensions you enter.

- Enter new measurements (in pixels) in the Width and Height text boxes.
- Enter a scaling percentage in the Scale text box.

Select Maintain Proportions to keep the width and height of the selected cast member in proportion. If you change the width, the proportional height is automatically entered in the Height text box. If you use Transform Bitmap to change several cast members at once, be sure to deselect Maintain Proportions. If you don't, all cast members will be resized to the values in the Width and Height text boxes.

4 To change the color depth, select an option from the Color Depth pop-up menu.

For more information about the color depth of bitmap cast members, see “Controlling color” on page 255.

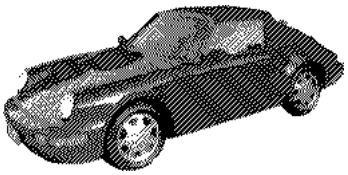
5 To change the palette, select a palette from the Palette pop-up menu and select one of the following remapping options:

Remap Colors replaces the original colors in the graphic with the most similar solid colors in the new palette. This is the preferred option in most cases.

Dither blends the colors in the new palette to approximate the original colors in the graphic.

256 grays

Remapped to closest colors in black and white



Dithered in black and white

6 Click Transform to execute the changes.

The settings you select in the Transform Bitmap dialog box cannot be undone.

Controlling bitmap images with Lingo

Lingo lets you control bitmap images in two ways. First, you can perform simple operations that affect the content of entire image cast members. These operations include changing the background and foreground colors as well as switching the image that appears in a specific cast member with that of another cast member. Each of these operations manipulates a property of the entire image cast member.

Second, you can use Lingo to perform fine manipulations of the pixels of an image or to create entirely new images. When you use Lingo you can be extremely flexible about which images you display. You can create images based on dynamic information, such as user input, or based on any other factors you want to include. To perform this kind of image operation, Lingo works with image objects. See "Creating image objects" on page 222.

To change the image assigned to a bitmap cast member:

- Set the `picture` cast member property. See `picture` (cast member property) in the *Lingo Dictionary*.

To specify the background or foreground of a bitmap sprite:

- Set the `backColor` or `foreColor` sprite property. See `backColor` and `foreColor` in the *Lingo Dictionary*.

To capture the current graphic contents of the Stage:

- Set a bitmap's `picture` cast member property to the Stage's `picture` property. See `picture` (cast member property) in the *Lingo Dictionary*.

  For example, the `member("Archive").picture = (the stage).picture` statement makes the current image of the Stage the image for the bitmap cast member Archive.

Creating image objects

An image object can be either a self-contained set of image data or a reference to the image data of a cast member or of the Stage. If an image object is created by referring to a cast member, the object contains a reference to the image of the member. The following statement creates an image object that contains a reference to the image of the cast member called Boat.

```
myImage = member("Boat").image
```

Because the image object `myImage` contains a reference to the cast member Boat, any changes you make to the object are reflected in the cast member. These changes are also reflected in any sprites made from that cast member.

You can also create an image object that contains a reference to the graphic contents of the Stage:

```
myImage = (the stage).image
```

Any changes to this image object are reflected on the Stage.

To create an image object that is a self-contained set of image data instead of a reference to a cast member, you must tell Lingo what kind of image you want to create. You must provide the parameters that describe the size and bit depth of the image you are creating.

The following statement creates an image object that contains a 640 x 480 pixel, 16-bit image:

```
myImage = image(640, 480, 16)
```

Editing image objects

After you create an image object, its data can be edited with a variety of Lingo commands that are designed to manipulate the pixels of the image. You can crop images, draw new pixels on them, copy sections of them, and work with mask and alpha channel information. For more information, see the individual commands in the *Lingo Dictionary*.

To draw a line on an image object:

- Use the `draw()` command. You must specify the locations of each end of the line as well as the line's color.

The following statement draws a line on the previously created 640 x 480 image object `myImage`, running from 20 pixels inside the upper left corner to 20 pixels inside the lower right corner, and colors it blue:

```
myImage.draw(20, 20, 620, 460, rgb(0, 0, 255))
```

To draw a rectangle on an image object:

- Use the `fill()` command. You provide the same information as for the `draw` command, but Director draws a rectangle instead of a line.

The following statement draws a red 40 x 40 pixel rectangle near the upper left corner of the image object `myImage`:

```
myImage.fill(rect(20, 20, 60, 60), rgb(255, 0, 0))
```

To determine the color of an individual pixel of an image object or set that pixel's color:

- Use the `getPixel` or `setPixel` command.

To copy part or all of an image object into a different image object:

- Use the `copyPixels()` command, which requires you to specify the image from which you are copying, the rectangle to which you are copying the pixels, and the rectangle from which to copy the pixels in the source image.

The following statement copies a 40 x 40 rectangle from the upper left area of the image object `myImage` and puts the pixels into a 40 x 40 rectangle at the lower right of the 300 x 300 pixel object called `myNewImage`:

```
myNewImage.copyPixels(myImage, rect(260, 260, 300, 300), rect(0, 0, 40, 40))
```

When using `copyPixels()`, you can specify optional parameters that tell Lingo to modify the pixels you are copying before drawing them into the destination rectangle. You can apply blends and inks, change the foreground or background colors, specify masking operations, and more. You specify these operations by adding a property list at the end of the `copyPixels()` command.

The following statement performs the same operation as the previous example and tells Lingo to use the Reverse ink when rendering the pixels into the destination rectangle:

```
myNewImage.copyPixels(myImage, rect(260, 260, 300, 300), rect(0, 0, 40, 40),
  [#ink: #reverse])
```

To make a new image object from the alpha channel information of a 32-bit image object:

- Use the `extractAlpha() command`, which can be useful for preserving the alpha channel information of a 32-bit image object that you plan to reduce to a lower bit depth. Reducing the bit depth can delete the alpha information.

The following statement creates a new image object called `alphaImage` from the alpha channel information of the 32-bit image object called `myImage`:

```
alphaImage = myImage.extractAlpha()
```

There are many more image-editing operations available through Lingo. See the categorized section of the *Lingo Dictionary* for a complete list of these commands.

Using gradients

Director can create gradients in the Paint window. You can use gradients with the Brush tool, the Bucket tool, the Text tool, or any of the filled shape tools. Typically, a gradient consists of a foreground color at one side (or the center) of an image and another color, the destination color, at the other side (or outside edge) of the image. Between the foreground and destination colors, Director creates a blend of the two colors.

To use a gradient:

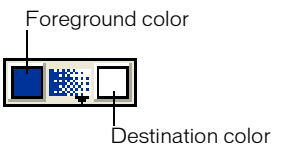
1. Select the Brush tool, the Bucket tool, or one of the filled shape tools.
2. Select the type of gradient from the Gradient pop-up menu.

Selecting a gradient type automatically sets the current Paint window ink to Gradient. You can also select Gradient ink from the Ink pop-up menu at the bottom left of the Paint window to create a gradient with all the current settings.

To manually specify a gradient, select Gradient Setting from the pop-up menu. See "Editing gradients" on page 225.

3. Select a foreground color from Gradient Colors pop-up menu on the left.

The foreground color is the same color that is specified for the Paint window.



4. Select a destination color from the Gradient Colors pop-up menu on the right.

The destination color is the color of the gradient when it completes the color transition.

5 Use the current tool in the Paint window.

Director uses the gradient you've defined to fill the image.

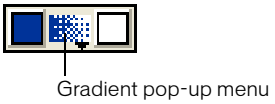
6 To stop using a gradient, select Normal from the Ink pop-up menu. See "Using Paint window inks" on page 229.

Editing gradients

You can change gradients before using them by changing the settings in the Gradient Settings dialog box. In the Gradient Settings dialog box, you set the foreground and background colors as well as the pattern to use with your gradient. There are several pop-up menus that control the style of your gradient fill. Each choice you make is immediately previewed on the left.

To edit gradient settings:

1 Select Gradient Settings from the Gradient Colors pop-up menu.



2 To determine whether the gradient is created with the pattern you select with the Patterns pop-up menu in the Paint window or with a dithered pattern, select a Type option, as described in the following list:

Dither produces a smooth transition between colors. If you select Dither, only dithering options appear in the Method pop-up menu.

Pattern uses the current pattern for the color transition. If you select Pattern, only pattern options appear in the Method pop-up menu.

3 To determine how a gradient shifts between colors, select an option from the Method pop-up menu:

If you select Dither as the Type option, the following choices are available:

Best Colors ignores the order of the colors in the palette. Instead, it uses only colors that create a continuous blend from foreground to background colors and blends them with a dithered pattern. Dithering is a technique that creates color from two or more colors of pixels interspersed together.

Adjacent Colors uses all colors between the foreground and background colors and blends them with a dithered pattern.

Two Colors uses only the foreground and background colors and blends them with a dithered pattern.

One Color uses only the foreground color and fades it with a dithered pattern.

Standard Colors ignores all colors between the foreground and background colors and adds several blended colors with a dithered pattern to create the gradient.

Multi Colors ignores all the colors between the foreground and background colors and adds several blended colors with a randomized dithered pattern to create a smooth gradient.

If you select Pattern as the Type option, the following options are available:

Best Colors ignores the order of the colors in the palette and uses only colors that create a continuous blend of the foreground and background colors.

Best Colors Transparent ignores the order of the colors in the palette and uses only colors that create a continuous blend of the foreground and background colors. White pixels in patterns created with this method are transparent.

Adjacent Colors uses all the colors in the palette between the foreground and background colors for the gradient.

Adjacent Colors Transparent uses all the colors in the palette between the foreground and background colors for the gradient. White pixels in patterns that are created with this method are transparent.

4 To determine the way the gradient fills an area in the Paint window, select one of the following options from the Direction pop-up menu:

Top to Bottom puts the foreground color at the top and the destination color at the bottom.

Bottom to Top puts the foreground color at the bottom and the destination color at the top.

Left to Right puts the foreground color on the left and the destination color on the right.

Right to Left puts the foreground color on the right and the destination color on the left.

Directional lets you determine the direction of the gradient. You set the direction of the gradient in the Paint window with the paint tool used to fill the area.

Shape Burst creates a gradient that starts at the edge of the area and moves toward the center. The foreground color begins at the edge and the destination color appears in the center. This option works only on the Macintosh.

Sun Burst begins with the foreground color at the edge of the area and moves in concentric circles to the destination color at the center.

5 To control how colors cycle in a gradient, select a Cycles option, as described in the following list:

Sharp cycles have a banded appearance; smooth cycles go from foreground to destination and then back to foreground.

One cycles the gradient once through the range of colors you define.

Two Sharp cycles through the range of colors from foreground to destination twice.

Two Smooth cycles the gradient from foreground to destination and then from destination to foreground.

Three Sharp cycles the gradient from foreground to destination three times.

Three Smooth cycles the gradient from foreground to destination, destination to foreground, and foreground to destination.

Four Sharp cycles the gradient from foreground to destination four times.

Four Smooth cycles the gradient from foreground to destination, destination to foreground, foreground to destination, and destination to foreground.

6 To select how colors are distributed between the foreground and destination colors of the gradient, select a Spread option, as described in the following list:

Equal provides even spacing of colors between the foreground and destination colors.

More Foreground increases the amount of the foreground color in the gradient.

More Middle increases the amount of the middle color in the gradient.

More Destination increases the amount of the destination color in the gradient.

7 To determine whether the full range of the gradient is created over the paint object, the cast member, or the entire Paint window, select a Range option, as described in the following list:

Paint Object paints the full gradient as the fill or brush stroke of the object, regardless of the object's location in the Paint window.

Cast Member paints the full gradient within the size of the cast member.

Window paints a full gradient only if the object is the length or width of the entire window; otherwise, it paints a partial gradient that corresponds to the object's location in the window.

8 To select a foreground, background, or destination color for the gradient, use the appropriate color picker.

The foreground color is the starting color of the gradient, and the destination color is the ending color. Background color has no effect unless you are using a pattern.

9 To select a pattern, use the Patterns pop-up menu.

Using patterns

You can select among three sets of patterns that are included with Director or create custom patterns. The patterns you change or edit in the Paint window do not affect the patterns that are available for shapes.

To use a pattern:

1. Select the Brush tool, the Bucket tool, or one of the filled shape tools.
2. Select the type of pattern from the Patterns pop-up menu.

   To manually specify a pattern, select Pattern Settings from the pop-up menu. See "Editing patterns" on page 228.

Editing patterns

You can change patterns before using them by changing the settings in the Pattern Settings dialog box. Each change you make is immediately previewed.

To select a new set of patterns or create a custom pattern:

1. Select Pattern Settings from the bottom of the Patterns pop-up menu.
2. Select an option from the pop-up menu at the top of the Pattern Settings dialog box:

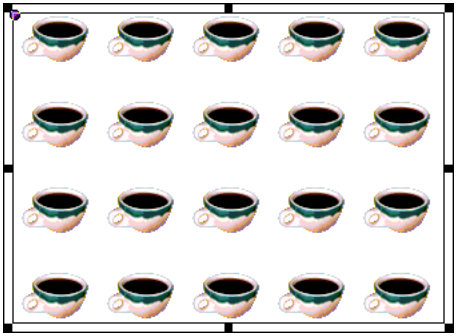
- To select one of the standard, noneditable sets of patterns, select QuickDraw, Grays, or Standard.
- To edit a pattern, select Custom. Custom is an editable copy of the Standard palette set.

3. Select the pattern to edit or use the Copy and Paste buttons to move an existing pattern to one of the empty tile positions.
4. Use any of the following methods to edit the pattern:

- Click the magnified image of the pattern. Click a blank pixel to fill it, and click a filled pixel to make it blank.
- Click the right, left, up, and down arrows to move the pattern one pixel in any direction.
- Click the Black and White square to reverse the colors of the pattern (for example, black becomes white, and white becomes black).

Creating a custom tile

Custom tiles provide an effective way of filling a large area with interesting content without using much memory or increasing the downloading time. They are especially useful for large movies on the web. A custom tile uses the same amount of memory no matter what size area it fills.



To create a custom tile:

1. Create a bitmap cast member to use as a tile, and display it in the Paint window.
2. Click the pattern box in the Paint window, and select Tile Setting from the bottom of the Patterns pop-up menu.
3. Click an existing tile position to edit.

   The existing tiles appear next to the Edit label. You must replace one of the built-in tiles to create a new one. To restore the built-in tile for any tile position, select it, and click Built-in.
4. Click Cast Member.

   The cast member appears in the box at the lower left. The box at the right shows how the image appears when it is tiled. The dotted rectangle inside the cast member image shows the area of the tile.

   To select a different cast member for the tile, use the arrow buttons to the right of the Cast Member button to move through the movie's cast members.
5. Drag the dotted rectangle to the area of the cast member you want tiled.
6. Use the Width and Height controls to specify the size of the tile.

   The new tile appears in the tile position you selected. You can use it in the Paint window or from the Tool palette to fill shapes.

Using Paint window inks

You can use Paint window inks to create color effects for bitmap cast members. Paint window inks are different from sprite inks, which affect entire sprites and do not change cast members.

Select an ink effect from the Ink pop-up menu at the bottom of the Paint window.

The result of the ink you select depends on whether you are working in color or in black and white. Also, some inks work better when painting with patterns, and others work better when painting with solid colors.

Ink	B&W	Color	Works with
Normal	✔	✔	Solids and patterns
Transparent	✔	✔	Patterns
Reverse	✔	✔	Solids and patterns
Ghost	✔	✔	Solids (B&W) and patterns (color)
Gradient	✔	✔	Brush, Bucket, shape tools
Reveal	✔	✔	Brush, shape tools
Cycle		✔	Solids and patterns
Switch		✔	Brush
Blend		✔	Solids and patterns
Darkest		✔	Patterns
Lightest		✔	Patterns
Darken		✔	Brush
Lighten		✔	Brush
Smooth		✔	Brush
Smear		✔	Brush
Smudge		✔	Brush
Spread	✔	✔	Brush
Clipboard	✔	✔	Brush

Normal is the default ink. It is opaque and maintains the color of the current foreground color and pattern.

Transparent ink makes the background color of patterns transparent so artwork drawn previously in the current cast member can be seen through the pattern.

Reverse ink makes overlapping colors reverse. Any pixel in the foreground art that was originally white becomes transparent. Any pixel that was black reverses the color of the background art.

Ghost ink in black and white creates an image that can be seen only when drawn over a black background. In color, Ghost ink draws with the current background color.

Gradient lets you paint with the gradient fill that you selected in the Gradient Settings dialog box. See “Using gradients” on page 224. A gradient fill is one that progresses from one color, called the foreground color, to another color, called the destination color. You can paint with Gradient ink using the Brush tool, the Bucket tool, and the shape tools.

Reveal works indirectly with the art in the previous cast position. Imagine the previous cast member’s artwork covered with a white area. Reveal ink erases the white area to show the artwork in the previous window. Reveal ink can be used to create specific shapes from shades created with the Airbrush tool. Because it is impossible to mask certain shapes for the airbrush, spray an area with the airbrush first; then, in the next cast member, paint the shapes you need with a Reveal ink. As you paint your object, you expose the airbrush pattern in the previous window.

Cycle is a color ink. As you draw with Cycle ink, the colors change as the ink progresses through the palette. The beginning and ending points of the color cycle are determined by the foreground and destination colors. If you want to cycle through the whole palette, select white as the foreground color and black as the destination color. This ink works only when your computer is set to 256 colors.

Switch changes any pixel that is the current foreground color to the current gradient destination color as you paint over pixels of that color.

Blend creates a translucent color ink. You can see the background object, but its color is blended with the foreground object's color. Select the percentage of blend in the Paint Window Preferences dialog box.

Darkest is a useful ink for coloring black-and-white artwork. For example, if you paint yellow over black and white, black remains black because it is darker than yellow, and white becomes yellow because yellow is darker than white.

Lightest is a useful ink for coloring black-and-white artwork. For example, if you paint yellow over black and white, black objects become yellow when painted with the Lightest ink effect, and white remains white because it is lighter than yellow.

Darken makes colors darker. The more times you click with the Brush tool, the darker the area becomes. The colors of the foreground, background, and destination inks have no effect on Darken. Darken creates an effect that is the same as reducing a color's brightness with the controls in the Color Palettes window. You can change the rate of this ink effect in the Paint Preferences dialog box.

Lighten makes colors lighter. The more times you click with the Brush tool, the lighter the area becomes. The color of the foreground, background, and destination inks have no effect on Lighten. Lighten creates an effect that is the same as increasing a color's brightness with the controls in the Color Palettes window. You can change the lightness of this ink effect in the Paint Preferences dialog box.

Smooth blurs existing artwork when it is painted with the Brush tool. It is not directional as are Smear and Smudge. The color of the foreground, background, and destination inks have no effect on Smooth. Use it to smooth out jagged edges.

Smear works with the Brush tool and functions like mixing paint. Any area you drag across with a Smear ink spreads in the direction of the brush, fading as it gets farther from the source. The color of the foreground, background, and destination inks have no effect on Smear ink.

Smudge is a color ink for the Brush tool that is similar to Smear ink. It also functions like mixing paint. The colors fade faster as they are spread. The color of the foreground, background, and destination inks have no effect on Smudge ink.

Spread works with the Brush tool in color. Whatever is under the Brush tool when you start to drag is picked up as the ink for the brush. Copies of what is beneath the brush are pushed across the window as you draw.

Clipboard uses the current contents of the Clipboard as a pattern with which to paint. The Clipboard contents must originate in Director.

Using bitmap filters

Bitmap filters are plug-in image editors that apply effects to bitmap images. You can install Photoshop-compatible filters to change images within Director.

Original image

Filtered image

You can apply a filter to a selected portion of a bitmap image, to an entire cast member, or to several cast members at once.

To install a filter:

- Place the filter in the Xtras folder in the Director application folder. See "About installing Xtra extensions" on page 51.

To apply a filter:

1. Open the cast member in the Paint window, or select the cast member in the Cast window.

   You can apply a filter to several cast members at once by selecting them all in the Cast window. To apply a filter to a selected portion of a cast member, use the Marquee or the Lasso tool in the Paint window to select the part you want to change.

2. Select Xtras > Filter Bitmap.
3. In the Filter Bitmap dialog box, select a category on the left and a filter on the right.

   To view all the filters at once, select All from the Categories list.

4. Click Filter.

   Many filters require you to enter special settings. When you select one of these filters, a dialog box or other type of control appears after you click Filter. When you finish selecting filter settings and proceed, the filter changes the cast member.

   Some filters have no changeable settings. When you select one of these filters, the cast member changes with no further steps.

Using filters to create animated effects

You can use Auto Filter to create dramatic animated effects with bitmap filters. Auto Filter applies a filter incrementally to a series of cast members. You can use it either to change a range of selected cast members or to generate a series of new filtered cast members based on a single image. When you define a beginning and ending setting for the filter, Auto Filter applies an intermediate filter value to each cast member.

You can tween a bitmap filter with Auto Filter.

Note: Although most filters do not support auto-filtering, the Auto Filter dialog box lists only those filters that support it.

To use Auto Filter:

1. Select a bitmap cast member or a range of cast members, and select Xtras > Auto Filter.

   If you want to change only a portion of a bitmap cast member, use the Marquee or the Lasso tool in the Paint window to select the part you want to change.

2. In the Auto Filter dialog box, select a filter.
3. Click Set Starting Values, and use the filter controls to enter filter settings for the first cast member in the sequence.

   When you finish working with the filter controls, the Auto Filter dialog box reappears.

4. Click Set Ending Values, and use the filter controls to enter filter settings for the last cast member in the sequence.
5. Enter the number of new cast members you want to create. The text box is not available if you selected a range of cast members.
6. Click Filter to begin the filtering.

   A message appears to show the progress. Some filters are complex and require extra time for computing.

   Auto Filter generates new cast members and places them in empty cast positions following the selected cast member. If you selected a range of cast members, no new cast members appear, but the cast members in the range you selected are changed incrementally.

Using onion skinning

Onion skinning derives its name from a technique used by conventional animators, who would draw on thin "onion skin" paper so that they could see through it to one or more of the previous images in the animation.

With onion skinning in Director, you can create or edit animated sequences of cast members in the Paint window using other cast members as a reference. Reference images appear dimmed in the background. When you work in the Paint window, you can view not only the current cast member that you're painting but also one or more cast members that are blended into the image.

You can use onion skinning to do the following:

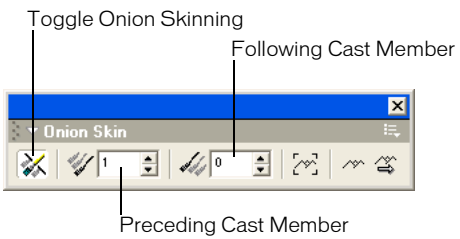
- To trace over an image or create a series of images all in register (aligned) with a particular image.
- To see previous images in the sequence, and use those images as a reference while you are drawing new ones.
- To create a series of images based on another parallel animation. The series of images serves as the background while you paint a series of foreground images.

Onion skinning uses registration points to align the current cast member with the previous ones you selected. Be careful not to move registration points for cast members after onion skinning. If you do, the cast members might not line up the way you want. See "Changing registration points" on page 219.

You must have created some cast members to use onion skinning.

To activate onion skinning:

1 Open the Paint window, and select View > Onion Skin. The Onion Skin toolbar appears.



2 Click the Toggle Onion Skinning button at the far left of the toolbar to enable onion skinning.

To define the number of preceding or following cast members to display:

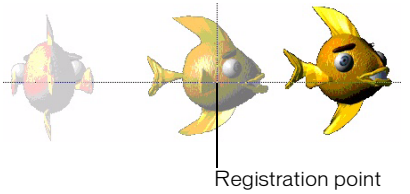
1 Open the Paint window, and select View > Onion Skin. The Onion Skin toolbar appears.

2 If necessary, click the Toggle Onion Skinning button on the Onion Skin toolbar to activate onion skinning.

3 Specify the number of preceding or following cast members you want to display.

- To specify the number of preceding cast members to display, enter a number in the Preceding Cast Members text box.

- To specify the number of following cast members to display, enter a number in the Following Cast Members text box.



Two preceding cast members shown with onion skinning and registration points

The specified number of cast members appear as dimmed images behind the current cast member. The order is determined by the position in the cast.

To create a new cast member by tracing over a single cast member as a background image:

1 Open the Paint window, and select View > Onion Skin. The Onion Skin toolbar appears.

2 In the Paint window, open the cast member that you want to use as the reference image or background.

3 If necessary, click the Toggle Onion Skinning button on the Onion Skin toolbar to activate onion skinning.

4 To set the background image, click the Set Background button on the Onion Skin toolbar.

5 To create a new cast member, click the New Cast Member button in the Paint window.

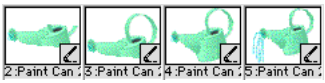
6 Click the Show Background button on the Onion Skin toolbar.

The original cast member appears as a dimmed image in the Paint window. You can paint on top of the original cast member's image.

7 Paint the new cast member using the background image as a reference.

To use a series of images as a background while painting a series of foreground images:

1 In the Cast window, arrange the series of cast members you want to use as your background in consecutive order.



Cast members in the foreground and the background series must be adjacent to each other in the cast.

2 Open the Paint window, and select View > Onion Skin. The Onion Skin toolbar appears.

The Onion Skin toolbar appears.

3 If necessary, click the Toggle Onion Skinning button on the Onion Skin toolbar to activate onion skinning.

Make sure all values in the Onion Skin toolbar are set to 0.

4 Open the cast member you want to use as the first background cast member in the reference series. Click the Set Background button.

5 Select the position in the cast where you want the first cast member in the foreground series to appear. Click the New Cast Member button in the Paint window to create a new cast member.

The first cast member in the foreground series can be located anywhere in any cast.

6 Click the Show Background button to reveal a dimmed version of the background image.

7 Click the Track Background button on the Onion Skin toolbar.

8 Paint the new cast member using the background image as a reference.

9 When you finish drawing the cast member, click the New Cast Member button again to create the next cast member.

When Track Background is enabled, Director advances to the next background cast member in the series. Its image appears in the background in the Paint window.

10 Repeat step 8 until you finish drawing all the cast members in the series.

About the Paste as Pict option

You use the Paste as Pict option to paste a PICT image into the cast and have it remain in PICT format.

If you paste a PICT image into the cast using the Paste command in the Edit menu, Director converts it to a bitmap. If you want the artwork to remain in PICT format, use Paste as PICT when you paste it into the cast.

You might want to use Paste as PICT for several reasons. PICT cast members might occupy less memory than bitmap cast members. Some PICT cast members, such as compound images that consist of lines, shapes, and text, can stretch and scale more smoothly than bitmap cast members. PICT cast members also look better when printed on a laser printer.

However, PICT cast members animate more slowly than bitmap cast members, and they don't support ink effects. When you use color cycling or palette transitions, PICT cast members might have unexpected results.

Setting bitmap cast member properties

To view important information about cast members, change a cast member's name, select alpha settings, or turn on highlighting and dithering, you use bitmap cast member properties.

To view or change bitmap cast member properties:

1. Select a bitmap cast member, and click the Member tab in the Property inspector using the Graphical view.

   The Member tab displays the following:

- A text box to view or change the cast member's name, a Comments text box to enter text that appears in the Comments column of the Cast List window, and an Unload pop-up menu that lets you determine how to remove a cast member from memory.
- View-only fields that indicate when the cast member was created and modified as well as the name of the person who modified the cast member.

2. If the bitmap cast member is linked to an external file, the full path for the file appears in the Filename field. To choose a different file to link to the cast member, either type a new filename into the field, or click the Browse button and select the path to the new filename.
3. Click the Bitmap tab using the Graphical view.
4. To invert the current cast member when the user clicks it, select Highlight.

   Use this option to create buttons. Even if Highlight When Clicked is selected, the cast member does not do anything unless it is controlled by a behavior or a Lingo script.

5. To make Director approximate an original color in the bitmap if there is a palette problem, select Dither. When a color is not available because of a palette conflict, Dither displays a pattern of pixels of similar colors. If this option is off, Director uses the color in the current palette that is closest to the original.
6. If the imported bitmap has a white canvas that you want to remove, select Trim. If you want to retain the white canvas, deselect Trim.
7. To make Director use the alpha channel (transparency) data in the cast member, select Use Alpha.

   This option is on by default for all imported cast members with alpha channel data.

8. To determine how a transparent area receives a mouse click, use the Alpha Threshold slider to specify a value.

   Any area with a greater degree of opacity than the specified threshold can receive a mouse click.

9. To assign a different palette to an 8-bit cast member while maintaining the cast member's original palette references, select a new palette from the Palette pop-up menu.

Setting PICT cast member properties

You use PICT cast member properties to change the names of PICT cast members and set their properties.

To view or change PICT cast member properties:

1. Select a PICT cast member, and open the Property inspector in Graphical view.
2. To view or edit the cast member name, use the Name field text box on the Member tab.
3. To specify how Director removes the cast member from memory if memory is low, select an option from the Unload pop-up menu. See "Controlling cast member unloading" on page 152.

Setting Paint window preferences

You can use Paint window preferences to modify the settings of several tools and drawing methods in the Paint window.

To change Paint window preferences:

1. Select Edit > Preferences > Paint.
2. To make tools remember the last color or ink used, select the following options:

   Remember Color remembers the last color used with a tool, which remains selected for the next time you use the Brush or Airbrush tools.

   Remember Ink remembers the last ink used with a tool, which remains selected for the next time you use any tool.
3. To control the way colors cycle when you draw with Cycle ink, select one of the following options:

   Repeat Sequence causes colors to cycle from the foreground color to the destination color and then repeat from foreground to destination.

   Reverse Sequence causes colors to cycle from the foreground color to the destination color and then from destination to foreground.
4. To set a line width that is thicker than the widths available in the Paint window, use the Other Line Width slider to enter a value.

   The width you set is the width that appears when you draw a line after selecting Other Line Width.
5. To set the opacity of a color when using the Blend ink effect in the Paint window, use the Blend slider to enter a value.

   You can vary the blend value between 0 and 100%.
6. To set the rate at which artwork changes when you use the Darken or Lighten effects in the Paint window, use the Lighten or Darken slider to enter a value.

7 To determine how colors are used when using Smooth, Lighten, Darken, or Cycle effects, select one of the following Interpolate By options:

Color Value ignores the order of the colors in the palette and produces a continuous blend of the foreground and destination colors.

Palette Location uses all the colors in the palette between the foreground and destination colors.

Compressing bitmaps

If you plan to distribute your movie over the Internet, you can compress your bitmap images to ensure faster downloading. Director lets you compress images at the movie level and for individual cast members. Bitmap compression set at the cast member level overrides compression settings at the movie level.

In addition to Director standard compression, you can use JPEG compression and specify a range of image quality. If you have Fireworks installed, you can use the Optimize in Fireworks button to launch Fireworks and then dynamically apply compression settings while viewing how your image looks at those settings. When you determine the most suitable compression level, Director remembers the settings you established in Fireworks. For more information, see "Optimizing Bitmaps in Fireworks" in the Director Support Center website at www.macromedia.com/support/director/vector/d8/fw_bitmaps.html.

To compress a bitmap at the cast member level:

1 Select bitmap cast members or sprites, and click the Bitmap tab in the Property inspector.

If you selected multiple cast members or sprites, the Property inspector displays the compression setting if it is the same for each selected object. If the compression settings are not the same, the Compression pop-up menu is blank.

2 Click the Compression pop-up menu, and do one of the following:

- To compress selected bitmaps using the same settings as those established for movie-level compression, select Movie Setting. For more information on setting bitmaps at the movie level, see the information on the Compression tab under "Changing Publish settings" on page 577.
- To use the standard Director compression, select Standard.
- To use JPEG compression, select JPEG, and move the slider bar to the desired level of compression. The higher the number you specify, the less your bitmap is compressed (that is, 100 indicates no compression).

Movie Setting is usually the default compression setting, except under certain conditions when the compression feature is disabled or when Director controls image-compression choices.

For example, when the image is a JPEG, the compression setting defaults to JPEG compression. You cannot select another compression option.

Similarly, the Compression setting defaults to Standard compression, and you cannot change this setting when the cast member is any of the following:

- An 8-bit cast member created in the Paint window
- A GIF imported as a bitmap with no alpha channel information
- An 8-bit PNG
- A linked cast member or a cast member created with Lingo

Note: If you open a Director 7 movie in Director MX, bitmap cast members are assigned Movie Setting as the default, and compression settings at the movie level, set in the Publish Settings dialog box, default to the Standard compression setting. This ensures the movie will play as it did in Director 7.

To compress bitmaps at the movie level:

1. Select File > Publish Settings.

   The Publish Settings dialog box appears.

2. On the Compression tab, make a selection from the Image Compression pop-up menu, and click OK.

- To use the standard Director compression, select Standard.
- To use JPEG compression, select JPEG, and move the slider bar to the desired level of compression. The higher the number you specify, the less your bitmap is compressed (that is, 100 indicates no compression).

Note: Director saves your publish settings when you save your movie.

Working with Macromedia Fireworks

You can combine the power of Macromedia Fireworks and Director. Fireworks lets you export graphics and interactive content into Director. The export process preserves the behaviors and slices of the graphic. You can safely export sliced images with rollovers and even layered images. Director users can take advantage of the optimization and graphic design tools of Fireworks without compromising quality.

Placing Fireworks files into Director

Director can import flattened images from Fireworks, such as JPEGs and GIFs. It can also import 32-bit PNG images with transparency. For sliced, interactive, and animated content, Director can import Fireworks HTML.

Exporting graphics with transparency

In Director, transparency can be achieved by importing 32-bit PNG images. You can export 32-bit PNG graphics with transparency from Fireworks.

To export a 32-bit PNG with transparency:

1. In Fireworks, select Window > Optimize, change the export file format to PNG 32, and set Matte to transparent.
2. Select File > Export.
3. Select Images Only from the Save as Type pop-up menu. Name the file, and click Save.

Exporting layered and sliced content to Director

By exporting Fireworks slices to Director, you can export sliced and interactive content such as buttons and rollover images. By exporting layers to Director, you can export layered Fireworks content such as animations.

To export Fireworks files to Director:

1. In Fireworks, select File > Export.

   Note: You can also click the Quick Export button and select Source as Layers or Source as Slices from the Director pop-up menu. Select Source as Layers if you are exporting an animation, and select Source as Slices if you are exporting interactive content such as buttons.

2. In the Export dialog box, type a filename, and select a destination folder.
3. Select Director from the Save As pop-up menu.
4. Select one of the following options from the Source pop-up menu:

   Fireworks Layers exports each layer in the document. Select this option if you are exporting layered content or an animation.

   Fireworks Slices exports the slices in the document. Select this option if you are exporting sliced or interactive content such as rollover images and buttons.

5. Select Trim Images to automatically crop the exported images to fit the objects on each frame.
6. Select Put Images in Subfolder to select a folder for images.
7. Click Save.

Importing Fireworks files into Director

In Director, you can import flattened images that you have exported from Fireworks, such as JPEGs, GIFs, and 32-bit PNGs. You can also import Fireworks layers, slices, and interactive elements by inserting Fireworks HTML.

To import a flattened Fireworks image:

1. In Director, select File > Import.
2. Navigate to the desired file, and click Import.
3. Change options, if desired, in the Image Options dialog box. For information about each option, see “Choosing import image options” on page 150.
4. Click OK.

   The imported graphic appears in the cast as a bitmap.

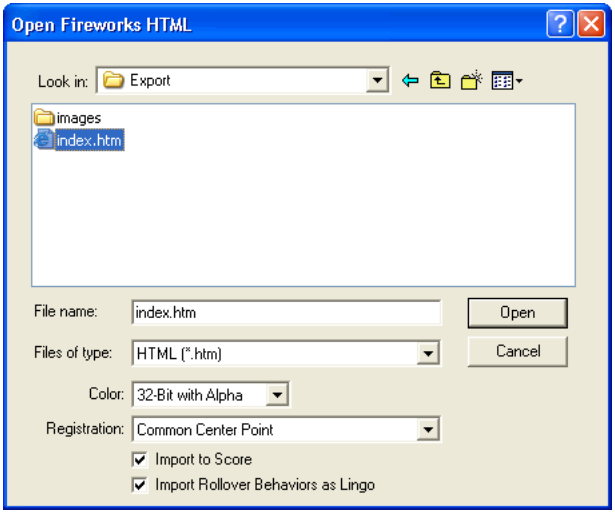
To import layered, sliced, or interactive Fireworks content:

1 In Director, select Insert > Fireworks > Images from Fireworks HTML.

Note: The location and name of this menu command might be different depending on your version of Director.

2 Locate the Fireworks HTML file you exported for use in Director.

The Open Fireworks HTML dialog box appears.



3 Change the following options if desired:

Color lets you specify a color depth for the imported graphics. If the graphics contain transparency, select 32-bit color.

Registration lets you set the registration point for the imported graphics.

Import Rollover Behaviors as Lingo converts Fireworks behaviors to Lingo code.

Import to Score places cast members into the Score when they're imported.

4 Click Open.

The graphics and code from the Fireworks HTML file are imported.

Note: If you are importing a Fireworks animation, drag keyframes in Director to offset the timing of each imported layer as necessary.

Editing Director cast members in Fireworks

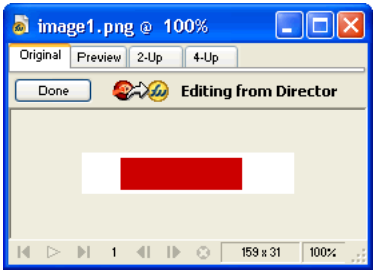
Using launch-and-edit integration, you can make changes to Director cast members by launching Fireworks to edit them from inside Director. You can also launch Fireworks from inside Director to optimize cast members.

To launch Fireworks to edit a Director cast member:

1. In Director, right-click (Windows) or Control-click (Macintosh) the graphic in the Cast window.
2. Select Launch External Editor from the context menu.

   Note: If Fireworks does not launch as your external image editor, select File › Preferences › Editors in Director, and set Fireworks as the external editor for bitmap graphic file types.

   The file opens in Fireworks, and the document window indicates that you are editing a file from Director.



3. Make changes to the image, and click Done when you finish.

   Fireworks exports the new graphic to Director.

Optimizing cast members in Director

You can launch Fireworks from Director to make quick optimization changes to selected cast members.

To launch Fireworks to change optimization settings for a Director cast member:

1. In Director, select the cast member in the Cast window, and click Optimize in Fireworks on the Bitmap tab in the Property inspector.
2. In Fireworks, change the optimization settings as desired.
3. Click Update when you finish. Click Done if the MIX Editing dialog box appears.

The image is exported back to Director using the new settings.

CHAPTER 8
Vector Shapes

Vector shapes and bitmaps are the two main types of graphics used with Macromedia Director MX. A vector shape is a mathematical description of a geometric form that includes the thickness of the line, the fill color, and additional features of the line that can be expressed mathematically. A bitmap defines an image as a grid of colored pixels, and it stores the color for each pixel in the image.

For more information on using bitmaps in Director MX, and how they compare to vector shapes, see Chapter 7, "Bitmaps," on page 203.

You can create vector shapes in the Director Vector Shape window by defining points through which a line passes. The shape can be a line, a curve, or an open or closed irregular shape that can be filled with a color or gradient.

You can also use Lingo to dynamically create and control vector shapes. You can create a vector shape entirely with Lingo or modify an existing one as the movie plays.

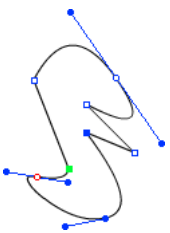
Because vector shapes are stored as mathematical descriptions, they require less RAM and disk space than an equivalent bitmap image and they download faster from the Internet.

Drawing vector shapes

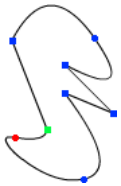
You create vector shapes with drawing tools in the Vector Shape window. You can use the Pen tool to create irregular shapes or use shape tools to create rectangles and ellipses. A vector shape can include multiple curves, and you can split and join the curves. Shape properties such as fill color, stroke color, and stroke width are set at the cast-member level and not for individual curves.

When you create vector shapes, you create vertices, which are fixed points. You can also create handles, which are points that determine the degree of curvature between vertices. These curves are known as Bézier curves. A vertex without a handle creates a corner.

As you draw vector shapes, control handles appear on the vertices: round curve points for vertices with handles and square corner points for vertices without handles.



- The first vertex in a curve is green.
- The last vertex in a curve is red.
- All other vertices are blue.
- Unselected vertices are solid.
- Selected vertices are unfilled.



To open the Vector Shape window:

- Select Window > Vector Shape.

Zooming in and out in the Vector Shape window

You can use the Magnify tool or the Zoom commands on the View menu to zoom in or out at four levels of magnification.

To zoom in or out, do one of the following:

- Select View > Zoom and then select the level of magnification.
- Right-click (Windows) or Control-click (Macintosh) and select Zoom In or Zoom Out from the context menu.
- Press Control + the Plus (+) key (Windows) or Command + the Plus (+) key (Macintosh) to zoom in, or Control + the Minus (-) key (Windows) or Command + the Minus (-) key (Macintosh) to zoom out.

To return to normal view:

- Select View > Zoom > 100%.

Using vector shape drawing tools

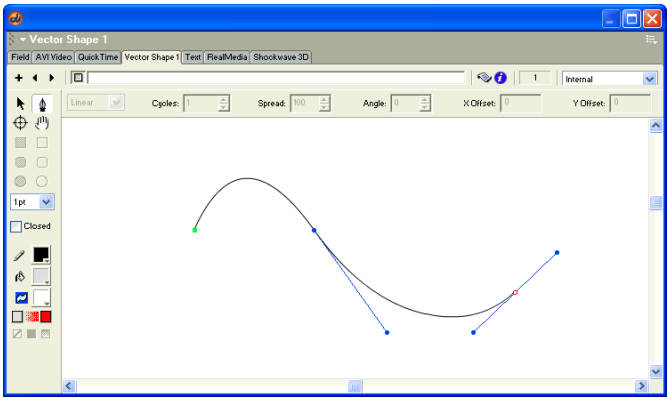
You use the tools in the Vector Shape window to draw free-form shapes or geometric figures. You can define a shape with the Pen tool by creating curve or corner points through which a line passes.

To draw regular shapes, you use the Rectangle, Rounded Rectangle, and Ellipse tools.

To create a vector shape using the Pen tool:

1 In the Vector Shape window, click the New Cast Member button.

2 Click the Pen tool and begin to draw:



- To create a corner point, click once.
- To create a curve point, click and drag. Dragging creates control handles that define how the line curves through the point you define.
- To constrain a new point to vertical, horizontal, or a 45° angle, hold down Shift while clicking.

To draw using a basic shape tool:

1 In the Vector Shape window, click the New Cast Member button.

2 Select the Filled or Unfilled Rectangle, Rounded Rectangle, or Ellipse tool.

3 Hold down the mouse button to start a shape, drag to draw, and release the mouse button to end the shape.

To constrain a rectangle to a square, or to constrain an ellipse to a circle, hold down Shift while dragging.

To select a vertex or vertices, do one of the following:

- To select one vertex, select the Arrow tool and click the vertex.
- To select multiple vertices, either select the Arrow tool and hold Shift while clicking the vertices, or click and drag a selection rectangle over the vertices (marquee-select).
- To select all the vertices in a curve, select the Arrow tool and double-click one of the vertices in the curve.

To create multiple curves, do one of the following:

- If you use the Pen tool, double-click the last vertex drawn. The next vertex will start a new curve.
- With no vertices selected, use the Pen tool to start a new curve.
- To create two separate curves from one, select two adjacent vertices in a curve and select Modify > Split Curve.
- If the current shape is empty or closed, select one of the shape tools and draw a new shape.

Note: If you create multiple shapes in the Vector Shape window, Director treats all the shapes as one if you change shape attributes. If, for example, you create ten open shapes in one Vector Shape window and select Close, Director closes all ten shapes.

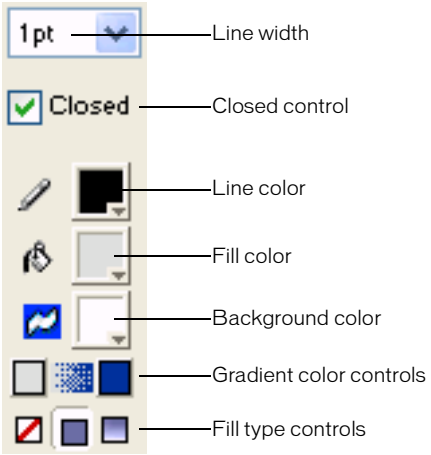
Choosing fill and line settings for vector shapes

You can use either controls in the Vector Shape window or Lingo to choose a vector shape's fill color, line width and color, and background color. The background is the area outside of a vector shape but within the cast member's bounding rectangle.

Because a vector shape is a single object, you don't need to select any part of the vector shape to make the following changes.

To select the fill and line settings:

1. Open a vector shape in the Vector Shape window.
2. Select fill and line settings using the appropriate controls at the left of the window.



- To set the line width, select a point size option from the Line Width menu.
- To close or open vector shapes, select or deselect the Closed option (see "Editing vector shapes" on page 249).
- To choose the line color, select a color from the Line Color menu.
- To choose the fill color, select a color from the Fill Color menu.

- To set the background color, select a color from the Background Color menu. Choosing a background color that matches the color of the background results in better performance than using Background Transparent ink.
- To set gradient fill colors, select colors from the Gradient Colors control. For more information about creating gradient fill, see "Editing vector shapes" on page 249.
- To set the fill type, select from the following Fill type control options: No Fill, Solid, or Gradient.

Specifying vector shape fills and strokes with Lingo

You can use Lingo to specify a vector shape's fills and strokes.

To specify the strokes that form a vector shape with Lingo:

- Set the `strokeColor` and `strokeWidth` cast member properties. See `strokeColor` and `strokeWidth` in the *Lingo Dictionary*.

To specify a vector shape's fill with Lingo:

- Set the `fillColor`, `fillMode`, `fillOffset`, and `fillScale` cast member properties. See `fillColor`, `fillMode`, `fillOffest`, and `fillScale` in the *Lingo Dictionary*.

Editing vector shapes

To edit vector shapes, you use the Vector Shape window. You change vector shapes by moving, adding, or deleting control points and changing the way they control curves. You can also change the way a vector shape is placed on the Stage by moving its registration point using either the Vector Shape window or Lingo.

To adjust the outline of a vector shape:

1. Open a vector shape in the Vector Shape window.
2. Click the Arrow tool and make any of the following changes:

- To move a curve or corner point, drag it to any location.
- To move multiple points, Shift-click or marquee select all the points you want to move, then drag any one of the selected points.
- To drag a single curve within a shape, select the Arrow tool and drag the curve. If the curve is filled, you can click anywhere within the filled area and drag the curve.
- To adjust a curve, select a curve point and drag a control handle.

  By default, the two control handles remain at a 180° angle from each other. If you want to drag one control handle independently from the other one, hold down Control (Windows) or Command (Macintosh) when you drag it. To constrain the control handles to vertical, horizontal, or a 45° angle, hold down Shift as you move them.
- To change a corner point to a curve point, Alt-click (Windows) or Option-click (Macintosh) and drag away from the handle to extend a control handle.
- To change a curve point to a corner point, drag the control handles directly over the curve point.
- To delete a point, select the point and press Backspace (Windows) or Delete (Macintosh).

- To move the window view without using the scroll bars, click the Hand tool and drag anywhere inside the shape.

To add a point in the middle of a shape:

1. Open a vector shape in the Vector Shape window.
2. Click the Pen tool.
3. If the shape is closed, move the pointer over a line until it changes and then click the mouse button. If the shape is open, hold down Alt (Windows) or Option (Macintosh) and move the pointer over a line until it changes; then click the mouse button.

To add a new point that is connected to a certain end point:

1. Click the Arrow tool and select an end point.
2. Click the Pen tool, and click the location where you want to add the next point.

To join two curves:

1. Select a vertex in each curve.

   If you select two endpoint vertices, you will join them. If you select points in the middle of the curve, you will join the start of the second curve to the end of the first curve.
2. Select Modify > Join Curves.

To split two curves:

- Select two adjacent vertices, and select Modify > Split Curves.

To change the registration point:

1. Click the Registration Point tool.

   The dotted lines in the window intersect at the registration point. The default registration point is the center of the cast member.

   The pointer changes to a cross hair when you move it to the window.
2. Click to set the new registration point.

   You can also drag the dotted lines around the window to reposition the registration point.
3. To reset the default registration point at the center of the cast member, double-click the Registration Point tool.

To change a vector shape cast member's registration point with Lingo:

- Set the `regPoint` or `regPointVertex` cast member property. You can test the `centerRegPoint` property to determine whether Director automatically recenters the registration point when the cast member is edited. (If you specify a value for `regPointVertex`, any values in the `regPoint` and `centerRegPoint` properties are ignored.) See `centerRegPoint`, `regPoint`, and `regPointVertex` in the *Lingo Dictionary*.

To close or open vector shapes:

- Select or deselect the Close box at the left side of the window.

  If the shape is closed, Director draws a line between the last and first points defined; if it is open, Director removes the line between the last and first points.

To close a shape with Lingo:

- Set the `closed` cast member property to `true`. See `closed` in the *Lingo Dictionary*.

To scale a vector shape:

- Control-Alt-drag (Windows) or Command-Option-drag (Macintosh) to proportionally resize a vector shape.

  You can also enter a scaling percentage for a vector shape using the Cast Member Properties dialog box. See "Setting vector shape properties" on page 252.

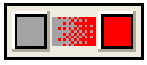
Defining gradients for vector shapes

You can use controls in the Vector Shape window or Lingo to specify the type of gradient, how it is placed within a shape, and how many times it cycles within the shape. A gradient for a vector shape shifts between the fill color and the end color you define. You can create linear or radial gradients. Changes you make to vector shape gradients have no effect on gradients for bitmaps in the Paint window. You can fill only closed vector shapes with gradients.

To define a gradient for a vector shape:

1. Create a closed vector shape in the Vector Shape window.
2. Click the Gradient button in the Fill type controls.

3. To select colors for the gradient, click the color box on the left side of the Gradient Colors control and select a starting color from the Color menu. To select the ending color, repeat this step using the color box on the right side of the Gradient Colors control.



4. Select Linear or Radial from the Gradient Type pop-up menu at the top of the window.

5. To define the number of times the gradient should change colors within the shape, use the Cycles control.

6 To specify the rate at which the gradient shifts between colors, use the Spread control to enter a percentage.

A setting of 100% uses the entire width or height of the shape to gradually shift colors. Lower settings make the shift more abrupt. For settings over 100%, the end color is reached at a theoretical location beyond the edges of the shape.

7 To rotate the gradient within the shape, use the Angle control to enter the number of degrees.

This setting affects only linear gradients.

8 To offset the gradient within the shape, enter X Offset (horizontal) and Y Offset (vertical) values.

To specify a gradient with Lingo:

- Set the `fillColor`, `fillDirection`, `fillMode`, `fillOffset`, `fillScale`, `gradientType`, and `endColor` cast member properties. See `fillColor`, `fillDirection`, `fillMode`, `fillOffset`, `fillScale`, `gradientType`, and `endColor` in the *Lingo Dictionary*.

Controlling vector shapes with Lingo

You can use Lingo to modify a vector shape by setting properties and using commands and functions related to the shape's vertices. For more information on each of these commands, properties, and expressions, see the *Lingo Dictionary*.

- To display a list that contains the location of each vertex and control handle in a vector shape, test the `vertexList` property.
- To access a vertex directly, use the `vertex` chunk expression.
- To add or delete a vertex, use the `addVertex()` or `deleteVertex()` command.
- To move a vertex or a vertex handle, use the `moveVertex()` or `moveVertexHandle()` command.
- To display the vertex list for a vector shape, test the `curve` property.
- To add a new shape to the vector shape, use the `newCurve()` command.
- To display or specify the registration point for the vector shape's cast member, test or set the `regPointVertex` property.
- To display or specify the point around which a vector shape scales and rotates, test or set the `originMode` property.

Setting vector shape properties

You can use the Property inspector to view and change settings for selected vector shape cast members. In addition to setting standard name and unload properties, you can specify anti-aliasing based on system performance and how the shape fits within the bounding rectangle.

To view or change vector shape cast member properties:

1 Select a vector shape cast member and click the Member tab on the Property inspector.

2 To specify how Director removes the cast member from memory if memory is low, be sure you're in Graphical view and select an option from the Unload pop-up menu. See "Controlling cast member unloading" on page 152.

3 To set specific vector shape settings, click the Vector tab.

4 To set the stroke color, choose a color from the Color menu, or enter a color value in the Stroke Color text box.

5 To set the width of the stroke, use the Width slider.

6 To set the fill color, select a color from the Color menu, or enter a color value in the Fill Color text box.

7 To set the type of fill, select one of these three options: No Fill, Solid, or Gradient.

8 To change the setting for anti-aliasing, click Anti-alias.

A check mark indicates that Anti-alias is on.

9 To specify how vector shapes are scaled on the Stage, select an option from the Scale Mode pop-up menu.

Show All maintains the vector shape's aspect ratio and, if necessary, fills in any gap along the horizontal or vertical dimension using the vector shape's background color.

No Border maintains the vector shape's aspect ratio by cropping the horizontal or vertical dimension as necessary without leaving a border.

Exact Fit stretches the vector shape to fit the sprite exactly, disregarding the aspect ratio.

Auto Size adjusts the vector shape's bounding rectangle to fit the movie when it is rotated, skewed, or flipped.

No Scale places the vector shape on the Stage with no scaling. The movie stays the same size no matter how you resize the sprite, even if it means cropping the vector shape.

10 To change the size of the cast member, either enter a percentage in the Percentage text box (Graphical view) or use the Scale slider (List view) to determine a percentage.

Using shapes

Shape cast members are the same non–anti-aliased shapes that were available in older versions of Director. Shapes are different cast member types than vector shapes. Similar to vector shapes, they are very memory-efficient.

Shapes are images you can create directly on the Stage with the Line, Rectangle, Rounded Rectangle, and Ellipse tools on the Tool palette. You can fill shapes with a color, pattern, or custom tile. Shapes require even less memory than vector shapes, but Director does not anti-alias shapes, so they don't appear as smooth on the Stage as vector shapes. You can use shapes for creating simple graphics and backgrounds when you want to keep your movie as small as possible. Shapes are especially useful for filling an area with a custom tile to create an interesting background that downloads quickly from the Internet. See "Creating a custom tile" on page 229.

To create a shape:

1 Select a frame in the Score where you want to draw a shape.

2 Select a shape, color, line thickness, and pattern setting with the controls in the Tool palette. (To open the Tool palette, select Window > Tool Palette.)

3 Click a tool and then drag on the Stage to draw the shape.

The new shape appears on the Stage and in the Cast window.

Setting shape cast member properties

You can use cast member properties to view and change settings for selected shape cast members. You can change the type of shape and choose a new fill color or pattern. You can also use Lingo to control shape cast member properties.

To view or change shape cast member properties:

1. Select a shape cast member and open the Property inspector in Graphical view.
2. Use the Name field on the Member tab to view or edit the cast member name.
3. To specify how Director removes the cast member from memory if memory is low, select an option from the Unload pop-up menu. See "Controlling cast member unloading" on page 152.
4. To change the type of shape, click the Shape tab and select an option from the Shape pop-up menu.
5. To fill the shape with the current color and pattern, select Filled.

To specify a shape's type with Lingo:

- Set the `shapeType` cast member property. See `shapeType` in the *Lingo Dictionary*.

To specify a shape's fill with Lingo:

- Set the `filled` and `pattern` shape cast member properties. See `filled` and `pattern` in the *Lingo Dictionary*.

To specify the line size for a shape with Lingo:

- Set the `lineSize` cast member or sprite property. See `lineSize` in the *Lingo Dictionary*.

CHAPTER 9
Color, Tempo, and Transitions

Several behind-the-scenes functions in Macromedia Director MX are important to the appearance and performance of a movie.

To control the way Director manages colors, it's important to understand the difference between RGB and index color, and how to assign colors to various elements in your movie. See the next section.

To control the speed at which your movie plays, you use settings in the tempo channel. See "About tempo" on page 267.

To make scenes in your movie flow together without creating the animation yourself, you can use predefined transitions. See "Using transitions" on page 270.

All these features involve using the channels at the top of the Score.

Controlling color

Selecting colors for movie elements is as simple as making a selection from a menu. To make sure that the colors you select are displayed correctly on as many systems as possible, it helps to understand how Director controls color.

Director provides a variety of color controls. The following list describes the most important:

- Use the Movie tab in the Property inspector to change modes for selecting colors. The modes are RGB values or palette index.
- Use the pop-up Color menu to select colors for movie elements. The Color menu is available throughout the Director application—for example, in the Tool palette.
- Use Transform Bitmap to remap bitmap images to new palettes and change their color depth. You can also make the same changes when you import a bitmap. See "Changing size, color depth, and color palette for bitmaps" on page 220, and "About importing bitmaps" on page 204.
- Use the Score's palette channel to change the movie's color palette as a movie plays.
- Use the Color Palettes window to change the colors in a color palette or to create a custom color palette cast member.

Specifying palette index and RGB color

Director can use either palette index values or RGB values to specify colors. RGB values are much more reliable and accurate for specifying colors than palette index values. RGB is the system that most web pages use.

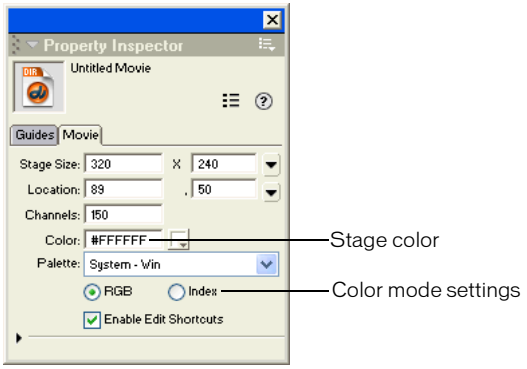
Director identifies a palette index color by the number of its position in a set of colors called a color palette. Color number 12, for example, might be blue. If a different palette is active, color number 12 might be red. When a computer is set to display 256 colors or fewer, it can display only the colors in the palette currently active in the system. This means that images created to display with the colors of one palette do not appear correctly when a different palette is active. If you use palette index color in a movie and then switch palettes during the movie, or never make sure that the correct palette is active, the images in your movie might appear with the wrong colors.

Director identifies an RGB color as a set of hexadecimal numbers that specify the amounts of red, green, and blue required to create the color. When a computer is set to display thousands or millions of colors, Director always displays RGB colors accurately. When a computer is set to 256 colors, Director finds the closest color in the current color palette to approximate the RGB color.

To choose the color mode for the current movie, you use the color mode settings on the Movie tab of the Property inspector. When you select RGB, all the colors you select from the Color menu in Director are specified in RGB values. When you select Index, the colors you choose are specified according to their position in the current palette. The Color menu indicates which method is being used.

To change the color mode of a movie:

1 Display the Movie tab of the Property inspector.



2 Select either RGB or Index.

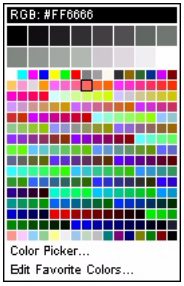
Changing the color depth of a movie

When you save a Director movie, it is set to the same color depth as the system on which you are authoring it. You can use Lingo to reset the system color depth to match the color depth of a movie. See `switchColorDepth` in the *Lingo Dictionary*.

If you want to set the color depth of a movie without using Lingo, you can use system utilities to change the color depth of your system before you save the movie file. On the Macintosh, you can also make the movie reset the system color depth by selecting Edit > Preferences > General and selecting Reset Monitor to Movie's Color Depth.

Choosing colors for movie elements

Use the Color menu to select colors for movie elements such as the Stage, vector shapes, and the foreground and background of sprites. For some elements, such as Stage and sprite colors, you can also enter hexadecimal values for any RGB color. The Color menu displays the colors in the current palette; the 16 larger color boxes at the top of the menu identify your favorite colors.



If the movie is set to specify colors as RGB values, selecting a color from the Color menu specifies the RGB value of the color, not its index value. (For an explanation of the difference between index and RGB color, see “Specifying palette index and RGB color” on page 255.) The bar at the top of the Color menu indicates whether the movie is set to RGB or index color.

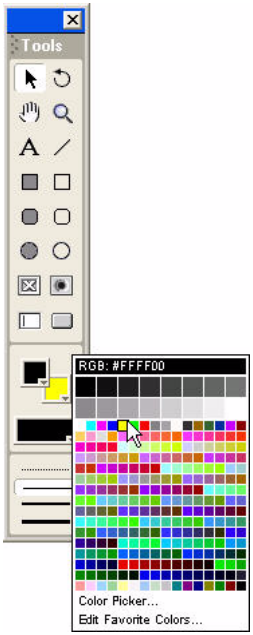
If you want to select a color that is not in the current palette (and therefore not available on the Color menu), you can use the system color picker to specify any color. You can also change the set of colors available on the Color menu by displaying a different color palette.

To open the Color menu:

1 Do one of the following:

- Select a sprite and display the Sprite tab of the Property inspector.
- Select Window > Tool Palette.

2 Click and hold the mouse button while pointing at the Foreground Color and Background Color buttons.



Note: To open the Color menu in the opposite mode (RGB or index), hold down the Alt key (Windows) or Option key (Macintosh) while clicking the color box.

To select colors not on the Color menu:

1 Open the Color menu.

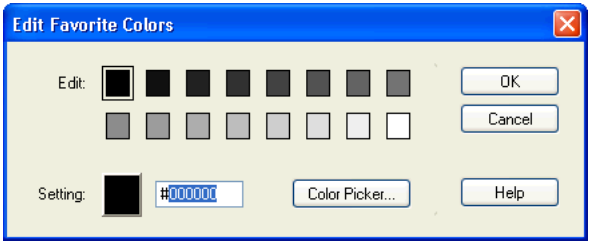
2 Click Color Picker.

3 Use the color picker that appears to select colors.

To edit the favorite colors on the Color menu:

1 Open the Color menu.

2 Select Edit Favorite Colors.



3 Select the color box you want to change.

4 Select a new color for the box using one of the following options:

- Click the color box to open the Color menu and select a color from the current palette.
- Enter an RGB value for a color in the box to the right of the color box.
- Click Color Picker and then use the system color picker to specify a new color.

5 Click OK.

To change the color palette displayed on the Color menu:

1 Select Window > Color Palettes or double-click the mouse button on the Foreground Color and Background Color buttons in the Tool palette.

2 Select a color palette from the Palette pop-up menu.

Changing color palettes during a movie

The palette channel in the Score determines which palette is active for a particular frame in a movie. To define the palette that is active in a particular frame of a movie, use Modify > Frame > Palette. When the playhead reaches the frame with the palette change, Director switches to the new palette.

The settings in the palette channel have no effect on a movie playing in a web browser. Do not use any of these settings for movies on the web.

For a stand-alone disk-based movie that takes over the entire screen, changing palettes during a movie is a viable option for displaying 8-bit graphics with the best possible colors.

If you place a cast member that has its own custom palette on the Stage—and if it's the first cast member that has a different palette in the frame—Director automatically assigns the new palette to the palette channel. The new palette becomes the active palette unless you clear it from the palette channel or replace it with a different palette, and it remains in effect until you set a different palette in the palette channel.

Only one palette can be active at any time. If an 8-bit image appears with the wrong colors, it requires a different palette. See "Solving color palette problems" on page 265.

Director contains several color palettes. The Windows and Macintosh system palettes are the default selections. Web216 is nearly identical to the palettes used by Netscape Navigator and Microsoft Internet Explorer. Use it for any movie you plan to play in a browser. Any additional palettes you create or import appear as cast members.

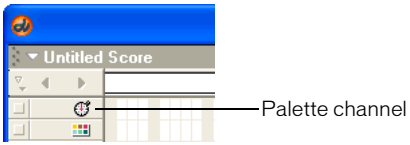
While working on a movie, you can change the active palette in the authoring environment by selecting a new palette in the Color Palettes window. The palette that is active in the authoring environment while you work does not change the palette in the movie on which you're working. Any settings in the palette channel reset the active palette as soon as the movie plays.

To specify a palette:

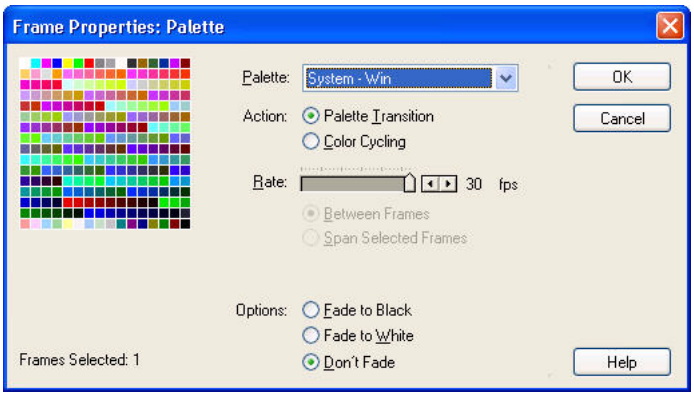
1 In the Score, do one of the following:

- Double-click the cell in the palette channel where you want the new palette setting to appear.
- Right-click (Windows) or Control-click (Macintosh) the cell in the effects channel where you want the new palette setting to appear, and then select Palette from the Context menu.
- Select the cell in the effects channel where you want the new palette setting to appear, and then select Palette from the Score window's Options menu.
- Select a frame in the palette channel, and select Modify > Frame > Palette.

  (If you don't see the palette channel, the effects channel is hidden. To display it, click the Hide/Show Effects Channel tool in the upper right of the score window.)



2 Select the options you want to use in the Frame Properties: Palette dialog box.



- Select a new palette.
- Specify how you want Director to manage the palette change. For example, to hide a palette change within a fade, first select a new palette from the pop-up menu. Select the Palette Transition option, and then select Fade to Black or Fade to White. Use the Rate slider to set the speed of the fade.

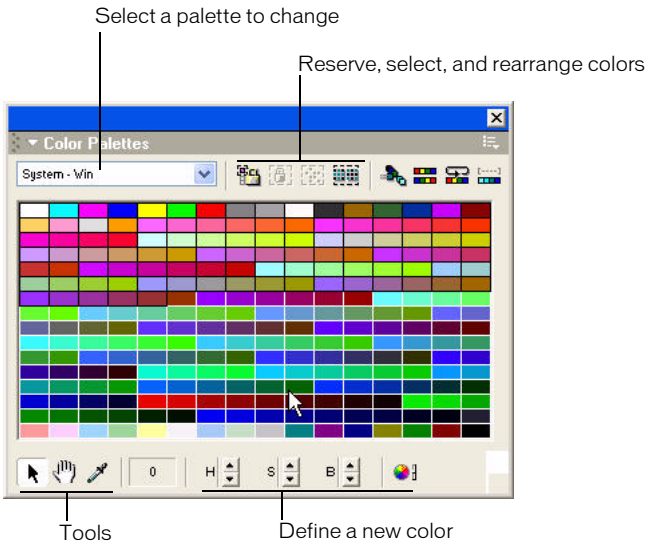
  To stop the movie while the palette changes, first select a new palette from the Palettes pop-up menu. Select the Palette Transition option, and then select Between Frames. Use the Rate slider to set the speed of the transition.

3 Click Set.

  The palette you select now appears in the cell that you selected in the Score's palette channel. The setting remains in effect in the movie until you set a different palette in the palette channel.

Using the Color Palettes window

Use the Color Palettes window to change and rearrange color palettes and to determine which colors in a palette are used in an image. This section explains basic features of the Color Palettes window.



If you add new palettes to your movie from other graphics applications, those palettes appear in the palette list and in the Cast window.

The row of buttons on the right side of the Color Palettes window are for reserving, selecting, and rearranging colors in the current palette. If you attempt to change one of the nine built-in palettes, Director creates a copy of the palette for you to modify.

Note: Selecting a new palette in the Color Palettes window does not change the palette for the movie or any frame in the movie. Use the Movie tab in the Property inspector to select the movie color palette, or select Modify › Frame Palette to change the color palette at a particular frame.

When you modify a palette, all the cast members using the palette also change, so make sure you always keep a copy of the original palette.

To open the Color Palettes window:

- Select Window > Color Palettes.

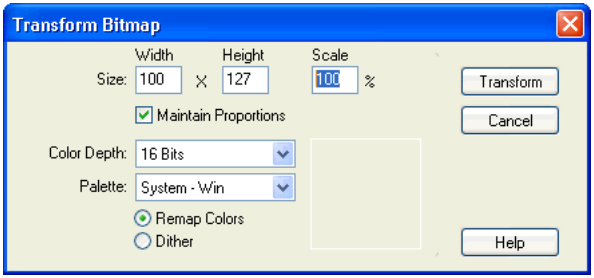
To edit a palette already used in a movie:

1. Select Window > Color Palettes.
2. Select the palette you want to edit from the Palettes pop-up menu.
3. Double-click any color within the palette.

   Director makes a copy of the palette and prompts you to enter a name.
4. Enter a name, and press OK.
5. Edit the palette using any of the methods discussed later in this section.

6 Select all the cast members that use the old version of the palette, or use Find to locate all the cast members using a particular palette.

7 Select Modify > Transform Bitmap and select the desired options.



Note: Be sure to select Remap Colors, not Dither.

8 Click Transform to remap all the cast members to the new palette.

To select one or more colors:

1 Click a color in the Color Palettes window. If the selection arrow is not active, click the Arrow tool at the bottom of the window.

2 To select a range, drag across colors or click the first color in the range, and then Shift-click the last.

3 Control-click (Windows) or Command-click (Macintosh) to select multiple discontiguous colors.

To match the color of any pixel on the Stage with the same color in the palette:

1 Click the Eyedropper tool.

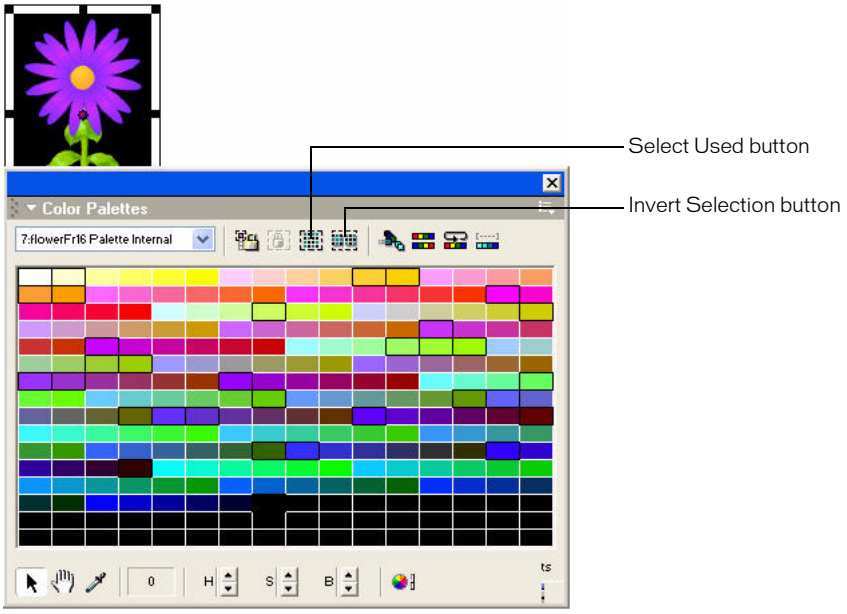
2 Drag any color in the Color Palettes window to any point on the Stage.

The selection in the Color Palettes window and the foreground color in the Tool palette changes to the color at the pointer location.

To select colors in the palette used by the current cast member:

1 In the Cast window, select the cast member.

2 Select Window > Color Palettes.



3 Click the Select Used button in the Color Palettes window.

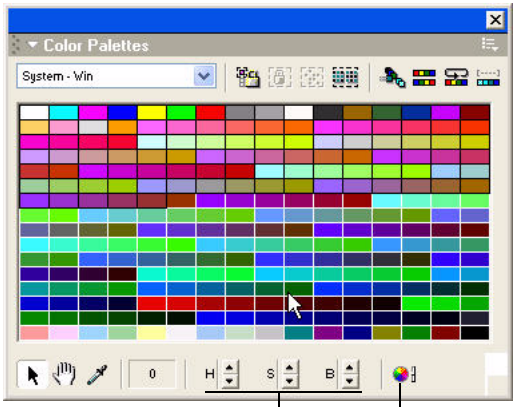
4 In the Select Colors Used In Bitmap dialog box, click Select.

To select all colors not currently selected:

- Click the Invert Selection button in the Color Palettes window.

Changing colors in a color palette

You can define a new color for a color palette by selecting a color you want to change and then using either the controls at the bottom of the Color Palettes window or the system color.



To edit selected colors in the Color Palettes window:

1. Select Window > Color Palettes.
2. Select the palette you want to change from the Palette pop-up menu.
3. Select a color within the palette to change.

   If you attempt to change one of the default palettes, Director makes a copy of the palette and prompts you to enter a name.
4. To change the color using the H, S, and B (hue, saturation, and brightness) controls, click the arrows next to the controls.

   Hue is the color that is created by mixing primary colors.

   Saturation is a measure of how much white is mixed in with the color. A fully saturated color is vivid; a less saturated color is a washed-out pastel or, in the case of black, a shade of gray.

   Brightness controls how much black is mixed in with a color. Colors that are very bright have little or no black. As more black is added, the brightness is reduced, and the color gets darker. If brightness is reduced to 0, then no matter what the values are for hue or saturation, the color is black.
5. To change the color using the system color picker, click the Color Picker button.

   For instruction on using the Windows or Macintosh color picker, see your system documentation.

Controlling color palettes with Lingo

By using the `puppetPalette` command, you can change the current palette and specify how quickly a new palette fades in. This command is useful when you want to change the palette to suit changing conditions in the movie without entering a new frame. For example, you can change the palette when you switch a cast member assigned to a sprite.

The new palette remains in effect until a new `puppetPalette` command is issued, a new palette is set in the palette channel, or a new movie starts.

See `puppetPalette` in the *Lingo Dictionary*.

Solving color palette problems

When images in your movie appear with the wrong colors, you probably have the wrong color palette active. Color palette problems occur only if you are using 8-bit bitmaps and you want your movie to be displayed correctly on 256-color systems (8-bit bitmaps always appear correctly on computers that are set to display thousands or millions of colors).

Eight-bit bitmaps don't store information about actual colors; they identify colors by referring to positions in the current color palette. When saving an 8-bit bitmap, a graphics program creates a palette with the colors required for that particular image. This palette is saved with the file and must be active when the bitmap appears in a Director movie for the bitmap to appear with the proper colors. Only one palette can be active. Whenever it's necessary to display more than one 8-bit bitmap on the screen at one time, as is often the case in Director movies, all the images must refer to the same palette.

To solve color palette problems, follow these guidelines:

- To avoid color problems in movies for the web, map all 8-bit bitmaps in your movie to the Web216 color palette that is built in to Director. This is essentially the same palette used by Netscape Navigator and Microsoft Internet Explorer.
- Do not attempt to change palettes while a movie is playing in the browser. The browser, not the Director movie, controls the palette. Browsers ignore all palette channel settings.
- Make sure all the 8-bit images that are on the Stage at the same time refer to the same palette.
- If bitmaps are not dithering or remapping to the current palette, make sure the Remap Palettes If Needed option on the Movie tab of the Property inspector is selected. See "Setting Stage and movie properties" on page 27.
- Make sure there are no palette changes in the palette channel of which you are unaware. For example, when a cast member you are placing on the Stage has a palette different from the currently active palette, Director adds the new palette to the palette channel. If you don't realize that this has happened, you might find the palette changing unexpectedly when the movie plays.
- For disk-based movies, simplify your work and avoid frequent palette changes by mapping all the images in your movie to as few palettes as possible.
- Remap existing cast members to a new color palette using the Modify > Transform Bitmap command.

- If the Import option for Palette in the Image Options dialog box is not available while you are importing an image, the image's palette might not meet standard system requirements.

  Note: Use an image editor to make sure the image's palette meets the following requirements: The palette must contain exactly 16 or 256 colors. The first and last colors in the palette must be black or white, and there must be only one black and one white in the entire palette.

- Don't change colors that are used by your system software for interface elements. In Windows, these colors always appear as the first ten and the last ten colors in the palette.

Setting palette cast member properties

When you create a color palette in the Color Palettes window or import a bitmap with its own palette, the palette appears in a cast as an ordinary cast member. You use cast member properties to name the palette and to specify how it is unloaded from memory.

To view or change color palette cast member properties:

1. Select a color palette cast member.
2. To display the Property inspector, select Modify > Cast Member > Properties, or select Window > Property Inspector.
3. If necessary, click the Member tab and display the Graphical mode.

   The following non-editable settings appear:

- The cast member size in kilobytes
- The cast member creation and edit dates
- The name of the last person who modified the cast member

4. To view or edit the cast member name, use the Name field.
5. To add comments about the cast member, use the Comments field.
6. To specify how Director removes the cast member from memory if memory is low, select one of the following options from the Unload pop-up menu:

   3–Normal sets the selected cast members to be removed from memory after any priority 2 cast members have been removed.

   2–Next sets the selected cast members to be among the first removed from memory.

   1–Last sets the selected cast members to be the last removed from memory.

   0–Never sets the selected cast members to be retained in memory; these cast members are never unloaded.

7. To modify the colors in the palette, click Edit.

About tempo

Tempo is the number of frames per second that Director tries to play. You can control tempo using the Score tempo channel or Lingo's `puppetTempo` command.

Director tempo settings control the maximum speed at which the playhead moves from frame to frame. The tempo doesn't affect the duration of any transitions set in the transition channel, nor does it control the speed at which a sound or digital video plays. Tempo settings don't always control animated GIFs; see "Using animated GIFs" on page 205.

Settings in the tempo channel can also make a movie pause and wait for a mouse click or key press. For information on making a movie wait for a cue point in a sound or video, see "Synchronizing media" on page 328.

For simple movies, using the tempo channel is often the best way to define tempos. For more sophisticated control of the speed of a movie, use Lingo's `puppetTempo` command to control tempo.

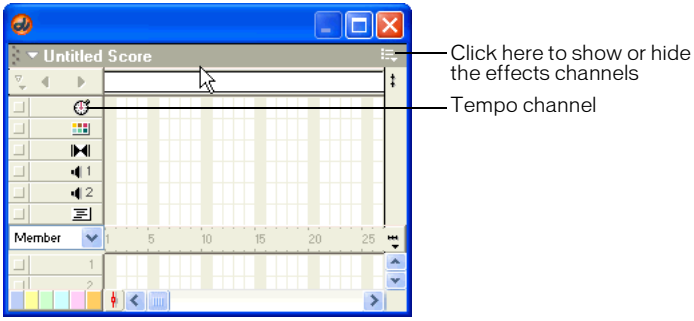
You can't make a movie go faster than the computer allows. Many factors can make movies play more slowly than the specified tempo, such as the following:

- Playing the movie on a slower computer
- Making the movie wait for cast members to download from a slow Internet connection
- Animating several large sprites at the same time
- Animating stretched sprites
- Color depth differences between the movie and monitor
- Animating sprites that have blend values

Specifying tempo properties

It's best to begin a movie with a tempo setting in the first cell of the tempo channel. If you don't set a tempo until later in the movie, the beginning tempo is determined by the setting in the floating Control panel. Director plays a movie at the tempo you've set until it encounters a new tempo setting in the tempo channel or a `puppetTempo` command is issued.

Enter tempo changes in the tempo channel at the top of the Score. (If you don't see the tempo channel, the effects channel is hidden. To display it, click the Hide/Show Effects Channel tool in the upper right of the Score window.)



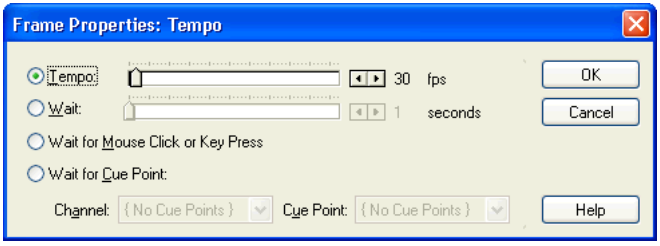
To specify a tempo setting:

1 In the Score, do one of the following:

- Double-click the cell in the tempo channel where you want the new tempo setting to appear.
- Right-click (Windows) or Control-click (Macintosh) the cell in the effects channel where you want the new tempo setting to appear, and then select Tempo from the Context menu.
- Select a frame in the tempo channel, and select Modify > Frame > Tempo.

  If you don't see the tempo channel, the effects channel is hidden. To display it, click the Hide/Show Effects Channel tool in the upper right of the Score window.

2 Select the option you want to use in the Frame Properties: Tempo dialog box.



- To set a new tempo for the movie, select Tempo, then use the Tempo arrows or drag the slider.
- To pause the movie at the current frame for a certain length of time, select Wait, then use the Wait arrows or drag the slider.
- To pause the movie until the user clicks the mouse or presses a key, select Wait for Mouse Click or Key Press.
- To pause the movie until a sound or digital video cue point passes, select Wait for Cue Point and select a channel and cue point. See "Synchronizing media" on page 328.

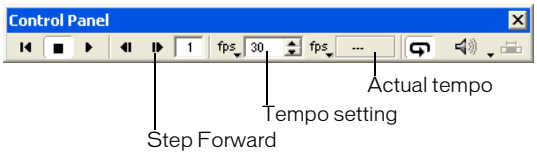
3 Click OK.

  A number that matches the setting you've selected appears in the tempo channel. If you can't read the number, you might need to zoom the score. To do so, click the Zoom Menu button at the right edge of the sprite channel, or select View > Zoom. Then select a percentage from the pop-up menu.

Comparing actual speed with tempos you've set

It's good practice to test the performance of your movie on a system that is similar to that of your users. Make sure the movie plays well on the slowest systems likely to be used.

The tempo you've set and the actual speed of a movie both appear in the floating Control panel.



Note: The Control panel attached to the bottom of the Stage does not include tempo settings. Tempo settings are available only from the floating (detached) version of the Control panel. To detach the Control panel from the Stage, Right-click (Windows) or Control-click (Macintosh) the Control panel. In the context menu, select Detach Control Panel. For more information about the Control panel, see "The Control panel" on page 21.

To compare the actual speed of a movie with the tempos you've set:

1. Play the movie from start to finish, and then rewind it to the beginning.
2. Use the Step Forward button to step through the movie frame by frame.
3. In each frame, compare the tempo setting shown in the floating Control panel with the actual speed shown there.

   If you haven't recorded the actual speed of a movie in a particular frame, the actual tempo field displays two dashes (--).

Locking frame durations

To make Director play a movie at the same tempo on all types of computers, use the Lock Frame Durations option in the Movie Playback Properties dialog box (see "Setting movie playback options" on page 592). For frames without tempo settings, Director uses the current tempo. Lock Frame Duration prevents a movie from playing too fast on a fast system, but it cannot prevent a movie from playing slowly on a slow system.

To turn on Lock Frame Durations:

1. Select Modify > Movie > Playback.
2. Select Lock Frame Durations.

Controlling tempo with Lingo

To override the tempo set in the movie's tempo channel, you use the `puppetTempo` command. This approach is useful when you want to change the movie's tempo in response to conditions that you can't control, such as the type of computer the movie is playing on or a user's action.

The `puppetTempo` command doesn't retain control of the tempo channel. If the movie encounters any tempo settings in the tempo channel, the `puppetTempo` settings will be overridden.

See `puppetTempo` in the *Lingo Dictionary*.

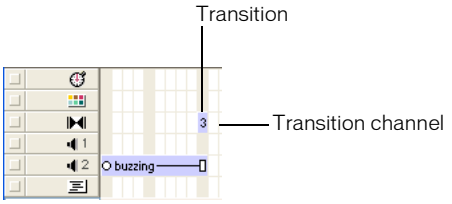
Using transitions

Transitions create brief animations that play between frames to create a smooth flow as sprites move, appear, or disappear or as the entire Stage changes. Director provides dozens of transitions built into the application, and many third-party Xtra extensions also include transitions. For example, you can dissolve from one scene to the next, display a new scene strip by strip, or switch to a scene as though revealing it through venetian blinds. You can also use many of the transitions to make individual elements appear or disappear from the screen.

After they are defined, transitions appear in the Cast window as cast members. You can place them in the transition channel by dragging them from the cast to the Score.

Creating transitions

The same as tempos, palettes, sounds, and behaviors, transitions have a channel set aside for them in the Score.



A transition always takes place between the end of the current frame and the beginning of the frame where the transition is set. If you want to create a dissolve between two scenes, set the transition in the first frame of the second scene, not in the last frame of the first scene.

To add a transition:

1. In the transition channel, select the frame in which you want the transition to occur.
2. Select Modify > Frame > Transition, or double-click the frame in the transition channel.
3. In the Frame Properties Transition dialog box, select a category if desired, and then select the transition you want. You can quickly scroll through transitions by typing the first letter of the transition's name.

   Many transitions have default settings for Duration and Smoothness. You can adjust the sliders to change the settings.

   For many transitions, you can also select whether the transition affects the entire Stage or only the area that's changing.

   Xtra extension transitions might offer additional options provided by the developer. If the Options button is available when you select an Xtra extension transition, click it to view and change the transition options.
4. Click OK.

   Director displays the cast member number that corresponds to the transition in the transition channel. The transition also appears in the cast.

Tips for using transitions

Here are some points to remember when working with transitions:

- To play a sound while a transition occurs, place the sound in the frame immediately before the transition.
- The Dissolve Pixels, Dissolve Pixels Fast, or Dissolve Patterns transitions might look different on Windows and Macintosh systems. Test to ensure satisfactory results.
- If you export a movie that contains transitions as a digital video or PICS file, the transitions might not be preserved.
- A transition that occurs while a sound or digital video is decompressing might require more system resources than are available on less powerful systems. This might cause the sound to stop playing. If you notice this behavior while testing on low-end systems, try making the transition shorter, and avoid complex transitions such as Dissolve.
- Avoid looping on a frame that contains a transition. Playing a transition continuously might cause performance issues.
- Options will become available only when transition Xtra extensions are available.

Using transition Xtra extensions

You can add custom transitions that are available as transition Xtra extensions. Transition Xtra extensions appear in the Frame Properties: Transitions dialog box. Transition Xtra extensions are often more complex than the transitions that are provided with Director and might include an additional dialog box for specialized settings.

To install a transition Xtra extension:

- Place the transition Xtra extension in the Xtras folder in the Director application folder. The transition Xtra extension must be present when the movie runs.

Controlling transitions with Lingo

To set a transition with Lingo, you use the `puppetTransition` command. This command gives you the flexibility to select a transition that is appropriate for current movie conditions or to apply a transition to sprites before the playhead exits the current frame.

For example, use the `puppetTransition` command to specify one of several transitions, depending on which sprites are on the Stage when the playhead enters a new frame, or apply a transition to a new sprite when it appears but the playhead doesn't exit the frame.

The `puppetTransition` command applies only to the frame in which you issue the command. You do not need to explicitly return control of the transition channel to the Score after the transition occurs.

The `puppetTransition` command's parameters perform the same functions as the options in the Frame Properties: Transition dialog box.

See `puppetTransition` in the *Lingo Dictionary*.

Setting transition cast member properties

You use the Property inspector to set values for the transition cast member.

To view or change transition cast member properties:

1. Select a transition cast member.
2. To display the Property inspector, select Modify > Cast Member > Properties, or select Window > Property Inspector.
3. If necessary, click the Member tab and display the Graphical mode.

   The following noneditable settings appear:

- The cast member size in kilobytes
- The cast member creation and edit dates
- The name of the last person who modified the cast member

4. To view or edit the cast member name, use the Name field.
5. To add comments about the cast member, use the Comments field.
6. To specify how Director removes the cast member from memory if memory is low, select one of the following options from the Unload pop-up menu:

   3–Normal sets the selected cast members to be removed from memory after any priority 2 cast members have been removed.

   2–Next sets the selected cast members to be among the first removed from memory.

   1–Last sets the selected cast members to be the last removed from memory.

   0–Never sets the selected cast members to be retained in memory; these cast members are never unloaded.

7. If you are using an Xtra extension transition, click Options to set values that are specific to the Xtra extension transition. The contents of the Options dialog box is determined by the developer of the Xtra extension. Refer to any documentation supplied with the Xtra extension.

CHAPTER 10
Text

Macromedia Director MX creates text that is editable, anti-aliased, and compact for fast downloading in any font on any platform. Combine these features with any of the animation capabilities of Director, such as rotation, and you can create text effects that are not possible in any other application.

You can embed fonts in a movie to ensure that text appears in a specific font when a movie is delivered, regardless of which fonts are available on the user's computer.

Because Director renders text in the display font, and anti-aliases, or smooths, it as the movie plays, text in Director is very compact and downloads quickly from the Internet. Most of the high-quality text you see in web browsers is actually a GIF or JPEG graphic, and takes longer to download than Director text.

Director provides many ways to add text to a movie. You can either create new text cast members within Director or import text from an outside source such as a document stored on the Internet. You can import plain text, RTF, or HTML documents. After text is part of your movie, you can format the text in a variety of ways using the Director formatting tools. Director offers standard professional formatting functions, including alignment, tabs, kerning, spacing, subscripts, superscripts, color, and so on. You can also create hypertext links for any text.

Text in Director is editable when you are working on your movie and, optionally, while a movie plays.

You can also use Lingo to control text. For example, you can use Lingo to edit the text in existing cast members, specify text formatting such as font and size, and interpret strings that users enter.

To create the smallest possible text cast members, use field text. Field text is standard text controlled by your system software, the same as the text you see in dialog boxes and menu bars. Director does not anti-alias field text or support paragraph formatting and tabs for fields. As with regular text, Lingo can control field text and specify whether field text is editable while a movie plays.

Whereas regular text is best suited for large type that you want to look as good as possible, field text is an excellent choice for large blocks of smaller text in standard fonts (such as Times or Helvetica) that do not need to be anti-aliased.

Embedding fonts in movies

Before creating text or field cast members, it's good practice to embed the fonts you want to use in the movie. Embedding fonts makes Director store all font information in the movie file so that a font will display properly even if it is not installed in a user's system. Because embedded fonts are available only to the movie, there are no legal obstacles to distributing fonts in Director movies.

Embedded fonts appear in a movie as cast members and work on Windows and Macintosh computers. Director compresses embedded fonts so they usually only add 14 to 25K to a file.

For the best display at smaller sizes, include bitmap versions of a font when you embed a font. For small font sizes, usually from about 7 to 12 points, bitmap fonts often look better than anti-aliased outline fonts (see "About anti-aliased text" on page 280). Adding a set of bitmap characters does, however, make the font cast member larger. Examine the text display quality of your movie to find out if this option is worthwhile.

To speed up movie downloading, you can keep a file size small by specifying a subset of characters to include. You can also specify which point sizes to include as bitmaps and which characters to include in the font package. If you do not embed fonts in a movie, Director substitutes available system fonts.

If you create embedded fonts using the original font name followed by an asterisk (*), such as Arial* for the Arial font, Director uses the embedded font for all the text in the movie that uses the original font. This saves you the trouble of manually reapplying the font to all the text in existing movies.

After you embed a font in a movie file, the font appears on all the movie's font menus, and you can use it as you would any other font.

To embed a font in a movie:

1. Select Insert > Media Element > Font.
2. From the Original Font pop-up menu, select a font that is currently installed on your system.

   You cannot embed a font that is not installed on your system.

   In the New Font Name text box, the name of the font is followed by an asterisk (*). This name will appear on all font menus in Director. In most cases, you should not change the name of a font.
3. To include bitmap versions of the font in specified sizes, click the Sizes button for Bitmaps, and enter the point sizes you want to include, separated by spaces or commas. For example, you might enter **9, 10, 14**.
4. To include bitmap versions of bold or italic characters with the font, select Bold or Italic.

   This option provides better-looking bold and italic fonts if you are including a bitmap version of the font, but it increases the file size.
5. To specify the characters that the font includes, select an option for Characters:

   Entire Set includes every character (symbols, punctuation, numbers, and so on) with the font.

   Partial Set lets you select exactly which characters are included. To select a group of characters, select Punctuation, Numbers, Roman Characters, or Other. If you select Other, enter the characters to be included in the text box on the right. In some double-byte languages, other groups of characters might appear.

To embed a font in a movie with Lingo:

- Use the `recordFont` command. See `recordFont` in the *Lingo Dictionary*.

Creating text cast members

You can create text within Director or import text from external files.

Creating text in Director

Director provides two ways to create text cast members: directly on the Stage or in the Text window.

To create text cast members directly on the Stage:

1. Click the Text tool in the Tool palette.
2. Drag the pointer on the Stage to create a text cast member.

   You cannot adjust the height of the text object at this point: The height adjusts automatically when you add text.

   When you release the mouse button, a text insertion point appears in the area you defined.
3. Enter text.

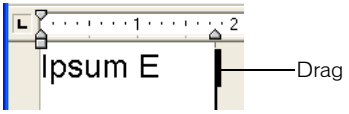
   The new text cast member appears in the first available position in the current cast, and the sprite is placed in the first open cell in the current frame in the Score.

To create text cast members in the Text window:

1. Select Insert > Media Element > Text.

   If the Text window is already open, click the New Cast Member button to create a new text cast member.
2. Enter text in the Text window.

   The text you enter appears in the first available cast position, but it is not automatically placed on the Stage.
3. To change the width of the cast member, drag the bar at the right edge of the cast member.



Importing text

You can import text from any application that saves text in rich text format (RTF), in plain text (ASCII), or from HTML documents. Use the standard importing procedure with File > Import to import any RTF, ASCII, or HTML document. To import an HTML document from the Internet, click the Internet button in the Import dialog box (File > Import) and enter a URL in the File URL text box.

Text and RTF files are always imported and stored inside the movie file, even if you select Link to External File.

When you import text from an HTML document, Director recognizes most standard tags and parameters, including tables, and approximates the formatting. Director does not recognize embedded objects other than tables, and it does not support nested tables. It also does not recognize `APPLET`, `FORM`, `FRAME`, `INPUT`, or `IMAGE` tags.

Director ignores any tags it does not recognize. For HTML files that are updated frequently, make sure you're satisfied with the formatting when importing.

When you import text from an RTF file, Director recognizes most standard RTF formatting, but it does not import pictures embedded in the file.

The amount of text in a cast member is limited only by the memory that is available in the playback system.

Importing text with Lingo

Lingo can import text in several ways. See individual entries in the *Lingo Dictionary*.

- To import text from a URL, use the `getNetText()` function.
- To import text from an external file from a URL or the local computer, select or create a text cast member and set its `fileName` property to the name of the external file that contains the text.
- To import text from a file on disk, use the `getPref()` function. If no `setPref` command has already written such a file, the `getPref()` function returns `VOID`.

Editing and formatting text

Director offers several ways to edit and format text. You can edit text directly on the Stage and format it with the floating Text inspector, or use the Text window to work in a more traditional text editing environment. Many of the same formatting controls are in the Font and Paragraph dialog boxes, as well as in the Text window and the Text inspector. Select the most convenient option for your work style.

Selecting and editing text on the Stage

For basic text editing, it's fastest to edit text directly on the Stage.

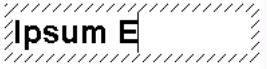
To edit text on the Stage:

1. Click a text cast member on the Stage to select it as a sprite.

   The text sprite appears as a normal sprite with double borders.

2. Click twice to edit the text.

   An insertion point appears in the text, and you can begin editing.



3. Use the Text inspector (Window > Text Inspector) to reformat the text.

   You can also use the Modify > Font and Modify > Paragraph commands to reformat selected text.

   When you make a change, Director updates all sprites that display the text cast member.

Note: If you're changing the background color of text, you have two options. To change the background color of the cast member, double-click the text sprite on the Stage and assign a value from the Color box on the Tool palette. You can also tint the sprite's background, which blends the background color of the cast member with the background color of the sprite. To apply this effect, select the sprite, and select a background color on the Property inspector's Sprite tab.

To edit text on the Stage during playback:

1. Select a text sprite, and click Editable in the Property inspector's Sprite tab. See "Displaying and editing sprite properties in the Property inspector" on page 162.
2. Begin playing back the movie.
3. On the Stage, double-click to edit the text.

Formatting characters

After you created text cast members for your movie, you can format them in several ways: You can set the font, style, size, line spacing, and color. The following procedure uses the Font dialog box, but many of the same options are available in the Text inspector and the Text window.

To format characters:

1. Double-click inside a text sprite.
2. Drag to select the text you want to format.
3. Select Modify > Font to open the Font dialog box.
4. Select from the following options in the Font dialog box:

- To specify the font, select a font from the list of available fonts. Be sure to use embedded fonts for movies that you intend to distribute (see "Embedding fonts in movies" on page 274).
- To use bold, italic, underline, superscript, subscript, or strikeout for text, click the appropriate box.
- To change the point size of text, increase or decrease the size with the Size option.
- To change the distance between lines of text, increase or decrease the spacing with the Spacing option.
- To specify kerning between selected characters, use the Kerning option to specify the number of points. This setting supplements the standard kerning that is applied to the entire cast member in the Text tab of the Property Inspector. See "About kerning" on page 281.
- To change the text color, click the Color box and select a color from the Color menu.

Formatting paragraphs

You can specify the alignment, indentation, tabs, and spacing for each paragraph in a text cast member. The following procedure explains how to format paragraphs while you work in the Text window, but many of the same formatting options are available in the Text inspector and the Paragraph dialog box.

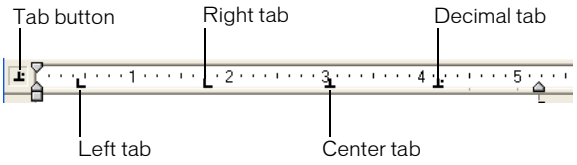
To make formatting changes to a paragraph:

1. Double-click the text cast member in the Score to open the Text window.
2. If the ruler is not visible, select View > Rulers.

   To change the unit of measure on the text ruler, select Edit > Preferences > General, and select Inches, Centimeters, or Pixels from the Text Units pop-up menu.
3. Place the insertion point in the paragraph you want to change, or select multiple paragraphs.

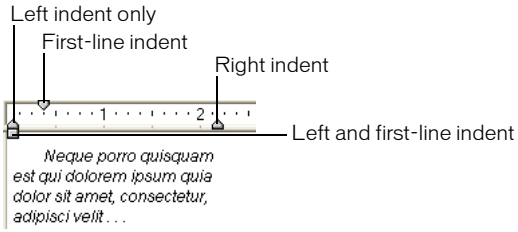
4 To define tabs, use any of the following options:

- Set a tab by clicking the Tab button until the type of tab you want appears. Then click the ruler to place the tab.



- Move a tab by dragging the tab marker on the ruler.
- Remove a tab by dragging the tab marker up or down off the ruler.

5 To set margins, drag the indent markers on the ruler.

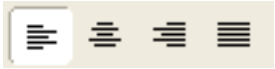


6 To set line spacing, change the setting with the Line Spacing control.

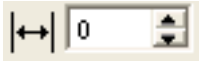
Director adjusts line spacing to match the size of the text you are using.

If you change the line spacing setting, Director stops making automatic adjustments. To resume automatic adjustments of spacing, enter 0 in the Line Spacing text box.

7 To set paragraph alignment, click one of the alignment buttons.



8 To change the kerning of selected characters, change the value of the Kerning option.



9 Set spacing before and after paragraphs by selecting Modify > Paragraph and using the Spacing Before and After options.

Formatting entire cast members

Director can apply formatting changes to entire cast members. This process is much faster than manually opening each cast member and applying changes. Any change you apply to a cast member affects all the text within the cast member.

To format text cast members:

1 In a Cast window or on the Stage, select the cast members you want to change.

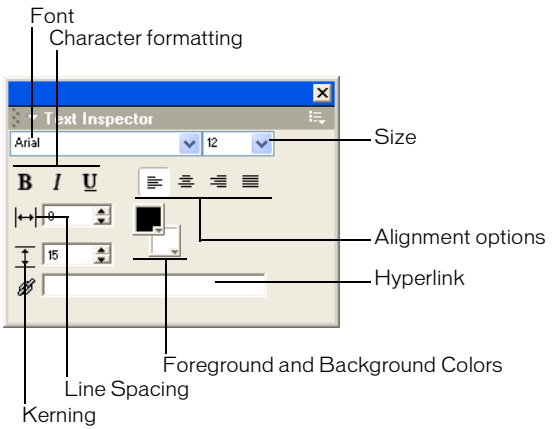
You can select as many cast members as you want to change.

2 Use the Text inspector, Modify > Font, or Modify > Paragraph to make formatting changes.

The change affects all the text in the selected cast members.

Formatting with the Text inspector

The Text inspector provides many useful formatting controls in a compact window for use on the Stage or with entire cast members in the Cast window.



Most of the formatting controls also appear at the top of the Text window and in the Font and Paragraph dialog boxes.

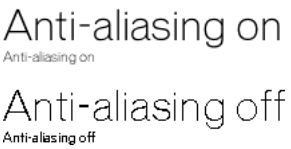
To display the Text inspector:

- Select Window > Text Inspector, or press Control+T (Windows) or Command+T (Macintosh).

About anti-aliased text

Anti-aliased text is text that uses color variations to make its jagged angles and curves look smoother. Director activates anti-aliasing by default. You can change this setting in the Text tab of the Property inspector (see “Setting text or field cast member properties” on page 285). Anti-aliasing functions the same way for embedded fonts and for system fonts that have not been embedded (see “Embedding fonts in movies” on page 274).

Using anti-aliased text dramatically improves the quality of large text on the Stage, but it can blur or distort smaller text. Experiment with the size settings to get the best results for the font you are using.



Director can anti-alias all outline (TrueType, PostScript, and embedded) fonts but not bitmap fonts. When you select a font that cannot be anti-aliased, the message "This font cannot be anti-aliased" appears in the Font dialog box below the font list. (Display the Font dialog box by selecting text or a text sprite and then selecting Modify > Font.)

About kerning

Kerning is a specialized form of spacing between certain pairs of characters that look best when they overlap slightly, such as A and W (AW). Kerning dramatically improves the appearance of large text for headlines, but it often does not improve the appearance of text at small font sizes.

If the Kerning option is selected on the Property inspector's Text tab, Director kerns all the characters in the cast member according to standard kerning tables (see "Setting text or field cast member properties" on page 285). The setting you enter in the Kerning text box in the Text window or Font dialog box (see "Formatting characters" on page 278) supplements the standard kerning.

Finding and replacing text

You can use the Find > Text command to quickly search for and replace text in the Text, Field, or Script window. All searches start at the insertion point and search forward.

To search and replace text:

1. Select Window > Text, Window > Field, or Window > Script to open the window in which you want to search.
2. Place the insertion point at the position where you want the search to begin.
3. Select Edit > Find > Text.
4. Enter the text for which you want to search in the Find box.
5. Enter the text you want to use in place of the found text in the Replace box.
6. To specify the cast members in which to search, select one of the following Search options:

   Cast Member [Cast Member Name] limits the search to the current cast member.

   Cast [Cast Name] limits the search to cast members in the current cast.

   All Casts extends the search to all cast members in all casts.

7 To set additional search options, select Wrap-Around, Whole Words Only, or Case Sensitive.

Wrap-Around specifies whether Director returns to the beginning of text after it reaches the end. If you select this option but not All Casts, Director continues searching from the top of the current text after it reaches the bottom of the window. If you select both options, Director searches all cast members of the same type (either text, field, or script, depending on where you initiated the search), beginning with the currently selected cast member and returning to the first cast member of that type if necessary.

Whole Words Only searches only for occurrences of the specified whole word.

Case Sensitive searches only for text with the same capitalization as the text in the Find box.

Creating a hypertext link

In the Text inspector, you can turn any selected range of text into a hypertext link that links to a URL or initiates other actions. Director automatically adds standard hypertext link formatting to the selected text so that it initially appears with blue underlining. You can turn off this formatting in the Property inspector's Text tab. See "Setting text or field cast member properties" on page 285.

The following procedure describes how to add a hypertext link to selected text. To make a hypertext link active, you need to write an `on hyperlinkClicked` event handler. See `on hyperLinkClicked` in the *Lingo Dictionary*.

You can enter any string in the Hyperlink text box; it does not have to be a URL. The string cannot contain a double quotation mark or the Lingo continuation character.

To define a hypertext link:

1 Select the text you want to define as a hypertext link.

2 Select Window > Text Inspector to open the Text inspector.

3 In the Hyperlink text box, enter the URL to which you want to link, or enter any message you want to send to the `on hyperlinkClicked` handler. Then press Enter (Windows) or Return (Macintosh).

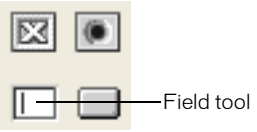
Working with fields

Working with field cast members is similar to working with text. As with text cast members, you edit fields on the Stage or in a window, and apply formatting with the Text inspector. Not all text formatting options are available for fields: you cannot apply spacing, tabs, or indents to individual paragraphs within fields. Alignment settings apply to every paragraph in the field.

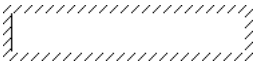
To create a field cast member:

1 Perform one of the following actions:

- Select Insert > Control > Field.
- Click the Field tool in the Tool palette, and drag on the Stage to define the area of the field.



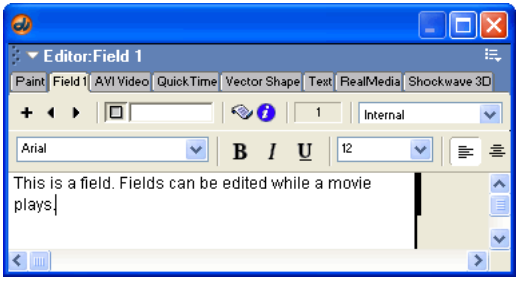
The field is created, and an insertion point is placed at the beginning of the field.



2 Enter the text for the field. When you finish, click outside the field to exit the field.

To specify field settings:

- Select Window > Field, or double-click a field cast member in the Cast window.



If necessary, use the Previous Cast Member and Next Cast Member buttons to navigate to the field you want to edit. See “Setting text or field cast member properties” on page 285.

Using editable text

Editable text lets users enter text on a web page, customize a game, and so on. When text is editable, editing the text changes the text cast member and all the text in the sprites where the cast member appears.

You can make text editable and let users tab between editable sprites from Lingo or the Property inspector (see “Setting text or field cast member properties” on page 285).

You can make a text sprite editable in only a certain range of frames in the Score.

To make a text sprite editable in a range of frames:

1. Select a range of frames within a sprite.

   You can select an entire sprite, or Shift-Alt-click (Windows) or Shift-Option-click (Macintosh) to select frames within a sprite.
2. Click the Property inspector's Text or Field tab using the Graphical view.
3. Click Editable.

To control whether text is editable with Lingo:

- Set the `editable` property. See `editable` in the *Lingo Dictionary*.

To have Lingo specify whether pressing Tab opens the next sprite for editing:

- Set the `autotab` property. See `autoTab` in the *Lingo Dictionary*.

Converting text to a bitmap

You use the Convert to Bitmap command to change a text or field cast member to a bitmap. The converted graphic can then be edited in the Paint window. After you convert a cast member to a bitmap graphic, you cannot undo the change.

This command works only with text and field cast members. You can't convert a shape to a bitmap.

To convert text to a bitmap:

1. In the Cast window, select the cast members to convert.
2. Select Modify > Convert to Bitmap.

   Director converts the cast members to bitmaps.

Mapping fonts between platforms for field cast members

Director uses a file named Fontmap.txt to map fonts in fields between the Windows and Macintosh platforms. When you create a new movie, Director looks for Fontmap.txt in the same folder as the Director application.

The version of Fontmap.txt that is included with Director assigns fonts as shown in the following table. These settings provide the best equivalents of common system fonts on both platforms.

Windows font	Macintosh font
Arial	Helvetica
Courier	Courier
Courier New	Courier
MS Serif	New York
MS Sans Serif	Geneva
Symbol	Symbol
System	Chicago

Windows font	Macintosh font
Terminal	Monaco
Times New Roman	Times (because Times New Roman is larger than Times, Fontmap.txt assigns a smaller point size.)

Fontmap.txt also determines the scaling of fonts and how special characters such as bullets and symbols are translated between platforms. Again, the default settings are correct for nearly all applications, but you can edit the settings if necessary.

Setting text or field cast member properties

Use the Property inspector to view and change settings for selected text cast members. In addition to standard Name and Unload properties, you can specify whether text is editable while the movie plays, improve performance with pre-rendering, and control anti-aliasing and kerning.

To view or change text or field cast member properties:

1. Select a text cast member in the Cast window.
2. To display the Property inspector, perform one of the following actions:

- Select Modify > Cast Member > Properties.
- Select Window > Property Inspector.

3. Click the Member tab, if it's not already selected, using the Graphical view.

   The following noneditable settings appear:

- The cast member size in kilobytes
- The cast member creation and edit dates
- The name of the last person who modified the cast member

4. To view or edit the cast member name, use the Name field.
5. To add comments about the cast member, use the Comments field.
6. To specify how Director removes the cast member from memory if memory is low, select an option from the Unload pop-up menu. See "Controlling cast member unloading" on page 152.
7. To change the text of the cast member, click Edit.
8. Click the Property inspector's Text or Field tab using the Graphical view.

9 To determine how Director places text within the boundaries of the cast member, select one of the following Framing options:

Adjust to Fit expands the text box vertically when text that is entered extends beyond the current size of the box.

Scrolling attaches a scroll bar to the right side of the text box. This is useful when there is a large amount of text. The scroll bar is drawn direct to Stage, which means that even if another cast member is in front of a cast member that contains a scroll bar, the scroll bar appears in the front.

Fixed retains the original size of the text box. If you enter text that extends beyond the limits of the box, the text is stored but doesn't appear. You can set up scrolling with Lingo (see "Controlling scrolling text with Lingo" on page 290).

Limit to Field Size (available only for field cast members) displays only the amount of text that fits within the field's bounding rectangle.

10 To set editing and display options, select from the following options:

Editable makes the cast member editable while the movie plays (see "Using editable text" on page 283).

Wrap increases the vertical size of the text box or field on the Stage so that all text is visible.

Tab advances the text insertion point to the next editable sprite on the Stage when the user presses Tab.

DTS (Direct to Stage) (text cast members only) makes text display more quickly by rendering it directly to the Stage without composing it with other sprites. Selecting the DTS option prevents other sprites from appearing over the text, and limits the ink options to Copy.

Use Hypertext Styles (text cast members only) makes hypertext links appear the same as in a web browser, initially using blue underlining, and then red after the link has been visited. (See "Creating a hypertext link" on page 282.)

11 To make text of a text cast member appear on the Stage more quickly, select a pre-render option. Pre-rendering controls when text buffers are created.

Without pre-rendering, large amounts of anti-aliased text can take a while to load. This can cause a noticeable delay when the text is displayed for the first time. When a pre-render option is selected, text buffers are created when the current text member is loaded, instead of when the member first appears on the Stage.

Select one of the following pre-render options from the Pre-Render pop-up menu:

None provides no pre-rendering.

Copy Ink optimizes the pre-rendering for Copy Ink (this option renders text more quickly than Other Ink).

Other Ink pre-renders the text for all other ink types.

If you select a pre-render option, you can make text appear on the Stage even more quickly by selecting Save Bitmap. See the next section.

12 To control how Director anti-aliases text for a text cast member, select one of the following Anti-Alias options:

All Text anti-aliases all the text in the text block.

Larger Than anti-aliases only text that is larger than the point size entered in the Points text box.

None turns off anti-aliasing for the current cast member.

Anti-aliasing dramatically improves the appearance of large text, but it can blur or distort smaller text. Experiment with the size setting to get the best results for the font you are using. (See "About anti-aliased text" on page 280.)

13 To control how Director kerns text, select a Kerning option.

Kerning often does not improve the appearance of text at small point sizes. See "About kerning" on page 281.

All Text kerns all the text in the cast member according to the standard kerning table.

Larger Than kerns only text that is larger than the point size entered in the Points text box.

None turns off kerning for the current cast member.

14 To add borders and shadings (field cast members only) select options from the Box Shadow, Border, Drop Shadow, and Margin pop-up menus.

Using the Save Bitmap feature for pre-rendered text

The Save Bitmap feature works with pre-render options to display a buffer image of your text while your user waits for the actual text to load. This feature is useful when you're working with a large amount of anti-aliased text. (The Save Bitmap feature is different from the Convert to Bitmap menu command, which converts a text cast member into a bitmap image.)

You can also use the Save Bitmap feature with pre-render options if you're using special text characters for an audience that is not equipped to display them. For example, using Save Bitmap enables a non-Japanese system to display a text sprite that contains Japanese characters. Using the Save Bitmap option adds to the file size. The feature works with static text but not with editable or scrolling text.

To use the Save Bitmap feature for pre-rendered text:

1 Select the text sprite.

2 On the Property inspector's Text tab, select from the Pre-Render pop-up menu:

- If the text sprite's ink is Copy Ink, select Copy Ink.
- If the text sprite's ink is any type of ink other than Copy Ink, select Other Ink.

For this procedure to work, you must make the correct selection from the Pre-Render pop-up menu. You can determine the Sprite's ink on the Sprite tab of the Property inspector.

3 Select Save Bitmap.

Formatting chunks of text with Lingo

The Director interface lets you format a variety of text characteristics, such as the font, size, style, and line spacing. Using Lingo, you can format text dynamically as the movie plays. You can also use Lingo to rapidly format text during authoring.

Formatting text with Lingo

Lingo can format text in an entire cast member or any specific chunk of text using the following properties. See entries for individual properties in the *Lingo Dictionary*.

- To select or identify a chunk of text in a field cast member, use the `selStart` and `selEnd` cast member properties. These properties identify the first and last characters of a text selection.
- To refer to a selected chunk of text, use the `selection` cast member property.
- To specify the font for a text cast member, field cast member, or chunk expression, set the `font` cast member property.
- To specify the character size for a text cast member, field cast member, or chunk expression, set the `fontSize` property.
- To specify the line spacing for a field cast member, set the `lineHeight` property.
- To specify the style for a text cast member, field cast member, or chunk expression, set the `fontStyle` property.
- To specify the drop shadow size for the characters in a field cast member, set the `boxDropShadow` property.
- To specify additional spacing to be applied to a chunk expression in a text cast member, set the `charSpacing` property.
- To specify the foreground color for a field cast member, set the `foreColor` property.

Applying paragraph formats with Lingo

Lingo can control paragraph formatting such as alignment and indenting for a chunk expression. See entries for individual properties in the *Lingo Dictionary*.

- To set text alignment for a text or field cast member, set the `alignment` property.
- To set line spacing in points for a text cast member, set the `fixedLineSpace` property.
- To add pixels below paragraphs in a text cast member, set the `bottomSpacing` property.
- To add pixels above paragraphs in a text cast member, set the `topSpacing` property.
- To specify line spacing in a field cast member, set the `lineHeight` property.
- To add pixels to the first indent in a chunk expression in a text cast member, set the `firstIndent` property.
- To set the left indent (in pixels) of a chunk expression in a text cast member, set the `leftIndent` property.
- To set the right indent (in pixels) of a chunk expression in a text cast member, set the `rightIndent` property.
- To specify or obtain a list of tabs that are in a chunk expression in a text cast member, set or test the `tabs` property.

Formatting text or field cast members with Lingo

In addition to formatting text in any chunk expression, Lingo can specify anti-aliasing and kerning for an entire text cast member and control the appearance of the text's bounding rectangle.

Setting anti-aliasing and kerning with Lingo

You can use Lingo to specify anti-aliasing and kerning for a text cast member. See entries for individual properties in the *Lingo Dictionary*.

- To specify whether Director anti-aliases text in a text cast member, set the `antiAlias` cast member property.
- To specify the size at which anti-aliasing in a text cast member takes effect, set the `antiAliasThreshold` cast member property.
- To specify automatic kerning for a text cast member, set the `kerning` cast member property.
- To specify the size at which automatic kerning for a text cast member takes effect, set the `kerningThreshold` cast member property.

Formatting text boxes with Lingo

Lingo can specify the type of box that surrounds a text or field cast member. For field cast members, Lingo can also specify box characteristics such as borders, margins, drop shadows, and height. See entries for individual properties in the *Lingo Dictionary*.

- To specify the type of box around a text or field, set the `boxType` cast member property.
- To specify the size of the border around a field, set the `border` field cast member property.
- To specify the size of the margin inside a field's box, set the `margin` field cast member property.
- To specify the size of the drop shadow for a field's box, set the `boxDropShadow` field cast member property.
- To specify the height of a field's box on the Stage, set the `pageHeight` field cast member property.

Setting text autotabbing and wrapping with Lingo

Lingo can set text autotabbing and wrapping. See entries for individual properties in the *Lingo Dictionary*.

- To specify autotabbing for text or field cast members, set the `autoTab` cast member property.
- To specify whether lines wrap in a field cast member, set the `wordWrap` cast member property.

Controlling scrolling text with Lingo

Lingo can scroll text and determine the location of specific text within the text box for text and field cast members. For example, this statement sets the `scrollTop` value for the text cast member called Discussion to 0, which makes its first line appear at the top of its scrolling field:

```
(member "Discussion").scrollTop = 0
```

This procedure can be useful for making a scrolling field automatically scroll back to the top. For more information on the following properties, see individual entries in the *Lingo Dictionary*.

- To scroll up or down by a specific number of pages in a text or field cast member, use the `scrollByPage` command.
- To scroll up or down by a specific number of lines in a text or field cast member, use the `scrollByLine` command.
- To determine the number of lines that appear in a field cast member on the Stage, set the `lineCount` cast member property. (This property doesn't apply to text cast members.)
- To determine a line's distance from the top edge of a text or field cast member, use the `linePosToLocV()` function.
- To determine the number of the line that appears at a specific vertical position in a text or field cast member, use the `locVToLinePos()` function. (This measures the distance from the top of the cast member, not what appears on the Stage.)
- To determine the point in a text or field cast member that is closest to a specific character, use the `charPosToLoc()` function.
- To determine the character that is closest to a specific point in a text or field cast member, use the `locToCharPos()` function.
- To check or set the distance from the top of the line that is currently visible to the top of the box for a scrolling field or text cast member, test or set the `scrollTop` cast member property.

Checking for specific text with Lingo

The Lingo operators `contains` and the equals symbol (=) are useful for checking strings. The `contains` operator compares two strings to see whether one string contains the other. The equals symbol operator can determine whether a string is exactly the same as the contents of a field cast member. Use these operators to check whether a specified string is in a field cast member. See `contains` in the *Lingo Dictionary*.

You can also use Lingo to evaluate strings returned by the `text` property of a text or field cast member. See `text` in the *Lingo Dictionary*.

Modifying strings with Lingo

As time passes or other conditions change, you might want to update and change text. For example, you might want to frequently update a text sprite that displays the user's name or a description of a musical selection that the user is currently streaming from a website. See individual entries in the *Lingo Dictionary*.

- To set the entire content of a text or field cast member, set the `text` cast member property to a new chunk of text. The chunk can be a string or another text cast member.
- To combine character strings, use the `&` and `&&` operators. The `&` operator attaches the second string to the end of the first string. The `&&` operator includes a space between two strings when they are combined.
- To insert a string of characters into another string, use the `put...after`, `put...into`, or `put...before` command. The `put...before` command places the string at the beginning of another string. The `put...into` command replaces a specified chunk expression with another chunk expression. The `put...after` command places the string at the end of another string.
- To delete a chunk expression from a string of text, use the `delete` command.

CHAPTER 11
Using Flash and Other Interactive Media Types

To add complex media and new capabilities to your Macromedia Director MX movie, you can use Macromedia Flash movies, other Director movies, and ActiveX controls. Each of these multimedia formats has interactive capabilities that are preserved by Director.

A Flash movie in a Director movie provides a vector-based, scalable, interactive animation that is optimized for use on the web.

Director movies within other Director movies simplify complex productions. A linked movie appears within another movie as a single cast member, saving you the trouble of managing extra cast members and Score data. Using discrete movies also helps you manage file size for easier downloading.

ActiveX controls in Director can manage ActiveX application resources from within a movie. ActiveX controls provide a variety of features, including web browsing, spreadsheet functions, and database management. ActiveX controls function as normal sprites in a movie. ActiveX controls work only in Director for Windows and only in projectors.

Using Flash Movies

You can incorporate Flash vector-based animation in your Director movies, projectors, and Macromedia Shockwave movies for the web simply by importing a Flash movie into Director and using it like any other cast member. Effects that once required multiple versions of a bitmap cast member—such as blending one shape into another—can now be accomplished with a single, small Flash movie.

Director can import Flash 2 files or later. It supports the new features of Macromedia Flash MX, including access to Flash Communication Server MX.

In Director, you can control nearly every Flash movie property—including playing, rewinding, and stepping forward and backward through any Flash movie, adjusting quality settings, and turning sound on or off—using Lingo commands.

In Flash, you can create cross-platform Windows and Macintosh movies and then play or manipulate them in Director. You can create Flash movies that communicate with your Director movie by sending events that Director scripts can capture and process. You can store entire Flash movies in the Director cast file, or you can link to external Flash movies. Director automatically loads the Flash movie it encounters in the Score into memory from disk, from a network drive, or from anywhere on the Internet.

Flash movies are particularly effective for use in Shockwave movies because, as vector-based media, they are extremely small and therefore load much more quickly than most other media types. Because Flash movies are vector-based, you can scale and rotate them while still maintaining their sharpness. For example, you can create splash screens for your Shockwave movies that load quickly and entertain your users while the rest of the Director movie streams into memory, or you can create interactive maps in Flash that users can pan across or zoom in on to reveal details with vector-based precision. However, because each Flash sprite on the Stage loads its own instance of the Flash Asset Xtra, performance can slow as the number of Flash sprites increases.

Adding a Flash movie cast member

All Flash cast members added to a Director movie must have been created with Flash 2.0 or later and saved in the Flash format (SWF).

The following procedure explains how to create a Flash cast member and set properties for it at the same time. You can also import a cast member by using the Import command or by dragging and dropping a SWF file to the Director Cast window.

To add a Flash movie as a cast member:

1. Select Insert > Media Element > Flash Movie.
2. In the Flash Asset Properties dialog box, select the Flash movie (SWF) file you want to add to your Director cast.

- To add a file from your computer or from a network drive, click Browse, select the file, and click Open. Director creates a relative link to the file, so it must maintain the same location relative to the Director file, or the link will become invalid.
- To add a file from a location on the Internet, click Internet, type the URL of the file, and click OK.
- Type the pathname or the URL of the file in the Link File box.

3. Set Media options:

Linked leaves the actual media of the Flash movie stored in an external file. When a sprite created with this cast member appears on the stage in a Director movie, Director will automatically load the file into memory by looking in the location specified in the Link File box. Deselect Linked to have Director copy the Flash movie into the cast.

Preload requires Director to load the entire Flash movie into memory before playing the movie's first frame. Deselect Preload to have Director start playing the movie immediately, while continuing to stream the cast member into memory. This option is only available if you selected Linked. If the Flash file is internal instead of linked, it must load completely into memory before beginning to play.

4 Select Playback options to control how a Flash movie sprite plays in a Director projector, in a Shockwave movie, and while you are authoring in Director:

Image displays the image of the Flash movie when it plays. When Image is deselected, the Flash movie is invisible.

Sound enables any sound in the Flash movie to play. When Sound is deselected, the movie plays without sound.

Paused displays only the first frame of the movie without playing the movie. When Paused is deselected, the movie begins playing immediately when it appears on the Director Stage.

Loop makes the movie play again from frame 1 once it finishes. When Loop is deselected, the movie plays once and stops.

Direct to Stage displays the movie when it appears on the stage with the fastest, smoothest playback. Deselect Direct to Stage to have Director apply ink effects and perform compositing of the sprite with other sprites in a memory buffer before actually displaying it. The disadvantage of the Direct to Stage option is that the movie always appears on top of other sprites, regardless of the channel in which it appears in the Score, and ink effects don't work.

5 Specify a Scale value by typing the percentage to scale the cast member.

6 Specify a Quality value:

- Select a high-quality setting to have the Flash movie play with anti-aliasing turned on, which slows down performance; select Auto-High to have Director start playing the movie with anti-aliasing on but turn it off if it can't play the movie at the required frame rate.
- Select a low-quality setting to turn off anti-aliasing but speed up performance; select Auto-Low to have Director start playing the movie without anti-aliasing but turn on anti-aliasing if it can do so and continue playing the movie at the required frame rate.

7 Select a Scale Mode value to control how the Flash movie's sprites are scaled on Stage:

Show All maintains the movie's aspect ratio and, if necessary, fills in any gaps along the horizontal or vertical dimension using the movie's background color.

No Border maintains the movie's aspect ratio by cropping the horizontal or vertical dimension as necessary without leaving a border.

Exact Fit stretches the movie to fit the sprite exactly, disregarding the aspect ratio.

Auto-Size adjusts the sprite's bounding rectangle to fit the movie when it is rotated, skewed, or flipped. This option always sets the scale to 100% in the Director score.

No Scale places the movie on the Stage with no scaling. The movie stays the same size no matter how you resize the sprite, even if it means cropping the movie.

8 Select a Rate value to control the tempo at which Director tries to play the Flash movie:

Normal plays the Flash movie at the tempo stored in the Flash movie.

Fixed plays the movie at a rate you specify by typing a value in the entry box.

Lock-Step plays a frame of the Flash movie for each Director frame.

Note: A Flash movie will not play faster than the frame rate set in the Director movie.

9 When you have finished selecting options, click OK.

Director adds the Flash movie to the cast.

Note: You can also use Lingo extensions to adjust these and other properties of the Flash movie. See "Controlling a Flash movie with Lingo" on page 297.

About using a Flash movie in a Director movie

Once you have added a Flash movie to the Director cast, using it in your movie is as simple as dragging it to the stage and positioning it where you want it. You can then use the Flash movie sprite in much the same way that you use other sprites.

When working with a Flash movie on the Stage, keep these points in mind:

- A Flash movie's animation plays only as long as the Flash movie's sprite is actually on the Stage. (Flash movies resemble digital video and sound sprites in this regard.)
- Because a Flash movie uses a vector graphics format, you can stretch the movie's sprite without loss of the movie's clarity.
- You can rotate, skew, scale, or flip a Flash movie just as you would a vector shape or bitmap.
- If the movie is set up to play direct-to-Stage, the movie will always appear on top of other sprites, regardless of the channel in which it is placed, and ink effects will be ignored.
- Only the Copy, Transparent, Background Transparent, and Blend ink effects work with Flash movies, and only when the sprite is not played Direct-to-Stage.
- Blend and color settings are supported for Flash sprites just as they are for vector shapes.

Editing a Flash cast member

If you have Macromedia Flash MX installed, you can launch the Flash authoring tool from within Director to edit your Flash cast members.

To edit a Flash cast member, do one of the following:

- Double-click the Flash cast member in the cast or a Flash sprite in the Score or on the Stage.
- Select Edit > Launch External Editor while a Flash cast member is selected.

If Flash MX is installed and the Flash source file (FLA) is specified in the Property inspector, Flash MX launches with the source file open for editing, and changes are immediately reflected in Director when the Flash file is saved in Flash. If the source file is not specified in the Property inspector, a file dialog box appears so you can locate the source file. If Flash MX is not installed, the Flash properties dialog box opens instead.

To specify a source file (FLA) path for a SWF cast member before initiating a launch and edit session:

1 Select the SWF cast member in the cast.

2 Open the Property inspector.

3 Select the Flash tab.

4 Enter the path in the Filename field or Click the Browse button to browse to the file.

If you install Flash MX before installing Director, Flash is added to the list of external editors automatically when you install Director. If you install Flash MX after installing Director, you can enable Flash launch and edit by adding Flash MX to the list of external editors.

To add Flash MX to the list of external editors:

1. Select Edit > Preferences > Editors.
2. Select Flash, and click Edit.
3. Select Use External Editor, and click Browse.
4. Browse to the location of your Flash MX application.
5. Select the Flash application file, and click Open.
6. Click OK, and then click OK again.

Flash MX will now launch when you double click a Flash cast member.

Controlling a Flash movie with Lingo

Lingo gives you precise control over the way Director streams and displays a Flash movie. You can use Lingo to check and control member streaming, zoom and colorize the Flash asset, and pan the Flash image.

When a movie is playing, Lingo can change the Flash cast member's properties. Some cast member properties, such as the `flashRect` and `frameRate` cast member properties, are valid only after the Flash movie's header has streamed into memory.

Director provides the following Lingo that lets you manage how Director uses a Flash movie. For more information, see the *Lingo Dictionary*.

- To control whether changes to a Flash movie cast member immediately appear in sprites that use the cast member, set the cast member's `broadcastProps` property.
- To control whether a Flash movie is stored in an external file, set the `linked` property.
- To control which frame of a Flash movie Director uses for the Flash movie's thumbnail image, set the `posterFrame` property.
- To display a list of a Flash movie's current property settings in the Message window, use the `showProps` command.

Controlling a Flash movie's appearance with Lingo

Lingo can control how a Flash movie appears on the Stage and which part of the Flash movie appears in its sprite's bounding rectangle. Lingo can also skew, rotate, scale, and flip the Flash movie.

Director supports only the Copy, Transparent, Background Transparent, and Blend inks for Flash sprites, and only when the sprite is not played Direct-to-Stage.

Flipping, rotating, and skewing Flash sprites

Lingo can flip, rotate, and skew Flash sprites as the movie plays. For more information, see the *Lingo Dictionary*.

- To flip a Flash sprite, set the `flipH` and `flipV` sprite properties.
- To skew a Flash sprite, set the `skew` sprite property.
- To rotate a Flash sprite, set the `rotation` property. Set the `obeyScoreRotation` property to specify whether a Flash sprite obeys the rotation specified in the Score.

  If `obeyScoreRotation` is set to `TRUE`, Director ignores the cast member's `rotation` property and obeys the Score rotation settings instead.

Colorizing and blending Flash sprites

You can use Lingo to change a sprite's color and blend as the Director movie plays. For more information, see the *Lingo Dictionary*.

To specify the color of a Flash sprite:

- Set the `color` sprite property.

To specify the blend for a Flash sprite:

- Set the `blend` sprite property.

Scaling Flash movies

You can use Lingo to scale Flash cast members and sprites. For more information, see the *Lingo Dictionary*.

To control the scaling of a Flash movie:

- Set the `scale` and `scaleMode` properties.

To set the scale percentage of a Flash movie within its sprite's bounding rectangle:

- Set the `viewScale` property.

Obeying a Flash movie's cursor settings

Flash movies can be designed to use different cursors depending on which part of the Flash movie the mouse pointer is rolled over. To allow a Flash sprite to use the cursor settings defined in the Flash movie, attach the Flash Cursor behavior to the Flash sprite.

To write your own Lingo to test the cursor settings of the Flash movie, use the `getFlashProperty()` function and test for the `#cursor` property.

Controlling a Flash movie's bounding rectangle and registration points

You can use to Lingo to control a Flash movie's bounding rectangle and to set a Flash movie's registration points. For more information, see the *Lingo Dictionary*.

- To control which part of a Flash movie appears within its sprite's bounding rectangle, set the `viewH`, `viewpoint`, `viewScale`, and `viewV` properties.
- To control the default size for all new Flash sprites, set the `defaultRect` property. Use the `defaultRectMode` property to control how the default size is set.
- To determine the original size of a Flash cast member, test the `flashRect` property.
- To specify a Flash movie's registration point around which scaling and rotation occurs, set the `originH`, `originMode`, `originPoint`, and `originV` properties.
- To center a Flash cast member's registration point after resizing the cast member, set the `centerRegPoint` property to `TRUE`.

Placing Flash movies on the Stage

Lingo can set whether a Flash movie appears at the front of the Stage and whether specific areas of a Flash movie and the Stage overlap. For more information, see the *Lingo Dictionary*.

- To determine whether a Flash movie plays in front of all other layers on the Stage and whether ink effects work, set the `directToStage` property.
- To determine which Stage coordinate coincides with a specified coordinate in a Flash movie, use the `flashToStage()` function.
- To determine which Flash movie coordinate coincides with a specified coordinate on the Director Stage, use the `stageToFlash` function.
- To improve performance for a Director movie that uses a static (not animated) Flash movie, set the `static` property.
- To control whether a Flash movie's graphics are visible, set the `imageEnabled` property.
- To control whether a Flash movie plays sounds, set the `sound` property.
- To control whether Director uses anti-aliasing to render a Flash movie, set the `quality` property.

Streaming Flash movies with Lingo

In addition to the Lingo that lets you stream many of the Director media types, Director offers Lingo that specifically lets you control and monitor streaming Flash movies. For general information about using Lingo to stream media in Director, see Chapter 27, "Using Shockwave Player," on page 591. For more information on specific Lingo functions and commands, see the *Lingo Dictionary*.

- To specify whether a linked movie streams or not, set the `preLoad` property.
- To specify how much of a Flash cast member streams into memory at one time, set the `bufferSize` cast member property.
- To check how many bytes of a Flash movie have streamed into memory, test the `bytesStreamed` property.
- To determine how much of a Flash movie is currently streamed, test the `percentStreamed` property or check the `streamSize` function.
- To set when Director attempts to stream part of a Flash movie, set the `streamMode` property.
- To clear an error setting for a streaming Flash movie, use the `clearError` command.
- To determine whether an error occurred while streaming a Flash movie, use the `getError()` function.
- To check the current state of a streaming file, test the `state` property.
- To attempt to forcibly stream a specified number of bytes of a Flash movie, use the `stream` command.

Playing back Flash movies with Lingo

Lingo lets you control how a Flash movie plays back and whether the Flash movie retains its interactivity.

Controlling Flash movie playback with Lingo

You can use Lingo to control a Flash movie's tempo, to specify which frame plays, and to start, stop, pause, and rewind the Flash movie. For more information, see the *Lingo Dictionary*.

- To control the tempo of a Flash movie, set the `fixedRate` and `playBackMode` properties.
- To determine the original frame rate of a Flash movie, test the `frameRate` property.
- To determine the number of frames in a Flash movie, test the `frameCount` property.
- To determine the frame number associated with a label in a Flash movie, use the `findLabel()` function.
- To play a Flash movie starting from a specified frame, set the `frame` property or use the `goToFrame` command.
- To set whether a Flash movie starts playing immediately when the Flash sprite appears on the Stage, set the `pausedAtStart` property.
- To check whether a Flash movie is playing or paused, test the `playing` property.
- To rewind a Flash movie to frame 1, use the `rewind sprite` command.
- To stop a Flash movie at its current frame, use the `stop` command. .

- To stop a Flash movie at its current frame but let any audio continue to play, use the `hold` command.
- To specify a separate timeline within a Flash cast member as the target of subsequent Lingo sprite commands, use the `tellTarget()` and `endTellTarget()` commands.
- To call a series of actions that reside in a frame of a Flash movie sprite, use the `callFrame()` command.

Controlling Flash movie interactivity with Lingo

Lingo can control whether a Flash movie remains interactive. For more information, see the *Lingo Dictionary*.

- To control whether the actions in a Flash movie are active, set the `actionsEnabled` property to `TRUE`.
- To control whether buttons in a Flash movie are active, set the `buttonsEnabled` property.
- To control when a Flash movie detects mouse clicks or rollovers, set the `clickMode` property.
- To control whether clicking a button in a Flash movie sends events to sprite scripts, set the `eventPassMode` property.
- To determine which part of a Flash movie is directly over a specific point on the Stage, use the `hitTest` function.
- To check whether the mouse pointer is over a button in a Flash movie, test the `mouseOverButton` property.

Using Lingo to set and test Flash variables

Two sprite functions exist to support access to ActionScript variables in Flash sprites: `getVariable()` and `setVariable`(). For more information, see the *Lingo Dictionary*.

- To return a string that contains the current value of a Flash sprite variable, use the following statement:

  ```
  spriteReference.getVariable( "variableName", TRUE)
  ```

  The parameter `TRUE` is the default, and is therefore optional.

- To return a reference to the value of a Flash variable instead of the variable's literal value, add a value of `FALSE` to the end of the command. This lets you get or set the value of the variable simply by using the reference.

  ```
  myVariableReference = spriteReference.getVariable( "variableName", FALSE)
  ```

  Once you have created the reference to the variable, you can test it with the following statement:

  ```
  put myVariableReference
  -- value
  ```

- To set the current value of a Flash sprite variable to a specified string, use the following statement:

  ```
  spriteReference.setVariable( "variableName", "newValue" )
  ```

  Note: Be sure to pass the Flash variable's name and value as strings in both the `getVariable()` and `setVariable()` functions. Failure to do so will result in script errors when the functions are executed.

In previous versions of Director, there were only three possible return values for this function: `#background`, `#normal`, and `#button`. In Director 8.5 and later, there is a fourth return value possible: `#editText`. This value indicates that an editable text field within the Flash sprite is over the specified location. See `getVariable()`, `setVariable()`, and `hitTest()` in the *Lingo Dicitonary*.

Sending Lingo instructions from Flash movies

A Flash movie can send Lingo instructions to a Director movie. (Flash 2 movies do not support this feature.) The Lingo can determine how the movie responds when the user clicks a button or the Flash movie enters a frame. In Flash, you can send a string to Lingo with a Flash `on getURL` handler. The string can be an event message, a complete Lingo statement or a simple string such as `"Hello Tom"`.

In Flash, you create a button or frame and then assign it a Get URL action in which you specify the Lingo that the Flash cast member sends.

To set up a Flash movie to generate an event:

1. In Flash, select a button.
2. Select Window > Actions.
3. In the Actions pane, click the Actions tab and select Browser/Network > getURL.
4. Double-click the getURL action to add it to the button instance.
5. In the URL field, enter the Lingo that you want Flash to send to the movie.
6. In the Window field, enter the name of the window you want the result to be displayed in.

- To specify a string to pass to an `on getURL` handler in the Director movie, enter the string. In Director, include an `on getURL` handler that receives the string from the Flash movie and reads the string as a parameter.

  For example, in Flash, you can specify this in the Network URL field:

  ```
  Dali
  ```

  In Director, you can write this handler:

  ```
  on getURL me stringFromFlash
    go to frame stringFromFlash
  end
  ```

  When the `on getURL` handler receives the text string (“Dali”), it reads the string and then jumps to the frame labeled Dali in the Director Score.

- To specify an event message, specify the word `event` followed by a colon, the name of a handler you will write in Director, and a parameter (if any) to pass along with the event.

  For example, in Flash, you can specify this in the Network URL field:

  ```
  event: FlashMouseUp "Dali"
  ```

  In Director, you write this handler:

  ```
  on FlashMouseUp me whichFrame
    go to frame whichFrame
  end
  ```

  When the Director script receives the `FlashMouseUp` message and the `whichFrame` parameter, the movie jumps to the frame specified by `whichFrame`, which is the frame "Dali".

- To specify a Lingo statement, specify the word `lingo`, followed by a colon, followed by the Lingo statement that you want Director to execute.

  For example, in Flash, you can specify this in the Network URL field:

  ```
  lingo: go to frame "Dali"
  ```

  When Director receives the `getURL` message from the Flash movie, the movie immediately executes the Lingo statement. In this case, the movie jumps to the frame containing the marker "Dali".

- To send XML data from a Flash sprite or a global Flash object to Lingo, use the *`XMLobject`*`.send` ActionScript method. It includes the parameters `URL` and `targetWindow`. Then include an `on sendXML` handler in your Lingo. This handler takes the same parameters, as follows:

  ```
  on sendXML me, URL, targetWindow, xmlData
  ```

  The `xmlData` parameter is the XML data contained in the original *`XMLObject`*. You can then add Lingo to the handler to process the XML data. A common action is to send the XML data to the URL and await the response of the server located at the URL, as in this example:

  ```
  on sendXML me, URL, targetWindow, xmlData
    gotoNetPage URL, targetWindow
    postNetText(URL, xmlData)
  end
  ```

You can place handlers to capture events from Flash movies in a Flash sprite or cast member script or in a frame or movie script. The event follows the normal Director message hierarchy.

Using Flash objects in Lingo

With Director MX, you can create Flash ActionScript objects and access all of their properties and methods. You can create a wide variety of Flash objects, including arrays, dates, Booleans, XML objects, and net connection objects for use with Flash Communication Server MX. If you have authored a Flash movie that contains ActionScript classes that generate custom objects, you can access those objects in Lingo as well. You can also create references to existing ActionScript objects with the `getVariable()` command. For more information on accessing these objects, see "Using Lingo to set and test Flash variables" on page 301.

When creating Flash objects, you can choose to create an object within a Flash sprite, or you can create a global Flash object.

- To create a Flash object within a Flash sprite, you must have a Flash movie in the cast and a Flash sprite on the Stage. Do not use a Flash cast member created with the Lingo command `new(#Flash)`, as this will only create a Flash cast member shell, which will contain no actual internal Flash data. When you create a Flash object within a sprite, the object uses the same instance of the Flash player that Director loads when the Flash cast member appears on the Stage.

  In your Lingo script, use the `newObject()` method with a sprite reference. If the object you want to create requires parameters, include them with the `newObject()` command:

  ```
  myNewFlashObject = sprite(1).newObject("Array", "apple", "orange", "banana")
  ```

  In this example, the specified sprite, `sprite(1)`, is the Flash sprite. The object is an array. (In Lingo, arrays are called lists.) The array contains three strings: `"apple"`, `"orange"`, and `"banana"`.

- To create a global Flash object, use the `newObject()` command without a sprite reference. When you do this, Director loads a special instance of the Flash Player into memory. This way, you can use Flash objects without the need for a Flash cast member or sprite.

  In your Lingo, use the `newObject()` command without a sprite reference:

  ```
  myNewFlashObject = newObject("Array", "apple", "orange", "banana")
  ```

Because Director loads an instance of the Flash Player when you first create a global Flash object and each time you create a Flash sprite, you should avoid doing both in the same movie. This causes an extra instance of the Flash Player to be loaded into memory, which can slow your movie's performance.

Note: If you do not import any Flash cast members, you must manually add the Flash Asset Xtra to your movie's Xtra list for global Flash objects to work correctly in Shockwave and projectors. For more information about the movie Xtra list, see Managing Xtra extensions for distributed movies.

The `newObject()` command creates the object you specify and a reference to it. In the preceding examples, the object is an array and the reference is stored in the variable named `myNewFlashObject`. The first parameter included with the `newObject()` command is the type of object to create. The subsequent parameters are the values to put into the array. In this case the values are a list of names of fruit.

- To access a property of the object, such as the array's length, you only need to refer to the property as a property of the object reference you created:

```
put myNewFlashObject.length
-- 3
```

- To access a part of the object, such as the value of the third item in the array, use the following syntax:

```
put myNewFlashObject[2]
-- "banana"
```

Note: The items in an ActionScript array are numbered beginning with zero, while the items in a Lingo list are numbered beginning with one. Be sure to use the correct number when referring to items in arrays or lists.

- To access a method of the object, use the same syntax and specify the method name after the object reference:

```
myNewFlashObject.sort()
```

For more information about the types of objects supported by Flash and the methods and properties used to control them, see the Flash documentation.

Setting callbacks for Flash objects

Some kinds of Flash objects generate events that need to be routed to an appropriate Lingo handler. For example, a Flash Communication Server connection object generates an event each time an incoming message is received from the server. You can tell Lingo to route events like this to a specific handler in a specific Lingo script object by using the `setCallback()` command.

- To set up a callback for an event from a Flash object, use Lingo similar to this:

```
myConnection = sprite(1).newObject("NetConnection")
sprite(1).setCallback(myConnection, "onStatus", #dirOnStatusHandler, me)
```

In the first line of this example, a new `netConnection` object is created along with a reference to it named `myConnection`. The second line tells Lingo to call the handler named `dirOnStatusHandler` whenever the `myConnection` object generates an `onStatus` event. The argument `me` indicates that the handler is located in the same script object that the `setCallback()` command is being issued in. In this case that script object is attached to sprite 1.

The callback handler could look like the following:

```
on dirOnStatusHandler (me, aInfoObject)
  if (aInfoObject[#level] = "error") then
    member("chat input").text = "Error sending last message."
  end if
end
```

Using the Flash local connection object

Macromedia Flash MX includes an object type called local connection. The Flash local connection object can be very useful for allowing separate movies on the same computer to connect to and communicate with each other. Because the local connection object is a Flash object supported in Director, it can allow communication between separate Flash movies, Director movies, or combinations of the two. You can use the messaging capability of the local connection object for simple tasks such as exchanging chat messages, or more complex ones such as exchanging sprite property data.

To use the local connection object, you can either create a global local connection object or associate the object with a Flash sprite in the Score. Once you have created the object, you can control it entirely through Lingo. The following are examples of a script that is attached to a Flash sprite in channel 1 of the Score. The script contains a `beginSprite` handler and other handlers that manage the local connection object.

Initialize properties

The first thing to do is declare some properties that you will use throughout the local connection script to store references to the local connection object and 2 connections, one outgoing and one incoming.

- The property `pCon_name` stores the name of an outgoing connection
- The property `pOtherCon_name` stores the name of an incoming connection
- The property `pLocalCon` stores a reference to the local connection object

The beginning of the script might look like this, including the start of the `beginSprite` handler:

```
property pCon_name
property pOtherCon_name
property pLocalCon

on beginSprite (me)
  pCon_name = "userA"
  pOtherCon_name = "userB"
```

Creating the local connection object

The next step is to create a new local connection object. Once the object is created, you can use the `setCallback()` command to set up handlers to respond to the events the local connection object generates. You can then also use the methods of the local connection object to connect to other movies and send messages.

- To create the new local connection object, use the `newObject()` command:

  ```
  pLocalConn = sprite(1).newObject("LocalConnection")
  ```

  This Lingo assigns the property `pLocalConn` to be a reference to the newly created object.

Setting up callbacks

The next step is to set up callback handlers with the `setCallback()` command. You should set up a callback for each event you expect the object to generate. Local connection objects generate `onStatus` and `allowDomain` events, as well as an event for each incoming message received. These incoming message events are named by the string that is passed as the subject, or first parameter, of the message.

To set up each callback, use the `setCallback()` command and include the name of the local connection object, the name of the event to respond to, the Lingo handler name, and the Lingo script object that contains the handler as arguments with the command.

To set up localConnection callbacks:

1. Set up the `onStatus` callback. An `onStatus` event is generated each time a message is sent by the local connection object and contains information about the success or failure of the send operation.

   ```
   sprite(1).setCallback(pLocalConn, "onStatus", #myOnStatus, me)
   ```

   This Lingo statement sets a callback for the event named `onStatus` generated by the object `pLocalConn`. The Lingo handler name is `myOnStatus` and the Lingo script object that contains it is the same script object that contains this `setCallback()` command, referred to as `me`. Note the quotes around the event name and the pound sign (#) preceding the handler name. The pound sign converts the handler name to a symbol.

   The actual callback handlers, such as the `myOnStatus` handler, are illustrated later in this section.

2. Set up the `allowDomain` callback. An `allowDomain` event is generated each time the local connection object receives an incoming message.

   ```
   sprite(1).setCallback(pLocalConn, "allowDomain", #myAllowDomain, me)
   ```

   In this case, the event name is `AllowDomain` and the handler name is `myAllowDomain`.

   If the `myAllowDomain` handler determines that the message is coming from an allowed domain, an event named with the message subject is generated. When a movie is running from a user's computer and not in a browser, the domain is `localHost`. When the movie is running in a browser, the domain is determined by the server that hosts the movie, such as macromedia.com. For more information about allowing domains, see the Flash Communication Server MX documentation.

3. Set up the callback for these user-defined messages. Decide what string you want to use as your message subjects, so that you know what the event name will be. In the following example, the user-defined message subject and event name are `incomingMessage`:

   ```
   sprite(1).setCallback(pLocalConn, "incomingMessage", #myIncomingMessage, me)
   ```

Writing callback handlers

Now the callbacks are set up. In order for them to work, however, you must write the callback handlers themselves. While the `setCallback()` commands are all inside a `beginSprite` handler in this example, the callback handlers must be outside the `beginSprite` handler because they are handlers by themselves. In this example, the callback handlers are located in the same Lingo script attached to the Flash sprite, just after the `beginSprite` handler.

The `onStatus` event is generated each time the local connection object sends an outgoing message. The `myOnStatus` handler might look like this:

```
on myOnStatus (me, aInfoObject)
  if (aInfoObject[#level] = "error") then
    member("chat input").text = "Error sending last message."
  else
    member("chat output").text = member("chat output").text & RETURN & \
      member("chat input").text
  end if
end myOnStatus
```

Two arguments are passed with the `onStatus` event by the local connection object. The `me` argument tells Lingo that the event was generated on the same Lingo script object that contains the `myOnStatus` handler. The `aInfoObject` argument contains a Flash array object containing information about the status of the message sending operation. The handler checks to see if the `aInfoObject` argument contains an error. In this example, if there is an error, an error message is displayed in a chat input field. If no error occurs, a text output field is updated with the contents of the chat input field. For more information about the Flash `infoObject`, see the Flash Communication Server MX documentation.

The `allowDomain` event is generated each time the local connection object receives an incoming message. This provides an opportunity for the `myAllowDomain` callback handler to determine whether the message is coming from a trusted domain. The `myAllowDomain` callback handler must return `TRUE` in order for the incoming message to be processed.

The `myAllowDomain` handler might look like this:

```
on myAllowDomain (me, aSendingDomain)
  if aSendingDomain = "myDomain.com" then
    return TRUE
  else
    member("chat output").text = & RETURN & "Message received from \
    unapproved domain."
    return FALSE
  end if
end myAllowDomain
```

The handler checks that the domain is the one that is expected, and returns TRUE if it is. If the message comes from another domain, the return value is FALSE.

Once the `allowDomain` callback has returned `TRUE`, the local connection object forwards the incoming message to the callback handler set up for the event. In this example, the subject of the message is `incomingMessage` and the callback handler is `myIncomingMessage`.

The `myIncomingMessage` handler might look like the following:

```
on myIncomingMessage (me, aObject, aMessage)
  member("chat output").text = & RETURN & aMessage
end myIncomingMessage
```

This handler simply appends the incoming message `aMessage` to the end of a chat output field.

Sending messages and closing the connection

In order to complete your script, you must finish the `beginSprite` handler and write handlers for sending messages from the object and closing the connection when you are finished using it.

- To finish the `beginSprite` handler that already contains the `newObject()` command and all the `setCallback()` commands, you must add a `connect()` command. This is actually a Flash ActionScript command that you send to the local connection object you created.

  ```
  pLocalConn.connect(pCon_name)
  ```

  The argument `pCon_name` gives the actual connection a name, "userA", that was declared at the beginning of the script.

- To send messages, write a handler that uses the `send()` method of the local connection object:

  ```
  on sendMessage (me, aMessage)
    tMessage = pCon_name && ":" && aMessage
    pLocalConn.send(pOtherCon_name, "incomingMessage", tMessage)
  end sendMessage
  ```

  The `send()` method requires three arguments: the recipient of the message, the event to be triggered when the message is received, and the message itself.

- To close the connection, write a handler that uses the `close()` method of the local connection object:

  ```
  on closeConnection (me)
    pLocalConn.close()
  end closeConnection
  ```

  You can call this handler from any other handler by using the statement:

  ```
  sendSprite (1, #closeConnection)
  ```

  You might also use the `close()` method in an `endSprite` handler:

  ```
  on endSprite (me)
    pLocalConn.close()
  end endSprite
  ```

Now that the local connection object is set up and it has handlers for callbacks, sending messages, and closing the connection, it is ready to be used by the movie.

Using Flash Communication Server MX

Macromedia Flash Communication Server MX allows Flash movies on separate computers to share information, including sound, video, text and other data in real time. You can use Flash Communication Server MX in Director by using Flash cast members that are designed to work with the server, or by creating `NetConnection` and `NetStream` objects in Lingo that you use to communicate with the server.

As with any Flash ActionScript object you create in Lingo, you use the exact same commands and properties to manipulate the object as you would in ActionScript. For a detailed example, see the previous section. The Director MX installation CD for Windows includes Flash Communication Server MX Personal Edition, the Flash Communication Server MX authoring components for Flash MX, and documentation. The Director MX installation CD for Macintosh includes the Flash Communication Server MX authoring components for Flash MX and documentation. For specific information about the `NetConnection` and `NetStream` objects and how to connect to the FlashCom server, refer to the Flash Communication Server MX documentation.

The steps required to communicate with Flash Communication Server MX are identical to those you would use in ActionScript.

To create a NetConnection object:

- Use the Lingo `newObject()` command.

```
myNetConObject = sprite(1).newObject("NetConnection")
```

To create a NetStream object:

- Use the `newObject()` command and include the `NetConnection` object as a parameter:

```
myStream = sprite(1).newObject("NetStream", myNetConObject)
```

The `NetStream` object can send text messages without the need for a Flash sprite on the Stage.

To create a global NetConnection object that does not require a sprite reference:

- Use the Lingo `newObject()` command and omit the sprite reference.

```
myNetConObject = newObject("NetConnection")
```

To create a global NetStream object that does not require a sprite reference:

- Use the `newObject()` command and include the `NetConnection` object as a parameter, and omit the sprite reference:

```
myStream = newObject("NetStream", myNetConObject)
```

To send text messages with the NetStream object:

- Use the send command.

```
myStream.send(handlerName {,p1, ...,pN})
```

To send audio or video, you need to associate a camera and microphone with the `NetStream` object.

To associate a video camera with the NetStream object:

- Use the ActionScript attachVideo command.

```
myStream.attachVideo(source)
```

To associate a microphone with the NetStream object:

- Use the ActionScript attachAudio command.

```
myStream.attachAudio(source)
```

To publish a video, audio, or other data stream with the NetStream object:

- Use the ActionScript publish command.

```
mystream.publish(whatToPublish)
```

To play a non-video data stream from the server with the NetStream object:

- Use the ActionScript play command

```
mystream.play(whatToPlay)
```

To receive a video stream from the server, the stream must be attached to a video clip instance in a Flash sprite. A sample Flash movie containing a video clip object is included in the Macromedia/Support/Flash/ folder on the Director installation CD.

To create a Lingo reference to the video clip object in the Flash sprite:

- Use the `getVariable()` command.

```
videoRef = sprite(1).getVariable(nameOfFlashVideoClip, FALSE)
```

To play a video stream through the video clip object:

- Use the `attachVideo()` command with the reference to the video clip.

```
videoRef.attachVideo(source)
```

For detailed examples of how to use Flash Communication Server MX in Director, see the Director Support Center (www.macromedia.com/support/director/).

Using the Flash Settings panel

When you use a Flash cast member in your Director movie, you may want to display the Flash Settings panel. The Flash Settings panel lets users choose privacy, storage, camera, and microphone settings that affect playback of Flash movies that communicate with a Flash Communication Server. For more information about the options in the Settings panel, see the Macromedia Flash Player Help section of the Macromedia website (www.macromedia.com/support/flashplayer/help/).

Opening the Settings panel

You must have a Flash sprite on the Stage to display the Settings panel. The sprite must be at least as large as the Settings panel (214x137 pixels). The Flash sprite's Direct-to-Stage property must be set to `TRUE`. You can set this property in the Flash tab of the Property inspector. If the Flash sprite is not set to display Direct-to-Stage or is too small, the Settings panel will not appear, but no error will occur.

You display the Settings panel in a Director movie by using the Lingo `settingsPanel()` command. Once the panel is displayed, the user can choose the desired settings and then close the panel.

To display the Flash Settings panel, use the following Lingo:

```
sprite(flashSpriteReference).settingsPanel(integerWhichTabToDisplay)
```

For more information on the parameters for this command, see `settingsPanel()` in the *Lingo Dictionary*.

You might decide to invoke the Settings panel by allowing the user to click a button on the Stage that opens the panel. In this case, you would use the `settingsPanel()` command in a `mouseUp` or `mouseDown` handler attached to the button sprite. You could also use the `settingsPanel()` command at any other time to open the panel, depending on how you want to make the panel available.

Emulating the Flash Player context menu in Shockwave

You might decide that you want to allow users to access the Settings panel by right-clicking (Windows) or Control-clicking (Macintosh) on your Flash sprite when your movie is playing in a browser. To do this, you must first disable the context menu that is built into the Shockwave Player. After the Shockwave context menu is disabled, you can trigger the Flash Settings panel by right-clicking or Control-clicking.

To disable the Shockwave context menu:

1. Select File > Publish Settings.
2. Click the Shockwave Save Tab.
3. Deselect the Display Context Menu in Shockwave option. This sets a parameter named `swContextMenu` in the Shockwave `<Object>` and `<Embed>` tags to `FALSE`.
4. Click OK.
5. Save your movie. Your Publish Settings are saved with the movie.

Once you have disabled the Shockwave context menu, you can attach a `mouseUp` handler to your Flash sprite that tests for the `rightMouseDown` property or the `controlDown` property. In Windows, you can choose just to write an `on rightMouseUp` handler.

The handler might look like the following:

```
on mouseUp
  if the rightMouseDown or the controlDown then
    sprite(1).settingsPanel(0)
  end if
end
```

or

```
on rightMouseUp
  sprite(1).settingsPanel(0)
end
```

You can also choose to use ActionScript in your Flash movie to enable the Settings panel. For more information, see the Macromedia Flash MX documentation.

Playback performance tips for Flash movies

Performance of Flash movies can vary greatly, depending on the options in effect and the playback environment. The following are tips for getting optimal playback performance from Flash:

- If adequate for your needs, use the Low quality setting rather than High. Using Low turns off anti-aliasing, which speeds up Flash animation rendering. A handy technique is to switch the quality of the sprite to Low while displaying a fast-moving animation sequence (such as a spinning logo), and then switch the quality back to High on the fly as the animation slows down or comes to a stop. This way, performance can be improved during the part of the sequence where it would be more difficult to perceive the improved quality anyway, without sacrificing quality in the end result.
- Experiment with different system color depths to see what provides the best performance. For example, some graphics, such as gradients, display faster at 16 bits.

- Use Copy ink if possible. Transparency, using Background Transparent ink, requires much more processing time. If your Flash sprite is in the background (no other Director sprites are behind it), use Copy instead of Background Transparent, and author your Flash movie in such a way that its background color is the same as the background color you chose for your Director Stage.
- Use Direct to Stage if possible. Layering and transparency are not supported in this mode; however, if you just want to play a Flash movie within a box with the best performance possible, this may be the way to go.
- Make sure that the Director movie tempo is set high enough. Unless you're using Direct to Stage, your Flash movie will not play faster than the Director movie frame rate, regardless of the `frameRate` or `fixedRate` setting. For smoothest playback, set the Director frame rate to at least 30 frames per second (fps).
- Use Lock-Step or Fixed playback mode to adjust the Flash movie frame rate. Lock-Step gives the best performance, because playback of the Flash movie is synchronized to the Director movie frame for frame.
- Set the `static` property of the sprite to `TRUE` if your sprite contains no animation (such as a static block of text) and doesn't overlap other moving Director sprites. This keeps Director from redrawing the sprite every frame unless it moves or changes size.
- When modifying Flash properties using Lingo, set the properties for the sprite rather than for the cast member. Setting the properties for the cast member modifies values at the cast member level and broadcasts the change to all sprites on the Stage. This overhead can affect performance. If you have only a single sprite for the cast member, modify the sprite property directly.
- Avoid using more Flash sprites on the Stage at the same time than necessary. Each Flash sprite loads its own instance of the Flash Asset Xtra into memory, which can slow performance.
- Limit the amount of Lingo that executes while the Flash movie plays. Avoid tight repeat loops between frames. The usual Director performance optimizations apply when using Flash movies.
- If you import compressed SWF files (new in Flash MX), be aware that Director will use memory for both the compressed and uncompressed versions of the file until the file has been completely uncompressed into memory.

For more information about using Flash in Director, see the Flash section of the Director Support Center (www.macromedia.com/support/director/programs_fl.html).

Using Director movies within Director movies

You can import a Director movie into another movie as an internal or linked cast member, with the Import command. As with other media types, you can link to an external movie file or import the file so that it becomes internal media. The way you choose to import a movie affects its properties:

- For linked movies, cast member scripts and behaviors (sprite scripts) work as before; select Enable Scripts in the Linked Movie tab of the Property inspector. Frame and movie scripts do not work. As with other types of linked media, the external movie file must be present on the system when the host movie plays.
- For movies imported as internal media, the movie appears as a film loop, and interactivity does not work. Use this mainly for animations.

For both types of imported movies, the host movie controls the tempo settings, palette settings, and transitions. Settings for these functions in the imported movie are ignored.

Once it is imported, the movie appears as a cast member in the Cast window. The cast members of a movie imported as internal media also appear in the Cast window. You can animate the cast member just as you would any graphic cast member, film loop, or digital video.

To import a Director movie:

1. Select File > Import.
2. From the Files of Type pop-up menu, select Director Movie.
3. Select a Director movie.
4. To determine whether the movie is imported into the current movie file or linked externally, select a Media option.

   Standard Import imports all the movie's cast members into the current cast and creates a film loop that contains the Score data. Scripts in the imported movie will not work.

   Link to External File creates a cast member that references the external movie file. A linked movie appears as a single cast member.
5. Click Import.

To place a Director movie cast member in the current movie:

1. Do one of the following:

- For an internal movie, drag the film loop cast member to the Stage or Score.
- For a linked external movie, drag the movie cast member to the Stage or Score.

2. Extend the sprite through all the frames in which you want it to appear.
3. To change any of the movie's properties, use the Movie tab of the Property inspector.

   See the next section.

Setting linked Director movie properties

To determine whether a linked Director movie is cropped or scaled to fit within a sprite's bounding rectangle, you use the Property inspector. You can also use the Property inspector to enable the movie's scripts, mute its sounds, and specify whether it loops.

To set linked movie properties:

1. Select a linked movie cast member.
2. To display the Property inspector, select Modify > Cast Member > Properties, or select Window > Property Inspector.
3. If necessary, display the Member tab in Graphical mode.

   The following noneditable settings are displayed:

- The cast member size in kilobytes
- The cast member creation and edit dates
- The name of the last person who modified the cast member

4 To view or edit the cast member name, use the Name field.

5 To add comments about the cast member, use the Comments field.

6 To specify how Director removes the cast member from memory if memory is low, select one of the following options from the Unload pop-up menu:

3–Normal sets the selected cast members to be removed from memory after any priority 2 cast members have been removed.

2–Next sets the selected cast members to be among the first removed from memory.

1–Last sets the selected cast members to be the last removed from memory.

0–Never sets the selected cast members to be retained in memory; these cast members are never unloaded.

7 Click the Linked Movie tab in Graphical mode.

8 To determine how the linked movie appears within the sprite bounding rectangle, select a Framing option:

Crop displays the movie image at its default size. Any portions that extend beyond the sprite's rectangle are not visible.

Center is available only if Crop is selected. It keeps the movie centered within the sprite's bounding rectangle if you resize the sprite.

Scale resizes the movie to fit inside the bounding rectangle.

9 To determine how the linked movie plays back, set the following options

Play Sound enables the sound portion of the linked movie. Turn this option off to mute sounds.

Loop replays the linked movie continuously from the beginning to the end and back to the beginning.

Enable Scripts makes all the scripts in the linked movie work the same way they do when the movie plays by itself.

If you import a Director movie internally, it is imported as a film loop. In this case, the Linked Movie tab in the Property inspector is replaced by the Film Loop tab, and the Enable Scripts option is not available.

Using ActiveX controls

In Director movies that you intend to publish only as projectors for Windows, you can embed ActiveX (formerly known as OLE/OCX controls) controls that let you take advantage of the technology and adapt ActiveX controls to make them function as sprites in Director. You can use ActiveX controls to manage application resources for the hosted ActiveX control—for instance, to manage properties, events, and windows and filing properties. You can also manage resources used by the ActiveX control within the Director movie. ActiveX controls are not allowed in Shockwave.

The range of uses for ActiveX in Director is as limitless as the variety of ActiveX controls available. Using the Microsoft Web Browser control (installed with Microsoft Internet Explorer 3.0 or higher), you can browse the Internet from within a multimedia production; using the FarPoint Spreadsheet control, you can create and access spreadsheets; using the InterVista VRML control, you can explore virtual worlds; using the MicroHelp extensive library of Windows widget controls, you can build and simulate complete Windows applications.

Note: Not all ActiveX controls expose their methods and properties in all hosts. Test the controls you want to use to see how they work in Director. Because ActiveX controls are non-Macromedia software, Macromedia Technical Support does not support them.

Inserting an ActiveX control

You can place ActiveX controls in a Director movie and have them function as sprites. Note that this procedure is designed only for Director for Windows.

To insert an ActiveX control on the Stage:

1. Make sure that the ActiveX control you want to use in Director is installed on your system.

   Most controls have their own installation utilities provided by the manufacturer of the control.

2. Select Insert > Control > ActiveX.

3. In the dialog box that appears, select the desired ActiveX control and then click OK. The ActiveX Control Properties dialog box appears.

   (If the desired ActiveX control does not appear in the list, it may not have been installed properly by the system. You can attempt to verify this by viewing the list of ActiveX controls in another application such as Visual Basic.)

   The ActiveX Control Properties dialog box lets you edit each ActiveX control and view information regarding each method the control supports and each event the control can generate.

4. Set the values for each property in the ActiveX control and then click OK. The ActiveX control now appears in the cast.

5. Drag the ActiveX control from the cast to the Stage.

   Once the ActiveX control appears on the Stage, it can be repositioned and resized just like any other sprite Xtra. When you pause the movie, the ActiveX control stays in authoring mode and does not react to mouse or keyboard events. When you play the movie, the control responds to user input.

Setting ActiveX control properties

An ActiveX control describes its information using properties—named characteristics or values such as color, text, font, and so on. Properties can include not only visual aspects but also behavioral ones. For example, a button might have a property that indicates whether the button is momentary or push-on/push-off. An ActiveX control's properties define its state—some or all of which properties may persist. Although the control can change its own properties, it is also possible that the container holding the control might change a property, in response to which the control would change its state, user interface, and so on.

When an ActiveX control is inserted into a Director movie, the properties that the control exposes can be viewed and edited by clicking the Properties tab of the Control Properties dialog box for the ActiveX Xtra. Each property exported by the ActiveX control is identified along with the current value of the property. The user edits a property value by simply clicking over the existing value with the mouse. For most properties, such as numeric or string values, the new value can be directly entered into the list using the keyboard.

In Director, all properties that an ActiveX control exports are properties of the corresponding sprite. This is the generic Lingo syntax for setting an ActiveX control property:

```
sprite(X).propertyName = value
```

The generic Lingo syntax for getting an ActiveX control property is as follows:

```
value = sprite(X).propertyName
```

As an example, if the Microsoft Access Calendar control is inserted into a Director movie as the second sprite on the score, the following Lingo code sets the Year property of the Calendar control to a specific year:

```
sprite(2).year = 1995
```

To get the Year property from the same Calendar control and place it into a Lingo variable named `CalendarYear`, you can use the following Lingo code:

```
CalendarYear = sprite(2).year
```

Some ActiveX control properties are read-only, and trying to set a property for such a control will cause an error in Director. For more information, see the documentation for the ActiveX control you are using.

Using ActiveX control methods

An ActiveX control describes its functionality using methods. Methods are simply functions implemented in the control that Director can call to perform some action. For example, an edit or other text-oriented control supports methods that let Director retrieve or modify the current text, perhaps performing such operations as copy and paste.

When you insert an ActiveX control in a Director movie, you can view the methods exposed by the control by clicking the Methods tab of the Control Properties dialog box for the ActiveX control. The dialog box displays each method supported by the ActiveX control and a description of the parameters for each method.

In Director, all methods that an ActiveX control supports are functions for the corresponding sprite. The generic Lingo syntax for calling an ActiveX control method is as follows:

```
ReturnValue = sprite(N).MethodName(param1, param2, ...)
```

As an example, if the Microsoft Access Calendar control is inserted into a Director movie as the second sprite on the Score, the following Lingo code would increment the year displayed within the Calendar control:

```
sprite(2).NextYear()
```

For the same Calendar control, the following Lingo code would decrement the year displayed by the Calendar control:

```
sprite(2).PrevYear()
```

Parameters passed to the ActiveX control are automatically converted from their Director data types to equivalent ActiveX data types. Likewise, the return value is automatically converted from an ActiveX data type to an equivalent Director data type.

Using ActiveX control events

Each ActiveX control typically generates a variety of events. For example, a button ActiveX control may generate a `click` event when the button is pressed, and a calendar ActiveX control may generate a `dateChanged` event when the date within the calendar is changed. Director converts any event generated by the ActiveX control to a sprite event that it can handle. A list of the control's events appears in the Events tab of the ActiveX Control Properties window.

To respond to an event generated by the ActiveX control, you must write an event handler to capture the event. You can place these event handlers in movie scripts, sprite behaviors, scripts assigned to cast members, or frame behaviors. However, you normally place the handler in the behavior attached to the sprite for the ActiveX control.

As an example, if the Microsoft Access Calendar control is inserted into a Director movie as a sprite on the score, the following Lingo code would capture the `click` event from the Calendar control:

```
on click
  -- Do something interesting here.
  beep 2
end
```

A sprite behavior is a good location for this handler.

CHAPTER 12
Sound and Synchronization

You can give your movie added appeal by including a soundtrack, a voice-over, ambient noises, or other sounds.

With Macromedia Director MX, you can control when sounds start and stop, how long they last, their quality and volume, and several other effects. Using Macromedia Shockwave Audio, you can compress sounds for easier distribution and stream them from an Internet source.

The media synchronization features in Director let you synchronize events in a movie to precise cue points embedded in sound.

Sound makes significant demands on a computer's processing power, so you might need to manage sounds carefully to make sure they do not adversely affect your movie's performance.

Lingo gives Director more flexibility when playing sound and can help overcome performance concerns. You can use it to play sound in ways not possible with the Score alone. Using Lingo, you can do the following:

- Turn sound on and off in response to movie events.
- Control sound volume.
- Control the pan of a sound relative to the pan of a QuickTime VR movie. (For more information on using video and QuickTime VR in Director, see "Using Video" on page 331.)
- Preload sound into memory, queue multiple sounds, and define precise loops.
- Precisely synchronize sound and animation.

Importing internal and linked sounds

Director handles sounds as either internal or linked. You can determine whether a sound is internal or linked when you import it. Each type of sound has advantages for different situations.

Director stores all the sound data for an internal sound cast member in a movie or cast file and loads the sound completely into RAM before playing it. After an internal sound is loaded, it plays very quickly. This makes internal sound best for short sounds, such as beeps or clicks, that recur frequently in your movie. For the same reason, making a large sound file an internal sound is not a good choice because the sound might use too much memory.

Director does not store sound data in a linked sound cast member. Instead, it keeps a reference to a sound file's location and imports the sound data each time the sound begins playing. Because the sound is never entirely loaded into RAM, the movie uses memory more efficiently.

Also, Director streams many sounds, which means it begins playing the sound while the rest of the sound continues to load from its source, whether on disk or over the Internet. This can dramatically improve the downloading performance of large sounds. Linked sounds are best for longer sounds such as voice-overs or nonrepeating music.

Director can stream the following sounds:

- QuickTime, Shockwave Audio, and MP3 sounds that are linked from a URL
- QuickTime, Shockwave Audio, MP3, AIFF, and WAV sounds that are linked to a local file

Director imports AIFF and WAV sounds (both compressed and uncompressed), AU, Shockwave Audio, and MP3. For best results, use sounds that have 8- or 16-bit depth and a sampling rate of 44.1, 22.050, or 11.025 kHz.

To import a sound:

1. Select File > Import.
2. Select sound files to import.
3. To determine whether the imported sounds are internal or linked, select a Media option:

   Standard Import makes all the selected sounds internal sound cast members.

   Link to External File makes all the selected sounds linked.
4. Click Import.

Note: If you're authoring on a Macintosh computer that has an audio input or attached microphone, you can record sounds directly into a movie's cast by selecting Insert › Media Element › Sound. The Sound command opens the Macintosh sound recording dialog box. Director for Windows has no equivalent feature.

Setting sound cast member properties

You can use sound cast member properties to make a sound loop, change its name, change the external sound file to which it's linked (if it's a linked sound), and set its unload priority.

To set sound cast member properties:

1. Select a sound cast member.
2. Click the Sound tab in the Property inspector.

   There are several noneditable options in the Property inspector's Sound tab:

- The duration of the sound
- The sample rate, sample size, and channels

3. To make the sound play continuously, click Loop (see "Looping a sound" on page 322).
4. To play the sound, click the Play button.
5. Click the Member tab in the Property inspector.

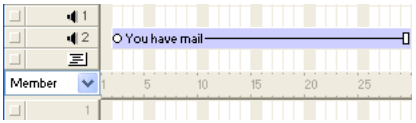
   The following noneditable settings appear:

- The cast member size in kilobytes
- The cast member creation and edit dates
- The name of the last person who modified the cast member

6. To view or edit the cast member name, use the Name text box.
7. To change the external sound file to which the cast member is linked (if it is a linked sound), enter a new path and file in the Filename text box. You can also use the Browse button to select a new file.
8. To specify how Director removes the cast member from memory if memory is low, select an option from the Unload pop-up menu. See "Controlling cast member unloading" on page 152.

Controlling sound in the Score

You control sounds in the Score in much the same way that you control sprites. You place sounds in one of the two sound channels at the top of the Score and extend the sounds through as many frames as required.



Unless you use a behavior or other Lingo to override the Score's sound channels, sounds play only as long as the playhead is in the frames that contain the sound. After a sound begins playing, it plays at its own speed. Director cannot control the speed at which a sound plays. If a sound is not set to loop, it stops playing at the end, even if the sprite specifies a longer duration. See "Looping a sound" on page 322.

Note: You can speed up or slow down a sound by converting it to a sound-only QuickTime movie and using the `movieRate` sprite property.

In addition to the two sound channels in the Score, Director can use as many as six additional sound channels simultaneously. However, the additional channels are accessible only from Lingo or from behaviors. Available RAM and the computer's speed are the constraints on how many sounds Director can use effectively.

To place a sound in the Score:

1. If the sound channels are not visible, click the Hide/Show Effects Channels button at the upper right side of the Score.
2. Do any of the following:

- Drag a sound cast member from a Cast window to a frame in one of the sound channels.
- Double-click a frame in the sound channel, and then select a sound from the Frame Properties: Sound dialog box. You can also preview any sound cast member in the movie from this dialog box.
- Drag a sound to the Stage to place it into the first available sound channel in the current frame of the Score.

3. Extend the sound through as many frames as necessary.

   New sounds are assigned the same number of frames as set for sprites in the Sprite Preferences dialog box. You might need to adjust the number of frames to make the sound play completely or change a tempo setting to make the playhead wait for the sound to finish. See "Synchronizing media" on page 328.

Note: Sound in the last frame of a movie continues to play (but not loop) until the next movie begins or you exit from the application. This sound can provide a useful transition while Director loads the next movie. You can stop the sound using the `puppetSound` command.

Looping a sound

You might find that you want to play a sound repeatedly to create a continuous sound effect, such as the sound of a person walking. A looped sound repeats as long as the playhead is in a frame where the sound is set. See "Importing internal and linked sounds" on page 320.

To make a sound loop:

1. Select a sound cast member.
2. On the Sound tab in the Property inspector, select the Loop option.

You can also loop sounds with Lingo. See "Playing sounds with Lingo" on page 323.

Using sound in Windows

The following issues are specific to managing sound for Windows:

- In Windows, a sound that is already playing in either sound channel overrides the sound in a QuickTime or AVI video or in a Flash movie. It also prevents the video sound from playing even after the sound in the sound channel stops. After the sound in a digital video starts, however, it overrides a sound in either sound channel.
- To mix QuickTime audio tracks with internal Director sounds, use the `soundDevice` system property to specify QT3Mix or install the Microsoft DirectSound sound driver software version 5.0 or later (available from www.microsoft.com), and use the `soundDevice` property to specify DirectSound..See `soundDevice` in the *Lingo Dictionary*. (Windows NT4 does not support DirectSound 5.) Check the Director Support Center at www.macromedia.com/support/director/ for the latest developments related to this issue.
- The default number of sounds that Director can mix in Windows is eight. This number can be decreased by modifying the value for MixMaxChannels in the Director.ini file in the Director folder.

Playing sounds with Lingo

Lingo lets you play and control sounds regardless of the settings in the Score. You can use Lingo to play sounds, turn them on and off, and play external sounds that aren't cast members. Using Lingo to play sounds lets you control the exact timing of when sounds start and stop. Lingo also lets you play only part of a sound cast member or play several sounds in succession without interruption.

Sounds played by Director play at the volume that is set in the computer's sound level control. You can use Lingo to modify the computer's sound level to suit the needs of your movie or to modify the volume of the sound channel.

You can also use Lingo to control and stream Shockwave Audio. See "Playing Shockwave Audio and MP3 audio with Lingo" on page 327.

Playing sound cast members

After you import a sound as a cast member, you can control many aspects of how the sound plays.

To play sound cast members regardless of the settings in the Score:

- Use the `queue()` and `play()` functions. The `queue()` function loads the sound into the Director RAM buffer so that it can be play immediately when called. The `play()` command starts the sound playing. If you omit the `queue()` function, the sound might not play immediately when called. See `queue()` and `play() (sound)` in the *Lingo Dictionary*.

The following statements load the sound called Siren into RAM and start it playing in sound channel 1:

```
sound(1).queue(member("Siren"))
sound(1).play()
```

To queue more than one sound to play in succession:

- Use the `queue()` function to list sounds in the order you want them to play. If you queue them before they play, Director plays the sounds with no pauses between the sounds. After the sounds are queued, you need only one `play()` command.

These statements queue the sound members Explosion and Siren and play them in succession in sound channel 2:

```
sound(2).queue(member("Explosion"))
sound(2).queue(member("Siren"))
sound(2).play()
```

To control how a queued sound plays:

- Include optional parameters in a property list within the `queue()` function. See `queue()` in the *Lingo Dictionary*.

When you use `setPlayList()`, any previously set queue of sounds is replaced by the new playlist.

After queuing sounds, you can still control whether the queue is obeyed. You can select to interrupt loops with the `breakLoop()` command or to pause playback with the `pause()` function. The `playNext()` command lets you skip immediately to the next sound in the queue. For more information on sound commands, see the *Lingo Dictionary*.

Playing external sound files

In addition to playing sounds you have imported as cast members, you can also play external sound files that have not been imported.

To play external sound files that aren't cast members:

- Use the `sound playFile` command. See `sound playFile` in the *Lingo Dictionary*.

Playing external sound files from disk minimizes the amount of RAM that is used to play sounds. However, because the computer can read only one item from disk at a time, loading cast members or playing more than one sound from disk can cause unacceptable pauses when you use the `sound playFile` command.

Controlling sound channels

You can use Lingo to make actions in a movie dependent on whether a sound is playing. Lingo lets you determine whether a sound is playing in a particular sound channel and control how a channel plays sound. For more information on each of these commands, functions, and properties, see the *Lingo Dictionary*.

- To determine whether a specific channel is playing a sound, use the `isBusy()` function.
- To turn off the current sound in a specific channel, use the `setPlayList()` command with `[ ]` as the new play list. This deletes the entire sound queue and leaves the current sound playing. Use the `stop()` command to stop the currently playing sound.
- To fade a specific channel's sound in and out, use the `fadeTo()` function.
- To control a specific sound channel's volume, specify the `volume` property.
- To control the left-to-right panning of a sound, specify the `pan` property.

About Shockwave Audio

Shockwave Audio is a technology that makes sounds smaller and plays them faster from disk or over the Internet.

Shockwave Audio can compress the size of sounds by a ratio of up to 176:1 and is streamable, which means Director doesn't have to load the entire sound into RAM before it begins playing. Director starts to play the beginning of the sound while the rest of the sound is still streaming from its source, which can be from a disk or over the Internet. When used properly, the Shockwave Audio compression and streaming features provide fast playback of high-quality audio, even for users with relatively slow modem connections to the Internet.

Compression quality in Shockwave Audio

Although Shockwave Audio uses advanced compression technology that alters original sounds as little as possible, the more a sound is compressed, the more it is changed.

Set the amount of compression by selecting a bit rate setting in any of the Shockwave Audio Xtra extensions. The bit rate is not related to sampling rates you might have used in other audio programs. Try compressing the same sound at several different bit rates to see how the sound changes.

Select the bit rate that is appropriate for the intended delivery system (modem, ISDN, CD-ROM, hard disk, and so on), the type of movie, and the nature of the sound. Voice-over sound quality, for example, might not need to be as high as that of music. Test the sound on several systems to find the right balance between quality and performance.

The more compressed a sound is, the faster it streams. If you select to use a high quality and low degree of compression, a slow delivery system might not send the data fast enough, which results in gaps during playback. Most developers choose 16 kilobits per second (Kbps) for the best results over the Internet.

The following table suggests some general guidelines for setting the bit rate for different delivery systems. It also provides a rough estimate of perceived quality for different rates of compression. Real transmission times might be slower than the times that are shown in this table, depending on network traffic and server load.

Delivery	Bit rate	Quality
T1	64 to 128 Kbps	Equal to source material
ISDN or CD-ROM	32 to 56 Kbps	FM stereo to CD
28.8 modem	16 Kbps	FM monaural or good-quality AM
14.4 modem	8 Kbps	Telephone

Note: Any sound compressed at less than 48 Kbps is converted to monaural.

Compressing internal sounds with Shockwave Audio

Shockwave Audio can compress any internal sounds in a movie. Although internal sounds are not streamed, compressing them with Shockwave Audio dramatically decreases the size of the sound data in a movie, shortens the download time from the Internet, and saves disk space.

You can use Shockwave Audio settings to specify compression settings for internal sound cast members. The selected compression settings apply to all internal sound cast members. You cannot specify different settings for different cast members.

You can select compression settings at any time, but compression occurs only when the Director movie is compressed with the Create Projector, Save as Shockwave Movie, or Update Movies commands. When you create a projector, Director compresses sounds only if the Compressed option is turned on in the Projector Options dialog box. Compressing sounds can substantially increase the time required to compress a Director movie. See "Creating projectors" on page 582.

Note: Shockwave Audio does not compress SWA or MP3 audio sounds.

When you distribute a movie that contains sounds compressed with Shockwave Audio, the SWA Decompression Xtra is already included in the Shockwave player. If you compress sounds in Shockwave format in a projector, you must provide the SWA Decompression Xtra for the projector.

To have Director compress internal sound cast members when you create a projector, save a movie as Shockwave, or update the movie:

1. Select File > Publish Settings.
2. Select the Compression tab.
3. Select Compression Enabled to turn on compression.
4. Select a setting from the kBits/second pop-up menu.
5. Select Convert Stereo to Mono if you want to convert a stereo file to monaural.

   At rates lower than 48 Kbps, all sounds are converted to monaural.
6. Click OK.

Streaming linked Shockwave Audio and MP3 audio files

Director streams sounds that have been compressed with Shockwave Audio as well as MP3 audio files, from either a local disk or a URL. Before you can set up a streaming Shockwave Audio cast member, you must create a Shockwave Audio or MP3 file.

To create external Shockwave Audio files, do one of the following:

- In Windows, select Xtras > Convert WAV to SWA, and select the WAV files to convert.
- On the Macintosh, use the Peak LE 2 software to export Shockwave Audio sounds.

For both methods, the audio settings are similar to those for using Shockwave Audio to compress internal sounds. See "Compressing internal sounds with Shockwave Audio" on page 326.

Note: Converting WAV to SWA does not compress IMA compressed sounds.

To stream a linked Shockwave Audio or MP3 sound:

1. Select Insert > Media Element > Shockwave Audio.

   This process creates a cast member that controls the streaming Shockwave Audio.

2. In the SWA Cast Member Properties dialog box that appears, click Browse and select a Shockwave Audio file on a local disk, or enter a URL in the Link Address box.

   Unless you select a file in the same folder as the movie, the movie always links to the exact location that you specify. Be sure to link to the correct location.

3. Set the remaining cast member properties in the Property inspector, as described in the following list:

- To set the volume of the sound, use the Volume slider in the SWA tab in the Property inspector.
- To select the sound channel for the sound, select a number from the Channel pop-up menu in the SWA tab. To avoid potential conflicts, select Any, which causes the sound to play in the highest numbered available sound channel.
- To specify the size of the stream buffer, use the Preload option in the SWA tab. Director attempts to load enough sound data to play for the specified time in seconds. This prevents gaps in sounds that play over slow or interruption-prone Internet connections.

4. Drag the Shockwave Audio cast member to a sprite channel (*not* one of the sound channels) to create a sprite. Extend the sprite through all frames in which the sound should play, or use the tempo channel to make the movie wait for the end of the sound. See "Synchronizing media" on page 328.

   You cannot place streaming audio cast members in the sound channels. The sound streams from the source location when the movie plays.

Playing Shockwave Audio and MP3 audio with Lingo

Use SWA Lingo to preload and control SWA and MP3 sounds and to determine how much sound has streamed over the Internet.

Lingo that controls other types of sounds can also control streaming SWA and MP3 sounds by controlling the sound channel in which the sound plays. For more information on each of these commands, functions, and properties, see the *Lingo Dictionary*.

- To preload part of a streaming sound file into memory, use the `preLoadBuffer member` command.
- To specify the amount of a streaming cast member to download before playback begins, set the `preLoadTime` cast member property.
- To determine what percentage of a streaming sound file has played, test the `percentPlayed` cast member property.
- To determine the percent of a streaming file that has streamed from an Internet server, test the `percentStreamed` cast member property.
- To specify the sound channel in which a streaming sound plays, set the `soundChannel` property.
- To begin playback of a streaming cast member, use the `play member` command.
- To pause a streaming sound file, use the `pause member` command.

- To stop a streaming sound file, use the `stop member` command.
- To determine the state of a streaming sound file, test the `state` cast member property.
- To determine whether an error occurred when streaming a sound file, use the `getError()` function.
- To obtain a string describing an error that occurred when streaming a sound file, use the `getErrorString()` function.
- To determine the length of a streaming sound file, use the `duration` cast member command.
- To determine the bit rate of a streaming sound cast member, test the `bitRate` cast member property.
- To determine the original bit depth of a streaming sound, test the `bitsPerSample` property.
- To determine the sample rate of the original sound used for a streaming cast member, test the `sampleRate` cast member property.
- To determine the number of channels in a streaming sound, test the `numChannels` streaming cast member property.
- To specify a streaming sound's volume, specify the `volume` streaming cast member property.
- To specify a streaming sound file's URL, set the `URL` cast member property.
- To obtain or set the copyright text in a streaming sound file, test or set the `copyrightInfo` cast member property.

Synchronizing media

To pause the playhead until a specified cue point in a sound or digital video is reached, you can use the Wait for Cue Point option in the Tempo dialog box. You can also use this function to wait for the end of the sound or digital video, even if it has no cue points. Cue points can also be used to trigger events that Lingo can interpret. See "Synchronizing sound with Lingo" on page 329.

Note: The methods discussed in this section for synchronizing media apply to sound and digital video. For more information on using video in Director MX see "Using Video" on page 331.

For example, you can use cue points to make text appear in time with narration. First, use a program such as Peak LE 2 to place cue points in the sound file that correspond to the times when you want the text to appear on Stage. In Director, use the Tempo dialog box to pause the playhead at the frame where the corresponding text appears until the voice-over reaches the proper cue point.

In Windows, use Sound Forge 4.0 or later or Cool Edit 96 or later to define cue points (called markers or regions within these programs). For instructions, see the Readme Windows Sound Loop-Cue.txt file in the Director application folder.

On the Macintosh, use Sound Edit 16 2.07 or later, or Peak LE 2 or later, to define cue points in AIFF and Shockwave Audio sounds and in QuickTime digital videos.

Note: You can insert cue points into QuickTime files only on the Macintosh; however, the cue points can be used on both platforms.

AVI digital video does not support cue points.

To use cue points:

1. Place cue points in a sound file or (on the Macintosh only) in a QuickTime file.

   Use an audio-editing program to define cue points in sounds and digital videos.

2. Import the sound or digital video into Director.

   Note: Digital video is always linked, whether you select the Standard Import option or the Link to External File option in the Import dialog box.

3. Place the sound or digital video in a channel in the Score, and extend it through all the frames in which you want it to play.
4. Double-click the frame in the tempo channel where you want the playhead to wait for a cue point.
5. In the Tempo dialog box, select Wait for Cue Point.
6. Select the sound or digital video from the Channel pop-up menu.
7. Select the desired cue point from the Cue Point pop-up menu.

   Select the End or Next cue point or any named or numbered cue point in the sound or digital video. Director recognizes the end of a sound, regardless of whether you've defined cue points.

   When the movie plays, the playhead pauses at the frame until the cue point passes.

Synchronizing sound with Lingo

By writing Lingo that performs an action when a cue point is reached in a sound or QuickTime file, you can synchronize a movie with sound or digital video. For more information on each of these functions and properties, see the *Lingo Dictionary*.

- To set up Lingo that runs when the movie reaches a cue point in a sound or QuickTime file, put the Lingo in an `on cuePassed` handler.
- To determine whether a sound or QuickTime file has passed a specific cue point, use the `isPastCuePoint()` function.
- To find the ordinal number of the last cue point passed in a sound or QuickTime file, use the `mostRecentCuePoint` function.
- To obtain a list of names for the cue points in a specific sound or QuickTime file, test the `cuePointNames` property.
- To obtain a list of times for cue points in a specific sound or QuickTime file, test the `cuePointTimes` property.

Accessibility

With Lingo and behaviors, you can provide captioning to help users with hearing impairment experience the audio portions of your movies. For more information, see Chapter 23, "Making Director Movies Accessible," on page 551.

CHAPTER 13
Using Video

You can give your Macromedia Director MX movie added appeal by including digital video. Digital video not only offers high-quality real-time image animation and sound but also supports new types of media such as QuickTime VR.

Director supports QuickTime video for Windows and Macintosh, and Video for Windows (AVI). Director also supports RealMedia content (Windows only). QuickTime is a multimedia format in its own right. It offers sophisticated sound features and can include graphics in many formats, including basic navigation of QuickTime VR2 files. For a list of supported QuickTime formats, see the Apple Computer website at www.apple.com. To use QuickTime, you must also obtain QuickTime 3 or later (QuickTime 6 or later is recommended) from Apple.

The Director media synchronization features let you synchronize events in a movie to precise cue points embedded in digital video.

Video can make significant demands on a computer's processing power, so you might need to manage video content carefully to make sure it does not adversely affect your movie's performance.

Lingo gives Director more flexibility when playing digital video and can help overcome performance concerns. You can use it to play digital video in ways that are not possible with the Score alone. Using Lingo, you can do the following:

- Precisely synchronize digital video and animation.
- Turn digital video on and off on demand and control individual video tracks.
- Control QuickTime VR.

Note: You can export movies or portions of movies as QuickTime or AVI videos. See "Exporting digital video and frame-by-frame bitmaps" on page 586.

Importing digital video

When you import QuickTime, RealMedia, or AVI digital video, the cast members you create always remain linked to the original external file, even if you select the Standard Import option. When you distribute a movie, you must always include all digital video files along with the movie.

QuickTime must be installed on a computer in order to author or play back a movie that contains QuickTime digital video. RealPlayer 8 or RealOne Player must be installed on a computer to author or play back a movie that contains RealMedia digital video.

Director converts an AVI video to QuickTime when it plays on a Macintosh.

For security reasons, Shockwave will link to media on a local disk only if it is in a folder named dswmedia. To test movies in a browser locally before uploading them to your Internet server, place the movie, linked casts, and linked media in folders within a dswmedia folder, and use relative links to refer to them. In order for them to be accessible from your server, you must use file and folder names that do not have spaces or capital letters and that have recognized file extensions such as .dcr and .gif. For more information, see the Director Support Center website at www.macromedia.com/support/director.

To import a digital video:

1. Select File > Import.
2. Select QuickTime, AVI (Windows only), or RealMedia (Windows only) from the Files of Type pop-up menu.
3. Select the digital video files to import.

   Because digital video is always imported as linked, you do not have to select an option in the Media pop-up menu.
4. Click Import.

   When you import an AVI file, you will be prompted to select QuickTime or AVI as the import format.

   If you select QuickTime, Director imports the video as a QuickTime Asset Xtra, which provides additional playback options. See “Setting digital video cast member properties” on page 333.

Using the Video window

Whether a digital video is a cast member or a sprite on the Stage, you can preview it in the Video window. There are different versions of the window for QuickTime, RealMedia, and AVI movies.

To open the Video window, do either of the following actions:

- Double-click a digital video cast member.
- Select Window > QuickTime; Window > AVI Video; or Window > RealMedia.

The Video window appears.

If you are working with a QuickTime digital video, a video controller bar appears that lets you start, stop, rewind, or forward the movie. With AVI, you can click the movie to start and stop it. With RealMedia, you can use control buttons to start, stop, and rewind the movie.

Setting digital video cast member properties

Use cast member properties to control the media in a digital video, specify how it is framed and whether it plays direct-to-Stage, and set other important options.

To set digital video cast member properties:

1. Select a digital video cast member in the cast.
2. Click the Member tab in the Property inspector.

   There are several noneditable options on the Member tab in the Property inspector:

- The cast member size in kilobytes
- The cast member creation and edit dates
- The name of the last person who modified the cast member

3. Use the Name text box to view or edit the cast member name.
4. To change the external file to which the cast member is linked, enter a new path and file in the Filename text box. You can also use the Browse button to select a new file.
5. To specify how Director removes the cast member from memory if memory is low, select an option from the Unload pop-up menu. See "Controlling cast member unloading" on page 152.
6. Click the QuickTime or AVI tab in the Property inspector to set the remaining properties.

   Note: The remaining steps in this section discuss QuickTime and AVI cast members. For information about setting the properties for RealMedia cast members, see "The RealMedia tab in the Property inspector" on page 349.

7. To determine how a movie image appears within the sprite bounding rectangle when the movie is rotated, scaled, or offset, set the following Framing options:

   Crop displays the movie image at its default size. Any portions that extend beyond the sprite's rectangle are not visible. For more information, see "Cropping digital video" on page 339.

   Center is available only if Crop is selected. It determines whether transformations occur with the cast member that is centered within the sprite or with the cast member's upper left corner aligned with the sprite's upper left corner.

   Scale fits the movie inside the bounding rectangle.

8. To determine how the video plays back, set the following options in the upper portion of the window:

   Video displays the video portion of the digital video. If this option is turned off, the video portion does not play. Deselect this option and select Sound if you want to play only the audio portion of a movie.

   Audio plays the sound portion of the digital video.

   DTS (Direct to Stage) allows QuickTime or AVI drivers installed on the computer to completely control the video playback. For more information, see "Playing digital video direct-to-Stage" on page 334.

   Controls (QuickTime only) displays a controller bar at the bottom of the video if Direct to Stage is selected.

Paused stops the digital video when it first appears on the Stage (while playing the Director movie).

Loop replays the digital video continuously from the beginning to the end.

Preload (AVI only) loads the cast member into memory when the movie starts. For more information, see "Preloading AVI digital video" on page 341.

Streaming (QuickTime only) begins playing the video while the rest of the video continues to load from its source.

9 If Direct to Stage is selected, select one of the following options from the Playback pop-up menu to specify how to synchronize the video to its soundtrack:

Sync to Sound makes the digital video skip frames (if necessary) to keep up with its soundtrack. The digital video might also take less time to play.

Play Every Frame (No Sound) makes every frame of the digital video appear but does not play the soundtrack because the video cannot play the soundtrack asynchronously while the video portion plays frame by frame. Depending on the data rate of the digital video, the sprite might play more smoothly with this option selected, but this is not a certainty. In addition, playing every frame might cause the digital video to take more time to play.

10 If Play Every Frame (No Sound) is selected, select the following options from the Rate pop-up menu to set the rate at which a digital video plays:

Normal plays each frame at its normal rate, and no frames are skipped.

Maximum plays the movie as fast as possible while still displaying each frame.

Fixed plays the movie using a specific frame rate. Enter the number of frames per second in the field at the right. Use this option only for digital videos that use the same frame rate for each frame of the movie.

Playing digital video direct-to-Stage

Director can play digital video using a feature called Direct to Stage. Direct to Stage lets QuickTime or AVI drivers installed on the computer completely control the video playback. The Direct to Stage feature cannot be used with RealMedia video.

Direct to Stage often provides the best performance from a digital video, but it has two disadvantages:

- The digital video always appears in front of all other sprites on the Stage, no matter which channel contains the sprite.
- Ink effects do not work, so it is difficult to conceal the video's bounding rectangle with Background Transparent ink.

When Direct to Stage is off, Director layers a digital video on the Stage exactly the same as other sprites, and Background Transparent ink works normally. (Matte ink does not work for digital videos.)

To set Direct to Stage options:

1 Select a digital video cast member.

2 Click the QuickTime or AVI tab in the Property inspector.

3 Select or deselect Direct to Stage (DTS).

4 If Direct to Stage is selected, select one of the following Playback options:

Sync to Soundtrack makes the digital video skip frames (if necessary) to keep up with its soundtrack. The digital video might also take less time to play.

Play Every Frame makes every frame of the digital video appear but does not play the soundtrack because the video cannot play the soundtrack asynchronously while the video portion plays frame by frame. Depending on the data rate of the digital video, the sprite might play more smoothly with this option selected, but this is not a certainty. In addition, playing every frame might cause the digital video to take more time to play.

5 (QuickTime only) If Direct to Stage is on, select Controls to display a controller bar below the movie to let the user start, stop, and step through the movie.

Controlling digital video in the Score

You add a digital video cast member to a movie the same way as you would add any other sprite. Digital videos begin playing when the playhead reaches the frame that contains the video sprite. Use the QuickTime or AVI tab in the Property inspector to make QuickTime and AVI movies pause or loop. See "Setting digital video cast member properties" on page 333. Use the RealMedia tab in the Property inspector to make RealMedia movies pause. See "The RealMedia tab in the Property inspector" on page 349.

If there's a white bounding rectangle around the video, use the Background Transparent ink to remove it. Inks don't work if Direct to Stage is turned on (see "Playing digital video direct-to-Stage" on page 334). Matte ink does not work for any type of digital video.

To create a digital video sprite:

1 Drag a digital video cast member to any sprite channel in the Score.

2 Extend the sprite through as many frames as necessary.

Playing complete digital videos

A digital video, the same as a sound, is a time-based cast member. If you place a video in only a single frame of the Score, the playhead moves to the next frame before Director has time to play more than a brief instant of the video.

To make sure that Director plays an entire digital video, do one of the following:

- Create a tempo setting in the tempo channel using the Wait for Cue Point option in the Frame Properties: Tempo dialog box. This option keeps the playhead from moving to the next frame until a cue point in the video has passed or, if there are no cue points, until the end of the video is reached. For more information, see "Synchronizing video and animation" on page 341.
- Use Lingo or behaviors to make the playhead stay in a frame until the end of the video or until a certain cue point passes. See "Synchronizing video and animation" on page 341.
- Extend the video through enough frames to give it time to play all the way through.

QuickTime VR

You can use a QuickTime VR movie in a Director movie by inserting it as you would any other QuickTime cast member. To get the best performance, turn on Direct to Stage (see "Playing digital video direct-to-Stage" on page 334).

Playing digital video with Lingo

Lingo can take advantage of the most important and powerful features of digital video. Besides playing digital video linearly, Lingo can pause, stop, and rewind a video. These abilities are useful for jumping to segments within a digital video and for emulating a typical digital video control panel. This last feature is especially useful for AVI digital video, which has no control panel.

Lingo also lets you work with individual tracks in a digital video by determining the tracks' content and position and turning these tracks on and off.

For information on using Lingo with RealMedia movies, see "Using RealMedia content in Director" on page 341.

Controlling digital video playback with Lingo

The following list describes how you can control digital video with Lingo. For more information, see the *Lingo Dictionary*.

- To turn on looping in a digital video cast member, set the digital video's `loop` cast member property to `TRUE`.
- To determine the current time of a digital video sprite, check the sprite's `currentTime` property.
- To pause a digital video sprite, set the sprite's `movieRate` property to 0.
- To start a paused digital video sprite, set the sprite's `movieRate` property to 1.
- To play a digital video sprite in reverse, set the sprite's `movieRate` property to -1.
- To rewind a digital video sprite to the beginning, set the sprite's `movieTime` property to 0.
- To control a digital video sprite's playback rate, set the sprite's `movieRate` property to the desired rate.
- To mix QuickTime audio tracks with internal Director sounds (necessary only in Windows), use the `soundDevice` system property to specify QT3Mix.

Determining digital video content with Lingo

The following list describes how Lingo can determine a digital video's content. For more information, see the *Lingo Dictionary*.

- To determine the time units a digital video cast member uses, check the video's `timeScale` cast member property.
- To determine whether a digital video is QuickTime or AVI, check the digital video's `digitalVideoType` cast member property.
- To determine the number of tracks in a digital video sprite or cast member, check the digital video's `trackCount` sprite or cast member property.
- To determine which type of media a digital video track contains, check the digital video's `trackType` sprite or cast member property.
- To determine the start time of a track in a digital video sprite or cast member, check the digital video's `trackStartTime` sprite or cast member property.
- To determine the stop time of a track in a digital video sprite or cast member, check the digital video's `trackStopTime` sprite or cast member property.

- To determine whether a sprite's track is enabled to play, check the digital video's `trackEnabled` sprite property.
- To obtain the text at the current time from a text track in a digital video sprite, check the digital video's `trackText` sprite property.
- To determine the time of the track before the current time in a digital video, check the digital video's `trackPreviousSampleTime` cast member property and `trackPreviousKeyTime` sprite property.
- To determine the time of the next sample after the current time in a digital video, check the digital video's `trackNextSampleTime` cast member property and `trackNextKeyTime` sprite property.

Turning on and off digital video tracks with Lingo

By turning a digital video's soundtracks on or off, you can play only the animation or control which sounds play.

To control whether individual digital video tracks play:

- Use the `setTrackEnabled` command. See `setTrackEnabled` in the *Lingo Dictionary*.

Controlling QuickTime with Lingo

Lingo can control QuickTime in ways that aren't available for AVI. You can use Lingo to control a QuickTime video's appearance and sound volume. For QuickTime VR, you can use Lingo to pan a QuickTime VR digital video and specify what happens when the user clicks or rolls over portions of the video.

You can set the rotation, scale, and translation properties for either a QuickTime cast member or a sprite. For more information, see the *Lingo Dictionary*.

- To determine whether a cast member or sprite is a QuickTime VR digital video, test the `isVRMovie` property.
- To obtain a floating-point value that identifies which version of QuickTime is installed on the local computer, use the `quickTimeVersion()` function.
- To control a QuickTime sprite's sound volume, set the `volume` sprite property.
- To set the internal loop points for a QuickTime cast member or sprite, set the `loopBounds` sprite property.

Applying masks for QuickTime

Director provides specific Lingo properties for applying masks to QuickTime digital videos. For more information, see the *Lingo Dictionary*.

- To use a black-and-white cast member as a mask for QuickTime media rendered direct-to-Stage, set the `mask` cast member property.
- To control the way Director interprets a QuickTime video's mask cast member property, set the `invertMask` property.

Responding to user interaction

Lingo lets you control how QuickTime VR responds when the user clicks a QuickTime VR sprite. Use Lingo to specify how Director handles image quality, clicks and rollovers on a QuickTime VR sprite, clicks on hotspots, and interactions with QuickTime VR nodes. For more information, see the *Lingo Dictionary*.

- To set the codec quality to use when the user drags on a QuickTime VR sprite, set the `motionQuality` sprite property.
- To specify the codec quality to use when a QuickTime VR panorama image is static, set the `staticQuality` sprite property.
- To enable or disable a specific hotspot for a QuickTime VR sprite, use the `enableHotSpot` command.
- To control how Director passes mouse clicks on a QuickTime sprite, set the `mouseLevel` sprite property.
- To find the approximate bounding rectangle for a specific hotspot in a QuickTime VR sprite, use the `getHotSpotRect()` function.
- To specify the name of the handler that runs when the pointer enters a QuickTime VR hotspot that is visible on the Stage, set the `hotSpotEnterCallback` QuickTime VR sprite property.
- To find the ID of the hotspot, if any, at a specific point on the Stage, use the `ptToHotSpotID()` function. .
- To specify the name of the handler that runs when the user clicks a hotspot in a QuickTime VR sprite, set the `triggerCallback` sprite property.
- To determine the name of the handler that runs when the pointer leaves a QuickTime VR hotspot that is visible on the Stage, set the `hotSpotExitCallback` property.
- To specify the ID of the current node that a QuickTime VR sprite displays, set the `node` QuickTime VR sprite property.
- To specify the name of the handler that runs after the QuickTime VR sprite switches to a new active node on the Stage, set the `nodeEnterCallback` QuickTime VR sprite property.
- To specify the name of the handler that runs when a QuickTime VR sprite is about to switch to a new active node on the Stage, set the `nodeExitCallback` QuickTime VR sprite property.
- To determine the type of node that is currently on the Stage, test the `nodeType` QuickTime VR sprite property.

Rotating and scaling QuickTime video

Lingo can rotate and scale QuickTime videos, as described in the following list. For more information, see the *Lingo Dictionary*.

- To control the rotation of a QuickTime sprite, set the `rotation` QuickTime sprite property.
- To control the scaling of a QuickTime sprite, set the `scale` QuickTime sprite property.

Panning QuickTime VR

Use Lingo to pan a QuickTime VR digital video without the user dragging the image, as described in the following list. For more information, see the *Lingo Dictionary*.

- To set the current pan of the QuickTime VR sprite, set the `pan` QuickTime VR sprite property.
- To nudge a QuickTime VR sprite in a specific direction, use the `nudge` command.

Displaying QuickTime video

Lingo can control how a movie displays QuickTime videos, as described in the following list. For more information, see the *Lingo Dictionary*.

- To specify the type of warping performed on the panorama of a QuickTime VR sprite, set the `warpMode` QuickTime VR sprite property.
- To specify a QuickTime VR sprite's current field of view, set the `fieldOfView` QuickTime VR sprite property.
- To swing a QuickTime VR sprite to a specific pan, tilt, or field of view, set the `swing` function.

Cropping digital video

Cropping a digital video means trimming the edges off the top or sides of the movie image. Cropping doesn't permanently remove the portions you crop, but it hides them.

To crop a digital video:

1. Select the cast member in the Cast window.
2. Click the QuickTime or AVI tab in the Property inspector.

   Note: Cropping is not allowed with RealMedia movies.

3. Select Crop.

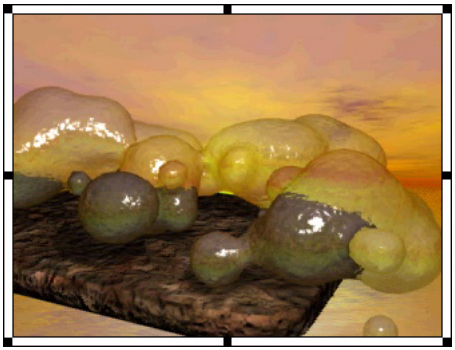
   Director retains the movie's original size if you resize the bounding rectangle; however, the edges of the movie will be clipped if you make the bounding rectangle too small.

4. Select Center, if you wish.

   Director centers the movie when you resize the bounding rectangle. If Center is not selected, the movie maintains its original position when you resize its bounding rectangle. Center is available only if Crop is selected.

5. Select the video in the Score.

6 Go to the Stage and drag any of the handles that appear on the selection rectangle that surrounds the video image.



Director displays only as much of the movie image as will fit in the area that is defined by the selection rectangle.

If you would rather scale the movie than resize it, select Scale instead of Crop on the QuickTime tab in the Property inspector. Director scales the movie if you resize the bounding rectangle.

To use Lingo to move the image of a QuickTime video around within the sprite's bounding rectangle:

- Set the digital video's `translation` QuickTime sprite or cast member property.See `translation` in the *Lingo Dictionary*.

About using digital video on the Internet

In both stand-alone projectors and movies playing in web browsers, Director can handle digital video the same way it handles all other media, or it can stream the digital video using QuickTime 4 or later. You can link the digital video to a URL, and the movie begins to download and play the digital video when its sprite first appears on the Stage.

In order for the digital video cast member to stream, you must set its `streaming` property to `TRUE`. QuickTime 4 or later must be installed to enable streaming.

If a streaming QuickTime file contains cue points you want to use, you must set the text track to be preloaded (use a QuickTime editor such as MoviePlayerPro to do this). If you do not preload the text track, Director will disable the cue points so it can stream the file without entirely downloading it first.

You can also import a Real Time Streaming Protocol (RTSP) stream as a QuickTime cast member. The rtsp:// URL must end with the filename extension .mov so that Director knows it should be treated as a QuickTime stream.

When you use streaming digital video in a movie that is distributed on the Internet, remember the following points:

- The video begins to play immediately unless the member's `pausedAtStart` property is set to `TRUE` or the `controller` member property is set to `TRUE`.
- After a digital video begins to download, the download continues until it is finished, even if the sprite no longer appears on the Stage. Use the `percentStreamed` QuickTime sprite property to test how much of the media has been downloaded.The feature works with QuickTime videos only. .See `percentStreamed` in the *Lingo Dictionary*.

Preloading AVI digital video

You can eliminate the delay caused by loading an AVI digital video from disk during a Director movie by loading it at the beginning of the movie. You can preload an entire AVI digital video (or as much of the video as will fit into available memory) using the Property inspector.

To preload an AVI digital video:

1. Select an AVI digital video cast member in the Cast window.
2. Click the AVI tab in the Property inspector.
3. Select Preload.

This option uses the `preLoad` or `preLoadMember` command. If there is not enough memory to load the entire movie, Director loads only what will fit into memory. If this option is turned off, Director does not load the movie into memory and instead plays it from disk. This results in slower animation speeds, since each frame must be retrieved from disk before it is played.

Synchronizing video and animation

To pause the playhead until a specified cue point in digital video is reached, you can use the Wait for Cue Point option in the Tempo dialog box. You can also use this function to wait for the end of the digital video, even if it has no cue points. Cue points can also be used to trigger events that will be interpreted by Lingo.

The techniques for synchronizing digital video and animation are the same as those for synchronizing sound and animation. For details see "Synchronizing media" on page 328.

Using RealMedia content in Director

The Macromedia Director Xtra for RealSystem Streaming Media (Xtra for RealMedia) adds RealAudio and RealVideo to the media types supported by Director (Windows only), and handles the playback of RealMedia content in the Shockwave player (Windows only) using an embedded RealPlayer engine. Support for the RealAudio and RealVideo media types allows Director developers to add streaming RealMedia content to Shockwave movies and manipulate it using the standard controls available in Director. This content can be viewed by users who have the Shockwave player and RealPlayer 8 or RealOne Player installed on their system.

RealNetworks RealAudio and RealVideo formats are recognized as the standard for streaming media content on the web today. The ability to add RealMedia content to Shockwave movies allows Director developers to take advantage of the 180 million RealPlayer programs currently in use, and because the Xtra for RealMedia provides an automatic detection and installation prompt feature for RealPlayer 8 and RealOne Player, there is no risk of locking out any of the 200 million users who have already installed the Shockwave player. In addition, the Xtra for RealMedia is automatically downloaded and installed the first time a user attempts to view a Shockwave movie containing RealMedia content.

This document contains instructions for using existing RealMedia streams in Director and assumes a basic familiarity with Director, including using inspectors and behaviors.

You cannot create or edit RealMedia content in Director. RealMedia streaming content is created with RealNetworks production tools such as RealProducer Plus and RealProducer Basic. For information about creating content with these tools, see the RealNetworks website at www.realnetworks.com.

System requirements

To create Shockwave movies containing RealMedia content, the following must be installed:

- Director MX, which includes the Xtra for RealMedia (Windows only)
- RealPlayer 8 or RealOne Player (RealNetworks products available for download at www.real.com)

To view Shockwave movies containing RealMedia content, the following software must be installed:

- The Shockwave player.
- RealPlayer 8 or RealOne Player. If a user without RealPlayer 8 or RealOne Player attempts to play a Shockwave movie containing a RealMedia cast member, a dialog box asks whether the user wants to go to the RealNetworks website and download RealPlayer 8 or RealOne Player.
- The Xtra for RealMedia (listed in the Movie Xtras dialog box as RealMedia Asset.x32 on Windows) is not part of the standard Shockwave 8.5 installation but is available as an Xtra download package from Macromedia's website (www.macromedia.com). The first time a user attempts to view a Shockwave movie containing RealMedia content, the Shockwave player automatically downloads and installs this Xtra. (For more information, see "Publishing Shockwave movies with RealMedia" on page 353.)

In addition, viewers of your Shockwave movies must have one of the following operating system/browser setups:

- Microsoft Windows 95/98/XP/2000/NT4 or later with Microsoft Internet Explorer 4.01 or later or Netscape Navigator 4.0 or later

License restrictions and copyright information

The Macromedia Director license agreement outlines the restrictions and requirements for creating and serving content created using Macromedia Director Xtra for RealSystem Streaming Media (referred to as the Xtra for RealMedia in this document and RealMedia Asset.x32 (Windows) in the Movie Xtras dialog box). Please read the license agreement carefully before creating Shockwave movies using RealMedia content.

RealMedia sample file

If you have RealOne Player or RealPlayer 8 installed on your system and are familiar with Director, viewing and using RealMedia files in Director is incredibly quick and easy. Before you begin reading this document, please view the RealMedia sample file included on the Director MX CD or the videotest.rm file included in the RealPlayer program installation folder.

To view the sample file:

1. Launch Director.
2. Select File > Import.
3. Browse to one of these test files:

- If you have the Director MX CD, select a file in the Macromedia\Support\RealMedia folder.
- If you don't have the Director MX CD, select the videotest.rm file in the RealPlayer 8 or RealOne Player installation folder.

4. Click Import.

   The file appears in the Cast window.

5. Drag the file to the Stage and select Control > Play.

After you view the sample file, you are ready to start laying out the other elements of your movie.

About RealMedia streams in Director

Director includes the following RealMedia support:

- The RealMedia tab in the Property inspector
- RealMedia behaviors
- Lingo elements for RealMedia, including functions, methods, and properties
- The RealMedia viewer

Director supports RealAudio and RealVideo stream formats, but does not support other formats that RealPlayer supports, such as SMIL (Synchronized Multimedia Integration Language), RealPix, or RealText. Although some of these formats may work with the Xtra for RealMedia, there might be significant problems with playback.

RealMedia cast members

RealMedia cast members are always linked cast members; they reference an external stream via a URL (of type HTTP, RTSP, or PNM) to a location on the Internet or a local file on your hard disk or network file server. RealMedia cast members are always of type `#realMedia`.

Sprites created from RealMedia cast members are treated as regular sprites and can be rotated, skewed, stretched, flipped, colorized, composited with other sprite layers with ink, and manipulated with the new Lingo elements for RealMedia as well as standard sprite and cast member Lingo.

All RealMedia properties and methods invoked on a RealMedia sprite invoke the corresponding cast member's properties and methods. This is because Director plays back RealMedia files at the cast member level rather than the sprite level. For more information, see "RealMedia stream playback" on page 345.

You can have as many RealMedia streams and cast members in your Director movie as you want, as long as you play them consecutively, not concurrently. This version of Director does not support playing multiple RealMedia cast members at the same time.

RealMedia video

The RealVideo portion of your RealMedia file is rendered offscreen, and there is no Direct to Stage option. This means that you can layer other sprites on top of your RealMedia sprite. For example, you might do this if you wanted to display text across the RealVideo as it plays. You can use new Lingo elements to jump forward or backward in the stream, or grab the current frame of the RealVideo stream and use it as a texture for a 3D object.

RealVideo is fully integrated into the graphics capabilities of Director, and you add RealMedia cast members containing RealVideo to a movie just as you would any other cast member. The RealVideo content begins playing when the playhead reaches the frame containing the RealMedia content, unless the `pausedAtStart` property of the sprite or cast member is set to `TRUE`.

RealMedia audio

You can have the RealAudio portion of your RealMedia cast member processed in one of two ways: by Director (the default) or by RealPlayer. Your choice depends mainly on whether you want to use Lingo sound elements.

- If you use Director to process RealAudio in your movie, you can use Lingo sound methods and properties to control and manipulate RealAudio, including mixing RealAudio with other Director audio. However, note that all RealAudio is played in a single sound channel. If you inadvertently overlap RealMedia cast members in the score, and the second RealMedia cast member begins to play before the first cast member is finished, the second cast member's sound is played in the same sound channel as the first cast member, even if you assigned a different sound channel to the second cast member. If the RealMedia cast members do not overlap, they are played in the sound channel specified. (If you do not assign a sound channel to a RealMedia cast member, the RealAudio is played in the highest available sound channel.)

  For more information about working with Director audio, see the Lingo entries for `realPlayerNativeAudio()`, `soundChannel (RealMedia)`, and `audio (RealMedia)` in the *Lingo Dictionary*. For information on using standard Lingo sound elements with RealMedia content, see "Using Lingo sound elements with RealMedia" on page 354, as well as the sound methods and properties in the main *Lingo Dictionary*.

- If you use RealPlayer native audio to process RealAudio, all Lingo sound elements and the audio property in the Property inspector are ignored. You enable RealPlayer native audio by setting the `realPlayerNativeAudio()` function to `TRUE`. This function should be executed in a `prepareMovie` event handler in a movie script. This is a system-level function that you can only set using Lingo, so you must set it before the first RealMedia cast member is encountered in the Score, which causes Director to load the RealPlayer engine. Once the RealPlayer is loaded, changes to this function are ignored.

RealMedia stream playback

In Director, RealMedia playback occurs at the cast member level, not the sprite level. Therefore, if you have two sprites of a cast member, and you apply a command or property to one of the sprites, the command will be applied to both of the sprites. For example, if you select the Display Real Logo check box (or call the corresponding `displayRealLogo` Lingo property in a script) for one of the sprites, the Display Real Logo check box is automatically selected for both of the sprites, and the RealNetworks logo is displayed when either sprite plays. This is true for all methods and properties, not just the `displayRealLogo` property.

If your movie contains more than one RealMedia sprite (not playing at the same time) that reference the same cast member, you may want to create two cast members referencing the same URL, so that the sprites can be controlled independently. Sprites that reference the same cast member are subject to the methods and properties of the member.

Streaming

Streaming is the most efficient and user-friendly method of downloading, viewing, and listening to video and audio content on the Internet. Users can begin viewing content as soon as a small portion (usually a few seconds) of the file has downloaded. As the stream plays, the rest of the stream continues to download in the background.

If you understand how the streaming process works in Director, and for RealMedia cast members in particular, you can minimize the amount of time users must wait before your content begins to play in the browser.

The Shockwave player first downloads the Score information, scripts, and information about the size and shape of each cast member, and then downloads the media in the cast members as they are played in the movie. When a RealMedia cast member begins to play, the streaming process begins and cycles through the various states. If you are viewing content in the RealMedia viewer, the `mediaStatus` property value that corresponds to the state in the streaming process is displayed in the status bar.

During the seeking or buffering state (`mediaStatus #buffering`), RealMedia cast members are downloading into a buffer that holds the portion of the stream that is about to play. This initial loading of the buffer is what causes the delay between the call to the `play` command (in the Score or user initiated) and the actual playing of the stream. Once the stream begins to play, the information in the buffer is continually updated with the next portion of the stream to be played, and the stream plays without interruption. For more information, see the entry for `percentBuffered` in this document.

When using Lingo with RealMedia cast members, you need to know which streaming state the cast member has reached, or script errors can result. For complete information on the order of the states in the streaming process and the impact on RealMedia cast members, see the `state (RealMedia)` and `mediaStatus` entries in this document.

Streaming of RealMedia cast members is handled by RealPlayer, not the Shockwave player. Since the streaming of RealMedia cast members is independent of the streaming functionality of Director, RealMedia cast members are not placed in the Director cache, and NetLingo does not apply to RealMedia cast members.

Authoring tips

Review the following guidelines before you begin creating RealMedia cast members and assembling your movie.

- Whenever possible, refer to sprites rather than cast members in Lingo scripts. Because future versions of Director may enable sprite-level playback of RealMedia cast members, referring to sprites may help ensure that your movies are forward-compatible with Director.
- After you create a RealMedia cast member, play the movie once to obtain and save the `duration`, `height`, and `width` properties of the RealMedia cast member, and then lay out the rest of your movie. These properties are not known until the cast member is played, and the values initially displayed in the Property inspector are placeholders.
- When using RealMedia cast members, it is a good idea to loop the playing of the cast member or sprite in a limited number of frames in the movie. The reason for this is that the Score is frame-based not time-based, which makes it difficult to determine the frame span for the sprite or cast member in the Score. This is true for sprites and cast members of all media types, but especially for streaming RealMedia sprites and cast members that are subject to network congestion and rebuffering.
- RealPlayer is not designed to play concurrent streams, and since RealAudio and RealVideo files in Director movies are played by an embedded RealPlayer engine, playing more than one RealMedia cast member at the same time is not supported.
- If the RealMedia cast member in your movie references a local file instead of a remote URL, be sure that the file path you specified in the Property inspector is relative to the final document, or that you update the file path with the new location of the file before publishing your movie.

  All RealMedia content must live on a server authorized to serve RealMedia streaming content. For more information about serving RealMedia content, see the RealProducer Help installed with the RealProducer program, and visit the developer section of the RealNetworks website at www.realnetworks.com/devzone.

Creating RealMedia cast members

As with other media types, there are three ways to create a RealMedia cast member: insert the RealMedia content using Insert > Media element, import the remote or local RealMedia file using File > Import, or use the New Cast Member (+) button in the RealMedia viewer. The instructions for importing remote and local files differ slightly.

When you initially create a RealMedia cast member, the values listed for the height, width, rect, and duration properties in the Property inspector are placeholder values. The actual values of these properties remain unknown until the cast member is played and saved for the first time. For more information, see “Obtaining dynamic RealMedia cast member properties” on page 348.

Before following these instructions, make sure the Property inspector is open (Window > Property Inspector).

To create a RealMedia cast member using Insert › Media Element:

1. Select Insert > Media Element > RealMedia.
2. On the Member tab in the Property inspector, enter the name of the RealMedia cast member and enter the URL, or use the "..." button to browse to the location of a local RealMedia file.
3. Use the options on the RealMedia tab in the Property inspector to specify the properties of the cast member.

   For details, see "The RealMedia tab in the Property inspector" on page 349.

To create a RealMedia cast member from a remote file using File › Import:

1. Select File > Import or press Control+R to open the Import File dialog box.
2. Click the Internet button.
3. In the dialog box that appears, enter the URL where your RealMedia file is located and click OK.
4. Click Import.

   The RealMedia cast member is now listed in the Cast window with a RealMedia icon. The name of the cast member is automatically entered in the Property inspector's Name field, and the URL of the file is automatically entered in the Filename field on the Property inspector Member tab.
5. Specify the properties of the cast member using the Property inspector RealMedia tab. For details, see "The RealMedia tab in the Property inspector" on page 349.

To create a RealMedia cast member from a local file using File › Import:

1. Select File > Import or press Control+R to open the Import File dialog box.
2. Navigate to the RealMedia file you want to import.
3. Click Import.

   The RealMedia cast member is now listed in the Cast window with a RealMedia icon. The name of the cast member is automatically entered in the Property inspector's Name field, and the URL of the file is automatically entered in the Filename field on the Property inspector Member tab.
4. Specify the properties of the cast member using the Property inspector RealMedia tab. For details, see "The RealMedia tab in the Property inspector" on page 349.

To create a RealMedia cast member using the New Cast Member (+) button in the RealMedia viewer:

1. Select Window > RealMedia to open the RealMedia viewer.
2. Click the New Cast Member (+) button on the RealMedia viewer to create a new cast member.
3. On the Member tab in the Property inspector, enter a name for the RealMedia cast member, and enter the URL or use the "..." button to browse to the location of a local RealMedia file.
4. Use the options on the Property inspector RealMedia tab to specify the properties of the cast member. For details, see "The RealMedia tab in the Property inspector" on page 349.

Obtaining dynamic RealMedia cast member properties

When a RealMedia cast member is initially created, the values that are listed in the Property inspector for the dynamic properties—`height`, `width`, `rect`, and `duration`—are placeholder values. After you play the cast member on the Stage or in the RealMedia viewer, the actual values for the properties are saved and appear in the Property inspector. When you save the movie, these values are saved with the cast member.

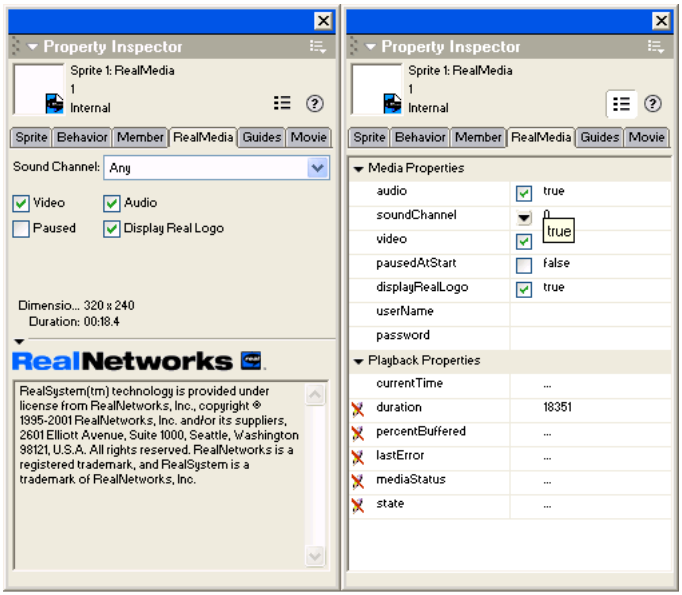
It's a good idea to obtain and save the actual values of the dynamic RealMedia properties before you begin laying out your movie. Although you cannot set or change any of these properties, you can adjust the height and width of RealMedia sprites on the Stage to fit your movie's proportions. It is important to remember that the actual playback time of a stream can vary, depending on the level of network congestion and stream rebuffering and that the `duration` value of a cast member referencing a live feed is always 0.

To play RealMedia cast members:

- To play the RealMedia cast member with other elements of your Director movie, drag the RealMedia cast member to the Stage or Score and select Control > Play. The RealMedia cast member will start to play after the playhead reaches the frame that contains the cast member, unless the `pausedAtStart` property for the cast member is set to `TRUE`.
- To play the cast member without the other elements of your movie, double-click the cast member in the Cast window and click the Play button in the RealMedia viewer.

The RealMedia tab in the Property inspector

The RealMedia tab in the Property inspector displays the properties of RealMedia cast members. To set or change the editable properties, you can use the Property inspector or the Lingo properties for RealMedia. Even if you are not planning to use the Lingo properties, it is a good idea to read the Lingo entries for the properties that appear in the Property inspector because they contain valuable information. See “Using Lingo sound elements with RealMedia” on page 354.



Two views of the RealMedia tab in the Property inspector

You can work with the following media properties:

- `audio (RealMedia)` specifies whether the audio portion of the RealMedia stream plays (`TRUE`) or not (`FALSE`). The default setting is `TRUE`. This property has no effect if `realPlayerNativeAudio()` is enabled.
- `soundChannel (RealMedia)` specifies the Director sound channel where the RealAudio plays. The default setting is Any (0), which means the audio plays in the highest available channel. This property has no effect if you enable `realPlayerNativeAudio()`.
- `video (RealMedia)` specifies whether the video portion of the RealMedia stream appears (`TRUE`) or not (`FALSE`). The default setting is `TRUE`.
- `pausedAtStart (RealMedia)` specifies whether the RealMedia stream begins to play automatically when the playhead enters the frame span of the RealMedia cast member or sprite (`FALSE`) or not (`TRUE`). The default setting is `FALSE`.
- `displayRealLogo` specifies whether the RealNetworks logo appears. When this property is set to `TRUE`, the RealNetworks logo appears at the beginning of the stream and when the video is stopped or rewound.

- `userName (RealMedia)` lets you specify a user name if the cast member references a protected URL. For security purposes, after a user name has been entered, it cannot be retrieved. If this property has been set, the value that appears in the Property inspector is ********.
- `password` allows you to specify a password if the cast member references a protected URL. For security purposes, after a password has been entered, it cannot be retrieved. If this property has been set, the value that appears in the Property inspector is ********.

You can work with the following playback properties:

- `currentTime (RealMedia)` displays the current time in the RealMedia stream in milliseconds. Setting this property in the Property inspector is the same as using the `seek` command in Lingo.
- `duration (RealMedia)` displays the length of the RealMedia stream in milliseconds. This property is not known until the movie has been played once and saved. The duration of a live stream is always 0. This property cannot be set.
- `percentBuffered` displays the percentage of the playback buffer that has been filled with the RealMedia stream. This property cannot be set.
- `lastError` displays the last error returned by RealPlayer. This property cannot be set.
- `mediaStatus` displays the current status of the RealMedia stream. For a list of possible values, see the `mediaStatus` entry. This property cannot be set.
- `state` displays which state the cast member is currently in the streaming process. For a list of possible values, see the `state (RealMedia)` entry. This property cannot be set.

About RealMedia behaviors

The RealMedia behaviors are designed to let you easily add playback controls for RealMedia streams in your movie using custom graphics.

The following RealMedia behaviors are listed in the Media > RealMedia section of the Library palette:

RealMedia Target identifies a RealMedia sprite as the target for RealMedia behaviors that are attached to the graphic, text, or field sprites for the playback controls. You must attach this behavior to a RealMedia sprite on the Stage before you can use any of the other RealMedia behaviors. This behavior does not control the RealMedia sprite by itself, but works with the other RealMedia behaviors to control the sprite.

RealMedia Control Button lets a graphic sprite function as a control button for the RealMedia sprite with the RealMedia Target behavior attached. Possible control button behaviors are Pause, Play, Stop, Small Forward, Small Backward, Large Forward, Large Backward, Toggle Audio, Audio On, Audio Off, Toggle Video, Video On, and Video Off.

RealMedia Slider Bar lets a graphic sprite define the horizontal limits of travel for the RealMedia Slider Knob behavior, which must be used with this behavior. The RealMedia Slider Bar behavior requires that a RealMedia sprite (with the RealMedia Target behavior attached) be on the Stage.

RealMedia Slider Knob lets a graphic sprite function as a slider to control and monitor the playback location (current time) of the RealMedia sprite with the RealMedia Target behavior attached. When the user drags a sprite that has this behavior attached, a seek action is performed on the stream.

RealMedia Buffering Indicator lets a text area or field provide a graphical display of the stream-buffering progress of the RealMedia sprite with the RealMedia Target behavior attached. As stream buffering progresses, the width of the sprite increases from 0 to 100%.

RealMedia Stream Information lets a text area or field display text information for the RealMedia sprite with the RealMedia Target behavior attached. The text information can include one of the following: the percent buffered, media status, current time, or file location or URL of the RealMedia file. You select the information to display using the pop-up menu in the Parameters dialog box for this behavior.

Using RealMedia behaviors

You attach RealMedia behaviors in the same way as you do other Director behaviors: drop the behavior onto the sprite and use the dialog box to assign a group and other parameters.

The RealMedia Target behavior is the central RealMedia behavior and must be dropped onto the RealMedia sprite before you can use any other behavior.

The RealMedia Slider Knob and RealMedia Slider Bar behaviors must be used together; if they can't locate one another, a one-time error message appears.

To attach RealMedia behaviors:

1. Create a RealMedia sprite on the Stage.
2. Open the Library palette (Window > Library Palette), and select Media > RealMedia from the pop-up menu to display the RealMedia behaviors.
3. Drag the RealMedia Target behavior to the RealMedia sprite on the Stage.
4. Enter the number of milliseconds for a long and short seek operation, and assign the behavior to a group or accept the defaults.

   The number of milliseconds you specify for a long or short seek is the number that is used by the various forward and back options of the RealMedia Control Button behavior. Be aware that short seeks are ineffective because the amount of time it takes the stream to rebuffer is generally longer than the number of milliseconds that are skipped in the stream.
5. Create graphic sprites to act as slider controls and Play, Stop, and Pause buttons for the RealMedia sprite and place them on the Stage. You can also create a graphic sprite to display the buffering progress of the RealMedia stream.

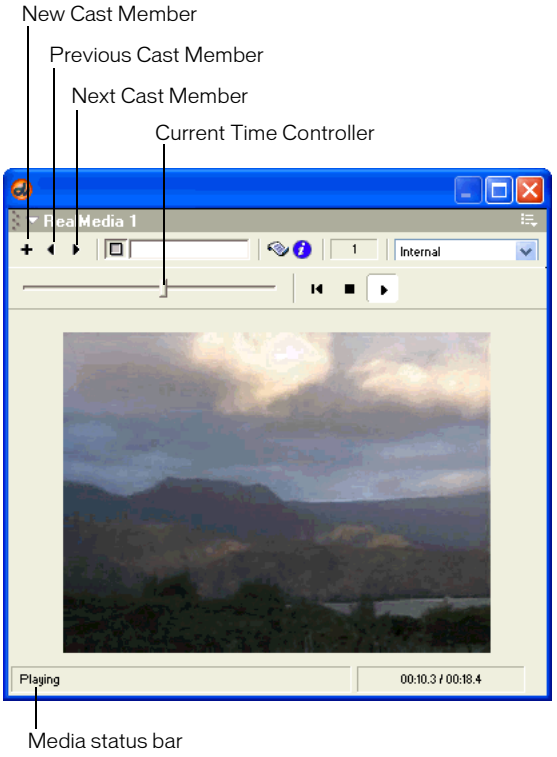
   These sprites should be basic graphic sprites, not functional buttons; the RealMedia behaviors add the button functionality.
6. Drag the RealMedia Control Button, RealMedia Slider Bar, RealMedia Slider, and RealMedia Buffering Indicator behaviors to the sprites that you created on the Stage, and select the appropriate action and group using the pop-up menu in the Parameters dialog box.

   The group to which you assign the behavior must be the same group you created for the RealMedia Target behavior.
7. Create a field on the Stage to display playback information about the RealMedia sprite similar to the information that appears in the status bar of the RealMedia viewer.
8. Drag the RealMedia Stream Information behavior to the field; then select the type of information you want to display and the group that the behavior belongs to in the Parameters dialog box.

You can create as many of these features as you like. You do not have to use control buttons in movies with RealMedia cast members if you want to control them from the Score or using Lingo.

The RealMedia viewer

The new RealMedia viewer is a simple media viewer that lets you play RealMedia cast members in isolation from other elements of your movie. You cannot edit RealMedia cast members in the RealMedia viewer.



The RealMedia viewer

The viewer has the following controls:

New Cast Member (+) lets you create a new RealMedia cast member. You need to open the Property inspector to specify the name and filename for the cast member.

Next Cast Member (right arrow) lets you view the next RealMedia cast member (in the current cast) in the viewer.

Previous Cast Member (left arrow) lets you view the previous RealMedia cast member (in the current cast) in the viewer.

Play initiates the streaming process for the current RealMedia cast member. (For details about the streaming process, see the `state (RealMedia)` property.)

Rewind stops playback, empties the stream buffer, and resets the stream to the beginning. This is equivalent to the `stop (RealMedia)` command in Lingo.

Stop stops the playback but does not reset the stream to the beginning or empty the stream buffer. If the user clicks Play after clicking Stop, play resumes where it left off, without rebuffering (unless it is a live stream, in which case it rebuffers to join the live stream in progress). This is equivalent to the `pause (RealMedia)` command in Lingo.

Current Time Controller lets the user jump ("seek") to any position in the RealMedia stream. The slider is disabled if the duration of the stream is not yet known (for example, the first time a stream plays), if `mediaStatus` is `#closed`, or if the cast member references a live feed. If the user drags the slider while the stream is playing, the stream buffers and automatically starts playing from the new position, but if the slider is dragged while the stream is paused or stopped, the user must click the Play button to restart the stream. This is equivalent to the `seek` command in Lingo.

The media status bar displays the current value of the `mediaStatus` property on the left, and the current time and duration of the stream on the right, in the format MM:SS.S or HH:MM:SS.S. If the stream is playing, the status appears as Playing.

To view a RealMedia cast member in the RealMedia viewer:

1. Select Window > RealMedia to open the RealMedia viewer.
2. Do one of the following:

- Click the Play button to play the RealMedia cast member that is currently on the Stage or selected in the Cast window.
- Use the Next (right arrow) and Previous (left arrow) buttons to select the RealMedia cast member you want to view, and click the Play button.
- Double-click a RealMedia cast member in the Cast window; a RealMedia viewer opens automatically.

Publishing Shockwave movies with RealMedia

The Xtra for RealMedia is not part of the standard Shockwave 8.5, but can be downloaded from the Macromedia website. The first time a user attempts to play a Shockwave movie that contains a RealMedia cast member, the Shockwave player automatically downloads and installs the Xtra for RealMedia if you selected RealMedia Asset.x32 in the Movie Xtras dialog box.

To add the Xtra for RealMedia to your movie:

1. Select Modify > Movie > Xtras to display the Movie Xtras dialog box.
2. Select RealMedia Asset.x32 in the list.

   If RealMedia Asset.x32 does not appear in the list, click the Add button, and select it in the Add Xtras dialog box.
3. Select the Include in Projector and Download if Needed options.
4. Click OK.

Using Lingo sound elements with RealMedia

All the Lingo elements in this section are documented in the main *Lingo Dictionary* and are discussed here only as they pertain to working with RealMedia content. For complete information, see the *Lingo Dictionary*.

Supported sound elements

The following Lingo elements operate on a sound channel and are fully supported for sound channels playing the audio portion of a RealMedia cast member:

- `isBusy()`
- `elapsedTime`
- `fadeIn()`
- `fadeOut()`
- `fadeTo()`
- `pan` (sound property)
- `soundBusy()`

Although you can use the following Lingo elements with a RealMedia cast member, they cause problems when used on a sound channel. For example, you can use `member("Real").stop()` but should not use `sound(whichChannel).stop()` if the audio portion of a RealMedia cast member uses `whichChannel`.

- `member` (sound property)
- `pause()`
- `play()`
- `stop()`

You can use the following property on a sound channel playing the audio portion of a RealMedia stream but not directly on a RealMedia cast member. For example, you can use `sound(whichChannel).volume = 200`, but not `member("Real").volume = 200`.

`volume`

You can set the system variable `soundEnabled` to `FALSE` to turn off RealAudio, but if you reset it to `TRUE`, you must also call the `play` command to resume playback.

Unsupported sound elements

The following Lingo elements are not supported for RealMedia cast members or for sound channels playing the audio portion of a RealMedia stream:

- `breakLoop()`
- `channelCount`
- `endTime`
- `getPlayList()`
- `loopCount`
- `loopEndTime`
- `loopsRemaining`
- `loopStartTime`
- `playNext()`
- `puppetSound`
- `queue()`
- `rewind()`
- `sampleCount`
- `setPlayList()`
- `soundClose` (obsolete)
- `sound playFile`
- `status` (use the `state (RealMedia)` or `mediaStatus` RealMedia cast member properties instead)

CHAPTER 14
Behaviors

A behavior in Macromedia Director MX is prewritten Lingo script that you use to provide interactivity and add interesting effects to your movie. You drag a behavior from the Library palette and drop it on a sprite or frame to attach it.

If the behavior includes parameters, a dialog box appears that lets you define those parameters. For example, most navigation behaviors let you specify a frame to jump to. You can attach the same behavior to as many sprites or frames as necessary and use different parameters for each instance of the behavior.

Most behaviors respond to simple events such as a click on a sprite or the entry of the playhead into a frame. When the event occurs, the behavior performs an action, such as jumping to a different frame or playing a sound.

Director comes packaged with customizable, reusable behaviors for many basic functions; you and other developers can also create your own behaviors by writing Lingo script. To modify behaviors, you use the Behavior inspector or Property inspector.

For more information about using included behaviors, see "Using Director behaviors" on the Director Support Center at www.macromedia.com/support/director/lingo/d8/d8behaviors.html.

Attaching behaviors

You use the Library palette to display behaviors included in Director.

Director allows you to attach the same behavior to several sprites or several frames at the same time. You can attach as many behaviors as you want to a sprite, but you can attach only one behavior to a frame. If you attach a behavior to a frame that already has a behavior, the new behavior replaces the old one. Behaviors attached to frames are best suited to actions that affect the entire movie. For example, you might attach `Loop Until Media in Frame is Available` to make the movie wait while the media for a particular frame downloads.

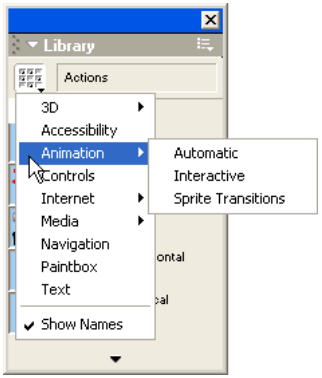
When you attach a behavior, and the Parameters dialog box appears, note that the parameters you specify apply to the behavior only as it is attached to the current sprite or frame. These settings do not affect the way the behavior works when attached elsewhere. Use the Behavior inspector to change parameters for behaviors attached to sprites or frames.

Once you attach a behavior to a sprite or frame, Director copies the behavior from the Behavior library to the currently selected cast in the movie. This means you don't have to include the Behavior library when you distribute the movie.

To attach a behavior to a single sprite or frame using the Library palette:

1 Select Window > Library Palette.

2 Select a library from the Library pop-up menu in the upper left corner of the palette.

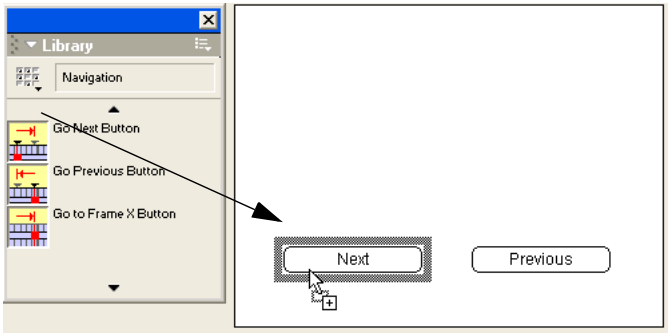


3 To view a brief description of included behaviors, move the pointer over a behavior icon.

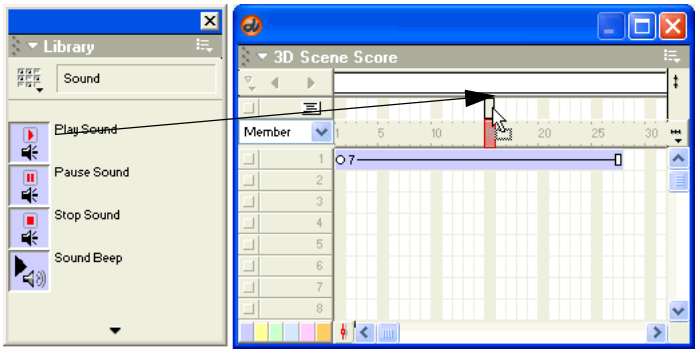
If the behavior includes a longer description, you can view it in the Behavior inspector. See "Getting information about behaviors" on page 361. The behaviors included with Director come with descriptions. Behaviors from other sources may not.

Select Show Names from the Library pop-up menu to turn the display of behavior names on or off.

4 To attach a behavior to a single sprite, drag a behavior from the Library palette to a sprite on the Stage or in the Score.



5 To attach a behavior to a frame in the behavior channel, drag a behavior from the Library palette to a frame in the behavior channel.



6 Enter parameters for the behavior in the Parameters dialog box.

Note: If you attach a behavior from a Director library of behaviors, the behavior is copied to an internal cast, to prevent you from accidentally changing the original behavior.

To attach the same behavior to several sprites at once using the Library palette:

- Select the sprites on the Stage or in the Score and drag a behavior to any one of them.

To attach behaviors that are already attached to a sprite or frame:

1 Select Window > Behavior Inspector to open the Behavior inspector.

2 Do one of the following:

- Select a sprite or several sprites.
- Select a frame or several frames.

3 Select a behavior from the Behaviors pop-up menu.

Director attaches the behavior you select to the sprite(s) or frame(s).

Note: Some behaviors work only when applied to either a sprite or a frame; for more information, read the behavior descriptions.

To change parameters for a behavior attached to a sprite or frame:

1 Select the sprite or frame to which the behavior is attached.

2 In the Behavior tab of the Property inspector, use the pop-up menus or text fields to change any parameters.

The Behavior tab has the same fields for the behavior as those in the Parameters dialog box.

Changing the order of attached behaviors

Director executes behaviors in the order they were attached to a sprite, and they are listed in this order in the Property inspector and Behavior inspector. It's sometimes necessary to change the sequence of behaviors so that actions occur in the proper order.

To change the order of the behaviors attached to a sprite:

1 Select the sprite in the Score or on the Stage.

2 Open the Behavior inspector or click the Behavior tab in the Property inspector.

3 Select a behavior from the list.

4 Click the arrows in the toolbar to move the selected behavior up or down on the list.

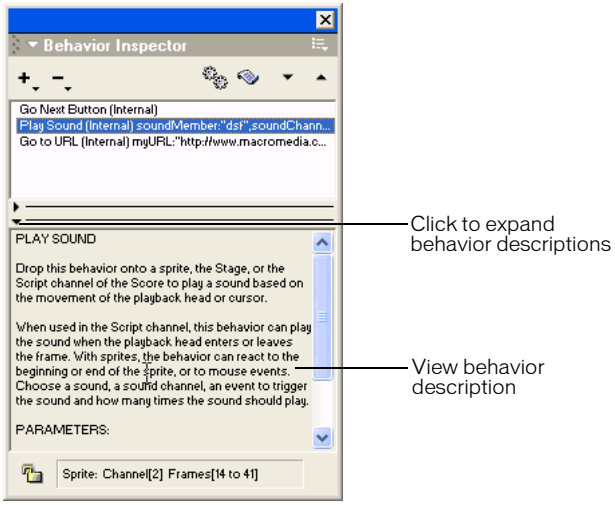
Getting information about behaviors

Behaviors included with Director have pop-up descriptions that appear when you hold the pointer over a behavior in the Library palette. Some behaviors, however, have longer descriptions and instructions, which you can view in the Behavior inspector. A scrolling pane in the Behavior inspector displays the complete description provided by the behavior's author. The Behavior inspector only displays information about a behavior attached to a sprite or frame.

To view a behavior description:

1. Open the Behavior inspector.
2. Select a sprite or frame to which a behavior has been attached.
3. Click the arrow that expands the Behavior inspector's description pane.

   You can leave the description pane expanded and select different behaviors to see their descriptions.

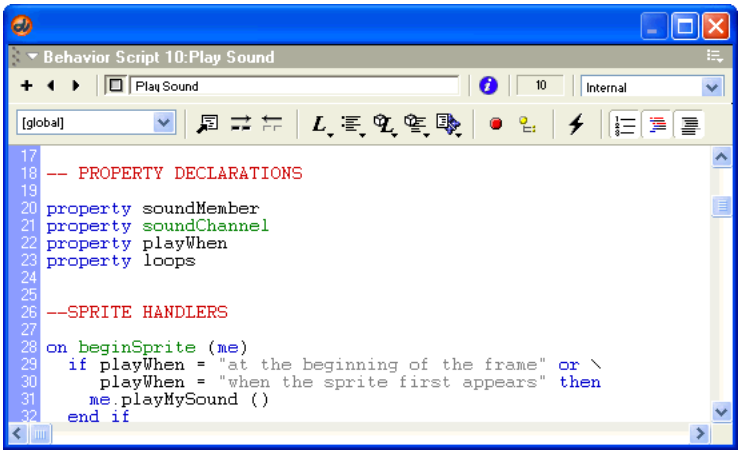


All of the behaviors included in the Director library have descriptions. Behaviors from other developers may not.

Creating and modifying behaviors

Without any scripting or programming experience, you can use the Behavior inspector to create and modify behaviors to perform basic actions. To create behaviors with more complex structures, you need to understand Lingo.

Using the Behavior inspector is a good way to learn Lingo. You can examine the scripts created by the Behavior inspector to see how basic functions are assembled. Select any behavior and click the Script button to view the associated Lingo script.



All behaviors detect an event and then perform one or more actions in response. The Behavior inspector lists the most common events and actions used in behaviors.

For experienced Lingo programmers, the Behavior inspector also provides a shortcut for writing simple scripts.

Note: To always edit behaviors in the Script window instead of the Behavior inspector, select Edit › Preferences › Editors. In the Editors Preferences dialog box, select Behaviors from the list and then click Edit. In the Select Editor box, select Script Window.

To create or modify a behavior:

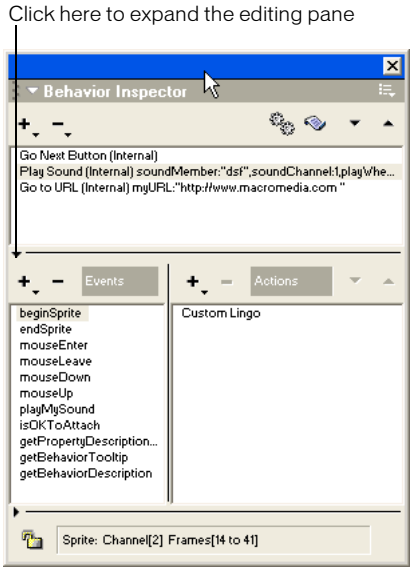
1 Do one of the following:

- To create a new behavior, click the Behaviors pop-up menu, select New Behavior, and enter a name for the new behavior.

  The behavior appears in the currently selected Cast window in the first empty position. Select an empty cast position first if you want the behavior to appear in a different place.

- To modify a behavior, select it in the Behavior inspector.

2 Click the arrow in the lower left of the Behavior inspector to expand the editing pane.



The editing pane shows the events and actions in the current behavior. If you're creating a new behavior, no events or actions appear.

- To add a new event or action group to the behavior, select an event from the Events pop-up menu and then select actions for the event from the Actions pop-up menu.

  You can choose as many actions as you need for a single event.
- To change an existing event or action group, select an event from the list and then add or remove actions in the Actions list.
- To delete an event or action group, select the event and press Delete.
- To change the sequence of actions in an event or action group, select an event from the Events list, select an action from the Actions list, and then click the up and down arrows above the Actions list to change the order of actions.
- To lock the current selection so nothing changes in the Behavior inspector when new sprites are selected, click the Lock Selection button in the lower left of the expanded Behavior inspector.

If you are familiar with Lingo, you can also edit a behavior's script directly.

Events and actions in the Behavior inspector

The actions and events included with Director are basic building blocks you can use to create simple or complex behaviors.

The Behavior inspector makes the following events available:

Mouse Up indicates that the mouse button was released.

Mouse Down indicates that the mouse button was clicked.

Right Mouse Up indicates that the right mouse button was released. (On the Macintosh, Director treats a Control-click the same as a right mouse click on a Windows system.)

Right Mouse Down indicates that the right mouse button was clicked.

Mouse Enter indicates that the pointer entered a sprite's region.

Mouse Leave indicates that the pointer left a sprite's region.

Mouse Within indicates that the pointer is within the sprite's region.

Key Up indicates that a key was released.

Key Down indicates that a key was pressed.

Prepare Frame indicates that the playhead has left the previous frame but has not yet entered the next frame.

Enter Frame indicates that the playhead has entered the current frame.

Exit Frame indicates that the playhead has exited the current frame.

New Event indicates that a specified message was received from a script or behavior. You must specify a name for this event.

The Behavior inspector makes the following actions available:

Go to Frame moves the playhead to the specified frame.

Go to Movie opens and plays the specified movie.

Go to Marker moves the playhead to the specified marker.

Go to Net Page goes to the specified URL.

Wait on Current Frame waits at the current frame until another behavior or script advances to the next frame.

Wait until Click waits at the current frame until the mouse button is clicked.

Wait until Key Press waits at the current frame until a key is pressed.

Wait for Time Duration waits at the current frame for the specified time.

Play Cast Member plays the specified sound cast member.

Play External File plays the specified external sound file.

Beep plays the current system beep.

Set Volume sets the system volume level to the specified setting.

Change Tempo changes the movie's tempo to the specified setting.

Perform Transition performs the specified transition.

Change Palette changes to the specified palette.

Change Location moves the current sprite to the specified coordinates.

Change Cast Member switches the sprite's cast member to the specified cast member.

Change Ink switches to the specified ink.

Change Cursor changes the pointer to a shape you select from the pop-up menu.

Restore Cursor restores the current system pointer.

New Action executes any Lingo function or sends a message to a handler. You specify the new handler's name.

Writing behaviors with Lingo

If you are familiar with Lingo, you can author your own behaviors.

From the perspective of Lingo, a behavior is a script with these additional features:

- Each instance of the behavior has independent values for properties. Lingo uses a `property` statement to declare properties that can have independent values in each instance of the behavior. See `property` in the *Lingo Dictionary*.
- The same set of handlers can be shared by multiple sprites or frames.

  The handlers in a behavior are basically the same as other handlers. Include as many handlers as appropriate to implement the behavior.

  A behavior is usually attached to multiple sprites or frames. As a result, the sprites and frames share the same handlers. Director tracks which instance of the behavior is which by assigning each instance a reference number. The variable `me` contains the reference for the object that the instance of the behavior is attached to.

  In many cases it's most efficient to create behaviors dedicated to specific tasks and then attach a set of behaviors that perform the variety of actions you want.
- The behavior can have parameters that users edit from the Parameters dialog box. The optional `on getPropertyDescriptionList` handler sets up the Parameters dialog box. See `on getPropertyDescriptionList` in the *Lingo Dictionary*.
- A description of the behavior can be added to the Behavior inspector. The optional `on getBehaviorDescription` handler displays a description of the behavior in the Behavior inspector. See `on getBehaviorDescription` in the *Lingo Dictionary*.
- A brief description appears as a tooltip for the behavior in the Library palette if the optional `on getBehaviorToolTip` handler that creates the tooltip has been written. See `on getBehaviorTooltip` in the *Lingo Dictionary*.

Setting up a Parameters dialog box

It's impossible to predict exactly what a user will want behaviors to do. You can make behaviors more flexible by letting the user customize the behavior's parameters.

For example, this handler moves the sprite 5 pixels to the right each time the playhead enters a new frame:

```
on enterFrame me
  if the locH of sprite the spriteNum of me > the stageRight then
    set the locH of sprite the spriteNum of me = the stageLeft
  else
    set the locH of sprite the spriteNum of me to ¬
    (the locH of sprite the spriteNum of me + 5)
  end if
end
```

However, users could adjust the speed of each sprite if they could specify how far individual sprites move to the right in each frame.

To allow users to set different values for a property in different instances of the behavior, the behavior's script needs two types of Lingo:

- A `property` statement that allows each instance to maintain a separate value for the property
- An `on getPropertyDescriptionList` handler that sets up the property

Setting behavior properties with Lingo

Behaviors usually have properties for which each instance of the behavior maintains its own values. (An instance is each sprite or frame that the behavior is attached to.) These properties are shared among handlers in a behavior's script the same way that properties are shared among handlers in an object.

To declare which properties can have independent values in each instance of the behavior:

- Put the `property` statement at the beginning of the behavior's script.

A `property` statement starts with the word `property` followed by the names of the individual properties. For example, the statement `property movement` declares that `movement` is a property of the behavior.

Customizing a behavior's property

If a behavior's script includes an `on getPropertyDescriptionList` handler, Director lets users set the property's initial values from the Parameters dialog box. The behavior's Parameters dialog box opens in three circumstances:

- After the user drags a behavior to a sprite or frame
- When the user double-clicks the behavior in the Behavior inspector dialog box
- When the user clicks the Parameters button in the Behavior inspector

The `on getPropertyDescriptionList` handler generates a property list that specifies these attributes of the property:

- The default initial value
- The type of data the property contains, such as Boolean, integer, string, cast member, or a specific type of cast member
- A comment in the Parameters dialog box to describe what the user is setting

The definition of a behavior's property must include the property's name, default value, and data type and the descriptive string that appears in the Parameters dialog box. The definition can also include an optional specification for the range of values allowed for the property.

The name of the property comes first in the definition. The remainder of the definition is a property list that assigns a value to each of the property's attributes.

For example, to define the property `movement` as an integer that can be set to a value from 1 to 10 and whose default value is 5, use a phrase similar to this:

```
#movement: [#default: 5, #format:#integer, ¬
#comment: "Set motion to the right:", #range: [#min:1, #max:10]]
```

- `#movement` is the property's name. A symbol (`#`) operator must precede the name in the property definition. A colon separates the name's definition and the list of parameters.
- `#default` specifies the property's default value. This example sets 5 as the default.
- `#format` specifies the property's type. This example sets the type as an integer. Some other possible types are Boolean, string, cast member, event, and sound. For a complete list of possible values for `#format`, see `on getPropertyDescriptionList` in the *Lingo Dictionary*.
- `#comment` specifies a string that appears next to the parameter in the Parameters dialog box. This example makes "Set motion to the right" the comment that appears in the Parameters dialog box.
- `#range` specifies a range of possible values that the user can assign to the property. Specify the possible values as a list.

  To specify a range between a minimum and maximum number, use the form [`#min:minimum, #max:maximum`]. The example sets the range from 1 to 10. When the range is between a maximum or minimum number, the Parameters dialog box provides a slider that sets the value.

  To specify no range, omit the `#range` parameter. If the property's definition doesn't include `#range`, a text entry field appears for the user to enter a value in the Parameters dialog box.

  To specify a set of possible choices, use a linear list. For example, the list `[#mouseUp, #mouseDown, #keyUp, #keyDown]` makes these four events possible choices for a parameter. When you specify values in a linear list, the choices appear in a pop-up menu in the Parameters dialog box. (For this example list, you need to specify `#format: #symbol` for the list to display correctly.)

As another example, this statement defines the property `whichSound`:

```
addProp description, #whichSound, [#default: "", #format:#sound, #comment: ¬
"Which cast member"]
```

The value `#sound` assigned to `#format` provides a pop-up menu in the Parameters dialog box that includes every sound cast member available in the movie.

If the behavior includes a command that plays a sound, this property can be used to specify a sound cast member to play. For example, if the user selects Growl from the pop-up menu in the Parameters dialog box, the statement `puppetSound whichSound` would play the sound cast member Growl.

Creating an on getPropertyDescriptionList handler

To build a list of properties for a behavior, add each property to the list that the `on getPropertyDescriptionList` handler returns. Then use the `return` command to return the list.

For example, this handler creates a property list named Description that contains the definitions for `movement` and `whichSound`:

```
on getPropertyDescriptionList

  set description = [:]

  addProp description, #Movement, [#default: 5, #format:#integer, #comment: ¬
  "Set motion to the right:", #range: [#min:1, #max:10]]

  addProp description, #noise, [#default:"", format: #sound, ¬
  #comment:"Sound cast member name"]

  return description

end
```

Alternatively, you can use this syntax to do the same as the previous handler:

```
on getPropertyDescriptionList

  return [¬

  #Movement: [#default: 5, #format:#integer, #comment: ¬
  "Set motion to the right:", #range: [#min:1, #max:10]],

  #noise: [#default:"", format: #sound, ¬
  #comment:"Sound cast member name"]
  ]

end
```

Including a description for the Behavior inspector

An `on getBehaviorDescription` handler in a behavior's script provides a description that appears in the bottom pane of the Behavior inspector when the behavior is selected. For example, this handler displays the phrase "This changes sprite color and position" in the Behavior inspector:

```
on getBehaviorDescription
  return "This changes sprite color and position"
end
```

Example of a complete behavior

If the handlers described here were in one behavior, the script would look like this (the `puppetSound` command was added to the `on mouseUp` handler in this example):

```
property movement, noise

on getPropertyDescriptionList
  set description = [:]

  addProp description, #movement, [#default: 5, ¬
  #format:#integer, #comment: "Set motion to ¬
  the right:", #range: [#min:1, #max:10]]

  addProp description, #noise, [#default:"", ¬
  #format: #sound, #comment:"Sound cast ¬
  member name"]

  return description
end

on getBehaviorDescription
  return "This changes sprite color and position"
end

on mouseUp me
  set the foreColor of sprite the spriteNum of me ¬
  to random(255)
  puppetSound noise
end

on enterFrame me
  if the locH of sprite the spriteNum of me > ¬
  the stageRight then
    set the locH of sprite the spriteNum ¬
    of me = the stageLeft
  else
    set the locH of sprite the spriteNum of me to ¬
    (the locH of sprite the spriteNum of me + ¬
    movement)
  end if
end
```

When this behavior is attached to a sprite, each time the playhead enters a frame, the sprite moves to the right by the amount the user specifies. When the user clicks a sprite, its color changes and a specified sound plays.

Sending messages to behaviors attached to sprites

Lingo can run handlers in behaviors attached to specific sprites by sending messages to the behaviors attached to one sprite, all sprites, or several specific sprites.

Sending messages to a sprite

The `sendSprite` command sends a message to a specified sprite. If none of the sprite's behaviors has a handler that corresponds to the message, the message passes to the cast member script, the frame script, and then the movie script. See `sendSprite` in the *Lingo Dictionary*.

For example, this handler sends the custom message `bumpCounter` and the argument 2 to sprite 1 when the user clicks the mouse:

```
on mouseDown me
  sendSprite (1, #bumpCounter, 2)
end
```

Note: The symbol (#) operator must precede the message in the `sendSprite` command.

Sending messages to all sprites

The `sendAllSprites` command sends a message to every sprite in the frame. If no behavior of the specified sprite has a handler that corresponds to the message, the message passes to the cast member script, the frame script, and then the movie script. See `sendAllSprites` in the *Lingo Dictionary*.

For example, this handler sends the custom message `bumpCounter` and the argument 2 to all sprites in the frame when the user clicks the mouse button:

```
on mouseDown me
  sendAllSprites (#bumpCounter, 2)
end
```

Note: The symbol (#) operator must precede the message in the `sendAllSprites` command.

Sending messages to specific behaviors only

The `call` command sends an event to specific behaviors. Unlike the `sendSprite` command, the `call` command doesn't pass the message to frame scripts, scripts of the cast member, or movie scripts.

Before sending a message to a specific behavior, check the `scriptInstanceList` sprite property to find a behavior script reference to use with the `call` command.

The `scriptInstanceList` property provides a list of references for the behaviors attached to a sprite while a movie is playing.

For example, this handler displays the list of references for all behaviors attached to the same sprite as this behavior's handler:

```
on showScriptRefs me
  put the scriptInstanceList of sprite the ¬
  spriteNum of me
end
```

This handler sends the message `bumpCounter` to the first script reference attached to sprite 1 (the `getAt` function identifies the first script reference in the `scriptInstanceList`):

```
on mouseDown me
  xref = getAt (the scriptInstanceList of sprite 1,1)
  call (#bumpCounter, xref, 2)
end
```

Note: The symbol (#) operator must precede the message in the `call` command.

To remove instances of a sprite while the movie is playing:

- Set the sprite's `scriptInstanceList` property to an empty list([]). See `scriptInstanceList` in the *Lingo Dictionary*.

Using inheritance in behaviors

Behaviors can have ancestor scripts in the same way that parent scripts do. (Ancestor scripts are additional scripts whose handlers and properties a parent script can call on and use.)

- The ancestor's handlers and properties are available to the behavior.
- If a behavior has the same handler or property as an ancestor script, Lingo uses the property or handler in the behavior instead of the one in the ancestor.

For more information about the concept of ancestors and inheritance, see "Using parent scripts and child objects" on page 417.

To make a script an ancestor, do one of the following:

- Declare that `ancestor` is a property in the `property` statement at the beginning of the behavior's Score script.

  For example, the statement `property ancestor` declares that `ancestor` is a property.

- Include a statement that specifies which script is the ancestor. Put the statement in an `on beginSprite` handler in the behavior.

  For example, this handler makes the script Common Behavior an ancestor of the behavior when Director first enters the sprite:

  ```
  on beginSprite
    set the ancestor of me to new (script "Common Behavior")
  end
  ```

  This handler will let the behavior also use the handler in the script Common Behavior.

CHAPTER 15
Navigation and User Interaction

Adding interactivity lets you involve your audience in your Macromedia Director MX movies. Using the keyboard, the mouse, or both, your audience can download content from the Internet, jump to different parts of movies, enter information, move objects, click buttons, and perform many other interactive operations.

Unless made to do otherwise, a movie plays through every frame in the Score from start to finish. Behaviors and Lingo can make the movie jump to a different frame, movie, or URL when a specified event occurs. With Lingo, you can include simple navigation instructions as part of more complex handlers; you can also place navigation Lingo in movie scripts and scripts that are attached to cast members such as buttons.

There are several other interactive features that you can add to your movie:

- Draggable sprites give your audience the ability to move sprites anywhere on the Stage. You can also create boundaries beyond which sprites cannot move.
- Editable fields are fields in which your audience can enter or edit information.
- Rollovers make certain sprites change in appearance when the mouse pointer passes over them, even if the user has not clicked the mouse. Using rollovers is an excellent way to give your audience feedback based on their actions.
- The mouse pointer (that is, the cursor) can be changed based on criteria you select. Using Lingo, you can provide animated cursors or specify one of the standard cursors or a bitmap cast member as a cursor image. See `cursor (command)` and `cursor (sprite property)` in the *Lingo Dictionary*.
- Push buttons, radio buttons, and check boxes provide an easy to way to quickly create user interfaces for forms or applications.

Creating basic navigation controls with behaviors

Director provides behaviors that let you create basic navigation controls without knowing Lingo. You can use behaviors to move the playhead to a frame number or marker. You can also stop the playhead at any frame and wait for the user to act.

The following examples explain the basic use of the `Hold on Current Frame` and `Go Next Button` behaviors. You can also create custom navigation behaviors or get them from third-party developers. For information on using behaviors, see Chapter 14, "Behaviors," on page 357.

To use basic navigation behaviors:

1. Create a movie that contains a sprite in frame 1 and at least one marker in a later frame.
2. Select Window > Library Palette, and select the Navigation library.
3. Drag `Hold on Current Frame` to frame 1 in the script channel.

   Typically, you use this behavior in a frame that requires user interaction such as selecting a menu command.
4. Play the movie.

   The playhead remains in frame 1 where you attached the behavior. Notice that the movie is still playing, but the playhead remains on the single frame. Use the `Go Next Button` behavior to send the playhead to a new frame and continue playing, as described in the following steps.
5. Stop the movie.
6. Drag the `Go Next Button` behavior from the Library palette to the sprite in frame 1.
7. Rewind and play the movie again.

   The playhead is again stopped in the first frame by the `Hold on Current Frame` behavior.
8. Click the sprite to which you attached the `Go Next Button` behavior.

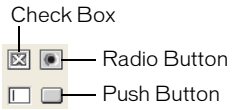
   The playhead jumps to the frame that contains the next marker and continues playing.

Adding push buttons, radio buttons, and check boxes

Director MX provides several built-in user interface elements for quickly adding interactivity to your movies. These elements include push buttons, radio buttons, and check boxes.

To add a push button, radio button, or check box:

1. Open the Tool palette by selecting Window > Tool Palette, if it's not already open.
2. Select the Push Button, Radio Button, or Check Box tool in the Tool palette.



3. Click and drag on the Stage to create the selected button type.
4. Type a label in the text area next to the button or check box.

Setting properties for push buttons, radio buttons, and check boxes

When you create a push button, radio button, or check box on the Stage, a Button cast member is added to the Cast. You can use button cast member properties to change the name and button type of button cast members.

To view or change button cast member properties:

1. Select a button cast member (a push button, radio button, or check box) and click the Member tab of the Property inspector using the Graphical view.
2. To view or edit the cast member name, use the Name text box.
3. To specify how Director removes the cast member from memory if memory is low, select an option from the Unload pop-up menu. See "Controlling cast member unloading" on page 152.
4. To change the type of button, click the Button tab and select Push Button, Check Box, or Radio Button from the Type pop-up menu.

Jumping to locations with Lingo

The Lingo navigation features can make a movie jump to other frames, to other movies, or to Internet movies and web pages. You can also use Lingo to make a movie appear to pause by looping in one frame or a group of frames.

For details about specifying the locations of frames, markers, and movies, see "Identifying frames and movies" on page 406.

Jumping to a different frame

Lingo lets you jump to a different frame in the current movie or in another movie.

- To jump to a specific frame in the current movie, use the `go` command, followed by an identifier for the frame.

  For example, the statement `go to "Begin Over"` jumps to the frame labeled Begin Over.

- To jump to the beginning of a different movie, use the `go` command, followed by an identifier for the movie.

  For example, the statement `go to movie "Citizen_Kane"` goes to the beginning of the movie Citizen_Kane.dir.

- To jump to a frame in a different movie, use the `go` command, followed by an identifier for the frame and the movie; use `frame` followed by the frame identifier and `movie` followed by the name of the movie.

  For example, the statement `go to frame "Rosebud" of movie "Citizen_Kane"` goes to the frame labeled Rosebud in the movie Citizen_Kane.dir.

See `go` in the *Lingo Dictionary*.

Jumping to a URL

Lingo lets you jump to a URL that represents an Internet movie or a web page.

- To jump to an Internet movie, use the `gotoNetMovie` command.

For example, the statement `gotoNetMovie "http://www.yourserver.com/movies/movie1.dcr"` retrieves and plays the movie named movie1.dcr. See `gotoNetMovie` in the *Lingo Dictionary*.

- To jump to a web page, use the `gotoNetPage` command.

  For example, the statement `gotoNetPage "http://www.yourserver.com/movies/intro.html"` displays the web page named intro.html in a browser window. See `gotoNetPage` in the *Lingo Dictionary*.

Looping in a group of frames

Looping within frames lets you create animation that recycles or makes a movie appear to pause. Such looping is useful for allowing a network operation to complete before the movie proceeds. Looping a movie by jumping from the current frame back to the first frame in the sequence can create a recycling animation effect.

- To loop within one segment of the Score, use the `go loop` statement to return to the first marker to the left of the frame that contains the `go loop` statement. If there is no previous marker, the playhead jumps to frame 1.
- To pause a movie in one frame but keep it playing so the movie can react to events, use the statement `go to the frame` to loop in the current frame.
- To resume playing a movie that is looping in one frame, use the `go to the frame + 1` statement.

Jumping away and returning to the original location

You might want a movie to jump to a different frame or a separate movie and then return to the original frame. For example, at a website that describes the weather, you could jump to a movie segment that explains a weather term and then return to the original location.

To jump away and return to the original location:

- Use the `play` and `play done` commands.

The `play` command branches a movie to another frame, another movie, or a specified frame in another movie. The `play done` command remembers the original frame and returns to it without requiring that you specify where to return.

Use the `play` and `play done` commands in the following situations:

- When the movie you want to play does not have instructions about where to return.
- When you want to play several movies sequentially from a single script. When one movie finishes, Lingo returns to the script that issued the `play` command.
- When you want to put one sequence inside another sequence and easily return to where you were in the outer sequence.
- When you want to jump to one loop from several different locations.

See `play` and `play done` in the *Lingo Dictionary*.

Detecting mouse clicks with Lingo

Users can click the mouse button in several ways, each of which Lingo can detect. The following are ways that you can use Lingo to detect what the user does with the mouse. See individual properties and functions in the *Lingo Dictionary*.

- To determine the last place the mouse was clicked, use the `clickLoc()` function.
- To determine the last active sprite (a sprite with a script attached) that the user clicked, use the `clickOn` function.
- To determine whether the last two clicks were a double-click, use the `doubleClick` function.
- To determine the time since the mouse was last clicked, use the `lastClick()` function.
- To determine whether the mouse button is pressed, check the `mouseDown` property.
- To determine whether the mouse button is released, check the `mouseUp` property.
- To determine whether the user presses the right mouse button (Windows) or Control+click (Macintosh), check the `rightMouseDown` property.
- To determine whether the user releases the right mouse button (Windows) or Control+click (Macintosh), check the `rightMouseUp` property.

For example, this handler checks whether the user double-clicked the mouse button and, if so, runs the `openWindow` handler:

```
on mouseDown
  if the doubleClick = TRUE then openWindow
end
```

Making sprites editable and draggable

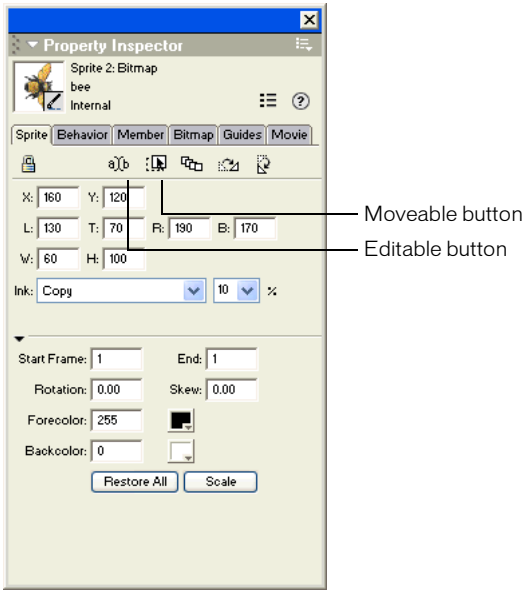
Using the Property inspector, you can make a sprite editable, draggable, or both while your movie is running. See "Displaying and editing sprite properties in the Property inspector" on page 162.

To make a sprite draggable on the Stage:

- Click the Moveable button in the Property inspector.

To make a text sprite editable:

- Click the Editable button in the Property inspector.



Making sprites editable or moveable with Lingo

Lingo can make sprites editable or moveable regardless of the settings in the Score. You can also use Lingo to constrain a moveable sprite to a certain region. For example, you can create a draggable slider with an indicator that moves across a gauge. For more information, see individual properties and functions in the *Lingo Dictionary*.

- To make a text sprite editable with Lingo, set the text sprite's `editable` property to `TRUE`. For best results, set this property in a script that is attached to the sprite or the frame where the sprite is located.
- To make a sprite moveable with Lingo, set the `moveableSprite` sprite property to `TRUE`. For best results, set this property in a script that is attached to the sprite or the frame where the sprite is located.
- To restrict the registration point of a moveable sprite so it stays within the bounding rectangle of a second sprite, use the `constraint` sprite property.
- To constrain a sprite along a horizontal or vertical path, use the `constrainH()` or `constrainV()` function.

Checking which text is under the pointer with Lingo

Lingo can detect which text component in a text or field cast member is currently under the mouse pointer. See individual properties and functions in the *Lingo Dictionary*.

Use Lingo that applies to text and field cast members as follows:

- To detect which character in a text or field cast member is under the pointer, use the `pointToChar()` function.
- To detect which item in a text or field cast member is under the pointer, use the `pointToItem()` function.
- To detect which word in a text or field cast member is under the pointer, use the `pointToWord()` function.
- To detect which paragraph in a text or field cast member is under the pointer, use the `pointToParagraph()` function.

Use Lingo that applies only to text cast members as follows: To detect whether a specific point is in a hypertext link within a text cast member and is under the pointer, use the `pointInHyperlink()` function.

Use Lingo that applies only to field cast members as follows:

- To detect which line in a field is under the pointer, use the `mouseLine` function.
- To detect which word in a field is under the pointer, use the `mouseWord` function.

Responding to rollovers with Lingo

You often want some action to occur when the user rolls the mouse pointer over a sprite or a particular place on the Stage. You can use Lingo to specify how the movie responds to such rollovers.

Director provides several event handlers that run when the pointer rolls over a sprite. Messages for each of these events are sent to the sprite script, the script of the cast member, the frame script, and then the movie script. See individual event handlers and functions in the *Lingo Dictionary*.

- To set up Lingo that runs when the mouse pointer enters a sprite's bounding rectangle, place the Lingo in an `on mouseEnter` event handler.
- To set up Lingo that runs when the mouse pointer leaves a sprite's bounding rectangle, place the Lingo in an `on mouseLeave` event handler.
- To set up Lingo that runs when the user clicks a sprite, rolls the pointer off the sprite, and then releases the mouse button, place the Lingo in an `on mouseUpOutside` event handler.
- To set up Lingo that runs when the mouse pointer is within a sprite's bounding rectangle when the playhead enters the frame that contains the sprite, place the Lingo in an `on mouseWithin` event handler.

  The `mouseWithin` event can occur repeatedly as long as the mouse pointer remains inside the sprite.
- To determine whether the cursor is over a specific sprite, use the `rollOver()` function.

Finding mouse pointer locations with Lingo

Determining where the mouse pointer is on the Stage is a common need in Director.

To determine the mouse pointer's horizontal and vertical positions:

- Use the `mouseH()` and `mouseV()` functions. See `mouseH` and `mouseV` in the *Lingo Dictionary*.

The `mouseV()` function returns the distance, in pixels, between the mouse pointer and the upper left corner of the Stage. The `mouseH()` function returns the distance, in pixels, between the mouse pointer and the upper left corner of the Stage.

The statements `put the mouseH` and `put the mouseV` display the mouse pointer's location in the Message window.

For example, this handler directs the Message window to display the distance (in pixels) between the pointer and the upper left corner of the Stage:

```
on exitFrame
  put the mouseH
  put the mouseV
  go to the frame
end
```

Checking keys with Lingo

Lingo can detect the last key that the user pressed. See individual properties and functions in the *Lingo Dictionary*.

- To obtain the ANSI value of the last key that was pressed, use the `key()` function.
- To obtain the keyboard's numerical (or ASCII) value for the last key pressed, use the `keyCode()` function.

  A common place for using `key` and `keyCode` is in an `on keyDown` handler, which instructs Lingo to check the value of `key` only when a key is actually pressed. For example, the following handler in a frame script sends the playhead to the next marker whenever the user presses Enter (Windows) or Return (Macintosh):

  ```
  on keyDown
    if the key = RETURN then go to marker (1)
  end
  ```

Equivalent cross-platform keys

Because of inherent differences between Windows and Macintosh keyboards, keys on Windows and Macintosh computers don't always correspond directly.

This discrepancy can create confusion because Lingo often uses the same term to refer to corresponding keys on Windows and Macintosh computers, even though the key's name differs on the two platforms.

The following table lists Lingo elements that refer to specific keys and the keys they represent on each platform.

Lingo term	Windows key	Macintosh key
RETURN	Enter	Return
commandDown	Control	Command

Lingo term	Windows key	Macintosh key
optionDown	Alt	Option
controlDown	Control	Control
ENTER	Enter key on the numeric keypad (during authoring, pressing Enter starts playing the movie)	Enter key on the numeric keypad (during authoring, pressing Enter starts playing the movie)
BACKSPACE	Backspace	Delete

Identifying keys on different keyboards

Characters can vary on different keyboards. You can avoid possible confusion by identifying a character by its ASCII value. See individual properties and functions in the *Lingo Dictionary*.

- To obtain a character's ASCII value, use the `charToNum()` function.

  For example, the following statement finds the ASCII value for the letter A and displays it in the Message window:

  ```
  put charToNum("A")
  -- 65
  ```

- To find out which character corresponds to an ASCII value, use the `numToChar()` function.

  For example, the following statement finds the character that corresponds to the ASCII value 65. The result is the letter A:

  ```
  put numToChar(65)
  -- A
  ```

About animated color cursors

Director supports animated cursors. You can use any 8-bit bitmap source in your Director cast as an image in the cursor animation, automatically scale images, and generate masks for 16 x16 pixel and 32 x 32 pixel cursors. (Macintosh computers don't support 32 x 32 pixel cursors.)

An animated cursor consists of a series of bitmap cast members. Each bitmap cast member is a frame of the cursor. You can control the rate at which Director plays the frames of an animated cursor. Using the Cursor Properties Editor, you designate one or more bitmap cast members as frames of a single cursor cast member.

Xtra extensions that support animated cursors

The Director installation program places two animated color cursor files in the Media Support folder within the Director application's Xtras folder. The specific files depend on the platform you are using.

Windows	PowerPC	Purpose
Cursor Options.x32	Cursor Options	This file supports the creation of cursors while you author movies in Director. Do not distribute this file with projectors; it is not licensed for redistribution.
Cursor Asset.x32	Cursor Asset	Distribute this file with any movies or projectors that you create using the animated color cursors.

Requirements for animated color cursors

All cast members used for an animated color cursor must meet certain criteria:

- They must be bitmap cast members.
- They must have a color depth of 8 bits (256 colors).
- They must use only the first eight or the last eight colors that are in the standard System - Win palette. These colors provide the most predictable results when playing back across platforms. Other colors might not appear correctly.

The cast members need not be in sequence in the cast, and they need not be in the same cast.

A cursor's maximum size depends on the computer:

- With Microsoft Windows 98, Windows 2000, and Windows XP, you can create cursors of either 16 x 16 pixels or 32 x 32 pixels (almost always 32 x 32 pixels, but some video cards might support only 16 x 16 pixels).
- With Macintosh OS X, you can create cursors of 16 x 16 pixels.

When you create cursors in the Cursor Properties Editor, Director dims any size option that is not available on your computer.

The 16 x16 and 32 x 32 pixel sizes are the maximum sizes at which Director can display a cursor on the screen. The actual cast members you specify for the cursor can be larger than the maximum, and Director scales the cast members to the appropriate size, maintaining the aspect ratio as it scales them. If you specify a cast member smaller than the maximum size, Director displays the cast member at its original size, without scaling. For example, if you select a maximum size of 16 x 16 pixels and specify a cursor that is 12 x 14 pixels, Director displays the cursor at 12 x 14 pixels.

Creating an animated color cursor cast member

Before creating an animated color cursor cast member, make sure that the cast members you want to use in the cursor are stored in a cast that is linked to the movie. See "Managing external casts" on page 153.

To create an animated color cursor cast member:

1. Select Insert > Media Element > Cursor.

   Director opens the Cursor Properties Editor, which you use to set up the cursor.

2. From the Cast pop-up menu, select the cast that contains the cast member you want to add as a frame in your cursor.

   The cast members used for a single cursor can be stored in different casts.

3. Use the < and > buttons to find the cast member you want.

   As you click the buttons, the preview shows a thumbnail of the selected cast member. If you do not see the cast member you want, the cast member probably isn't a bitmap or has a color depth greater than 8 bits (256 colors). The Cursor Properties Editor shows only bitmaps that can be used in an animated color cursor.

   You can also enter a cast member number in the Member box and press Tab; Director selects the cast member that has that number or the cast member with the number closest to it.

4. Select the cast member you want, and click Add.

   You see the cast member in the Cursor Frames preview area. The Frame X of Y field shows where the cast member falls within an animated series of cursor frames.

5. Repeat steps 2 through 4 until you have added all the cast members for the cursor.

   In the Cursor Frames area, you can use the < and > buttons to review the order of the cursor frames. Click the Remove button to delete the currently selected frame from the cursor (this deletes the cast member only from the cursor animation, not from the cast).

6. In the Interval field, specify the number of milliseconds that elapse between each frame of the cursor animation.

   This interval affects all frames of the cursor and cannot vary for different frames. The cursor frame rate is independent of the frame rate set for the movie using the tempo channel or the `puppetTempo` Lingo command.

   Note: By inserting the same bitmap in multiple frames of the cursor, you can create the illusion of variable-rate cursor animation.

7. In the Hotspot Position fields, specify the location of the mouse pointer's active point.

   Director uses this point to track the mouse pointer's position on the screen. For example, Director uses this point's location when it returns values for the `mouseH()` and `mouseV()` functions. The hotspot also determines the point where a rollover occurs.

   The first field specifies the horizontal (*x*) location, and the second field specifies the vertical (*y*) location. The upper left pixel is location 0,0. In a 16 x 16 pixel cursor, the lower right pixel is location 15,15. You can't enter a point that is beyond the bounds of the cursor.

8. Click one of the Size options to specify the maximum size of the cursor.

   If a Size option is dimmed, your computer does not allow you to create cursors of that size.

9. Select the Automask option if you want the white pixels of the cursor frames to be transparent.

   Note: The Automask option makes all white pixels transparent. If you want some white pixels to be opaque, you can't use white for those pixels, but you can achieve the same effect by using the lightest shade of gray available in the system palette.

10. Click OK to close the Cursor Properties Editor.

    After you create a cursor cast member, use Lingo to switch to the cursor in a movie, as shown in the next section.

Using an animated color cursor in a movie

After you add an animated color cursor to the cast, use Lingo to switch to the animated cursor as you would any other cursor. You can set up an animated cursor as the movie's cursor or a sprite's cursor.

To switch to an animated color cursor, use the following command:

```
cursor (member whichCursorCastMember)
```

For *whichCursorCastMember*, substitute a cast member name (surrounded by quotation marks) or a cast member number. For example, the following sprite script changes the cursor to the cast member named myCursor when the cursor is over the sprite:

```
on mouseEnter
  cursor (member "myCursor")
end
```

To reset the cursor to the regular arrow cursor, specify a cursor type of -1 and do not use parentheses. The following sample sprite script resets the cursor:

```
on mouseLeave
  cursor -1
end
```

Note: Do not place an animated color cursor cast member on the Stage.

For more information, see `cursor (command)` in the *Lingo Dictionary*.

CHAPTER 16
Writing Scripts with Lingo

Lingo, the scripting language of Macromedia Director MX, adds interactivity to a movie. You can use Lingo to control a movie in response to specific conditions and events. For example, Lingo can play a sound after a specified amount of the sound has streamed from the Internet.

Scripting basics

The information in this section introduces and explains basic Lingo scripting concepts that Director uses. If you are new to scripting, review this section before you begin writing scripts in Lingo.

Types of scripts

Director uses four types of scripts: behaviors, movie scripts, parent scripts, and scripts attached to cast members. Behaviors, movie scripts, and parent scripts all appear as cast members in the Cast window.

Behaviors are scripts that are attached to sprites or frames in the Score, and are referred to as sprite behaviors or frame behaviors. The Cast window thumbnail for each behavior contains a behavior icon in the lower right corner.

When used in this chapter, the term "behavior" refers to any Lingo script that you attach to a sprite or a frame. This differs from the behaviors that come in the Director Library Palette. For more information about the behaviors built in to Director, see Chapter 14, "Behaviors," on page 357.

All behaviors that have been added to the cast appear in the Behavior inspector's Behavior pop-up menu. (Other types of scripts don't appear there.)

You can attach the same behavior to more than one location in the Score. When you edit a behavior, the edited version is applied everywhere the behavior is attached in the Score.

Movie scripts can respond to events such as key presses, mouse clicks, and your own custom events, and can control what happens when a movie starts, stops, or pauses. Handlers in a movie script can be called from other scripts in the movie as the movie plays.

A movie script icon appears in the lower right corner of the movie script's Cast window thumbnail.

Movie scripts are available to the entire movie, regardless of which frame the movie is in or which sprites the user is interacting with. When a movie plays in a window or as a linked movie, a movie script is available only to its own movie.

Parent scripts are special scripts that contain Lingo used to create child objects. You can use parent scripts to generate script objects that behave and respond similarly yet can still operate independently of each other. A parent script icon appears in the lower right corner of the Cast window thumbnail.

For information about parent scripts, see "Using parent scripts and child objects" on page 417.

Scripts attached to cast members are attached directly to a cast member, independent of the Score. Whenever the cast member is assigned to a sprite, the cast member's script is available.

Unlike behaviors, movie scripts, and parent scripts, cast member scripts don't appear in the Cast window. However, if Show Cast Member Script Icons is selected in the Cast Window Preferences dialog box, cast members that have a script attached display a small script icon in the lower left corner of their thumbnails in the Cast window.

How scripts flow

Director always executes Lingo statements starting with the first statement and continuing in order until it reaches the final statement or a statement that instructs Lingo to go somewhere else.

To set up statements so that they run when specific conditions exist, you use `if...then`, `case`, and `repeat` loop structures. For example, you can create an `if...then` structure that tests whether text has finished downloading from the Internet and, if it has, then attempts to format the text. See "Controlling flow in scripts" on page 410.

The order in which statements are executed affects the order in which you should place statements. For example, if you write a statement that requires some calculated value, you need to put the statement that calculates the value first. For instance, in the following example, the first statement adds two numbers, and the second assigns a string representation of the sum to a field cast member to be displayed on the Stage:

```
x = 2 + 2
put string(x) into member "The Answer"
```

About planning and debugging scripts

When you write scripts for an entire movie, the quantity and variety of scripts can be very large. Deciding which Lingo commands to use, how to structure scripts effectively, and where scripts should be placed requires careful planning and testing, especially as the complexity of your movie grows.

Before you begin writing scripts, formulate your goal and understand what you want to achieve. This is as important—and typically as time consuming—as developing storyboards for your work.

When you have an overall plan for the movie, you are ready to start writing and testing scripts. Expect this to take time. Getting scripts to work the way you want often takes more than one cycle of writing, testing, and debugging.

The best approach is to start simple and test your work frequently. When you get one part of a script working, start writing the next part. This approach helps you identify bugs efficiently and ensures that your Lingo is solid as you write more complex scripts.

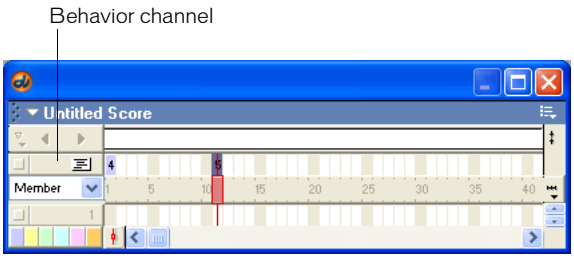
For more information about debugging scripts, see “Troubleshooting Lingo”.

Performing common tasks

The following are ways to perform common tasks for creating, attaching, and opening scripts.

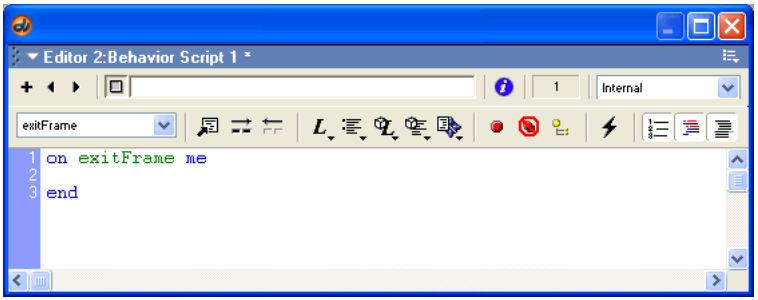
To create a frame behavior (script attached to a frame):

- Double-click the behavior channel in the frame that you want to attach a behavior to.



When you create a new behavior, the behavior receives the cast number of the first available location in the current Cast window.

When you create a new frame behavior, the Script window opens and already contains the line `on exitFrame`, followed by a line with a blinking insertion point, and then a line with the word `end`. This makes it easy for you to quickly attach a common behavior to the frame.



One of the most common frame behaviors is one that keeps the playhead looping in a single frame. This can be useful when you want your movie to keep playing in a single frame while waiting for the user to click a button or for a digital video or sound to finish playing.

To keep the playhead in a single frame:

- In a frame behavior, type the following statement on the line after the `on exitFrame` statement:

```
go to the frame
```

The Lingo expression "the frame" always refers to the frame currently occupied by the playhead. This statement essentially tells the playhead to "go back to the frame you are currently in".

To create a sprite behavior (script attached to a sprite):

- In the Score or on the Stage, select the sprite that you're attaching the behavior to. Then select Window > Behavior Inspector and select New Behavior from the Behavior pop-up menu.

When you create a new sprite behavior, the Script window opens and already contains the line `on mouseUp`, followed by a line with a blinking insertion point, and then a line with the word `end`. This makes it easy for you to quickly attach a common behavior to the sprite.

To open a behavior for editing:

1. Double-click the behavior in the Cast window.

   The Behavior inspector opens.

2. Click the Script Window icon in the Behavior inspector.

   The Script window displays the behavior.

Alternatively, you can open the Script window and cycle through the scripts until you reach the behavior.

To remove a behavior from a Score location:

- Select the location and then delete the script from the list displayed in the Property inspector (Behavior tab).

To attach existing behaviors to sprites or frames, do one of the following:

- Drag a behavior from a cast to a sprite or frame in the Score or (for sprites) to a sprite on the Stage.
- In the score, select the sprites or frames that you're attaching the behavior to. Then select Window > Behavior Inspector and select the existing behavior from the Behavior pop-up menu.

To create a movie script (script attached to a movie), do one of the following:

- If the current script in the Script window is a movie script, click the New Script button in the Script window. (Clicking the New Script button always creates a script of the same type as the current script.)
- If the current script in the Script window is not a movie script, click the New Script button and then change the new script's type with the Script Type pop-up menu in the Script tab of the Property inspector.
- If no sprites or scripts are selected in the cast, Score, or Stage, then open a new Script window; this will create a new movie script by default.

To open a movie script or parent script for editing:

- Double-click the script in the Cast window.

To change a script's type:

1. Select the script in the Cast window or open it in the Script window.
2. Click the Script tab of the Property inspector and select a script type from the Type pop-up menu.

To cycle through the scripts in the Script window:

- Use the Previous Cast Member and Next Cast Member arrows at the top of the Script window to advance or back up to a script.

To duplicate a script:

- Select the script in the Cast window and select Duplicate from the Edit menu.

To create a script that is attached automatically to every sprite made from a specific cast member, attach the script to the cast member itself.

To create a script attached to a cast member or open an existing one, do one of the following:

- Right-click (Windows) or Control-click (Macintosh) on a cast member in the Cast window and select Cast Member Script from the context menu.
- Select a cast member in the Cast window and then click the Cast Member Script button in the Cast window.

Lingo terminology

Like any programming language, Lingo uses specific terminology and has rules of grammar and punctuation that you must follow. This information is summarized in this section.

Important Lingo terms are listed here in alphabetical order. References are included for terms that are discussed in more detail elsewhere in this chapter.

Arguments are placeholders that let you pass values to scripts (see "Using arguments to pass values to a handler" on page 396). For example, the following handler, called `addThem`, adds two values it receives in the arguments `a` and `b`.

```
on addThem a, b
  c = a + b
end
```

Commands are terms that instruct a movie to do something while the movie is playing. For example, `go to` sends the playhead to a specific frame, a marker, or another movie.

Constants are elements that don't change. For example, the constants `TAB`, `EMPTY`, and `RETURN` always have the same meaning.

Events are actions that occur while a movie is playing. For example, when a movie stops, a sprite starts, the playhead enters a frame, or the user types at the keyboard, these actions are events.

Expressions are any part of a statement that produces a value. For example, `2 + 2` is an expression.

Functions are terms that return a value. For example, the `date()` function returns the current date set in the computer. The `key()` function returns the key that was pressed last. Parentheses occur at the end of a function.

Handlers are sets of Lingo statements within a script that run when a specific event occurs in a movie (see "Using handlers" on page 396). For example, the following statements comprise a handler that plays a beep sound when the mouse button is clicked:

```
on mouseDown
  beep
end
```

Keywords are reserved words that have a special meaning. For example, `end` indicates the end of a handler.

Lists are ordered sets of values used to track and update an array of data, such as a series of names or the values assigned to a set of variables (see "Using lists" on page 398). A simple example is a list of numbers such as `[1, 4, 2]`.

Messages are notices that Director sends to scripts when specific events occur in a movie (see "Using messages to identify events" on page 394). For example, when the playhead enters a specific frame, the `enterFrame` event occurs and Directors sends an `enterFrame` message. If a script contains an `on enterFrame` handler, the statements within that handler will run, because the handler received the `enterFrame` message.

Operators are terms that calculate a new value from one or more values. For example, the addition (+) operator adds two or more values together to produce a new value.

Properties are attributes that define an object. For example, `picture` is a property of a bitmap cast member.

Statements are valid instructions that Director can execute (see "Writing Lingo statements" on page 392). For example, `go to frame 23` is a statement.

Variables are elements used to store and update values (see "Storing and updating values in variables" on page 402). To assign values to variables or change the values of many properties, you use the equals (=) operator or the `set` command. For example, the statement `set startValue = 0` places a value of 0 into a variable named `startValue`.

Lingo syntax

Lingo supports a variety of data types, including references to sprites and cast members, `TRUE` and `FALSE` or 1 and 0 (Boolean) values, strings, constants, integers, floating-point numbers, points, rects, colors, and dates.

The following are general syntax rules that apply to all Lingo. Most Lingo terms also have their own individual requirements about terms that they must be combined with. For the rules for a specific Lingo term, see the term's syntax in the *Lingo Dictionary*.

Parentheses

Functions that return values require parentheses. When you define functions in handlers, you need to include parentheses in the calling statement.

Use parentheses after the keyword `sprite` or `member` to refer to the object's identifier: for example, `member("Patrice Lumumba")` refers to the member named Patrice Lumumba.

You can also use parentheses to override Lingo's order of precedence in math operations or to make your Lingo statements easier to read.

For example, this math expression will yield a result of 13:

```
5 * 3 - 2
```

while this expression will yield a result of 5:

```
5 * (3 - 2)
```

Character spaces

Words within expressions and statements are separated by spaces. Lingo ignores extra spaces.

In strings of characters surrounded by quotation marks, spaces are treated as characters. If you want spaces in a string, you must insert them explicitly.

You can see Lingo that uses strings in "Writing strings" on page 405.

Uppercase and lowercase letters

Lingo is not case-sensitive—you can use uppercase and lowercase letters however you want. For example, the following statements are equivalent:

```
Set the hiLite of member "cat" to True
set the hilite of member "Cat" to True
SET THE HILITE OF MEMBER "CAT" TO TRUE
Set The Hilite Of Member "Cat" To True
```

However, it's a good habit to follow script writing conventions, such as the ones that are used in this book, to make it is easier to identify names of handlers, variables, and cast members when reading Lingo code.

Literal strings are case-sensitive. See "Writing strings" on page 405.

Comments

Comments in scripts are preceded by double hyphens (--). You can place a comment on its own line or after any statement. Lingo ignores any text following the double hyphen on the same line.

Comments can consist of anything you want, such as notes about a particular script or handler or notes about a statement whose purpose might not be obvious. Comments make it easier for you or someone else to understand a procedure after you've been away from it for a while.

Adding large numbers of comments does not increase the size of your movie file when it is saved as a compressed DCR or DXR file. Comments are removed from the file during the compression process.

Double hyphens can also be used to make Lingo ignore sections of code you want to deactivate for testing or debugging purposes. By adding double hyphens rather than removing the code, you can temporarily turn it into comments. Select the code you want to turn on or off and then use the Comment or Uncomment buttons in the Script window to add or remove double hyphens easily.

Optional keywords and abbreviated commands

You can abbreviate some Lingo statements. Abbreviated versions of a command are easier to enter but may be less readable than the longer versions. The `go` command is a good example. All the following statements are equivalent, but the last one uses the fewest keystrokes.

```
go to frame "This Marker"
go to "This Marker"
go "This Marker"
```

It is good practice to use the same abbreviations throughout a movie so your Lingo is easier to read.

Describing conditions

A script often needs to determine whether a certain condition exists before carrying out a set of instructions. For example, a script may need to check whether a network operation is finished before doing something that requires the operation's result.

The term `TRUE` or the number 1 indicates that the condition you're testing for exists. The term `FALSE` or the number 0 indicates that a condition doesn't exist.

Writing Lingo statements

When you are writing statements in a Lingo script, you can choose between two types of syntax: verbose syntax and dot syntax.

Verbose syntax

Verbose syntax is similar to English. Because of this, verbose syntax is an excellent way to learn to program for the first time: as a new programmer, you can read verbose Lingo and get a fairly good idea of what it is doing. Most users will start out writing Lingo exclusively with verbose syntax because it is so easy to understand.

Here are three examples of verbose Lingo that is very English-like and has a literal meaning:

```
set the stageColor to 255
put the text of member "Instructions" after member "Introduction"
if x=5 then
  go to frame 22
end if
```

Almost all of Lingo's functionality is available through verbose syntax, but there are a few exceptions. Most of these exceptions are found in Lingo used for manipulating text.

The disadvantage of verbose Lingo is that it can quickly become very long when you write complex scripts. Longer scripts are harder to read and debug. Once your scripts reach a certain level of complexity, you may find it easier to use dot syntax.

For several examples that compare verbose and dot syntax, see the next section.

Dot syntax

Dot syntax is a concise form of Lingo that makes longer scripts easier to read and comprehend for users who have at least a basic understanding of the language. By understanding and using dot syntax, you can make your scripts shorter and easier to read and debug. An understanding of dot syntax makes it easier to learn other programming languages, since many of them use dot syntax exclusively.

If you are just beginning to learn Lingo, you will probably want to start with verbose syntax and then begin using dot syntax as your understanding of Lingo improves. You can use verbose syntax and dot syntax in combination. You may want to do this as you begin the process of learning dot syntax.

Because most users will want to use dot syntax after they achieve a basic understanding of Lingo, most of the Lingo examples in this book are written with dot syntax. However, this chapter will provide extensive examples of both syntaxes.

Almost any Lingo statement can be written with either verbose syntax or dot syntax. The following example demonstrates how the two types of syntax relate to each other.

This statement sets the forecolor of sprite 12 to 155 using verbose syntax:

```
set the forecolor of sprite 12 to 155
```

The following statement does the same thing by using dot syntax. It also omits the `set` command, which is optional:

```
sprite(12).forecolor = 155
```

You can use dot syntax to express the properties or functions related to an object or to specify a chunk of text within a text object. A dot syntax expression begins with the name of the object, followed by a period (dot), and then the property, function, or text chunk that you want to specify.

For example, the `loc of sprite` property indicates a sprite's horizontal and vertical position on the Stage. The expression `sprite(15).loc` refers to the `loc of sprite` property of sprite 15.

As another example, the `number` cast member property specifies a cast member's number. The expression `member("Hot Button").number` refers to the cast member number of the Hot Button cast member.

Expressing a function related to an object follows the same pattern. For example, the `pointInHyperLink` text sprite function reports whether a specific point is within a hyperlink in a text sprite. In addition to the syntax demonstrated in the *Lingo Dictionary*, you can use the dot syntax *textSpriteObject*`.pointInHyperlink()` to express this function.

The following `put` statement will evaluate the specified expression and return `TRUE` or `FALSE` depending on whether the pointer is located over a hyperlink in the text sprite in channel 3:

```
put sprite(2).pointInHyperlink(mouseLoc)
```

This is how the same statement is written with verbose syntax:

```
put pointInHyperlink(sprite 2, the mouseLoc)
```

To identify chunks of text, include terms after the dot to refer to more specific items within text. For example, the expression `member("News Items").paragraph(1)` refers to the first paragraph of the text cast member News Items. The expression `member("News Items").paragraph(1).line(1)` refers to the first line in the first paragraph. These text chunk expressions are available only with dot syntax.

Using messages to identify events

To run the appropriate set of Lingo statements at the right time, Director must determine what is occurring in the movie and which Lingo to run in response to certain events.

Director sends messages to indicate when specific events occur in a movie, such as when sprites are clicked, keyboard keys are pressed, a movie starts, the playhead enters or exits a frame, or a script returns a certain result. Handlers within scripts contain instructions that run when a specific message is received.

Although you can define your own message names (see "Defining custom messages" on page 394), most common events that occur in a movie have built-in message names. See the following categories in the "Lingo by Feature" section of the *Lingo Dictionary* for the built-in messages that describe events.

- Keyboard and mouse events.
- Frame events.
- Browser and Internet events.
- Sprite events.
- Movie in a window (MIAW) events.
- Movie events.
- Synchronizing media events.
- Idle events.
- Timeout events.
- Authoring behavior events.

Defining custom messages

In addition to using built-in message names, you can define your own messages and corresponding handler names. A custom message can call another script, another handler, or the statement's own handler. When the called handler stops executing, the handler that called it resumes.

Director can send a custom message from any location. The message is first available to handlers in the script from which the message was sent. If no handler is found, the message is available to movie scripts.

If more than one movie script contains a handler for the message, the handler in the movie script that has the lowest cast member number is executed.

A custom handler name must meet the following criteria:

- It must start with a letter.
- It must include alphanumeric characters only (no special characters or punctuation).
- It must consist of one word or of several words connected by an underscore—no spaces are allowed.
- It must be different from the name of any predefined Lingo element.

Using Lingo keywords for handler names can create confusion. Although it is possible to explicitly replace or extend the functionality of a Lingo element by using it as a handler name, this should be done only in certain advanced situations.

When you have multiple handlers with similar functions, it is useful to give them names that have similar beginnings so they appear together in an alphabetical listing, such as the listing that can be displayed by the Edit > Find > Handler command.

Understanding the order of messages in a movie

Director follows a definite order when sending messages about events that occur during the course of a movie.

When the movie first starts, events occur in the following order:

1. `prepareMovie`
2. `beginSprite`

   This event occurs when the playhead enters a sprite span.
3. `prepareFrame`

   Immediately after the `prepareFrame` event, Director plays sounds, draws sprites, and performs any transitions or palette effects. This event occurs before the `enterFrame` event. An `on prepareFrame` handler is a good location for Lingo that you want to run before the frame draws.
4. `startMovie`

   This event occurs in the first frame that plays.

When Director plays a frame, events occur in the following order:

1. `beginSprite`

   This event occurs only if new sprites begin in the frame.
2. `stepFrame`
3. `prepareFrame`

   Immediately after the `prepareFrame` event, Director plays sounds, draws sprites, and performs any transitions or palette effects. This event occurs before the `enterFrame` event.
4. `enterFrame`

   After `enterFrame` and before `exitFrame`, Director handles any time delays required by the tempo setting, idle events, and keyboard and mouse events.
5. `exitFrame`
6. `endSprite`

   This event occurs only if the playhead exits a sprite in the frame.

When a movie stops, events occur in the following order:

1. `endSprite`

   This event occurs only if sprites currently exist in the movie.
2. `stopMovie`

Using handlers

As described in "Using messages to identify events" on page 394, Director sends messages to handlers within scripts when specific events occur. You attach a set of handlers to an object by attaching the handlers' script to the object. See "Creating and attaching scripts with the Script window" on page 412.

Each handler begins with the word `on` followed by the message that the handler should respond to. The last line of the handler is the word `end`. You can repeat the handler's name after `end`, but this is optional.

When an object receives a message that corresponds to a handler attached to the object, Director runs the Lingo statements within the handler. For example, the `mouseDown` message indicates that the user clicked the mouse button. To indicate in your script that an action should be performed when the mouse is clicked, you include a line in your script that begins with `onMouseDown`. You follow this line with the Lingo statements that should execute when the script receives the `mouseDown` message.

Using arguments to pass values to a handler

By using arguments for values, you can give the handler exactly the values that it needs to use at a specific time, regardless of where or when you call the handler in the movie. Arguments can be optional or required, depending on the situation.

To create arguments for a handler:

- Put the arguments after the handler name. Use commas to separate multiple arguments.

For example, the following handler, called `addThem`, adds two values it receives in the arguments `a` and `b`, stores the result in local variable `c`, and uses the Lingo term `return` to send the result back to the original handler:

```
on addThem a, b
  -- a and b are argument placeholders
  c = a + b
  return c
end
```

When you call a handler, you must provide specific values for the arguments that the handler uses. You can use any type of value, such as a number, a variable that has a value assigned, or a string of characters. Values in the calling statement must be in the order they follow in the handler's arguments, and they must be surrounded by parentheses.

The following statement is a calling statement for the `on addThem` handler:

```
set mySum = addThem(4, 8)
```

Because `4` is first in the list of arguments, Lingo substitutes it for `a` in the handler. Likewise, because `8` is second in the list of arguments, Lingo substitutes `8` for `b` everywhere in the handler.

After the calling statement sends these parameters to the handler, the handler returns the value `12`, which corresponds to the variable `c` inside the `on addThem` handler. The variable `mySum` in the calling statement is then set to `12`.

You can also use expressions as values. For example, the following statement substitutes `3+6` for `a` and `8>2` (or `1`, representing `TRUE`) for `b`, and would return `10`:

```
set mySum = addThem(3+6, 8>2)
```

Returning results from handlers

Often you want a handler to report some condition or the result of some action.

To return results from a handler:

- Use the `return` function to have a handler report a condition or the result of an action. For example, the following handler returns the current color of sprite 1:

```
on findColor
  return sprite(1).foreColor
end
```

When you define a handler that returns a result, you must use parentheses after the handler when you call it from another handler. For example, the statement `put findColor()` calls the `on findColor` handler and then displays the result in the Message window.

Deciding where to place handlers

You can place handlers in any type of script, and a script can contain multiple handlers. It's a good idea to group related handlers in a single place, though, for easier maintenance.

The following are some useful guidelines for many common situations:

- To set up a handler that affects a specific sprite or runs in response to an action on a specific sprite, put the handler in a behavior attached to the sprite. To set up a handler that should be available any time the movie is in a specific frame, put the handler in a behavior attached to the frame.

  For example, to have a handler respond to a mouse click while the playhead is in a frame, regardless of where the click occurs, place an `on mouseDown` or `on mouseUp` handler in the frame behavior rather than in a sprite behavior.

- To set up a handler that runs in response to messages about events anywhere in the movie, put the handler in a movie script.
- To set up a handler that runs in response to an event that affects a cast member, regardless of which sprites use the cast member, put the handler in a cast member script.

Determining when handlers receive a message

A movie can contain more than one handler for the same message. Director manages this situation by sending the message to objects in a definite order.

The general order in which messages are sent to objects is as follows:

1. Messages are sent first to behaviors attached to a sprite involved in the event. If a sprite has more than one behavior attached to it, behaviors respond to the message in the order in which they are attached to the sprite.
2. Messages are sent next to a script attached to the cast member assigned to the sprite.
3. Messages are then sent to behaviors attached to the current frame.
4. Messages are sent last to movie scripts.

When a message reaches a script that contains a handler corresponding to the message, Director executes the handler's instructions.

After a handler intercepts a message, the message doesn't automatically pass on to the remaining locations. (You can use the `pass` command to override this default rule and pass the message to other objects.) If no matching handler is found after the message passes to all possible locations, Director ignores the message.

The exact order of objects to which Director sends a message depends on the message. For details about the sequence of objects to which Director sends specific messages, see the *Lingo Dictionary* entry for the message.

Using lists

Lists (called arrays in ActionScript and some other languages) provide an efficient way to track and update an array of data, such as a series of names or the values assigned to a set of variables. For example, if you know you will need to keep track of many names or numbers in your Director project, you may want to store them in a list. The list operator `[ ]` designates that the items within the brackets comprise a list.

You can create two types of lists with Lingo: linear lists and property lists.

- In a linear list, each element is a single value. For example, this linear list is a simple set of numbers:

  ```
  [100, 150, 300, 350]
  ```

- In a property list, each element contains two values separated by a colon. One value is a property name, always preceded by a pound (#) sign; the other value is the value associated with that property. For example, the following statement sets the variable `myList` to a property list containing values for the properties #speed, #direction, and #weight. These could be the properties of an asteroid.

  ```
  myList = [#speed: 155, #direction: 237, #weight: 8746]
  ```

  Properties can appear more than once in a property list.

Both kinds of lists can be empty, containing no values at all. An empty linear list consists of two square brackets `[ ]`. An empty property list consists of two square brackets surrounding a colon `[:]`.

It's usually easier to manipulate a list by assigning it to a variable when you create the list. The value contained in the variable is actually a reference to the list, not the list itself.

For more information on lists, see `list()` in the *Lingo Dictionary*.

Creating linear lists

The most common way to create a linear list is to use the list operator (`[ ]`). You can also use the `list()` function to create a linear list.

To create a linear list, do one of the following:

- Place the list elements within the list operator (`[ ]`).
- Specify the list's elements as parameters of the `list()` function. (This function is useful when you use a keyboard that doesn't provide square brackets.)

In both cases, you use commas to separate items in the list.

For example, the following statements have the same effect; each statement creates a linear list of three names:

```
set workerList = ["Bruno", "Heather", "Carlos"]
set workerList = list("Bruno", "Heather", "Carlos")
```

To create an empty linear list:

- Set the list to `[ ]`.

Creating property lists

The only way to create a property list is to use the list operator (`[ ]`). You cannot use the `list()` function to create a property list.

To create a property list:

- Place the list elements within the list operator, and use commas to separate the elements. Precede each property with the pound (#) sign, and separate each property from its value with a colon.

For example, the following statements create two different property lists. Each list specifies the Stage coordinates of a sprite.

```
sprite1Location = [#left:100, #top:150, #right:300, #bottom:350]
sprite2Location = [#left:400, #top:550, #right:500, #bottom:750]
```

To create an empty property list:

- Set the list to `[:]`.

Setting and retrieving items in a list

Lingo lets you set and retrieve individual items in a list. The syntax differs for linear and property lists.

To set a value in a linear list:

- Use the equals (=) operator. (You can also use the `setAt` command introduced in earlier versions of Director.)

For example, the statement `workerList[2] = "Tiffany"` makes Tiffany the new value for the second item in the list workerList.

To retrieve a value in a linear list:

- Use the list variable followed by the number that indicates the value's position in the list. Place square brackets around the number. (You can also use the `getAt` or `getaProp` commands, which were introduced in earlier versions of Director.)

For example, in the linear list `set workerList = ["Bruno ", "Heather ", "Carlos "]`, the expression `workerList[2]` represents the second value in the list workerList. The value is Heather.

To set a value in a property list, do one of the following:

- Use the equals (=) operator. (You can also use the `setAProp` command, which was introduced in earlier versions of Director.)

  For example, the statement `foodList[#Bruno] = "sushi"` makes sushi the new value associated with the property Bruno.

- Use dot syntax.
- For example, the statement `foodList.Bruno = "sushi"` makes sushi the new value associated with the property Bruno in the list `foodList`.

To retrieve a value in a property list, do one of the following:

- Use the list variable followed by the name of the property associated with the value. Place square brackets around the property. (You can also use the `getaProp` or `getAt` commands, or the `getPropAt()` function, which were introduced in earlier versions of Director.)

  For example, in the property list `foodList = [#breakfast:"Waffles", #lunch:"Tofu Burger", #dinner:"Hungarian Goulash"]`, the expression `foodList[#breakfast]` represents the value associated with the property `#breakfast`. The value is Waffles.

- Use dot syntax.

  For example, using the `foodList` property list above, `foodList.breakfast` represents the value Waffles.

Checking items in a list

You can determine the characteristics of a list and the number of items the list contains by using the following commands and functions. See entries for individual commands in the *Lingo Dictionary*.

- To display the contents of a list, use the `put` command followed by the variable that contains the list.
- To determine the number of items in a list, use the `count()` function.
- To determine a list's type, use the `ilk()` function.
- To determine the maximum value in a list, use the `max()` function.
- To determine the minimum value in a list, use the `min()` function.
- To determine the position of a specific property, use the `findPos`, `findPosNear`, or `getOne` command.

Adding and deleting items in a list

You can add or delete items in a list by using the following commands. See entries for individual commands in the *Lingo Dictionary*.

- To add an item at the end of a list, use the `append` command.
- To add an item at its proper position in a sorted list, use the `add` or `addProp` command.
- To add an item at a specific place in a linear list, use the `addAt` command.
- To add an item at a specific position in a property list, use the `addProp` command.
- To delete an item from a list, use the `deleteAt`, `deleteOne`, or `deleteProp` command.
- To replace an item in a list, use the `setAt` or `setaProp` command.

You do not have to explicitly remove lists. Lists are automatically removed when they are no longer referred to by any variable. Other types of objects must be removed explicitly, by setting variables that refer to them to `VOID`.

Copying lists

Assigning a list to a variable and then assigning that variable to a second variable does not make a separate copy of the list. For example, the statement `landList = ["Asia", "Africa"]` creates a list that contains the names of two continents. The statement `continentList = landList` assigns the same list to the variable `continentList`. However, adding Australia to `landList` using the statement `add landList, "Australia"` automatically adds Australia to `continentList` also. This happens because both variable names point to the same object in memory.

To create a copy of a list that is independent of the first list:

- Use the `duplicate()` function. See `duplicate() (list function)` in the *Lingo Dictionary*.

For example, this statement creates a list and assigns it to the variable `oldList`:

```
oldList = ["a", "b", "c"]
```

This statement uses the `duplicate()` function to make an independent copy of the list and assign it to the variable `newList`:

```
newList = duplicate(oldList)
```

After `newList` is created, editing either `oldList` or `newList` has no effect on the other.

Sorting lists

Lists can be unsorted. However, Lingo can sort a list in alphanumeric order, with numbers before strings. Strings are sorted according to their initial letters, regardless of how many characters they contain. Sorted lists perform slightly faster than unsorted lists.

Lingo sorts a linear list according to the values in the list. Lingo sorts a property list according to the properties in the list.

To sort a list:

- Use the `sort` command followed by the list's name. See `sort` in the *Lingo Dictionary*.

About variables

Director uses variables to store and update values. As the name implies, a variable contains a value that can be changed or updated as the movie plays. By changing the value of a variable as the movie plays, you can do things such as store a URL, track the number of times a user takes part in an online chat session, or record whether a network operation is complete.

It's a good idea always to assign a variable a known value the first time you define the variable. This is known as initializing a variable. Initializing variables makes it easier to track and compare the variable's value as the movie plays.

Variables can be global or local. A global variable can exist and retain its value as long as Director is running, including when a movie branches to another movie. A local variable exists only as long as the handler in which it is defined is running. See "Using global variables" on page 403 and "Using local variables" on page 404.

Storing and updating values in variables

Variables can hold any of the types of information found in Director: numbers, strings, `TRUE` or `FALSE` values, symbols, lists, or the result of a calculation. To store and retrieve the values of properties and variables, Lingo uses the equals (=) operator and the `set` and `put` commands.

Also, a variable in Lingo can contain different types of data at different times. (The ability to change a variable's type distinguishes Lingo from other languages such as Java, in which a variable's type cannot be changed.)

For example, the statement `x = 1` creates the variable `x`, which is an integer variable because you assigned the variable an integer. If you subsequently use the statement `x = "one"`, the variable `x` becomes a string variable, because the variable now contains a string.

You can convert a string to a number or a number to a string with the `value()` and `string()` functions. For example, the statement `x = value("1")` stores the number 1 in the variable `x`. The statement `x = string(1)` stores the string "1" in the variable `x`.

Some properties cannot be set, but can only be tested. Often these are properties that describe some condition that exists outside the control of Director. For example, you cannot assign a value to the `numChannels` cast member property, which indicates the number of channels within a Shockwave movie. However, you can retrieve the number of channels by referring to the `numChannels` property of a cast member.

To assign a value to a variable:

- Use the equals (=) operator. For improved readability, you can use the optional `set` command at the beginning of the statement.

For example, any of these statements will change the cast member assigned to sprite 2 by setting the sprite's `member` property to a different cast member. The last two statements use dot syntax (see "Dot syntax" on page 393):

```
set the member of sprite 2 = member "Big Flash"
set sprite (2).member = member ("Big Flash")
sprite (2).member = member ("Big Flash")
```

As another example, each of these statements assigns a URL to the variable `placesToGo`:

```
placesToGo = "http://www.macromedia.com"
set placesToGo = "http://www.macromedia.com"
```

Variables can also hold the results of mathematical operations. Both of these statements add the result of an addition operation to the variable `mySum`:

```
mySum = 5 + 5
set mySum = 5 + 5
```

It's good practice to use variable names that indicate what the variable is used for. This will make your Lingo easier to read. For example, the variable `mySum` indicates that the variable contains the sum of numbers.

To test the values of properties or variables:

- Use the `put` command in the Message window or check the values in the Watcher window.

For example, the statement `put myNumber` displays the value assigned to the variable `myNumber` in the Message window.

As another example, the following statement returns the cast member assigned to sprite 2 by retrieving the sprite's `member` property:

```
put the member of sprite 2
```

Using global variables

Global variables can be shared among handlers and movies. A global variable exists and retains its value as long as Director is running or until you issue the `clearGlobals` command.

In Macromedia Shockwave, global variables persist among movies displayed by the Lingo `goToNetMovie` command, but not among those displayed by the `goToNetPage` command.

Every handler that declares a variable as global can use the variable's current value. If the handler changes the variable's value, the new value is available to every other handler that treats the variable as global.

It's good practice to start the names of all global variables with a lowercase *g*. This helps identify which variables are global when you examine Lingo code.

Because you usually want global variables to be available throughout a movie, it is good practice to declare global variables in an `on prepareMovie` handler. This ensures that the global variables are available from the very start of the movie.

To declare that a variable is global, do one of the following:

- Use the term `global` before the variable name at the top of the Script window, before any individual handlers. This makes the variable global for every handler in the script.
- Declare the variable as global by using the term `global` before the variable name on a separate line in every handler that uses the global variable.

When you use the term `global` to define global variables, the variables automatically have `VOID` as their initial value.

The following statements make `gName` a global variable and give it the value Mary:

```
global gName
gName = "Mary"
```

To display all current global variables and their current values:

- Use the `showGlobals` command in the Message window.

To clear all current global variables:

- Use the `clearGlobals` command in the Message window to set the value of all global variables to `VOID`.

See `global`, `clearGlobals`, and `showGlobals` in the *Lingo Dictionary*.

To monitor the values of global variables during movie playback, use the Object inspector. See "Using the Object inspector" on page 433.

Using local variables

A local variable exists only as long as the handler in which it is defined is running. However, after a local variable is created, you can use the variable in other expressions or change its value while Lingo is still within the handler that defined the variable.

Treating variables as local is a good idea when you want to use a variable only temporarily in one handler. This helps you avoid unintentionally changing the value in another handler that uses the same variable name.

To create a local variable:

- Assign the variable a value using the equals (=) operator or the `set variableName = value` command.

Unless the handler uses the term `global` to declare that a variable is global, the variable is automatically a local variable.

To display all current local variables in the handler:

- Use the `showLocals` command.

You can use this command in the Message window or in handlers to help with debugging. The result appears in the Message window.

To monitor the values of local variables during movie playback, use the Object inspector. See "Using the Object inspector" on page 433.

Expressing literal values

A literal value is any part of a statement or expression that is to be used exactly as it is, rather than as a variable or a Lingo element. Literal values that you encounter in Lingo are character strings, integers, decimal numbers, cast member names and numbers, frame and movie names and numbers, symbols, and constants.

Note: The `value()` function can convert a string into a numerical value. The `string()` function can convert a numerical value into a string.

Each type of literal value has its own rules.

Writing strings

Strings are words or groups of characters that Lingo treats as regular words instead of as variables. Strings must be enclosed in double quotation marks. For example, you might use strings to give messages to the user of your movie or to name cast members. In the statement

```
member ("Greeting").text = "Hello"
```

"Hello" and "Greeting" are both strings. "Hello" is the literal text being put into the text cast member; "Greeting" is the name of the cast member.

Similarly, if you test a string, double quotation marks must surround each string, as in the following example:

```
if "Hello Mr. Jones" contains "Hello" then soundHandler
```

Lingo treats spaces at the beginning or end of a string as a literal part of the string. The following expression includes a space after the word *to*:

```
put "My thoughts amount to "
```

Although Lingo does not distinguish between uppercase and lowercase when referring to cast members, variables, and so on, literal strings are case sensitive. For example, the following two statements place different text into the specified cast member, because `"Hello"` and `"HELLO"` are literal strings.

```
member ("Greeting").text = "Hello"
member ("Greeting").text = "HELLO"
```

Using integers

An integer is a whole number, without any fractions or decimal places.

Director works with integers between -2,147,483,648 and +2,147,483,647. (For numbers outside this range, use decimal numbers, sometimes called floating-point numbers.) Enter integers without using commas. Use a minus (`-`) sign for negative numbers.

You can convert a decimal number to an integer by using the `integer()` function. For example, the statement `set theNumber = integer(3.9)` rounds off the decimal number 3.9 and converts it to the integer 4.

Some Lingo commands and functions require integers for their parameters. The requirements for specific Lingo elements can be found in Director Help or the *Lingo Dictionary*.

Using decimal numbers

A decimal number, sometimes called a floating-point number, is any number that includes a decimal point. The `floatPrecision` property controls the number of decimal places used to display these numbers. (However, Director always uses the complete number in calculations.) For information about setting the number of decimal places used for decimal numbers, see the `floatPrecision` entry in Director Help or the *Lingo Dictionary*.

You can also use exponential notation with decimal numbers: for example, `-1.1234e-100` or `123.4e+9`.

You can convert an integer or string to a decimal number by using the `float()` function. For example, the statement `set theNumber = float(3)` stores the value `3.0` in the variable.

Identifying cast members and casts

Note: If you rearrange (and thus renumber) cast members while creating a movie, Director doesn't automatically update references to cast member numbers in Lingo scripts. Therefore, although some of the examples in this section illustrate how to reference cast members by number, the best practice is to always name cast members and refer to them by name in Lingo scripts.

Lingo refers to a cast member by using the term `member` followed by a cast member name or number in parentheses. (Cast member names are strings and follow the same syntax rules as other strings.) An alternative syntax is the term `member`, without parentheses, followed by the cast member name or number.

For example, the following all refer to cast member 50, which has the name Hammer:

```
member("Hammer")
member(50)
member "Hammer"
member 50
```

If more than one cast contains a cast member with the same name, you must use a second parameter to specify the cast member's cast. When your movie uses more than one cast and you identify a cast member by its number, you must also specify the cast. Otherwise, the second parameter is optional.

To specify a cast without parentheses when using `member`, include the term `of castLib` followed by the cast's name or number. When the cast member's name is unique in the movie, the cast's name or number isn't required, but you can include it for clarity.

For example, the following statements refer to cast member 50, which is named Hammer, in castLib 4, which is named Tools:

```
member(50, 4)
member 50 of castLib 4

member("Hammer", 4)
member "Hammer" of castLib 4

member(50, "Tools")
member 50 of castLib "Tools"

member("Hammer", "Tools")
member "Hammer" of castLib "Tools"
```

If more than one cast member has the same name and you use the name in a script without specifying the cast or cast member number, Lingo uses the first (lowest numbered) cast member in the lowest numbered cast that has the specified name.

Identifying frames and movies

Use these Lingo terms to refer to frames in a movie:

- The function `the frame` refers to the current frame.
- The keyword `frame` followed by the frame number or the frame marker label refers to a specific frame. For example, `frame 60` indicates frame 60.
- The keyword `loop` refers to the marker at the beginning of the current segment. If the current frame has a marker, `loop` refers to the current frame; if not, `loop` refers to the first marker before the current frame. If there are no markers in the movie, `loop` refers to the first frame.

- The word `next` or `previous` refers to the next marker or the marker before the current scene, respectively.
- The term `the frame` followed by a minus or plus sign and the number of frames before or after the current frame refers to a frame that's a specific number of frames before or after the current frame. For example, `the frame - 20` refers to the frame 20 frames before the current frame.
- The term `the frameLabel` identifies the label assigned to the current frame.
- The `labelList` system property contains a list of all of the markers in the Score. Each marker is separated in the list by a carriage return.
- The function `marker()`, with a positive or negative number of markers used as the parameter, refers to the marker that's a specific number of markers before or after the current frame. For example, `marker(-1)` returns the frame number of the previous marker and `marker(2)` returns the frame number of the second marker after the current frame. If the frame is marked, `marker(0)` returns the frame number of the current frame; if not, `marker(0)` gives the frame number of the previous marker.
- The term `movie` followed by the movie name refers to the beginning of another movie. For example, `movie "Navigation"` refers to the beginning of the movie called Navigation.
- The word `frame` plus a frame identifier, the word `of`, the word `movie`, and the movie name refers to a specific frame in another movie; for example, `frame 15 of movie "Navigation"` refers to frame 15 of the movie called Navigation.

Using symbols

A symbol is a string or other value that begins with the pound (#) sign.

Symbols are user-defined constants. Comparisons using symbols can usually be performed very quickly, providing more efficient code.

For example, the statement

```
userLevel = #novice
```

runs more quickly than the statement

```
userLevel = "novice"
```

Symbols can't contain spaces or punctuation.

Convert a string to a symbol by using the `symbol()` function. Convert a symbol back to a string by using the `string()` function.

```
x = symbol("novice")
put x
-- #novice

x = string(#novice)
put x
-- "novice"
```

See `# (symbol)` and `string()` in the *Lingo Dictionary*.

Expressing constants

A constant is a named value whose content never changes. For example, `TRUE`, `FALSE`, `VOID`, and `EMPTY` are constants because their values are always the same.

The constants `BACKSPACE`, `ENTER`, `QUOTE`, `RETURN`, `SPACE`, and `TAB` refer to keyboard characters. For example, to test whether the user is pressing the Enter key, use the following statement:

```
if the key = ENTER then beep
```

Using operators to manipulate values

Operators are elements that tell Lingo how to combine, compare, or modify the values of an expression. They include the following:

- Arithmetic operators (such as +, -, /, and *)
- Comparison operators (for example, <>, >, and >=), which compare two arguments
- Logical operators (`not`, `and`, `or`), which combine simple conditions into compound ones
- String operators (`&` and `&&`), which join strings of characters

Understanding operator precedence

When two or more operators are used in the same statement, some operators take precedence over others in a precise hierarchy that Lingo follows to determine which operators to execute first. This is called the operators' precedence order. For example, multiplication is always performed before addition. However, items in parentheses take precedence over multiplication. For example, without parentheses, Lingo performs the multiplication in this statement first:

```
total = 2 + 4 * 3
```

The result is 14.

When parentheses surround the addition operation, Lingo performs the addition first:

```
total = (2 + 4) * 3
```

The result is 18.

Descriptions of the operators and their precedence order follow. Operators with higher precedence are performed first. For example, an operator whose precedence order is 5 is performed before an operator whose precedence order is 4. Operations that have the same order of precedence are performed left to right.

Arithmetic operators

Arithmetic operators add, subtract, multiply, divide, and perform other arithmetic operations. Parentheses and the minus sign are arithmetic operators.

Operator	Effect	Precedence
`()`	Groups operations to control precedence order.	5
-	When placed before a number, reverses the sign of a number.	5
*	Performs multiplication.	4
mod	Performs modulo operation.	4
/	Performs division.	4

Operator	Effect	Precedence
+	Performs addition.	3
-	When placed between two numbers, performs subtraction.	3

Note: When only integers are used in an operation, the result is an integer. Using integers and floating-point numbers in the same calculation results in a floating-point number.

When dividing one integer by another doesn't result in a whole number, Lingo rounds the result down to the nearest integer. For example, the result of `4/3` is `1`.

To force Lingo to calculate a value without rounding the result, use `float()` on one or more values in an expression. For example, the result of `4/float(3)` is 1.333.

Comparison operators

Comparison operators compare two values and determine whether the comparison is true or false. These are the comparison operators available in Lingo:

Operator	Meaning	Precedence
<	Is less than	1
<=	Is less than or equal to	1
<>	Is not equal to	1
>	Is greater than	1
>=	Is greater than or equal to	1
=	Equals	1

Logical operators

Logical operators test whether two logical expressions are true or false. These are the logical operators available in Lingo:

Operator	Effect	Precedence
and	Determines whether both expressions are true.	4
or	Determines whether either or both expressions are true.	4
not	Negates an expression.	5

The `not` operator is useful for toggling a `TRUE` or `FALSE` value to its opposite. For example, the following statement turns on the sound if it's currently off and turns off the sound if it's currently on:

```
set the soundEnabled = not (the soundEnabled)
```

String operators

String operators combine and define strings. These are the string operators available in Lingo:

Operator	Effect	Precedence
&	Concatenates two strings.	2
&&	Concatenates two strings and inserts a space between the two.	2
"	Marks the beginning or end of a string.	1

Controlling flow in scripts

Lingo uses `if...then...else`, `case`, and `repeat` statements to perform an action depending on whether a condition exists. See the following sections.

Using if statements

Statements that check whether a condition is true or false begin with the Lingo term `if`. If the condition exists, Lingo executes the statement that follows `then`. If the condition doesn't exist, Lingo skips to the next statement in the handler.

To optimize your script's performance, test for the most likely conditions first.

The following statements test several conditions. The term `else if` specifies alternative tests to perform if previous conditions are false:

```
if the mouseMember = memberNum("map 1") then
  go to "Cairo"
else if the mouseMember = member ("map 2") then
  go to "Nairobi"
else
  alert "You're lost."
end if
```

When writing `if…then` structures, you can place the statement following `then` in the same line as `then`, or you can place it on its own line by inserting a carriage return after `then`. If you insert a carriage return, you must also include an `end if` statement at the end of the `if…then` structure.

For example, the following statements are equivalent:

```
if the mouseMember = member("map 1") then go to "Cairo"
if the mouseMember = member("map 1") then
  go to "Cairo"
end if
```

For more information, see `if` in the *Lingo Dictionary*.

Using case statements

The `case` statement is a shorthand alternative to repeating `if…then` statements when setting up a multiple branching structure. A `case` statement is often more efficient and easier to read than a large number of `if...then...else` statements.

The condition to test for follows the term `case` in the first line of the `case` structure. The comparison goes through each line in order until Lingo encounters an expression that matches the test condition. When a matching expression is found, Director executes the Lingo that follows the matching expression.

For example, the following `case` statement tests which key the user pressed most recently and responds accordingly:

```
case (the key) of
  "A": go to frame "Apple"
  "B", "C":
     puppetTransition 99
     go to frame "Oranges"
  otherwise beep
end case
```

- If the user pressed A, the movie goes to the frame labeled Apple.
- If the user pressed B or C, the movie performs the specified transition and then goes to the frame labeled Oranges.
- If the user pressed any other letter key, the computer beeps.

A `case` statement can use comparisons as the test condition.

For more information, see `case` in the *Lingo Dictionary*.

Repeating an action

Lingo can repeat an action a specified number of times or while a specific condition exists.

To repeat an action a specified number of times:

- Use a `repeat with` structure. Specify the number of times to repeat as a range following `repeat with`.

This structure is useful for performing the same operation on a series of objects. For example, the following repeat loop makes Background Transparent the ink for sprites 2 through 10:

```
repeat with n = 2 to 10
  set the ink of sprite n = 36
end repeat
```

This example performs exactly the same action as above, but uses dot syntax:

```
repeat with n = 2 to 10
  sprite(n).ink = 36
end repeat
```

This example performs a similar action, but with decreasing numbers:

```
repeat with n = 10 down to 2
  sprite(n).ink = 36
end repeat
```

To repeat a set of instructions as long as a specific condition exists:

- Use a `repeat...while` statement.

For example, these statements instruct a movie to beep continuously whenever the mouse button is being pressed:

```
repeat while the mouseDown
  beep
end repeat
```

Lingo continues to loop through the statements inside the repeat loop until the condition is no longer true or until one of the instructions sends Lingo outside the loop. In the previous example, Lingo exits the repeat loop when the mouse button is released because the `mouseDown` condition is no longer true.

To exit a repeat loop:

- Use the `exit repeat` command.

For example, the following statements make a movie beep while the mouse button is pressed, unless the mouse pointer is over sprite 1. If the pointer is over sprite 1, Lingo exits the repeat loop and stops beeping. (The term `rollover` followed by a sprite number indicates that the pointer is over the specified sprite.)

```
repeat while the stillDown
  beep
  if rollover (1) then exit repeat
end repeat
```

See `repeat with`, `repeat while`, and `exit repeat` in the *Lingo Dictionary*.

Creating and attaching scripts with the Script window

To create scripts and write the Lingo statements that make up handlers, you use the Script window.

To open the Script window, do one of the following:

- Select Window > Script.
- Double-click a script cast member in the Cast window.

For more ways to create and open scripts, see "Performing common tasks" on page 387.

You can change the font of text in the Script window and define different colors for various code components. See the next section.

Setting Script window preferences

To change the default font of text in the Script window and the color of various code elements, you use Script window preferences. Director automatically colors different types of code elements unless you turn off Auto Coloring.

To set Script window preferences:

1. Select Edit > Preferences > Script.
2. To choose the default font, click the Font button and select settings from the Font dialog box.
3. To choose the default color of text in the Script window, select a color from the Color menu.
4. To choose the background color for the Script window, select a color from the Background color menu.
5. To make new Script windows automatically color certain code elements, select Enable for Auto Coloring. This option is on by default.

   With Auto Coloring off, all text appears in the default color.

6 To make new Script windows automatically format your scripts with proper indenting, select Enable for Auto Format. This option is on by default.

7 To make new Script windows display line numbers for your scripts, select Enable for Line Numbering. This option is on by default.

8 If Auto Coloring is on, select colors for the following code elements from the corresponding color menus:

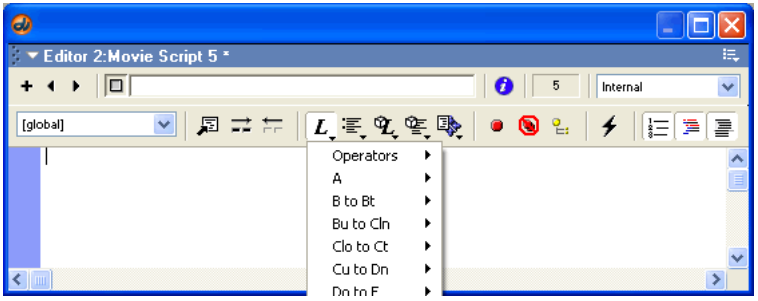
- Keywords
- Comments
- Literals
- Custom (terms you define in your own Lingo code)

9 To change the line number column background color, click the Line Number color menu and choose a new color.

10 To change the location of the Call Stack, Variable, and Watcher panes in the Debugger window, select left, top, right, or bottom from the Debugger Panes menu.

Inserting common Lingo terms

The Script window provides pop-up menus of common Lingo terms that you can use to insert Lingo in a script. The same menus also appear in the Message window.



- The Alphabetical Lingo menu lists every element in alphabetical order, except 3D Lingo.
- The Categorized Lingo menu lists categories of elements according to the features they are often used for. It does not include 3D Lingo.
- The Alphabetical 3D Lingo menu lists all 3D Lingo elements in alphabetical order.
- The Categorized 3D Lingo menu lists categories of all 3D Lingo elements according to the features they are used for.
- The Scripting Xtras menu contains Lingo terms that are provided by any third-party Xtra extensions that you have installed.

When you select an element from the Lingo pop-up menus, Director inserts the element at the insertion point in the Script window.

When an element requires additional parameters, Lingo includes placeholder names that indicate the additional required information. When more than one argument or parameter is required, Lingo highlights the first one for you, so all you have to do is type to replace it. You must select and change the other parameters yourself.

Some cast member types and scripting Xtra extensions provide Lingo terms that do not appear in the Lingo menus. These member types and Xtra extensions often have their own documentation, and you can find some information from within Director.

To display a list of available Xtra extensions:

- Issue the command `showXlib` in the Message window.

To display a list of methods for an Xtra:

- Issue the command `put mmessageList("XtraName")` in the Message window.

Entering and editing text

Entering and editing text in a Script window is similar to entering and editing text in any other field.

The following are common editing tasks you perform in the Script window:

- To select a word, double-click the word.
- To select an entire script, select Select All from the Edit menu.
- To start a new line, enter a carriage return.
- To wrap a long line of code with a continuation symbol, press Alt+Enter (Windows) or Option+Return (Macintosh) where you want to insert a soft line break.

  The continuation symbol (\) that appears indicates that the statement continues on the next line. Director 7 and earlier used a different continuation symbol (¬) instead.
- To locate a handler in the current script, select the handler's name from the Handler pop-up menu in the Script window.
- To compile the Lingo you have written, click the Script window's Recompile button or close the Script window. When you edit a Script, an asterisk appears in the Script window title bar, indicating that the script needs to be recompiled.
- To reformat a script with proper indentation, press Tab in the Script window.

  Lingo automatically indents statements when the syntax is correct. If a line doesn't indent properly, there is a problem in the Lingo syntax on that line.
- To open a second Script window, Alt-click (Windows) or Option-click (Macintosh) the New Cast Member button in the Script window. This can be helpful for editing two different sections of a long script simultaneously.
- To toggle line numbering, click the Line Numbering button.
- To toggle Auto Coloring, click the Auto Coloring button. Auto coloring displays each type of Lingo element (properties, commands, and so on) in a different color.
- To toggle Auto Formatting, click the Auto Format button. Auto Formatting adds the correct indenting to your scripts each time you add a carriage return or press Tab.

Finding handlers and text in scripts

The Find command in the Edit menu is useful for finding handlers and for finding and editing text and handlers.

To find handlers in scripts:

1. Select Edit > Find > Handler.

   The Find Handler dialog box appears.

   The leftmost column in the Find Handler dialog box displays the name of each handler in the movie. The middle column displays the number of the cast member associated with the handler's script. The rightmost column lists the cast that the cast member is in.

2. Select the handler that you want to find.

3. Click Find.

   The handler appears in the Script window.

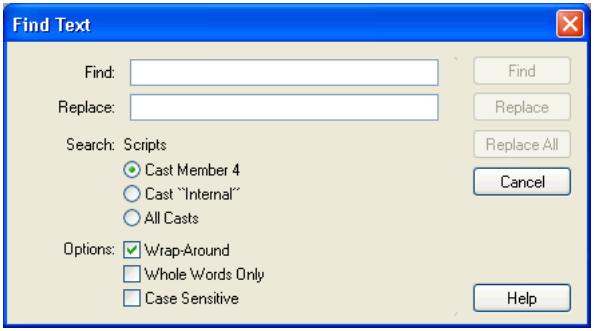
   The title bar at the top of the Script window indicates the script's type.

To find text in scripts:

1. Make the Script window active.

2. Select Edit > Find > Text.

   The Find Text dialog box appears.



3. Enter text that you want to find in the Find field, and then click Find.

   Find is not case-sensitive: `ThisHandler`, `thisHandler`, and `THISHANDLER` are all the same for search purposes.

To specify which cast members to search:

- Select the appropriate option under Search: Scripts.

To start the search over from the beginning after the search reaches the end:

- Select the Wrap-Around option.

To search only for whole words and not fragments of other words that match the word:

- Select the Whole Words Only option.

To find the next occurrence of the text specified in the Find field:

- Select Edit > Find Again.

To find occurrences of selected text:

1. Select the text.
2. Select Edit > Find > Selection.

Using linked scripts

In addition to scripts stored as internal cast members, you can choose to keep scripts in external text files and link them to your Director movie. These linked scripts are similar to linked image or digital video files you can import into Director movies.

Advantages of using linked scripts include the following:

- One person can work on the Director file while another works on the script.
- You can easily exchange scripts with others.
- You can control the scripts separately from the Director file in a source code control application such as Microsoft Visual SourceSafe or Perforce by Perforce Software. Applications such as this prevent multiple programmers working on the same Director project from overwriting each other's work.

Linked scripts are used by Director only during authoring. At runtime, Director projectors and Shockwave use a special internal copy of the script data stored in the movie. This way, your linked scripts need not be distributed with your movies and cannot be copied by end users.

To import a script as a linked text file:

1. Select File > Import.
2. Select Script as the type of file to import.
3. Select the script file(s) you want to import.

   You can import files with the file extensions .txt or .ls; the .ls extension is the Director linked script extension.

   To create a list of files you want to import, you can use the Add and Add All buttons. This is especially useful if you want to import scripts from multiple locations.
4. Select Link to External File from the Media pop-up menu.
5. Click Import.

You can edit linked scripts normally in the Director Script window. Changes you make are written to the external files each time you save your Director movie. (If you imported the linked script from a UNIX server, UNIX line endings are preserved.) If you import a script whose text file is locked, you will not be able to edit the script in Director.

You cannot apply custom text colors to linked scripts in the Script window. Script auto coloring, however, is enabled for linked scripts.

To turn an internal script cast member into an external, linked script cast member:

1. Select the internal cast member and click the Script tab of the Property inspector.
2. Click Link Script As.
3. Enter a name for the script file in the Save As dialog box.
4. Click Save.

To reload a linked script after it is edited:

- Use the `unloadMember` command.

If a linked script is edited outside of Director, you can reload it by using the `unloadMember` command in the Message window. The following statement will cause the script `myScript` to be unloaded and then reloaded:

```
unloadMember member "myScript"
```

Using parent scripts and child objects

Parent scripts provide the advantages of object-oriented programming within Director. These advantages include the ability to write less code and use simpler logic to accomplish tasks in Lingo. You can use parent scripts to generate script objects that behave and respond similarly yet can still operate independently of each other.

Lingo can create multiple copies (or instances) of a parent script. Each instance of a parent script is called a child object. You can create child objects on demand as the movie plays. Director doesn't limit the number of child objects that can be created from the same parent script. You can create as many child objects as the computer's memory can support.

Director can create multiple child objects from the same parent script, just as Director can create multiple instances of a behavior for different sprites. You can think of a parent script as a template and of child objects as implementations of the parent template.

This section describes the basics of how to write parent scripts, and create and use child objects, and it provides script examples. It doesn't teach fundamental object-oriented programming concepts; however, to use parent scripts and child objects successfully, you must understand object-oriented programming principles. For an introduction to the basics of object-oriented programming, see one of the many third-party books on that subject.

Similarity with other object-oriented languages

If you are familiar with an object-oriented programming language such as Java or C++, you may already understand the concepts that underlie parent scripting but know them by different names.

Terms that Director uses to describe parent scripts and child objects correspond to the following common object-oriented programming terms:

Parent scripts correspond to classes.

Child objects correspond to instances.

Property variables correspond to instance variables or member variables.

Handlers correspond to methods.

Ancestor scripts correspond to the Super class or base class.

Parent script and child object basics

A parent script is a set of handlers and properties that define a child object; it is not a child object itself. A child object is a self-contained, independent instance of a parent script. Children of the same parent have identical handlers and properties, so child objects in the same group can have similar responses to events and messages.

Typically, parent scripts are used to build child objects that make it easier to organize movie logic. These child objects are especially useful when a movie requires the same logic to be run several times concurrently with different parameters. You can also add a child object to a sprite's `scriptInstanceList` or the `actorList` as a way to control animation.

Because all the child objects of the same parent script have identical handlers, those child objects respond to events in similar ways. However, because each child object maintains independent values for the properties defined in the parent script, each child object can behave differently than its sibling objects—even though they are instances of the same parent script.

For example, you can create a parent script that defines child objects that are editable text fields, each with its own property settings, text, and color, regardless of the other text fields' settings. By changing the values of properties in specific child objects, you can change any of these characteristics as the movie plays without affecting the other child objects based on the same parent script.

Similarly, a child object can have a property set to either `TRUE` or `FALSE` regardless of that property's setting in sibling child objects.

Differences between child objects and behaviors

While child objects and behaviors are similar in that they both can have multiple instances, they have some important differences as well. The main difference between child objects and behaviors is that behaviors are associated with locations in the Score because they are attached to sprites. Behavior objects are automatically created from initializers stored in the Score as the playhead moves from frame to frame and encounters sprites with attached behaviors. In contrast, child objects from parent scripts must be created explicitly by a handler.

Behaviors and child objects differ in how they become associated with sprites. Director automatically associates a behavior with the sprite that the behavior is attached to, but you must explicitly associate a child object with a sprite. Child objects don't require sprite references and exist only in memory.

Ancestor basics

Parent scripts can declare ancestors, which are additional scripts whose handlers and properties a child object can call on and use.

Ancestor scripting lets you create a set of handlers and properties that you can use and reuse for multiple parent scripts.

A parent script makes another parent script its ancestor by assigning the script to its `ancestor` property. For example, the following statement makes the script What_Everyone_Does an ancestor to the parent script in which the statement occurs:

```
set ancestor to new(script "What_Everyone_Does")
```

When handlers and properties are not defined in a child object, Director searches for the handler or property in the child's ancestors, starting with the child's parent script. If a handler is called or a property is tested and the parent script contains no definition for it, Director searches for a definition in the ancestor script. If a definition exists in the ancestor script, that definition is used.

A child object can have only one ancestor at a time, but that ancestor script can have its own ancestor, which can also have an ancestor, and so on. This lets you create a series of parent scripts whose handlers are available to a child object.

See `ancestor` in the *Lingo Dictionary*.

Writing a parent script

A parent script contains the Lingo needed to create child objects and define their possible actions and properties. First you need to decide how you want the child objects to behave. Then you can write a parent script that does the following:

- Optionally declares any appropriate property variables; these variables represent properties for which each child object can contain a value independent of other child objects. See "Parent script and child object basics" on page 418.
- Sets up the initial values of the child objects' properties and variables in the `on new` handler.
- Contains additional handlers that control the child objects' actions.

Declaring property variables

Each child object created from the same parent script initially contains the same values for its property variables. A property variable's value belongs only to the child object it's associated with. Each property variable and its value persists as long as the child object exists. The initial value for the property variable is typically set in the `on new` handler; if it's not set, the initial value is `VOID`.

To declare a property variable:

- Use the `property` keyword at the beginning of the parent script. See `property` in the *Lingo Dictionary*.

To set and test property variables from outside the child object:

- Set and test property variables in the same way you would any other property in Lingo, by using the syntax `the` *`propertyName`* `of` *`whichObject`* or *`whichObject.propertyName`*.

This statement sets the `speed` property of the object `car1`:

```
car1.speed = 55
```

Creating the on new handler

Each parent script typically uses an `on new` handler. This handler creates the new child object when another script issues a `new(script parentScriptName)` command, which tells the specified parent script to create a child object from itself. The `on new` handler in the parent script can also set the child object's initial property values, if you want. The `on new` handler always starts with the phrase `on new`, followed by the `me` variable and any arguments being passed to the new child object. See `new()` in the *Lingo Dictionary*.

The following is a sample `on new` handler:

```
property spriteNum

on new me, aSpriteNum
  spriteNum = aSpriteNum
  return me
end
```

This handler creates a new child object from the parent script and initializes the child's `spriteNum` property with the value passed to it in the `aSpriteNum` argument. The `return me` statement returns the child object to the handler that originally called the `on new` handler. For more information about calling the `on new` handler, see "Creating a child object" on page 421.

Adding other handlers

You determine a child object's behavior by including in the parent script the handlers that produce the desired behavior. For example, you could add a handler to the code above to make the sprite change color.

The following parent script defines a value for the property `spriteNum` and contains a second handler that will change the `forecolor` property of the sprite.

```
property spriteNum

on new me, aSpriteNum
  spriteNum = aSpriteNum
  return me
end

on changeColor me
  spriteNum.forecolor = random(255)
end
```

Using the me variable

Typically, one parent script creates many child objects, and each child object contains more than one handler. The term `me` is a special parameter variable. It must always be the first parameter variable stated in every handler definition in a parent script.

The `me` variable tells the handlers in the child object that they are to operate on the properties of that object and not on the properties of any other child object. This way, when a handler within a child object refers to properties, the handler will use its own child object's values for those properties.

This is why it is always important to define `me` as the first parameter for parent scripts and to pass the same parameter if you need to call other handlers in the same parent script, since these will be the handlers in each of the script's child objects.

When referring to properties defined in ancestor scripts, you must use the me parameter as the source of the reference. This is because the property, while defined in the ancestor script, is nevertheless a property of the child object. For example, these statements both use me to refer to an object and access properties defined in an ancestor of the object:

```
--access ancestor property
x = me.y
```

or

```
x = the y of me
```

Because the me variable is present in each handler of the child object, it indicates that all the handlers control that same child object.

See me in the *Lingo Dictionary*.

Creating a child object

Child objects exist entirely in memory; they are not saved with a movie. Only parent and ancestor scripts exist on disk.

To create a new child object, you use the new function and assign the child object a variable name or position in a list so you can identify and work with it later.

To create a child object and assign it to a variable, use the syntax:

```
set variableName = new(script "scriptName", argument1, argument2,
  argument3...)
```

where *scriptName* is the name of the parent script and *argument1*, *argument2*, *argument3*... are any arguments you are passing to the child object's on new handler.

The new() function creates a child object whose ancestor is *scriptName*. It then calls the on new handler in the child object with the specified arguments.

You can issue a new statement from anywhere in a movie. You can customize the child object's initial settings by changing the values of the arguments passed with the new statement.

Each child object requires only enough memory to record the current values of its properties and variables and a reference to the parent script. Because of this, in most cases you can create and maintain as many child objects as you require.

You can produce additional child objects from the same parent script by issuing additional new statements.

To create child objects without immediately initializing their property variables, use the rawNew() function. The rawNew() function does this by creating the child object without calling the parent script's on new handler. In situations where large numbers of child objects are needed, rawNew() allows you to create the objects ahead of time and defer the assignment of property values until each object is needed.

This statement creates a child object from the parent script Car without initializing its property variables and assigns it to the variable car1:

```
car1 = script("Car").rawNew()
```

To initialize the properties of one of these child objects, call its on new handler:

```
car1.new
```

Checking child object properties

You can check the values of specific property variables in individual child objects by using a simple *objectName.PropertyName* syntax. For example, this statement assigns the variable x the value of the carSpeed property of the child object in the variable car1:

```
x = car1.carSpeed
```

Querying object properties from outside the objects themselves can be useful for getting information about groups of objects, such as the average speed of all the car objects in a racing game. You might also use the properties of one object to help determine the behavior of other objects that are dependent on it.

In addition to checking the properties you assign, you can check whether a child object contains a specific handler or find out which parent script an object came from. This is useful when you have objects that come from parent scripts that are similar but that have subtle differences.

For example, you may want to create a scenario in which one of several parent scripts might be used to create a child object. You can then determine which parent script a particular child object came from by using the script() function, which returns the name of an object's parent script.

These statements check whether the object car1 was created from the parent script named Car:

```
if car1.script = script("Car") then
  beep
end if
```

You can also get a list of the handlers in a child object by using the handlers() function, or check whether a particular handler exists in a child object by using the handler() function.

This statement places a list of the handlers in the child object car1 into the variable myHandlerList:

```
myHandlerList = car1.handlers()
```

The list would look something like this:

```
[#start, #accelerate, #stop]
```

These statements use the handler() function to check whether the handler on accelerate exists in the child object car1:

```
if car1.handler(#accelerate) then
  put "The child object car1 contains the handler named on accelerate."
end if
```

Removing a child object

You can remove a child object from a movie by setting all variables that contain a reference to the child object to another value. If the child object has been assigned to a list, such as actorList, you must also remove the child object from the list. (The actorList property is useful for tracking and manipulating the child objects in a movie. For details, see "Using actorList" on page 423.)

To remove a child object and the variables that refer to it:

- Set each variable to VOID.

Director deletes the child object when there are no more references to it. For example, if ball1 contains the only reference to a specific child object, then the statement set ball1 = VOID deletes the object from memory.

To remove an object from actorList:

- Use the `delete` command to delete the item from the list. See `delete` in the *Lingo Dictionary*.

Using scriptInstanceList

You can use the `scriptInstanceList` property to dynamically add new behaviors to a sprite. Normally, `scriptInstanceList` is the list of behavior instances created from the behavior initializers defined in the Score. If you add child objects created from parent scripts to this list, the child objects receive the messages sent to other behaviors.

For example, this statement adds a child object to the `scriptInstanceList` property of sprite 10:

```
add sprite(10).scriptInstanceList, new(script "rotation", 10)
```

This is a possible parent script that the statement refers to:

```
-- parent script "rotation"
property spriteNum

on new me, aSpriteNum
  spriteNum = aSpriteNum
  return me
end

on prepareFrame me
  sprite(spriteNum).rotation = sprite(spriteNum).rotation + 1
end
```

When a child object is added to `scriptInstanceList`, you must initialize the child object's `spriteNum` property. Typically you do this from a parameter passed in to the `on new` handler.

Note: The `beginSprite` message is not sent to dynamically added child objects.

Using actorList

Lingo can set up a special list of child objects (or any other objects) that receives its own message each time the playhead enters a frame or the `updateStage` command updates the Stage.

The special list is `actorList`, which contains only objects that have been explicitly added to the list. See `actorList` in the *Lingo Dictionary*.

The message is the `stepFrame` message that is sent only when the playhead enters a frame or the `updateStage` command is used. See `on stepFrame` in the *Lingo Dictionary*.

Objects in `actorList` receive a `stepFrame` message instead of an `enterFrame` message at each frame. If the objects have an `on stepFrame` handler available, the Lingo in the `on stepFrame` handler runs each time the playhead enters a new frame or the `updateStage` command updates the Stage.

Some possible uses of `actorList` and `stepFrame` are to animate child objects that are used as sprites or to update a counter that tracks the number of times the playhead enters a frame.

An `on enterFrame` handler could achieve the same results, but the `actorList` property and `on stepFrame` handler are optimized for performance in Director. Objects in `actorList` respond more efficiently to `stepFrame` messages than to `enterFrame` messages or custom messages sent after an `updateStage` command.

To add an object to the actorList:

- Use the statement `add the actorList, theObject`.

The object's `on stepFrame` handler in its parent or ancestor script will then run automatically each time the playhead advances. The object will be passed as the first argument (that is, the `me` argument) to the `on stepFrame` handler.

Director doesn't clear the contents of `actorList` when branching to another movie, which can cause unpredictable behavior in the new movie. If you don't want child objects in the current movie to be carried over into the new movie, insert a statement that clears `actorList` in the `on prepareMovie` handler of the new movie.

To clear child objects from actorList:

- Set `actorList` to `[ ]`, which is an empty list.

For more information, see `actorList` and `on stepFrame` in the *Lingo Dictionary*.

Creating timeout objects

You can create a timeout object—a script object that acts like a timer and sends a message when the timer expires. This is useful for scenarios that require specific things to happen at regular time intervals or after a particular amount of time has elapsed.

Timeout objects can send messages that call handlers inside child objects or in movie scripts. You create a timeout object by using the `new()` function. You must specify a name for the object, a handler to be called, and the frequency with which you want the handler to be called. Once a timeout object is created, Director keeps a list of currently active timeout objects, called `timeOutList`.

To create timeout objects:

- Use the syntax *`variableName`* `= timeOut("`*`theName`*`").new(`*`integerMilliseconds`*`, #`*`handlerName`*`, `*`targetObject`*`)`

This statement uses the following elements:

- *`variableName`* is the variable you are placing the timeout object into.
- `timeOut` indicates which type of Lingo object you are creating.
- *`theName`* is the name you give to the timeout object. This name will appear in the `timeOutList`. It is the `#name` property of the object.
- `new` is the Lingo function that creates a new object.
- *`integerMilliseconds`* indicates the frequency with which the timeout object should call the handler you specify. This is the `#period` property of the object. A value of 2000 will call the specified handler every 2 seconds.
- `#`*`handlerName`* is the name of the handler you want the object to call. This is the `#timeOutHandler` property of the object. You represent it as a symbol by preceding the name with the # sign. For example, a handler called `on accelerate` would be specified as `#accelerate`.
- *`targetObject`* indicates which child object's handler should be called. This is the `#target` property of the object. It allows specificity when many child objects contain the same handlers. If you omit this parameter, Director will look for the specified handler in the movie script.

This statement creates a timeout object named `timer1` that will call the `on accelerate` handler in the child object `car1` every 2 seconds:

```
myTimer = timeOut("timer1").new(2000, #accelerate, car1)
```

To determine when the next timeout message will be sent from a particular timeout object, check its `#time` property. The value returned is the point in time, in milliseconds, when the next timeout message will be sent.

This statement determines the time when the next timeout message will be sent from the timeout object `timer1` and displays it in the Message window:

```
put timeout("timer1").time
```

Using timeOutList

When you begin creating timeout objects, you can use `timeOutList` to check the number of timeout objects that are active at a particular moment.

The following statement sets the variable `x` to the number of objects in `timeOutList`. See `count()` in the *Lingo Dictionary*.

```
x = (the timeOutList).count
```

You can also refer to an individual timeout object by its number in the list.

The following statement deletes the second timeout object in `timeOutList`. See `forget()` in the *Lingo Dictionary*.

```
timeOut(2).forget
```

Relaying system events with timeout objects

When you create timeout objects that target specific child objects, you enable those child objects to receive system events. Timeout objects relay these events to their target child objects. The system events that can be received by child objects include `prepareMovie`, `startMovie`, `stopMovie`, `prepareFrame`, and `exitFrame`. By including handlers for these events in child objects, you can make the child objects respond to them for whatever purposes you see fit. System events received by child objects are also received by movie scripts, frame scripts, and other scripts designed to respond to them.

This parent script contains a handler for the system event `exitFrame` as well as a custom handler:

```
property velocity

on new me
  velocity = random(55)
end

on exitFrame
  velocity = velocity + 5
end

on slowDown mph
  velocity = velocity - mph
end
```

For information on specific timeout properties, see `timeout()` in the *Lingo Dictionary*.

Troubleshooting Lingo

Scripts don't always do what you want the first time. The script often has an error in its syntax: possibly a word is misspelled or a small part of the script is missing. Other times the script might work but doesn't produce the expected result.

Mistakes or bugs almost always occur when writing Lingo, so you should allow enough time for debugging when you develop multimedia titles.

As your skill with Lingo increases, you'll probably encounter different types of problems as you master one area but start learning others. However, the basic troubleshooting techniques described in this section are useful for novice and advanced users alike.

The best way to correct a Lingo bug varies from situation to situation. There aren't one or two standard procedures that resolve the problem. You need to use a variety of tools and techniques, such as the following:

- An overview and understanding of how scripts in the movie interact with each other
- Familiarity and practice with common debugging methods

The following tools help you identify problems in Lingo:

- The Message window, when tracing is on, displays a record of the frames that play and the handlers that run in the movie.
- The Debugger window displays the Lingo that is currently running, the sequence of handlers that Lingo ran to get to its current point, and the value of variables and expressions that you select.
- The Script window lets you enter comments, insert stopping points in the script, and select variables whose value is displayed in the Object inspector.
- The Object inspector lets you view and set the values of objects and properties you select.

Good scripting habits

Good scripting habits can help you avoid many Lingo problems in the first place.

- Try to write Lingo in small sets of statements and test each one as you write it. This isolates potential problems where they are easier to identify.
- Insert comments that explain what the Lingo statements are intended to do and what the values in the script are for. This makes it easier to understand the script if you return to it later or if someone else works on it. For example, the comments in these Lingo statements make the purpose of this `if…then` statement and repeat loop clear:

```
if the soundLevel = 0 then
  -- Loop for 4 seconds (240 ticks)
  startTimer
  repeat while the timer < 240
  end repeat
end if
```

- Make sure that Lingo syntax is correct. Use the Script window's Lingo menu to insert preformatted versions of Lingo elements. Rely on the *Lingo Dictionary* to check that statements are set up correctly.
- Use variable names that indicate the variables' purpose. For example, a variable that contains a number should be called something like `newNumber` instead of `ABC`.

Basic debugging

Debugging involves strategy and analysis, not a standard step-by-step procedure. This section describes the basic debugging approaches that programmers successfully use to debug any code, not just Lingo.

Before you modify a movie significantly, always make a backup copy.

Identifying the problem

It might seem obvious, but the first thing to do when debugging is to identify the problem. Is a button doing the wrong thing? Is the movie going to the wrong frame? Is a field not editable when it should be?

If you copied the Lingo from another movie or from a written example, check whether the Lingo was designed for some specific conditions. Perhaps it requires that a sprite channel is already puppetted. Maybe cast member names must follow a specific style convention.

Locating the problem

Do the following to start locating a problem:

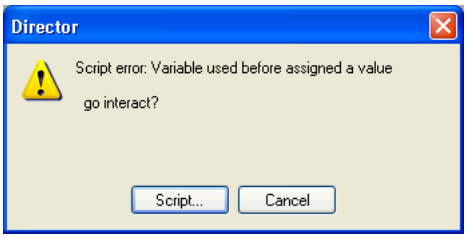
- Think backwards through the chain to identify where the unexpected started to happen.
- Use the Message window to trace which frames the movie goes through and the handlers that Lingo runs.
- Determine what the Lingo should be doing and consider what in these statements relates to the problem. For example, if a text cast member isn't editable when you expect it to be, where in the movie does (or doesn't) Lingo set the cast member's `editable` property?
- If a sprite doesn't change as intended on the Stage, is the `updateStage` command needed somewhere?
- Does the problem occur only on certain computers and not others? Does it happen only when the display is set to millions of colors? Maybe something in the computer is interfering with the application.

You can focus on specific lines of Lingo by inserting a breakpoint—a point where Lingo pauses—in a line. This gives you a chance to analyze conditions at that point before Lingo proceeds. For information on how to insert breakpoints in a script, see "Using the Debugger window" on page 435.

Solving simple problems

When finding a bug, it's a good idea to check for simple problems first.

The first debugging test occurs when you close the Script window. Director gives you an error message if the script contains incorrect syntax when you close the Script window. The message usually includes the line in which the problem was first detected. A question mark appears at the spot in the line where Director first found the problem.



For example, the message "String does not end correctly" tells you that the problem relates to the string in the line `go to Interact`. The only string in this line is Interact, which is the name of a marker. After thinking about syntax for strings, you'll see that the problem is that no beginning quotation mark precedes Interact.

Syntax errors are probably the most common bug in Lingo. When a script fails, it is a good idea to first make sure that:

- Terms are spelled correctly, spaces are in the correct places, and necessary punctuation is used. Lingo can't interpret incorrect syntax.
- Quotation marks surround the names of cast members, labels, and strings within the statement.
- All necessary parameters are present. The specific parameters depend on the individual element. See the *Lingo Dictionary* to determine any additional parameters an element requires.

If the Script window closes without an error message, the script might contain a bug. If Lingo isn't doing what you want, check that:

- Values for parameters are correct. For example, using an incorrect value for the number of beeps that you want the `beep` command to generate gives you the wrong number of beeps.
- Values that change—such as variables and the content of text cast members—have the values you want. You can display their values in the Object inspector by selecting the name of the object and clicking Inspect Object in the Script window, or in the Message window by using the `put` command.
- The Lingo elements do what you think they do. You can check their behavior by referring to the *Lingo Dictionary*.

Using the Message window

The Message window provides a way for you to test Lingo commands and to monitor what is happening in Lingo while a movie plays.

To open the Message window:

- Select Window > Message.

Managing the Message window

The Message window has an Input pane and an Output pane. The Input pane is editable. The Output pane is read-only. You can adjust the sizes of the Input and Output panes by dragging the horizontal divider that separates them.

To resize the Output pane:

- Drag the horizontal divider to a new position.

To hide the Output pane completely:

- Click the Collapse/Expand button in the center of the horizontal divider.

  When the Output pane is hidden, output from Lingo that executes is displayed in the Input pane.

To display the Output pane if it is hidden:

- Click the Collapse/Expand button again.

To clear the contents of the Message window:

- Click the Clear button.

  If the Output pane is visible, its contents are deleted.

  If the Output pane is not visible, the contents of the Input pane are deleted.

To delete a portion of the contents of the Output pane:

1. Select the text to be deleted.
2. Press the Backspace or Delete key.

To copy text in the Input or Output pane:

1. Select the text.
2. Select Edit > Copy.

Testing Lingo

You can test Lingo commands to see how they work by entering them in the Message window and observing the results. When you enter a command in the Message window, Director executes the command immediately, regardless of whether a movie is playing.

To test a one-line Lingo statement:

1. Type the statement directly in the Message window.
2. Press Enter (Windows) or Return (Macintosh). Director executes the statement.

If the statement is valid, the Message window displays the result of the statement in the Output pane at the bottom of the window. If the script is invalid, an alert appears.

For example, if you type the following statement into the Message window:

```
put 50+50
```

and press Enter (Windows) or Return (Macintosh), the result will appear in the Output pane:

```
-- 100
```

If you type the following statement into the Message window:

```
the stagecolor = 255
```

and press Enter (Windows) or Return (Macintosh), the Stage will become black.

You can test multiple lines of Lingo all at once by copying and pasting Lingo statements into the Message window or by pressing Shift-Return after each line of Lingo.

To execute multiple lines of Lingo by copying and pasting:

1. Copy the lines of Lingo to the clipboard.
2. Enter a blank line in the Message window.
3. Paste the Lingo into the input pane of the Message window.
4. Place the insertion point at the end of the last line of Lingo.
5. Press Control+Enter (Windows) or Control+Return (Macintosh). Director finds the first blank line above the insertion point and executes each line of Lingo after the blank line in succession.

To enter multiple lines of Lingo manually:

1. Enter a blank line in the Message window.
2. Enter the first line of Lingo.
3. Press Shift+Return at the end of the line.
4. Repeat steps 2 and 3 until you have entered the last line of Lingo.
5. Press Control+Enter (Windows) or Control+Return (Macintosh). Director finds the first blank line above the insertion point and executes each line of Lingo after the blank line in succession.

You can test a handler without running the movie by writing the handler in a Movie Script or Behavior Script window, and then calling it from the Message window.

To test a handler:

1. Type the handler in a Movie Script or Behavior Script window.
2. Type the handler name in the Message window.
3. Press Enter (Windows) or Return (Macintosh). The handler executes.

   Any output from `put` statements in the handler appears in the Message window.

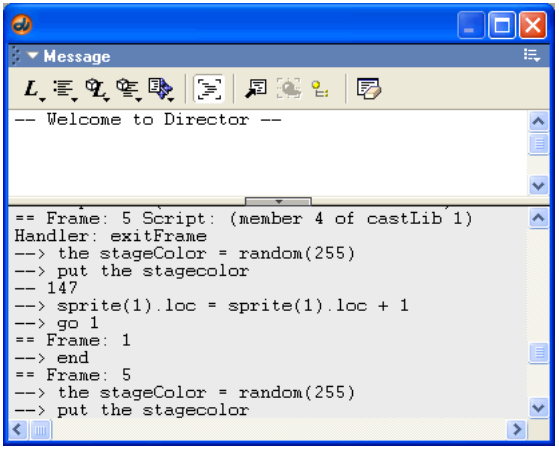
Like the Script window, the Message window contains pop-up menus of Lingo commands. When you select a command from one of the pop-up menus, the command appears in the Message window with the first argument that you must provide selected. Several menus are provided to give you easy access to the whole catalog of Lingo terms.

The Lingo menus include the following:

- Alphabetical Lingo includes all Lingo except 3D Lingo, presented in an alphabetical list.
- Categorized Lingo includes all Lingo except 3D Lingo, presented in a categorized list.
- Alphabetical 3D Lingo includes all 3D Lingo, presented in an alphabetical list.
- Categorized 3D Lingo includes all 3D Lingo, presented in a categorized list.
- Scripting Xtras contains Lingo terms that are provided by any third-party Xtra extensions that you have installed.

Monitoring Lingo

When its Trace button is turned on, the Output pane of the Message window displays a record of the Lingo that movie executes as it plays. This is useful for tracking the flow of Lingo and seeing the result of specific lines of Lingo.



Entries after a double equal sign (==) indicate what has occurred in the movie—such as which frame the movie has just entered, which script is running, or the result of a function or setting a value.

For example, the following line indicates several things:

```
== Frame: 39 Script: 1 Handler: mouseUp
```

- The movie entered frame 39.
- The movie ran script 1, the first script attached to the frame.
- The movie ran the `on mouseUp` handler in script 1 after the movie entered the frame.

Entries after an arrow made up of a double hyphen and right angle bracket (`-->`) indicate lines of Lingo that have run. For example, the lines:

```
--> sound fadeOut 1,5*60
--> if leftSide < 10 then
--> if leftSide < 200 then
--> go to frame "Game Start"
```

indicate that these Lingo statements have run. Suppose you were trying to determine why the playhead didn't go to the frame labeled "Game Start." If the line `--> go to frame "Game Start"` never appeared in the Message window, maybe the condition in the previous statement wasn't what you expected.

The Message window Output pane can fill with large amounts of text when the Trace button is on. To delete the contents of the Output pane, click the Clear button. If the Output pane is not visible, the contents of the Input pane are deleted.

You can keep track of the value of variables and other objects by selecting the name of the object in the Message window and clicking the Inspect Object button. The object is added to the Object inspector, where its value is displayed and updated as the movie plays. For more information about the Object inspector, see "Using the Object inspector" on page 433.

When you are in debugging mode, you can follow how a variable changes by selecting it in the Message window and then clicking the Watch Expression button. Director then adds the variable to the Watcher pane in the Debugger window, where its value is displayed and updated as the movie plays. For more information about the Watcher pane, see "Using the Debugger window" on page 435.

Advanced debugging

If the problem isn't easy to identify, try the following approaches:

- Determine which section has the problem. For example, if clicking a button produces the wrong result, investigate the script assigned to the button.

  If a sprite does the wrong thing, try checking the sprite's properties related to the sprite. Are they set to the values you want when you want?

- Figure out where the Lingo flows. When a section of the movie doesn't do what you want, first try to trace the movie's sequence of events in your head. Look at other scripts in the message hierarchy to make sure Director is running the correct handler.
- Follow the tracing in the Message window; this shows which frames the movie goes through and any handlers that the movie calls as the movie plays.
- Try using the Step Script and Step Into features in the Debugger window and see whether the results differ from what you expect.

- Check variables and expressions. Analyze how their values change as the movie plays. See if they change at the wrong time or don't change at all. If the same variable is used in more than one handler, make sure that each handler that uses the variable states that the variable is global.

  You can track the values of variables and expressions by displaying their values in the Watcher pane or the Object inspector.

- Make changes one at a time. Don't be afraid to change things in a handler to see if the change eliminates the problem or gives some result that helps point to the problem.

  However, don't trade one problem for another. Change things one at a time and change them back if the problem isn't fixed. If you introduce too many changes before solving a problem, you might not determine what the original problem was and you might even introduce new problems.

- Re-create the section. If you haven't found the problem, try re-creating the section from scratch. For example, if rolling the pointer over a sprite doesn't make the sprite behave the way you want, create a simple movie that contains just the sprite and handler with the `rollover` statement.

  Don't just copy and paste scripts; that might just copy the problem. Re-creating the section lets you reconstruct the logic at its most basic level and verify that Director is working as you expect. If the section that you re-create still doesn't work properly, chances are that there is something wrong in the logic for the section.

  If the section that you re-create works properly, compare that section to the original movie to see where the two differ. You can also copy the section into the original piece and see whether this corrects the problem.

Using the Object inspector

With the Object inspector, you can view and set properties of many kinds of objects that are not displayed in the Property inspector. These include Lingo objects such as global variables, lists, child objects from parent scripts, all 3D cast member properties, sprite properties, Lingo expressions, and so on. In addition, the Object inspector displays changes to object properties that occur while a movie plays, such as changes due to Lingo scripts or changes to sprite Score properties. These kinds of changes are not displayed in the Property inspector during movie playback.

The Object inspector can be very useful for understanding the structure of complex objects. For example, 3D cast members have many layers of properties. Because the Object inspector shows you a visual representation of the nested structure of those properties, it makes it much easier to become familiar with them and their relationships to each other. Understanding the property structure of objects in Director is important when writing Lingo scripts.

The ability to watch the values of properties change while a movie plays is helpful for understanding what is happening in the movie. It is especially helpful when testing and debugging Lingo scripts, because you can watch as the values change based on scripts you've written.

The Director Debugger window displays this information also, but is only available when you are in debugging mode. For more information about debugging, see "Advanced debugging" on page 432.

There are 2 ways to view an object in the Object inspector. You can drag items directly into the Object inspector or enter the name of an item into the Object inspector manually.

To drag an item to the Object inspector, do one of the following:

- Select a sprite in the Score window and drag it to the Object inspector.
- Select a cast member in the Cast window and drag it to the Object inspector.
- Select a the name of an object in the Script, Message, or Text window and drag it to the Object inspector.

To enter an object manually in the Object inspector:

1. Double-click in the first empty cell in the Object column of the Object inspector.
2. Type the name of the object into the cell. Use the same name you would use to refer to the object in Lingo.
3. Press Enter (Windows) or Return (Macintosh). If the object has subproperties, a plus sign (+) will appear to the left of it.
4. Click the plus sign. The properties of the object appear below it. Properties with sub-properties appear with a plus sign to their left. Click each plus sign to display the sub-properties.

The following are some of the objects you can enter into the Object inspector:

- Sprites: `sprite(3)`
- Cast members: `member(2)`
- Global variables: `gMyList`
- Child objects: `gMyChild`
- Flash objects: `gMyFlashObject` (For more information about using Flash objects in Director, see "Using Flash objects in Lingo" on page 304.)
- Lingo expressions: `sprite(7).blend`

You can also navigate the contents of the Object inspector with the arrow keys on your keyboard.

To move up or down in the list of items:

- Use the Up and Down arrow keys.

To view an item's sub-properties:

- Select the item and press the Right arrow key.

To hide an item's sub-properties:

- Select the item and press the Left arrow key.

System properties, such as `the milliseconds`, `the mouseLoc`, and `the ticks` are only updated in the Object inspector when the Autopoll option is turned on. Using Autopoll increases the processor workload, which can slow your movie's performance when you add more than a few system properties to the Object inspector.

To turn on Autopoll:

1. Right-click (Windows) or Control-click (Macintosh) in the Object inspector. The Object inspector context menu appears.
2. Select Autopoll from the context menu. When Autopoll is on, a check mark appears next to the Autopoll item in the context menu.

To turn off Autopoll:

- Select Autopoll from the context menu again

You can set the value of an object or property in the Object inspector by entering a new value in the box to the right of the object or property name.

To set an object or property value:

1. Double-click the value to the right of the item name.
2. Enter the new value for the item.
3. Press Enter (Windows) or Return (Macintosh). The new value is set and reflected in your movie immediately.

You can enter a Lingo expression as the value for an item. For example, you might set the value of `sprite(3).locH` to the expression `sprite(8).locH + 20`.

You can also remove items from the Object inspector.

To remove a single item from the Object inspector:

- Select the item and press the Backspace (Windows) or Delete (Macintosh) key.

To clear the entire contents of the Object inspector:

- Right-click (Windows) or Control-click (Macintosh) inside the Object inspector and select Clear All from the context menu.

When you open a separate movie from the one you are working on, the objects you entered in the Object inspector remain. This makes it easy to compare different versions of the same movie. When you exit Director, the items in the Object inspector are lost.

Using the Debugger window

The Debugger window is a special mode of the Script window. It provides several tools for finding the causes of problems in your Lingo scripts. By using the Debugger, you can quickly locate the parts of your Lingo code that are causing problems. The Debugger window allows you to run scripts one line at a time, skip over nested handlers, edit the text of scripts, and view the values of variables and other objects as they change. Learning to use the tools in the Debugger window can help you become a more efficient Lingo programmer.

The Debugger window can help you locate and correct errors in Lingo scripts. It includes several tools that let you do the following:

- See the part of the script that includes the current line of Lingo.
- Track the sequence of handlers that were called before getting to the current handler.
- Run selected parts of the current handler.
- Run selected parts of nested handlers called from the current handler.
- Display the value of any local variable, global variable, or property related to the Lingo that you're investigating.

Entering debugging mode

In order to access the Debugger window, a break must occur in a script. A break occurs when Director encounters a script error or a breakpoint in a script.

When a script error occurs, the Script Error dialog box appears. The dialog box displays information about the type of error that occurred, and asks you whether you want to debug the script, edit the script in the Script window, or cancel.

To enter debugging mode, do one of the following:

- Click Debug in the Script Error dialog box.
- Place a breakpoint in a script.

When Director runs and encounters a breakpoint, the script stops executing and the Script window changes to debugging mode. The movie is still playing, but Lingo is stopped until you use the Debugger to tell Director how to proceed. If you have multiple Script windows open, Director searches for one containing the script where the breakpoint occurred and changes that window to debugging mode.

To add a breakpoint that will open the Debugger window:

1. Double-click on the script that you want to contain the breakpoint.
2. Click in the left margin of the Script window next to the line of Lingo where you want the breakpoint to appear. Lingo will stop executing at the beginning of this line, and the Script window will enter debugging mode.

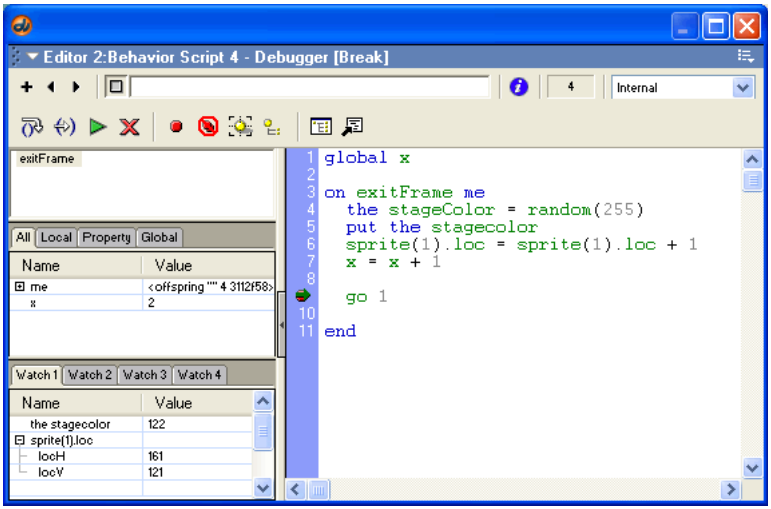
If the Script window is open when Director encounters a script error or a breakpoint, the Debugger window replaces the Script window.

To stop debugging and resume normal script execution, do one of the following:

- Click the Run Script button in the Debugger window.
- Click the Stop Debugging button in the Debugger window.

  The Script window reappears in place of the Debugger window.

When the Debugger window opens, it shows the current line of Lingo and offers several choices for what to run next.



To see which is the current line of Lingo:

- Look for the green arrow next to a line of Lingo in the Script pane.

  The green arrow points to the current line. You can't select a different line of Lingo by clicking it in the Script pane.

Viewing the call stack

The Call Stack pane, located in the upper left of the Debugger window in the preceding illustration, displays the sequence of nested handlers that ran before the current line of code. This sequence is called the call stack. Use the call stack to keep track of the structure of your Lingo while you are debugging. You can view the variables associated with a specific handler by clicking the handler name in the Call Stack pane. The variables are displayed in the Variable pane.

Viewing variables in the Variable pane

The Variable pane displays the variables associated with the current handler. The current handler is the handler displayed in the Script pane and the last handler displayed in the Call Stack pane. You can also display the variables associated with previous handlers in the call stack. As you step through a script, changes to the values of any of the variables are displayed in red. For more information about stepping through scripts, see "Stepping through scripts" on page 439.

To display the variables associated with a handler in the call stack:

- Click the name of the handler in the Call Stack pane. The variables appear in the Variable pane.

The Variable pane includes four tabs for viewing variables:

The All tab displays both global and local variables associated with the current handler.

The Local tab displays only the local variables associated with the selected handler.

The Property tab displays the properties declared by the current script.

The Global tab displays only the global variables associated with the selected handler.

You can sort the variables in the Variable pane:

- To sort the variables by name, click the word "Name" that appears above the variable names.
- To sort the variables in reverse-alphabetical order, click the word "Name" a second time.

You can change the values of local variables of the current handler and global variables in the Variable pane. You cannot change the value of local variables that are not in the current handler.

To change the value of a variable in the Variable pane:

1. Double-click the value of the variable in the Value column.
2. Enter the new value for the variable.
3. Press Enter (Window) or Return (Macintosh).

Viewing objects in the Watcher pane

With the Watcher pane in the Debugger window, you can view variables and other data objects associated with the current handler, as well as objects associated with other handlers. By adding objects to the Watcher pane, you can keep track of their values as they change because of Lingo scripts. When the value of an object changes due to the execution of a line of Lingo, Director changes the color of the object's name in the Watcher pane to red.

The Watcher pane displays only the objects you add to it. You can use up to four separate tabs in the Watcher pane to organize objects into groups.

To add an object to the Watcher pane whose name appears in the Script pane:

1. Select the name of the object in the Script pane.
2. Click the Watch Expression button.

To add an object to the Watcher pane whose name does not appear in the Script pane:

1. Double-click the first empty cell in the object column of the Watcher pane.
2. Type the name of the object in the cell and press Enter (Windows) or Return (Macintosh).

   If the object has properties, a plus sign (+) appears next to the object's name.

To display an object's properties:

- Click the plus sign next to the object name.

The Watcher pane lets you organize objects in a few ways.

To organize objects in the Watcher pane, do one of the following:

- To sort the objects in the Watcher pane, click the Name column head at the top of the left column. The object names in the column are listed in alphabetical order.
- To sort the objects in reverse-alphabetical order, click the Name column head a second time.
- To organize objects into groups, use the tabs in the Watcher pane. To add an object to a specific tab, click the tab you want to use before adding the object.
- To clear the contents of a tab in the Watcher pane, select the tab and then right-click (Windows) or Control-click (Macintosh) in the Watcher pane and select Clear All.

Stepping through scripts

The Debugger window provides you with a set of tools for running scripts slowly, so you can watch the effect that each line of Lingo has on your movie. You can execute one line of Lingo at a time and choose whether to execute nested handlers one line at a time or all at once.

To execute only the current line of Lingo indicated by the green arrow:

- Click the Step Script button.

Many handlers include calling statements to other handlers. You can focus your attention on such nested handlers, or ignore them and focus on Lingo in the current handler.

When you are confident that nested handlers are performing as expected and want to concentrate on Lingo in the current handler, the Debugger window can step over nested handlers and go directly to the next line of Lingo in the current handler. When the Debugger steps over a nested handler, it executes the handler, but does not display the handler's code or pause within the nested handler.

To step over nested handlers:

- Click the Step Script button in the Debugger window.

  The Step Script button runs the current line of Lingo, runs any nested handlers that the line calls, and then stops at the next line in the handler.

If you suspect that nested handlers aren't performing as expected and want to study their behavior, the Debugger window can run nested handlers line-by-line as well.

To run nested handlers one line at a time:

- Click the Step Into Script button in the Debugger window.

  Clicking the Step Into button runs the current line of Lingo and follows the normal Lingo flow through any nested handlers called by that line. When finished with a nested handler, the Debugger window stops at the next line of Lingo within the upper-level handler.

When you are finished debugging, you can exit the Debugger at any time:

- To resume normal execution of Lingo and exit the Debugger window, click the Run Script button.
- To exit the Debugger and stop playback of the movie, click the Stop Debugging button.

Editing scripts in debugging mode

When you are in debugging mode, you may edit your scripts directly in the Debugger window. This way you can fix bugs as soon as you find them and continue debugging.

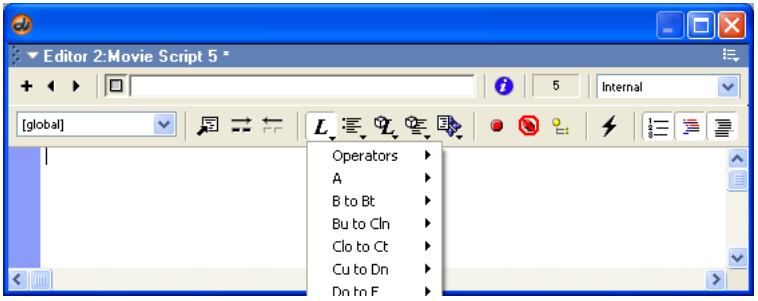
To edit a script in the Debugger window:

1. Click in the Script pane and place the insertion point where you want to begin typing.
2. Enter the changes to the script.

   You can jump to a specific handler by selecting the name of the handler and clicking the Go To Handler button.
3. When you are finished debugging and editing scripts, click the Stop Debugging button. The Script window returns to Script mode.
4. Click the Recompile All Modified Scripts button.

Using the Script window

Several buttons in the Script window help debug scripts.



The script window buttons have the following functions:

To go to the handler selected in the Script window:

- Click Go To Handler.

To make the current line of Lingo a comment:

- Click Comment.

To remove commenting from the current line of Lingo:

- Click Uncomment.

To turn breakpoints in the current line of Lingo on and off:

- Click Toggle Breakpoint.

To turn off all breakpoints.

- Click Ignore Breakpoints.

To add the selected expression or variable to the Object inspector:

- Click Inspect Object.

To recompile the movie's scripts:

- Click Recompile All Modified Scripts.

CHAPTER 17
3D Basics

Macromedia Director MX lets you bring robust, high-performance 3D graphics to the web. Director MX lets you develop a wide spectrum of 3D productions, ranging from simple text handling to interactive product demonstrations to complete immersive game environments. Using Macromedia's free Shockwave Player 8.5, users can view your work on the web with Netscape Navigator, Microsoft Internet Explorer, or other Shockwave-supported browsers.

Director MX lets you detect the capabilities of the user's system and adjust playback demands accordingly. A powerful computer with 3D hardware acceleration brings the best results, but users can successfully use Director MX movies with 3D on most Macintosh or Windows hardware platforms. The faster the computer's graphics processing, the better the results. The ability to adjust for client-side processing power makes Director MX ideal for web delivery.

What you need to know

Director MX is a major step forward for Director. If you're not familiar with Director, you should gain at least a basic knowledge before using 3D in Director MX. The Director MX documentation and help files included with Director MX are the place to start.

You can perform many basic 3D operations using the built-in 3D behaviors in Director.For more information, see "Using 3D behaviors" on page 466. Most complex 3D operations, however, are performed using Lingo, the built-in scripting language of Director. The 3D documentation assumes you understand Lingo. If you have not yet learned Lingo, you'll want to start by reading Chapter 16, "Writing Scripts with Lingo," on page 385. You should also become familiar with the *Lingo Dictionary,* which lists alphabetically all the Lingo commands and properties that are available in Director MX. The *Lingo Dictionary* defines each Lingo expression, illustrates its syntax, and provides examples.

Because 3D is primarily controlled with Lingo, the new 3D commands and properties are described in detail. You'll find them grouped by category in Chapters 18 through 20. The *Lingo Dictionary* presents the same commands and properties in the standard Lingo dictionary format, with syntax and code examples.

From 2D to 3D

Because Director MX is an evolutionary development, most of what you know about Director still holds true. The following are the main components common to Director MX and earlier versions:

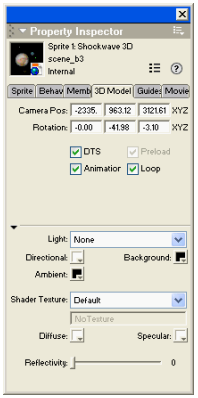
- The Stage is the authoring area in which the Director movie is assembled.
- The Score displays the arrangement of channels that organize, display, and control the movie over time.

  Because 3D is primarily Lingo-controlled, it involves much less direct manipulation of the Score than other Director features.
- The Cast window is where all cast members, including the 3D cast members, are stored.

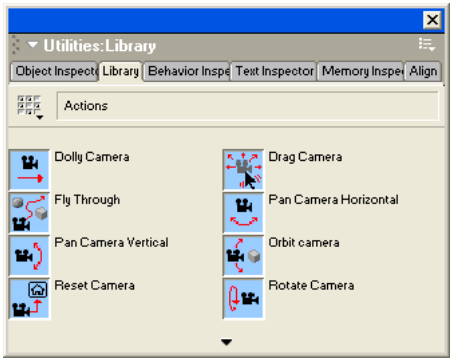
  Cast members are the media in your movies, such as sounds, text, graphics, and 3D scenes.
- Sprites are instances of cast members that appear on the Stage with individual properties and attributes.

  A sprite of a 3D cast member displays a particular camera's view into the 3D world. The 3D cast member contains models, which are individual objects inside the 3D cast member. For more information about models, see "The 3D world" on page 452. Also see "About the 3D cast member" on page 455 and Chapter 19, "Working with Models and Model Resources," on page 473.
- The Property inspector is a tabbed panel that lets you view and control properties of multiple objects in your movie.

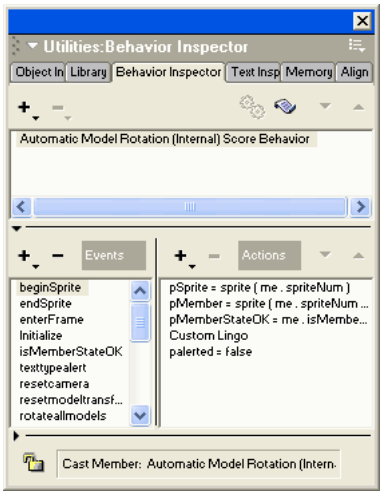
  The Property inspector has been modified to include a 3D Model tab. See "Using the Property inspector for 3D" on page 448.



- The Behavior library lets you select the behaviors you want to use.



- The Behavior inspector lets you create and modify behaviors.



  For an introduction to the Behavior inspector, see “3D behaviors” on page 452. For a full discussion, see “Using 3D behaviors” on page 466. Also see Chapter 3, “Director MX 3D Tutorial,” on page 103.

- Director MX provides easy but powerful 3D text handling.

  For more information, see “Creating 3D text” on page 462.

- Lingo is the Director scripting language. It can be used to create movies that are more complex and interactive.

  For detailed Lingo information, see “About the 3D cast member” on page 455, Chapter 19, “Working with Models and Model Resources,” on page 473, “About lights and cameras” on page 511, and Chapter 20, “Controlling the 3D World,” on page 521.

  3D Lingo commands and properties are covered according to function in each of these chapters. They are also presented in dictionary form, with syntax guidelines, definitions, and examples, in the *Lingo Dictionary*.

The 3D Xtra

The 3D Xtra lets you include 3D models in a Director movie. You can import 3D models or worlds created with a 3D modeling program and use Director to deliver them on the web. You can also combine the abilities of Director and your 3D modeling software by building a 3D world in your modeling program and adding to it or modifying it in Director.

To use 3D images and text created in third-party rendering software, you must convert the file to the W3D (Web 3D) format, which Director supports. Typically, each rendering application requires its own specific file converter to create W3D files. See the documentation for your 3D modeling software for information about creating W3D files.

Using the Shockwave 3D window

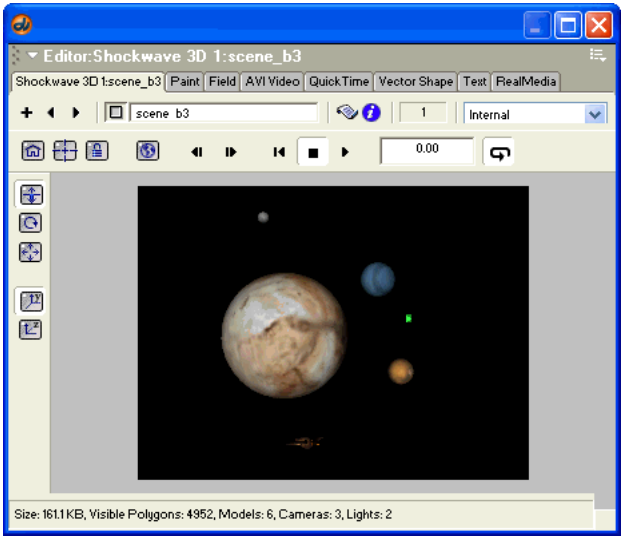
The Shockwave 3D window provides an easy way for you to inspect a 3D cast member. Some properties of 3D cast members can also be edited in this window.

To use the Shockwave 3D window:

1 Select a 3D cast member in the cast.

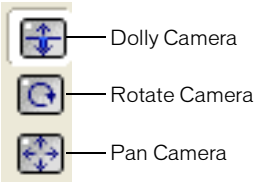
2 Click the Shockwave 3D Window button on the Director MX toolbar.

The Shockwave 3D window appears, displaying the 3D cast member currently selected in the cast.

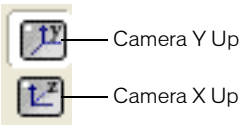


3 Use the following controls:

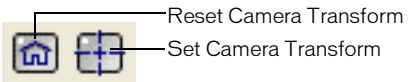
- The camera buttons along the side—Dolly, Rotate, and Pan—let you change your viewing angle by zooming in and out, moving around the models, and moving in a straight line horizontally or vertically, respectively. Hold the Shift key while using these tools to make the camera move faster.



- The two buttons below the camera buttons let you control whether the *y*-axis or the *z*-axis is the up axis when using the Camera Rotate tool.



- The playback buttons let you either play the cast member's animation at normal speed or step through the animation, forward or backward, controlling the movement with mouse clicks.
- The Loop button lets you play animations within the 3D cast member repeatedly.
- The Set Camera Transform and Reset Camera Transform buttons let you set and undo the changes you make to camera angles. Set Camera Transform remembers the current camera position. Reset Camera Transform restores the camera to the previously remembered position.



- The Root Lock button fixes an animation in place, so that it doesn't change its position on the Stage while playing.

- The field at the top of the Shockwave 3D window shows the name of the cast member on display. The square button to the left of the text box lets you drag that cast member to the Stage or the Score.
- The New Cast Member, Previous Cast Member, and Next Cast Member buttons at the upper left of the Shockwave 3D window let you add or display 3D cast members.
- The Reset World button restores the 3D scene to its original state, with all models, cameras, and so on assuming their original positions.

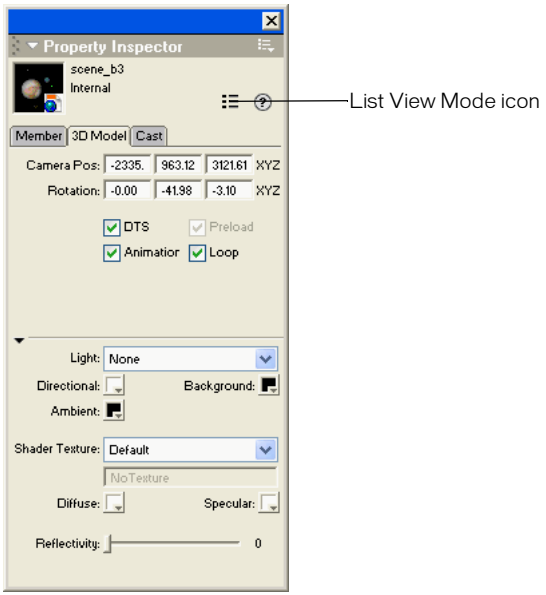
Using the Property inspector for 3D

The Property inspector lets you modify the 3D cast member without using Lingo. The 3D Model tab of the Property inspector offers a simple way to view and control numerous aspects of the 3D world.

To view the 3D Model tab:

1. Open the Cast window if it isn't already open.
2. Click the 3D cast member you want to select.
3. Click the Property inspector button in the toolbar. The Property inspector opens.
4. Click the 3D Model tab in the Property inspector.

The Property inspector should appear in Graphical view. If the Property inspector is in List view, click the List View Mode icon to toggle the view to Graphical.



The Property inspector's 3D Model tab provides several options:

- The fields at the top of the tab show the initial position and orientation of the default camera. The default (0, 0, 0) represents a vantage point looking up the *z*-axis through the middle of the screen. The values you enter in these fields replace the displayed values and move the camera.
- The Direct to Stage (DTS) option controls whether rendering occurs directly on the Stage (the default) or in the Director offscreen buffer. The offscreen graphics buffer is where Director calculates which sprites are partly hidden behind other sprites. When Direct to Stage is on, Director bypasses its offscreen buffer and saves time, increasing playback speed. When Direct to Stage is on, however, you can't use the inker modifier on 3D models or place other sprites on top of the 3D sprite.

- The Preload option controls how media that's being downloaded to the user's computer is displayed. The media can be held back from display until it has been completely streamed into memory, or it can be displayed progressively on the Stage as data becomes available.
- The Play Animation option controls whether any existing animation, either bones or keyframe, is played or ignored.
- The Loop option controls whether the animation loops continuously or plays once and stops.
- The Director Light area lets you select one of ten lighting positions to apply to a single directional light. You can also adjust the color for the ambient light. (Directional light comes from a particular, recognizable direction; ambient light is diffuse light that illuminates the entire scene.) Finally, you can adjust the background color of the scene.
- The Shader Texture area lets you work with shaders and textures. A shader determines the method used to render the surface of a model; a texture is an image that is applied to the shader and drawn on the surface of the model. Using the Property inspector, you can assign a texture to a shader. You can also control its specular (highlight) color, its diffuse (overall) color, and its reflectivity. For more information, see "The 3D world" on page 452 and Chapter 19, "Working with Models and Model Resources," on page 473.

Using rendering methods

The rendering method refers to the specific way Director displays 3D images on the Stage. The methods available depend on the type of hardware you have. The rendering methods include the following:

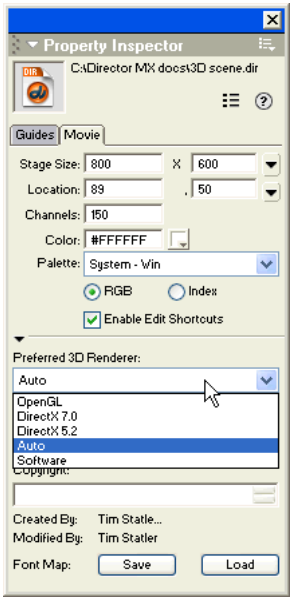
- `#auto`: Director selects the best method based on the client computer's specific hardware and drivers.
- `#openGL`: OpenGL drivers for a 3D hardware accelerator are used. OpenGL is available for the Macintosh and Windows platforms.
- `#directX7_0`: DirectX7_0 drivers for a 3D hardware accelerator are used. This option is available for Windows only.
- `#directX5_2`: DirectX5_2 drivers for a 3D hardware accelerator are used. This option is available for Windows only.
- `#software`: The Director built-in software renderer is used. This option is available on the Macintosh and Windows platforms.

The rendering method can have a dramatic effect on performance. If your hardware permits you to select different methods, you can do so using the following procedure.

To choose a rendering method:

1. Select the Stage.
2. Open the Property inspector.
3. Click the Movie tab.

4 Select a rendering method from the pop-up menu.



If you don't select a rendering method, Director defaults to `#auto`.

Below the pop-up menu, the name of the active 3D renderer property appears. The value of this property indicates which rendering method is currently being used. This is especially useful when you want to know which renderer is active while you have `#auto` selected.

Using 3D Anti-aliasing

Director MX gives you the ability to use anti-aliasing with 3D cast members in your movies. Anti-aliasing improves the appearance of graphics by smoothing the lines between shapes or areas of different color so that the lines do not appear jagged. When you use anti-aliasing with a 3D sprite, the edges of each model in the sprite appear smoother against each other and against the background. Anti-aliasing of 3D sprites is particularly well-suited for merchandise demos and other e-commerce applications because its image quality is high and it can be turned on and off, as needed, in real time.

Effects of anti-aliasing

An anti-aliased 3D sprite uses more processor power and memory than one that is not anti-aliased, resulting in lower frame rates. Because of this, it is recommended that you turn off anti-aliasing for 3D sprites while any part of the sprite is being moved or animated and turn it back on when the animation is complete. Movies that are designed to animate quickly, such as games, might work better with anti-aliasing turned off. During authoring, movies that use anti-aliasing continue to draw heavily on the processor, even after the movie is stopped. You might want to turn off anti-aliasing each time you stop your movie to ensure that the performance of Director is not affected.

Determining whether anti-aliasing is supported

Not all 3D renderers can perform the additional calculations that anti-aliasing requires. If you have a 3D sprite that you want to anti-alias, check first that the 3D renderer supports anti-aliasing. The renderers that currently support anti-aliasing include the Director software renderer, and DirectX 5.2 and DirectX 7.0.

If the 3D sprite is in channel 1 of the Score, you would test the `antiAliasingSupported` property of sprite 1, as shown in the following example:

```
if sprite(1).antiAliasingSupported = TRUE then
```

Turning on anti-aliasing

If the `antiAliasingSupported` property is `TRUE`, you can turn on anti-aliasing for the 3D sprite by setting the sprite's `antiAliasingEnabled` property to `TRUE`.

```
sprite(1).antiAliasingEnabled = TRUE
```

For example, if you have a 3D sprite in channel 5 and you want to turn on anti-aliasing for the sprite when it first appears on the Stage, you would write a `beginSprite` script and attach it to the sprite. Your script should contain Lingo as shown in the following example:

```
on beginSprite
  -- check whether anti-aliasing is supported by the current 3D renderer
  if sprite(5).antiAliasingSupported = TRUE then
    -- if it is, turn on anti-aliasing for the sprite
    sprite(5).antiAliasingEnabled = TRUE
  end if
end beginSprite
```

Turning off anti-aliasing

If you plan to animate any part of a 3D sprite, you might want to turn anti-aliasing off temporarily to improve the animation performance. To do this, set the `antiAliasingEnabled` property for the sprite to `FALSE`. You can then set it back to `TRUE` when the animation is complete.

It is a good idea to turn anti-aliasing on and off on separate handlers. For example, you might want to animate a model, camera, or light while the mouse button is held down and stop the animation when the mouse button is released. In that case you would turn off anti-aliasing in a `mouseDown` handler and turn it back on in a `mouseUp` handler, as shown in the following example:

```
on mouseDown
  -- user interaction/animation is about to start so turn
  -- anti-aliasing OFF
  sprite(1).antiAliasingEnabled = FALSE

  -- start animation
end

on mouseUp
  -- stop animation

  -- the interaction/animation has ended so turn
  -- anti-aliasing ON
  sprite(1).antiAliasingEnabled = TRUE
end
```

3D behaviors

The Director MX Behavior library includes new 3D-specific behaviors. For more information on these behaviors, see Chapter 3, “Director MX 3D Tutorial,” on page 103.

3D behaviors are divided into four types:

- Local behaviors are actions that accept triggers only from the sprite to which they’re attached.
- Public behaviors are actions that accept triggers from any sprite.
- Triggers are behaviors that send signals to a local or public behavior to cause the behavior to execute.

  For example, attaching the Create Box action and Mouse Left trigger behaviors to a sprite will cause a box to be created in the 3D world each time the sprite is clicked with the left mouse button.
- Independent behaviors are behaviors that perform their actions without a trigger.

  The Toon behavior, for example, changes a model’s rendering style to the toon style.

3D text

You can easily create 3D text in Director MX by performing the following steps:

1. Create 2D text.
2. Convert the text to 3D by selecting 3D Mode from the Display pop-up menu on the Text tab of the Property inspector.
3. Set properties of the 3D text using the 3D Text tab to manipulate the specific properties of the 3D text.

You can also manipulate the text cast member with Lingo or a behavior. For more information, see the Chapter 3, “Director MX 3D Tutorial,” on page 103 and “Creating 3D text” on page 462.

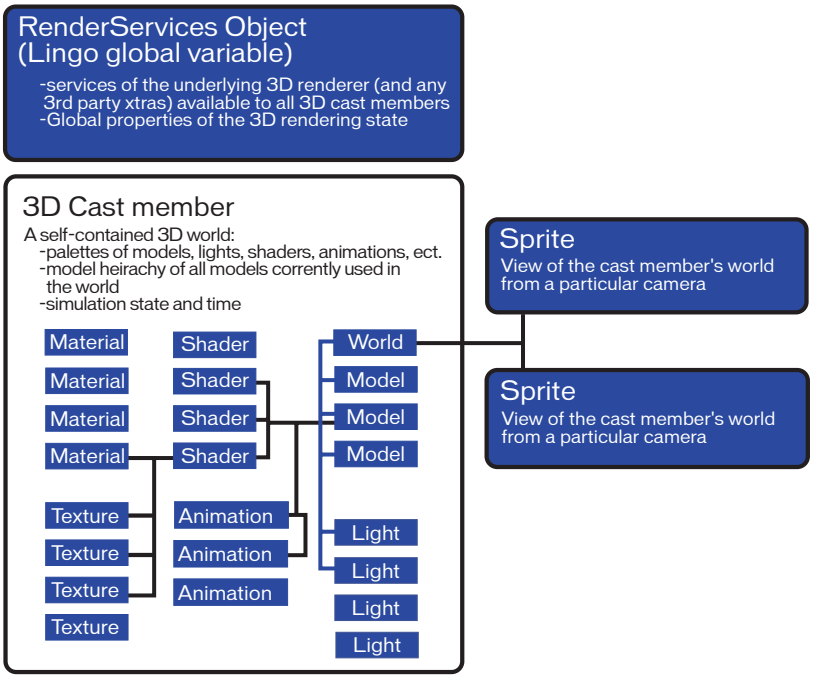
The 3D world

This section provides a brief overview of the contents of 3D cast members. For more detailed information, see “About the 3D cast member” on page 455.

Each 3D cast member contains a complete 3D world. It can contain models (the objects that viewers see within the world) that are illuminated by lights and viewed by cameras. A sprite of a 3D cast member represents a specific camera’s view into the world. Imagine that the 3D cast member is a room filled with furniture with cameras pointing in from several windows. A given sprite using that cast member will display the view from one of those cameras, but the room itself—the 3D cast member—remains the same regardless of which view is used.

The key difference between 3D cast members and other cast members is that the models within the 3D world are not independent entities—they’re not sprites. They are integral parts of the 3D cast member sprite.

The illustration that follows shows the relationships between the components of a 3D cast member:



Your movies can use 2D and 3D cast members simultaneously. For example, a product demonstration movie might consist of a 3D cast member that represents the product and one or more 2D controls that allow users a virtual tryout of the product.

Models and model resources

Models are the objects that users see within the 3D world. Model resources are elements of 3D geometry that can be used to draw 3D models. A model is a visible object that makes use of a model resource and occupies a specific position and orientation with the 3D world. The model also defines the appearance of the model resource, such as what textures and shaders are used. For more information, see Chapter 19, "Working with Models and Model Resources," on page 473.

The relationship between a model and a model resource is similar to that between a sprite and a cast member. Model resource data can be reused because multiple models can use the same model resource in the same way as cast member data can be reused by multiple sprites. Unlike sprites, however, models don't appear in and can't be controlled from the Score.

For example, a 3D cast member might contain two model resources. One could be the geometry for a car body, and the other could be the geometry for a car wheel. In order for a complete car to appear visibly in the 3D scene, the model resource for the car body would be used once, and the model resource for the wheel would be used four times—once for each wheel.

All models are located within a parent-child hierarchy. A model can have any number of children but only one parent. If a model doesn't have another model as a parent, its parent is the group called "world," which is, for all practical purposes, the 3D cast member.

A model's parent and children don't have to be models, however. Models, lights, cameras, and groups all share the same parent-child hierarchy. A light, for example, can be the child of a group and the parent of a model.

The primary benefit of these parent-child relationships is that they make it easier to move complex models around in the 3D world and to have the component parts of those models move together in the proper way. In the example of the car previously described, if the wheels of the car are defined as children of the car model, then moving the car will cause the wheels to be moved with the car in the expected manner. If no parent-child relationship is defined between the car and the wheels, moving only the car will cause the wheels to be left behind in their original position in the world.

Lights and cameras

Lights are used to light the 3D world. Without lights, the objects within the world can't be seen.

Although lights control the appearance of the 3D world, cameras control how a sprite views the 3D world. A 3D sprite displays a particular camera's view into the world. For more information, see "About lights and cameras" on page 511.

Groups

Groups are collections of models, lights, cameras, or other groups. Groups let you rotate or translate their contents simultaneously. A group has a name, a transform, and a parent, and it can have one or more children. It has no other properties. The highest level group is the group called "world," which is essentially synonymous with the 3D cast member. For more information, see "Groups" on page 462.

Shaders and textures

A model's surface color is determined by its shader or shaders. You can draw images on the surface of a model by applying one or more textures to each shader. For more information, see "Shaders" on page 487 and "Textures" on page 494.

Modifiers

Modifiers let you control many aspects of how models are rendered and how they behave. When you attach a modifier to a model, you can then set the properties for that modifier with Lingo. Depending on the type of modifier you use, setting its properties can give you fine control over the model's appearance and behavior. Modifiers are described in "Working with Models and Model Resources" on page 473 and "About lights and cameras" on page 511.

Animation

Director MX supports complex model animations through the following means:

- The collision modifier let models respond appropriately to collisions.
- The Bones player modifier lets models that have a skeletal structure defined in them play back animations of those skeletons. These animations are created in separate 3D modeling tools.
- The Keyframe player modifier lets models play back time-based animation sequences. These sequences can also be created in separate 3D modeling tools.

3D animations are called motions and can be initiated by 3D behaviors or Lingo. For more information, see "Animation modifiers" on page 502 and "Motions" on page 510.

CHAPTER 18
The 3D Cast Member, 3D Text, and 3D Behaviors

This chapter introduces several Macromedia Director MX features that let you create a 3D movie:

- A 3D cast member contains a complex internal structure that includes model resources, models, lights, and cameras. Each of these objects has its own array of properties.
- Director MX lets you convert 2D text to 3D and then work with the 3D text as you would with any other 3D cast member. You can apply behaviors to the 3D text, manipulate it with Lingo, and view and edit it in the Shockwave 3D window.
- Director MX comes with a library of behaviors that let you build and control a 3D environment without any knowledge of Lingo. Although scripting is still required for complex projects, you can build simple 3D movies with behaviors alone.

About the 3D cast member

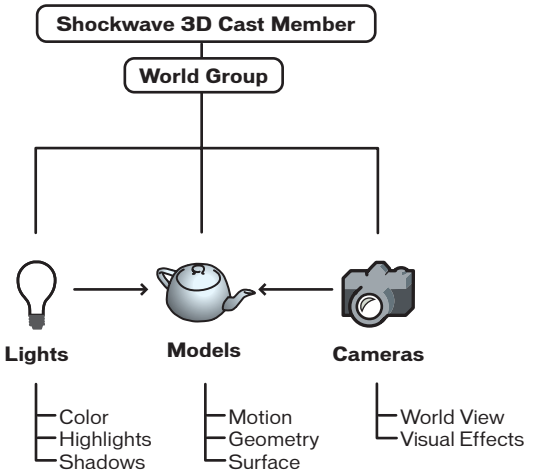
Each Director 3D cast member contains an entire 3D world. Each world is a collection of one or more models and other objects. These objects include the following:

- Model resources are elements of 3D geometry used to render models. The same model resource can be used by several models in the 3D world.
- Models are visible objects in the 3D cast member that use a model resource geometry. For more information on models, see Chapter 19, "Working with Models and Model Resources," on page 473.
- Shaders are methods of displaying the surface of a model. Shaders control how the surface of the model reflects light, and whether the surface looks like metal, plaster, or other materials.
- Textures are simple 2D images that are drawn onto the surface of a 3D model. A model's surface appearance is the result of the combination of its shader and any textures that have been applied to it.
- Motions are predefined animation sequences that involve the movement of models or model components. Individual motions can be set to play by themselves or with other motions. For example, a running motion can be combined with a jumping motion to simulate a person jumping over a puddle.
- Lights are sources of illumination within the 3D world. Lights can be directional, such as a spotlight, or they can be diffuse.

- Cameras are views into the 3D cast member. Each sprite that uses a given cast member can display the view from a different camera. For more information on sprites, see Chapter 17, "3D Basics," on page 443.
- Groups are clusters of models, lights, and/or cameras that are associated with one another. This makes moving the associated items much easier; rather than moving each item separately, you can write Lingo that moves the group with a single command.

Each model, light, camera, and group within a 3D cast member is referred to as a *node*. Nodes can be arranged in parent-child hierarchies. When a parent moves, its children move with it. For example, a car wheel can be a child of a car body. These parent-child relationships are established in your third-party 3D modeling software or with Lingo.

The following figures show the relationships between cameras, lights, and models within the 3D cast member as well as the relation of a model to a model resource and of a model to shaders, textures, and motion.



Although the elements of a 3D scene can be modified and manipulated with 3D behaviors, complex work requires Lingo scripting. For more information on behaviors, see "3D behaviors" on page 452. The following section describes the commands and properties that can manipulate each type of node in a 3D cast member. For another view of this material, with examples of the use of individual commands and properties, see the *Lingo Dictionary*.

Model resources

Model resources are pieces of 3D geometry that can be used to display 3D models. Model resources are visible only when they are used by a model. Model resources are reusable, and multiple models can share the same model resource.

The following commands and properties perform basic model resource operations:

Command	Function	Returns
`modelResource.count`	Returns the number of model resource objects included in the cast member.	Integer.
`modelResource(name)`	Returns the model resource named *name*.	Returns the model resource object named *name*, if it exists. Returns `void` if the object does not exist.
`modelResource[index]`	Returns the model resource at the designated position in the index. The index number can change if model resources are added or deleted.	Returns the model resource object at that index number if it exists. Returns `void` if the object does not exist at that index number.
`newMesh(name, numFaces, numVertices, numNormals numColors, numTexture Coordinates)`	Creates a new mesh model resource. *numFaces* is the user-specified number of triangles. *numVertices* is the user-specified number of vertices. A vertex can be used by more than one face. *numNormals* is the user-specified number of normals. Enter 0 or omit this step to use the `generateNormals()` method. *numColors* is the user-specified number of colors. You can specify a color for each point of a triangle. *numTextureCoordinates* is the number of user-specified texture coordinates. Enter 0 or omit this step to get the default coordinates.	Returns a new mesh model resource with a unique name. If the name isn't unique, returns a Lingo error.
`newModel Resource(name, type)`	Creates a new model resource and adds it to the model resource object list. The *type* can be `#plane`, `#box`, `#sphere`, `#cylinder`, `#extrusion`, or `#particle`.	Returns a new model resource object with a unique name. If the name isn't unique, returns a Lingo error.
`newModel Resource(name, type, facing)`	Creates a new model resource with the specified facing and adds it to the model resource object list. The *type* can be `#plane`, `#box`, `#sphere`, or `#cylinder`. The *facing* can be `#front`, `#back`, or `#both`.	Returns a new model resource object with a unique name. If the name isn't unique, returns a Lingo error.
`deleteModel Resource(name)`	Deletes the model resource named *name*. Lingo references to this model resource persist but can do nothing.	`TRUE (1)` if the model resource named *name* exists. `FALSE (0)` if the model resource named *name* doesn't exist.
`deletemodel Resource(index)`	Deletes the model resource with the given index number. Lingo references to this model resource persist but can do nothing.	`TRUE (1)` if the model resource with this index number exists. `FALSE (0)` if the model resource with this index number doesn't exist.

Models

The models in a cast member are the actual visible objects that are seen in the 3D cast member. Models move according to the motions you assign to them in your 3D modeling software. Their movement results from repositioning and reorienting their geometries in 3D space.

The following commands and properties can be used to perform basic model operations:

Command	Function	Returns
`model.count`	Returns the number of model objects included in the cast member.	Integer.
`model(`*`name`*`)`	Returns the model named *`name`*.	Returns the model object named *`name`* if it exists. Returns `void` if the object does not exist.
`model[`*`index`*`]`	Returns the model at the designated position in the index. The index number can change if models lower in the list are deleted.	Returns the model object at that index number if it exists. Returns `void` if the object does not exist at that index number.
`newModel(`*`name`*`,` *`modelResource`*`)`	Creates a new model named *`name`* and adds it to the world. Fails if a model by that name already exists. The *`modelResource`* argument is optional and can be set at a later time. If supplied, this second argument must be an existing model resource object.	Returns a new model with a unique name. If the name isn't unique, returns a Lingo error.
`deleteModel (`*`name`*`)`	Deletes the model named *`name`*. Lingo references to this model persist but can do nothing. Children of the model aren't deleted but are *re-parented* to the world group.	`TRUE (1)` if the model named *`name`* exists. `FALSE (0)` if the model named *`name`* doesn't exist.
`deleteModel (`*`index`*`)`	Deletes the model with the given index number. Lingo references to this model persist but can do nothing.	`TRUE (1)` if the model with this index number exists. `FALSE (0)` if the model with this index number doesn't exist.

Shaders

A shader defines the basic appearance of a model's surface. You apply textures to shaders. The standard shader is photorealistic. The following list describes some of the other available shaders:

- `#painter`, which looks like a painted surface
- `#engraver`, which looks like an engraved surface
- `#newsprint`, which looks like a newspaper photograph

The following commands and properties can be used to perform basic shader operations:

Command	Function	Returns
`shader.count`	Returns the number of shader objects included in the cast member.	Integer.
`shader(`*`name`*`)`	Returns the shader named *`name`*.	Returns the shader object named *`name`* if it exists. Returns `void` if the object does not exist.
`shader[`*`index`*`]`	Returns the shader at the designated position in the index. The index number can change if shaders are added or deleted.	Returns the shader object at that index number if it exists. Returns `void` if the object does not exist at that index number.

Command	Function	Returns
`newShader (name,type)`	Creates a new shader and adds it to the shader object list. The *type* can be `#standard`, `#painter`, `#engraver`, or `#newsprint`.	Returns a new shader object with a unique name. If the name isn't unique, returns a Lingo error.
`deleteShader (name)`	Deletes the shader named *name*. Lingo references to this shader persist but can do nothing.	`TRUE (1)` if the shader named *name* exists. `FALSE (0)` if the shader named *name* doesn't exist.
`deleteShader (index)`	Deletes the shader with the given index number. Lingo references to this shader persist but can do nothing.	`TRUE (1)` if the shader with this index number exists. `FALSE (0)` if the shader with this index number doesn't exist.

Textures

Textures are 2D images that are drawn on the surface of a 3D model. Textures can be assigned to models in your 3D modeling software, or you can use any bitmap cast member in your movie.

The following commands and properties can be used to perform basic texture operations:

Command	Function	Returns
`texture.count`	Returns the number of textures in the texture object list of the cast member.	Integer.
`texture(name)`	Returns the texture object named *name*.	Returns the texture object named *name* if it exists. Returns `void` if the object does not exist.
`texture[index]`	Returns the texture at the designated position in the index. The index number can change if textures are added or deleted.	Returns the texture object at that index number if it exists. Returns `void` if the object does not exist at that index number.

`newTexture (name, type, source)`	Creates a new texture named *name*.
	The *type* can have the following values:
	`#fromCastmember`
	`#fromImageObject`
	If *type* is `#from Castmember`, *source* is a cast member reference. For example, `member("concrete") or member[2,3]`
	If *type* is `#from ImageObject`, *source* is a Lingo image object.
		Returns a new texture object with a unique name. If the name isn't unique, returns a Lingo error.

`deleteTexture (name)`	Deletes the texture named *name*. Lingo references to this texture persist but can do nothing.	`TRUE (1)` if the texture named *name* exists. `FALSE (0)` if the texture named *name* doesn't exist.
`deleteTexture (index)`	Deletes the texture with the given index number. Lingo references to this texture persist but can do nothing.	`TRUE (1)` if the texture with this index number exists. `FALSE (0)` if the texture with this index number doesn't exist.

Motions

A motion is an animation of a model. Motions can be shared by multiple models. A 3D cast member contains a palette of motions that are available to any model in the world.

The following commands and properties can be used to perform basic motion operations:

Command	Function	Returns
`motion.count`	Returns the number of motion objects included in the cast member.	Integer.
`motion(`*`name`*`)`	Returns the motion named *`name`*.	Returns the motion object named *`name`* if it exists. Returns `void` if the object does not exist.
`motion[`*`index`*`]`	Returns the motion at the designated position in the palette of available motions.	Returns the motion object at that index number if it exists. Returns `void` if the object does not exist at that index number.
`newMotion (`*`name`*`)`	Creates a new motion object.	Returns a new motion object with a unique name. If the name isn't unique, returns a Lingo error.
`deleteMotion (`*`name`*`)`	Deletes the motion named *`name`*. Lingo references to this motion persist but return `void`.	`TRUE (1)` if the motion named *`name`* exists. `FALSE (0)` if the motion named *`name`* doesn't exist.
`deleteMotion (`*`index`*`)`	Deletes the motion at the given index. Lingo references to this motion persist but return `void`.	`TRUE (1)` if the motion with this index number exists. `FALSE (0)` if the motion with this index number doesn't exist.

Lights

Models in the 3D world are illuminated by lights. Each light has a color, direction, intensity, and other characteristics. By default, each 3D cast member contains one white light, which lets Director users see the models in the cast member without having to explicitly add a light. This light has a default position of upper-center in the world. You can modify or replace this light with one or more new lights. To turn off the default light, set its `color` property to `rgb(0,0,0)`.

The following commands and properties can be used to perform basic light operations:

Command	Function	Returns
`light.count`	Returns the number of light objects included in the cast member.	Integer.
`light(`*`name`*`)`	Returns the light named *`name`*.	Returns the light object named *`name`* if it exists. Returns `void` if the object does not exist.
`light[`*`index`*`]`	Returns the light at the designated position in the index. The index number can change if lights are added or deleted.	Returns the light object at that index number if it exists. Returns `void` if the object does not exist at that index number.
`newLight(`*`name`*`,` *`type`*`)`	Creates a new light and adds it to the light object list. The *`type`* can be `#ambient`, `#directional`, `#point`, or `#spot`.	Returns a new light object with a unique name. If the name isn't unique, returns a Lingo error.

Command	Function	Returns
`deleteLight (name)`	Deletes the light named *name*. Lingo references to this light persist but can do nothing.	`TRUE (1)` if the light named *name* exists. `FALSE (0)` if the light named *name* doesn't exist.
`deleteLight (index)`	Deletes the light with the given index number. Lingo references to this light persist but can do nothing.	`TRUE (1)` if the light with this index number exists. `FALSE (0)` if the light with this index number doesn't exist.

Cameras

Cameras provide different views of the 3D world. A 3D cast member can have many cameras. Each sprite that uses the cast member can display a different camera view of the 3D world.

The following commands and properties can be used to perform basic camera operations:

Command	Function	Returns
`camera.count`	Returns the number of camera objects included in the cast member.	Integer.
`camera(name)`	Returns the camera named *name*.	Returns the camera object named *name* if it exists. Returns `void` if the object does not exist.
`camera[index]`	Returns the camera at the designated position in the index. The index number can change if cameras are added or deleted.	Returns the camera object at that index number if it exists. Returns `void` if the object does not exist at that index number.
`newCamera (name)`	Creates a new camera and adds it to the camera object list.	Returns a new camera object with a unique name. If the name isn't unique, returns a Lingo error.
`deleteCamera (name)`	Deletes the camera named *name*. Lingo references to this camera persist but can do nothing.	`TRUE (1)` if the camera named *name* exists. `FALSE (0)` if the camera named *name* doesn't exist.
`deleteCamera (index)`	Deletes the camera with the given index number. Lingo references to this camera persist but can do nothing.	`TRUE (1)` if the camera with this index number exists. `FALSE (0)` if the camera with this index number doesn't exist.

Groups

Groups are collections of models and other objects that are formally associated with one another. These associations can be created in your 3D modeling software or with Lingo. Each 3D cast member has a default group called world, which is the cast member.

Groups simplify the rotation and translation of models by letting all members of a group move together with a single command. A group has a name, a transform, and a parent, and can also have children. It has no other properties.

The following commands and properties can be used to perform basic group operations:

Command	Function	Returns
`group.count`	Returns the number of group objects included in the cast member.	Integer.
`group(`*`name`*`)`	Returns the group named *`name`*.	Returns the group object named *`name`* if it exists. Returns `void` if the object does not exist.
`group[`*`index`*`]`	Returns the group at the designated position in the index. The index number can change if groups are added or deleted.	Returns the group object at that index number if it exists. Returns `void` if the object does not exist at that index number.
`newGroup(`*`name`*`)`	Creates a new group and adds it to the group object list.	Returns a new group object with a unique name. If the name isn't unique, returns a Lingo error.
`deleteGroup (`*`name`*`)`	Deletes the group named *`name`*. Lingo references to this group persist but can do nothing.	`TRUE (1)` if the group named *`name`* exists. `FALSE (0)` if the group named *`name`* doesn't exist.
`deleteGroup [`*`index`*`]`	Deletes the group with the given index number. Lingo references to this group persist but can do nothing.	`TRUE (1)` if the group with this index number exists. `FALSE (0)` if the group with this index number doesn't exist.

Creating 3D text

To create 3D text, you first create 2D text, and then you convert the text to 3D.

To create 3D text:

1. Select Window > Text to open the text editor.
2. Select the desired font, size, style, and alignment.

   Most standard fonts work well with 3D text. You might need to experiment to get specific results.
3. Enter the text. (You can edit the text after you've entered it.)
4. Drag the text cast member onto the Stage.

   You can either drag the cast member from the Cast window or drag the Drag Cast Member button next to the Name text box in the Text window.
5. Click the Property Inspector button in the Director toolbar.
6. Click the Text tab in the Property inspector.

7 Select 3D Mode from the Display pop-up menu.

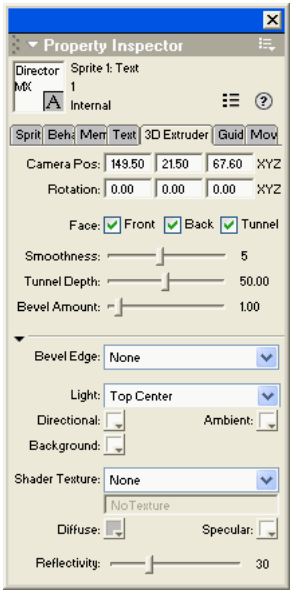
The text on the screen changes to 3D. You can now work with it, as discussed in the next section.

Modifying 3D text

After your 2D text has been changed to 3D, you can modify it.

To modify the 3D text:

1 Click the Property inspector's 3D Extruder tab.



2 Set the camera position and rotation.

As with the standard 3D Property inspector tab, you control camera position and rotation with the values that you enter in the text boxes at the top of the pane. The default camera position represents a vantage point looking up through the middle of the scene.

Note: You might prefer to define these settings using the Shockwave 3D window instead of the Property inspector.

3 Select from among the Front Face, Back Face, and Tunnel check boxes.

These options control which sides of the text appear.

4 Set the smoothness.

This determines the number of polygons that are used to construct the text. The more polygons that are used, the smoother the text appears.

5 Set the tunnel depth.

This is the length of the tunnel from the front face to the back face.

6 Select a beveled edge type.

Beveling makes the edges of the 3D letters appear rounded or angled. Select Round for rounded edges, and Miter for angled edges.

7 Select a bevel amount.

This determines the size of the bevel.

8 Set up the lighting.

You can select a color and position for the text's default directional light. A directional light is a point source of light and comes from a specific, recognizable direction. You can also select a color for the ambient and background lights in the 3D world that the text occupies. Ambient light is diffuse light that illuminates the entire world; background light appears to come from behind the camera.

9 Apply a shader and a texture.

Shaders and shader properties determine the appearance of the surface of the 3D text model. Textures are 2D images drawn on the surface of the text. Using the Property inspector, you can assign a texture to the text's shader. You can also control the color of the shader's specular highlights and its diffuse or overall color and reflectivity.

As with any model, you can apply a texture that uses a bitmap cast member. You can import a bitmap cast member or create a new one in the Paint window. Be sure to give your bitmap cast member a name if doesn't already have one. To assign this bitmap as the texture, specify it in the Property inspector: Select Member from the Shader Texture menu, and enter the name of the member you want to use in the field to the right of the menu.

Lingo for 3D text

Director MX contains Lingo commands and properties for working with 3D text. Most 3D Lingo commands and properties work with 3D text exactly as with any other Lingo object. For the methods and properties that don't work with 3D text, see the following section. For information about new 3D text properties that have been added, see "Lingo for 3D text". The new properties are also described in the *Lingo Dictionary.*

Exceptions

The following commands and properties do not work as expected with 3D text.

Type of Lingo	Element
Member property	`antiAlias`
Member property	`antiAliasThreshold`
Member property	`picture`
Member property	`preRender`
Member property	`scrollTop`
Member property	`useHypertextStyles`
Member property	`autoTab`
Member property	`boxType #scroll`
Member command	`scrollByPage`

Type of Lingo	Element
Member command	scrollByLine
Member function	charPosToLoc
Member function	linePosToLocV
Member function	locToCharPos
Member function	locVToLinePos
Sprite property	editable
Sprite function	pointInHyperLink
Sprite function	pointToChar
Sprite function	pointToItem
Sprite function	pointToLine
Sprite function	pointToParagraph
Sprite function	pointToWord
Hypertext Lingo	hyperlinkClicked
Hypertext Lingo	hyperlink
Hypertext Lingo	hyperlinks
Hypertext Lingo	hyperlinkRange
Hypertext Lingo	hyperlinkState

Lingo for 3D text

In addition to working with most existing commands and properties, 3D text also adds some Lingo properties of its own. These properties give you a more precise way to define the characteristics of the text than is possible using the Property inspector.

These properties can be set while the text is in 2D mode. They have no visible effect until the text appears in 3D mode.

When you access the properties listed in the following table for an extruded 3D text model that you created using the `extrude3D` command, you must refer to the model resource of the text. The Lingo syntax for this is shown in the following example:

```
member(whichMember).model[modelIndex].resource.3DTextProperty
```

For example, to set the `bevelDepth` property of the first model in cast member 1 to a value of 25, use the following syntax:

```
member(1).model[1].resource.bevelDepth = 25
```

Property	Access	Description	Range or Default
bevelDepth	Get and set	Degree of beveling on front or back faces.	Floating-point value from 1.0 to 100.0 Default is 1.0
bevelType	Get and set	Type of bevel.	#none #miter #round Default is #miter

Property	Access	Description	Range or Default
displayFace	Get and set	Faces of shape to display.	#front #tunnel #back Default is to show all three faces
displayMode	Get and set	Specifies how the text appears.	#modeNormal #Mode3D Default is #modeNormal, which is 2D text
member(1).extrude3d(member(2))	Not applicable	Creates a new model resource in member 2 by extruding the text in member 1. Member 1 must be a text cast member.	Specify an existing 3D cast member
smoothness	Get and set	Number of subdivisions for curved outlines.	Integer from 1 to 100 Default is 5
tunnelDepth	Get and set	Extrusion depth.	Floating-point value from 1.0 to 100.0

Using 3D behaviors

Director MX includes a library of behaviors that let you build and control a 3D environment without any knowledge of Lingo. Although scripting is still required for complex projects, you can build simple 3D movies with behaviors alone.

Behavior types

Director MX provides two types of 3D behaviors: trigger and action. Action behaviors are divided into three types: local, public, and independent. These behavior types and subtypes are detailed in the following table.

Type	Function
Trigger	A behavior that sends an event, such as a mouse click, to an action behavior
Local action	A behavior that is attached to a particular sprite and that can accept triggers only from that sprite
Public action	A behavior that can be triggered by any sprite
Independent action	A behavior that needs no trigger

If you're familiar with behaviors from earlier versions of Director, you'll recognize that the trigger/action distinction is new. In previous versions, the trigger instruction had to be included as a handler, such as `on mouseDown`, inside the behavior. The trigger behavior type makes it easier to reuse action behaviors in different ways with different triggers. These behaviors can be used with any 3D cast member.

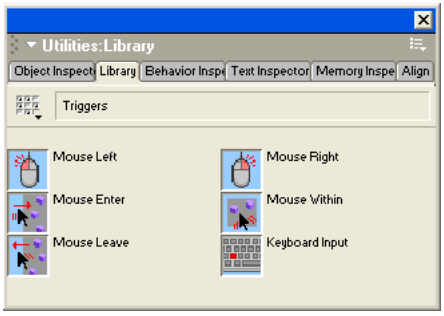
Using the 3D Behavior Library

All 3D behaviors are listed in the Behavior Library. The Behavior Library is divided into two sublibraries: actions and triggers.

To view 3D trigger behaviors:

1. Click the Library Palette button on the Director toolbar.
2. Click the Library List button and select 3D.
3. Select Triggers from the 3D submenu.

The trigger behaviors appear, as shown in the following figure.



The following table describes the available triggers.

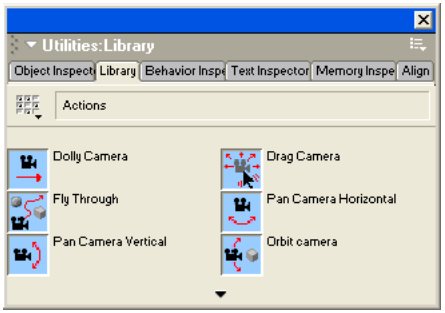
Name	Description
Mouse Left	Triggers action when the user presses, holds down, or releases the left mouse button (Windows) or the mouse button (Macintosh).
Mouse Right (Windows only)	Triggers action when user presses, holds down, or releases the right mouse button. This trigger does not work with Shockwave or on the Macintosh. The same results can be achieved by using the left mouse button (Windows) or the mouse button (Macintosh) with modifier keys.
Mouse Within	Triggers an action when the pointer is inside a sprite.
Mouse Enter	Triggers an action when the pointer enters a sprite.
Mouse Leave	Triggers an action when the pointer leaves a sprite.
Keyboard Input	Lets the author specify a given key as a trigger.

You can add modifier keys to any trigger, so that a given trigger can launch two actions, depending on whether the modifier key is pressed. You can, for example, use Mouse Left and Mouse Left-Shift as separate triggers.

To view 3D action behaviors:

1. Click the Library Palette button on the Director toolbar.
2. Click the Library List button and select 3D.
3. Select Actions from the 3D submenu.

The action behaviors appear, as shown in the following figure.



Local actions

When you attach a local action to a sprite, that action responds only to a trigger that is attached to that same sprite. The following table describes the available local actions.

Name	Effect	Description
Create Box	Primitive	Adds a box to the 3D world each time the trigger action occurs. The author can set the dimensions and texture.
Create Particle System	Primitive	Creates a particle system whenever the trigger is activated. The user can set the number of particles; the life span of each particle; the starting and finishing color of particles; and the angle, speed, and distribution of particles on emission. The user can also set gravity and wind effects along any axis.
Create Sphere	Primitive	Adds a sphere to the 3D world each time the trigger action occurs. The author can set the diameter and texture.
Drag Camera	Camera	Provides full camera control, including panning (changing the direction in which the camera is pointing), dollying (moving), and rotating, through a single behavior. Use separate mouse triggers for panning, zooming, and rotating.
Drag Model	Model	Lets users move a model in any direction by dragging it with the mouse.
Drag Model to Rotate	Model	Lets you specify an axis or pair of axes around which you can rotate a model by dragging it with the mouse.
Fly Through	Camera	Simulates flying through the 3D world with a camera. Accepts separate triggers for forward and reverse travel and for stopping.
Click Model Go to Marker	Model	Moves the playhead to a marker in the Score when a model is clicked.
Orbit Camera	Camera	Circles the camera around a model.
Play Animation	Model	Plays a preexisting animation when the model is clicked. This behavior cannot be used with 3D text.

Public actions

As with local actions, you can add public actions to a movie by attaching them to any 3D sprite. Unlike local actions, public actions are triggered whether the trigger is attached to the same sprite as the action or to any other sprite. Public actions use the same triggers as local actions. The following table describes available public actions.

Name	Effect	Description
Dolly Camera	Camera	Dollies the camera into or out of the 3D scene by a specified amount each time the trigger action occurs. Dollying in and dollying out require separate triggers.
Generic Do	Custom	Lets you use the standard triggers to launch custom handlers or execute specific Lingo commands. Requires knowledge of Lingo.
Pan Camera Horizontal	Camera	Pans along the horizontal axis by a specified number of degrees each time the trigger action occurs. Panning left and panning right require separate triggers.
Pan Camera Vertical	Camera	Pans along the vertical axis (up and down) by a specified number of degrees each time the trigger action occurs. Panning up and panning down require separate triggers.
Reset Camera	Camera	Resets the camera to its initial location and orientation when the trigger action occurs.
Rotate Camera	Camera	Rotates the camera around the *z*-axis by a specified number of degrees each time its trigger is activated. This makes the 3D scene appear to rotate and turn upside down.
Toggle Redraw	Drawing	Toggles the redraw mode on or off. Turning redraw off produces visible trails as a model moves through space. Turning redraw on causes the trails to disappear.

Independent actions

Independent actions don't require triggers. The following table describes the available independent actions.

Name	Effect	Description
Automatic Model Rotation	Motion	Automatically rotates a model around a given axis and continues rotating it while the movie plays. To rotate the model around multiple axes, attach multiple instances of the behavior to the sprite and select the desired axis for each one.
Level of Detail	Model	Enables the level of detail (LOD) modifier for the model. Dynamically lowers the number of polygons used to render the model as its distance from the camera increases. Reduces demands on the CPU.
Model Rollover Cursor	Model	Changes the mouse pointer to the pointer of your choice when the mouse rolls over the given model.
Show Axis	Debugging	Establishes red, green, and blue lines along the *x*-, *y*-, and *z*-axes, respectively, letting you see them in the 3D scene.
Subdivision Surfaces	Model	Enables the subdivision surfaces (SDS) modifier for the given model, which synthesizes additional detail to smooth out curves as the model's distance from the camera decreases.
Toon	Model	Enables the toon modifier, which renders the model in a cartoon style, with a reduced number of colors and distinct boundaries. The user can set the toon style precisely, selecting the number of colors, line color, brightness and darkness of highlights and shadows, and anti-aliasing.

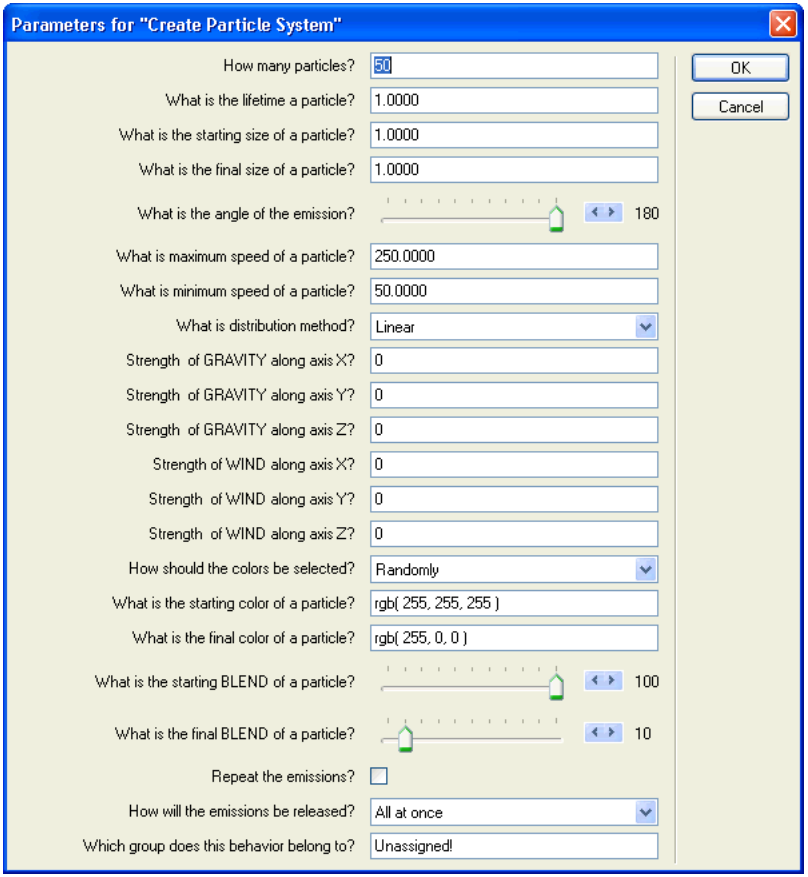
Applying 3D behaviors

You apply 3D behaviors in the same way as standard behaviors in Director MX. You can attach as many behaviors to a sprite as needed, but each behavior that requires a trigger must have a unique trigger to activate it.

To apply a 3D behavior:

1. Open the Library palette.
2. Open the 3D library.
3. Attach an action behavior to the sprite either on the Stage or in the Score.

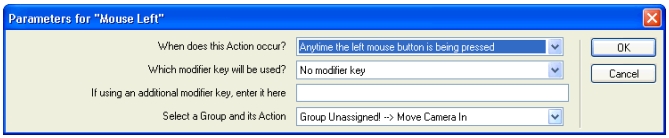
   The Parameters dialog box appears. You can use this dialog box to control the behavior. Depending on the behavior you select, the dialog box might have many options or only a few.



4. Specify options in the Parameters dialog box.
5. Click OK.

6 For local behaviors, attach a trigger behavior to the same sprite. For public behaviors, attach a trigger behavior to a specific sprite.

The Parameters dialog box appears. You can use this dialog box to control when the trigger should work; what modifier keys, if any, are associated with the trigger; and to which sprite group the trigger is assigned. (For more information about groups, see “About groups” on page 471.)



7 Specify options in the Parameters dialog box.

8 Click OK.

About groups

The Parameters dialog boxes of the local and public action behaviors give you the option to assign the behavior to a group. Groups let a single trigger initiate actions across multiple sprites. To establish a group, select a name for the group and enter that name in the Parameters dialog box of each behavior that you attach to the sprites in the group.

Because the triggers are sent to the group name rather than to a specific sprite number, there are no reference changes to update when a sprite moves from one Score channel to another.

CHAPTER 19
Working with Models and Model Resources

This chapter covers the Lingo commands and properties used to work with models and model resources, as well as lights and cameras to enhance Macromedia Director MX three-dimensional (3D) movies. You can also find the commands and properties given here in tabular form in alphabetical form, with accompanying syntax, definitions, and examples, in the *Lingo Dictionary* (Help > Lingo Dictionary).Because much of a model's behavior depends on modifiers (which are attached to the model), this chapter also discusses modifiers. A model's surface appearance, controlled by shaders and textures, is also discussed here.

Lights illuminate the 3D world and the models in it. Without lights, the world exists, and actions can take place, but users see nothing. You can add lights to your 3D world in your 3D modeling application or with the Macromedia Director MX Property inspector.

Cameras act as windows into a 3D world. Each camera that exists in a 3D cast member offers a different view into it, and each sprite that uses a 3D cast member uses one of these cameras. A camera's position can be moved with the Property inspector or the Shockwave 3D window. You can also use the Director 3D behaviors or Lingo to manipulate camera positions.

About models and model resources

Models are the objects you see in the 3D world. You can create models within Macromedia Director MX. Spheres, boxes, planes, cylinders, and particle systems can be created either with Lingo or with Director MX behaviors. These simple shapes are called *primitives*. They are the basic shapes from which more complicated models are built. (Particle systems are different from the other primitives: instead of being shapes, they create cascades of moving particles.)

For the most part, however, you should create complex models outside of Director, using a 3D modeling application, and then imported into Director in the W3D format.

Accessing properties and commands of a model or any other node type requires that the node be on the Stage or explicitly loaded with the `preLoad()` or `loadFile()` command.

The following sections describe models, model resources, and primitives in more detail, along with the Lingo used to work with them.

Model resources

Model resources are 3D geometries defined in 3D modeling software or created in Director 8.5 Shockwave Studio with Lingo. A model is an object that makes use of a model resource's geometry and occupies a particular position and orientation within the 3D world. Model resources are viewable only when in use by a model. Several models may use the same model resource.

Common model resource properties

The following properties are shared by all model resources:

Property Name	Access	Description	Range or Default
`name`	Get	Unique string naming model resource.	If imported, the name of the model. If created in Lingo, the assigned name in the constructor function.

`type`	Get	Type of geometry.	`#plane`
			`#box`
			`#sphere`
			`#mesh`
			`#cylinder`
			`#particle`
			`#fromfile`

`bone.count`	Get	Total number of bones in bones hierarchy.	Nonnegative integer.
`modelResource.getBoneId("name")`	Get	Returns a unique ID for the bone named *`name`* in this model's bone hierarchy. Returns `FALSE (0)` if no bone by that name can be found.	None.

File-defined model resource properties

Model resources defined by a W3D file imported into Director MX or loaded via Lingo have a `type` value of `#fromfile`. File-defined resources are automatically assigned level of detail (LOD) modifier settings that allow models using those geometries to adjust their level of detail as needed, depending on the model's distance from the camera. See "Level of detail (LOD) modifier properties" on page 498 for more information.

Primitives

Each type of primitive has its own set of Lingo commands and properties used to define its appearance.

Use the `newModelResource()` command to create new primitives at runtime.

Sphere properties

Spheres created at runtime aren't saved with the cast member's media when the Director movie is saved. Their `type` is `#sphere`. Their surface is generated by sweeping a two-dimensional semicircle arc in the *xy* plane from `startAngle` to `endAngle` in the *y*-axis. If `startAngle = 0.0` and `endAngle= 360.0`, a full sphere is generated. If `startAngle = 180.0` and `endAngle = 360.0`, a half sphere is generated. These properties can be modified or animated at runtime.

Property	Access	Description	Value Range
`radius`	Get and set	Radius of the sphere.	Positive floating-point value. The default is 25.0.
`resolution`	Get and set	Controls the number of polygons used in the creation of the sphere surface. The higher the value, the smoother the surface.	An integer value of 1 or greater. The default is 20.
`startAngle`	Get and set	Starting angle of the sweep.	Floating-point value of from 0.0 to 360.0. The default is 0.0.
`endAngle`	Get and set	Ending angle of the sweep.	Floating-point value of from 0.0 to 360.0. The default is 360.0.

Cylinder properties

Cylinders have a `type` property of `#cylinder`. Director generates a cylinder's surface by sweeping a 2D line around the *z*-axis in the *xy* plane from `startAngle` to `endAngle`. If `startAngle = 0.0` and `endAngle = 360.0`, a full cylinder is generated. If `startAngle = 180.0` and `endAngle = 360.0`, a half cylinder is generated. These properties can be modified or animated at runtime.

Property	Access	Description	Value Range
`topRadius`	Get and set	Radius of the top of the cylinder. Setting this value to 0 produces a cone.	Positive floating-point value. The default is 25.0.
`bottomRadius`	Get and set	Radius of the bottom of the cylinder.	Positive floating-point value. The default is 25.0.
`numSegments`	Get and set	Number of polygonal segments from bottom to top.	An integer value greater than 0.
`resolution`	Get and set	Number of polygonal segments around the circumference of the circle. Controls the smoothness of the cylinder's appearance.	An integer value greater than 1.
`height`	Get and set	Height of the cylinder along the *z*-axis.	Positive floating-point value. The default is 50.0.
`topCap`	Get and set	Value indicating whether the top of the cylinder is closed or open. `TRUE` = closed.	`TRUE` or `FALSE`. The default is `TRUE`.
`bottomCap`	Get and set	Value indicating whether the bottom of the cylinder is closed or open. `TRUE` = closed.	`TRUE` or `FALSE`. The default is `TRUE`.

Box properties

Boxes have a `type` property of `#box`. Box properties can be modified or animated at runtime.

Property	Access	Description	Value Range
`height`	Get and set	Height of the box, measured along the *y*-axis.	Positive floating-point value. The default is `50.0`.
`width`	Get and set	Width of the box, measured along the *x*-axis.	Positive floating-point value. The default is `50.0`.
`length`	Get and set	Length of the box, measured along the *z*-axis.	Positive floating-point value. The default is `50.0`.
`top`	Get and set	Value indicating whether the top of the box is closed or open. `TRUE (1)` = closed.	`TRUE (1)` or `FALSE (0)`. The default is `TRUE (1)`.
`bottom`	Get and set	Value indicating whether the bottom of the box is closed or open. `TRUE (1)` = closed.	`TRUE (1)` or `FALSE (0)`. The default is `TRUE (1)`.
`front`	Get and set	Value indicating whether the front of the box is closed or open. `TRUE (1)` = closed.	`TRUE (1)` or `FALSE (0)`. The default is `TRUE (1)`.
`back`	Get and set	Value indicating whether the back of the cylinder is closed or open. `TRUE (1)` = closed.	`TRUE (1)` or `FALSE (0)`. The default is `TRUE (1)`.
`left`	Get and set	Value indicating whether the left end of the box is closed or open. `TRUE (1)` = closed.	`TRUE (1)` or `FALSE (0)`. The default is `TRUE (1)`.
`right`	Get and set	Value indicating whether the right end of the box is closed or open. `TRUE (1)` = closed.	`TRUE (1)` or `FALSE (0)`. The default is `TRUE (1)`.
`lengthVertices`	Get and set	Number of vertices along the length of the box. Increasing the number of vertices improves lighting effects.	2 or more. The default is 4.
`width Vertices`	Get and set	Number of vertices along the width of the box. Increasing the number of vertices improves lighting effects.	2 or more. The default is 4.
`height Vertices`	Get and set	Number of vertices along the height of the box. Increasing the number of vertices improves lighting effects.	2 or more. The default is 4.

Plane properties

Planes are the default Director MX primitive. Planes, whose `type` property is `#plane`, are generated in the *xz* plane with Lingo. Plane properties can be modified or animated at runtime.

Property	Access	Description	Value Range
`width`	Get and set	Width of the plane	Positive floating-point value. The default is 1.0.
`length`	Get and set	Length of the plane	Positive floating-point value. The default is 1.0.
`lengthVertices`	Get and set	Number of vertices along the length of the plane	2 or more. The default is 2.
`widthVertices`	Get and set	Number of vertices along the width of the plane	2 or more. The default is 2.

Mesh generator properties

The mesh generator is the most complex model resource. It allows experienced 3D programmers to create complicated geometries at runtime.

The mesh generator primitive's `type` property is `#mesh` and is created by the member's `newMesh()` command. The parameters included with that command describe how large the mesh will be.

You can use the mesh deform modifier to manipulate vertex positions at runtime for `#mesh` or any other type of model resource. You can also use the `#mesh` primitive to change mesh properties directly, but this is usually not practical, because the mesh must be rebuilt mathematically after each modification.

Use these properties to work with mesh primitives:

Property	Access	Description	Value Range
`vertexList`	Get and set	Lingo vector values for each vertex in the mesh. Several faces may share a single vertex.	Set the value to the number of vectors specified in your `newMesh` call.
`normalList`	Get and set	Lingo vector values for each normal in the mesh. Several faces may share a single normal. A normalized vector is one in which all components are of unit length. You can use the `generateNormals()` command instead of specifying normals yourself. In that case, set 0 as the number of normals in your `newMesh()` call. The normals are calculated based on a clockwise vertex winding. That is to say, if you imagine the vertices being wound down a spindle, they would be wound from left to right, in a clockwise manner.	No default. Instead, set the value to the number of vectors specified in your `newMesh` call.

`textureCoordinateList`
 	
`texcoordlist`
	Get and set	A list of sublists identifying locations in an image used for texture-mapping a triangle. Each sublist contains two values between 0.0 and 1.0 that define a location and can be arbitrarily scaled to any texture size.	No default. Instead, set the value to the number of two-element sublists specified in your `newMesh` call.

Property	Access	Description	Value Range
`colorList`	Get and set	List identifying every color in the mesh. Any color can be shared by several faces. Alternatively, specify texture coordinates for the mesh faces and apply a shader to models using this model resource.	No default. Instead, set the value to the number of colors specified in your `newMesh` call.
`face.count`	Get	Number of triangles in the mesh.	The number of faces specified in your `newMesh` call.
`face[index].vertices`	Get and set	List indicating which vertices to use for faces at designated index points.	Set the value to a list of three integers specifying the indexes of the vertices in the `vertexList` that define this face.
`face[index].normals`	Get and set	List indicating which normals to use for faces at designated index points.	Set the value to a list of three integers specifying the indexes of the normals in the `normalList` that each point of the triangle should use. Don't set a value if you aren't defining your own normals.

`face[index].textureCoordinates`
 	
`face[index].texcoords`
	Get and set	List indicating which texture coordinates to use for faces at designated index points.	Set the value to a list of three integers specifying the indexes of the texture coordinates in the `textureCoordinates` List that each point of the triangle should use. Don't set a value if you aren't defining your own texture coordinates.

`face[index].colors`	Get and set	List indicating which colors to use for faces at designated index points.	Set the value to a list of three integers specifying the indexes of the colors in the colorList that each point of the triangle should use. Don't set a value if you aren't defining your own colors.
`face[index].shader`	Get and set	Shader used for rendering the face.	Shader defined for use with this face.

Mesh generator commands

Use these commands to work with mesh primitives:

Command	Description	Returns
`build()`	Builds the mesh according to the current property values. (The mesh construction properties specified in the previous table have no effect until `build()` is called.) Generates a Lingo error if any properties specify an invalid list.	Nothing
`generateNormals (style)`	Generates a new normal for every vertex in every triangle. The *`style`* parameter can be `#flat`, so that each triangle is clearly delineated, or `#smooth`. The command assumes that all triangles were specified in a clockwise order.	Nothing

Particle system properties

Particle systems are unique among model resources in that they include animation by default. Particle systems, whose `type` is `#particle`, can have an almost infinite variety of appearances, simulating fire, smoke, running water, and other streaming or bursting effects.

Use these properties to work with particle systems:

Property	Access	Description	Value Range
`lifetime`	Get and set	Lifetime of all particles emitted, in milliseconds.	Positive integer. The default is `10.000` ms.
`colorRange.end`	Get and set	Color value of a particle at the end of its life.	Any color value. The default is `rgb(255, 255, 255)`.
`colorRange.start`	Get and set	Color value of a particle at the start of its life.	Any color value. The default is `rgb(255, 255, 255)`.
`tweenMode`	Get and set	The variation of a particle's color throughout its life. The change can be based on either velocity or age.	`#velocity`: Alter particle color between `colorRange.start` and `colorRange.end` based on velocity. `#age`: Alter particle color between `colorRange.start` and `colorRange.end` based on the particle's lifetime.
`sizeRange.start`	Get and set	The size of a particle at the start of its life.	Positive integer. The default is `1`.
`sizeRange.end`	Get and set	Size of a particle at the end of its life. The size is linearly interpolated between *`startSize`* and *`endSize`*.	Positive integer. The default is `1`.
`blendRange.start`	Get and set	Opacity of a particle at the start of its life.	Any value between `0.0` and `100.0`.
`blendRange.end`	Get and set	Opacity of a particle at the end of its life.	Any value between `0.0` and `100.0`.

Property	Access	Description	Value Range
texture	Get and set	Texture to use when drawing each particle. The default is void.	Texture object.
emitter.numParticles	Get and set	Number of particles in a burst or stream.	Positive integer. The default is 1000.
emitter.mode	Get and set	Mode in which particles are emitted.	#burst: All particles emitted at once. #stream: X particles emitted per frame with X equalling emitter.numParticles/(*lifetime**milliseconds PerFrame). Note: milliseconds PerFrame is the time elapsed between rendered frames.
emitter.loop	Get and set	TRUE (1) or FALSE (0) value indicating whether particles die (FALSE) or are recycled (TRUE).	0 or 1.
emitter.direction	Get and set	Vector of original emission. At 1,0,0, the default, particles are emitted randomly over a sphere.	Any vector.
emitter.region	Get and set	Point, line, or region from which particles are emitted.	Possible values: single vector for point source two vectors for line segment four vectors for quadrilateral
emitter.distribution	Get and set	Half the angle over which particles are distributed, measured from the top of the screen.	0 to 180.
emitter.path	Get and set	Vector positions that define the path the particles follow.	Vector list.
emitter.pathStrength	Get and set	Degree to which particles remain on a path.	Percentage between 0.0 and 100.0.
emitter.minSpeed	Get and set	Minimum emission speed. (Particles are emitted at random speeds between a minimum and a maximum.)	Settable value. The default is 1.0.
emitter.maxSpeed	Get and set	Maximum emission speed. (Particles are emitted at random speeds between a minimum and a maximum.)	Settable value. The default is 1.0.
emitter.drag	Get and set	A drag value affecting simulation at each animation step.	Percentage between 0.0 and 100.0.

Property	Access	Description	Value Range
emitter.gravity	Get and set	Vector representing simulated gravity. The vector's length indicates its strength.	Any vector.
emitter.wind	Get and set	A vector representing simulated wind pushing particles in a given direction. The vector's length indicates its strength.	Any vector.

The extruder model resource

You can create extruder model resources only by using an existing text cast member. In many cases, you may choose to use the 3D text capabilities of the Property inspector instead.

Creating an extruder model resource is simple. If member 1 is a text cast member and member 2 is a 3D cast member, use the following Lingo:

```
member(1).extrude3d(member(2))
```

This generates a model resource in member 2 that is an extrusion of the 2D text in member 1.

Cast member commands

If the models and model resources you need aren't contained in a particular cast member, the following commands allow you to create models and model resources using other 3D cast members at runtime.

Command	Description	Returns
loadFile (fileName, Overwrite, GenerateUniqueNames)	This command loads a W3D format file from *fileName*, adds all models as children of the world, and updates all palettes. You can call this function only if the cast member's state property is either -1, meaning that an error occurred during a previous attempt to load the file, or 4, meaning that media loading is complete. If an attempt is made to call loadFile while the cast member is streaming media in, a Lingo error is generated. *Overwrite* is an optional variable that can be TRUE (1) or FALSE (0): TRUE (1) means the old world is replaced by the contents of the file. FALSE (0) means the new file is merged into the existing world. *GenerateUniqueNames* is a variable that has no meaning unless *Overwrite* is FALSE (0). If *Overwrite* is FALSE (0), then if *GenerateUniqueNames* is TRUE (1), all new elements sharing the same name as existing elements are assigned a new, algorithmically determined unique name. If *GenerateUniqueNames* is FALSE (0), all existing elements sharing the same name as new elements being read into the file are replaced by the new elements.	Nothing if the operation is successful, or a Lingo error if the operation fails
cloneModelFromCastmember (name, model, castmember)	Performs a deep clone of a model from one cast member and puts it into another cast member. The model, its resources, its children, and its children's resources all are put into the new cast member.	A model object

Command	Description	Returns
`cloneMotion FromCastMember (name, motion, castmember)`	Performs a deep clone of a motion from one cast member and puts it into another cast member.	A motion object
`newModel Resource(name, type)`	Creates a new model resource and adds it to the model resource palette. The *type* can be `#plane`, `#box`, `#sphere`, `#cylinder`, or `#particle`. The *type* cannot be `#mesh`. To create a new mesh model resource, use the `newMesh` command detailed below.	New model resource object
`newMesh(name, numFaces, numVertices, numNormals numColors, numTexture Coordinates)`	Creates a new mesh model resource. *numFaces* is the user-specified number of triangles. *numVertices* is the user-specified number of vertices. A vertex can be used by more than one face. *numNormals* is the user-specified number of normals. Enter `0` or omit this step to use the `generateNormals()` method. *numColors* is the user-specified number of colors. You can specify a color for each point of a triangle. *numTextureCoordinates* is the number of user-specified texture coordinates. Enter `0` or omit this step to get the default coordinates.	New mesh model resource

Models

Models can be referred to by name or number. Models can be added to or removed from the world at any time.

In the member's parent-child hierarchy, each model must have one parent, but it can have an unlimited number of children. A child's position and orientation depend on its parent's position and orientation, and it changes when the position and orientation of the parent changes. Models that don't have another model and a parent have the group named world as their parent. In this case, their `transform` property describes their position and rotation in the 3D world, and is identical to their `getWorldTransform()` property. All models that have models as parents have a relationship both to their immediate parent and to the world parent. You can add or remove models from the 3D world at any time by using the `addToWorld()` or `removeFromWorld()` commands.

For example, if the first child of the model named `car1` is a wheel model, the following `transform` Lingo would refer to the position of the wheel relative to the model named `car1`:

```
car1.child(1).transform.position
```

To refer to the position of the wheel model relative to the world itself, use `getWorldTransform()`:

```
car1.child(1).getWorldTransform().position
```

Node types

A model is one of four types of objects that share the same transform, parent, and child properties. The others are cameras, lights, and groups. Models, cameras, lights, and groups are generically referred to as *node types* or *nodes*. Nodes can be each other's parents or children, so long as any one node has exactly one parent. A node can have any number of children. A model, for example, can be the child of a light and the parent of a group.

Model properties

The properties of a model determine its particular appearance and relationship to the rest of the 3D world.

Property	Access	Description	Value
`name`	Get	Unique string name.	Any string.
`parent`	Get and set	This model's parent; either another object or the 3D cast member itself.	An object or cast member.
`child.count`	Get	Number of children (but not grandchildren) of a given model.	An integer.
`transform`	Get and set	Lingo transform object representing this model's position and orientation relative to its parent's position and orientation: `transform.position` gives the relative position. `transform.rotation` gives the relative rotation.	Set: a transform object. Get: reference to a transform object.
`userData`	Get and set	A property list containing all properties assigned to the model. Users can add, remove, get, and set properties on this list.	The default list includes the properties assigned in the 3D modeling tool. Additional properties may also be added.
`resource`	Get and set	Model resource object defining model's geometry.	Model resource object.
`shaderList`	Get and set	List of all shaders used by the model. Setting this property to a single shader sets every element of the `shaderList` to that shader.	List.
`shaderList.count`	Get	Number of shaders the model uses.	Positive integer.
`shaderList.[index]`	Get and set	Provides access to a particular shader used in a specific region of the model.	List.
`shader`	Get and set	Provides access to the first shader in the shader list.	Shader object.
`boundingSphere`	Get	A list containing a vector and a floating-point value. The vector represents the world position and the value represents the radius of a bounding sphere surrounding the model and all its children.	`[vector(0,0,0), 0.0]`
`worldPosition`	Get and set	Position of the model in world coordinates. Shortcut for the command `node.getWorldTransform()position`.	Vector object.

Property	Access	Description	Value
visibility	Get and set	The way in which the sides of the model's resource are drawn. The choices are as follows: #none, in which no polygons are drawn and the model is invisible. #front, in which only polygons on the outer surface of the model are drawn, so that, if the camera were inside the model, the model wouldn't be seen. Also known as "back face culling," this option optimizes performance. #back, in which only polygons on the inside of the object are drawn, so that if the camera were outside the model, the model wouldn't be seen. #both, in which all polygons are drawn and the model is visible regardless of orientation. This may solve drawing problems, but it can also affect performance because twice as many polygons must be drawn. The default is #front.	#none: #front #back #both
debug	Get and set	Value indicating whether debug information is drawn for this model. If the value is TRUE (1), lines from the x, y, and z axes are drawn sprouting up from the model to indicate its orientation, and a bounding sphere is drawn around the model.	TRUE (1) or FALSE (0). The default is FALSE (0).
boundingSphere	Get	A list containing a vector and a floating-point value. The vector represents the position of the model in world space, and the floating-point value represents the radius of the bounding sphere that contains the model and its children.	boundingSphere
worldPosition	Get	Position of the model in world coordinates. A quick shortcut for model.getWorldTransform().position.	worldPosition
pointAtOrientation	Get and set	A list of two orthogonal vectors, [objectRelativeDirecton, objectRelativeUp], that control how the model's pointAt() method works.	pointAtOrientation

Model commands

Use these commands to work with models:

Command	Description	Returns
addChild(aNode, preserveWorld)	Adds *aNode* to this model's list of children. An equivalent operation is to set *aNode.parent* to equal *this model*. The *preserveWorld* argument is optional. It can have two values: #preserveWorld or #preserveParent. If the value is #preserveWorld, the default, the world transform of the child being added remains intact. If the value is #preserveParent, the child's existing transform is interpreted as parent-relative.	Nothing
child[index]	Returns the child at the specified position in the index.	Node object
child(name)	Returns the child named *name*.	Node object

Command	Description	Returns
`clone(`name`)`	Clones a model named *name*, adds it to the child list of the model's parent, and adds it to the world. The clone shares the same model resource, shader list, and parent as the original model, but it has unique copies of the model's transform and modifier properties. All children of the model are automatically cloned. This can be avoided by removing the children, performing the cloning operation, and then adding the children back. If the name is omitted or is `""`, the clone isn't added to the model palette, has no parent, and has no children. This option lets you quickly create temporary model instances.	Lingo model object
`cloneDeep(`name`)`	Clones both the model and the model resource used by the model's children. Modifications to the clones' resource don't affect the source model's resource. This is a more memory-intensive operation than `clone(`*name*`)`.	Lingo model object
`addtoWorld()`	Adds the model to the currently active 3D world, setting its parent as "world." Equivalent to `model.parent=member("scene").group ("world")` All newly created models are added to the world by default, without it being necessary to use this command.	Nothing
`getWorld Transform()`	Sets this model's position and orientation relative to the world model's position and orientation.	Nothing
`remove FromWorld()`	For models whose parent hierarchy terminates in the world, this sets their parent to `void` and removes them from the world. Otherwise it does nothing.	Nothing
`isInWorld()`	For models whose parent hierarchy terminates in the world, the value is `TRUE (1)` and the model is potentially visible.	`TRUE (1)` or `FALSE (0)`
`registerScript (`eventName, handlerName, scriptInstance`)`	Registers a handler named *handlerName* that is called in the *scriptInstance* when the member function *sendEvent()* is called with *eventName* as an argument. If *scriptInstance* is 0, a movie script handler is called. The user defines what *eventName* is.	`TRUE (1)` or `FALSE (0)`, with `TRUE (1)` indicating that the event happened and `FALSE (0)` that it did not
`addModifier (`symbol`)`	Adds the modifier *symbol*.	`TRUE (1)` if *symbol* is a valid modifier `FALSE (0)` if *symbol* is not a valid modifier
`removeModifier (`symbol`)`	Removes the first modifier identified by *symbol*.	`TRUE (1)` if *symbol* is a valid modifier and attached to the model `FALSE (0)` if *symbol* is not a valid modifier or is not attached to the model
`update()`	Updates animation timing without rerendering. Used to force update of bone positions in an animation while inside a Lingo call.	`TRUE (1)` or `FALSE (0)`

Command	Description	Returns
`translate (`xIncrement, yIncrement, zIncrement, relativeTo`)`	Moves the model forward by *`xIncrement`* along the *x*-axis, *`yIncrement`* along the *y*-axis, and *`zIncrement`* along the *z*-axis. The *`relativeTo`* parameter is optional. It determines how arguments are interpreted. The possible values are as follows: `#self`: the default. Increments are applied relative to the model's local coordinate system. `#parent`: increments are relative to the model's parent's coordinate system. `#world`: increments are relative to the world coordinate system. Equivalent to `#parent` if parent is the world. node (model, light, camera, or group): increments are relative to the coordinate system of the argument object.	Nothing
`translate (`direction Vector, relativeTo`)`	Moves the model directionVector.length() in the direction of the vector *`directionVector`*. The *`relativeTo`* argument is optional and defaults to `#self`.	Nothing
`translate (`*`x,y,z, relativeTo`*`)`	Moves the model distance *x* along the *x*-axis, distance *y* along the *y*-axis, and distance *z* along the *z*-axis. The *`relativeTo`* argument is optional and defaults to `#self`. This command can also be written as `translate(vector(x,y,z)` *`relativeTo`*`)`.	Nothing
`rotate(`x,y,z, relativeTo`)`	Rotates the model by *x*° around the *x*-axis, *y*° around the *y*-axis, and *z*° around the *z*-axis. The *`relativeTo`* argument is optional and defaults to `#self`. If included, it defines the coordinate space of the axes. This command can also be written as `rotate(vector(`*`x,y,z) relativeTo`*`)`.	Nothing
`rotate (`position, axis, angle, relativeTo`)`	Rotates the model around the axis vector in the specified position the specified number of degrees. The *`relativeTo`* argument is optional and defaults to `#self`.	Nothing
`scale(`uniform Scale`)`	Scales the model the same amount in all directions.	Nothing
`scale(`x, y, z`)`	Scales the model by a factor of *x* in the *x* dimension, *y* in the *y* dimension, and *z* in the *z* dimension. Scaling is applied in object-relative space.	Nothing
`pointAt(`world Position, worldUp`)`	Rotates the model until it points at the world-relative position *`worldPosition`*. The optional *`worldUp`* argument gives the general position of the model's Up axis. The exact position can't be determined using this method. Both the object-relative axes are defined by the *`pointAtOrientation`* property. Default values are an object-relative forward direction of vector `(0, 0, -1)` and an object-relative up direction of vector `(0, 1, 0)`.	Nothing
`getWorld Transform()`	Calculates and returns a transform that converts object-relative positions for this model into world-relative positions.	A transform object

Moving models

Because the 3D world has no absolute frame of reference, moving and rotating is much more complex than in 2D, where all movement is in relation to screen position.

In 3D, everything is drawn relative to the camera's frame of reference. If the camera is behind an object, when the object moves to the left relative to the center of the world, or *world origin*, it appears to move toward the right of the screen.

Each piece of position and orientation information can be expressed relative to one or more frames of reference. A model's transform property, for instance, expresses its position and rotation relative to the model's parent. In general, there are four frames of reference to consider: relative to the object (model, light, camera) itself, relative to the object's parent, relative to the world, and relative to some other object.

- Object-relative: When you create a model in a 3D modeling program, you build it relative to its own frame of reference. For instance, when you create a model of a car, the front of the car may be pointed along its *z*-axis and the antenna may be pointed along its *y*-axis. To move such a car forward (along its *z*-axis) regardless of which direction it is pointing relative to the camera or the world, use `car.translate(0,0,10)`. To turn the car left, use `car.rotate(0,45,0)`.

  The car model might have wheel models as children. To rotate the wheel of a car relative to itself, rather than relative to its parent (the car), use the following Lingo:

  ```
  wheel.rotate(0,10,0)
  ```

  or

  ```
  car.child[1].rotate(0,10,0, #self)
  ```

  where the fourth parameter of the `rotate` command is the object the rotation should be relative to.

- Parent-relative: A model's `transform` property expresses its position and rotation relative to the model's parent. If you want the wheels of the car to move outward regardless of how the wheels are turned, use `car.child[1].translate(10,0,0,#parent)` or `car.child[1].transform.translate(10,0,0)`. If you want a planet model that is a child of the sun to orbit around the sun, use `planet.rotate(0,5,0, #parent)`.

- World-relative: If you want the car to move along the world's *x*-axis regardless of which way it is facing, use `model.translate(10,0,0,#world)`. If you want to rotate the car 20° around the world *y*-axis, with the rotation taking place at the world location vector (10, 10, 10), use `model.rotate(vector(10,10,10), vector(0,1,0), 20, #world)`.

- Relative to another object: If you want to move an object so that it goes toward the right edge of the screen, use `model.translate (vector(10,0,0), sprite(1).camera)`. If you want to rotate the object parallel to the camera and around the center of the screen, use `model.rotate(vector(0,0,0), vector(0,0,1), 20, sprite(1).camera)`.

Shaders

A model resource defines a model's shape, and shaders define the model's surface colors and reflectivity. You can use just one shader or more than one. For example, a box might have six different shaders, one for each face. If you do not specify a shader, the default `#standard` shader is used. If the shader's properties are modified, the change affects all models that use that shader.

Models that are created with Lingo are assigned the standard shader. You can replace the default shader of a model with any of the other types of shaders.

Properties of the standard shader

The standard shader makes the surface of a model appear in a photorealistic style. Use these properties to work with the standard shader:

Property Name	Access	Description	Default
`name`	Get	The string name of this shader.	None
`ambient`	Get and set	A Lingo color object describing the surface's reaction to ambient light.	`rgb(63,63, 63)`
`diffuse`	Get and set	A Lingo color object describing the surface's reaction to diffuse light. Ambient and diffuse color objects together describe a model resource's base color.	`rgb(255, 255,255)`
`specular`	Get and set	A Lingo color object describing the surface's specular highlight color. This setting has an effect only if there are lights in the scene whose specular property is `TRUE (1)`.	`rgb(255, 255,255)`
`shininess`	Get and set	An integer between `0` and `100` indicating how shiny a surface is.	`30.0`
`emissive`	Get and set	A Lingo color object describing the color of light this object seems to give off. This does not turn the surface using this shader into a light source; it just gives it the appearance of being one.	`rgb(0,0,0)`
`blend`	Get and set	An integer between `0` and `100` indicating how transparent `(0)` or opaque `(100)` this surfaces is. Unlike with a texture that includes alpha information, this setting affects the entire surface uniformly.	`100`
`transparent`	Get and set	This property controls whether or not the model is blended using alpha values or rendered as opaque. The default is `TRUE (1)` (alpha blended). The functionality of `shader.blend` is dependent on `shader.transparent`.	`TRUE (1)`

`renderStyle`	Get and set	This property can take the following values:
		`#fill`
		`#wire`
		`#point`
		When `shader.renderStyle = #fill`, the polygons of the mesh are filled.
		When `shader.renderStyle = #wire`, the polygon edges of the mesh are rendered.
		When `shader.renderStyle = #point`, the vertices of the mesh are rendered, provided that `#Fill` is supported by the `#software` renderer.
			`#fill`

`flat`	Get and set	When `shader.flat = TRUE (1)`, the mesh should be rendered with flat shading instead of Gouraud shading, which shades each polygon separately. Flat shading shades the mesh as a whole.	`FALSE (0)`

Property Name	Access	Description	Default
textureList	Get and set	A shader can use up to eight layers of textures. This eight-element list defines which texture is used for which layer. Get: Returns a list of texture objects, one per layer. Set: Specifies a texture object to be applied to all layers. An argument of void disables texturing for all layers.	void
textureList [index]	Get and set	A shader can use up to eight layers of textures. This property gives access to the texture at the indicated index position.	void
texture	Get and set	This property allows access to the texture for the first layer. It is equivalent to textureList[1]. An argument of void can be used to disable texturing for the first layer.	void

reflectionMap	Get and set	Get: Returns the texture associated with the third layer.
		Set: Specifies a texture to be used in the third layer and applies the following values:
		textureModeList[3] = #reflection
		blendFunctionList[3] = #blend
		blendSourceList[3] = #constant
		blendConstantList[3] = 50.0
			void

diffuseLightMap	Get and set	Get: Returns the texture associated with the second layer.
		Set: Specifies a texture to be used in the second layer and applies the following values:
		textureModeList[2] = #diffuse
		blendFunctionList[2] = #multiply
		blendFunctionList[1] = #replace
			void

specularLightMap	Get and set	Get: Returns the texture associated with the fifth layer.
		Set: Specifies a texture to be used in the fifth layer and applies the following values:
		textureModeList[5] = #specular
		blendFunctionList[5] = #add
		blendFunctionList[1] = #replace
			void

glossMap	Get and set	Get: Returns the texture associated with the fourth layer.
		Set: Specifies a texture to be used in the fourth layer and applies the following values:
		textureModeList[4] = #none
		blendFunctionList[4] = #multiply
			void

Property Name	Access	Description	Default
textureMode List[*index*]	Get and set	This property allows access to the texture coordinate generation function used for a texture at the texture level and then to allows you to change how textures are applied to a model's surface. The property can take the following values: #none #wrapPlanar #wrapCylindrical #wrapSpherical #reflection #diffuseLight #specularLight	#none
textureMode List	Get and set	Get: Returns a list of texture coordinate generation functions, one per layer. Set: Specifies texture coordinate generation modes to be applied to all layers. Possible values are as follows: #none #wrapPlanar #wrapCylindrical #wrapSpherical #reflection #diffuseLight #specularLight	#none
textureMode	Get and set	Access to the texture coordinate generation function for the first layer. Possible values are as follows: #none #wrapPlanar #wrapCylindrical #wrapSpherical #reflection #diffuseLight #specularLight	#none
wrapTransform List[*index*]	Get and set	Access to the texture coordinate generation transform associated with a specified layer. This transformation has effect only if the textureModeList[*index*] is #wrapPlanar, #wrapSpherical, or #wrapCylindrical. Controls the orientation of texture coordinate generation in model-relative space. Use this property to change the orientation, offset, and scale of how the wrapTransformList[*index*] is applied on the model.	transform(50.0000,0.0000,0.0000,0.0000, 0.0000,50.0000,0.0000,0.0000, 0.0000,0.0000,50.0000,0.0000, 0.0000,0.0000,0.0000,1.0000)

Property Name	Access	Description	Default
`wrapTransformList`	Get and set	Controls the orientation of UV generation in model space. Get: Returns a list of texture coordinate generation transforms, one per layer. Set: Specifies a texture coordinate generation transform to be applied to all layers.	`transform(50.0000,0.0000,0.0000,0.0000, 0.0000,50.0000,0.0000,0.0000, 0.0000,0.0000,50.0000,0.0000, 0.0000,0.0000,0.0000,1.0000)`
`wrapTransform`	Get and set	Access to the texture coordinate generation transform for the first layer. Controls the orientation of the UV generation in model space.	`transform(50.0000,0.0000,0.0000,0.0000, 0.0000,50.0000,0.0000,0.0000, 0.0000,0.0000,50.0000,0.0000, 0.0000,0.0000,0.0000,1.0000)`
`textureTransformList`	Get and set	Access to the list of texture coordinate modifier transforms, one per texturing layer. The `textureTransform` is applied to all texture coordinates regardless of the `textureMode` property setting. This is the last modification of the texture coordinates before they are sent to the renderer. Allows you to manipulate the scale, orientation, and positional offsets of the source image before it's wrapped. `WrapTransformList` changes the projection of the transformed texture. The `textureTransform` matrix operates on the texture in `textureImage` space, which is defined to exist only on the x,y plane. Rotations about the *z*-axis are rotated around the `(0,0)` point, which maps to the upper left corner of the texture. Translating by integers when `textureRepeat` is `TRUE (1)` has no effect, because the width and height of the textures are defined to be `1.0` in `textureImage` space. Care must be taken not to scale any dimension (even *z*) by `0`.	Identity transform
`textureTransformList[`*index*`]`	Get and set	Access to the texture coordinate modifier transform associated with a specified layer.	Identity transform
`textureTransform`	Get and set	Access to the texture coordinate modifier transform for the first layer.	Identity transform

Property Name	Access	Description	Default
blendFunction List[*index*]	Get and set	Access to the blending function associated with a texture layer at the position indicated by *index*, which must be a positive integer smaller than or equal to 8. Possible values are as follows: #replace #multiply #add #blend #alpha #constant For detailed information on all of these options, see blendFunctionList in the *Lingo Dictionary*.	#multiply
blendFunction	Get and set	Access to the list of blending functions, #multiply, #replace, #blend, and #add, for the first layer.	#multiply
blendFunction List	Get and set	Access to the list of blending functions, #multiply, #replace, #blend, and #add, for all layers.	#multiply
blendSource List[*index*]	Get and set	Access to the blending source associated with a specified layer. When the blendFunction property is set to #blend for the ‹index›th layer, this results in the ‹index›th texture being combined with the result of the previous layers for the entire texture using a single blending ratio. The blending ratio, in this case, is the value of blendConstant for layer ‹*index*›. For example, if the layer at that index position's blendConstant value is 0.9, the resultant texture will be 90% of the texture at that index position and 10% of the result of the previous texture layers Possible values are #constant and #alpha.	#constant
blendSource List	Get and set	Access to the blending sources for each layer, providing that the blend function is set to #blend. Possible values are #constant and #alpha.	#constant
blendSource	Get and set	Access to the blending sources for the first layer, providing that the blend function is set to #blend. Possible values are #constant and #alpha.	#constant
blendConstant List[*index*]	Get and set	The blending ratio used for a specific layer when the blend function is set to #blend and blendSourceList[*index*] is set to #constant. Returns a floating-point value from 0.0 to 100.0.	50.0
blendConstant List	Get and set	The blending ratio used for any layer when the blend function is set to #blend and blendSourceList[*index*] is set to #constant. Returns a floating-point value from 0.0 to 100.0.	50.0

Property Name	Access	Description	Default
`blendConstant`	Get and set	The blending ratio used for the first layer when the blend function is set to `#blend` and `blendSourceList[index]` is set to `#constant`. Returns a floating-point value from `0.0` to `100.0`.	`50.0`
`textureRepeat List[index]`	Get and set	Allows you to get or set the texture clamping behavior associated with a specified layer. Texture clamping refers to how a texture "clamps" to its shader. If the ratio of the texture to the shader is less than 1 to 1 and `textureRepeatList` is set to `TRUE (1)`, the texture tiles over the shader. If `textureRepeatList` is set to `FALSE (0)`, the texture isn't repeated but appears only once in one part of the shader. If the ratio of the texture to the shader is greater than 1 to 1 and `textureRepeatList` is set to `FALSE (0)`, the border of the texture is extended past the unit UV coordinate range.	`TRUE (1)`
`textureRepeat List`	Get and set	Access to the list of texture clamping behaviors, one per layer. When set to `FALSE (0)`, the border of the texture is extended past the unit UV coordinate range. Get: Returns a list of texture clamping behaviors, one per layer. Set: Specifies a texture clamping behavior to be applied to all layers.	`TRUE (1)`
`textureRepeat`	Get and set	Access to the texture clamping behavior for the first layer. When set to `FALSE (0)`, the border of the texture is extended past the unit UV coordinate range.	`TRUE (1)`

Properties of the painter shader

The `#painter` shader gives the model a painted effect. Use these properties to work with the painter shader:

Property	Access	Description	Default
`name`	Get and set	Name of shader	None
`style`	Get and set	Possible values: `#toon`: sharp transitions between available colors `#gradient`: smooth transitions between available colors `#blackAndWhite`: sharp transitions between black and white	`#gradient`
`colorSteps`	Get and set	Number of color steps used for lighting calculations	`2`
`shadow Percentage`	Get and set	Percentage of lighting intensity that is the threshold between highlight and shadow	`50`

Property	Access	Description	Default
highlightPercentage	Get and set	Percentage of lighting steps to be treated as highlight	50
shadowStrength	Get and set	Factor controlling darkness of shadowed areas	1.0
highlightStrength	Get and set	Factor controlling brightness of highlighted areas	1.0

Properties of the newsprint shader

The #newsprint shader creates a dithering effect similar to a newspaper photograph. Use these properties to work with the newsprint shader:

Property	Access	Description	Default
name	Get and set	Name of shader	None
brightness	Get and set	Value controlling amount of white in shader	0.0
density	Get and set	Value controlling density of dots in newsprint image	45.0

Properties of the engraver shader

The #engraver shader gives the effect of an engraved metal surface. You can control the size and number of etched lines by adjusting the brightness and density properties, respectively. Use these properties to work with the engraver shader:

Property	Access	Description	Default
name	Get and set	Name of shader	None
brightness	Get and set	Value controlling amount of white in shader	0.0
density	Get and set	Value controlling number of lines used to shade an area	40.0
rotation	Get and set	Angle describing 2D rotational offset for engraving lines	0.0

Textures

Each shader can have textures applied to it. Textures are 2D images drawn on the surface of a model. The appearance of the model's surface is the combined effect of the shader and textures applied to it. If you do not specify a texture, a default red-and-white bitmap is used.

The pixel height and width of the 2D images you use as textures should be powers of 2 (that is, 2, 4, 8, 16, 32, and so on). All the textures used in a 3D scene must be able to fit in the computer's video RAM at the same time. If not, Director switches to software rendering, which slows performance.

Be aware of the limitations of your video RAM and that of your intended audience. Some video cards have as little as 4 megabytes of video RAM. Carefully budget your total texture size when designing your 3D world.

Texture properties

Use these properties to work with textures:

Property	Access	Description	Default
`name`	Get and set	Name of texture.	None
`type`	Get	Possible values: `#fromfile`: bitmap defined as part of 3D import `#castmember`: bitmap derived from Director cast member	None
`member`	Get and set	If the type is `#castmember`, this property identifies the source of the bitmap. If the type if `#fromfile`, this property is `void`.	None
`width`	Get	Width, in pixels.	None
`height`	Get	Height, in pixels.	None
`quality`	Get and set	Property with the following possible values: `#low`: texture is not mipmapped `#medium`: mipmapping is at a low bilinear setting (default) `#high`: the mipmapping is at a high trilinear setting For more information, see `quality` in the *Lingo Dictionary*.	`#medium`
`nearFiltering`	Get and set	Determines whether bilinear filtering is used when rendering a projected texture map that covers more screen space than the original. For more information, see `nearFiltering` in the *Lingo Dictionary*.	`TRUE (1)`
`compressed`	Get and set	The property can be `TRUE (1)` or `FALSE (0)`: `TRUE (1)`: the texture is compressed `FALSE (0)`: the texture is not compressed The value changes automatically from `TRUE (1)` to `FALSE (0)` when the texture is to be rendered. The value can be set to `FALSE (0)` to decompress or to `TRUE (1)` to remove the decompressed representation from memory.	`TRUE (1)`

Texture commands

The pixel height and width of the 2D images you use as textures should be powers of 2 (that is, 2, 4, 8, 16, 32, and so on). If not, the image will be resized to a dimension that is a power of 2. The `scaleDown()` command allows you to retain manual control over this procedure at the texture level.

Command	Description	Returns
`scaleDown()`	Reduces the height of the texture to the next lowest power of 2. This is useful for dynamically resizing textures to fit on a client machine.	Nothing

Groups

Groups have many of the same properties and commands as models, except that you need to substitute the word `group` for the word `model` when writing Lingo scripts. A group can contain models, lights, cameras, or other groups.

Group properties

The properties of the group determine its particular appearance and relationship to the rest of the 3D world.

Use these properties to work with groups:

Property	Access	Description	Value
`name`	Get	Unique string name.	Any string.
`parent`	Get and set	This group's parent; either another object or the 3D cast member itself.	An object or cast member.
`child.count`	Get	Number of children (but not grandchildren) of a given group.	An integer.
`transform`	Get and set	Lingo transform object representing this group's position and orientation relative to its parent's position and orientation. `transform.position` gives the relative position. `transform.rotation` gives the relative rotation.	Set: a transform object. Get: reference to a transform object.
`userData`	Get and set	A property list containing all properties assigned to the group. Users can add, remove, get, and set properties on this list.	The default list includes the properties assigned in the 3D modeling tool. User properties are then added.
`bounding Sphere`	Get	A list containing a vector and a floating-point value. The vector represents the position of the group in world space. The floating-point value represents the radius of the bounding sphere that contains the group and its children.	A list, with the default value of `[vector (0,0,0), 0.0]`.
`world Position`	Get	Position of the group in world coordinates. A quick shortcut for `group.getWorldTransform().position`	A vector object.
`pointAt Orientation`	Get and set	A list of two orthogonal vectors, `[objectRelativeDirection, objectRelativeUp]`, that control how the groups `pointAt()` method works.	A vector list.

Group commands

Use these commands to work with groups:

Command	Description	Returns
`addChild(aNode, preserveWorld)`	Adds *aNode* to this group's list of children. An equivalent operation is to set *aNode.parent* to equal *this group*. The *preserveWorld* argument is optional. It can have two values: `#preserveWorld` or `#preserveParent`. If the value is `#preserveWorld`, the world transform of the child being added remains intact. If the value is `#preserveParent`, the child's existing transform is interpreted as parent-relative.	Nothing
`child[index]`	Returns the child at the specified position in the index.	Lingo group object
`child(name)`	Returns the child named *name*.	Lingo group object
`clone(name)`	Clones a group named *name*, adds it to group's parent's child list, and adds it to world All children of the group are automatically cloned. This can be avoided by removing the children, performing the cloning operation, and then adding the children back. If the name is omitted or is `""`, the clone isn't added to the group palette, has no parent, and has no children. This option lets you quickly create temporary group instances.	Lingo group object
`cloneDeep(name)`	Clones both the group and the parent used by the group's children. Modifications to the clones' resource don't affect the parent. This is a more memory-intensive operation than `clone(name)`.	Lingo group object
`addtoWorld()`	Adds the group to the currently active 3D world, setting its parent as "world." Equivalent to `group.parent=member("scene").group("world")`. All newly created groups are added to the world by default, without it being necessary to use this command.	Nothing
`getWorld Transform()`	Sets this group's position and orientation relative to the world group's position and orientation.	Nothing
`remove from world`	For groups whose parent hierarchy terminates in the world, this sets their parent to `void` and removes them from the world. Otherwise it does nothing.	Nothing
`isInWorld()`	For groups whose parent hierarchy terminates in the world, the value is `TRUE (1)`.	`TRUE (1)` or `FALSE (0)`
`registerScript (eventName, handlerName, scriptInstance)`	Registers the handler named *handlerName* that is found in the script *scriptInstance* when the member function `sendEvent()` is called with *eventName* as an argument. If *scriptInstance* is 0, a movie script handler is called. The user defines what *eventName* is.	`TRUE (1)` or `FALSE (0)`, with `TRUE (1)` indicating that the event happened and `FALSE (0)` that it did not

Command	Description	Returns
`translate (xIncrement, yIncrement, zIncrement, relativeTo)`	Moves the group forward by *xIncrement* along the *x*-axis, *yIncrement* along the *y*-axis, and *zIncrement* along the *z*-axis. The *relativeTo* parameter is optional. It determines how arguments are interpreted. The possible values are as follows: #self: the default. Increments are applied relative to the group's local coordinate system. #parent: increments are relative to the group's parent's coordinate system. #world: increments are relative to the world coordinate system. Equivalent to #parent if parent is the world. node (group, light, camera, or group): increments are relative to the coordinate system of the argument object.	Nothing
`translate (direction Vector, relativeTo)`	Moves the group `directionVector.length()` in the direction of the vector *directionVector*. The *relativeTo* argument is optional and defaults to #self.	Nothing
`translate (x,y,z, relativeTo)`	Moves the group distance *x* along the *x*-axis, distance *y* along the *y*-axis, and distance *z* along the *z*-axis. The *relativeTo* argument is optional and defaults to #self. This command can also be written as `translate(vector(x,y,z) relativeTo)`.	Nothing
`rotate(x,y,z, relativeTo)`	Rotates the group by *x* degrees around the *x*-axis, *y* degrees around the *y*-axis, and *z* degrees around the *z*-axis. The *relativeTo* argument is optional and defaults to #self. If included, it defines the coordinate space of the axes. This command can also be written as `rotate(vector(x,y,z) relativeTo)`.	Nothing
`rotate (position, axis, angle, relativeTo)`	Rotates the group around the axis vector in the specified position the specified number of degrees. The *relativeTo* argument is optional and defaults to #self.	Nothing
`pointAt(world Position, worldUp)`	Rotates the model until it points at the world-relative position worldPosition. The optional *worldUp* argument gives the general position of the model's Up axis. The exact position can't be determined using this method. Both the object-relative axes are defined by the `pointAtOrientation` property. Default values are an object-relative forward direction of vector (0, 0, -1) and an object-relative up direction of vector (0, 1, 0).	Nothing
`getWorld Transform()`	Calculates and returns a transform that converts object-relative positions for this group into world-relative positions.	A transform object

Modifiers

Modifiers control how a model is rendered or how it animates. They are attached to a model with the `addModifier()` command. Once a modifier has been attached, its properties can be manipulated with Lingo. The tables that follow detail the properties of the modifiers included with Director MX.

Level of detail (LOD) modifier properties

The level of detail (LOD) modifier provides per-model control over the number of polygons used to render a model, based on the model's distance from the camera. This modifier is attached to all imported models.

Use these properties to work with the level of detail modifier:

Property	Access	Description	Default
whichModel.lod.auto	Get and set	TRUE (1) means that polygons are automatically reduced based on the distance from the camera. The fewer polygons that are drawn, the faster performance will be. The lod.bias property controls how aggressively this takes place. FALSE (0) means that you can control polygon reduction on a per-model basis, provided you've attached the level of detail modifier to the model. The level of detail modifier lets you override the default settings. To release level of detail data from memory once the model has been streamed in, set the userData property sw3D to TRUE (1).	TRUE (1).
whichModel.lod.bias	Get and set	Aggressiveness with which the level of detail is reduced when in automatic mode. A value of 0.0 is most aggressive and removes all polygons. A value of 100.00 should result in no visible degradation of the geometry. A middle level can be used to remove polygons at runtime that were not removed during authoring.	A value between 0.0 and 100.0. The default is 100.0.
whichModel.lod.level	Get and set	The percentage of the model resource mesh resolution to use when the automatic mode is FALSE (0).	A value between 0.0 and 100.0. The default is 100.0.

Toon modifier properties

The toon modifier changes a model's rendering to imitate a cartoon drawing style. Only a few colors are used, and the model's shader, texture, and related properties are ignored.

Use these properties to work with the toon modifier:

Property	Access	Description	Default
whichModel.toon.style	Get and set	The following are the possible values: #toon: sharp transitions between available colors #gradient: smooth transitions between available colors #black and white: sharp transitions between black and white	#gradient
whichModel.toon.colorSteps	Get and set	Maximum number of colors available, rounded to the nearest power of 2, with a limit of 16	2
whichModel.toon.shadowPercentage	Get and set	The percentage of color steps to be used in shadows	50
whichModel.toon.highlightPercentage	Get and set	The percentage of color steps to be used in highlight	50
whichModel.toon.shadowStrength	Get and set	A floating-point value that determines shadow darkness	1.0
whichModel.toon.highlightStrength	Get and set	A floating-point value that determines highlight brightness	1.0

Property	Access	Description	Default
whichModel.toon.lineColor	Get and set	Lingo color object describing line color	Black (rgb 0,0,0)
whichModel.toon.silhouettes	Get and set	TRUE (1) or FALSE (0) value indicating presence or absence of lines around silhouettes	TRUE (1)
whichModel.toon.creases	Get and set	TRUE (1) or FALSE (0) value indicating whether lines are drawn when mesh boundaries meet at a crease	TRUE (1)
whichModel.toon.creaseAngle	Get and set	A floating-point value controlling crease angle detection	0.01
whichModel.toon.boundary	Get and set	TRUE (1) or FALSE (0) value indicating whether lines are drawn at boundary of surface	TRUE (1)

Inker modifier properties

The inker modifier adds silhouette, crease, and boundary edges to an existing model. Silhouettes are edges along the border of a model. Crease edges are created when the angle between two areas of the mesh exceeds a given threshold.

Use these properties to work with the inker modifier:

Property	Access	Description	Default
whichModel.inker.lineColor	Get and set	Lingo color object describing line color	Black (rgb 0,0,0)
whichModel.inker.silhouettes	Get and set	TRUE (1) or FALSE (0) value indicating presence or absence of lines around silhouettes	TRUE (1)
whichModel.inker.creases	Get and set	TRUE (1) or FALSE (0) value indicating whether lines are drawn when mesh boundaries meet at a crease	TRUE (1)
model.inker.creaseAngle	Get and set	A floating-point value controlling crease angle detection	0.01
whichModel.inker.boundary	Get and set	TRUE (1) or FALSE (0) value indicating whether lines are drawn at boundary of surface	TRUE (1)

Subdivision surfaces modifier properties

The subdivision surfaces (SDS) modifier causes the model to be rendered with additional geometric detail in the area of the model that the camera is currently looking at. The additional detail must be created in a third-party modeling application and imported into Director along with the 3D cast member. The SDS modifier is available only for models created outside of Director. The SDS modifier should not be combined with the level of detail or toon modifier on the same model.

Use these properties to work with the SDS modifier:

Property	Access	Description	Default
whichModel.sds.enabled	Get and set	Enables/disables subdivision surfaces modifier functionality.	TRUE (1)
whichModel.sds.subdivision	Get and set	The following are the possible values: #uniform: mesh is uniformly scaled up in detail, with each face subdivided the same number of times #adaptive: additional detail is added only when there are major orientation changes and only to those areas of the mesh that are currently visible	#uniform
whichModel.sds.depth	Get and set	Maximum recursion depth, with a range of 0 to 5, to which the subdivision surfaces modifier is applied. At a value of 0, no change occurs.	1
whichModel.sds.tension	Get and set	Percentage of matching between modified and original surfaces.	65
whichModel.sds.error	Get and set	Percentage of error tolerance. This property applies only if sds.subdivision equals #adaptive.	0.0

Collision modifier properties

The collision modifier allows a model to be notified of and respond to collisions. You can access a model's collision modifier properties using syntax such as `model.collision.`*`whichProperty`*.

Detecting collisions and responding to collisions are separate tasks. If the `enabled` property is set to `TRUE`, and a script has been registered to be notified of collisions using the `setCollisionCallback()` method, that Lingo script instance receives a callback. However, the collision isn't resolved unless the `resolve` property is also set to `TRUE`.

This separation is deliberate and valuable: it can be important for a collision to be registered. In a game, for example, a projectile could strike a wall and the player's score could be increased. In that same game, however, you might not want the projectile to bounce off the wall. In that case, you'd set the `enabled` property to `TRUE` and set the `resolve` property to `FALSE`.

Use these properties to work with the collision modifier:

Property	Access	Description	Default
whichModel.collision.enabled	Get and set	TRUE (1) or FALSE (0) value indicating whether collisions between this model and other models will trigger a collision event.	TRUE (1)

Property	Access	Description	Default
whichModel.collision.resolve	Get and set	TRUE (1) or FALSE (0) value indicating whether collisions are automatically resolved. If the value is TRUE (1) and if the other model has the collision modifier applied and has enabled set to TRUE (1), the models will be moved back to the position of their original contact.	TRUE (1)
whichModel.collision.immovable	Get and set	TRUE (1) or FALSE (0) value indicating whether the model can be moved. If a model cannot be moved, the 3D Xtra can save time by not checking it for collisions with other models that also have their immovable property set to TRUE.	FALSE (0)

Collision modifier commands

Use this command to work with the collision modifier:

Command	Description	Returns
whichModel.collision.setCollisionCallback (#handlerName, scriptObjectName)	If collision.enabled is set to TRUE (1), this command registers the Lingo script instance to receive an event when a collision occurs. If collision.enabled is set to FALSE (0), no event occurs. What happens when a collision occurs depends on the value assigned to the resolve property. You can override this value by using the collisionData.resolveA() or collisionData.resolveB() commands. The collisionData object will be the second argument passed to *#handlerName* in the specified script object *scriptObjectName*.	Nothing

Collision modifier events

These events are generated when collisions occur:

Event Name	Description
#collideAny	The first event called when any collision occurs.
#collideWith	The event called whenever a collision with a specified model occurs. It is implicitly registered for when setCollisionCallback() is called.

Animation modifiers

Once you've created animations in your modeling software, you apply animation modifiers to models to play them back in Director.

Director supports both model keyframe and character bone animations, and modifiers are available to enable both. Keyframe animations modify a model's transform properties over time. Bones animations modify the model's geometry over time. Creating bones animation in a 3D modeling application can be complex, but it results in more natural-looking movements.

The two animation types can be combined. You might, for example, combine a "run in place" bones animation with a "move around the room" keyframe animation.

Bones animations use the Bones player modifier. Keyframe animations use the Keyframe player modifier. Most commands and properties are available to both players.

- Motions: A 3D cast member contains a set of motions authored in your 3D modeling application. For bones animation, each motion contains a list of tracks, and each track contains the keyframes for a particular bone. A bone is a segment of the skeleton of a model. For example, track 14 of the motion named `Run` could be named `RtKneeTrack` and move a bone named `RtKnee`. These names are defined in the 3D modeling application.
- Play list: The Bones player manages a queue of motions. The first motion in the play list is the motion that is currently playing or paused. When that motion finishes playing, it's removed from the play list and the next motion begins. Motions can be added with *`bonesPlayerOrKeyframePlayer`*`.play("run")`, which adds the motion to the top of the list, or *`bonesPlayerOrKeyframePlayer`*`.queue("motion")`, which adds it to the end of the list. Using the `play` command starts the motion immediately. The motion previously at the beginning of the play list is halted unless `autoBlend` is turned on. When you use `queue`, the motion is added to the end of the play list. Motions are removed from the play list automatically when they are complete, or you can remove them explicitly using `bonesPlayer.playNext()`.
- Motion blending: If `autoblend` is `TRUE`, an ending motion blends smoothly into the next motion using the *`bonesPlayerOrKeyframePlayer`*`.blendTime` property to determine how long the blend should be. You can control this manually by setting *`bonesPlayerOrKeyframePlayer`*`.autoBlend` to `FALSE` and using *`bonesPlayerOrKeyframePlayer`*`.blendFactor` to control the blend frame by frame.
- Motion mapping: You can create new motions by combining existing motions. For example, a walking motion could be combined with a shooting motion to produce a walk-and-shoot motion. This is available only with Bones player animations.

You can add the Keyframe player modifier at runtime to a model created in Director MX, but you cannot add the Bones player modifier at runtime. The Bones player modifier is automatically attached to models with bones animation exported from a 3D modeling application. Since the required bones information can't be assigned in Director, it has to exist before the model is imported into Director.

Bones player commands

Use these commands to work with bones animations:

Command	Description	Returns
whichModel.bonesPlayer.play("name", looped, startTime, endTime, playRate)	Plays the motion named *name* starting at the time *timeOffset*, with the currently playing motion being pushed down the play list. If *looped* is FALSE (0), the preceding motion begins again when this motion completes. *StartTime* can be an integer number of milliseconds, or it can be the symbol #synchronized. Use #synchronized to start this new motion at the same relative time offset to it's total duration as the currently playing motion is to it's total duration. The *playRate* parameter indicates how fast to play the motion. A value of 2 doubles the speed of the motion. This value is multiplied by the value of the bonesPlayer.playRate property. If blending is enabled, blending begins the instant play() is called.	Nothing
whichModel.bonesPlayer.playNext	Ends the currently playing motion, removes it from the play list, and begins the next motion. if blending is enabled, blending begins the instant playNext() is called.	Nothing
whichModel.bonesPlayer.queue("name", looped, startTime, endTime, playRate)	Adds the specified motion to the end of the play list. The parameters are same as those for the play() command.	Nothing
whichModel.bonesPlayer.removeLast()	Removes the most recently added motion from the play list. The motion will be removed from the play list even if it is also the currently playing motion.	Nothing
whichModel.bonesPlayer.pause()	Pauses the Bones player.	Nothing

Bones player properties

Use these properties to work with bones animations:

Property	Access	Description	Default
whichModel.bonesPlayer.playing	Get	TRUE (1)= playing; FALSE (0)= paused.	TRUE (1)
whichModel.bonesPlayer.playList	Get	A linear list of property lists, where each property list yields the parameters for the currently playing and queued animations. For example, [[#name: "Walk_rt_turn", #loop: 0, #startTime: 0, #endTime: 4000, #scale: 1.0000], [#name: "Walk", #loop: 1, #startTime: 0, #endTime: -1, #scale: 1.0000]].	Empty list []

Property	Access	Description	Default
whichModel. bonesPlayer. currentTime	Get and set	Current local time of motion at the top of the play list, in milliseconds. The motion's duration property tells you how long the animation lasts.	0
whichModel. bonesPlayer. playRate	Get and set	A value indicating how quickly or slowly to play back the motion. For example, a value of 2.0 doubles the speed of the motion; a value of 0.5 halves the speed of the motion. This value is multiplied by the value of the *playRate* parameter of the play or queue command.	1.0
whichModel. bonesPlayer. playList.count	Get	Current linear list of property lists, with each property list containing the name of a motion and its playback properties.	0
whichModel. bonesPlayer. rootLock	Get and set	TRUE means the model's root bone remains at its current position. The root bone is the central bone from which all other bones branch. If this property is set to TRUE during a walking motion, the model appears to walk in place.	FALSE
whichModel. bonesPlayer. currentLoopState	Get and set	A value of TRUE means the top motion in the play list loops. A value of FALSE turns off looping for the motion at the top of the play list.	FALSE
whichModel. bonesPlayer. blendTime	Get and set	Length in milliseconds of the period when blending takes place between motions. The blendTime property is linked to motion duration. Motion blending is disabled if blendTime = 0 and autoBlend = TRUE.	500
whichModel. bonesPlayer. autoBlend	Get and set	If TRUE, automatic linear blending (from 0.0 to 100.0) is applied over the blend time. Otherwise, blendTime is ignored, and the amount of blending is user-determined by the blendFactor property.	TRUE (1)
whichModel. bonesPlayer. blendFactor	Get and set	The degree of blending between motions, expressed as a floating-point value between 0.0 and 100.0. A value of 0.0 uses all the previous motion. A value of 100.0 uses all of the next motion in the play list. The blend factor can be changed frame by frame to create custom blending effects.	0
whichModel. bonesPlayer. bone[boneID] transform	Get and set	A transform relative to the parent bone. You can get and set the entire transform, but you can't call any methods of this property.	Depends on the bone
whichModel. bonesPlayer. bone[boneID] worldTransform	Get and set	A transform relative to the world coordinates. You can get and set the entire transform to move a bone.	Depends on the bone
whichModel. bonesPlayer. positionReset	Get and set	TRUE (1) = object returns to starting position at end of animation. FALSE (0) = object remains at final animation position after motion completes.	TRUE (1)

Property	Access	Description	Default
whichModel. bonesPlayer. rotationReset	Get and set	Normally a model snaps back to its original rotation after a motion finishes playing. This property maintains any or all of the rotational changes after playing is complete. The values are as follows: #none #x #y #z #xy #xz #all	#all

whichModel.
bonesPlayer.
lockTranslation
	Get and set	Defines the axis of translation to ignore when playing back a motion.
		The values are as follows:
		#none
		#x
		#y
		#z
		#xy
		#xz
		#all
		To keep a model locked to a ground plane with the top pointing along the *z*-axis, set lockTranslation to #z.
		lockTranslation = #all is equivalent to rootLock = TRUE (1).
			#none

Bones player events

These events are generated by bones animations:

Event name	Description
#animation Started	This is a system-defined notification event triggered when a motion begins playing. If looping is on, this event is triggered only by the first playthrough. During a blend of two animations, this event is triggered as the blend begins.
#animation Ended	This is a system-defined notification event triggered when a motion ends. If looping is on, this event is triggered only by the first playthrough. If blending is on, this event is generated for the first animation when the blend is complete. There may be some latency because of the overhead of scheduling all other Director events.

Keyframe player commands

Use these commands to work with keyframe animations:

Command	Description	Returns
whichModel.`keyframePlayer.play("name", looped, startTime, endTime, playRate)`	Plays the motion named *`name`* starting at the time *`startTime`*, with the currently playing motion being pushed down the play list. If *`looped`* is `FALSE (0)`, the preceding motion begins again when this motion completes. The *`startTime`* parameter can be an integer number of milliseconds, or it can be the symbol `#synchronized`. Use `#synchronized` to start this new motion at the same relative time offset to its total duration as the currently playing motion is to its total duration. The *`playRate`* parameter indicates how fast to play the motion. A value of 2 doubles the speed of the motion. This value is multiplied by the value of the `keyframePlayer.playRate` property. If blending is enabled, blending begins the instant `play()` is called.	Nothing
whichModel.`keyframePlayer.playNext`	Ends the currently playing motion, removes it from the play list, and begins the next motion. If blending is enabled, blending begins the instant `playNext()` is called.	Nothing
whichModel.`keyframePlayer.queue("name", looped, startTime, endTime, playRate)`	Adds the specified motion to the end of the play list. The parameters are same as those for the `play()` command.	Nothing
whichModel.`keyframePlayer.removeLast()`	Removes the most recently added motion from the play list. The motion will be removed from the play list even if it is also the currently playing motion.	Nothing
whichModel.`keyframePlayer.pause()`	Pauses the Keyframe player.	Nothing

Keyframe player properties

Use these properties to work with keyframe animations:

Property	Access	Description	Returns
whichModel.`keyframePlayer.playing`	Get	`TRUE (1)` = playing; `FALSE (0)` = paused.	`TRUE (1)`
whichModel.`keyframePlayer.playList`	Get	A linear list of property lists, where each property list yields the parameters for the currently playing and queued animations. For example, `[[#name: "Walk_rt_turn", #loop: 0, #startTime: 0, #endTime: 4000, #scale: 1.0000], [#name: "Walk", #loop: 1, #startTime: 0, #endTime: -1, #scale: 1.0000]]`.	Empty list `[]`
whichModel.`keyframePlayer.currentTime`	Get and set	Current local time of motion at top of play list, in milliseconds.	`0`

Property	Access	Description	Returns
whichModel. keyframePlayer. playRate	Get and set	A value indicating how quickly or slowly to play back the motion. For example, a value of 2.0 doubles the speed of the motion; a value of 0.5 halves the speed of the motion. This value is multiplied by the value of the *playRate* parameter of the play or queue command.	1.0
whichModel. keyframePlayer. playList.count	Get	Current number of motions in the play list.	0
whichModel. keyframePlayer. rootLock	Get and set	TRUE (1)= root translational component of the model remains at its referenced unanimated position (and therefore cannot disappear offstage).	FALSE (0)
whichModel. keyframePlayer. currentLoopState	Get and set	TRUE (1)= animation loops; FALSE (0)= animation plays through once.	FALSE (0)
whichModel. keyframePlayer. blendTime	Get and set	Length in milliseconds of the period when blending takes place between motions. The blendTime property is linked to motion duration. Motion blending is disabled if blendTime = 0 and autoBlend = TRUE.	500
whichModel. keyframePlayer. autoBlend	Get and set	If TRUE, automatic linear blending (from 0.0 to 100.0) is applied over the blend time. Otherwise, blendTime is ignored, and the amount of blending is user-determined by the blendFactor property.	TRUE (1)
whichModel. keyframePlayer. blendFactor	Get and set	The degree of blending between motions, expressed as a floating-point value between 0.0 and 100.0. A value of 0.0 uses all the previous motion. A value of 100.0 uses all of the next motion. The blendFactor can be changed frame by frame to create custom blending effects.	0
whichModel. keyframePlayer. positionReset	Get and set	TRUE (1) = object returns to starting position at end of animation; FALSE (0) = object remains at final animation position, and begins again from there if looping is on.	TRUE (1)

Property	Access	Description	Returns
whichModel. keyframePlayer. rotationReset	Get and set	Normally a model snaps back to its original rotation after a motion finishes playing. This property maintains any or all of the rotational changes after playing is complete. The values are as follows: #none #x #y #z #xy #xz #all	#all

whichModel.
keyframePlayer.
lockTranslation
	Get and set	Defines the axis of translation to ignore when playing back a motion.
		The values are as follows:
		#none
		#x
		#y
		#z
		#xy
		#xz
		#all
		To keep a model locked to a ground plane with the top pointing along the *z*-axis, set lockTranslation to #z.
		LockTranslation = #all is equivalent to rootLock = TRUE (1).
			#none

Keyframe player events

These events are generated by keyframe animations:

Event name	Description
#animation Started	This is a system-defined notification event triggered when a motion begins playing. If looping is on, this event is triggered only by the first playthrough. During a blend of two animations, this event will be triggered as the blend begins.
#animationEnded	This is a system-defined notification event triggered when a motion ends. If looping is on, this event is triggered only by the first playthrough. If blending is on, this event will be generated for the first animation when the blend is complete. There may be some latency because of the overhead of scheduling all other Director events.

Mesh deform modifier properties

The mesh deform modifier lets you alter an existing model resource's geometry at runtime. You can create twist, bend, and ripple effects. Unlike other modifiers, the mesh deform modifier directly affects model resources as well as the models that use those resources. For example, if three car models share the same model resource, adding this modifier to one model and then deforming it will deform all the car models.

The mesh deform modifier is complex and is primarily useful for users with a thorough understanding of 3D geometry. However, you can take advantage of much of the modifier's potential by using only the vertexList property.

Use these properties to work with the mesh deform modifier:

Property	Access	Description
whichModel.meshDeform.mesh.count	Get	Returns the number of meshes in a model.
whichModel.meshDeform.mesh[index].vertexList	Get and set	Returns a list of the vertices for the specified mesh. To modify the vertices in this mesh, set this property to a list of modified vertex positions, or modify individual vertices using bracket analysis.
whichModel.meshDeform.mesh[index].normalList	Get and set	Returns a list of the normals for the specified mesh.
whichModel.meshDeform.mesh[index].textureCoordinateList	Get and set	Returns a list of the texture coordinates for the specified mesh.
whichModel.meshDeform.mesh[index].face.count	Get	Returns the number of triangular faces in a given mesh.
whichModel.meshDeform.mesh[index].face.[index]	Get	Returns a list of three indexes into the vertex, normal, texture coordinate, and color lists. These indexes correspond to the corners of the face for the specified mesh.
whichModel.meshDeform.mesh[index].face[index].neighbor[index]	Get	Returns a list of lists describing the neighbors of a particular face of a mesh opposite the face corner specified by the neighbor index (1,2,3). If the list is empty, the face has no neighbors in that direction. If the list contains more than one list, the mesh is nonmanifold. This is rare. Usually the list contains four integer values. The first value is for the index into the mesh[] list, where the neighbor face lives. The second is FaceIndex, the index of the neighbor face in that mesh. The third is vertexIndex, the index within the neighbor face. The last is for Flipped, which describes whether the neighbor face is oriented in the same (0) or the opposite (1) way as the original face.
whichModel.meshDeform.face.count	Get	Returns the total number of faces in the model, which is equivalent to the sum of all the *model*.meshDeform.mesh[*index*].face.count properties in a given model.

Motions

Motions are simply animations that have been predefined in a 3D modeling application. They are included in the file that's exported from the 3D application and imported into Director.

Motions can be reused on any model in the 3D cast member, as long as the motion is appropriate to the geometry of the model. The Lingo that follows can be used with either keyframe or bones motions.

Motion properties

Use these properties to work with motions:

Property	Access	Returns
`name`	Get	Name of motion.
`duration`	Get	Time in milliseconds motion needs to play to completion.
`type`	Get	The type of motion with the following values: `#keyFrame`: suitable for use with the Keyframe player `#bones`: suitable for use with the Bones player `#none`: no mapping has been made for this motion The default is `#none`.

Motion commands

Use this command to work with motions:

Command	Description
`map(motion, "bone name")`	Maps the given motion into the current motion beginning at the named bone. If no bone name is specified, the mapping begins at the root bone. The `map()` command will replace any motion tracks mapped previously to the specified bone and all of its children. Motion mapping has no effect on motions that are already on a play list.

About lights and cameras

Lights illuminate the 3D world and the models in it. Without lights, the world exists, and actions can take place, but users see nothing. You can add lights to your 3D world in your 3D modeling application or with the Macromedia Director MX Property inspector. For information on the Property inspector, see Chapter 17, "3D Basics," on page 443. You can also add and remove lights, change their color or position, and manipulate their parent-child relationships using Lingo commands and properties. Those commands and properties are detailed here. You can find the same lighting commands and properties, with more detailed syntax and coding examples, in the *Lingo Dictionary* (Help > Lingo Dictionary).

Cameras act as windows into a 3D world. Each camera that exists in a 3D cast member offers a different view into it, and each sprite that uses a 3D cast member uses one of these cameras. A camera's position can be moved with the Property inspector or the Shockwave 3D window. You can also use the Director 3D behaviors or Lingo to manipulate camera positions. For information on the Property inspector and the Shockwave 3D window, see Chapter 17, "3D Basics," on page 443. For information about behaviors, see Chapter 18, "The 3D Cast Member, 3D Text, and 3D Behaviors," on page 455. More complex manipulations require the use of Lingo commands and properties. These are detailed here and in the *Lingo Dictionary* (Help > Lingo Dictionary). Accessing the properties and commands of a light or camera requires that the light or camera be on the Stage or explicitly loaded with the `preLoad()` or `loadFile()` command.

Lights and cameras have the same `transform` methods and parent-child properties as models and groups. Lights and cameras can be added, deleted, cloned, moved, and rotated in the same ways as models and groups. You can access their names, parents, children, and other properties in the same way you would with models and groups. However, there are some important differences, which arise from the specific roles that lights and cameras play in the 3D world.

Light properties

Use these properties to work with lights:

Property Name	Access	Description	Default
`name`	Get	Unique name of this light. If the light was exported from a 3D modeling package, the name is the name assigned there.	None
`parent`	Get and set	The model, light, camera, or group that is this light's parent. If the light has no parent, it cannot contribute light.	`Group ("World")`
`child.count`	Get	Number of immediate children (no grandchildren) that the light has.	0
`transform`	Get and set	Lingo transform object representing light's position relative to its parent's transform. The `transform.position` gives the relative position; `transform.rotation` gives the relative rotation.	Identity transform
`userData`	Get and set	A property list associated with this light. The list defaults to the properties assigned in the 3D modeling tool, but users can add or delete properties at any time.	Properties assigned in 3D modeling tool
`type`	Get and set	The kind of light this is. Must be one of the following: `#ambient`: applied to all sides of the model `#directional`: applied to those parts of the light facing the light's direction. Distance to the light isn't important. `#point`: Like a bare light bulb, omnidirectional and illuminating all parts of the model facing the light `#spot`: Like a spotlight, casting light on model parts that face it, with brighter illumination the closer the model is. Similar to `#directional`, except that the apparent distance from the light is taken into account.	None
`color`	Get and set	Lingo color object defining color and intensity. Ranges from rgb(255,255,255), which is pure white to rgb(0,0,0), which is no light at all.	`rgb(191,191, 191)`
`spotAngle`	Get and set	Angle of the light's projection cone. If type equals `#spot`, setting a value less than the umbra causes a Lingo "property not found" error.	`90.0`
`attenuation`	Get and set	A three-value vector controlling the constant, linear, and quadratic attenuation factors for spotlights.	`vector (1.0,0.0,0.0 )`
`specular`	Get and set	`TRUE (1)`/`FALSE (0)` value that controls whether or not the light produces specular effects on surfaces. The property is ignored for ambient lights. Although `TRUE (1)` is the default, switching to `FALSE (0)` may improve performance.	`TRUE (1)`

Property Name	Access	Description	Default
spotDecay	Get and set	TRUE (1)/FALSE (0) value that controls whether or not spotlight intensity falls off with camera distance.	FALSE (0)
pointAt Orientation	Get and set	Two orthogonal vectors (objectRelativeDirection and objectRelativeUp) controlling how the light's pointAt command works.	None
boundingSphere	Get	A list containing a vector and a floating-point value, with the vector representing the position and the value the radius of a bounding sphere surrounding the light and all its children.	[vector (0,0,0), 0.0]
worldPosition	Get and set	Position of the light in world coordinates. Shortcut for the command node.getWorldTransform ()position.	Vector object

Light commands

Use these commands to work with lights:

Command	Description	Returns
addChild (aNode, preserveWorld)	Adds the node *aNode* to this light's list of children. An equivalent operation is to set *aNode.parent = this light*. The *preserveWorld* argument is optional. It can have two values: #preserveWorld or #preserveParent. If the value is #preserveWorld, the world transform of the child being added remains intact. If #preserveParent, the child's transform is interpreted as remaining parent-relative.	Nothing
child[index]	Returns the child at the specified position in the index.	Lingo light object
child(name)	Returns a reference to the named child.	Lingo light object
clone(name)	Clones a light named *name*, adds it to light's parent's child list, and adds it to the world. All children of the light are automatically cloned.This can be avoided by removing the children, performing the cloning operation, and then adding the children back. If the name is omitted or is "", the clone isn't added to the light palette, has no parent, and has no children. This option lets you quickly create temporary light instances.	Lingo light object
cloneDeep (name)	Clones both the light and all resources used by the light's children.	Lingo light object
addtoWorld()	Adds light to currently active 3D world, setting its parent as "world". Equivalent to: light.parent = member ("scene").light("world"). All newly created lights are added to the world by default, without it being necessary to use this command.	Nothing
removeFrom World()	For lights whose parent hierarchy terminates in the world, this sets their parent to void and removes them from the world. Otherwise it does nothing.	Nothing
isInWorld()	For lights whose parent hierarchy terminates in the world, the value is TRUE (1).	TRUE (1) or FALSE (0)

Command	Description	Returns
`registerScript (eventName, handlerName, scriptInstance)`	Registers a handler named *handlerName* that is called in the instance *scriptInstance* when the event *eventName* occurs. If *scriptInstance* is 0, a movie script handler called *eventName* is called. The user defines what *eventName* is.	`TRUE (1)` or `FALSE (0)`, with `TRUE (1)` indicating that the event happened and `FALSE (0)` that it did not
`translate (xIncrement, yIncrement, zIncrement, relativeTo)`	Moves the light forward by *xIncrement* along the *x*-axis, *yIncrement* along the *y*-axis, and *zIncrement* along the *z*-axis. The *relativeTo* parameter is optional. It determines how arguments are interpreted. The possible values are as follows: `#self`: the default. Increments are applied relative to the light's local coordinate system. `#parent`: increments are relative to the light's parent's coordinate system. `#world`: increments are relative to the world's coordinate system. Equivalent to `#parent` if the parent is the world. `node` (model, light, camera, or group): increments are relative to the argument's coordinate system.	Nothing
`translate (direction Vector, relativeTo)`	Moves the light `directionVector.length()` in the direction of the vector *directionVector*. The *relativeTo* argument is optional and defaults to `#self`.	Nothing
`translate(x,y,z, relativeTo)`	Moves the light distance *x* along the *x*-axis, distance *y* along the *y*-axis, and distance *z* along the *z*-axis. The *relativeTo* argument is optional and defaults to `#self`. This command can also be written as translate `(vector(x,y,z) relativeTo)`	Nothing
`rotate(x,y,z, relativeTo)`	Rotates the light by *x* degrees around the *x*-axis, *y* degrees around the *y*-axis, and *z* degrees around the *z*-axis. The *relativeTo* argument is optional and defaults to `#self`. If included, it defines the coordinate space of the axes. This command can also be written as rotate `(vector(x,y,z) relativeTo)`	Nothing
`rotate (position, axis, angle, relativeTo)`	Rotates the light around the axis vector in the specified position the specified number of degrees. The *relativeTo* argument is optional and defaults to `#self`.	Nothing
`pointAt(world Position, worldUp)`	Rotates the light until it points at the world-relative position *worldPosition*. The optional *worldUp* argument indicates the position of the light's Up axis. Both the object-relative axes are defined by the `pointAtOrientation` property. Default values are an object-relative forward direction of vector `(0,0,-1)` and an object-relative up direction of vector `(0,1,0)`.	Nothing
`getWorld Transform()`	Calculates and returns a transform that converts object-relative positions for this light into world-relative positions.	A transform object

Cameras

Cameras act as view ports into the 3D world. By default, a newly added camera's view is positioned at the world's origin, the vector (0,0,0), and looks down the negative *z*-axis. Changing a camera's `transform` property affects the camera's position and orientation. When a 3D sprite is created from a 3D cast member, the sprite uses one of the cast member's cameras. Changing the camera that the sprite is using changes what's seen in the sprite.

Cameras can also have overlays and backdrops. Overlays are 2D images drawn in front of the camera's lens. Backdrops are 2D images drawn behind the 3D scene. Backdrops provide a background image for the scene regardless of which way the camera is pointing.

Camera properties

Use these properties to work with cameras:

Property Name	Access	Description	Default
`name`	Get and set	Unique name of this camera. If the camera was exported from a 3D modeling program, the name is the name assigned there.	None
`parent`	Get and set	The model, light, camera, or group that is this light's parent. If the camera has no parent, it cannot contribute light.	`group ("world")`
`child.count`	Get	Number of immediate children (no grandchildren) the camera has.	`0`
`transform`	Get and set	Lingo transform object representing camera's position relative to its parent's transform. The `transform.position` property gives the relative position; `transform.rotation` gives the relative rotation.	Identity transform
`userData`	Get and set	A property list associated with this camera. The list defaults to the properties assigned in the 3D modeling tool, but users can add or delete properties at any time.	Properties assigned in 3D modeling tool
`hither`	Get and set	A specified distance from the camera that defines the near *z*-axis clipping of the view frustum. Objects closer than hither are not drawn.	`5.0`
`yon`	Get and set	A specified distance from the camera that defines the far *z*-axis clipping of the view frustum. Objects farther than yon are not drawn.	`3.403e38`
`rect`	Get and set	The rectangle controlling the screen size and position of the camera, with the coordinates given relative to the upper left corner of the sprite.	`rect(0,0,320,200)`
`projectionAngle`	Get and set	The vertical projection angle of the view frustum.	`30.0`

Property Name	Access	Description	Default
`colorBuffer.clearAtRender`	Get and set	`TRUE (1)` or `FALSE (0)` value indicating whether color buffer is or isn't cleared out after each frame. If value is set to `TRUE (1)`, the effect is similar to the trails ink effect, although it's limited to the redrawing of models within the sprite itself.	`TRUE (1)`
`colorBuffer.clearValue`	Get and set	Lingo color object defining color used to clear out buffer if `colorBuffer.clearAtRender` is `TRUE (1)`.	`rgb(0,0,0)`
`fog.enabled`	Get and set	`TRUE (1)` or `FALSE (0)` value indicating whether camera adds fog to the scene.	`FALSE (0)`
`fog.near`	Get and set	Distance to start of fog.	`0.0`
`fog.far`	Get and set	Distance to maximum fog intensity.	`1000.0`
`fog.color`	Get and set	Lingo color object describing fog color.	`rgb(0,0,0)`
`fog.decayMode`	Get and set	How fog varies between near and far, with the following possible values: `#linear`: density is linearly interpolated between `fog.near` and `fog.far`. `#exponential`: `fog.far` is saturation point; fog.near is ignored. `#exponential2`: `fog.near` is saturation point; `fog.far` is ignored.	`#exponential`
`projection`	Get and set	Method of determining the vertical field of view, which must be of type `#perspective` or `#orthographic`.	`#perspective`
`fieldOfView`	Get and set	A floating-point value specifying the vertical projection angle in degrees.	`30.0`
`orthoheight`	Get and set	The number of perpendicular world units that fit vertically into the sprite.	`200.0`
`rootNode`	Get and set	Property controlling which objects are visible in a particular camera's view. Its default value is the world, so all cameras you create show all nodes within the world. If, however, you change `rootNode` to be a particular node within the world, a sprite of the cast member will show only the root node and its children.	`group ("world")`
`overlay[index].loc`	Get and set	Location, in pixels, of the overlay, as measured from the upper left corner of the sprite's `rect` to the `overlay[`*`index`*`].source's regPoint`.	`point(0,0)`
`overlay[index].source`	Get and set	Lingo texture object used as the source for this overlay.	None
`overlay[index].scale`	Get and set	Scale value used by a specific overlay in the camera's list of overlays.	`1.0`
`overlay[index].regPoint`	Get and set	Texture-relative rotation point, similar to a sprite's `regPoint`.	`point(0.0)`

Property Name	Access	Description	Default
`overlay[index].rotation`	Get and set	Rotation value used by a specific overlay in the camera's list of overlays.	`0, 0`
`overlay[index].blend`	Get and set	Blend value used by a specific overlay in the camera's list of overlays. `100` is fully opaque; `0` is fully transparent.	`100.0`
`overlay.count`	Get and set	Number of overlays in use on this sprite.	`0`
`backdrop[index].loc`	Get and set	Location, in pixels, of the backdrop, as measured from the upper left corner of the sprite's rect to the `backdrop[`*`index`*`].source's regpoint`.	`point(0,0)`
`backdrop[index].source`	Get and set	Lingo texture object used as the source for this backdrop.	None
`backdrop[index].scale`	Get and set	Scale value used by a specific backdrop in the camera's list of backdrops.	`1.0`
`backdrop[index].rotation`	Get and set	Rotation value used by a specific backdrop in the camera's list of backdrops.	`0.0`
`backdrop[index].regPoint`	Get and set	Texture-relative rotation point, similar to a sprite's `regPoint`.	`point(0,0)`
`backdrop[index].blend`	Get and set	Blend value used by a specific backdrop in the camera's list of backdrops.	`100.0`
`backdrop.count`	Get	Number of backdrops in use on this sprite.	`0`
`boundingSphere`	Get	A list containing a vector and a floating-point value, with the vector representing the position and the value the radius of a bounding sphere surrounding the camera and all its children.	`[vector (0,0,0), 0.0]`
`worldPosition`	Get and set	Position of the camera in world coordinates. Shortcut for the command `node.getWorldTransform ()position`.	Vector object

Camera commands

Use these commands to work with cameras:

Command	Description	Returns
`addChild(aNode, preserveWorld)`	Adds *aNode* to this camera's list of children. An equivalent operation is to set `aNode.parent` to equal *thisCamera*. The *preserveWorld* argument is optional.I t can have two values: `#preserveWorld` or `#preserveParent`. If the value is `#preserveWorld`, the world transform of the child being added remains intact. If `#preserveParent`, the child's transform is interpreted as remaining parent-relative.	Nothing
`child[index]`	Returns the child at the specified position in the index.	Lingo camera object
`child(name)`	Returns the child named *name*.	Lingo camera object
`clone(name)`	Clones a camera named *name*, adds it to the cameras's parent's child list, and adds it to the world. All children of the camera are automatically cloned.This can be avoided by removing the children, performing the cloning operation, and then adding the children back. If the name is omitted or is `""`, the clone isn't added to the camera palette, has no parent, and has no children. This option lets you quickly create temporary camera instances.	Lingo camera object
`cloneDeep(name)`	Clones both the camera and all resources used by the camera's children.	Lingo camera object
`addtoWorld()`	Adds a camera to the currently active 3D world, setting its parent as `"world"` Equivalent to camera.parent=member `("scene").camera("world")`. All newly created cameras are added to the world by default, without it being necessary to use this command.	Nothing
`getWorld Transform()`	Calculates and returns a transform that converts object-relative positions for this light into world-relative positions.	A transform object
`removeFrom World()`	For cameras whose parent hierarchy terminates in the world, this sets their parent to `void` and removes them from the world. Otherwise it does nothing.	Nothing
`isInWorld()`	For cameras whose parent hierarchy terminates in the world, the value is `TRUE (1)`.	`TRUE (1)` or `FALSE (0)`
`registerScript (eventName, handlerName, scriptInstance)`	Registers a handler named *handlerName* that is called in the script *scriptInstance* when the event *eventName* occurs. If *scriptInstance is 0*, a movie script handler called *eventName* is called. The user defines what *eventName* is.	`TRUE (1)` or `FALSE (0)`, with `TRUE (1)` indicating that the event happened and `FALSE (0)` that it did not

Command	Description	Returns
`translate (xIncrement, yIncrement, zIncrement, relativeTo)`	Moves the camera forward by *`xIncrement`* along the *x*-axis, *`yIncrement`* along the *y*-axis, and *`zIncrement`* along the *z*-axis. The *`relativeTo`* parameter is optional. It determines how arguments are interpreted. The possible values are as follows: `#self`: the default. Increments are applied relative to the camera's local coordinate system. `#parent`: increments are relative to the camera's parent's coordinate system. `#world`: increments are relative to the world coordinate system. Equivalent to *`#parent`* if parent is the world. `node` (model, light, camera, or group): increments are relative to the coordinate system of the argument.	Nothing
`translate (direction Vector, relativeTo)`	Moves the camera *`directionVector.length()`* in the direction of the directionVector. The relativeTo argument is optional and defaults to `#self`.	Nothing
`translate(x,y,z, relativeTo)`	Moves the camera distance *x* along the *x*-axis, distance *y* along the *y*-axis, and distance *z* along the *z*-axis. The *`relativeTo`* argument is optional and defaults to `#self`. This command can also be written as `translate(vector(x,y,z) relativeTo)`.	Nothing
`rotate(x,y,z, relativeTo)`	Rotates the camera by *x* degrees around the *x*-axis, *y* degrees around the *y*-axis, and *z* degrees around the *z*-axis. The *`relativeTo`* argument is optional and defaults to `#self`. If included, it defines the coordinate space of the axes. This command can also be written as rotate`(vector(x,y,z) relativeTo)`	Nothing
`rotate (position, axis, angle, relativeTo)`	Rotates the camera around the axis vector in the specified position the specified number of degrees. The *`relativeTo`* argument is optional and defaults to `#self`.	Nothing
`pointAt(world Position, worldUp)`	Rotates the camera until it points at the world-relative position *`worldPosition`*. The optional *`worldUp`* argument indicates the position of the camera's Up axis. Both the object-relative axes are defined by the `pointAtOrientation` property. Default values are an object-relative forward direction of `vector (0,0,-1)` and an object-relative up direction of `vector (0,1,0)`.	Nothing
`getWorld Transform()`	Calculates and returns a transform that converts object-relative positions for this camera into world-relative positions.	A transform object

CHAPTER 20
Controlling the 3D World

Macromedia Director MX provides powerful methods for overall control of the three-dimensional (3D) world, including Lingo for handling new 3D-generated events, selecting models (picking), vector math operations, and transforms. In addition, the properties and methods of the Director global renderer services object supply common rendering properties for all 3D sprites and cast members. Finally, 3D cast member and sprite properties and commands allow additional control of their content during playback.

You can also find the commands and properties given here in tabular form in alphabetical form, with accompanying syntax, definitions, and examples, in the *Lingo Dictionary* (Help > Lingo Dictionary).

3D Lingo events

Event handling lets you use the `registerForEvent` command to specify a handler to run when a particular event occurs within a specific cast member. With the `registerForEvent` command you specify the type of event that will trigger the handler, the handler name, and the script object that contains the handler. The script object can be a child script, an instance of a behavior attached to a sprite, or any other script. If the script object isn't specified, the handler is called in the first movie script in which it is found.

Use these commands to set up event handling:

Command	Description	Returns
`registerForEvent (eventName, handlerName, scriptInstance, model)`	The event *eventName* is one of the following: `#collideAny`: Called when any collision occurs. `#collideWith`: Called when a collision with a specific model occurs and implicitly registered when `setCollisionCallback(...)` is called. Equivalent to calling `model.collision.setCollision Callback`. `#timeMS`: Sets up a time-based simulation callback using the format `registerForEvent (timeMS, handlerName, scriptInstance) begin, period, repetitions`. The *begin* and *period* arguments are in milliseconds. If *repetitions* is set to 0, the simulation continues indefinitely. `#animationStarted`: Called whenever a keyFrame or bones motion begins. `#animationEnded`: Called whenever a keyFrame or bones motion ends. Any user-defined symbol: Registers to receive any user-defined event sent from a SendEvent call.	`TRUE (1)` if the operation succeeds. `FALSE (0)` if the operation fails.
`unregister AllEvents()_`	Unregisters all events.	Nothing. A Lingo error is generated if the operation fails.
`sendEvent (eventName, arg1,arg2...)`	Sends an event named *eventName* to all scripts registered to receive it. Similar to `sendAllSprites()` except that the event is delivered only to scripts that are registered to receive it.	Nothing. A Lingo error is generated if the operation fails.

Collisions

By attaching the collision modifier (`#collision`) to a model, you can enable that model to automatically respond to collisions with other models. By using the properties of the collision modifier, you can control the details of how the model responds to collisions. For more information on collisions, see “Modifiers” on page 498.

Collision properties

When a collision occurs, it generates a `collideWith` event.The `collideWith` event passes an argument to the handler that is declared with the `registerForEvent` or `setCollisionCallBack` command. This argument is called a `collisionData` object and contains a property list with detailed information about the collision.

These properties are included in the `collisionData` object passed to the handler:

Property	Access	Description
`modelA`	Get	One model in the collision. If the Lingo script includes registration for collision with a particular model, `modelA` is that model.
`modelB`	Get	The second model in the collision.

Property	Access	Description
pointOf Contact	Get	Vector describing world-space location of collision. Available only if the collision has been resolved. Occurs if the model's collision modifier resolve property is TRUE (1) or either the collisionData resolveA() or collisionData resolveB() method is called.
collision Normal	Get	Vector indicating direction of collision. Available only if the collision has been resolved. Occurs if the model's collision modifier resolve property is TRUE (1) or either the collisionData resolveA() or collisionData resolveB() method is called.

Collision commands

Collision commands allow you to override certain aspects of the default behavior set for models during collisions. If neither of the models involved in the collision has resolve set to TRUE, you can manually resolve the collision using resolveA(true) for model A or resolveB(true) for model B.

Command	Description	Returns
collisionData.resolveA (trueOrFalse)	Resolves collision for model A.	Nothing
collisionData.resolveB (trueOrFalse)	Resolves collision for model B. If the argument is FALSE (0), the collision won't be resolved. This overrides the collision.resolve property, if any, set for model B.	Nothing

Selecting models

Selecting models (picking) refers to clicking on models in a 3D cast member. Because models are objects that exist within a 3D cast member and a 3D sprite, they are not normally sensitive to mouse clicks. Normally it is only the entire sprite that is sensitive to mouse clicks.

You can use Lingo to determine specifically which models have been clicked when a user clicks within a 3D sprite. In practice, this allows for changing model positions to make it appear that an action such as a button being pushed or a door being opened has taken place. Picking can be accomplished using cast member or camera commands.

Camera commands

These camera functions allow you to determine which models have been clicked when a user clicks the mouse within a 3D sprite. You can also translate coordinates in 3D space to coordinates in 2D sprite space and vice versa.

Function	Description	Returns
`worldSpaceTo SpriteSpace (vector)`	Returns the 2D sprite-space coordinates of a point from a 3D world vector.	A point.

`spriteSpaceTo WorldSpace (point)`	The opposite of the `worldSpaceToSpriteSpace (vector)`, this function returns a world-space vector on the camera's projection plane from a sprite-space point.
	Multiple world-space positions can map to the same sprite-space point. A round-trip
	`y=worldSpaceToSpriteSpace(x)`
	`z=worldSpaceToSpriteSpace(y)`
	won't necessarily result in `x=z`.
		A vector.

`modelUnder Loc(point)`	Returns the first model intersected by a ray from a location *`point`* within the `rect` of the sprite using this camera. The location *`point`* is relative to the upper left corner of the sprite, in pixels. The ray is cast forward in the direction the camera is looking. This function is useful for picking in conjunction with an `onMouseDown` handler. For accuracy, be sure to subtract the upper left corner of the sprite's `loc` from the `mouseLoc`.	The first model intersected by the ray. A value of `void` means there is no model under the ray.
`modelsUnder Loc(point, optionalMax NumberOf Models)`	Returns a list of all models intersected by a ray from a location *`point`* within the `rect` of the sprite using this camera. The location *`point`* is relative to the upper left corner of the sprite, in pixels. The ray is cast forward in the direction the camera is looking. This function is useful for picking in conjunction with an `onMouseDown` handler. For accuracy, be sure to subtract the upper left corner of the sprite's `loc` from the `mouseLoc`.	The first model intersected by the ray or a list of up to the specified maximum. If no maximum is specified, the command returns all models under the ray. `A value of void` means there is no model under the ray.
`modelsUnder Ray(`location Vector, direction Vector, optionalMax NumberOf Models`)`	Returns a list of models under the ray starting at the vector *`locationVector`* and pointing down the vector *`directionVector`*, with both vectors specified in world-relative coordinates.	The first model intersected by the ray plus a list of up to the specified maximum number of models. If the maximum number of models isn't specified, all models the ray intersects are returned.

Vector math

A 3D vector describes both direction and location in 3D space. Vector objects include floating-point values for position along each of the *x*-, *y*-, and *z*-axes. Vectors can be node-relative or world-relative. If they are node-relative, their *x*, *y*, and *z* values are relative to the position of the node. If they are world-relative, their *x*, *y*, and *z* directions are relative to the world.

Vector math operations perform calculations using each of the *x*, *y*, and *z* values. These calculations are useful for performing intelligent movement and rotation of models.

Vector creation commands

Use these functions to create vectors:

Function	Description	Returns
`vector(x,y,z)`	Creates a vector from arguments representing all axes.	A vector object
`randomVector()`	Creates a vector describing a randomly chosen point on the surface of a unit sphere. Differs from `vector(random(10)/10.0,random(10)/10.0,random(10)/10.0)` because the `randomVector()` method always results in a unit vector.	A unit vector

Vector properties

Use these properties to work with vectors:

Property	Access	Description
`magnitude`	Get	The magnitude of the vector. Equivalent to the length of the vector.
`length`	Get	The length of the vector. Equivalent to the magnitude of the vector.
`[index]`	Get and set	Returns the value of a vector at a specified point in an index between 1 and 3.
`x`	Get and set	The *x* component of a vector.
`y`	Get and set	The *y* component of a vector.
`z`	Get and set	The *z* component of a vector.

Vector commands

Use these commands to work with vectors:

Command	Description	Returns
`normalize()`	Normalizes the vector by modifying it into a unit vector of length 1. This is done by dividing each component of the vector by the vector's original length. That original length is the square root of the sum of the squares of each component.	Nothing. Vector is modified.
`getNormalized()`	Returns a normalized version of the vector.	A new vector object.
`dot(vector2)`	Returns the dot (inner) product of the first vector and the second vector (*`vector2`*). If both vectors are of unit length, the result is the cosine of the angle between the two vectors.	Dot product of the two vectors.
`angleBetween(vector2)`	Returns the angle between *`vector`* and *`vector2`*, in degrees.	Value of the angle in degrees.
`cross(vector2)` or `crossProduct(vector2)` or `perpendicularTo(vector2)`	Returns a vector perpendicular to the original vector and to *`vector2`*.	A new vector object.

Command	Description	Returns
`distanceTo (vector2)`	Returns the distance between *`vector`* and *`vector2`*. If these vectors represent positions in the 3D world, this is the distance between them.	Floating-point value of distance.
`duplicate()`	A copy of the vector.	A new vector object.

Vector binary operations

Use these syntaxes to perform additional vector math calculations:

Operator	Description	Returns
`vector1 +vector2`	Returns a new vector equaling `vector1 +vector2` for *x* equaling 1 through 3.	A new vector object
`vector1 - vector2`	Returns a new vector equaling `vector1 -vector2` for *x* equaling 1 through 3.	A new vector object
`vector1* vector2`	Returns the product of the two vectors.	A floating-point value
`vector1/ vector2`	Not supported.	`0`
`vector2*scalar`	Returns a new vector equaling `vector2 * scalar` for *x* equaling 1 through 3.	A new vector object
`vector2/scalar`	Returns a new vector equaling `vector2/scalar`.	A new vector object
`transform* vector`	Returns a new vector resulting from applying the positional and transformation changes defined by *`transform`* to *`vector`*. Note that vector*transform is an invalid operation.	A new vector object
`scalar-vector1`	Returns a new vector equaling `scalar-vector1`.	A new vector object
`vector1-scalar`	Returns a new vector equaling `vector1-scalar`.	A new vector object
`scalar + vector1`	Returns a new vector equaling `scalar + vector1`.	A new vector object
`vector1 + scalar`	Returns a new vector equaling `vector1 + scalar`.	A new vector object

Transforms

A transform is a data object describing a model's position, orientation, and scale in the 3D world. Transform functions can be used to move a given vector, light, camera, or model from its current location to a new position and/or orientation.

Transform creation function

Use the `transform()` function to create a new `transform` data object:

Function	Description	Returns
`transform()`	Creates a new transform initialized as the identity transform. The identity transform has no rotation and a vector position of `(0,0,0)`	A new transform object

Transform properties

Use these properties to work with transforms:

Property	Access	Description	Default
`position`	Get and set	Lingo vector object describing the position of a transform with the value `vector(xOffset, yOffset, zOffset)`. A model.transform position represents the model's position in relation to its parent.	`vector (0,0,0)`
`scale`	Get and set	Lingo vector object describing the x, y, and z scale of the transform with the vector value `vector(xScale, yScale, zScale)`. Scaling is always applied model-relative.	`vector (1,1,1)`
`rotation`	Get and set	Lingo vector object describing the *xRotation*, *yRotation*, and *zRotation* components of the transform with the value `vector(xRotation, yRotation, zRotation)`, with the rotation values defined in degrees. This value can vary because of the permissible types of transform operation. For example, `translate` followed by `rotate` gives a different value than `rotate` followed by `translate`, and the results can't be differentiated after the fact from the rotational information alone. The `rotate()` and `preRotate()` commands are the preferred way to modify a transform's orientation. Rotation is generally relative to the object's original orientation at the start of the movie.	`vector (0,0,0)`
`axisAngle`	Get and set	A list including a vector and a floating-point value that describes this transform's rotation as an axis/angle pair. The vector represents the direction, and the angle represents the rotation around the vector.	`[vector (1.0000, 0.0000, 0.0000) A]`

`x axis`	Get and set	A vector representing the transform's canonical x axis in transform space. Example:
		`transform.identity()`
		`transform.rotate(0,90,0))`
		`put transform.xaxis`
		`--vector(0,0,-1)`
		Canonical means reduced to the simplest possible mathematical expression.
			`vector (1,0,0)`

Property	Access	Description	Default

`y axis`	Get and set	A vector representing the transform's canonical y axis in transform space. Example:
		`transform.identity()`
		`transform.rotate(90,0,0)`
		`put transform.yaxis`
		`--vector(0,0,1)`
			`vector (0,1,0)`

`z axis`	Get and set	A vector representing the transform's canonical z axis in transform space. Example:
		`transform.identity()`
		`transform.rotate(0,90,0)`
		`put transform.zaxis`
		`--vector(1,0,0)`
			`vector (0,0,1)`

Transform commands

Use these commands to work with transforms:

Command	Description	Returns

`rotate (`xAngle, yAngle, zAngle`)`	Applies a rotation transformation after the current transformation:
	`model.transform.identity()`
	`model.transform.translate(100,0,0)`
	`model.transform.rotate(0,0,90)`
	After this series of transformations, performed in this order, the model's local origin will be at `(0,100,0)`, assuming the model's parent is the world.
		Nothing

`preRotate (`xAngle, yAngle, zAngle`)`	Applies a rotation transformation before the current transformation:
	`model.transform.identity()`
	`model.transform.translate(100,0,0)`
	`model.transform.preRotate(0,0,90)`
	After this series of transformations, performed in this order, the model's local origin will be at `(100,0,0)`, assuming the model's parent is the world.
		Nothing

`rotate (`point, vector, angle`)`	Similar to `transform.rotate(`*`xAngle, yAngle, zAngle`*`)`, except that the arguments are two vectors specifying an axis of rotation as a point and a vector, plus an angle specifying the clockwise rotation around that axis:
	`model.transform.identity()`
	`model.transform.translate(-50,0,0)`
	`model.transform.rotate(vector(100,0,0)`
	`vector(0,1,0))`
	After this series of transformations, performed in this order, the model's local origin will be at `(250,0,0)`, assuming the model's parent is the world.
		Nothing

`preRotate (`point, vector, angle`)`	Similar to `transform.preRotate(`*`xAngle, yAngle, zAngle`*`)`, except that the arguments are two vectors specifying an axis of rotation as a point and a vector, plus an angle specifying the clockwise rotation around that axis.
	`model.transform.identity()`
	`model.transform.translate(-50,0,0)`
	`model.transform.preRotate(vector(100,0,0)`
	`vector(0,1,0))`
	After this series of transformations, performed in this order, the model's local origin will be at `(150,0,0)`, assuming the model's parent is the world.
		Nothing

Command	Description	Returns

`translate (xIncrement,yIncrement,zIncrement)`	Translates the position of the transform relative to the transform's current orientation:
	`model.transform.identity()`
	`model.transform.rotate(0,90,0)`
	`model.transform.translate(100,0,0)`
	After this series of transformations, performed in this order, the model's local origin will be at `(100,0,0)`, assuming the model's parent is the world.
		Nothing

`preTranslate (xIncrement, yIncrement, zIncrement)`	Translates the position of the transform before the current transformation:
	`model.transform.identity()`
	`model.transform.rotate(0,90,0)`
	`model.transform.translate(100,0,0)`
	After this series of transformations, performed in this order, the model's local origin will be at `(0,0,100)`, assuming the model's parent is the world.
		Nothing

`multiply (transform2)`	Alters the original transform by applying the positional/rotational/scaling effects of *transform2* to the original transform. If `transform2` describes a rotation of 90° around the x axis and this transform describes a translation of 100 units in the y axis, `transform.multiply(`*`transform2`*`)` alters this transform so that it describes a translation followed by a rotation.	Nothing
`preMultiply (transform2)`	Alters the original transform by preapplying the positional/rotational/scaling effects of `transform2` to the original transform. If *`transform2`* describes a rotation of 90° around the x axis and this transform describes a translation of 100 units in the y axis, `transform.preMultiply(`*`transform2`*`)` alters this transform so that it describes a rotation followed by a translation.	Nothing
`interpolate (oTransform2, fPercentage)`	Returns a new transform by interpolating from the original transform to *`transform2`* by *`fPercentage`*. The value of `fPercentage` should be between 0 and 100.	A new transform object
`interpolateTo (oTransform2, fPercentage)`	Modifies the existing transform by *`fPercentage`*. The value of *`fPercentage`* should be between 0 and 100.	Nothing
`duplicate()`	Returns a new transform that is a copy of the original transform.	A new transform object
`identity`	Resets the transform to an identity transform: position: `-0,0,0` rotation: `0,00` scale: `1,1,1`	Nothing
`invert()`	Turns the transform into the inverse of its previous position and rotation. If you multiply a vector by a transform, the rotational and positional changes described by the transform are applied to the vector. Inverting the transform and multiplying the vector again restores the vector to its original.	Nothing
`inverse()`	Same as `invert()` except that the original transform is unaffected.	A new transform object

Transform operator

Use the asterisk (*) to multiply two transforms:

Operator	Description	Returns
transform1 * transform2	Returns a new transform that is the product of the two original transforms. Useful for combining the effects of two transforms.	A new transform object

Rendering functionality

The Director global `rendererServices` object encapsulates information about the functionality common to all 3D cast members and sprites in a movie. It provides a single place to query for the 3D mesh generators and modifiers available to all cast members.

Renderer services object properties

The global `getRendererServices()` object contains a property list with the following properties. For example, use the syntax `getRendererServices().renderer` to determine the currently active renderer.

Property	Access	Description	Default
`renderer`	Get and set	The rasterizer library all 3D sprites use to draw themselves. This property must be set before any 3D sprite comes into existence. Its default value is determined by the `preferredRenderer` property of the first cast member loaded from file. This is a run-time property that is not saved. Possible values are as follows: `#openGL`: openGL drivers for a hardware accelerator `#directX7_0`: DirectX7_0 drivers for a hardware accelerator `#directX5_2`: DirectX5_2 drivers for a hardware accelerator `#software`: built-in Director software renderer	None
`renderer DeviceList`	Get	A list of available rasterizer libraries. Possible values are as follows: `#openGL`: openGL drivers for a hardware accelerator `#directX7_0`: DirectX7_0 drivers for a hardware accelerator `#directX5_2`: DirectX5_2 drivers for a hardware accelerator `#software`: built-in Director software renderer	None
`current Renderer`	Get	The rasterizer currently in use. Possible values are as follows: `#openGL`: openGL drivers for a hardware accelerator `#directX7_0`: DirectX7_0 drivers for a hardware accelerator `#directX5_2`: DirectX5_2 drivers for a hardware accelerator `#software`: built-in Director software renderer	None

Property	Access	Description	Default
modifiers	Get	A list of modifiers available for 3D cast members. Possible values are as follows: #lod #toon #sds #bonesPlayer #keyframePlayer #inker #collision #meshDeform	None
primitives	Get	A list of basic 3D shapes available for all 3D cast members. Possible values are as follows: #box #sphere #plane #particle #cylinder	None
textureRenderFormat	Get and set	A four-digit integer identifying the pixel format used for textures on the 3D hardware accelerator card. Adjust this to improved color fidelity or to fit more textures on the card. You can fit twice as many 16-bit textures as 32-bit textures in the same space. If a movie tries to use more textures than will fit on a card at a single time, Director switches to software rendering. Possible values are as follows: #rgba8888: one byte for red, green, blue, and alpha #rgba8880: same as above, without alpha opacity #rgba5650: 16-bit color with no alpha; 5 bits for red, 6 for green, 5 for blue #rgba5550: 16-bit color with no alpha; 5 bits each for red, green, and blue #rgba5551: 5 bits each for red, green, and blue; 1 bit for alpha #rgba4444: 4 bits each for red, green, blue, and alpha	#rgba5551
depthBufferDepth	Get and set	Either 16 or 24, depending on the hardware card. Controls the precision of the hardware depth buffer.	None

Property	Access	Description	Default
colorBuffer Depth	Get	Either 16 or 32, depending on the hardware card. Controls the precision of the hardware output buffer.	None
getHardware Info()	Returns a property list of the specifics of the hardware card (if any) on the client's machine	A property list with the following entries: #Present: TRUE (1) if the card is present; FALSE (0) if the card is absent #vendor-stringname: the vendor name, with a value of Unknown if the name can't be determined #model-stringModel: the name of the model #maxTextureSize[*maxWidth, maxHeight*]: maximum height and width of textures. Textures are reduced in size if they exceed these maximums. #supportedTexturePixelFormat: texture pixel formats supported by card. #textureUnits: number of texture units the card has #depthBufferRange: list of bit-depth resolutions available #colorBufferRange: list of bit-depth resolutions	

Movie properties

Use these properties to control which renderer the movie uses:

Property	Access	Description
the preferred3d Renderer	Get and set	The renderer a particular movie prefers. The default value is #auto, which allows the movie to pick the best available renderer. This property is not the same as the currentRenderer property. The preferred3dRenderer property stipulates which renderer the movie prefers, whereas the currentRenderer property gives the renderer currently in use. The possible values for the preferred3dRenderer property are as follows: #openGL: openGL drivers for a hardware accelerator #directX7_0: DirectX7_0 drivers for a hardware accelerator #directX5_2: DirectX5_2 drivers for a hardware accelerator #software: built-in Director software renderer
the active3D Renderer	Get	The renderer the movie is actually using. Equivalent to the RendererServices object currentRenderer property. Possible values are as follows: #openGL: openGL drivers for a hardware accelerator #directX7_0: DirectX7_0 drivers for a hardware accelerator #directX5_2: DirectX5_2 drivers for a hardware accelerator #software: built-in Director software renderer

Cast member properties

You can control most cast member properties using the Property inspector. For more information, see "Using the Property inspector for 3D" on page 448.

Use the following properties to work with 3D cast members in Lingo:

Property	Access	Description	Default
preload	Get and set	TRUE (1) or FALSE (0) specification of whether the member is preloaded before display and playback or streamed in during playback. This property is only available for linked cast members.	None
animation Enabled	Get and set	TRUE (1) or FALSE (0) specification of whether animation, if any, will play.	TRUE (1)
loop	Get and set	TRUE (1) or FALSE (0) specification of whether animation loops or not.	TRUE (1)
directTo Stage	Get and set	TRUE (1) or FALSE (0) specification of whether rendering occurs directly to the Stage or to the Director offscreen buffer. If TRUE (1), other sprites that intersect with this sprite may flicker. If FALSE (0), rendering layers well, but speed declines.	TRUE (1): rendering occurs directly to the Stage
camera Position	Get and set	Independent *x*,*y*,*z* translation for the default camera with values ranging from *Float_Min* to *Float_Max*.	vector (0.0, 0.0, 250.0)
camera Rotation	Get and set	Independent *x*,*y*,*z* rotation transforms for the default camera with values ranging from *Float_Min* to *Float_Max*.	vector (0.0, 0.0, 0.0)
ambient Color	Get and set	Light applied to entire scene.	rgb(0,0,0)
backColor	Get and set	Background color in all views.	rgb(0,0,0)
directional Color	Get and set	Color of single "default" directional light.	rgb(255, 255,255)
directional Preset	Get and set	Absolute position of the single "default" directional light: #None #TopLeft #TopCenter #TopRight #MiddleLeft #MiddleCenter #MiddleRight #BottomLeft #BottomCenter #BottomRight	#TopCenter
specularColor	Get and set	Specular color of first shader: the color of reflections from the shader.	rgb(255, 255,255)
reflectivity	Get and set	Reflectivity of first shader, with values from 0.0 to 100.0.	0.0
diffuseColor	Get and set	Diffuse color of first shader: the shader's overall color.	rgb(255, 255,255)
textureType	Get and set	Default texture type for world. Values are as follows: #none: no texture #default: use original texture from Shader #member: use image from specified cast member	#default

Property	Access	Description	Default
`texture Member`	Get and set	Name of cast member to use as the source for the default texture when `textureType` is set to `#member`.	No texture
`percent Streamed`	Get	Percentage of file that has been downloaded, with values from `0` to `100`.	None
`bytes Streamed`	Get	Integer number of bytes that have been downloaded, with values from 0 to the size of the file in bytes.	None
`streamSize`	Get	Total size of stream to be downloaded, with values from `0` to the size of the file in bytes.	None
`state`	Get	Current state of streaming. Values are as follows: `0`: unloaded `1`: headerLoading `2`: headerLoaded `3`: mediaLoading `4`: =mediaLoaded `-1`: error Once state `3` or `4` has been reached, it's safe to execute Lingo that manipulates the 3D world. Before then, access to particular models may fail because those model definitions may not have been downloaded. Also, the `loadFile()` cast member method fails except at states `0` or `4`.	None

Cast member commands

The following commands allow you to reset cast member properties to original values they had at the time the cast member was imported into Director:

Command	Description	Returns
`resetToWorldDefault()`	Resets all cast member properties to the values stored in the original 3D world	Nothing
`resetWorld()`	Resets the 3D cast member to the state it was in when the movie first loaded	Nothing

Sprite properties

You can control most sprite properties using the Property inspector. For more information, see "Using the Property inspector for 3D" on page 448. Use the following properties to work with 3D sprites in Lingo.:

Property	Access	Description	Default
`directTo Stage`	Get and set	`TRUE (1)` or `FALSE (0)` specification of whether rendering occurs directly to the Stage or to the Director offscreen buffer. If `TRUE (1)`, other sprites that intersect with this sprite may flicker. If `FALSE (0)`, rendering layers well but speed declines.	`TRUE (1)`: rendering occurs directly to the Stage
`backColor`	Get and set	Background color in all views.	`rgb(0,0,0)`
`camera`	Get and set	Determines which camera this sprite is using.	None

Property	Access	Description	Default
`targetFrameRate`	Get and set	Controls the desired playback speed. If the `useTargetFramerate` property is `TRUE (1)`, then the `lod.bias` property of all model resources is dynamically altered until the target frame rate is met.	`30`
`useTargetFrameRate`	Get and set	If a target frame rate has been set and you want to use it, set this property to `TRUE (1)`.	`TRUE (1)`

Sprite commands

Use these commands to work with 3D sprites:

Command	Description	Returns
`camera(`index`)`	Accesses a specific camera in the sprite's list of views.	The camera requested
`addCamera(`camera, index`)`	Adds a camera named *`camera`* at the specified index number. If the index number is greater than the number of cameras in the sprite's camera count, or if there is no index, the camera is added to the end of the list.	An error if a camera of that name can't be found
`deleteCamera (`cameraOrIndex`)`	If *`cameraOrIndex`* is a camera, the camera by that name is deleted. If *`cameraOrIndex`* is an index number, the camera at that index number is deleted. In either case, the cameras after *`cameraOrIndex`* move forward in the list and the camera count is decreased by 1.	An error if a camera of that name or index number can't be found
`cameraCount()`	Returns the number of cameras in the sprite's `cameraList`.	An integer

CHAPTER 21
Movies in a Window

Macromedia Director MX can play several movies simultaneously by creating windows in which additional movies can play. A movie in a window (MIAW) is a distinct Director movie that retains all its interactivity.

You can use a MIAW to play another movie in a separate window while the main movie plays on the Stage. In addition, movies in windows and the main movie can communicate and interact with each other. This lets you create a variety of interactive features, such as an interactive portfolio, a control panel for a second movie or digital video, or a status display window.

The following list shows the typical workflow for using a movie in a window:

- Create and set up the window.
- Assign a movie to the window.
- Open the window and play the movie.
- Delete the window when the reason for playing the movie no longer applies.

When you create a MIAW, decide how you want it to function. For example, decide how you want to display it, how users should be able to move the window around the screen and dismiss it, and how the window should appear. You can specify the window's size and whether the window is visible, has a frame and title, or is in front of or behind other windows on the screen.

You can create and control movies in windows using behaviors from the Behavior Library or by writing your own Lingo scripts.

Macromedia Shockwave does not support MIAWs. Use MIAWs only with movies that you intend to distribute as projectors (see "About distribution formats" on page 574 and "About projectors" on page 582). However, you can use Lingo to have a Shockwave movie target a URL in a browser window. See "Jumping to a URL" on page 376.

Creating a MIAW using Lingo

In Lingo, you create a MIAW by specifying a window's rectangle (`rect` property) on the Stage and then specifying the filename for the movie that is assigned to the window. You can also make the window visible, change its type, set its title, and set the window's size and location.

The easiest way to create a MIAW is to open a window for an existing movie.

To create a new MIAW by opening a window for an existing movie:

- Use the following Lingo:

```
open window("movieName")
```

This statement creates a window, assigns it the movie `movieName`, and opens it on the Stage at the location where `movieName` was originally authored. You can use the commands that are discussed in the rest of this chapter to set various attributes of the MIAW.

You can also use a movie's filename as the argument for the `open window` command. This approach assigns that movie to a window and instructs Director to use the filename as the window title.

To create a MIAW using a filename and the Open Window command:

- Use the following Lingo:

```
on beginNewMovie theMovie
  global newWindow
  set newWindow to window theMovie
  set newWindow.titleVisible to FALSE
  open newWindow
end beginNewMovie
```

This version of the handler allows the window `newWindow` to use the default setting for its `rect` property. The default is to use the `rect` property of the movie that is being opened in the window.

You can also assign a MIAW to a variable, which makes it easier to write the handler and reuse it.

To assign a MIAW to a variable:

- Use the following Lingo:

```
on beginNewMovie theMovie
  global newWindow
  set newWindow to window "The Big Picture"
  set newWindow.rect to rect(0, 0, 250, 200)
  set newWindow.filename to theMovie
  set newWindow.titleVisible to FALSE
  open newWindow
end beginNewMovie
```

The variable `newWindow` contains a new window named The Big Picture. The handler sets the `rect` property of the window to a `rect` object, and then assigns a movie file to the window. The handler makes the title bar at the top of the window invisible, and opens the window.

Opening and closing a MIAW

Use the commands in this section to open and close movies in windows. For more information, see the *Lingo Dictionary*.

Opening a MIAW

Before you can play a movie in a separate window, you must open the window explicitly with Lingo.

To open a MIAW:

- Use the `open window` command.

Unless Lingo explicitly preloads the movie, Director doesn't load the movie into memory until the window is opened, which can cause a noticeable pause. To load the first frame of the movie, use the `preLoadMovie` command.

You can specify other window characteristics before or after you open the window.

Closing a MIAW

You can close the window for a MIAW but leave the movie in memory, or you can close the MIAW and remove the movie from memory when it's no longer in use.

- If you leave a MIAW in memory, you get better performance if the window is reopened; however, the movie still consumes memory. You might want to use this option if you expect a MIAW to be reopened after it initially runs, or if other windows or global variables refer to the MIAW.
- If you remove a MIAW from memory, performance slows down if the window is reopened, because the movie has to reload; however, it doesn't consume memory until the movie is reloaded. You might want to use this option if you don't expect a MIAW to be reopened after it initially runs or if you want to optimize memory on the computer running the MIAW.

To close a MIAW but keep it in memory:

- Use the `close window` command. After the window is closed, the window becomes invisible, but the movie continues playing. See `close window` in the *Lingo Dictionary*.

To close a MIAW and remove it from memory:

- Use the `forget window` command. The window is closed, and the movie is removed from memory. Use this command only if no other window or global variables still refer to the MIAW. See `forget window` in the *Lingo Dictionary*.

Setting the window type for a MIAW

You can select from the following seven styles of windows:

- Four document window styles: the standard document window, a document window with a zoom box and variable resize box, a document window with the variable resize box disabled, and a document window without a resize box
- An alert box style
- A plain box style
- A curved-border style

To specify the window type for a MIAW:

- Assign a value for the `windowType` property.

Different numerical values for the `windowType` property specify different types of window styles. When you don't specify a window type, Director uses a movable, sizable window without a zoom box and with a title bar, which is type -1. You can set the title property only for windows of type -1.

In most cases, it's best to specify window settings before you open the window to avoid delays as the window redraws.

See `windowType` in the *Lingo Dictionary*.

Setting the window size and location for a MIAW

Setting the screen coordinates for a MIAW lets you control the size of the window and where it appears. Setting the coordinates before the movie appears controls the initial position of the window; setting them after the window appears moves the window.

To specify the screen coordinates for a MIAW:

Set the `rect` property to the coordinates of the location where you want the window to appear, selecting from the following options:

- Define the coordinates as a rectangle in this order: left, top, right, and bottom, as shown in the following statement:

```
set window.rect "Sample" = [0, 0, 200, 300]
```

- Use the `rect()` function to define the window rectangle's four coordinates, as shown in the following statements:

```
set aRect = rect(0, 0, 200, 300)
set window.rect "Sample" = aRect
```

  For your convenience, assign the coordinates to a variable and use the variable in your Lingo statements.

See `rect(window)` and `rect()` in the *Lingo Dictionary*.

Cropping and scaling a MIAW

You can use Lingo to crop or scale a MIAW.

To crop a MIAW:

- Set the `rect` window property to an area that is smaller than the MIAW. See `rect(window)` in the *Lingo Dictionary*.

To scale a MIAW:

- Set the `drawRect` property to coordinates that are smaller than the MIAW's original size and apply the position to the window, as shown in the following example:

```
set aRect = [0, 0, 200, 300]
set window("Sample").drawRect = aRect -- sets window size to 200 x 300
set window("Sample").drawRect = aRect/2 -- scales the window to half its
  original size
```

When the `drawRect` property specifies a window rectangle that is smaller than the movie, the window appears in the upper left corner, and the movie is compressed to fit within the window. See `drawRect` in the *Lingo Dictionary*.

Controlling the appearance of a MIAW

You can use Lingo commands and properties to control whether a window is visible, is in front of or behind other windows, and has a title. For more information, see the *Lingo Dictionary*.

To specify whether the window is visible:

- Set the window's `visible` window property. To avoid a potential time lag when the window opens, use the `preLoadMovie` command to preload the movie before it's needed and then open the window when it needs to be visible. See `visible (window property)` in the *Lingo Dictionary*.

To control whether a movie appears in front of or behind other windows:

- Use the `moveToFront` and `moveToBack` commands. See `moveToFront` and `moveToBack` in the *Lingo Dictionary*.

To assign a title to a window:

- Set the `title` window property. See `title` in the *Lingo Dictionary*.

Listing the current movies in windows

The `windowList` property displays a list of all known MIAWs in the main movie.

For example, the following statement displays a list of current MIAW names in the Message window.

```
put the windowList
```

See windowList in the *Lingo Dictionary*.

Controlling interaction between MIAWs

Movies can interact with each other by sending Lingo messages back and forth. This lets movies share current values for variables, share information about current conditions, and send each other Lingo instructions.

Global variables can be declared in the main movie (the Stage) or in a MIAW. No matter where they are declared, they are available to the main movie and to all movies that are playing in windows. For more information about global variables, see "Using global variables" on page 403.

At times, you might want only one movie to respond when the user clicks the mouse or types on the keyboard. To control when Director can respond to any events that occur outside a window, set the `modal` window property. When a window's `modal` property is set to `true`, no other window, including the Stage, can respond to events such as mouse clicks and keystrokes.

To have a MIAW send a Lingo statement:

- Use the `tell` command. See `tell` in the *Lingo Dictionary*.

When using the `tell` command, be sure to specify the MIAW to which the instructions are directed. When you want a MIAW to send a Lingo message to the main movie, use `the stage` to refer to the main movie. For example, the statement `tell the stage to go to "Help"` instructs the main movie to go to the frame marked Help in the main movie.

To have a MIAW open another MIAW:

- In Lingo, only the main movie (the Stage) can open a MIAW. Therefore, to have one MIAW open another MIAW, you must use the `tell` command in the running MIAW to tell the Stage to open another MIAW.

For example, this statement in a MIAW tells the Stage movie to open the movie menuMovie in its own window:

```
tell the stage to open window "menuMovie"
```

See `tell` in the *Lingo Dictionary*.

Controlling events involving MIAWs

Lingo provides event handlers for typical events that can occur while a MIAW is playing, such as the movement of a window by the user. Such a handler is a good place for instructions that you want to run in response to an event that involves a window.

For example, to cause a sound to play whenever the user closes a MIAW, use the `queue()` and `play()` functions in an `on closeWindow` handler in a movie script within the movie that plays in the window. The `on closeWindow` handler will run whenever the MIAW that contains the handler closes.

See "Movies in a Window" in the "Lingo by Feature" section of the *Lingo Dictionary*.

CHAPTER 22
Using the XML Parser Xtra

The XML Parser Xtra lets Macromedia Director MX movies read, parse, and use the contents of Extensible Markup Language (XML) documents. Using the XML Parser Xtra requires that you understand the structure and content of the documents you are parsing. You can then access the XML document's contents through Lingo or convert the contents to a Lingo list that is meaningful to you and your movie. After your movie has read an XML document, it can perform actions that you define based on the contents of the document.

For example, an XML document might describe the structure of a molecule for an educational chemistry application. After the movie has parsed the XML that describes the molecule, it can use that information to draw an accurate visual representation of the molecule on the screen. In this case, the movie must be programmed to know ahead of time that the XML document describes a molecule and not a grocery list, in order to make logical use of it.

About XML

XML is similar to HTML in that it uses markup tags to define content. However, HTML has predefined tags that you can use to format any data. Any application that reads HTML must understand the meaning of tags such as `TITLE`, `P`, and `BODY`. HTML tags also describe how information appears on the screen. XML, on the other hand, consists of a set of rules that let you define custom tags and the type of data they can contain, and it has no visual component. With XML, there is no predefined way to display any given type of data such as molecular structures or grocery lists. An XML document is merely a container for the data.The Director developer, by knowing what kind of data the XML document contains, can make intelligent decisions about what the Director movie should do with the information.

One key advantage of XML over a regular text document is that XML is not order-dependent. If an application refers to the third item in a line of data, inserting new data or making subsequent changes to the way the data is produced could cause the application to fail. With XML, you can refer to the individual data components by name. If you insert a new chunk of data before the one in use, the name is still valid. Existing code continues to work, and the newly inserted data is ignored.

There are many sources of information for understanding, creating, and editing XML on the Internet. The following websites offer useful information about XML:

- www.xml.com
- www.ucc.ie/xml/
- www.w3.org/TR/REC-xml
- www.w3.org/DOM/

Using XML parser objects

The XML Parser Xtra lets Director developers access the nodes of an XML document. A node can be a tag (similar to an HTML tag, also called an element), character data (text that does not appear inside the angle brackets of a tag), or a processing instruction (a special type of tag that passes data to the parsing application for special processing). You can extract information from the XML document by looking at its nodes with Lingo. This access to XML data lets users incorporate XML documents into their movies and selectively extract data from the documents.

An XML document is well formed if it has a coherent nesting structure and no misplaced angle brackets. Some XML documents can be associated with a document type declaration (DTD) file that describes specific rules for the XML tags the document uses. The XML parser of the Xtra checks that the XML follows the general rules of creating and using XML tags to ensure that the document is well formed. However, the Xtra does not check the DTD file to ensure that the tags follow the specific rules for XML document tags, which is described by the DTD. For this reason, the Xtra is called *nonvalidating*. The creator of the original XML document must follow the rules described in the DTD. Your Director movie should also include Lingo that checks for errors in the use of the XML document's tags.

To use the XML Parser Xtra, create a parser object by using Lingo to assign a new instance of the Xtra to a variable. This variable now contains the parser object. Use a global variable if you need to access the XML data from anywhere in the Director movie.

```
global gParserObject
gParserObject = new(xtra "xmlparser")
```

The next step is to parse the XML data using the `parseString()` command. The data can come from the text of a cast member or a string variable. To parse XML from a URL, use `parseURL()` instead. `ParseString()` and `parseURL()` return either `VOID`, which indicates that the command is successful, or an error code that indicates a problem with the XML data.

The following Lingo statement sets the variable `errCode` to the return value of the `parseString()` command:

```
errCode = gParserObject.parseString(member("XMLtext").text)
```

After the XML Parser Xtra parses the data, the parser object contains all the data from the XML document.

The XML data can be considered a tree structure because most documents have tags nested within other tags, with each tag being like a branch of the tree.

The following example shows a short XML document:

```
<?xml version="1.0"?>
<e1><tagName attr1="val1" attr2="val2"/><e2>element 2</e2><e3>element 3</e3>
  </e1>
```

The following example is the same XML with its tree structure shown more clearly:

```
<?xml version="1.0"?>
  <e1>
    <tagName attr1="val1" attr2="val2"/>
    <e2>element 2</e2>
    <e3>element 3</e3>
  </e1>
```

There are two ways to access a parsed XML document. You can use the `makeList()` command to convert the document into a nested property list and use Lingo's list-access commands, or you can use the special Lingo commands of XML Parser Xtra to access the parsed data directly.

The following Lingo statement uses the `makeList()` command to convert the parsed data to a property list:

```
theList = gParserObject.makeList()
```

If you choose to make a property list with the `makeList()` command, the result is a nested property list, reflecting the tree structure of the XML.

Each element in the document is represented by its own property list, with another property list for each child element that it contains. The name of the element is the property name, and the content of the element is the property value. Attributes of an element are stored in a child list with the name !ATTRIBUTES. The property list of attributes contains the name of each attribute and its value. Character data has the property name !CHARDATA, and the value is the string representation of the character data. A processing instruction is a property with the name !PROCINST; its value is another two-element property list. The first property of this sublist is NAME, and the value is the string that represents the name of the processing instruction. The second property of the sublist has the name TEXT and contains the rest of the text in the processing instruction.

The property list resulting from the previous XML example would look like the following code:

```
["ROOT OF XML DOCUMENT": ["!ATTRIBUTES": [:], "e1": ["!ATTRIBUTES": [:],
  "tagName": ["!ATTRIBUTES": ["attr1": "val1", "attr2": "val2"]], "e2":
  ["!ATTRIBUTES": [:], "!CHARDATA": "element 2"], "e3": ["!ATTRIBUTES": [:],
  "!CHARDATA": "element 3"]]]]
```

The following example is the same property list with its nested structure shown more clearly:

```
["ROOT OF XML DOCUMENT": ["!ATTRIBUTES": [:],
  "e1": ["!ATTRIBUTES": [:],
    "tagName": ["!ATTRIBUTES": ["attr1": "val1", "attr2": "val2"]],
    "e2": ["!ATTRIBUTES": [:], "!CHARDATA": "element 2"],
    "e3": ["!ATTRIBUTES": [:], "!CHARDATA": "element 3"]
  ]
]]
```

Together, the Lingo statements that create a property list from a string of XML data would look like the following example:

```
global gParserObject
gParserObject = new(xtra "xmlparser")
errCode = gParserObject.parseString(member("XMLtext").text)
theList = gParserObject.makeList()
```

After this code has been executed, the variable `gParserObject` contains the parsed node structure of the XML document, and the variable `theList` is a property list that contains all the information in the document broken into property name and value pairs. All the regular Lingo commands and functions for sorting and accessing lists can work normally with `theList`.

Using XML document nodes

The XML document can contain different types of nodes. Each node can contain different kinds of data, depending on the node type. You should check the node type before accessing its data so you know what type of data to expect. Nodes are read-only, so you can retrieve the type, but you cannot set it.

You use Lingo to access the nodes of an XML document. The following table shows the Lingo terms that refer to nodes and their properties:

Node Lingo	Return value if an element	Return value if text	Return value if Processing Instruction
type	`#element`	`#text`	`#procInst`
`name`	String representing the name of the element	VOID	String representing the name of the processing instruction
`child[N]` (N is an integer)	The Nth child node of the node; VOID is returned if no Nth child exists or there is a script error	VOID	VOID
`attributeName[N]` (N is an integer)	String representing the name of the Nth attribute; VOID is returned if no Nth attribute exists or there is a script error	VOID	VOID
`attributeValue[N]` (N is an integer)	String representing the value of the Nth attribute; VOID is returned if no Nth attribute exists or there is a script error	VOID	VOID
`attributeValue[N]` (N is a string)	String representing the value of the attribute with the name N; VOID is returned if the node does not have an attribute named N or there is a script error	VOID	VOID
`text`	VOID	String representing the character data contained in this node	String representing the data section of the processing instruction

Note: The subfield `count` exists for any field that is accessible with bracket access. You can specify `whichNode.child.count` to find how many children are in the specified node.

Using this XML document as a starting point, the following examples demonstrate how to use these Lingo terms to access the data within various node levels of the XML structure.

The XML looks like the following example:

```
<?xml version="1.0"?>
  <e1>
    <tagName attr1="val1" attr2="val2"/>
    <e2>element 2</e2>
    <e3>element 3</e3>
    Here is some text
  </e1>
```

The following Lingo returns the name of the first XML tag:

```
put gParserObject.child[1].name
-- "e1"
```

The `gParserObject` variable contains the parsed XML. When used in the preceding Lingo, it refers to the root node of the XML document. The Lingo term `child[1]` refers to the first level of nested tag, which is the `e1` tag.

To find out what kind of node the first tag is, use the `type` function, as shown in the following example:

```
put gParserObject.child[1].type
-- #element
```

To refer to nodes that are nested more than one level deep, use more than one level of child reference. The following Lingo returns the name of the first tag that is nested within the `e1` tag:

```
put gParserObject.child[1].child[1].name
-- "tagName"
```

The following Lingo returns the name of the second tag that is nested within the `e1` tag:

```
put gParserObject.child[1].child[2].name
-- "e2"
```

To refer to text data that occurs within a particular tag, use the `text` property. The text is a child node of the tag that contains it, so you need an additional level of child reference. This Lingo returns the following string, which appears inside the `e2` tag from the previous XML example:

```
put gParserObject.child[1].child[2].child[1].text
-- "element 2"
```

In this example, the `gParserObject` variable refers to the root node of the XML. The `child[1]` refers to the `e1` tag, which occupies the first level down in the XML's nested structure. The `child[2]` refers to the second tag within the `e1` tag, which is the `e2` tag. The last `child[1]` refers to the text within the `e2` tag, which is `element 2`. Finally, the `text` property is specified, so Lingo returns the text of the node rather than any other property of the node.

The fourth child of the `e1` tag is a line of text that reads `here is some text`. This text is a child the same as the XML tags that precede it. You can get the type of this child the same way you get other children.

The following Lingo returns the type of the fourth child of the `e1` tag:

```
put gParserObject.child[1].child[4].type
-- #text
```

This Lingo returns the text of the fourth child of the `e1` tag, as shown in the following example:

```
put gParserObject.child[1].child[4].text
-- "
     here is some text
  "
```

The text element includes the white space for Return, Space, and Tab characters as well as the string `"here is some text"`.

You can use the Lingo `count` function to determine the number of children that exist at a particular level of the XML structure. The following Lingo returns the number of children at the 2nd level in the previous XML example:

```
put gparser.child[1].child.count
-- 4
```

Accessing attributes

Some XML tags contain attributes with values. Use the Lingo `attributeName` and `attributeValue` properties to access the attributes of tags that have values. In the previous XML example, the first tag nested inside the `e1` tag is called `tagName` and has two attributes called `attr1` and `attr2`.

The following Lingo uses the `attributeName` property to return the name of the first attribute of the tag called `tagName`, which is the first child of the `e1` tag:

```
put gParserObject.child[1].child[1].attributeName[1]
-- "attr1"
```

The following Lingo uses the `attributeValue` property with an integer to return the value of the first attribute of the `tagName` tag:

```
put gParserObject.child[1].child[1].attributeValue[1]
-- "val1"
```

The following Lingo uses the `attributeValue` property with a string to return the value of the `attr1` attribute:

```
put gParserObject.child[1].child[1].attributeValue["attr1"]
-- "val1"
```

The following Lingo uses the `count` function with the `attributeName` property to return the number of attributes in the first child of the `e1` tag:

```
put gParserObject.child[1].child[1].attributeName.count
-- 2
```

Parser objects and XML nodes

As described in earlier sections, the parser object in the `gParserObject` variable stores the root of the parsed tree of the XML document. An XML node is a node within the tree. The root node is like an XML node because almost all the operations on XML nodes can be applied to the root node.

In the previous XML example, the root of the tree is an XML element node named "ROOT OF XML DOCUMENT" that has no attributes and one child (the `e1` tag). You can get the same information about the root node as for any of the child nodes.

The following Lingo returns the root node's type, name, and number of children:

```
put gParser.type, gParser.name, gParser.count(#child)
-- #element "ROOT OF XML DOCUMENT" 1
```

The main difference between the root node and its child nodes is that there are several Lingo commands that apply to the entire XML document and operate on the root node only. These commands include `doneParsing()`, `getError()`, `ignoreWhiteSpace()`, `makeList()`, `parseString()`, and `parseURL()`.

Treating white space

The default behavior of the XML Parser Xtra is to ignore character data between XML tags when all the characters are white space. This type of white space is usually due to Return characters and superfluous space characters, but sometimes it can have meaning to the XML document.

You can use the `ignoreWhiteSpace()` function to change the way the Xtra treats white space. By setting the `ignoreWhiteSpace()` to `FALSE` instead of its default value of `TRUE`, you can tell the Xtra to treat instances of white space as literal data nodes. This way, white space between elements is treated as actual data.

The following Lingo statements leave `ignoreWhiteSpace()` set to the default `TRUE` value, and parse the given XML into a list. The `sample` element has no children in the list.

```
XMLtext = "<sample> </sample>"
parserObj.parseString(XMLtext)
theList = parserObj.makelist()
put theList
-- ["ROOT OF XML DOCUMENT": ["!ATTRIBUTES": [:], "sample": ["!ATTRIBUTES":
  [:]]]]
```

The following Lingo statements set `ignoreWhiteSpace()` to `FALSE`, and parse the given XML into a list. The `sample` element now has a child that contains one space character.

```
XMLtext = "<sample> </sample>"
parserObj.ignoreWhiteSpace(FALSE)
parserObj.parseString(XMLtext)
theList = parserObj.makelist()
put theList
-- ["ROOT OF XML DOCUMENT": ["!ATTRIBUTES": [:], "sample": ["!ATTRIBUTES":
  [:], "!CHARDATA": " "]]]
```

If there are non-white space characters in a !CHARDATA node, all the characters of the node, including leading and trailing white space characters, are retained.

XML and character sets

When you use XML, remember that different computer systems use different binary encoding to represent text characters.

The XML Parser Xtra adheres strictly to the XML specification, which states that XML documents are, by default, encoded using the UTF-8 character set. If the document is not encoded in UTF-8, it must include a declaration of its character set in the first line of the document.

The following XML declares the IOS-8859-1 character set, also known as Latin1:

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
```

This requirement applies to documents parsed by `parseString()` as well as files that are parsed by `parseURL()`.

The XML Parser Xtra supports the following character sets:

- **ISO-8859-1** Also called Latin 1. This is the most common Western encoding used on the web. It matches the default character set used on Windows in most Western countries. It does not match the character set used in most Western versions of the Mac OS (MacRoman) and does not match character sets commonly used in most non-Western countries. The first 127 characters (binary codes 1-127) are the same in most countries.
- **UTF-8** An 8-bit encoding of the Unicode character set. This is the XML default character set.
- **US-ASCII** Supports only 7-bit characters.
- **EUC-JP** The EUC character set, used widely in Japan.
- **SHIFT_JIS** Also used widely in Japan. Shift-JIS is the character set used by default in Japanese versions of Windows and the Mac OS.
- **UTF-16** A 16-bit encoding of the Unicode character set.

For many developers, Latin 1 is the most convenient encoding to use.

CHAPTER 23
Making Director Movies Accessible

As a Macromedia Director MX author, you might want to provide ways for computer users with disabilities to experience the movies that you create. Director includes accessibility features that let you do this. By using these features, you can make existing and new movies accessible to users who have hearing, visual, or mobility impairment.

With Lingo and behaviors, you can add text-to-speech capability to your movies. This lets visually impaired users hear the text in your movie read aloud by the computer. You can provide captioning to help users with hearing impairment experience the audio portions of your movies. Finally, you can enable your movies to be navigated with the keyboard instead of a mouse, which benefits users with certain kinds of mobility impairment.

If you work on projects sponsored by the U.S. government, you might be required to follow government guidelines for providing accessibility to disabled users.

You add accessibility to your Director movies by using the included accessibility behaviors or special Lingo commands. The text-to-speech behaviors and Lingo require the Speech Xtra. If you use text-to-speech in your movie, you need to add the Speech Xtra to your movie's Xtra list. This is discussed in detail in this chapter.

About government requirements

The U.S. government has stated that multimedia created for the purpose of fulfilling a government contract must be made accessible to computer users with disabilities. The government requirements include text-to-speech for the visually impaired, captioning for the hearing impaired, and keyboard navigation for the mobility impaired.

The full text of the government requirements is available at www.section508.gov/.

Making Director movies accessible

You can make your Director movies accessible by adding behaviors or writing custom Lingo scripts. Director includes several behaviors that let you easily add text-to-speech, captioning, and keyboard navigation to your movies with simple drag-and-drop procedures. If you want to have more control over how you implement accessibility in your movies, you can write custom Lingo scripts that use the text-to-speech commands. For more information about text-to-speech Lingo, see "Using accessibility Lingo" on page 559.

Using the Speech Xtra

The Speech Xtra adds special commands to Lingo that enable the Director text-to-speech capability. The text-to-speech behaviors require this Xtra because they use these Lingo commands. If you write custom text-to-speech Lingo scripts, you need to include the Speech Xtra in your movie's Xtra list. Keyboard navigation does not require the Speech Xtra.

The Speech Xtra supports Microsoft SAPI 4 and 5.1 on Windows. The Xtra supports all versions of text-to-speech on the Macintosh.

Because the Speech Xtra has no specific cast member type associated with it, it is not added automatically to a movie's Xtra list when a certain type of cast member is added to the movie. Therefore, when you use text-to-speech Lingo or behaviors in a projector, you must remember to add the Speech Xtra to the Xtra list manually. The Speech xtra is available automatically in the Director application and in Shockwave.

To add the Speech Xtra to a movie's Xtra list:

1. Select Modify > Movie > Xtras.
2. Click Add.
3. Select the Speech Xtra
4. Click OK to close the Add Xtras dialog box.
5. Click OK to close the Movie Xtras dialog box.
6. Save your movie.

Testing the Speech Xtra

To verify that your computer is configured correctly to let the Speech Xtra work, you can perform a simple test.

- To test the Speech Xtra, type the following Lingo into the Message window:

  ```
  put voiceInitialize()
  ```

  If the result is 1, then the Speech Xtra is working. If the result is 0, then you might not have text-to-speech software installed on your computer. For more information about text-to-speech software, see System requirements.

Using the Accessibility behavior library

You can make movies accessible in three ways. You can add keyboard navigation, text-to-speech, and captioning. The Director Library palette includes an Accessibility section that contains behaviors for enabling each capability.

For keyboard navigation, you use the Accessibility Target, Accessibility Item or Accessibility Text Edit Item, Accessibility Keyboard Controller, and Accessibility Group Order behaviors.

For text-to-speech, you use the keyboard navigation behaviors and then add either the Accessibility Speak or Accessibility Speak Member Text behavior. You can also use the Accessibility Speak Enable/Disable behavior to let users turn the text-to-speech feature on and off.

For captioning, you use the Keyboard navigation behaviors and Accessibility Speak behaviors and then add the Accessibility Captioning and Accessibility Synch Caption behaviors.

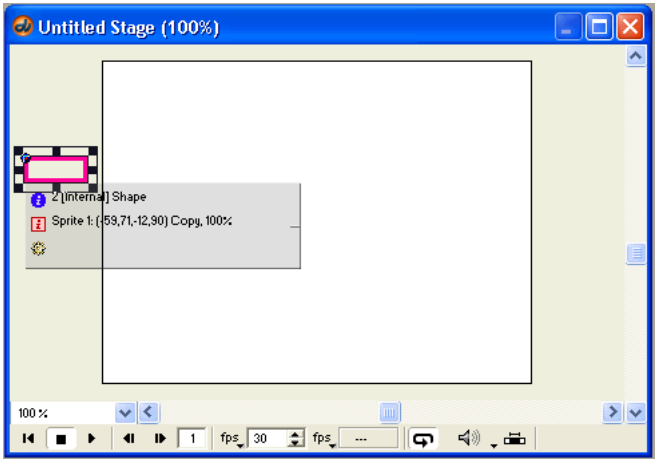
Enabling keyboard navigation

With the Accessibility Behavior library, you can easily make sprites on the Stage navigable with the keyboard. This lets mobility-impaired users select sprites and simulate mouse clicks without using a mouse. For example, if you have four button sprites on the Stage, you can apply accessibility behaviors that let them be selected by using the Tab key. As each sprite is selected, it is highlighted with a colored rectangle, called a focus ring, around its bounding rectangle. After a sprite is selected, the user can press Enter (Windows) or Return (Macintosh) to initiate the same action that a mouse click would initiate on the sprite.

The accessibility behaviors work with each other. Most of them cannot be used alone and must be used with other accessibility behaviors. To enable keyboard navigation, you must use the Accessibility Target, Accessibility Item, Accessibility Text Edit Item, Accessibility Group Order, and Accessibility Keyboard Controller behaviors together.

To apply the Accessibility Target behavior:

1. Create a shape sprite on the Stage using the Rectangle tool in the Tools panel. The accessibility behaviors use this sprite to create a focus ring around other sprites you define as navigable with the keyboard. The focus ring shows which sprite is the current selection during keyboard navigation.
2. Move the shape sprite off the Stage into the area immediately next to the Stage. You can expand the Stage window to display more of this area if necessary. The other accessibility behaviors will move the sprite onto the Stage when keyboard navigation is used.



A shape sprite off the visible part of the Stage.

3. Open the Library palette by selecting Window > Library palette.
4. Select Accessibility from the Library List menu in the upper-left corner of the Library palette.
5. Drag the Accessibility Target behavior on to the shape sprite that is located next to the visible part of the Stage.

6 In the dialog box that appears, enter a name for the behavior group.

Because the accessibility behaviors work together and are dependent on one another, a group name associates all the accessibility behaviors used in a given scene of your movie with one another. When you apply behaviors to a different scene of your movie, you might want to use a different group name. For example, you might use Accessibility_Scene_1. In addition, there should only be one instance of the Accessibility Target behavior in any given scene of your movie.

7 Select an initial state for text-to-speech, either enabled or disabled. If you select disabled, you need to use the Accessibility Speak Enable/Disable behavior to let users turn on text-to-speech later. See "Enabling text-to-speech" on page 555.

8 Click OK.

The next step in the process is to attach the Accessibility Keyboard Controller behavior to a sprite. This behavior intercepts keystrokes from the keyboard and enables those keyboard events to be used for navigation of the sprites on the Stage. You attach the Accessibility Keyboard Controller behavior to an editable text sprite that you place outside the visible part of the Stage.

To apply the Accessibility Keyboard Controller behavior to an off-Stage editable text sprite:

1 Place an editable text sprite on the Stage. Do not use a field sprite.

2 Move the text sprite off the Stage into the area immediately below the Stage. You can expand the Stage window to display more of this area if necessary.

3 Drag the Accessibility Keyboard Controller behavior from the Library palette to the sprite.

4 In the dialog box that appears, select the accessibility group name for the scene, such as Accessibility_Scene_1.

5 Click OK.

6 Select the editable text sprite if it is not still selected.

7 Using the arrow keys, move the sprite off the edge of the Stage until it is no longer on the visible part of the Stage.

Note: If the editable text sprite receives a Return character, its bounding rectangle can expand vertically. To prevent this from happening and unexpectedly causing the sprite to become visible on the Stage, set the sprite's Framing property to Fixed in the Property inspector's Sprite tab.

Now that the Accessibility Target behavior is attached to the shape sprite and the Accessibility Keyboard Controller behavior is attached to a text sprite, you are ready to apply the Accessibility Item or Accessibility Text Edit Item behaviors. To enable navigation to a sprite with the Tab key, attach the Accessibility Item behavior to the sprite. To enable navigation to an editable text sprite with the Tab key, attach the Accessibility Text Edit Item behavior to the sprite.

To apply the Accessibility Item or Accessibility Text Edit Item behaviors:

1 Drag the Accessibility Item or Accessibility Text Edit Item behavior from the Library palette to the designated sprite.

2 In the dialog box that appears, select the same group name that you used when applying the Accessibility Target behavior—for example, Accessibility_Scene_1.

3 You can specify a Lingo string to be executed when the user presses Enter (Windows) or Return (Macintosh) while the sprite is selected. You can use any valid Lingo string, such as a `go to frame 20` command or a call to a separate handler that you have written, such as `startAnimation`.

4 Click OK

5 Repeat this process for each sprite in the scene that you want to be navigable.

Note: The Accessibility Item and Accessibility Text Edit Item behaviors cannot be applied to sprites that have the Accessibility Target or Accessibility Keyboard Controller behaviors attached. If you are testing your movie while applying Accessibility Item or Accessibility Text Edit Item behaviors, you might need to rewind your movie to restore the shape sprite with the Accessibility Target behavior to its original location.

After all the sprites have had an Accessibility Item or Accessibility Text Edit Item behavior attached to them, you can add the Accessibility Group Order behavior to them. This behavior lets you specify the order in which each sprite is selected on the Stage when the user presses the Tab key. Apply this behavior to each sprite you want to be navigable with the Tab key.

To apply the Accessibility Group Order behavior:

1 Drag the Accessibility Group Order behavior from the Library palette to one of the sprites that already has an Accessibility Item or Accessibility Text Edit Item behavior attached.

2 In the dialog box that appears, select the group name that is used by the other accessibility behaviors in the scene, such as Accessibility_Scene_1.

3 Enter the tab order for the sprite. This is the order in which the sprites are selected when the user presses the Tab key. Be sure to number each sprite consecutively and to use each number only once. When the movie begins playing, the focus ring automatically goes to the sprite whose group order is 1.

4 Click OK.

5 Repeat this process for each sprite in the scene that will be navigable with the Tab key.

All the sprites can now be navigated to and activated with the keyboard. You can repeat this process for each scene in your movie.

Enabling text-to-speech

To help visually impaired users experience your Director movies, you can add the ability for your text cast members to be spoken aloud by the computer. You can also specify text to be spoken when sprites are selected. Because the text-to-speech feature in Director assumes that users are visually impaired, the feature is designed to be used with the keyboard navigation feature. Each text-to-speech behavior requires that the Accessibility Target, Accessibility Item or Accessibility Text Edit Item, Accessibility Group Order, and Accessibility Keyboard Controller also be applied to the appropriate sprites.

The following list describes the three text-to-speech behaviors:

- The Accessibility Speak behavior lets you specify a text string to be spoken when the user navigates to a sprite with the Tab key.
- The Accessibility Speak Member Text behavior lets you specify a text cast member to be spoken when a user navigates to a sprite with the Tab key.
- The Accessibility Speak Enable/Disable behavior lets you specify a user event that can turn the text-to-speech feature on or off.

To apply the Accessibility Speak behavior:

1. Begin by applying the keyboard navigation behaviors to sprites in your scene. For more information, see "Enabling keyboard navigation" on page 553.
2. Drag the Accessibility Speak behavior from the Library palette to the sprite you want to trigger the spoken text when the user navigates to it with the Tab key. This sprite must already be attached to an Accessibility Item or Accessibility Text Edit Item and an Accessibility Group Order behavior.
3. In the dialog box that appears, select the behavior group name for the scene, such as Accessibility_Scene_1. This group name enables the behaviors in a scene of your movie to communicate with each other so they can operate properly.
4. Enter the text to be spoken when the sprite is selected with the Tab key.
5. Click OK.

If you wish to have a large amount of text spoken, you can specify an entire text cast member to be spoken by using the Accessibility Speak Member Text behavior.

To apply the Accessibility Speak Member Text behavior:

1. Apply the keyboard navigation behaviors to sprites in your scene. For more information, see "Enabling keyboard navigation" on page 553.

   Drag the Accessibility Speak Member Text behavior from the Library palette to the sprite that you designate to trigger the spoken text when the user navigates to it with the Tab key. This sprite must already be attached to an Accessibility Item or Accessibility Text Edit Item and an Accessibility Group Order behavior.
2. In the dialog box that appears, select the behavior group name for the scene, such as Accessibility_Scene_1. This group name enables the behaviors in a scene of your movie to communicate with each other so they can operate properly.
3. Enter the name of the text cast member to be spoken when the sprite is selected with the Tab key.
4. Click OK.

You can let users toggle the text-to-speech feature on and off by using the Accessibility Speak Enable/Disable behavior. You add this behavior to a sprite that already has the keyboard navigation behaviors attached to it.

To apply the Accessibility Speak Enable/Disable behavior:

1. Apply the keyboard navigation behaviors to sprites in your scene. For more information, see "Enabling keyboard navigation" on page 553.
2. Drag the Accessibility Speak Enable/Disable behavior from Library palette to the sprite you want to use to toggle the text-to-speech behaviors.
3. In the dialog box that appears, enter the behavior group name for the scene so that this behavior is associated with the other behaviors in the scene.
4. Select an event to toggle the on/off state of the text-to-speech behaviors. This can be a mouse click or the beginning or ending of the sprite in the Score.
5. Select whether to turn speech on or off when the event you selected in the previous step occurs.
6. Enter the words to be spoken when text-to-speech is turned on.
7. Enter the words to be spoken when text-to-speech is turned off.
8. Click OK.

Using captioning

For users who are hearing impaired, you can add text captioning to your movies. Captioning is the practice of displaying text that corresponds to spoken narration or other sounds being played. Using the captioning behaviors in addition to the text-to-speech behaviors lets you make your movies accessible to users with all types of disabilities.

There are two captioning behaviors that are designed to be used together. Each is designed to be used with the keyboard navigation and text-to-speech behaviors. For information about applying text-to-speech behaviors, see "Enabling text-to-speech" on page 555.To enable captioning, you attach the Accessibility Captioning behavior to an empty text sprite that will display the captions. Next, you attach the Accessibility Sync Caption behavior to a sprite that has already had speech enabled with the text-to-speech behaviors.

To apply the Accessibility Captioning behavior:

1. Place the text sprite that you want to display caption text on the Stage.
2. Drag the Accessibility Captioning behavior from the Library palette to the text sprite.
3. In the dialog box that appears, select the behavior group name for the scene. This step associates the accessibility behaviors in the scene with one another so they work properly.
4. Click OK.

Next, you attach the Accessibility Sync Caption behavior to a sprite that has already had speech enabled.

To apply the Accessibility Sync Caption behavior:

1. Apply the keyboard navigation behaviors to sprites in your scene. For more information, see "Enabling keyboard navigation" on page 553.
2. Apply the text-to-speech behaviors to sprites in your scene. For more information, see "Enabling text-to-speech" on page 555.
3. Drag the Accessibility Sync Caption behavior from the Library palette to the sprite that will trigger the text-to-speech feature. This could be a text sprite that has the Accessibility Speak behavior attached or another sprite that will trigger speech with the Accessibility Speak Member Text behavior attached.
4. In the dialog box that appears, select the behavior group name for the scene. This associates the accessibility behaviors in the scene with one another so they work properly.
5. In the first At Word text box, enter the number of the word in the text that will be spoken where you want the captioning to begin. For example, if you want to begin captioning at the first word of the spoken text, enter the number **1**.
6. In the Initial Words text box, enter the number of words to display after the starting word number that you selected in the previous step. This is the number of words that can appear in the captioning sprite when the captioning begins. For example if you want the first section of text to begin at the first word and end at word 15, enter **1** in the previous step and **15** in the Initial Words text box. These words are replaced in the captioning display sprite by later sections of the text being spoken. You select the number of words in each section by using the remaining text boxes in the dialog box.
7. In the next At Word text box, enter the number of the word where the second section of text you want to display begins. For example, if you want the second section of displayed text to begin at word 16 of the spoken text, enter **16** in the At Word text box.
8. In the Display How Many of the Words That Follow text box, enter the number of words to display after the word number you selected in the previous step. For example if you want to display 22 words of text after word 16, enter **22** in this text box.
9. In the remaining text boxes, enter the numbers of the first word of each section of text followed by the number of words in each section. To use more than five sections, drop this behavior on the sprite again. This procedure can be repeated as often as necessary.
10. When you have finished entering values in the dialog box, click OK.

Using accessibility Lingo

If you have a basic understanding of Lingo, you can write custom scripts to add text-to-speech functionality to your movies. For more information about Lingo, see Chapter 16, "Writing Scripts with Lingo," on page 385.

First, you must initialize the speech software.

To initialize the text-to-speech software:

- Use the `voiceInitialize()` command.

The following frame script tests whether text-to-speech software is installed. If no software is installed, the script displays an alert dialog box.

```
on exitFrame
  if voiceInitialize() then
    go to frame "Start"
  else
    alert "Text-to-speech is not available"
  end if
end
```

To determine the number of available voices:

- Use the `voiceCount()` function.

To return a property list that describes the name, gender, age and index number of the current voice:

- Use the `voiceGet()` function.

To return a list of property lists that describes all the available voices:

- Use the `voiceGetAll()` function.

To set a particular voice as the current voice:

- Use the `voiceSet()` command.

After you select a voice for speech synthesis, you can control the progress of the speech.

To begin speech synthesis:

- Use the `voiceSpeak()` command.

To temporarily pause the speech:

- Use the `voicePause()` command.

  Some speech engines might continue to speak for several seconds after the pause command is used.

To resume the speech:

- Use the `voiceResume()` command.

To stop speech synthesis:

- Use the `voiceStop()` command.

To check whether the speech is currently speaking, paused, or stopped:

- Use the `voiceState()` function.

To set the volume of the voice:

- Use the `voiceSetVolume()` command.

To set the pitch of the voice:

- Use the `voiceSetPitch()` command.

To determine the chronological number of the current word within the string being spoken:

- Use the `voiceWordPos()` function.

The following frame script tests whether the current voice is female and starts speech if it is. In this case the `voiceSpeak()` command specifies the text of the cast member named "TextCommentary".

```
on exitFrame
  voiceProps = voiceGet()
  if voiceProps.gender = "female" then
    voiceSpeak(member("TextCommentary").text)
  end if
end
```

For a complete list of Lingo terms that control text-to-speech and keyboard navigation, see "Accessibility" on page 31 of the Lingo by Feature section of the Lingo Dictionary.

Deploying accessible movies

To successfully deploy an accessible movie, you become familiar with the Speech Xtra's system requirements and download procedure as well as the experience users will have with your accessible movie in real-world situations.

Adding the Speech Xtra

If you use the text-to-speech feature in a projector, you need to include the Speech Xtra in your movie's Xtra list. Normally, Xtra extensions that are not included in a movie's default Xtra list are added to the list when a cast member that requires one is added to the cast. You can view the default Xtra list by opening a new movie and selecting Modify > Movie > Xtras.

The Speech Xtra is a Lingo-only Xtra, which means that it adds commands and properties to the Lingo scripting language but does not add support for any new cast member types. Because the Speech Xtra is not associated with any kind of cast member, you must add it to the movie's Xtra list manually.

To add the Speech Xtra to the movie's Xtra List:

1. Open the movie.
2. Select Modify > Movie > Xtras.
3. In the dialog box that appears, click Add.

   A second dialog box appears.
4. Select the Speech Xtra from the list.
5. Click OK.

   The Add Xtras dialog box closes.
6. Click OK again.

   The movie Xtras dialog box closes.
7. Save your movie.

System requirements

Windows computers must have Microsoft Speech Application Programming Interface (SAPI) 4.0 or later installed. SAPI 5 is recommended. Windows XP includes SAPI 5. Earlier versions of Windows do not include SAPI by default. It can be downloaded from the Microsoft website at www.microsoft.com/speech/. A separate screen reader application is not necessary.

Macintosh OS 8.6 and later include text-to-speech software. No additions are necessary.

Understanding the Xtra download process

Because the Speech Xtra is from Macromedia, it is considered a trusted download. The user does not have to interact with any dialog boxes for the download to occur. When a user encounters an accessible Shockwave movie for the first time, the Xtra downloads automatically. The Xtra is approximately 45K on Windows and 35K on the Macintosh. After the download is complete, the movie begins to play. When the user encounters accessible movies in the future, no download occurs because the Xtra is already present on their computer.

CHAPTER 24
Managing Memory

Macromedia Director MX has effective built-in memory management that is sufficient for most projects. To make memory available for new sprites, Director simply unloads the cast members used for sprites that are no longer on the Stage. However, sometimes large cast members, such as high resolution images, large sounds, or digital video, can take longer to load or unload than typical, smaller cast members. When a cast member takes a lot of time to load or unload, it can cause slight delays in movie playback.

If you test your movie on the lowest performance computers that you want it to be able to play back on, you can determine whether any of these delays occur and make changes to correct them. This chapter describes how Director's memory management works and the steps you can take to ensure smooth playback of movies with large amounts of media.

How Director unloads items from memory

To effectively manage memory while a Director movie is running, it is helpful to understand how automatic unloading of cast members works in Director. By becoming familiar with this process, you can make intelligent choices about when and how to perform memory management tasks yourself, if necessary.

A cast member is automatically loaded into memory when Director needs to draw a sprite of it on the Stage. Immediately after being drawn, each cast member is dealt with according to the value of its `purgePriority` Lingo property. The default value of this property is 3. You can set this property in Lingo or by selecting a number from the Unload menu in the Member panel in the Property Inspector while the cast member is selected in the Cast.

The following are the possible values for `purgePriority`:

- When cast members with a purgePriority of 3 (normal) are no longer on the Stage, they can be unloaded from memory whenever Director needs memory for other tasks.
- Cast members with a purgePriority of 2 or 1 are only unloaded if memory is very low. They are added to the top of a list of recently used cast members that Director stores internally. This list is used to further prioritize cast members. Director assumes that the most recently used cast members are most likely to be used again and unloads them from memory only after all cast members with a `purgePriority` value of 3 are unloaded first.
- Cast members with a purgePriority of 0 are left in memory, and are not added to the recently used cast member list.

Whenever Director runs low on memory, such as when trying to load many large cast members, other cast members are automatically unloaded from memory, according to the following rules:

- The first cast members to be unloaded are those that have a `purgePriority` value of 3. This type of discarding is fast but is essentially random, which means you cannot predict which of these cast members will be unloaded at any given time. The worst-case scenario is that in order to load the cast member for channel 1 of a particular frame, the cast member that will be needed for channel 2 of that same frame gets unloaded.
- When there are no more cast members with a `purgePriority` value of 3 left to unload, Director starts unloading the cast members that have a `purgePriorty` value of 2 and were least recently used. This type of unloading is slower but can be more predictable.
- If more memory is still needed after the cast members with a `purgePriority` value of 2 are unloaded, then the least recently used cast members with a `purgePriority` value of 1 are unloaded.

Using Lingo to change a cast member's `purgePriority` property is a good technique for controlling memory management. However, changes to the `purgePriority` property do not take effect until the next time a cast member is used. For example, if you change the property in an `exitFrame` or `enterFrame` script in the same frame as a cast member is used, the cast member will be treated as if it had its old priority because all drawing on the screen is done before any `enterFrame` or `exitFrame` scripts are performed.

Loading and unloading individual cast members

There are several Lingo commands you can use to force specific cast members to load into memory or unload from memory. By using these commands, you can unload cast members that you know are no longer in use to make room for new ones. You can also force large cast members to load before they are actually needed. This prevents a pause that can occur when large cast members load normally, just before being drawn on the Stage.

Use the following Lingo terms to control cast member loading and unloading:

- To load a specific cast member or set of cast members, use the `preLoadMember()` command.
- To load all the cast members used in a specific frame or range of frames, use the `preLoad` command.
- To unload a specific cast member or set of cast members from memory, use the `unLoadMember()` command.
- To unload all the cast members used in a specific frame of your movie, use the `unload` command.
- To determine the number of bytes of memory required to display a range of frames, use the `ramNeeded()` function. To convert the number of bytes to kilobytes, divide the result by 1024.
- To determine the current amount of available memory, use the `freeBytes()` or `freeBlock()` function.

There are several more Lingo terms related to memory management. For a complete list, see Memory management in the Lingo by feature section of the Lingo Dictionary.

Preloading digital video

It is recommended that you do not preload digital video cast members. Digital video is played by streaming the video file from a disk. As the file is streamed, it is decompressed into memory one section at a time. Preloading a digital video file causes the entire file to be decompressed into memory at once, which can cause low memory situations on most computers.

You can cause a digital video to preload only its first segment without consuming unnecessary memory by placing it in the Score a frame or two before it is actually needed.

To preload a digital video safely:

1. Add a sprite of the digital video to the Score.
2. Begin the sprite one or two frames before the frame where you want to display the video.
3. Locate this sprite off the Stage except for at least one pixel of one corner of the sprite. This is so the user won't notice it.
4. Set the sprite's `movieRate` property to 0, which prevents the movie from playing when first loaded.
5. In the frame where you want the video to appear, use Lingo to set the sprite's `loc` property to place the sprite on the Stage in the location you select.
6. Set the `movieRate` property to 1 to start playing the video.

This way, the video will load its initial segment into memory and is ready to play immediately when your movie reaches the frame where you want it to appear. Experiment with preloading the video a few frames earlier if you find that preloading has not yet finished when your movie reaches the frame where the video appears.

CHAPTER 25
Managing and Testing Director Projects

As you work with Macromedia Director MX and develop projects with it, you might encounter some situations where a seemingly small change in the design of a project has a significant effect on the organization of the Director files and media files associated with it. A little bit of planning before you start a Director project can help avoid difficult changes during the course of development. Good testing practices can help you discover problems early in the project, while they are still small and easily remedied.

This chapter provides a few simple guidelines that can streamline your development process.

Managing Director projects

By carefully managing the resources that go into your Director movies, you can avoid problems that might arise when you make changes to the movie or change the location of the movie file or its linked media.

The following guidelines can help make your project go smoothly:

- Before you begin a project, plan where media should be located when you deploy your movie and replicate that organization at the beginning of your project. This prevents the links between your Director movies and external media files from being broken when you move the project to a different location on a disk or to a different disk volume.

  The following structure is a good example of a simple file organization:

  ```
  Project Directory
    contains:
    MyDirectorMovie.dir
    Linked_Media subdirectory
      contains:
      sound files
      graphic files
      digital video files
      other linked assets
  ```

  By establishing the final organization of your files before you import them into Director, you prevent the need to update links later in the project.

- When you work on a large project, plan your basic approach to all aspects of the movie before you start construction. This way, you can find problems with your strategies before you have invested a lot of time building on them. Finding problems early in a project makes them much easier to solve.

- Organize the cast members in your cast in a logical way. You might choose to group all the cast members of a particular type together, or you might choose to group the cast members from each scene together. Choose a system that works for you and that will make it easy to find cast members when your cast becomes large. You can also choose to keep groups of cast members in separate casts.
- When referring to cast members and frames in Lingo scripts, use the name of the cast member or the name of a frame marker. This avoids the need to change your code if you need to rearrange cast members or frames during the project.

  For example, the following Lingo refers to a cast member by its cast member number:

  ```
  member(16).text = "Good planning makes Director projects easy."
  ```

  If the text cast member 16 has to be moved in the cast, the script becomes invalid.

  Instead, use the following Lingo:

  ```
  member("Output_text").text = "Good planning makes Director projects easy."
  ```

  When you add a marker to a frame and use the marker name to refer to the frame, you can move the marker without breaking the script.

  The following Lingo refers to a frame by its number:

  ```
  go to frame 27
  ```

  It is better to add a marker to the frame and use the marker name, as in the following Lingo:

  ```
  go to frame "Main_menu"
  ```

- During work sessions, save your movie file often. Save a copy of the movie after each milestone, such as a day of work or after adding a significant new feature or section. This way, if problems arise, you can easily compare the current version of the file to a slightly older version to locate the source of the problem. Keep several copies of your file at different stages of development in case you need to go back several steps.

About testing movies to avoid problems

While you develop movies, you might encounter some difficulties because creating interesting movies and trying out new ideas always involves some experimentation. By testing your movies according to the simple guidelines described in this section, you can prevent problems from becoming obstacles.

Testing early in development

When you begin a Director project, it is a good practice to test the functionality of your movie early in the development process to help ensure that you discover any problems while they are still minor. Waiting to test lets small problems become larger ones as you add features to your movie that depend on problematic functionality that was implemented earlier. By incorporating testing into your authoring process early, you'll find these problems and have the opportunity to fix them before adding features to your movie.

Testing often during development

Testing should be an integral part of your Director development process. You should test the functionality of each small part of your movie as you add it rather than waiting until the movie's whole feature set is implemented.

When you build features that are interdependent, you should test each one before adding the next. If you test this way, you'll know that the most recently implemented feature is the most likely source of the problem. If you wait to test one feature until after the next feature is implemented and one of those features exhibits a problem, you have a more complex set of possibilities to evaluate.

Save multiple versions of your movie as you progress. When difficulties arise, compare the current version with the last saved version to help locate the source of the problem.

Testing on all target platforms

When you develop a Director movie, you should spend some time defining its audience. Part of this process is deciding what the minimum system requirements should be for the computers used by that audience.

You should determine the slowest processor speed you want your movie to play on and verify that the performance of your movie is acceptable on a processor of that speed. You should also determine if there is a range of configurations you have to support (such as Macintosh, Windows NT, and Windows 2000) and test enough of them to ensure success. Be sure to include parameters such as browser software, screen resolution, and available memory in your testing.

This approach can help you find problems that are specific to an operating system or configuration, which are distinct from authoring errors.

Testing strategies

You can use the following strategies to test your movies effectively:

- Be sure to use the Control > Preview in browser command. Testing in Director is different from testing a Director movie (DCR) file. The Preview in Browser command demonstrates the true behavior of the DCR file.
- If you encounter a problem, try to isolate the problem in a new Director file that incorporates only the problem feature or item. Make a list of the minimum steps that are required to reproduce the problem in a new file. This process usually reveals the source of the problem in your movie. It also reveals whether the problem is limited to one feature or if it is caused by the interaction of two or more features in your movie.
- Try to re-create the problem with different media. Sometimes the source of a problem is within a specific media item used in your movie.
- Try to re-create the problem on a different computer. This will help isolate problems with hardware configuration or with the Director installation on a specific computer. If the problem exists only when the movie is posted to a server, determine whether the problem exists on only one server or all servers. Occasionally the server's MIME types might need editing to include the MIME types for Director. For more information, see Director TechNote 16509, Configuring your server for Macromedia Shockwave Player, at www.macromedia.com/support/flash/ts/documents/tn4151.html.
- When you use Lingo, look for typing errors, missing punctuation, or inconsistent naming.

Resources

The following resources are available to help you with testing and troubleshooting your Director movies:

- Chapter 16, "Writing Scripts with Lingo," on page 385 contains extensive information about debugging Lingo scripts.
- Index of Director testing and troubleshooting TechNotes, at www.macromedia.com/support/director/troubleshoot.html
- TechNote 13872, General troubleshooting tips, at www.macromedia.com/support/general/ts/documents/troubleshooting_pt87.htm
- TechNote 3508, Troubleshooting and developing your logic, at www.macromedia.com/support/general/ts/documents/tn3508.html

CHAPTER 26
Packaging Movies for Distribution

When you finish authoring your Macromedia Director MX movie, you have a choice of several ways to prepare it for distribution. You can distribute a movie in the Shockwave format that plays in a browser or as a stand-alone projector. Stand-alone projectors can contain the software necessary to play the movie, or they can use an installed Shockwave player to play the movie independently of a browser. You can also export a movie as a digital video.

You can use several Director features to prepare movies for distribution. These features include determining Publish settings and deciding which Xtra extensions to include or download. You can also preview your movie in a browser and batch-process movie files to compress them and protect them from being edited.

Shockwave browser compatibility

Shockwave works with Netscape Navigator as a plug-in, with Microsoft Internet Explorer for Windows 95/98/ME/NT/2000/XP as an ActiveX control, and with Microsoft Internet Explorer for Mac OS as a plug-in. Shockwave can play Director movies in the following browsers:

Browser	Version	Platform
Netscape Navigator	4.0 or later	Windows 95/98/2000/XP/NT4.0 or later, Mac OS 8.6 - 9.x
Microsoft Internet Explorer	4.0 or later	Windows 95/98/2000/XP/NT4.0 or later
Microsoft Internet Explorer	4.5 or later	Mac OS 8.6 - 9.x
Microsoft Internet Explorer	5.1 or later	Mac OS 10.1 or later
America Online	4.0 or later	Windows 95/98/2000/XP/NT4.0 or later, Mac OS 8.6 - 9.x

When it first encounters an HTML page that references Shockwave, Internet Explorer for Windows asks the user for permission to download the Shockwave ActiveX control if it is not already installed. If the user approves, it downloads and installs the control.

Previewing a movie in a browser

You can preview a movie in a browser on your local computer to view JPEG-compressed bitmaps, and to check the movie design, Lingo, and any other performance issues related to playing a movie in a browser. Previewing a movie creates temporary Shockwave (DCR) and HTML files that open in a browser.

Note: When you use the Publish command rather than the Preview in Browser command, you can create permanent DCR and HTML files that let you view the movie in a browser.

You may notice that linked media do not work as expected when you preview a movie in a browser. Because of security restrictions, movies playing in browsers cannot read files from a local disk unless they are in the dswmedia folder (also called the support folder), which is a subfolder of the folder containing the Shockwave player.

Therefore, to preview a movie that uses linked media, you need to put the movie and all of its linked media in the dswmedia folder. The movie can open a file in a subfolder of dswmedia provided the relative paths have not changed. If you move the movie and its media to another server, the linked media will continue to work if you preserve the same folder structure. For details about security issues when playing a movie in a browser, see "Director and Internet Security" in the Director Support Center at www.macromedia.com/support/director/internet/security/.

To specify the browser to use for previewing:

1. Select Edit > Preferences > Network.
2. In the Preferred Browser box, enter the path to the browser application file.

To preview a movie in a browser:

- Select File > Preview in Browser or press F12.

About Xtra extensions

All Xtra extensions a movie requires must be installed on your user's system when the movie runs. When you distribute a movie, you must either include these Xtra extensions or provide the user with the means to download them. Using the Movie Xtras dialog box, you can specify the Xtra extensions to include in a projector and whether Xtra extensions should download for use with Shockwave movies. The Movie Xtras dialog box contains a list of the most commonly used Xtra extensions. Including all these Xtra extensions ensures that your movie will work in most cases but makes the projector much larger. You may want to remove Xtra extensions you know you aren't using.

Each time you create a sprite that requires an Xtra extension, Director adds the Xtra extension to the list of required Xtra extensions in the Movie Xtras dialog box. If you remove the sprite, Director does not remove the Xtra extension from the list, in case you later re-create the sprite. Director cannot detect Xtra extensions required in Lingo code. You must manually add any Xtra extensions required by your Lingo code to the list in the Movie Xtras dialog box. See "Managing Xtra extensions for distributed movies" on page 574.

Managing Xtra extensions controls the size and capabilities of the movie you distribute. Many important features in Director, such as text and vector shapes, are controlled by Xtra extensions, as is the ability to import all types of linked media. If you don't use a feature or import a media type that is controlled by an Xtra extension, you should not distribute the related Xtra extension with your movie. This is especially true for movies distributed on the Internet.

The Shockwave player includes the Xtra extensions that support the most common features and media types. These include text; vector shapes; Macromedia Flash; BMP, PICT, JPEG, and GIF file importing; sound management; and Shockwave Audio.

Xtra extensions not included with the Shockwave player must be installed in a user's system before the movie plays. Use the Download If Needed option in the Movie Xtras dialog box to make the movie prompt the user to download the Xtra extension. Director downloads Xtra extensions from the URL specified in the Xtrainfo.txt file in the Director application folder.

Xtra extensions downloading from projectors requires use of Lingo. See `gotonetmovie` in the *Lingo Dictionary*.

Xtrainfo.txt includes URLs for all Macromedia Xtra extensions included with Director, but you may need to manually edit Xtrainfo.txt to add the URL for third-party Xtra extensions or Macromedia Xtra extensions not included with Director. Xtrainfo.txt includes a description of how to enter this information. Xtra developers may also provide installation programs or other means of modifying Xtrainfo.txt automatically.

If a user chooses to download an Xtra extension, Director retrieves the Xtra extension from the URL specified in Xtrainfo.txt using the Verisign download security system. Verisign is a standard means of downloading software from secure sources. For more information on making Xtra extensions secure for download, see "Using the Xtra Packaging Kit" in the Xtras Support Center of the Macromedia website at www.macromedia.com/support/xtras/info/packaging/contents.html.

You can also include Xtra extensions in projector files. Select the Include in Projector option in the Movie Xtras dialog box for any Xtra extension you want to include.

Xtra extensions usually required for the movie to play back correctly include the following:

- Xtra extensions that create cast members (text, Flash, vector shapes, QuickTime, and so on)
- Shockwave Audio Xtra extensions (if the movie uses files in the SWA format)
- Transition Xtra extensions (if the movie uses third-party transitions)
- Import Xtra extensions, if the movie uses nonstandard types of linked external cast members
- Network Xtra extensions required for a movie to access the Internet
- Lingo Xtra extensions (if the movie uses any special Lingo that requires Xtra extensions)

Managing Xtra extensions for distributed movies

You can manage Xtra extensions for your movie using the Modify menu.

To manage Xtra extensions for the current movie:

1. Select Modify > Movie > Xtras.
2. To add or remove Xtra extensions, do any of the following:

- To add the Xtra extensions required to connect a projector to the Internet, click Add Network.
- To restore the list of default Xtra extensions, click Add Defaults.
- To manually add an Xtra extension to the list (which you would do, for example, if you've used Lingo code that requires Xtra extensions), click Add and select from the list of Xtra extensions installed in your system.
- To delete an Xtra extension from the list, highlight the Xtra extension and click Remove.

3. To change settings for Xtra extensions in the list, select an Xtra extension and select either of the following options:

   Include in Projector makes Director include the selected Xtra extension in any projector that includes the current movie.

   Download If Needed makes the movie prompt the user to download a required Xtra extension if it is not installed in the user's system. The Xtra extension is downloaded from the location specified in the Xtrainfo.txt file and permanently installed in the user's system.

4. To get information about a selected Xtra extension, click Info.

   The information comes from an Internet source. Not all Xtra extensions include information. Third-party Xtra extensions often include some explanations and information about the developers.

Note: Another way to include Xtra extensions with a movie is to create an Xtras folder containing all required Xtra extensions in the same folder as a projector file. This allows you to see which Xtra extensions are included without opening the movie. If you use this method, you cannot include Xtra extensions in the projector file because the movie will fail to initialize.

About distribution formats

Before deciding how to distribute a movie, it helps to understand how Director plays movies. Director movies play either with the Shockwave player or through a projector player. The Shockwave player is a system component that plays movies in web browsers and also outside browsers as stand-alone applications. A projector player can only play movies independently of a web browser.

You can distribute movies as Shockwave movies (with the DCR extension), projectors, or protected movies (DXR extension). You should not distribute source movies (DIR extension) unless you want your users to be able to change the movie in the Director authoring environment.

- A Shockwave movie is a compressed version of a movie's data and does not include a player. Shockwave movies are created primarily to distribute over the Internet for playback in a web browser. Another reason to create a Shockwave movie is to compress it for distribution on a disk when the movie is contained in a projector. In addition to compressing the data, saving a movie in the Shockwave format removes all information necessary to edit the movie.

- A projector is a movie intended for play outside of a web browser. A projector can include a player (called the Standard player), Xtra extensions, multiple casts, and linked media in a single file. A projector can also include several different movie files. Configured in this way, a projector can be a completely stand-alone application.

  You can use the Shockwave player projector option to make a much smaller projector. A Shockwave projector uses an installed Shockwave player on the user's system to play a movie instead of including the player code in the projector itself. If no Shockwave player is installed on the user's system, the user must download a copy. A Shockwave projector is excellent for distributing movies on the Internet that you don't want to play in a web browser.

  You can also reduce the file size of a projector by turning on projector options that compress the movie data, the player code, or both. In Windows, compressing the player code reduces the minimum projector size from approximately 2.1 MB to 1.1 MB for a projector, and to about 60K for a Shockwave projector.

  On the Macintosh, compressing the player code reduces the minimum projector size from approximately 2.5 MB to 1.2 MB for a projector, and to approximately 12K for a Shockwave projector.

- Protected movies (DXR extension) are uncompressed movies that users can't open for editing. These can be useful when you want to distribute uncompressed movies on a disk, but you don't want users to edit the source file. Protected movies may play faster than Shockwave movies from a disk because they do not need to be decompressed. These movies are preferable if disk space isn't limited. Like Shockwave movies, protected movies do not include the information necessary to edit the movie or the software that plays the movie. They can be played only by a projector, a movie in a window, or the Shockwave player.

Note: To edit a movie packaged for distribution, you must edit the source file (DIR) and create a new movie in one of the distribution formats. Always save your source files.

Using linked media on the Internet

When you distribute a movie on the Internet for playback in a web browser, the linked media must be at the specified URL when the movie plays. Otherwise, the user will receive an error message.

Distributing movies on a disk

Whenever a movie plays from a disk, it accesses all external linked files the same way that it did in the authoring environment. All linked media—bitmaps, sounds, digital videos, and so on—must be in the same relative location as they were when you created the movie. To make sure you don't forget any linked media when you distribute a movie on a disk, place linked files in the same folder as the projector or in a folder inside the Projector folder.

If your movie includes Xtra extensions, you must include the Xtra extensions in the projector. If a movie distributed on a disk connects to the Internet in any way, be sure to click the Add Network button in the Movie Xtras dialog box.

Distributing movies on a local network

If you plan to place a movie on a local area network (LAN), all files must be set to read-only, and users must have read/write access to their system folders. Otherwise, the requirements are the same as for normal disk-based distribution.

Creating Shockwave movies

You save your work as a Shockwave (DCR) movie to prepare it for playback in a Shockwave-enabled web browser, or to make disk-based movies smaller. Using a Shockwave movie also prevents your users from editing the movie if they own Director.

If the Shockwave movie you're creating will be distributed on the Internet and requires any Xtra extensions, make sure the Xtra extensions are listed in the Movie Xtras dialog box and that Download If Needed is selected for each required Xtra extension. See "Managing Xtra extensions for distributed movies" on page 574.

Note: Use Update Movies to convert several movies at once to the Shockwave format. For more information, see "Processing movies with Update Movies" on page 585.

Using Publish default settings

To create a Shockwave movie, you use the Publish command. The default settings create a DCR file and an HTML file with all of the tags necessary to display your DCR movie.

If you use the default Publish settings, Director does the following:

- Creates a DCR and HTML file in the same directory as your Director (DIR) movie.

  Note: Director creates a CCT file for each external cast and, by default, saves the CCT file in the same folder as the DCR file. To specify a different file location, hold Alt (Windows) or Option (Macintosh) when you select File › Publish. Continue to hold the key for access to dialog boxes that let you specify new paths for both your DCR and CCT files.

- Gives both your DCR and HTML files the same name as your DIR file, with the appropriate extensions (for example, MyMovie.dcr and MyMovie.html).
- Sets the DCR movie's width and height to match the dimensions of the DIR movie.
- Configures the DCR movie and HTML file so that if your users resize their browsers, the DCR movie remains the same size as the original DIR movie.
- Uses the same background color while loading your DCR movie as your movie Stage color.
- Compresses bitmap images and sound using JPEG compression. Note that if you've compressed images for individual cast members, those settings will override compression set at the movie level in Publish settings.

If you change the default Publish settings, Director saves those changes when you save your movie. For more on changing Publish settings, see the next section.

To create a Shockwave movie:

1. Save your movie.
2. Select File > Publish.

   Director creates a Shockwave version of your movie, and an HTML file if you selected a template, based on your Publish settings. Your default browser launches with the HTML page you just created.

   Note: Your default browser is specified in your Network Preferences dialog box. To change your default browser, select Edit › Preferences › Network.

Changing Publish settings

You can change Publish settings by using the Publish Settings dialog box.

To change Publish settings:

- Select File > Publish Settings.

  The Publish Settings dialog box appears with some or all of the following tabs, depending on the HTML template you select: Formats, General, Shockwave, Compression, Shockwave Save, and Image. The Image tab, for example, appears only if you select the Shockwave with Image HTML template.

To use the Formats tab:

- To select an HTML template, or to create a Shockwave file without an HTML template, you use the HTML Template pop-up menu.
- To create a Shockwave file without an HTML file, select no HTML Template.
- To use `OBJECT` and `EMBED` parameters in the HTML file to display the Shockwave file, use the Shockwave Default template.

  When you select the Detect Shockwave template, JavaScript and VB Script determine if the correct version of the Shockwave plug-in or ActiveX is on your user's computer. If not, a message tells your user to update Shockwave.
- To expand the Shockwave file to fill the entire browser window, select Fill Browser Window.
- To play a loader movie while the Shockwave file downloads, select Loader Movie.
- To display a game with a progress bar while the Shockwave file loads, select Loader Game.
- To display a progress bar and image while the Shockwave file downloads, select Progress Bar with Image.

  If you select the Shockwave with Image template, the template automatically detects the Shockwave player or Active X control on your user's browser and uses it to display your movie. If Shockwave is not found and the user's browser is Internet Explorer on Windows 95 or NT, the browser automatically installs the Active X control. In all other cases, the image that you specify on the Publish Settings Image tab is displayed. The Image tab is available only when you select the Shockwave with Image template.
- To display a progress bar while the Shockwave file downloads, select Simple Progress Bar.
- To center the Shockwave movie in the browser, select Center Shockwave.
- The HTML File and Shockwave File fields indicate where Director will save your HTML and DCR files, respectively. To specify another path, edit the path in the field, or click the field's Browse button and select a new path.
- To launch your movie in a browser automatically when you execute the Publish command, select Output: View in Browser.

To use the General tab:

- To make the DCR movie match the dimensions of your DIR movie, select Match Movie in the Dimensions field.
- If you use the default Match Movie setting in the Dimensions field, values in the `OBJECT` and `EMBED` tags in the HTML file are set to the exact dimension of your movie. To change the dimensions, select either Pixels or Percent of Browser Window, and type the new dimensions in the Width and Height fields. Your movie will resize to fit the new rectangle only if you have not selected No Stretching in the Stretch Style pop-up menu on the Shockwave tab.
- To change the background color of your HTML file, either click the Page Background color box and select a color, or enter a value in the hexadecimal field.

  The Page Background setting is different from Background Color, which you specify on the Shockwave tab. Background Color lets you determine the color that appears, while the DCR is downloading, in the rectangle where your DCR movie will play. Another background color option, Stage Fill Color, which you set on the Movie tab of the Property inspector, defines the color of the Stage.

To use the Shockwave tab:

- Select Shockwave playback options to enable the following features for your user:

  Volume Control lets users adjust the volume of the movie's soundtrack.

  Transport Control provides controls for rewinding, stopping, and stepping through the movie in Shockmachine.

  Zooming determines if stretchable Shockwave is allowed. You can disable zooming with Lingo by setting the `allowZooming` property. For more information, see the Lingo Dictionary.

  Save Local determines if the movie can be saved to Shockmachine.

  Display Progress Bar and Display Logo determine if the progress bar and logo, respectively, appear while the movie loads in the browser.

  For more information, see "Setting Shockwave playback options" on page 593.

- To specify how your movie behaves when the width and height values in the HTML file are a different size than the movie, select from the Stretch Style pop-up menu.

  If the HTML height and width values have been set to a percentage on the General tab, the movie will resize as the browser window resizes. The way in which the movie resizes varies according to the stretch style selected.

  No Stretching is the default and plays the movie at its original size.

  Preserve Proportions keeps the same aspect ratio of your original Director movie no matter what size the user makes the browser. The movie stretches to fill the height and width values specified in the HTML file or those determined by the percentage and size of your browser window.

  Stretch to Fill stretches the movie to fill the height and width values in the HTML file. If the aspect ratio of the movie changes, sprites on the Stage could appear distorted.

  Expand Stage Size lets users resize the Stage, but the sprites on the Stage remain the same size. The setting expands the Stage size to the size of the height and width values in the HTML file.

  Note: If, on the General tab, you're using the default Match Movie Dimension setting, the stretch style settings will not affect the way your movie responds to browser resizing.

- To determine how your movie will line up within the `OBJECT` or `EMBED` values in the HTML file, use the Stretch Position Horizontal Align and Vertical Align options.

  For more information about using stretch styles, see the procedure under "Setting movie options for browser resizing" on page 580.

- To change the background color that displays while your DCR file is downloading, either click the Background Color box and select a color, or enter a value in the hexadecimal field.
- To enable communication between Lingo and JavaScript, select Movie Uses Browser Scripting. This creates a flag for Netscape to start Java when the movie loads, which is required for this feature.

The Compression tab sets bitmap compression for all cast members in a movie. (You can set the compression quality for individual bitmap cast members on the Bitmap tab of the Property inspector.)

To use the Compression tab:

- To apply compression techniques used by Director in versions 4 through 7, select Standard. This setting is suitable for graphics with few colors.
- To use JPEG compression, click JPEG and specify the image quality setting by moving the slider to a value between 0 and 100 percent. The higher the percentage, the less the image is compressed.
- To compress the sound in your movie, select Compression Enabled and select the level of compression from the kBits/second pop-up menu. For more information about sound compression, see "Compressing internal sounds with Shockwave Audio" on page 326.
- To convert stereo sounds to monaural, select Convert Stereo to Mono.
- To include comments you might have entered in the Comments field of the Property inspector for your cast members, select Include Cast Member Comments. You can then use Lingo to access the comments in the DCR file.

To save your Shockwave file for playback with Shockmachine, you use fields on the Shockwave Save tab.

To use the Shockwave Save tab:

- To display the standard Shockwave context menu when your user right-clicks (Windows) or Control-Clicks (Macintosh) your DCR file playing in the browser, select Context Menu.
- To suggest a Shockmachine category, such as "games," enter a description in the Suggested Category field.
- To specify a title for the user interface, enter the title in the Shockwave Title field. The title can include spaces.
- To specify the URL to be sent when the Shockmachine user clicks the Shockmachine Send button, enter the URL in the Send URL text box. This URL is also used by the Send feature in Shockwave. Typically, the URL is the location of the web page that contains the Shockwave movie.

  If you do not specify a URL, Shockwave attempts to provide one. To avoid unpredictable results, Macromedia highly recommends that you provide the URL.

- To specify the path to a BMP file, use the Icon File field.

- The Package File field lets you enter a fully qualified or relative URL to a package text file. This text file, in XML, provides a list of URLs with support files to download for a complete save of the current project.
- To specify the size, in bytes, of all content with packages that needs to download for the movie to save successfully, use the Total File Size field.

For more information about the Shockwave Save fields, and for detailed instructions on developing for Shockmachine, see "Shockmachine development guide for Director" at www.macromedia.com/support/director/internet/shockmachine_for_d8/ in the Director Support Center.

If you selected the Shockwave with Image HTML template on the Formats tab, the Image tab appears on the Publish Settings dialog box.

You can specify the image that should appear if the user doesn't have Shockwave or the ActiveX control.

To use the Image tab:

- In the Poster Frame field, enter the frame number from your movie's Score that you want to appear as a JPEG image for users who are unable to view your movie.
- To specify compression for the image, move the Quality slider to the desired compression setting. The higher the percentage, the less the image is compressed.
- To specify that the image download as a progressive JPEG, select Progressive. The JPEG will then display at low resolution and increase in quality as it continues to download. Making a JPEG progressive also reduces its file size.

Setting movie options for browser resizing

If users view your movie in browsers, chances are they will resize their browsers. How your movie behaves when the browser size changes depends on what you select in the Publish Settings dialog box.

To set movie options for browser resizing:

1. Select File > Publish Settings.
2. On the General tab of the Publish Settings dialog box, select from the Dimensions pop-up menu. When you make a selection, the width and height values default to the movie size.

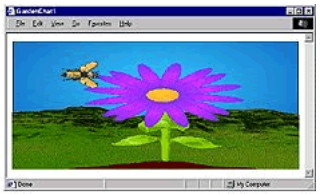
- To create an HTML file with parameters that match the height and width of the movie, select Match Movie.
- To specify height and width values in the HTML file in pixels, select Pixels.
- You can select Percentage of Browser Window, and specify a percentage in the Width and Height fields. (To make browser resizing affect the size of the DCR movie, you must specify percentages and select either Preserve Proportions, Stretch to Fill, or Expand Stage Size on the Shockwave tab of the Publish Settings dialog box.)

3. On the Shockwave tab, select an option from the Stretch Style pop-up menu.

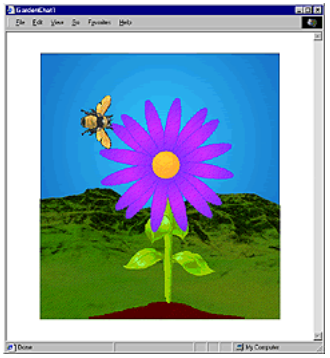
- To specify that your movie not resize at all, select No Stretching.

- To maintain the same aspect ratio of your original Director movie no matter what size the user makes the browser, select Preserve Proportions. The movie will fit within the width and height parameters, as much as possible, while preserving the movie's aspect ratio. The movie aligns within the window based on the align tags that you specify in step 4.


- To change the size of the movie to fit the size of the browser, select Stretch to Fill. Any browser resizing stretches the movie to fill the width and height parameters. Note, however, that if the aspect ratio of the movie changes, sprites on the Stage could appear distorted. If you select Stretch to Fill, Director ignores the align tags that you specify in step 4.

To let users resize the Stage without resizing the sprites, select Expand Stage Size. The movie is aligned within the browser based on the align tags that you specify in step 4.

4 To specify align tags for your movie, use the Horizontal Align and Vertical Align pop-up menus. You can select left, center, or right horizontal alignment, and top, center, or bottom vertical alignment.

About projectors

To create projectors for any version of Windows, you must use the Windows version of Director; likewise, you can create Macintosh projectors only with the Macintosh version of Director.

Projectors require certain Xtra extensions to use text, use Flash movies, connect to the Internet, and use certain other features. Director includes the most common required Xtra extensions by default. You can include or exclude Xtra extensions for each movie using the Include in Projector option in the Movie Xtras dialog box. You can also add Xtra extensions to a projector manually the same way you select movie files. (See the next section.)

In addition to the standard projector, you can create a fast-start projector, which typically launches faster. A fast-start projector doesn't include Xtra extensions inside the projector itself, so there's nothing to unpack.

Creating projectors

When creating a projector, place the starting movie at the top of the list of files in the Create Projector dialog box. If the Play Every Movie option is selected in the Projector Options dialog box, movies play in the order they appear in the list. If this option is off, only the first movie plays. If your movie contains Lingo that switches between movies, the order of the other movies may not be important.

You can include only Director MX movies in projectors. You can use the Update Movies command to convert older movies to the latest version of Director. For more information, see "Processing movies with Update Movies" on page 585.

To create a standard projector:

1 Select File > Create Projector.

2 Double-click the movies and external casts to include in the projector. Click Add All to include all the movies in the open folder.

Director transfers the name of the movies or casts to the file list.

3 Use the Move Up and Move Down buttons to arrange the movies in the proper order.

4 Click Options.

Director retains the options settings once you define them; you don't have to set them every time.

5 To control how movies interact with the user's system, select Playback options:

Play Every Movie specifies that the projector play all movies in the play list. Otherwise, the projector plays only the first movie in the play list (unless other movies are called by Lingo from the first movie). In a projector with Play Every Movie selected, pressing Control+period (Windows) or Command+period (Macintosh) branches to the next movie, and Control+Q (Windows) or Command+Q (Macintosh) quits.

Animate in Background allows the movie to continue playing if a user switches to another application. This is useful if you want the movie to continue running in the background when its window is not active. If this option is not selected, the movie pauses when the user switches to another application and resumes when the user switches back.

Reset Monitor to Match Movie's Color Depth (Macintosh only) automatically changes the color depth of your monitor to the color depth of each movie in the projector play list. For example, if you are working on a color monitor set to 256 colors and a movie in the play list was created in thousands of colors, the monitor automatically switches to thousands of colors.

6 To determine how the projector appears on the screen, make an Options selection:

Full Screen displays the movie in the entire screen, placing the menu bar (if there is one) at the top of the screen and hiding all of the desktop. If there's a menu, it overlays the top of the Stage.

In a Window displays the movie in a normal window, without taking over the screen. The window cannot be resized.

Show Title Bar is available only if In a Window is selected. If this option is selected, the window where the movie appears has a title bar. The window can be moved only if it has a title bar.

7 To specify how the Stage size of multiple movies in the projector can be adjusted, select a Stage Size option:

Use Movie Settings uses the Stage size of the new movie or matches the size of the current movie.

Match First Movie repositions and resizes the movie based on the first movie in the projector.

Center centers the Stage on the screen, which is useful if the Stage size is smaller than the screen size. Otherwise, the movie plays using its original Stage position. In Windows, projectors are always centered.

8 To compress the projector's movie data in the Shockwave format, select Compress (Shockwave Format).

This makes the projector smaller, but it may increase the load time as the movies are decompressed.

9 To determine how the player code is included in the projector, select an option for Player.

Standard includes the uncompressed player code in the projector file. This option starts the movie faster than other options but creates the largest projector file.

Compressed includes a compressed version of the player code in the projector file. This substantially reduces the projector file size, but decompressing the player code adds a few seconds to the startup time of a movie.

Shockwave makes the projector use the Shockwave player installed in a user's system instead of including the player code in the projector file. If the Shockwave player is not available when the movie runs, the movie prompts the user to download it.

For more about these options, see "About distribution formats" on page 574.

10 (Macintosh only) To make Director use available system memory when its own partition is full, select Use System Temporary Memory.

11 Once all projector options are set, click OK.

12 Click Create in the Projector dialog box and then enter a name and location for the projector.

To avoid problems with linked media, create the new projector in its final folder location and do not move it to a different folder.

Director turns the movies, casts, and included Xtra extensions into a single projector.

To create a fast-start projector:

1 Create a new folder on your computer desktop.

It does not matter what you name the folder.

2 In Director, select Modify > Movie: Xtras.

The Xtras dialog box appears.

3 Select the name of each Xtra and deselect Include in Projector for each, then click OK.

4 Select File > Save and Compact.

If you are adding multiple movies to the package, repeat steps 2 through 4 for each of the movies.

5 Select File > Create Projector.

6 In the Create Projector dialog box, select the movies to include in the projector and click Add.

7 Click Options and do one of the following:

- Select Shockwave (Windows) and click OK.
- Select Standard (Macintosh) and click OK.

8 In the Create Projector dialog box, click Create.

9 In the dialog box that appears, type a name for the projector. If necessary, use the pop-up menu to browse to the desktop folder you created in step 1, and then click Save.

10 Exit Director and return to your computer desktop.

11 Open the folder you created in step 1. Create a subfolder within this folder and name it Xtras.

12 In your Director application folder, copy the Xtra extensions required to play your movie into the Xtras folder you just created.

You must also include external movies, external casts, and linked media with your projector. If the external files are in the folder that contains the projector, the projector can automatically link to the files.

13 (Windows only) In your Director application folder, copy the files dirapi.dll, iml32.dll, proj.dll, and msvcrt.dll into the Xtras folder.

14 Launch your projector to see it open quickly and play your movies.

Processing movies with Update Movies

You can use the Update Movies command on the Xtras menu to do the following:

- Update movies and casts from older version of Director to the latest file format.
- Compress movies for faster downloading from the Internet.
- Remove redundant and fragmented data in movie and cast files. The Save and Compact and Save As commands do this as well.
- Prevent users from opening movie and cast files.
- Batch-process movie and cast files in large projects.

When beginning a project, use Update Movies to convert Director 7, 8, and 8.5 files to the latest file format.

At the end of a project, use Update Movies to compress all your movies and casts at once.

To update and compress movies and casts:

1 Select Xtras > Update Movies.

The Update Movies dialog box appears.

2 Select one of the Action options:

Update converts movies from Director 5 or later versions to the latest file format. As it updates movies, Director consolidates and removes fragmented data, just as when you use Save As. (To update movies from older versions, you must first convert them to the Director 5 file format.)

Protect removes all the data required to edit the movie, but it does not compress the movies further. It adds the DXR extension to movies, and CXT to casts. Protect also flags the movie so it can't be opened in the authoring environment.

Convert to Shockwave Movie(s) rewrites movies and casts in the compressed Shockwave file format and adds the DCR extension to movies and CCT to casts. This options also prevents users from opening the movie or cast and making changes. Once a movie is compressed, there is no way to it to recover an editable file, so be sure to keep the original movie.

3 Select one of the Original Files options:

Back Up into Folder specifies that the original files go in a selected folder. Click Browse to select the folder for the original files. To avoid overwriting old backups, you should select a new folder each time you run Update Movies.

Delete specifies that the newly updated files overwrite the original files. Be very careful when using this option. Once a file is protected or compressed, you cannot open it again in Director.

4 Click OK.

A dialog box appears from which you select the files to change.

5 Select the movies and casts you want to change and click one of the following:

- Click Add to add the selected files.
- Click Add All to add all the movies in the current folder. The items you select appear in the file list at the bottom of the dialog box. You can update movies in different folders at the same time.
- Select Add All Includes Folders before you click the Add All button to include any movies or casts inside folders appearing in the upper list. This option is useful for updating large projects with several levels of folders.

6 Click Update.

Director saves new versions of the selected movies with the same names and locations as the original movies. This ensures that all links and references to other files continue to work properly. Director copies the original movies to the folder you specified, re-creating their original folder structure. If you didn't specify a folder for the original movies, Director prompts you to select one.

Director adds the DCR extension to Shockwave movies and the CCT extension to external casts in the Shockwave format. Protected movies have the DXR extension, and protected casts have the CXT extension.

Exporting digital video and frame-by-frame bitmaps

You can export all or part of a movie as a digital video. You can use this digital video in other applications or import it back into Director. Any interactivity in the movie is lost when it is exported as a digital video. You can also export a movie or a part of a movie as a series of bitmaps: BMP in Windows, and PICS, PICT, or Scrapbook on the Macintosh.

You can export QuickTime digital video from either the Windows or the Macintosh version of Director. QuickTime must be installed on the system to export as QuickTime (version 4 or later is required for Windows; version 3 or later is required for Macintosh). You can export the AVI (Audio-Video Interleaved) format only using the Windows version of Director. When you export to AVI, all sounds are lost.

When Director exports animation as a video or bitmaps, it takes snapshots of the Stage moment by moment and turns each snapshot into a frame in the video or a bitmap file. Sprites animated solely by Lingo are not exported.

When Director exports video or bitmaps, it always uses the entire Stage.

To export to digital video or bitmaps:

1 Select File > Export.

The Export dialog box appears.

2 Select the range of frames you want from the Export options at the top of the dialog box:

Current Frame exports the current frame on the Stage. This is the default.

Selected Frames exports the selected frames in the Score.

All Frames exports all frames.

Frame Range exports only the range of frames that begin and end with the frame numbers you enter in the Begin and End boxes.

3 If you select Selected Frames, All Frames, or Frame Range as the Export option, select one of the following options. These options do not work with digital video.

Every Frame exports all frames in the selected range.

One in Every _ Frames exports only the frames at the interval you specify in the box.

Frames with Markers exports frames with markers set in the Score window.

Frames with Artwork Changes in Channel exports frames only when a cast member changes in the channel you specify in the box.

4 From the Format pop-up menu at the bottom of the dialog box, select a format.

- Windows: Video for Windows (.AVI), DIB File Sequence (.BMP), or QuickTime Movie (.MOV)
- Macintosh: PICT, Scrapbook, PICS, or QuickTime Movie

BMP is the standard format for a Windows bitmap series. PICT, Scrapbook, and PICS are all Macintosh bitmap file formats.

5 If you are exporting in PICS format, click Use Frame Differencing to create smaller files.

This option is dimmed unless you select PICS from the Format pop-up menu.

6 If you are exporting video, click the Options button.

The Video for Windows or QuickTime Options dialog box appears.

7 Select the options you want to use and then click OK.

For AVI movies, enter a number of frames per second for Frame Rate.

For information about the QuickTime options, see "Setting QuickTime export options" on page 588.

The Export dialog box reappears when you click OK.

8 Click Export.

A dialog box appears, prompting you to save the movie.

9 Name the file and then click Save.

When you click Export, a dialog box appears allowing you to name the file. If you are saving in video, PICS, or Scrapbook format, only one file will be created. If you are saving in BMP or PICT format, Director automatically creates one file for each frame, attaching the corresponding frame number to each file. For example, if the name of the exported file is Myfile, frame 1 will be exported to a file named Myfile0001.

Setting QuickTime export options

You use the QuickTime Options dialog box to specify options for exporting a movie as a QuickTime digital video. This dialog box appears when you click the Options button in the Export dialog box and QuickTime is the specified format.

To set QuickTime export options:

1. Select File > Export.
2. Select QuickTime Movie from the Format pop-up menu.
3. Click Options.
4. To set the speed the video will play, select a Frame Rate option:

   Tempo Settings exports the settings in the tempo channel to the QuickTime movie. This setting lets you create a QuickTime movie at any tempo, even if Director is not capable of playing the movie at that tempo in real time.

   The size of an exported QuickTime movie is influenced by the tempo settings, transitions, and palette transitions in the Director movie. Fast tempos, certain transitions, and palette transitions all increase the size of the QuickTime movie. The tempo settings determine the number of QuickTime frames per second and the number of frames per transition. The faster the tempo, the more frames per second.

   A movie that would work well with Tempo Settings as the Frame Rate option is one in which the tempos have been carefully timed. For instance, some frames could be set to a tempo of 10 frames per second, and their QuickTime frame durations would be exactly one-tenth of a second. Other frames later in the movie could be set to a tempo of 1 frame per second; when the movie is exported, these slower frames would each last precisely 1 second in the QuickTime movie.

   Real Time lets you export a QuickTime movie that matches the performance of the Director movie as it plays on your system. (You should always play the entire movie with Lingo disabled before using this feature.)

   When you export a movie with Real Time selected, each Director frame becomes a QuickTime frame. Each frame in the QuickTime movie will match the duration of the same frame in the Director movie.

   Director will generate as many frames as required to duplicate each transition, up to 30 frames per second. To increase the number of frames created for any transition, reduce the smoothness of the transition.

   This option causes Director to use the actual durations that were stored the last time you played the entire movie, regardless of the actual tempo settings of the movie.

5 To reduce the file size of a QuickTime movie at the expense of quality, select an option from the Compressor pop-up menu. Different options appear on the Compressor pop-up menu depending on the video hardware and software available in your system. Consult your QuickTime documentation.

Animation compression is for simple animations.

Cinepak compresses 16-bit and 24-bit video for playback from CD-ROMs.

Component Video is usually used when capturing from a live video feed.

Graphics compression is for exporting single frames of computer graphics.

None exports with no compression.

Photo-JPEG compression is good for scanned or digitized continuous-tone still images.

Video compression is for exporting video clips.

6 To determine the compression quality and resulting file size when using the chosen compressor, use the Quality slider. A higher-quality setting preserves the appearance of the images and motion but increases the size of the file. A lower-quality setting results in poorer image quality but decreases the size of the file.

7 To determine the color depth (the number of colors) of your artwork, select a setting from the Color Depth pop-up menu. The compression method you select determines the color depth options available to you in this pop-up menu.

8 To determine the method by which the exported QuickTime movie is resized, select values for Scale. You can select a percentage from the Scale pop-up menu, or you can type pixel dimensions in the fields. By entering the number of pixels, you can stretch a movie so that it plays in a rectangle that does not adhere to the original aspect ratio.

9 To choose which soundtracks are exported with your movie, select Channel 1 or Channel 2. A checked box indicates that the associated sound channel in the score is exported with your QuickTime file.

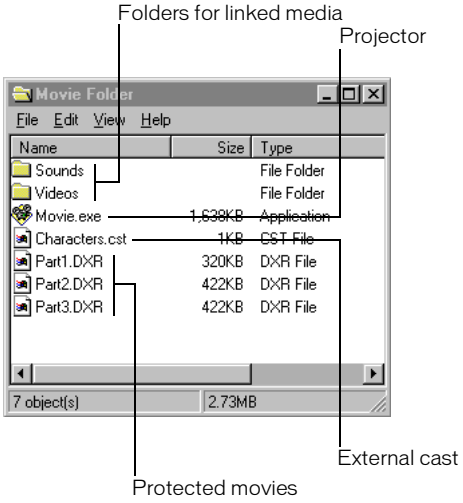
External sounds (sounds you imported as linked cast members) are not exported when you export a digital video. To include sound when you export a digital video movie, you must import the sounds as cast members instead of linking to them.

Looped sounds don't loop in a movie that you have exported as a digital video. To loop a sound in a movie that you plan to export as a digital video, you must trigger the sound by alternating it between the two sound channels.

About organizing movie files

In most cases, you should divide a large production into a series of smaller movies. You can combine as many movies as you want in a projector, but larger files take longer to save and are cumbersome to work with. Also, movies are easier to edit if they are organized in discrete sections.

The best way to organize a large production is to create a small projector file that launches the movie and then branches to Shockwave or protected movies. This saves you the trouble of re-creating the projector every time you change one part of a movie.



A typical file organization for a distributed movie

This approach also makes sense for movies on the Internet, but for different reasons. If the first movie is small, users don't have to wait as long for something to happen. Branching to a series of smaller movies also enables users to avoid downloading time for parts of the movie they do not use.

The size of your movie may be less of an issue if you use streaming Shockwave. For more information, see "Setting movie playback options" on page 592.

CHAPTER 27
Using Shockwave Player

Macromedia Director MX movies can use the Internet in various ways: hosting multiuser sessions such as chats and games, streaming movies and sounds, retrieving data from the network, and interacting with a browser. Whether it is distributed on disk or downloaded from the Internet, a movie can use an active network connection to retrieve linked files, send information, open web pages, and perform many other network activities.

To make a movie appear in a user's browser, you can save it as a Shockwave movie and embed it in an HTML document. The movie can play from a local disk or an Internet server. When the user opens the HTML document stored on an Internet server, the movie begins streaming to the user's system, and usually begins playing after the first frame's content has been downloaded.

You can also distribute a movie over the Internet as a projector—a packaged movie that the user downloads and executes. A projector plays in a stand-alone application, not in a browser. See "About distribution formats" on page 574.

When you author a movie, consider how the movie will be distributed and played on users' systems. If the movie will stream from an Internet source, you might need to modify the movie for the best streaming performance and to use the behaviors that are built in to Director to make the movie wait while certain cast members download. Controls and Lingo commands offer methods for sending and retrieving media and other information, interacting with a browser, and monitoring downloading.

About streaming movies

When you distribute a movie on the Internet, streaming provides an immediate and satisfying experience for your users. If you do not specify streaming, your user must wait for the entire movie to download before it begins to play. A streaming movie begins playing as soon as a specified amount of content reaches the user's system. As the movie plays, the remaining content downloads in the background and appears when it is needed. Streaming can dramatically decrease the perceived downloading time.

When Director streams a movie over the Internet, it first downloads the Score data and other nonmedia information such as scripts and the size of each cast member's bounding rectangle. This data is usually quite small compared with the size of the movie's media—usually only a few kilobytes. Before starting the movie, Director then downloads the internal and linked cast members that are required for the first frame of the movie (or more frames if you have increased the number in the Movie Playback dialog box). After the movie starts, Director continues to download cast members (along with any associated linked media) in the background, in the order the cast members appear in the Score.

If the movie jumps ahead in the Score or uses cast members that are referenced only by Lingo scripts, the required cast member might not be available when necessary. If cast members are not available, the movie either ignores them or displays a placeholder, depending on how you set the streaming options in the Movie Playback Properties dialog box.

A challenge of authoring for Internet streaming is ensuring that all cast members have been downloaded by the time the movie needs them. To avoid missing cast members, make sure that all the cast members required for a particular scene have been downloaded before beginning the scene. You can use the Director behaviors to wait for media in certain frames or for particular cast members. See "About streaming with the Score and behaviors" on page 594. You can also write custom Lingo code to do this. See "Checking whether media elements are loaded with Lingo" on page 595.

Director movies stream unless you turn off streaming. In addition to turning streaming off and on, you can specify that the media elements for a certain number of frames must finish downloading before the movie starts playing.

You control streaming movies by arranging sprites in the Score and controlling the movement of the playhead either with the Director behaviors or with Lingo. You can also use Lingo to specify when externally linked files are downloaded.

About network operations

Director lets a network operation begin even if a previous network operation isn't complete. This capability, often referred to as background loading, lets Director perform multiple operations while loading files. Because something else is happening while files are loading, the user doesn't perceive the wait.

Note: Loading data from a network is different from loading cast members in Director. Loading from a network loads data to the local disk. Loading cast members in Director means loading cast members into memory.

It's a good idea to author a Shockwave movie so that it performs other tasks while data is loading in the background. Because Internet operations require background loading, Lingo for the Internet behaves differently than Lingo commands that run within one movie. See "Using Lingo in different Internet environments" on page 598.

Setting movie playback options

To change basic streaming settings for a movie, you use the Movie Playback Properties dialog box. You can turn streaming off and on, specify a number of frames to download before playing the movie, and make Director display placeholders if cast members aren't downloaded yet. The Movie Playback Properties dialog box also includes options for locking the current tempo and pausing the movie when the window is deactivated.

Turning off streaming makes sense for some types of movies. For example, a game that requires all cast members to be available at once might not be suitable for streaming. Other movies work best if the media for a certain number of frames downloads before the movie begins playing. This option is especially useful for streaming movies that were not originally designed for streaming.

Placeholders are rectangles that appear in place of media elements for cast members that have not yet been downloaded. Placeholders are useful when testing to indicate places where media is missing.

You can specify streaming options any time before saving a movie as a Shockwave movie.

Note: If you want to test how a movie will stream from a server before you save the movie as a Shockwave movie, use File › Save and Compact to make sure the data in the movie is properly ordered and that redundant data is removed.

To set movie playback options:

1. Select Modify > Movie > Playback to define streaming options.
2. To stop the movie from streaming, deselect Play While Downloading Movie.
3. To make the movie wait for all media elements (internal and linked) for a specified range of frames, enter the number of frames in Download __ Frames Before Playing.

   By default, movies download the first frame only. Adjust this setting to the number of frames that is best for your movie.
4. To make the movie display placeholders for media elements that have not been downloaded, select Show Placeholders.

   The placeholders appear as rectangles when the movie plays.
5. To lock the movie to its current tempo settings, select Lock Frame Durations. See "Locking frame durations" on page 269.
6. To make the movie pause when its window is deactivated, turn on Pause When Window Inactive.

To set Shockwave playback options, see the next section.

Setting Shockwave playback options

To view Shockwave movies, your users must have the Shockwave player, which comes preinstalled on many computer systems. The player is also available for free downloading from Macromedia's website at www.macromedia.com/shockwave/download/.

The Shockwave player includes a volume control and a standard context menu that appears when a user right-clicks (Windows) or Control-clicks (Macintosh) a movie. You can select specific playback options to include for your users when you save your movie as a Shockwave movie.

Shockwave movies loop by default. To cause a Shockwave movie to play only once, add the `Hold on Current Frame` behavior to the last frame of the movie.

To set Shockwave playback options:

1 Select File > Publish Settings.

The Publish Settings dialog box appears.

2 On the Shockwave tab, select the options that you want to provide for your users, as described in the following list:

Volume Control lets users adjust the volume of the movie's soundtrack.

Transport Control provides controls for rewinding, stopping, and stepping through the movie in Shockmachine.

Zooming determines if Shockwave stretching is allowed. You can disable zooming with Lingo by setting the `allowZooming` property. For more information, see the *Lingo Dictionary*.

Save Local lets users save movies on their local computers for playback in Shockmachine.

Display Progress Bar and Display Logo determine if the progress bar and logo appear while the movie loads in the browser.

About creating multiuser applications

If you want to create multiuser movies or applications with Director, you need to use Macromedia Flash Communication Server MX in your Director movie. You do this by importing a Flash movie into your Director movie. This can be a Flash movie that has already been authored to communicate with the Flash Communication server or a simple Flash movie that can serve as a container for Flash script objects that you create with Lingo. By using Flash script objects in Lingo, you can implement Flash Communication server functionality entirely in Director.

For more information about using Flash Communication Server MX in Director, see Chapter 11, "Using Flash and Other Interactive Media Types," on page 293.

For information about using the Director Multiuser Server, see the Multiuser section of the Director Support Center. (www.macromedia.com/support/director/multiuser.html)

About streaming with the Score and behaviors

The easiest way to create a movie that streams well is to arrange the Score properly and use behaviors to control the playhead. Director downloads cast members in the order in which they appear in the Score. Try to arrange the Score so that events don't make the playhead jump far ahead in the Score, where cast members have not yet been downloaded. For example, if you place a menu in the first frame of a movie and a user selects an option that sends the playhead to frame 400, the cast members for frame 400 probably won't be available right away.

To avoid this problem, begin a movie with a simple introductory scene that contains a few small cast members, preferably vector shapes. You can use a streaming behavior from the Library palette to make the introduction loop until the cast members that are required for the next scene have been downloaded in the background.

Several behaviors that are included with Director control the playhead or a progress bar while media elements are downloading. These behaviors make it easy to allow enough time for downloading to catch up with action in the Score.

Looping behaviors

Looping behaviors make the playhead return (loop) to a frame or stay on the current frame until specified media elements have been downloaded and then continue to the next frame. Attach a looping behavior to a frame in the script channel, not to a sprite. The following looping behaviors are accessible by selecting Internet > Streaming from the Library List menu in the Library palette:

Loop until Next Frame is Available loops the playhead to a specified frame until all the media elements that are required for the next frame have been downloaded.

Loop until Member is Available loops the playhead to a specified frame until a certain cast member has been downloaded.

Loop until Media at Marker is Available loops the playhead to a specified frame until all the media elements for the frame at the specified marker have been downloaded.

Loop until Media in Frame is Available loops the playhead to a specified frame until all the media elements that are required for a certain frame have been downloaded.

Jumping behaviors

Jumping behaviors make the playhead skip to a specified frame or marker after certain media elements have been downloaded. Attach a jumping behavior to a frame in the script channel, not to a sprite.

Jump When Member is Available moves the playhead to the specified frame after a certain cast member has been downloaded.

Jump When Media in Frame is Available moves the playhead to the specified frame after the media elements for a particular frame have been downloaded.

Jump When Media in Marker is Available moves the playhead to the specified frame after the media elements for the frame at a particular marker have been downloaded.

Checking whether media elements are loaded with Lingo

Director has several options that let an initial portion of a movie start playing as soon as the required data and cast members are available. You can use Lingo to check whether media elements have been downloaded from a network by testing the following:

- Whether a specific cast member is loaded before the movie proceeds
- Whether the cast members used in a specific frame are loaded before the frame plays

Checking whether a cast member or sprite is loaded

To determine whether a specified cast member is available locally, you use the `mediaReady` cast member or sprite property. You can check for a specific cast member or the cast member that is assigned to a specific sprite. When `mediaReady` returns `TRUE`, the cast member is available. See `mediaReady` in the *Lingo Dictionary*.

This property always returns `TRUE` for local files. It is useful only for movies that stream from a remote server. Because playback can begin before the entire movie has been downloaded, you must make sure that necessary media elements have been downloaded as the movie plays.

Checking whether a frame's contents are loaded

Use the `frameReady()` function to determine whether all the media elements that the specified frame requires are available locally. See `frameReady()` in the *Lingo Dictionary*.

Downloading files from the Internet with Lingo

Lingo uses the Internet's resources by obtaining files from the Internet. The data is copied to the local disk or cache. After data is available on the local computer, use Lingo to retrieve the data for the movie. See "Retrieving network operation results with Lingo" on page 597.

For a movie or projector that is playing outside a browser, background loading isn't required. However, preloading is a good idea because it improves playback performance.

All network Lingo operations that obtain data from the network begin downloading the data and return a network ID. The data isn't immediately available.

An unlimited number of network Lingo operations can take place at once. When multiple network Lingo operations run simultaneously, rely on the network ID that the function returns to distinguish which operation is complete. Be aware that running more than four operations at once usually adversely impacts performance.

When using network Lingo, the current handler must finish before an operation's result can return. For best results, place Lingo that initiates a network operation and Lingo that uses the operation's result in different handlers. An `on exitFrame` handler is a good location for checking whether an operation is complete.

To execute a network Lingo operation:

1. Start the operation.

   For example, the following statement initiates a text downloading operation and assigns the network ID returned by the `getNetText()` operation to the variable `theNetID`:

   ```
   set theNetID = getNetText("http://www.thenews.com")
   ```

2. Make sure the operation finishes.

   To check an operation's status regularly until the function indicates that the operation is complete, use the `netDone()` function. See `netDone()` in the *Lingo Dictionary*.

   For example, the following statement loops in the current frame until the download operation is complete:

   ```
   if not netDone(theNetID) then go to the frame
   ```

3. Check whether the operation was successful by using the `netError()` function. See `netError()` in the *Lingo Dictionary*.

4. Obtain the results if the operation is complete.

To cancel a network operation in progress:

- Use the `netAbort` command to cancel a network operation without waiting for a result. This frees up capacity for Internet access, which lets other network operations finish faster. See `netAbort` in the *Lingo Dictionary*.

To retrieve a file as text:

1. Use the `getNetText()` function or the `postNetText` command to start retrieving text. See `getNetText()` or `postNetText` in the *Lingo Dictionary*.
2. Use the `netTextResult()` function to return the text you retrieved with `getNetText` or `postNetText`. See `netTextResult()` in the *Lingo Dictionary*.

To retrieve and play a new Shockwave movie from the network:

- Use the `gotoNetMovie` command. See `gotoNetMovie` in the *Lingo Dictionary*.

The current movie continues to run until the new movie is ready to play. After the new movie is ready, the player quits the current movie without warning and plays the new movie in the same display area as the calling movie.

To open a URL in the user's browser:

- Use the `gotoNetPage` command. This command works whether the URL refers to a Shockwave movie, HTML, or another MIME type. See `gotoNetPage` in the *Lingo Dictionary*.

You can specify that this command replace a page's content or open a new page. If the browser isn't open, the command launches the browser. If the `gotoNetPage` command replaces the page in which the movie is playing, the movie keeps playing until the browser replaces the page.

The `gotoNetPage` command is similar to the Director `open` command. It doesn't return a value.

To preload a file from the server into the cache:

- Use the `preloadNetThing()` function. See `preLoadNetThing()` in the *Lingo Dictionary*.

The `preloadNetThing()` function initiates downloading a linked movie asset into the cache, where it is available for later use. Director can later preload the asset into memory without a download delay.

The current movie continues playing while preloading occurs.

To test whether getNetText(), preloadNetThing, or gotoNetMovie operations are complete:

- Use the `netDone()` function. See `netDone()` in the *Lingo Dictionary*.

To post information to a server and retrieve a response:

- Use the `postNetText` command. See `postNetText` in the *Lingo Dictionary*.

Retrieving network operation results with Lingo

Lingo can retrieve network operation results, such as a text result, a unique identifier for a network operation, a file's MIME type, and the date an HTTP item was last modified.

A returned network ID is for the network operation whose results are being retrieved.

To retrieve the text result of a network operation:

- Use the `netTextResult()` function. See `netTextResult()` in the *Lingo Dictionary*.

To retrieve the "date last modified" string from the HTTP header for a specific item:

- Use the `netLastModDate()` function. See `netLastModDate()` in the *Lingo Dictionary*.

To obtain the MIME type of the HTTP item:

- Use the `netMIME()` function. See `netMIME()` in the *Lingo Dictionary*.

To conserve memory, Director discards the results of the `netTextResult()`, `netDone()`, `netError()`, `netMIME()`, and `netLastModDate()` functions within a short time after the operation completes successfully.

- For `netTextResult()`, Director discards the results when the next operation starts.
- For the other functions, Director retains the results through seven subsequent network operations.

To determine the state of a network operation that retrieves data:

- Use the `getStreamStatus()` function or the `on streamStatus` event handler. See `getStreamStatus()` or `on streamStatus()` in the *Lingo Dictionary*.

Using Lingo in different Internet environments

Some Lingo features behave differently, depending on whether the movie is playing back in a browser, as a projector, or within the authoring environment.

Using Lingo with Internet security restrictions

Because of security issues for movies that play back in browsers, the following Lingo features are unsupported for Shockwave movies playing in a browser. Many of these restrictions are imposed by the Internet environment. For details about security concerns when playing a movie on the Internet, see "Director and Internet Security" on the Director Support Center website at www.macromedia.com/support/director/internet/security/.

In general, the following Lingo features are unsupported because of Internet security concerns:

- Setting `colorDepth` for the user's monitor
- Saving a movie by using the `saveMovie` command
- Printing by using the `printFrom` command
- Opening an application by using the `open` command
- Stopping an application or the user's computer by using the `quit`, `restart`, or `shutDown` command
- Opening a local file that isn't in the dswmedia folder or a subfolder of the dswmedia folder
- Pasting content from the Clipboard by using the `pasteClipBoardInto` command
- Searching for files on a user's system with `getNthFileNameInFolder()`, `searchCurrentFolder`, or `searchPath`

Using URLs with Lingo

In addition to the Lingo that is explicitly intended for use with network operations, some Lingo elements can use URLs as references to external files.

The following Lingo elements can use URLs as file references in all circumstances:

- `moviePath`
- `pathName`
- `unloadMovie`

The following Lingo supports URLs as references to external files. If you use this Lingo in projectors or during authoring, you can avoid pauses while the file is being downloaded by first using `preloadNetThing` to download the file. After the file has been downloaded, you can use these Lingo elements with the file's URL without a delay.

When the following Lingo is used in a browser, however, you must first download the file by using the `preloadNetThing` command. If you do not, the Lingo fails.

- Using a `go to movie` statement
- Using an `importFileInto` command
- Using a `preLoadMovie` command
- Using a `play movie` command
- Using an `open window` command (disabled in browsers)

The following Lingo elements can use URLs to Shockwave Audio (SWA) sound files as file references:

- `streamName`
- `URL` cast member property

The following Lingo elements can use URLs as file references only during authoring or in projectors:

- `getNthFileNameInFolder()`
- `searchCurrentFolder`

The following elements don't work in Shockwave movies because Shockwave doesn't support movies in windows (MIAWs):

- `open window`
- `forget window`
- `close window`

Differences in scripting Lingo for browsers

The following list discusses some general differences in the way to script Lingo for a movie that plays over the Internet, depending on whether the movie is in a browser.

- For a movie playing in a browser, it is best to use `preloadNetThing` to load media elements into the browser's cache first. If the media elements aren't preloaded using `preloadNetThing`, linked media elements might not be present when they are needed.
- Avoid using long repeat loops in browsers; such repeat loops can make the computer appear unresponsive. As an alternative, you can split long operations into sections and execute them over a series of frames or check for user actions in an `on exitFrame` handler.
- Do not use a `repeat while` loop to check whether a network operation is complete.

Lingo that is unsupported in browsers

The following Lingo features are unsupported for movies that play back in browsers:

- Creating and managing a MIAW
- Installing and managing custom menus

Interacting with browsers

Lingo lets you write and read a preferences file within the dswmedia folder and display a string in a browser's status area.

To write to a preferences file on a local disk:

- Use the `setPref` command. See `setPref` in the *Lingo Dictionary*.

  After the command runs, a folder named Prefs is created inside the Shockwave player folder (in the same location as the Xtras folder). The `setPref` command can write only to that folder. The default folder locations for Windows and Macintosh are described in the following list:

  Windows The \Macromed\Shockwave 8 subfolder of the system folder; the system folder is typically c:\winnt\system32 or c:\windows\system

  Macintosh The System Folder:Extensions:Macromedia:Shockwave 8 folder

  The `setPref` command can't write to a file that is on a CD.

For more information, see "Director and Internet Security" on the Director Support Center website at www.macromedia.com/support/director/internet/security/security.htm.

To return the content of a file that was written by a previous setPref command:

- Use the `getPref()` function. If no `setPref` command has already written such a file, the `getPref()` function returns `VOID`. See `getPref()` in the *Lingo Dictionary*.

To specify text in a browser's status area:

- Use the `netStatus` function. See `netStatus` in the *Lingo Dictionary*.

Note: Some browsers do not support this function.

Testing your movie

However you select to create your movie, test it thoroughly before releasing it to the public. Make sure you test on systems with all common types of Internet connections, especially on slow modems and at busy times of day. The following list describes things you might want to check before distributing your movie over the Internet; remember, however, that each movie has its own special needs:

- Compare a streaming version of the movie to a nonstreaming version to see if the performance is different. Some smaller movies might work better without streaming playback.
- Verify that all linked media elements appear correctly. To see if the movie correctly handles an error, try forcing the linked media elements to fail.
- Run the movie on all systems your users are likely to have. For the general public, this includes Windows 95, 98, and NT as well as Mac OS 8.x and 9.
- Run the movie on slow modem connections and on fast T3 connections; problems can arise from fast as well as slow connections.
- Check for display problems on systems set to 8-, 16-, 24-, and 32-bit color. Also test as many types of monitors and display adapters as you can.
- Check for font mapping problems in your movie. If your movie uses nonstandard fonts, use embedded fonts. See “Embedding fonts in movies” on page 274.
- Check for sound problems, particularly if you stream sounds with SWA.

About downloading speed

Developers distributing multimedia over the Internet usually limit file size, primarily because most users connect at relatively slow speeds. At 28,800 bps, it takes 30 seconds to 1 minute to download a 60K file. Using streaming playback can help you avoid some of the delays caused by downloading large files.

Movies and streaming SWA sounds always compete for control of the network, which can cause a noticeable problem on slower connections.

If there is heavy traffic at the Internet access point or on the Internet host, or if there is network congestion, the rate drops even lower—to as low as a few hundred bytes per second. In general, it is a good idea to assume your movies will download at about 2K per second.

The following chart shows theoretical throughput times for modems of different speeds. The speeds 14,400 and 28,800 bps are common for modems; 64 Kbps and 128 Kbps are the throughput of an ISDN line; 1.5 Mbps is the throughput of a standard high-speed Internet connection (T1).

Content	14.4 Kbps	28.8 Kbps	64 Kbps	1.5 Mbps
Small graphics and animation, 30K	30 sec	10 sec	6 sec	1 sec
Small complete movie, 100 to 200K	100 to 200 sec	50 to 100 sec	20 to 40 sec	1 sec
500K movie	500 sec	120 to 240 sec	90 sec	3 sec
1 MB movie	--	--	180 sec	6 sec

INDEX

C

D

E

F

G

H

I

M

Q

R

S

T

x

z