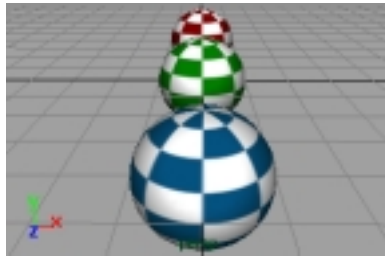# 4 CAMERAS AND VIEWS

In the real world, you use a camera to both *look at* the world and *record* the world. To look at the world from a camera's point of view, you look into the camera's *viewfinder*. When you take a photograph, you are recording a 2D image of the 3D world from the camera's point of view onto film or videotape.

There are two types of real-world cameras: still picture and motion picture. Still picture cameras record a single image at a time. Motion picture cameras record a continuous series of images (usually 24, 25, or 30 images per second) that, when played back in sequence, create the illusion of motion.

In Maya, you use a camera to either *look at* a scene or *render* a scene, or both. To look at a scene from a camera's point of view, you look at the camera's *view*. When you render a scene, you are creating and recording a digital 2D image of the 3D scene from a camera's point of view onto your computer's disk.

View

A view represents the view from a specific camera. You use views to look at your scene as you create it. A scene can contain several cameras, and therefore several views. Objects in a view appear as wireframe or shaded objects.
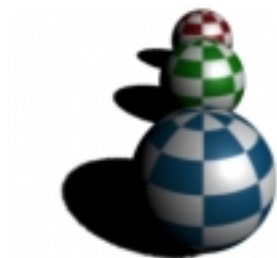
Rendered image

You render a scene by rendering a view from a specific camera. Usually you use several cameras to look at your scene when you're creating it, but only one camera to render your scene when it's finished.

There are two types of cameras in Maya: orthographic and perspective. Both types of cameras can render either a single image or a continuous series of images.

Perspective camera

Perspective cameras are similar to real-world cameras. They represent the effect of *perspective*. When an object is near the camera it appears larger than when it is far from the camera. You use a perspective camera to look at your scene as you create it, and to render your scene when it's finished.

Orthographic camera

Orthographic cameras are *not* like real-world cameras. They *do not* represent the effect of perspective. An object viewed from an orthographic camera appears to be the same size no matter how near or far it is from the camera.

You use orthographic cameras to look at your scene as you create it. (For example, you can use an orthographic camera to see the relative size of objects or to align objects.) You do not usually use orthographic cameras to render your scene when it's finished.

When you first start Maya, or create a new scene, by default the scene contains four cameras (and views): three orthographic cameras (side, top, and front) and one perspective camera (persp). You can, however, create additional cameras.

This chapter contains the following sections:

- "Creating cameras and views" on page 165
- "Camera views and view guides" on page 167

- "Camera icons and manipulators" on page 170
- "Setting up a camera" on page 173
- "Setting a camera's view" on page 176
- "Saving and loading a camera's view" on page 187
- "Making camera views render faster" on page 189.

Creating cameras and views

When you first start Maya, or create a new scene, by default the scene contains four cameras (and four views): three orthographic cameras (side, top, and front) and one perspective camera (persp). You can, however, create additional perspective and orthographic cameras (and views).

Usually, you use the four default cameras to view your scene, and create an additional perspective camera to actually render from. If you render from the default perspective camera, you may find it difficult to position the camera without having another perspective camera to view your scene from, especially if you are animating the camera.

You can create a camera from the main Maya window or from the view of another camera. When you create a camera from the main Maya window, by default, it is a perspective camera. In order to create an orthographic camera from the main Maya window, you must set the Create Camera Options.

After you have created a camera, you can change whether it is a perspective camera or an orthographic camera.

> **Note**
>
> If you are creating a camera that you plan to animate, see "Creating a camera to animate" on page 166.

To create a camera (and view) from the main Maya window:

Select Create > Camera.

Creating cameras and views

> **Note**
>
> To set camera properties as you create the camera, select Create > Camera □. See "Setting up a camera" on page 173.

To create a perspective camera (and view) from a view:

Select Panels > Perspective > New.

To create a perspective camera (and view) from Hypershade:

- Select Create > Utilities > Camera.
- Using the middle mouse button, drag the camera swatch from the Create > Cameras folder in Visor into the Hypershade panel.

To create an orthographic camera (and view) from the main Maya window:

1 Select Create > Camera □.

2 In the Orthographic Views section of the Create Camera Options window, turn on Orthographic.

3 Click the Create button.

To create an orthographic camera (and view) from a view:

Select Panels > Orthographic > New.

To change a perspective camera to an orthographic camera (or vice versa):

- In the Orthographic Views section of the camera's Attribute Editor, turn Orthographic on or off.
- In the camera's view, select View > Camera Settings > Perspective.

Creating a camera to animate

When you create a camera, by default, it is a *one-node* camera. A one-node camera has one node that controls its position and direction (the transform node).

A one-node camera is usually fine for rendering still images or for animations in which the camera does not move or the camera's motion is very simple. However, you may find that a one-node camera is difficult to animate for more complicated movements because you cannot easily control the point that the camera looks at or the camera's up direction.

To animate a one-node camera and control the point that the camera looks at or the camera's up direction, you need to use *constraints*. A constraint is a way of controlling, or *constraining*, an object's position, orientation, or scale based on the position, orientation, or scale of another object. (For information on using constraints, see "Constraints" in *Using Maya: Character Setup*.) Instead of animating a one-node camera using constraints, you may find it easier to animate a two-node or three-node camera.

A two-node camera has two nodes that control its position and direction, and a three-node camera has three. These extra nodes allow you to easily control the point that the camera looks at and the camera's up direction, and make animating the camera much easier.

> **Note**
> After you have created a camera, it is difficult to change whether it is a one-node, two-node, or three-node camera.

To create a one-node, two-node, or three-node camera:

1   Select Create > Camera □.

2   In the Animation Options section of the Create Camera Options window, select One, Two, or Three.

3   Click the Create button.

Camera views and view guides

When you first start Maya, or create a new scene, by default the scene contains four cameras and four views. Camera views appear in panels in the main Maya window.

If you create a new camera, its view is not automatically displayed in a panel. You can, however, control which views appear in which panels and how panels are arranged in the Maya window. You can also display view guides to help visualize how your scene will render.

Camera views

In the real world, you look at the world from a camera's point of view by looking into the camera's viewfinder.

In Maya, you look at a scene from a camera's point of view by displaying the camera's view, either in a panel or in a separate window.

To display a camera's view in a panel:

- From a view, select the camera's name from the Panels > Perspective or Panels > Orthographic sub-menu.

- Select the camera, and from a view, select Panels > Look Through Selected.

For more information on arranging views, see "Arranging views" in *Using Maya: Basics.*

To display a camera's view in a window:

From a view, select Panel > Tear Off Copy.

Camera view guides

In the real world, the viewfinder of a camera may contain one or several markings that help you determine what parts of the image will or will not be recorded by the camera.

In Maya, a camera's view may contain one or several view guides. By default, a camera's view does not display any view guides. Usually when you are creating a scene, you do not need to display any view guides. You can, however, display one or more of the several different types of view guides to help you determine what parts of the scene will or will not render.
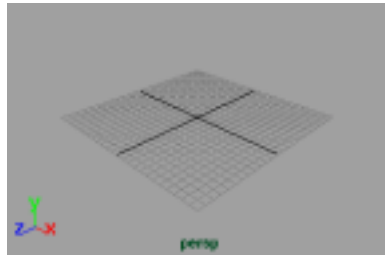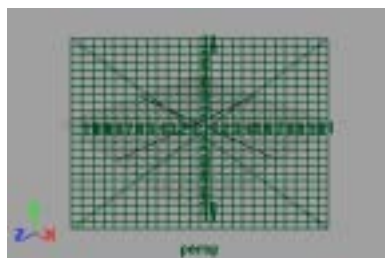
No view guides

By default, a camera's view does not include any view guides.
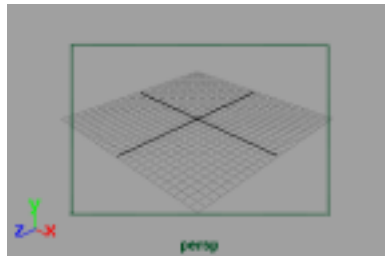
Film gate

The Film Gate view guide indicates the area of the camera's view that a real-world camera would record on film. The dimensions of the film gate represent the dimensions of the camera aperture. The film gate view guide indicates the area of the camera's view that will render *only* if the aspect ratios of the camera aperture and rendering resolution are the same.
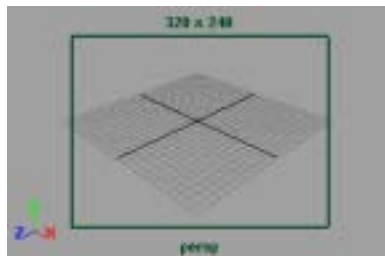
Resolution gate

The Resolution Gate view guide indicates the area of the camera's view that will render. The dimensions of the resolution gate represent the rendering resolution. The rendering resolution values are displayed above the resolution gate view guide.

Field chart

The Field Chart view guide represents the twelve standard cel animation field sizes. The largest field size (number 12) is identical to the rendering resolution (the resolution gate).
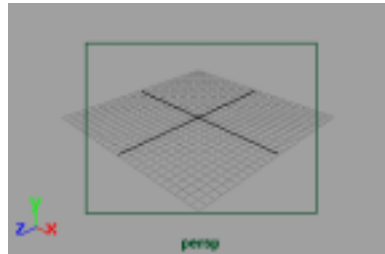
Safe action

The Safe Action view guide indicates the region that you should keep all of your scene's action within if you plan to display the rendered images on a television screen. The safe action view guide represents 90% of the rendering resolution (the resolution gate).

Safe title

The Safe Title view guide indicates the region that you should keep titles (text) within if you plan to display the rendered images on a television screen. The safe title view guide represents 80% of the rendering resolution (the resolution gate).

To display a camera view guide:

- From the view panel, select the guide from the View > Camera Settings sub-menu.

- Select the guide from the Display Options section of the camera's Attribute Editor.

> **Tip**
>
> To change the amount of space visible outside a view guide, in the Film Back section of the camera's Attribute Editor, adjust the Overscan attribute.

Camera icons and manipulators

Usually you adjust a camera while looking through its view. However, you can display camera icons and manipulators which allow you to visualize and adjust a camera's view without having to actually look through its view.

Camera icons

A camera icon represents the position and direction of a camera in a view. Camera icons are not visible by default.

> **Note**
>
> A camera's icon is *never* visible in its own view. You can only see a camera's icon from *another* camera's view.

Perspective Camera   Orthographic Camera

A circle on a two-node or three-node camera icon represents the view point (center of interest), and a circle on a three-node camera represents the camera's up direction. See "Creating a camera to animate" on page 166.

⊙ Up Direction Point

Center of
Interest
⊙

Center of
Interest
⊙

Two-Node Camera   Three-Node Camera

To display all camera icons:

Select Display > Show > Cameras.

To hide all camera icons:

Select Display > Hide > Cameras.

To hide or display all camera icons in a specific view:

In a view, select Show > Cameras.

Camera manipulators

Camera manipulators allow you to interactively adjust certain camera attributes.

Cycling Index

Cycling index

Click the Cycling Index manipulator to display each of the camera's three types of manipulators: Center of Interest, Pivot, and Clipping Planes. The position of the dash on the Cycling Index indicates which manipulator is displayed.

Center of interest

Move the two parts of the Center of Interest manipulator to change the camera's location (the manipulator on the camera icon) and direction (the manipulator on the circle). See "Setting a camera's center of interest" on page 178.
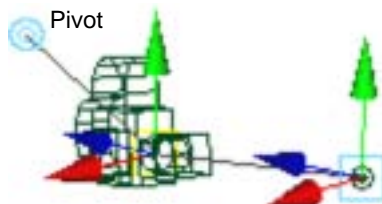
Pivot

Pivot

Move the Pivot manipulator and then click on it to change the point that the camera pivots about when you move the camera or the center of interest. Click the Pivot manipulator again to disable the pivot point.
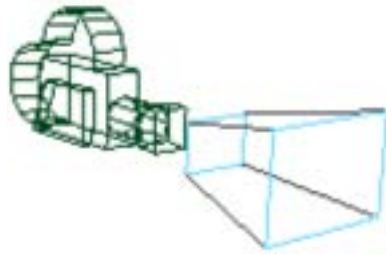
Clipping planes

Move the two parts of the Clipping Planes manipulator to change the location of the near and far clipping planes. See "Setting a camera's range" on page 184.

To display camera manipulators:

- Select Display > Show > Camera Manipulators.
- Click the Show Manipulator Tool (or press the hotkey t).

To display or hide a specific camera manipulator:

Select a camera and then select the manipulator from the Display > Camera/ Light Manipulator sub-menu.

To hide camera manipulators:

Select Display > Hide > Camera Manipulators.

To increase or decrease the size of camera manipulators:

Press - (decrease) or = (increase).

Setting up a camera

In the real world, every camera has certain basic physical characteristics that do not change (for example, the camera's film format: 16mm, 35mm, 70mm). You select a specific camera for its basic physical characteristics based on how you plan to use the film or video in post-production and how you plan to present the finished film or video.

In Maya, you can change all characteristics for a camera at any time. However, you usually set a camera's basic characteristics when you first create it. You set these characteristics based on how you plan to use the rendered images in post-production and how you plan to present the finished film or video.

For example, if you plan to render a scene and then combine it with live action, you will need to set up Maya's camera to match the real-world camera used to record the live action.

To set up a camera:

1   In the Film Back section of the camera's Attribute Editor (View > Camera Attribute Editor), select a preset Film Gate (for example, Super 16mm).

Maya automatically sets the following camera attributes. If you do not see an appropriate preset Film Gate, you must set these attributes manually.

Camera Aperture	The height and width of the camera's aperture or film back, measured in inches. The Camera Aperture controls the relationship between Focal Length and Angle of View.
Film Aspect Ratio	The ratio of the camera aperture's width to its height. When you set the Camera Aperture values, Maya automatically updates the Film Aspect Ratio (and vice versa).
Lens Squeeze Ratio	The amount that the camera's lens compresses the image horizontally. Most cameras do not compress the image they record, and their Lens Squeeze Ratio is 1. Some cameras (for example, anamorphic cameras), however, compress the image horizontally in order to record a large aspect ratio (wide) image onto a square area on film.

Tip

Turn on the Film Gate view guide in the Display Options section of the camera's Attribute Editor. See "Camera view guides" on page 168.

The Film Gate represents the region of your scene that a *real-world* camera would record. It *does not* usually represent the region of your scene that the Maya camera will render.

2   In the Resolution section of the Render Globals window (Window > Render Globals), select a preset Render Resolution (for example, 640 x 480).

Maya automatically sets the following attributes. If you do not see an appropriate preset Render Resolution, you must set these attributes manually.

Width, Height	The width and height of the image you want to render, measured in pixels. The ratio of the width and height is the *image aspect ratio.* When you set the Width, Maya automatically updates the Height (and vice versa) if Maintain Width/Height Ratio is on. When you set the Width or Height, Maya automatically updates the Device Aspect Ratio (if Lock Device Aspect Ratio is off) or the Pixel Aspect Ratio (if Lock Device Aspect Ratio is on).
Device Aspect Ratio	The aspect ratio of the display device you will be viewing the rendered image on. The *device aspect ratio* represents the *image aspect ratio* (see above) multiplied by the *pixel aspect ratio* (see below). Device Aspect Ratio and Pixel Aspect Ratio are related; when you set the Device Aspect Ratio, Maya automatically updates the Pixel Aspect Ratio.
Pixel Aspect Ratio	The aspect ratio of the individual pixels of the display device you will be viewing the rendered image on. Most display devices (for example, a computer monitor) have square pixels, and their Pixel Aspect Ratio is 1. Some devices, however, have non-square pixels (for example, digital video has a Pixel Aspect Ratio of 0.9). Pixel Aspect Ratio and Device Aspect Ratio are related; when you set the Pixel Aspect Ratio, Maya automatically updates the Device Aspect Ratio.

> **Tip**
>
> Turn on the Resolution Gate view guide in the Display Options section of the camera's Attribute Editor. See "Camera view guides" on page 168.

The Render Resolution, or Resolution Gate, represents the region of your scene that the camera will actually render.

3   Set the following camera attributes.

Film Fit	Controls the size of the resolution gate relative to the film gate, and whether the resolution gate fits within the film gate (Fill), fits only horizontally (Horizontal) or vertically (Vertical) within the film gate, or whether the film gate fits within the resolution gate (Overscan).
Film Fit Offset	Offsets the resolution gate relative to the film gate, either vertically (if Film Fit is Horizontal) or horizontally (if Film Fit is Vertical). You usually leave the Film Fit Offset as 0.
Film Offset	Vertically and horizontally offsets the resolution gate and the film gate relative to the scene. You usually leave both Film Offset values as 0. However, you can track the view in two dimensions using the Film Offset. See "Tracking a camera's view in two dimensions" on page 180.

Setting a camera's view

In the real world, you set a camera's view by first selecting a subject or *center of interest* and then selecting how the camera will view the center of interest. You can also selectively focus a camera so that certain objects are in sharp focus while other objects are not.

In Maya, you set a camera's view in the same way. You can also limit a camera's range so that only objects within this range are visible.

> **Tip**
>
> Turn on the Resolution Gate view guide to see the area of your scene that will actually render. See "Camera view guides" on page 168.

> **Note**
>
> By default, you cannot undo or redo all camera movements. To be able to undo or redo all camera movements, turn on Journal Command in the Display Options section of the camera's Attribute Editor, or in the camera's view select View > Camera Settings > Journal.

Center of interest

The point in 3D space that the camera looks at. An object that is located at this point appears in the center of the camera's view. See "Setting a camera's center of interest" on page 178.

How a camera views its center of interest

The distance and direction from which the camera views the center of interest. See "Setting how a camera views its center of interest" on page 181.

Camera range

The range of distances from the camera within which objects are visible. See "Setting a camera's range" on page 184.

Selective focus

The distance or range of distances within which objects appear sharply focused and outside of which objects appear blurred or out of focus. See "Selectively focusing a camera's view" on page 185.

Setting a camera's center of interest

A camera's center of interest is the point in 3D space that the camera looks at. An object that is located at this point appears in the center of the camera's view. You can set a camera's center of interest in several ways.

Looking at objects or regions in a scene

Tracks, tilts/pans, and/or dollies the camera so that selected objects, all objects, or a selected region are in the camera's view. See "Looking at objects or regions in a scene" on page 179.

Tracking

Moves the camera left, right, up, or down. The scene in the camera's view moves in the opposite direction. See "Tracking a camera's view" on page 179.

2D tracking

Moves the camera's film back; the camera does not move. The scene in the camera's view moves in the opposite direction. Perspective, or the relative orientation of objects in the scene, does not change. See "Tracking a camera's view in two dimensions" on page 180.

Tilting and panning

Tilts the camera up or down, or pans the camera left or right. The scene in the camera's view moves in the opposite direction. See "Tilting or panning a camera's view" on page 180.

Looking at objects or regions in a scene

You can easily set a camera's center of interest to the center of a specific object, group of objects, or region.

To look at selected objects:

Select View > Look At Selection.

The camera tilts and pans so that selected objects are in the center of the camera's view.

To look at and fill the view with selected objects:

Select View > Frame Selection (or press the hotkey f).

The camera tracks and dollies so that selected objects fill the camera's view.

To look at and fill the view with all objects in a scene:

Select View > Frame All (or press the hotkey a).

The camera tracks and dollies so that all objects in the scene (including lights and cameras if their icons are displayed in the view) fill the camera's view.

To look at and fill the view with a region of a scene:

Ctrl-Alt-drag over the region.

The camera tracks and dollies so that the selected region fills the camera's view.

Tracking a camera's view

Tracking a camera means moving the camera left, right, up, or down. The scene in the camera's view moves in the opposite direction.

To track a camera's view:

- Using the middle mouse button, Alt-drag in the camera's view. (The speed that Maya tracks the camera is based on the distance from the camera to the center of interest. If this distance is very small, the camera will track very slowly.)
- Select View > Camera Tools > Track Tool and drag in the camera's view.
- Select the Move tool (or press the hotkey w) and move the camera's icon.

- Select View > Frame Selection to track and dolly so that selected objects fill the camera's view.
- Select View > Frame All to track and dolly so that all objects in the scene fill the camera's view.

Tracking a camera's view in two dimensions

Tracking a camera in two dimensions means moving the camera's film back, not the camera itself. The scene in the camera's view moves in the opposite direction. The relative orientation of objects in the scene does not change.

To track a camera's view in two dimensions:

Adjust the camera's Film Offset values.

Tilting or panning a camera's view

Tilting a camera means rotating the camera up or down; panning a camera means rotating the camera left or right. The scene in the camera's view moves in the opposite direction. (The angle of rotation up or down is also referred to as *pitch*; the angle of rotation left or right is also referred to as *yaw*.)

To tilt or pan a camera's view:

- Select View > Camera Tools > Yaw-Pitch Tool and drag in the camera's view.
- Select View > Look At Selection to tilt or pan the camera so that selected objects are in the center of the camera's view.
- Move the camera's Center of Interest manipulator.

Setting how a camera views its center of interest

Once you set a camera's center of interest, you set *how* the camera looks at its center of interest. A camera can look at its center of interest from any direction or distance.

> **Note**
>
> The Film Gate, Camera Aperture, Film Aspect Ratio, Lens Squeeze Ratio, Film Fit, Film Fit Offset, and Film Offset attributes also affect a camera's view; however, you should set these attributes only when you are first setting up a camera. See "Setting up a camera" on page 173.

There are several ways you can set how a camera views its center of interest.

Tumbling

Changes the position from which the camera views its center of interest. The scene in the camera's view appears to rotate about the center of interest. See "Tumbling a camera's view" on page 182.

Rolling

Rotates the camera about its sight line. The camera's view rotates in the opposite direction. See "Rolling a camera's view" on page 182.

Dollying

Moves the camera toward or away from its center of interest. The scene in the camera's view becomes larger or smaller. The relative size of objects in the scene changes based on their distance from the camera. See "Dollying a camera's view" on page 183.

Zooming

Changes the lens's focal length; the camera does not move. The scene in the camera's view becomes larger or smaller. The relative size of objects in the scene *does not* change. See "Zooming a camera's view" on page 183.

Tumbling a camera's view

Tumbling a camera means changing the position from which the camera views its center of interest. The scene in the camera's view appears to rotate about the center of interest. (The angle of a camera's sight line relative to the ground plane is also referred to as its *elevation*; the angle of a camera's sight line relative to a plane perpendicular to the ground plane is also referred to as its *azimuth*.)

To tumble a camera's view:

- Alt-drag in the camera's view.
- Select View > Camera Tools > Tumble Tool and drag in the camera's view.
- Select View > Camera Tools > Azimuth Elevation Tool and drag in the camera's view.
- Move the camera icon manipulator.

Rolling a camera's view

Rolling a camera means rotating the camera about its sight line (the line connecting the camera to its center of interest).

To roll a camera:

- Select View > Camera Tools > Roll Tool and drag left or right in the camera's view.
- Select the Rotate tool (or press the hotkey e) and rotate the camera's icon using the blue rotate manipulator.

Dollying a camera's view

Dollying a camera means moving the camera toward or away from its center of interest. The scene in the camera's view becomes larger or smaller. The relative size of objects in the scene changes based on their distance from the camera.

> **Note**
>
> When you dolly an orthographic camera, the camera does not actually move. Instead, the camera's viewing plane increases or decreases in size. The effect in the camera's view, however, is the same as moving the camera.

To dolly a camera:

- Using the left *and* middle mouse buttons, Alt-drag in the camera's view.
- Select View > Camera Tools > Dolly Tool and drag in the camera's view.
- Select View > Frame Selection to track and dolly so that selected objects fill the camera's view.
- Select View > Frame All to track and dolly so that all objects in the scene fill the camera's view.

Zooming a camera's view

Zooming a camera means changing the lens's focal length; the camera does not move. The scene in the camera's view becomes larger or smaller. The relative size of objects in the scene does not change.

To zoom a camera:

- Select View > Camera Tools > Zoom Tool and drag in the camera's view.
- Adjust the camera's Angle of View attribute or Focal Length attribute.

> **Note**
>
> The Camera Scale attribute also affects the amount of zoom.

Setting a camera's range

In the real-world, cameras can see objects no matter how near or far they are from the camera's lens.

In Maya, cameras can only see objects within a finite range of distances from the camera. A camera's range is represented by its *clipping planes.* All cameras have a near clipping plane and a far clipping plane.

The near and far clipping planes are imaginary planes located at two specific points along a camera's sight line. Only objects between a camera's two clipping planes are visible in that camera's view. Any objects in your scene that are closer to the camera than the near clipping plane, or farther from the camera than the far clipping plane, will not be visible.

Note

If part of an object is in front of the *near* clipping plane, then only the part of the object beyond the near clipping plane will be visible. If part of an object is beyond the *far* clipping plane, then the entire object will be visible, including the part beyond the far clipping plane.

By default, Maya automatically sets a camera's clipping planes so that they are just slightly beyond the limits of the objects in your scene. However, you can also manually set a camera's clipping planes to limit which objects are visible in the camera's view (see "Selecting a range of objects and shadows to render" on page 227).

Tip

Turn on the camera's Clipping Planes manipulator (see "Camera manipulators" on page 172). The dimensions of the Clipping Planes manipulator represents the camera's film gate, *not* the rendering resolution, and may or may not indicate the region that will actually render. See "Film gate" on page 169.

Note

The camera's view only displays objects between the near and far clipping planes.

To set clipping planes automatically:

Turn on the camera's Auto Render Clip Plane attribute.

To set clipping planes manually:

1   Turn off the camera's Auto Render Clip Plane attribute.

2   Set the camera's Near Clip Plane attribute to the distance from the camera to the near clipping plane.

3   Set the camera's Far Clip Plane attribute to the distance from the camera to the far clipping plane.

Note

If the distance between the near and far clipping planes is much larger than is required to contain all the objects in your scene, the image quality of some objects may be poor. Set the Near Clip Plane attribute to the largest value and the Far Clip Plane attribute to the lowest value that still produces the desired result.

Note

If you set a camera's clipping planes manually so that a shadow-casting surface is beyond the far clipping plane, and a depth-map shadow-casting light is illuminating the surface, the surface will not render, but the surface's shadow *will* render. To remove the shadow, turn off Casts Shadows for the surface.

Selectively focusing a camera's view

In the real world, a camera has a range of distances within which objects will be sharply focused. This range of distances is known as the camera's *depth of field.* Objects that are outside of this range (closer to the camera or farther away from the camera) appear blurred or out of focus.

In Maya, by default all objects are sharply focused no matter now near or far they are from the camera. You can, however, selectively focus a camera to simulate depth of field.

> **Note**
>
> When you render a scene from a camera that uses depth of field, the entire scene will first render with all objects in sharp focus. Different objects in the image will then be blurred based on their distance from the camera.

To selectively focus a camera's view:

In the Depth of Field section of the camera's Attribute Editor, turn on Depth Of Field.

Properties of selective focus

You can change the properties of a camera's depth of field to control which objects are in sharp focus, and which objects are not.
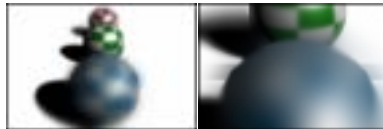
Focus distance

To change the distance from the camera at which objects appear in sharp focus, adjust the Focus Distance attribute. To scale the Focus Distance attribute, adjust the Focus Region Scale attribute.
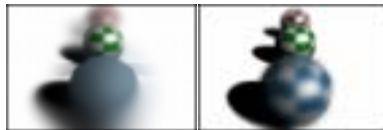
Focus range

To change the range of distances from the camera within which objects appear in sharp focus, adjust the F Stop attribute. (The smaller the F Stop, the shorter the depth of field.)

The Focal Length and Angle of View attributes also influence the range of distances from the camera within which objects appear in sharp focus.

> **Tip**
>
> To make the camera automatically focus on its center of interest (similar to a real-world camera's auto-focus function), connect the output of the camera group node's Distance Between attribute to the input of the camera shape node's Focus Distance attribute. This is only possible with two-node and three-node cameras because one-node cameras do not have a camera group node (see "Creating a camera to animate" on page 166 and "Connecting nodes" on page 18).

> **Note**
>
> Changing your scene's linear working unit will alter a camera's depth of field. Use the Focus Region Scale attribute to compensate for any changes you make to your scene's linear working unit if you want to maintain the same depth of field. For example, if you change your scene's linear working unit from centimeters to meters, change the Focus Region Scale value from 1 to 100. The Focus Region Scale attribute can also make controlling a camera's depth of field easier over very long distances (for example, stars and planets) or very short distances (for example, microscopic close-ups).

Saving and loading a camera's view

Once you have set a camera's view, you may want to save it. After you save a camera's view, you can adjust the view and later easily load the saved view.

You save a camera's view by creating a *bookmark*. By default, a camera has four pre-defined bookmarks: Perspective, Front, Top, and Side. You can add several additional bookmarks to a camera using the Bookmark Editor.

Saving and loading a camera's view
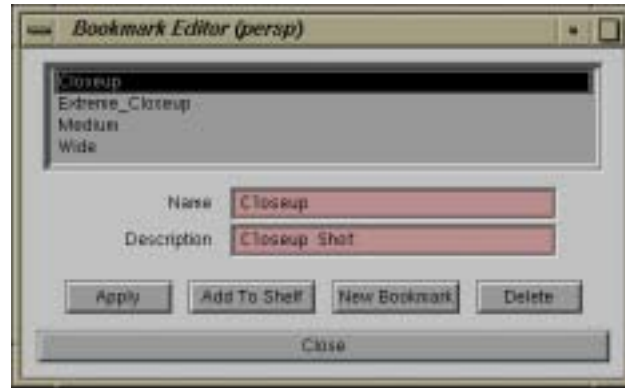
To save a camera's view:

1   In the camera's view, select View > Bookmarks > Edit Bookmarks.

   The Bookmark Editor appears.

2   To create a bookmark with a custom name, type the name of the bookmark in the Name field and click the Apply button.

   To create a bookmark with a system-assigned name, click the New Bookmark button.

3   Click the Close button.

To load a camera's view:

In the camera's view, select the bookmark from the View > Bookmarks menu or from the View > Predefined Bookmarks menu.

To rename a saved (bookmarked) camera view:

1   In the camera's view, select View > Bookmarks > Edit Bookmarks.

   The Bookmark Editor appears.

2   Select the bookmark you want to rename.

3   Type the new name for the bookmark in the Name field and press Enter.

4   Click the Close button.

To delete a saved (bookmarked) camera view:

1   In the camera's view, select View > Bookmarks > Edit Bookmarks.

    The Bookmark Editor appears.

2   Select the bookmark you want to delete.

3   Click the Delete button.

4   Click the Close button.

Making camera views render faster

Rendering a scene often takes a long time. You can, however, make camera views render faster by *not* selectively focusing the camera, or by selectively focusing the camera so that more objects are in focus.

To make camera views render faster:

Turn off Depth Of Field, or increase the F Stop (see "Selectively focusing a camera's view" on page 185).

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Making camera views render faster