Shade 3D

Manual

Your Journey Begins Here

Thank you for purchasing Shade3D.

This manual introduces the basic operations of Shade3D and describes the frequently-used functions in the form of a reverse look-up dictionary. For details on the functions, plugins, and others, refer to the online manuals provided with Shade3D. Additionally, for details on hardware settings and configuration such as your video card and monitor, refer to the manual provided with each peripheral.

Most of the functions in this manual apply universally to all versions of Shade3D, however some portions detail features available only in Shade3D Standard or Shade3D Professional. Sections of this manual devoted to features found only in higher end versions of Shade3D will be denoted in the beginning of each chapter or section.
Moreover, this manual collectively describes those operations that are common to the Windows and Mac versions. Those operations that are OS-dependent are described individually. Unless otherwise noted in the Windows version, mouse button operations assume the use of the left button.

We encourage you to visit the Shade3D section of Shade3D Co., Ltd., including the Shade3D support forum. There, you can find out the latest information about Shade3D, upgrades and available updates and frequently asked questions. You can also find information about displaying your work to share with others.

You can find more information about Shade3D here:

Shade3D Online Help

The Shade3D Online Help is periodically updated and is available at https://help.shade3d.jp/en/support/ShadeHelp/

Shade3D 16 Page

The product page for Shade3D is available at https://shade3d.jp/en/products/shade16/index.html

Shade3D Forum

The social Shade3D community forum is available at https://shade3d.jp/en/support/forum/

Shade3D Main Website

For the latest Shade3D news and updates please visit the main website at https://shade3d.jp/en/

Contents

1. The Shade3D Tool Set

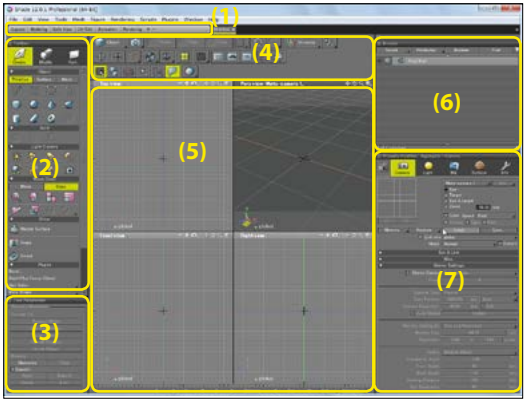
1

The Basic Interface

This chapter introduces the Shade3D tool set and basic interface used to perform most Shade3D operations.

Parts of the Interface

The basic screen is displayed when Shade3D first starts. The basic screen displays the Workspace Bar **(1)** at the top of the screen, the Toolbox **(2)** and Tool Parameters window **(3)** on the left, the Control Bar **(4)** in the upper middle of the screen, the Figure Window **(5)** in the lower middle, the Browser **(6)** in the upper-right corner, and Aggregate Window **(7)** in the lower-right corner of the screen.



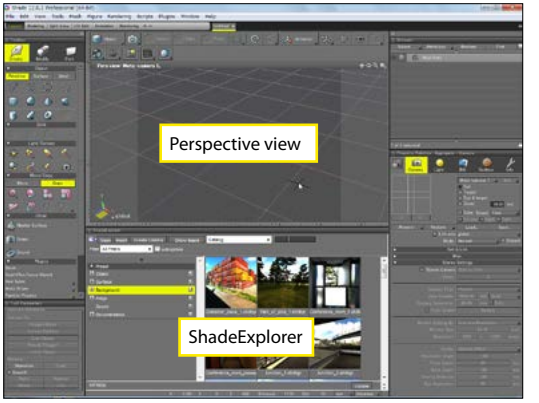
Workspace Bar

The Workspace Bar is used to switch between the workspaces that are provided by default. It can also be used to save or switch to workspaces that you have customized.

The following workspaces are provided as standard.

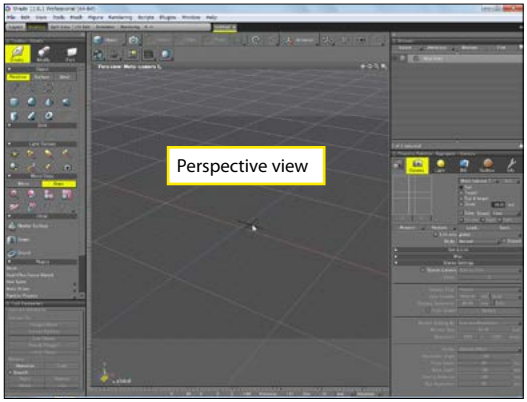
◆ **Layout**

The Layout workspace displays the **Perspective View** in the upper part of the screen and **ShadeExplorer** in the lower part. It is used to configure object arrangements, surface attributes, backgrounds, and the like.



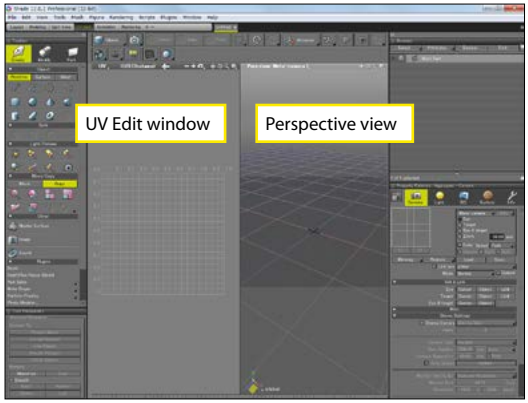
◆ Modeling

The Modeling workspace displays only the **Perspective View**, maximizing the viewport typically most useful for modeling.



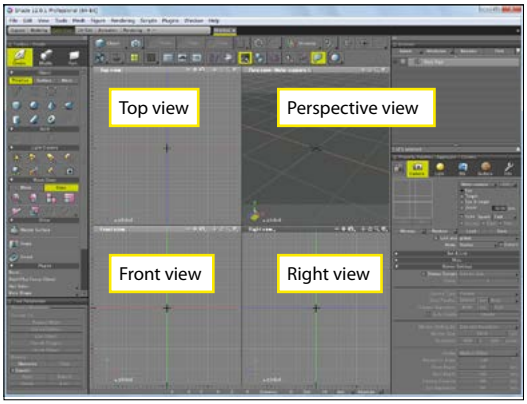
◆ UV Edit

The UV Edit workspace displays the **UV Edit window** on the left and the **Perspective View** on the right. It is used to work with uv maps and models.



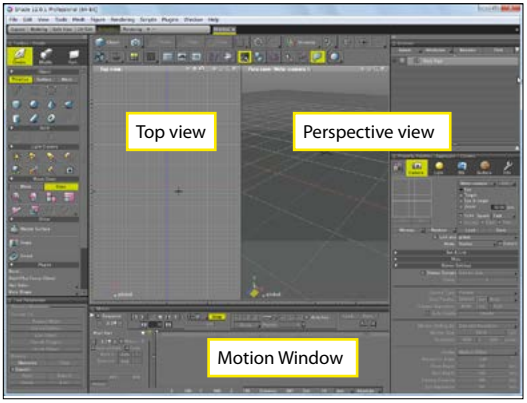
◆ Split View

The Split View is divided into four view types: **Top View**, **Front View**, **Perspective View**, and **Right View**. It is used to perform operations along the three axes and to perform work while checking on the status of the Perspective View.



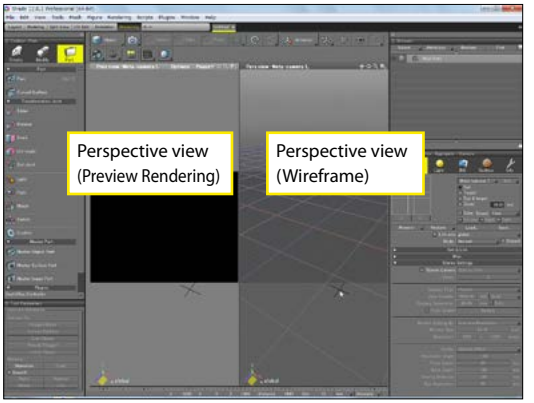
◆ Animation

The Animation workspace displays two windows in the upper part of the screen (the **Top View** on the left and the **Perspective View** on the right), as well as the **Motion Window** for controlling animations at the bottom of the screen. It is used to create and edit animations.



◆ Rendering

The Rendering workspace displays two Pespective views: that for preview rendering on the left and that for wireframe on the right. It is useful for making checks before rendering or for performing simple corrections.



Toolbox

The Toolbox provides tools for creating and editing objects, and is divided into three sections: **Create**, **Modify**, and **Part**. You can also access most of the functions provided by the Toolbox from the **Tools** menu.

◆ Toolbox: Create

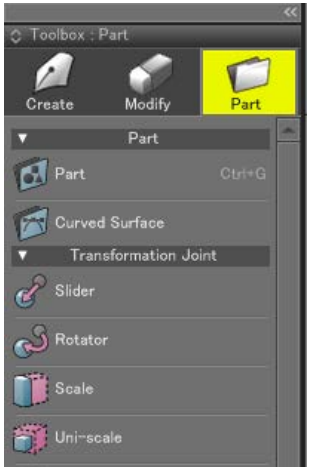
The Create tool set provides the tools needed for creating objects. The tools are divided into the **Object**, **Solid**, **Light/Camera**, **Move/Copy**, **Other**, and **Plugins** groups. Moreover, **Object** drops down to reveal **Primitive**, **Surface**, and **Mesh** options to allow you to directly specify the type of object to create.

◆ **Toolbox: Modify**

The Modify tool set provides tools for editing objects. The tools are divided into the **Surface**, **Mesh**, and **Tools** groups.

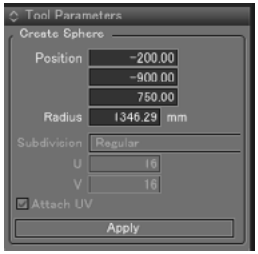
◆ **Toolbox: Part**

The Part tool set provides the tools needed for creating parts and joints. The tools are divided into the **Part**, **Transformation Joint**, and **Master Part** groups.

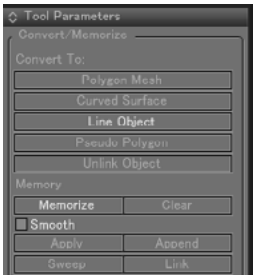


Tool Parameters

At object creation, the Tool Parameters Window displays the different parameters and allows you to modify them. For object selection, the Tool Parameters Window provides functions such as object conversion and line object memorization and application.



At object creation



At object selection

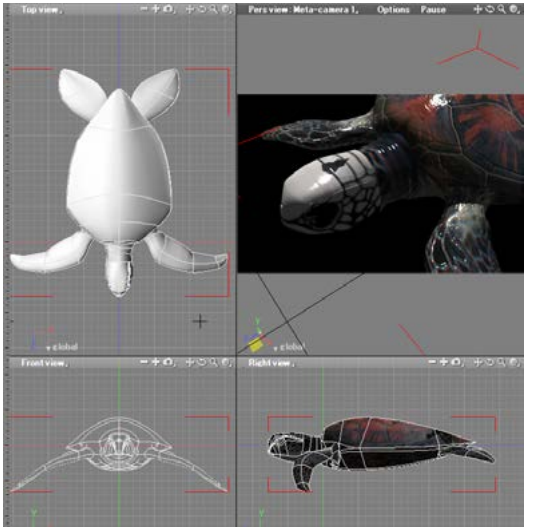
Control Bar

The Control Bar is used for changing Figure Window settings such as editing mode switching, manipulators, snaps, work planes, and stereo operations.

A pop-up menu is displayed by right-clicking an empty area on the Control Bar. From this pop-up menu, you can set Show/Hide for each button.

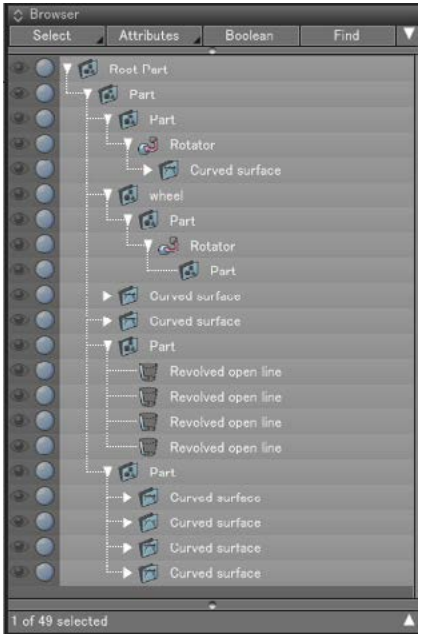
Figure Window

The Figure Window is used to create and edit objects using the tools you have selected from the Toolbox. The Figure Window can be a single viewport or can be divided into two or four viewports. Each viewport can display a different view of the scene. By default, the four viewports show the **Top View**, **Front View**, **Right View**, and **Perspective View** (the scene viewed from the camera position).



Browser

The Browser window is used to hierarchically manage the elements of the 3D scene. For example, you can change and delete objects, combine joint structures, configure object attributes, switch the object display/hide mode, and find objects by their names.

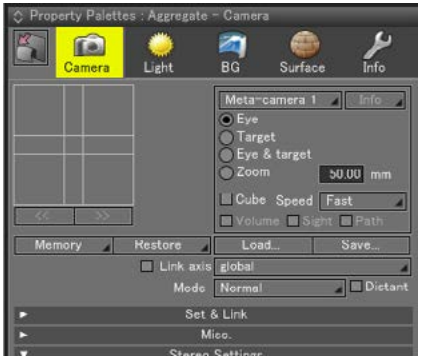


Aggregate Window

The Aggregate Window contains tools for performing operations related to the camera, distant light, background, surface attribute, and the like, and for displaying information. You can switch between these windows by clicking the icons at the top of the Aggregate Window.

◆ Camera

The first tab in the Aggregate Window is called the Camera Window. Here you can zoom, rotate, and move the selected camera to control the Perspective View, which in turn is used for rendering. You can also adjust the stereo settings from this window.



◆ Light

The second tab (labeled "Light") in the Aggregate Window is called the Distant Light Window. These settings mimic a light source at a considerable distance, like the sun, which illuminates everything in the scene equally.

◆ Background

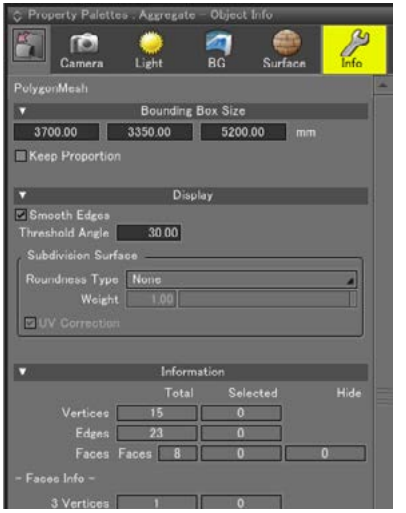
The third tab (labeled "BG") in the Aggregate Window is the Background Window. Here you can set up or change the background for the scene. In addition to the available presets, you can assign images and configure the background for IBL rendering with HDRI settings.

Surface

The fourth tab in the Aggregate Window is called the Surface Window. Here you can apply textures, image maps, and other surface attributes to objects in the scene.

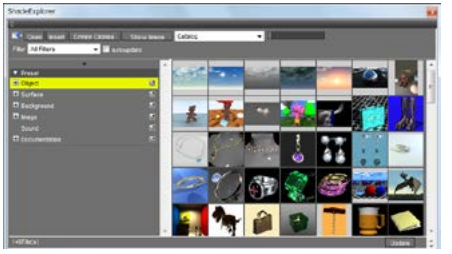
Object Info

The last tab (labeled "Info") in the Aggregate Window is called the Object Info Window. It is used to view and edit information related to the object you have selected. You can set elements such as the brightness of a light source object, joint values, and part movement and rotation, and also perform operations such as rounding polygon mesh corners.



ShadeExplorer

The ShadeExplorer Window is used to preview compatible Shade3D files and add them to your scene. The library of files in ShadeExplorer is organized by sample objects, surface attributes, backgrounds, images, and so on. In addition to the standard ones provided with Shade3D, you can add your own custom objects and textures to the library and create custom catalogs.



Motion Window

The Motion Window is used for creating animations. Here you can collectively manage all the movable joints in a scene and use keyframes to quickly create a smooth animation. Joint values at each frame can be finely tuned, and animation settings such as frame rate, total frames, start and end frames are all accessible here.

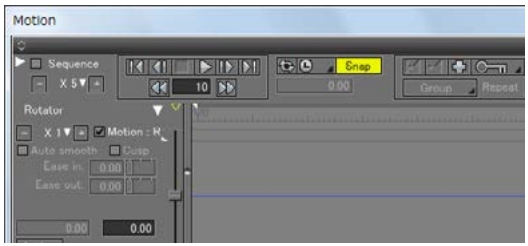
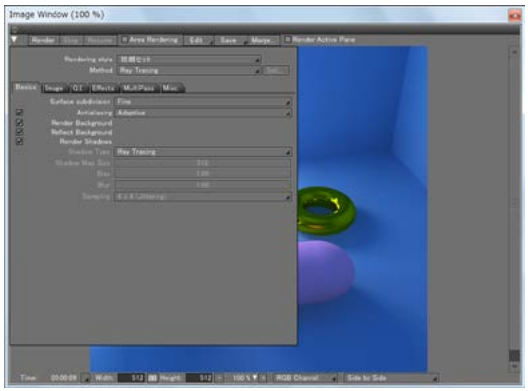


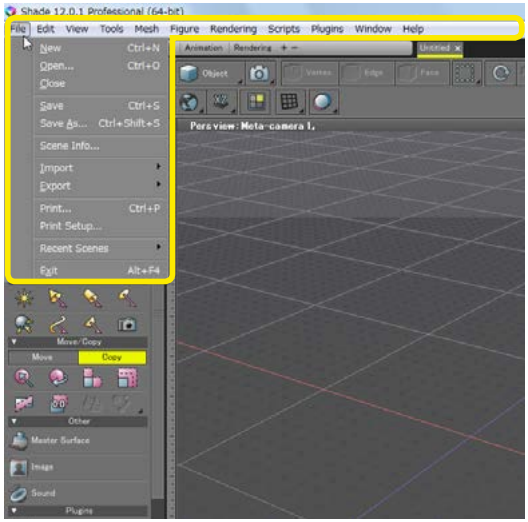
Image Window

The Image Window displays rendered images. The render settings are also available from this window, allowing you to specify the rendered image size, method of rendering, and much more. By default a list of all your rendered images is also saved here.



Menu Bar

The Menu Bar is used to open and save Shade3D scene files and to exit Shade3D. Using this Menu, you can access almost all Shade3D functions as well as import and export data and use scripts and plugins.

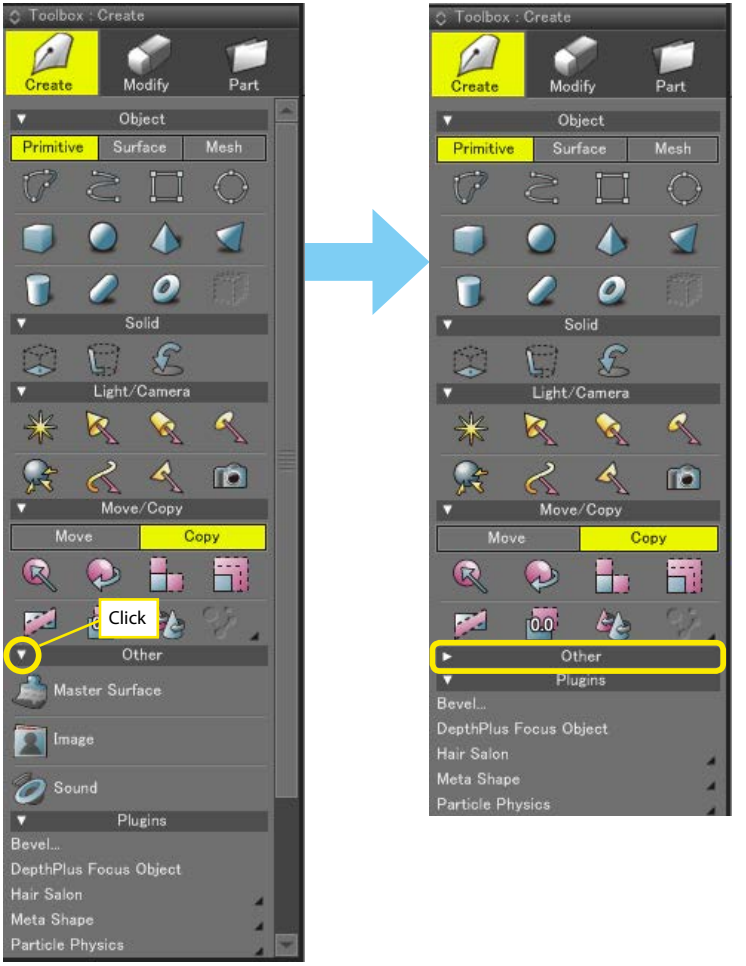


1

Customizing Windows in Shade3D

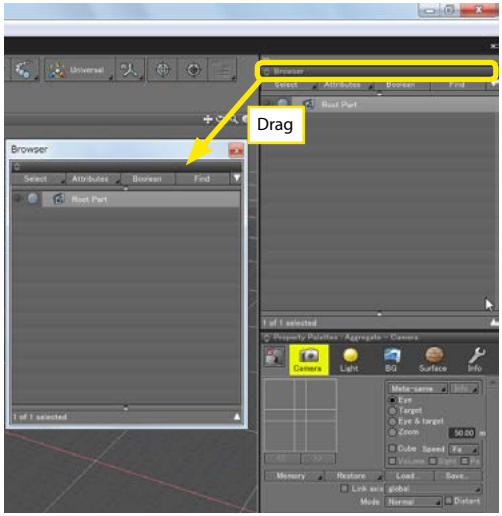
Collapsing and Expanding Tool Groups

By clicking the ▼ mark on the left of a tool group name in the **Toolbox** or **Browser**, you can collapse or expand the corresponding tool group. This way you can hide groups of tools you do not need immediate access to, keeping your workspace tidy and allowing you to focus on the tools you use most. Keep in mind that if the window cannot display all the tools at once, a scroll bar will appear.

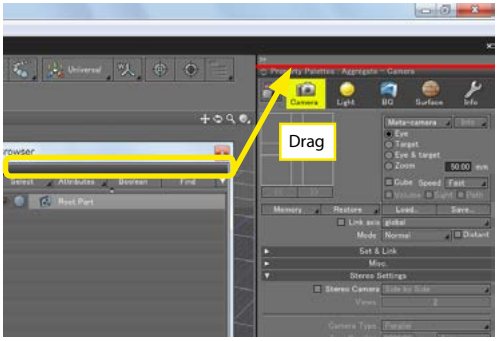


Floating Windows

You can detach windows from the main interface and float them as individual windows. Simply click on the window's title bar and drag it away (such as over the Figure Window) until you see the black window icon under the mouse pointer turn grey.

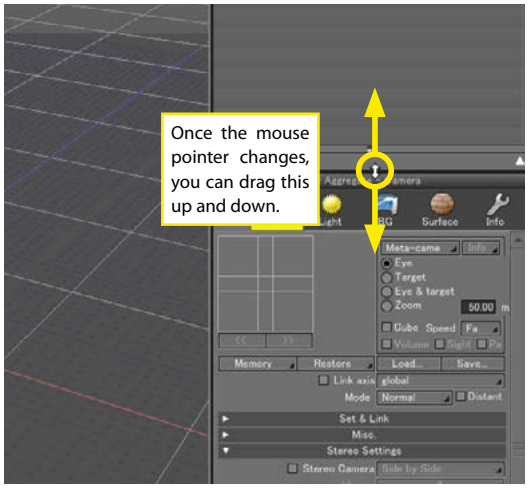


To return the window to its original position, drag the disclosure bar in the window onto the window to the right or left of the Shade3D screen, or to the right or left of the Shade3D screen itself. The title insertion position is displayed as a red line. Drag the title window to the desired position.



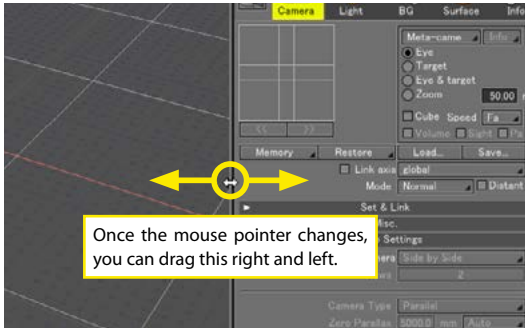
Moving Boundaries between Windows

When windows are lined up vertically, the boundary position can be changed by dragging the boundary part up or down.



Changing the Window Width

You can change the width of a window by dragging the boundary between it and the Figure Window.



2. Shade3D Experience Tour

Follow the Shade3D Experience Tour to try your hand at 3D modeling, animating and rendering using Shade3D.

1. Starting Shade3D

1 Start Shade3D as described below:

- **Windows**

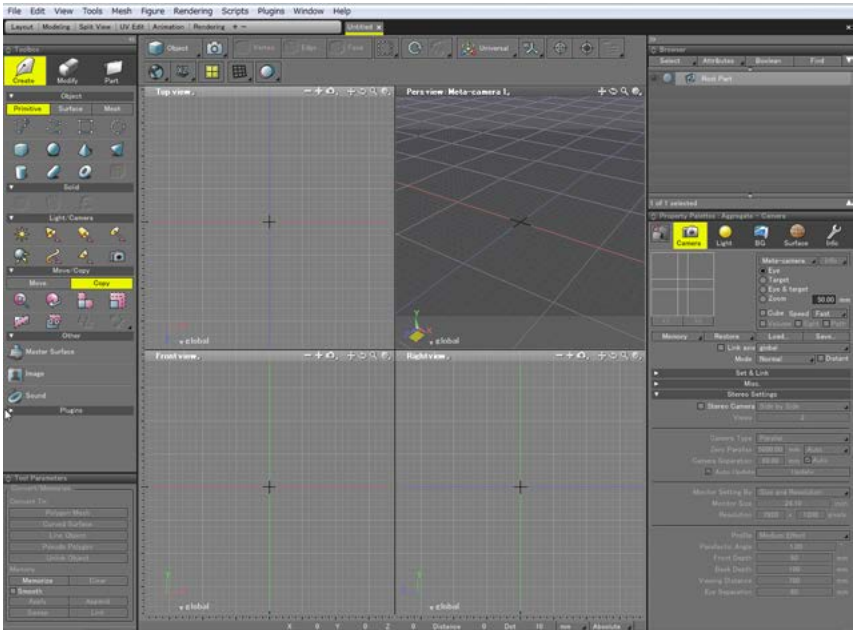
  Double-click the **Shade3D** shortcut icon created on the desktop.

  Alternatively, from the **Start** menu, select **Programs** > **Shade3D** > **Shade3D**.

- **Mac OS X**

  Double-click the **Shade3D** icon in the **Applications** folder.

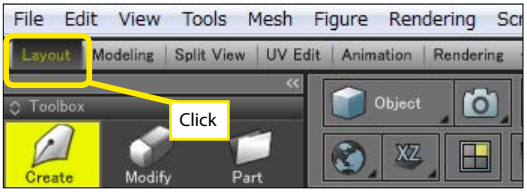
2 Shade3D starts.



2. Inserting Material Data into a Scene

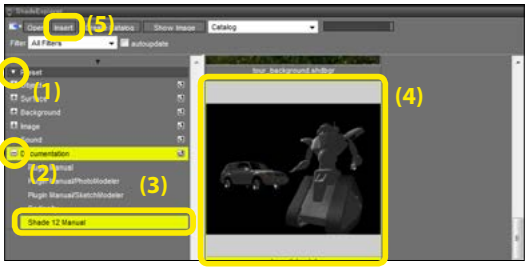
First we will open a Shade3D scene that has already been set up, using the file browser called ShadeExplorer.

1 Click the **Layout** workspace on the **Workspace Bar** (just below the Menu Bar).

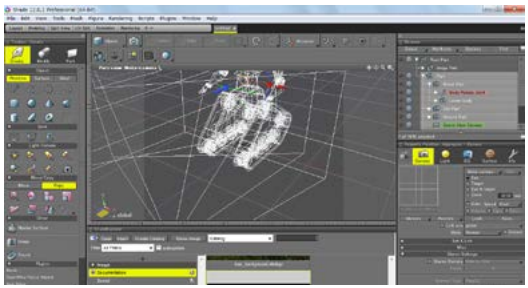


2 The screen changes and **ShadeExplorer** opens. From here we can browse the sample files included with Shade3D and add preset models to our scene.

3 Click the expand button ▼ to the left of **Preset** (1). Next click the plus symbol to the left of **Documentation** (2) and then click **Shade3D Manual** (3) to display the sample files used in this manual. Find and select the thumbnail preview titled **tour_data.shd** (4) and click the **Insert** button at the top of ShadeExplorer (5).

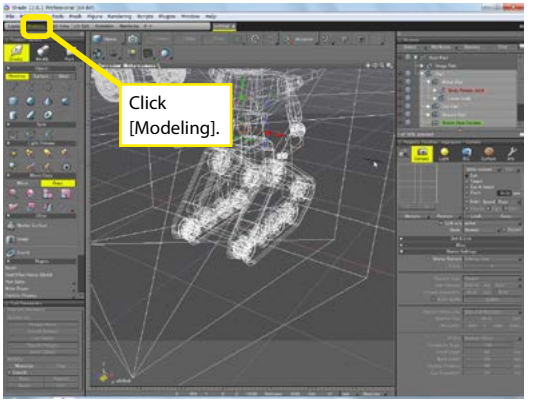


4 The selected model is inserted into the current Shade3D scene.



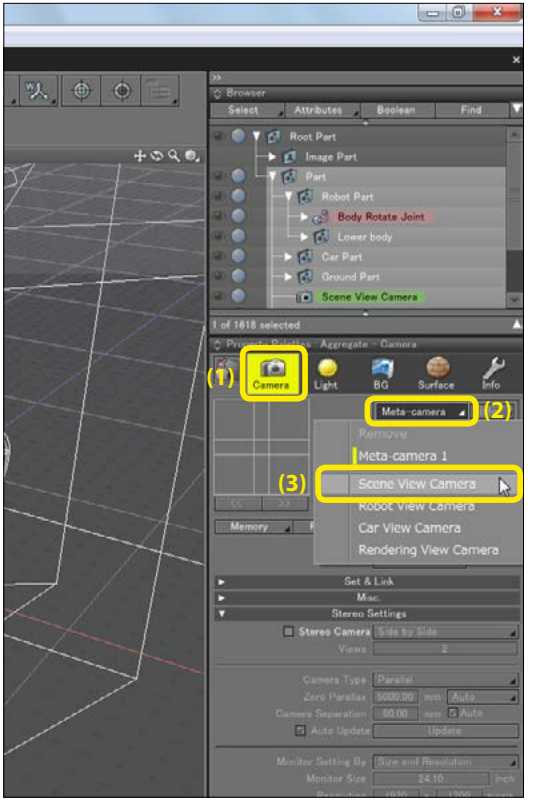
3. Using Cameras

You can change the screen display to that as viewed from the camera. Then, by operating the camera, you can view the robot and car from different angles.

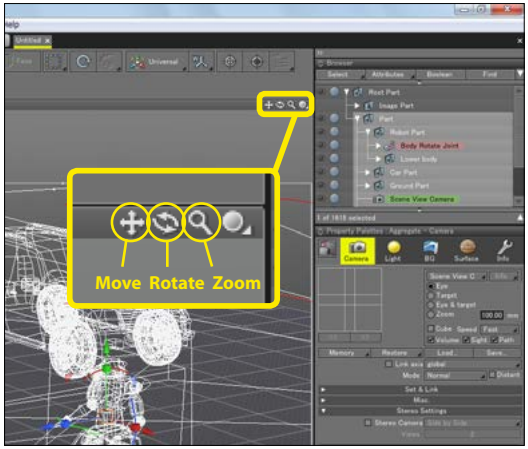


1 First, let's change the screen to enlarge the viewport. Select the **Modeling** workspace on the **Workspace Bar**. The Figure Window changes to show only the **Perspective View**, the scene as viewed from the camera.

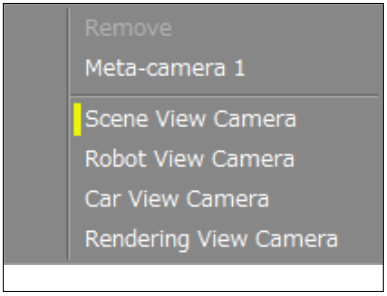
2 In the **Aggregate Window** in the lower-right corner of the screen, click the **Camera** tab to show the **Camera Window** **(1)**. Next click the camera pop-up menu **(2)** and select **Scene View Camera** **(3)**.



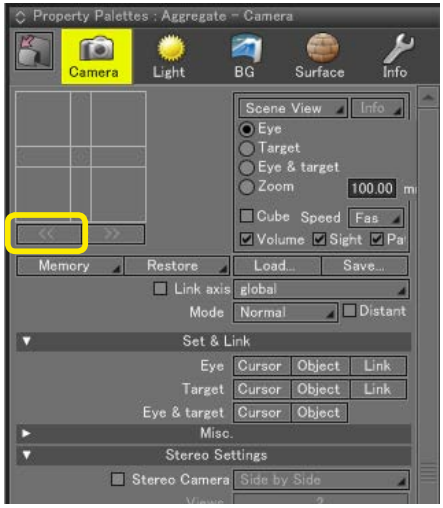
3 Move the camera by using the **Move**, **Rotate**, and **Zoom** icons of the **Navigation Tool** in the upper-right corner of the Figure Window. When you click and drag each icon with the mouse, the camera moves and the display changes. Let's take a look at the car and robot from various angles.



This scene provides **Robot View Camera** to view the robot, **Car View Camera** to view the car, and **Rendering View Camera** for rendering. You can change these cameras as desired by following the procedure given in step 2.



4 To return the camera to a previous state, click the << (return) button in the **Camera** Window. Like an undo command, this steps backward to previous camera positions.

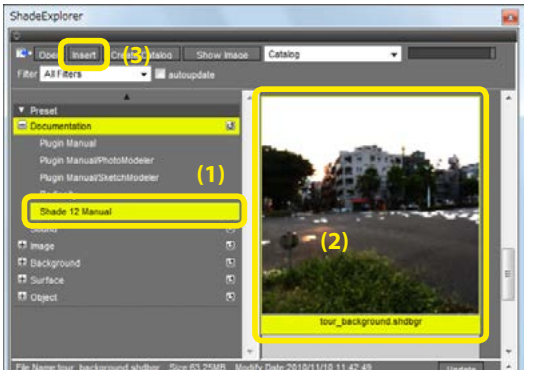


4. Adding a Background

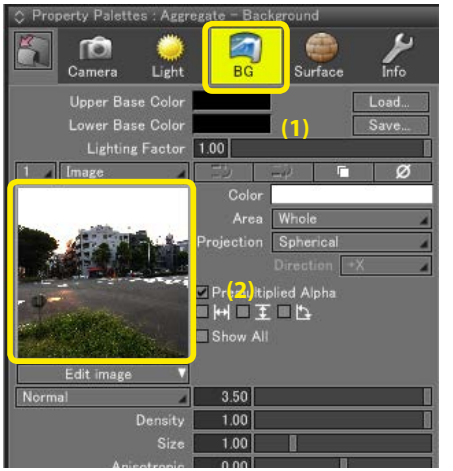
You can set a background for a scene by using ShadeExplorer. This time, let's open ShadeExplorer from the **Control Bar** (above the Figure Window).

1 Click the **ShadeExplorer** button on the Control Bar. ShadeExplorer will open.

2 From the browser area of ShadeExplorer, click and select **Shade3D Manual** **(1)**. From the preview area on the right, click **tour_background.shdbgr** for selection **(2)** and then click the **Insert** button **(3)**.



3 Click the **Background** button of **Aggregate** to switch to the **Background** Window **(1)**. The background selected in ShadeExplorer is displayed. You can confirm that the background has been configured **(2)**.

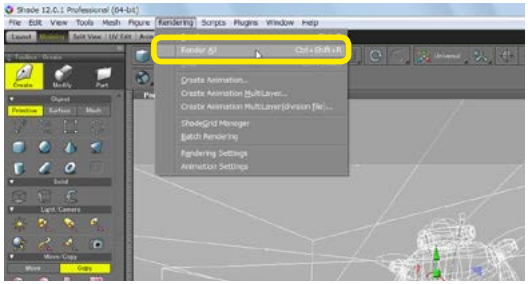


5. Rendering

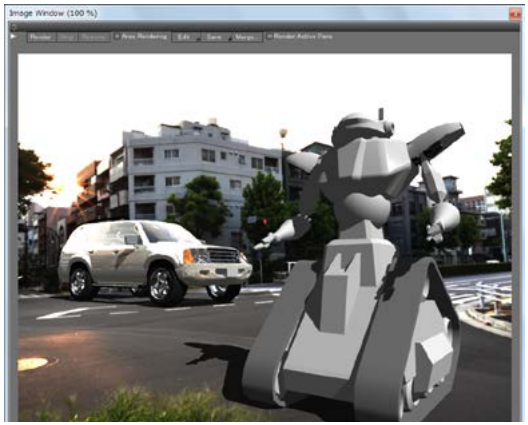
Let's render the scene created so far.

1 First, let's switch the camera to **Rendering View Camera**. If the Camera Window isn't already showing, click the **Camera** tab in the **Aggregate Window** to open it now (1). From the camera pop-up menu, select **Rendering View Camera** (2).

2 From the **Rendering** menu, select **Render All**. The **Image Window** opens and rendering begins.



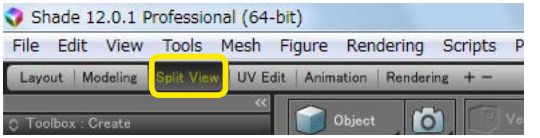
3 Once rendering is complete you can view the image of the scene rendered using **Ray Tracing**.



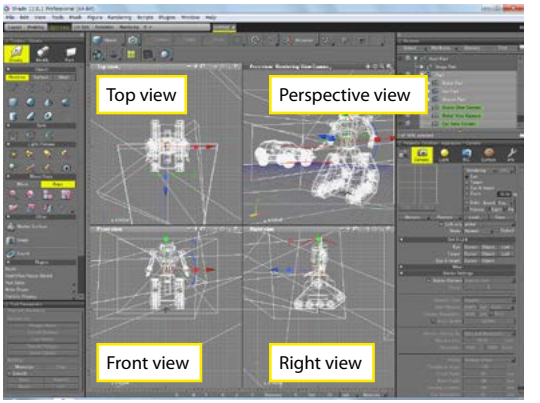
6. Switching to Split View

You can change the view to **Split View**, which is helpful for understanding more complicated models.

1 Click the **Split View** workspace on the **Workspace Bar**.



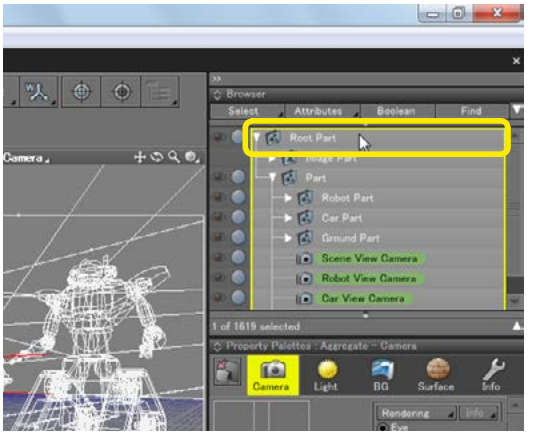
2 The following four viewports are displayed: **Top**, **Front**, **Right** and **Perspective** (the view from the camera).



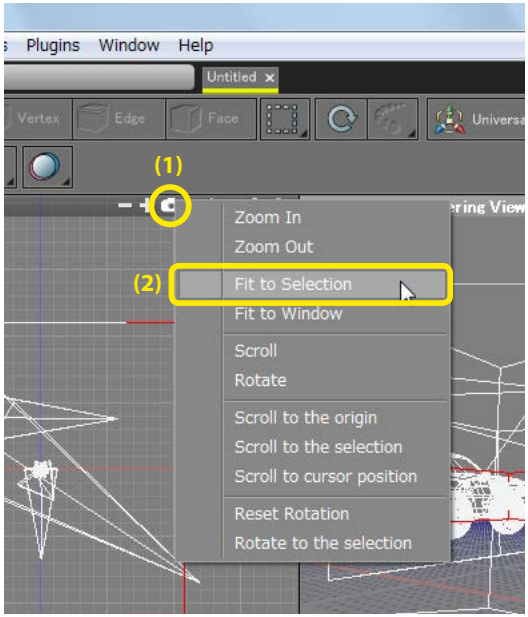
7. Fitting Objects in the Viewport

The current scene has a robot, a car, and the floor. However, not everything is showing in the Top, Front, and Right viewports since we are zoomed in too close. Let's adjust the zoom rate so that the objects in the scene fit within each of these viewports.

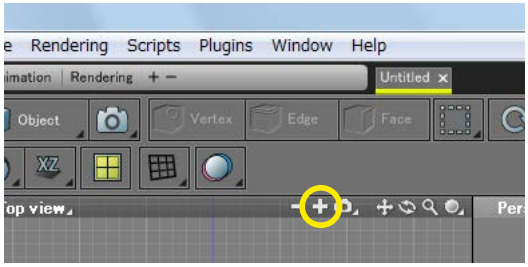
1 In the **Browser** in the upper-right corner of the screen, click **Root Part** to select all objects in the scene.



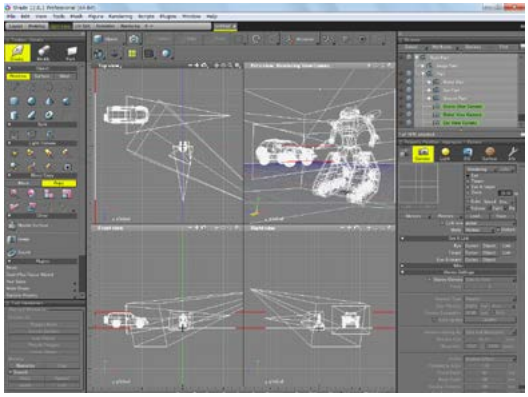
2 From the navigation tool in the upper-right corner of the **Top View** (the top left viewport), click the **View Operations** icon **(1)** to open a pop-up menu and select **Fit to Selection (2)**. Now all the objects in the scene fit in each of the viewports (except the Perspective View).



3 Now all the objects, including the floor, are visible. But now we are zoomed out a little too far. Click the [+] icon of the navigation tool to zoom in slightly. If you accidentally zoom in too much, click the [-] icon to zoom out again.



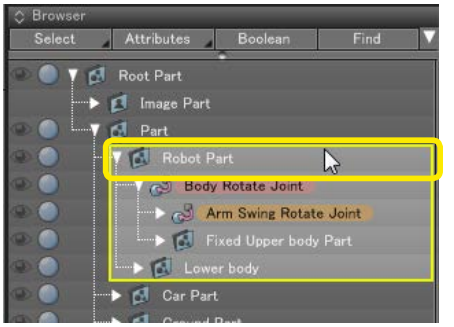
4 All the objects are perfectly contained within each of the viewports.



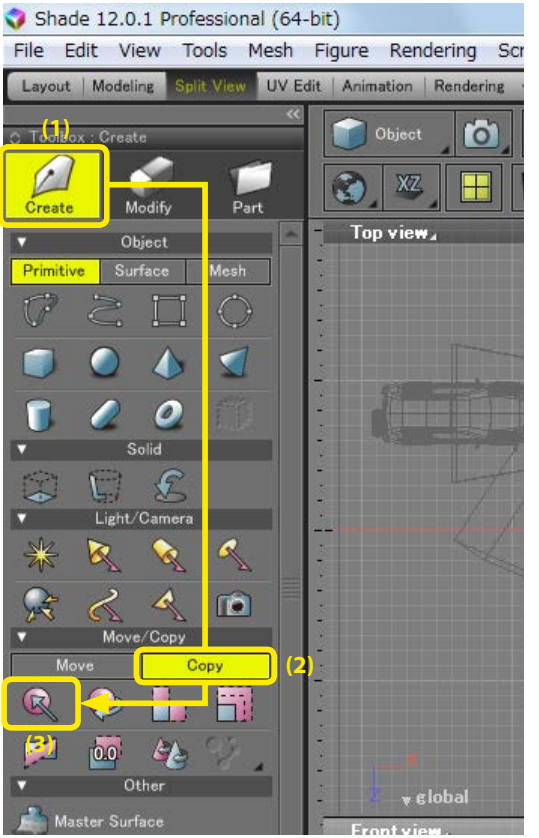
8. Copying Objects

Let's make a copy of the robot and add it to our scene.

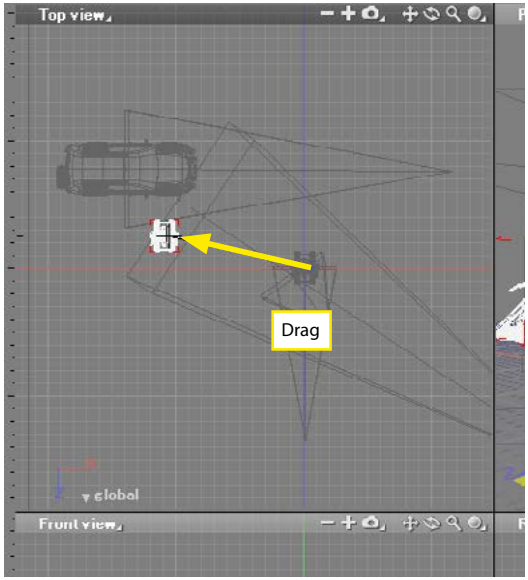
1 In the **Browser**, click **Robot Part**.



2 In the **Toolbox**, select **Create** **(1)**. Next, click **Copy** under the **Move/Copy** group **(2)** and then click **Translate** **(3)**.



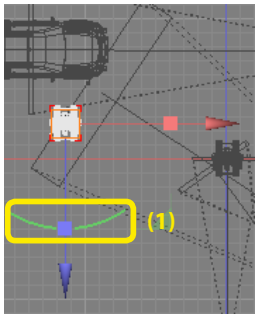
3 In the **Top View** (the top left viewport), drag the selected robot to the right side of the car. A copy of the robot is placed at the new position.

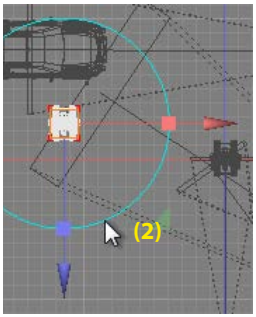


9. Rotating an Object to Face the Camera

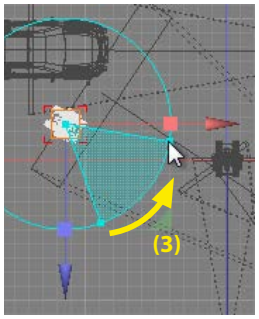
Let's rotate the second robot so that it faces the camera.

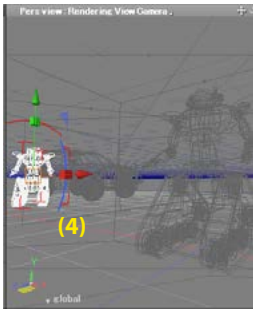
1 In the **Top View**, position the pointer at the green arc of **Universal Manipulator** displayed around the second robot **(1)**. The arc will change to a circle **(2)**.





2 Drag the circle counterclockwise **(3)** so that the robot faces the camera in the Perspective View **(4)**.



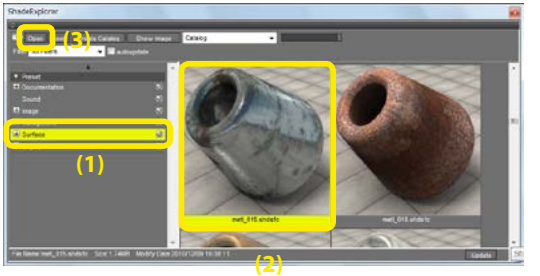


10. Adding Surface Attributes

1 Confirm that the copied robot is selected.

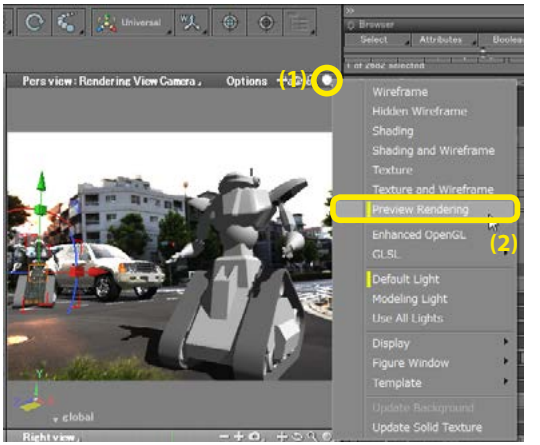
2 Click the **ShadeExplorer** button on the Control Bar to open ShadeExplorer.

3 From the browser area of ShadeExplorer, click and select **Surface** (1). In the preview area on the right, click and select **metl_015.shdsfc** (2) and then click the **Open** button (3). The surface attribute is set for the copied robot.



4 Click the **Surface** tab in the **Aggregate Window** to display the **Surface Window**. You can confirm that the selected surface material has been set for the robot.

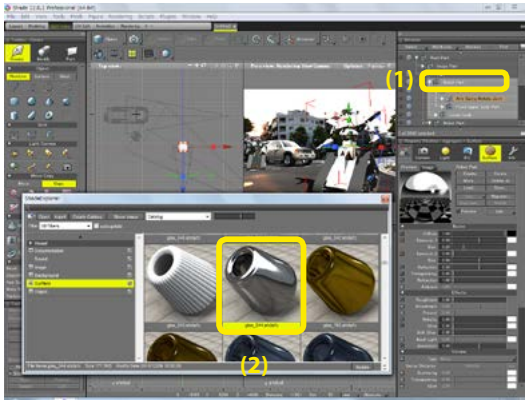
5 Confirm the surface attribute you have set, using **Preview Rendering** where you can immediately check the edited contents through the rendering result. From the **View Display** pop-up menu of **Perspective View** (1), select **Preview Rendering** (2). The preview rendering result is displayed and the inner robot appears with its surface attributes configured.



TIP

You can also check the preview render by switching to the Rendering workspace.

6 Set the surface attributes for the first robot. In the **Browser**, click and select the upper **Robot Part** (1) and then repeat the procedure for adding surface attributes, starting from step 2. This time, set **glss_044.shdsfc** as the surface material (2).

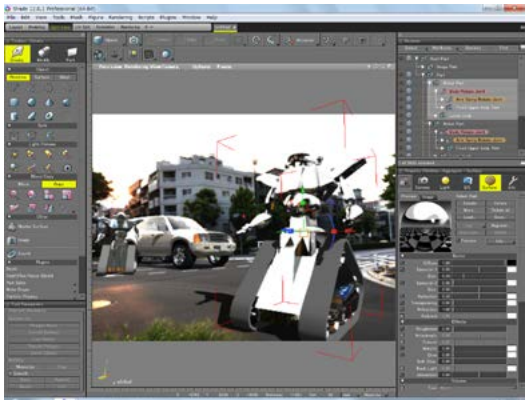


11. Changing Split Views

To enlarge the Perspective View, change the split views.

1 On the Control Bar, click the **Split View** button (1). **View Switcher** is displayed. Click the upper-right part (2).

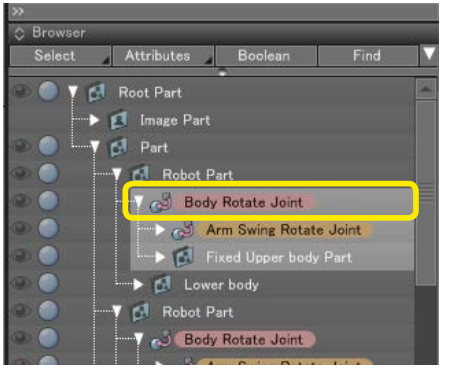
2 The display changes to that showing only the Perspective View.



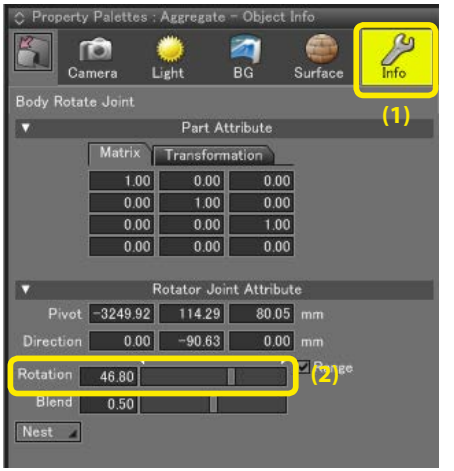
12. Moving the Robot

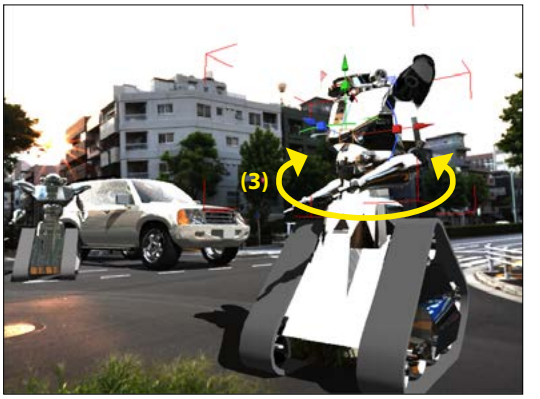
The robot object has joints set for its body and right arm. By operating the joints we can make the robot move.

1 In the **Browser**, click and select **Body Rotate Joint** in the upper **Robot Part**.

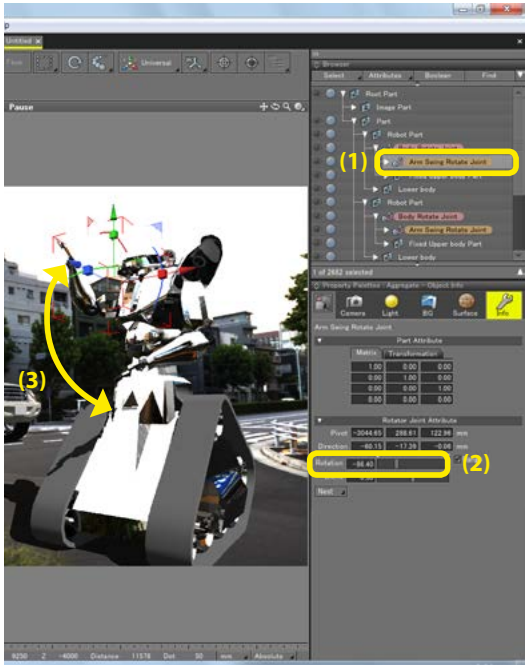


2 Click the **Info** tab of the **Aggregate Window** to open the **Object Info Window** **(1)**. If you drag the **Rotation** slider of the **Rotator Joint Attribute** group right and left **(2)**, the upper half of the body of the robot rotates right and left **(3)**.





3 Next, let's operate the right arm joint. In the **Browser**, select **Arm Swing Rotate Joint** in the upper **Robot Part** and then drag the **Rotation** slider of the **Object Info** Window to the right and left. The right arm of the robot rotates forward and backwards.



4 Operate the joints of each robot to set a pose.

13. IBL Rendering

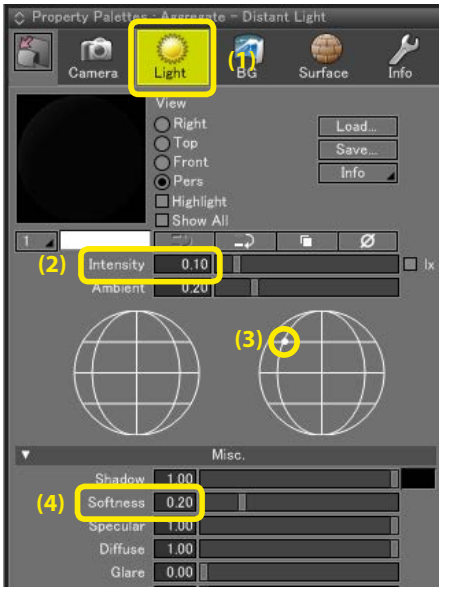
To complete the scene, let's change the Rendering Settings and render the scene using Image-Based Lighting (IBL). IBL rendering can achieve a photorealistic image by using the brightness of the background image as the light source.

1 Click the **BG** tab of the **Aggregate Window** to open the **Background Window** **(1)**. Set **Lighting Factor** to [1.4] **(2)**.

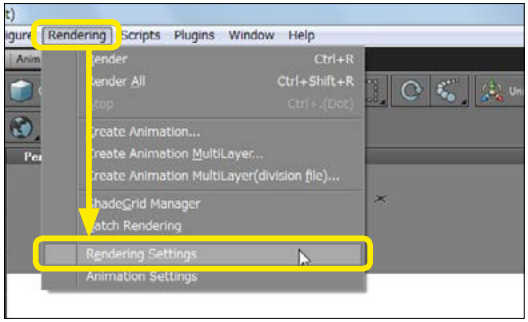
2 Next, set the distant light. Click the **Light** tab of the **Aggregate Window** to open the **Distant Light Window** **(1)**.

Because IBL rendering is generally performed using only the brightness of the background image, set **Intensity** to **0**. In the current example, shadow are difficult to render accurately when only the brightness of the background image is used. As a result, the rendering result may be unnatural. Should this occur, set a weak distant light so that shadows are rendered accurately.

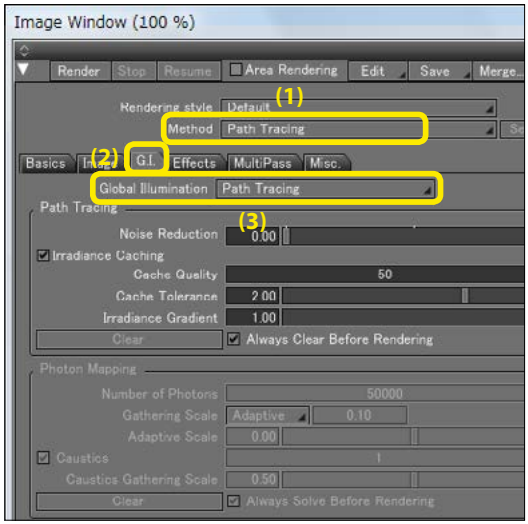
Set the following: Set **Brightness** to **0.1** **(2)**. In the right hemisphere of **Set Light Direction**, click the upper-left part to set the shadow direction **(3)**. Set **Softness** of the **Misc.** group to **0.2** to soften the shadow **(4)**.



3 From the **Rendering** menu, select **Rendering Settings**. The **Image Window** opens and the **Rendering Settings** are displayed.



4 From the **Method** pop-up menu, select **Path Tracing (1)**. Click the **G.I.** tab to change the display **(2)** and then select **Path Tracing** from the **Global Illumination** pop-up menu **(3)**.



5 From the **Rendering** menu, select **Render All** to perform IBL rendering.

Congratulations, you have completed the Shade3D Experience Tour!

3. Figure Window

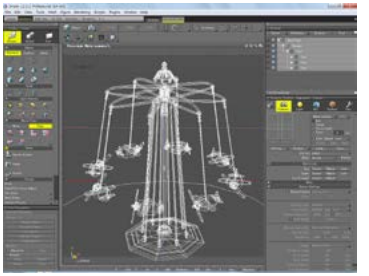
3–1. The Figure Window Display

Figure Window Workspaces

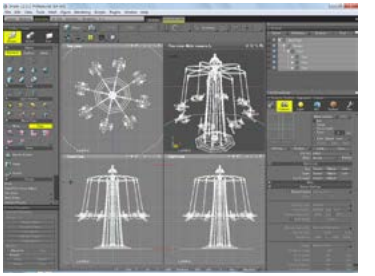
You can switch between workspace presets according to your needs.

Click a button on the **Workspace Bar** to switch to that workspace, or click the plus symbol on the right to add the current Figure Window layout as a custom workspace.

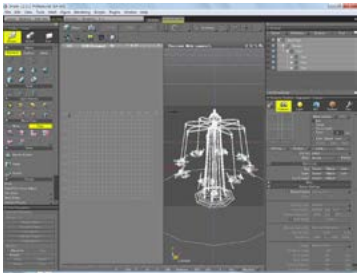
Layout
Displays the Perspective View and ShadeExplorer.



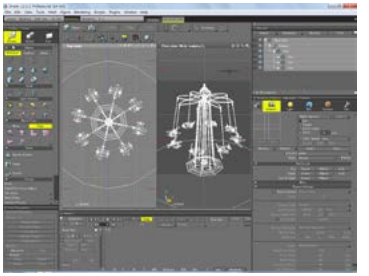
Modeling
Mainly displays the Perspective View.



Split View
Splits the view into four parts.



UV Edit
Displays the UV and Perspective View.



Animation
Displays the top view on the left, the Perspective View on the right, and the Motion window at the bottom.

Rendering
Displays the rendering preview on the left and the Camera View on the right.

TIP

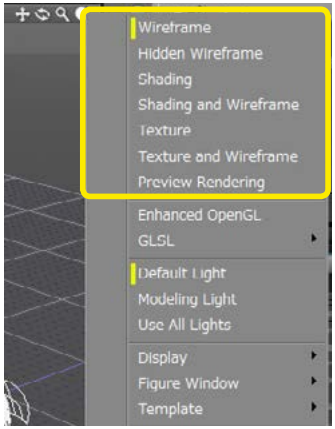
You can modify a workspace part or change its size by dragging the window name.

TIP

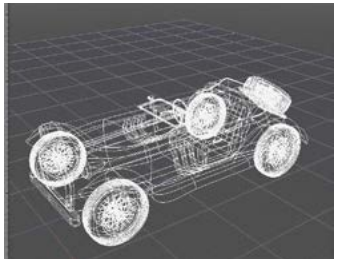
You can add a workspace that you have created by using the + button of the Workspace Bar.

Switching Display Modes

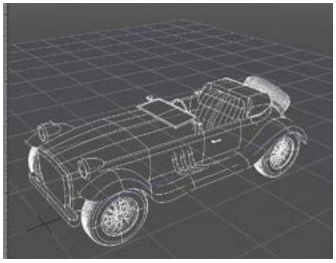
You can change the display mode for each viewport from the **Display** pop-up menu in the viewport's top-right corner.



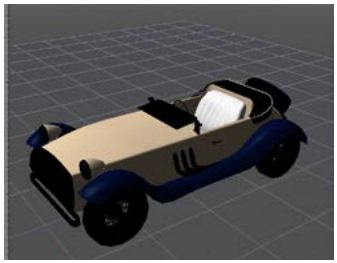
Use the **Display** pop-up menu to switch between display modes.



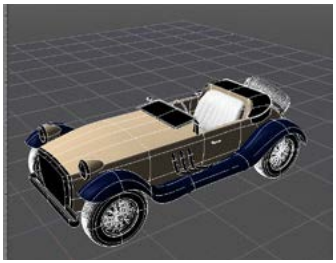
Wireframe
This is the standard, high-speed display mode.



Hidden Wireframe
Objects are displayed in wireframe format, but lines that would be hidden from sight are not shown. This can make modeling easier.

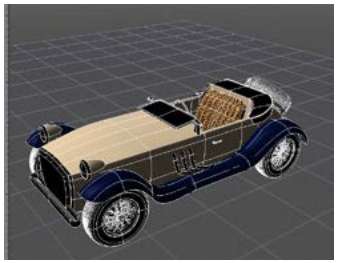


Shading
Objects are displayed with their diffuse color and the effects of any distant lights in the scene.

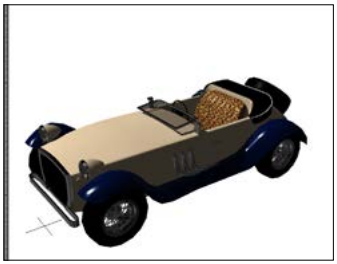


Shading and Wireframe
This is a combination of Shading mode and Hidden Wireframe mode. (The wireframe is superimposed on the shaded geometry.)

Texture
Objects are displayed with textures superimposed on their shaded geometry. This mode makes it easy to understand how the scene will look.



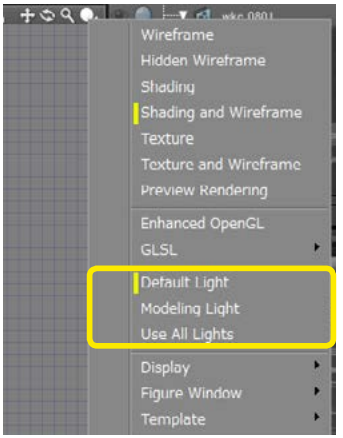
Texture and Wireframe
This is a combination of Shading, Texture, and Hidden Wireframe modes. In this mode objects can be edited while still making it possible to check their appearance.



Preview Rendering
Objects are displayed closely to how they will appear when rendered. This mode makes it easy to grasp how the scene will look when rendered.

Viewport Lighting

From the **Display** pop-up menu, you can adjust the display of lighting within each viewport. Wireframe and Preview Rendering modes are not affected.



From the **Display** pop-up menu, you can change the lighting mode.

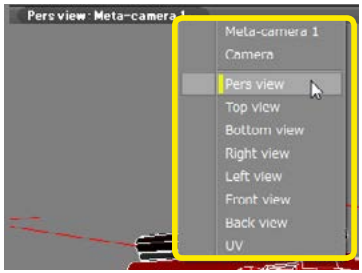
Default Light
The object is displayed using the first position of the distant light as the light source. The brightness and color of the first position of the actual distant light are not reflected. This is the standard list style.

Modeling Light
The object is displayed as if the light always exists in front of the object, as viewed from the viewport. The light is virtual and does not actually exist.

Use All Lights
The object is displayed with the brightness and colors of all lights in the scene reflected. This sample data shows that the yellow and brightness (0.7) set for the distant light, the green point light located at the front-right side, and the red point light located at the inner-left side are being reflected.

Switching Views

You can change the view displayed in each viewport from the **View** pop-up menu in the viewport's top left corner.

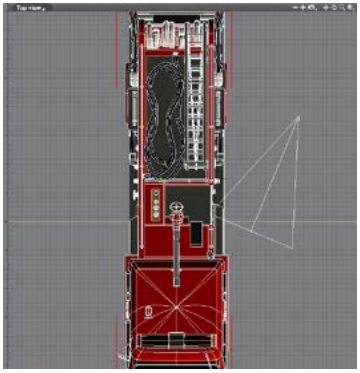


From the **View** pop-up menu, you can change the view displayed.

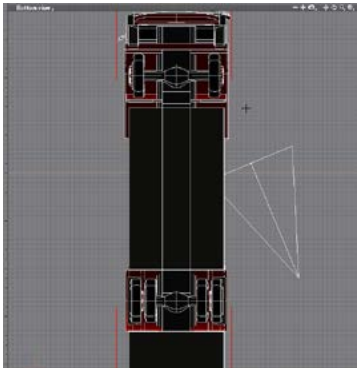
Meta Camera
Displays the view as seen from meta camera for the scene.

Camera
Displays the view as seen from the camera object created in the scene.

Pers View
Displays the view as seen from the camera selected in the Camera Window, regardless of the meta camera or camera object.

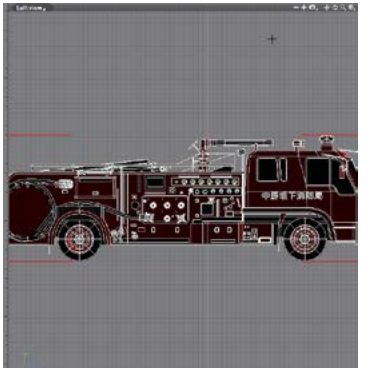


Top View
Displays the view as seen from just above.

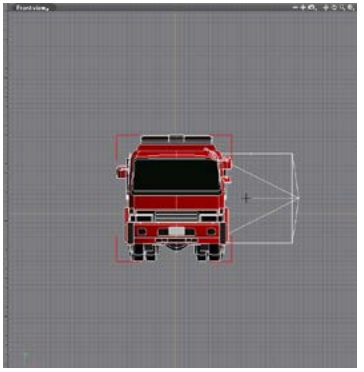


Bottom View
Displays the view as seen from just below.

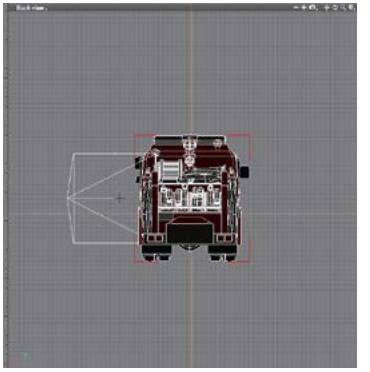
Right View
Displays the view as seen from the right.



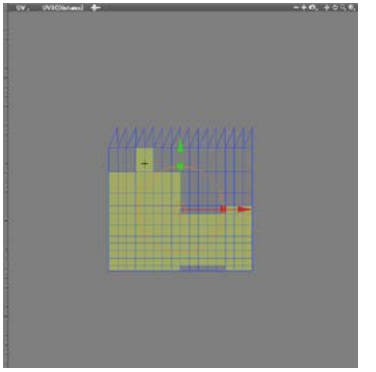
Left View
Displays the view as seen from the left.



Front View
Displays the view as seen from the front.



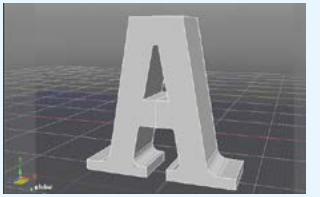
Back View
Displays the view as seen from the back.



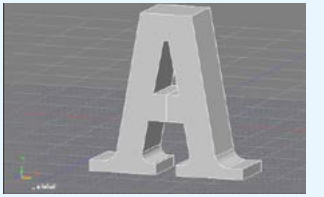
UV
Displays UVs for the object.

TIP

Click the Parallel Projection icon in the Perspective View to switch the view to Parallel Projection mode. Click the icon again to switch back.



Perspective Projection



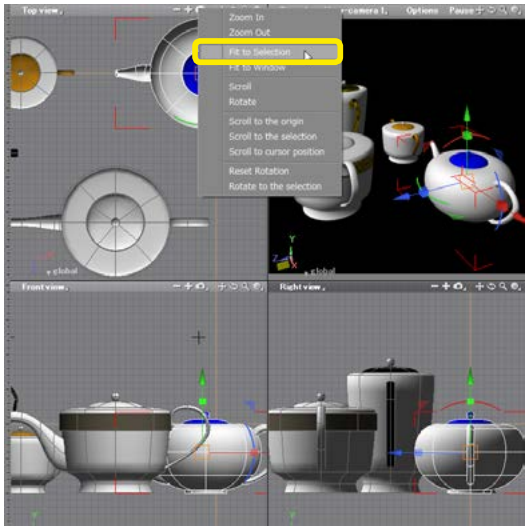
Parallel Projection

3–2. Navigating in the Figure Window

Zooming to the Selection

You can increase or decrease the zoom of the viewport, so that the object you have selected or all the objects in the scene are displayed. This works for any of the orthographic views (i.e., not Perspective View or a camera view).

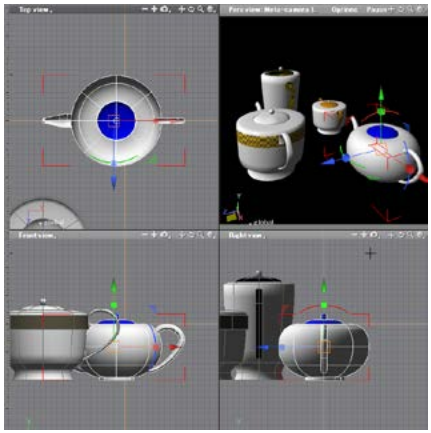
From the View Operations pop-up menu (the gear icon in the upper right of each viewport), select **Fit to Selection**.



TIP

To turn the camera towards the object you have selected, in the Camera Window, under **Set & Link**, click the **Object** button next to **Target**.

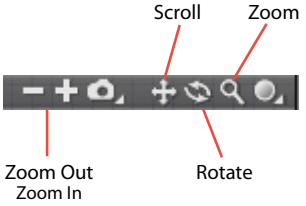
The viewport is zoomed so that the selected object is contained within the viewport.



Similarly, if you select **Fit to Window** from the same menu, the Figure Window view is zoomed in or out so that all objects in the scene fit within the viewports.

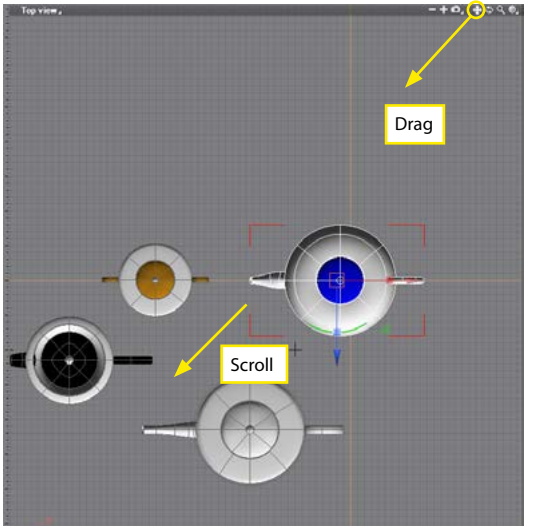
Using the Navigation Tools

You can scroll, rotate, or zoom the view by dragging or clicking the **Navigation Tool** icons in the upper-right corner of each viewport.



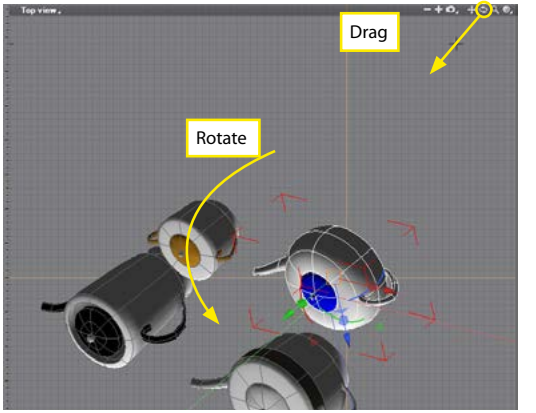
Scroll

The viewport is scrolled in the direction dragged. In Perspective View, the camera moves.



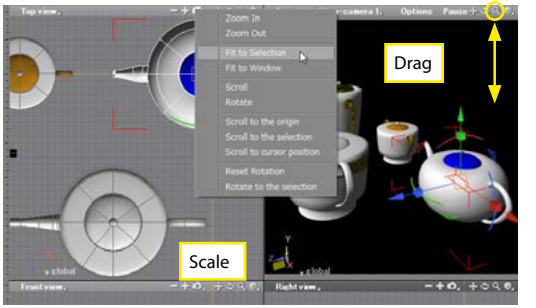
Rotate

The viewport is rotated in the direction dragged. In Perspective View, the eye of the camera rotates. In an orthographic view, clicking the icon will reset the rotation.



Zoom

You can zoom in or out in the viewports by clicking the [+] or [-] icon or by dragging the **Zoom** icon up or down. In Perspective View, zooming in or out moves the eye of the camera forward and backward.



The Scale Guide

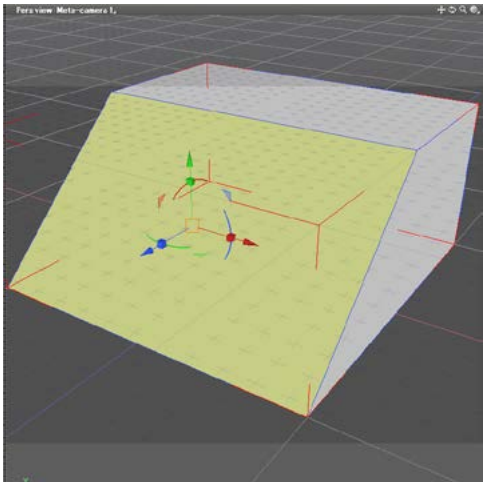
When zooming in the Figure Window, a scale guide will display on the right side of the viewport, roughly showing the current scale of the FIgure Window by highlighting one of five icons: a paper clip, a teacup, a person, a house, and a mountain.

To toggle the Scale Guide on or off, select **Figure** > **Scale Guide**.

Working with a Local Coordinate Axis

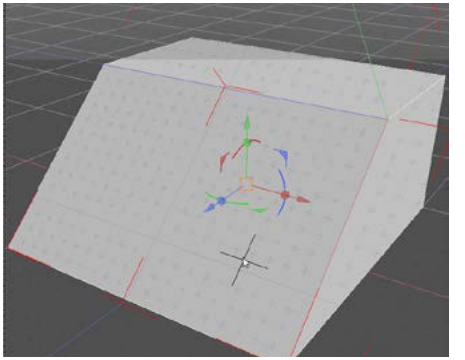
You can create a local axis to the work plane. So, you can easily create an object on any face.

1 Select the face for polygon mesh or vertices and the edges of three control points.

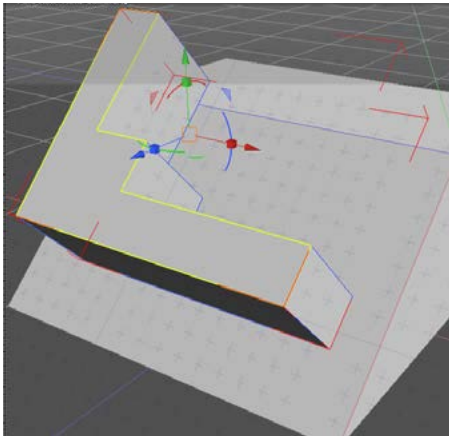


2 Click the word "global" in the Work Plane Controller, and select **Create Local Axis** from the pop-up menu.

3 The local axis is displayed and the work plane corresponding to the selected face appears in the Perspective View.



4 When modeling in local axis mode, modeling can be done in reference to a more convenient work plane.



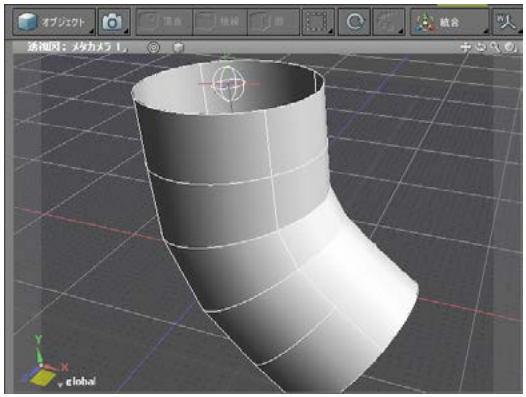
TIP

To cancel local axis mode, switch to global axis mode.

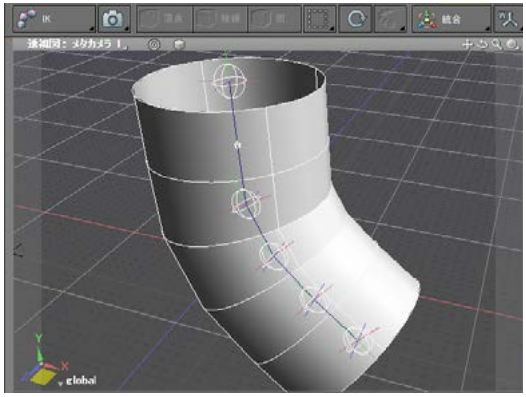
Displaying Joints

Displaying Hidden Joints

In the standard Object Mode, joints may become hidden behind other objects and become difficult to select, particularly if they are inside of another object. Switch to Joint Mode or IK Mode to bring the joints to the front, making it easier to see and select them.



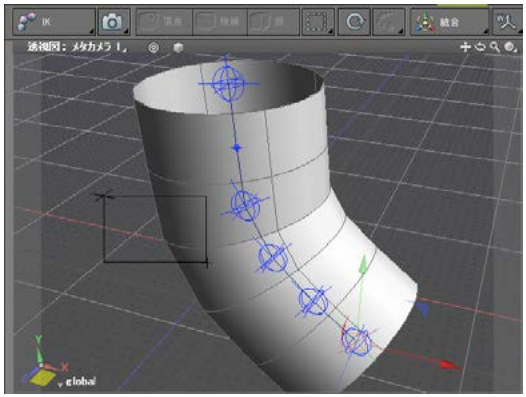
Object Mode



IK Mode

Preventing Accidental Selection of Objects

When selecting joints, switching to Joint Mode or IK Mode first will prevent accidental selection of objects in the scene. Likewise, you will not accidentally switch to Modify Mode when clicking on an object.



TIP

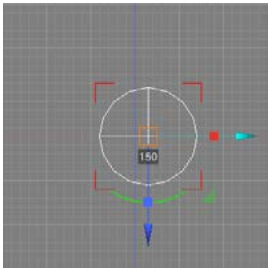
If the display mode is set to Shading or Texture, joints will not show in the viewport. To show joints in Shading or Texture display modes, from the Display pop-up menu, select **Display** > **Show Joint Wireframe** and **Display** > **Show Joint Line Wireframe**.

Numeric Values

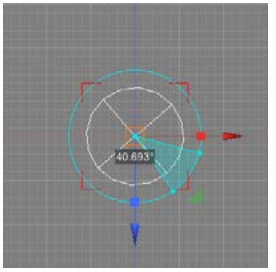
Showing Numeric Values while Editing

When editing an object using the 3D Manipulator or an editing tool, numeric values are displayed, showing the translation distance, rotation angle, scale amount (ratio). This works for Translate, Rotate, Scale, Uni-Scale, and Skew.

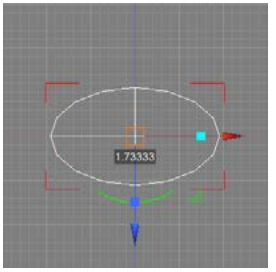
When Using the Manipulator:



Translate (distance)

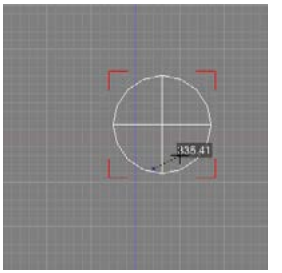


Rotate (angle)

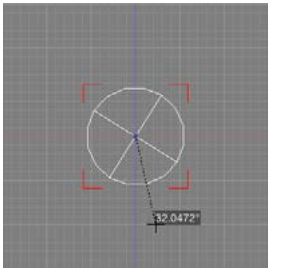


Scale (ratio)

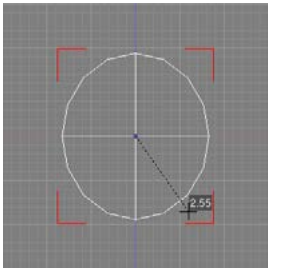
When Using an Editing Tool:



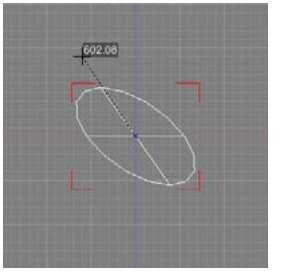
Translate (distance)



Rotate (angle)



Scale / Uni-Scale (ratio)



Skew (distance)

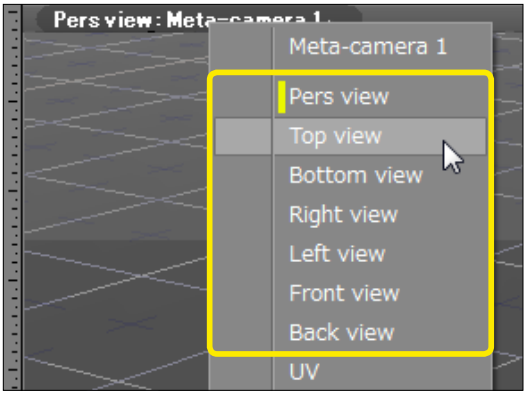
4. Creating Basic Objects

Switching Work Planes

Before creating an object, you will want to select the plane in 3D space used as a reference for modeling. This is called the **work plane**.

Changing the Viewport and Selecting a View

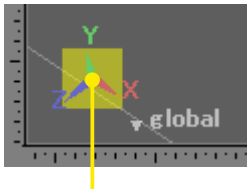
From the View Type menu of the Figure Window, you can change the viewport and select the work plane.



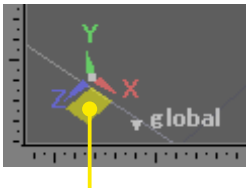
Perspective View (screen plane)
Top View and Bottom View (XZ plane)
Right View and Left View (YZ plane)
Front View and Back View (XY plane)

Selecting a Work Plane

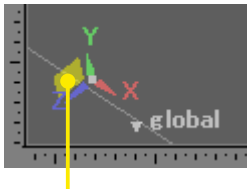
When working in the Perspective View, you can click and select the face on which to create an object by clicking it in Work Plane Controller.



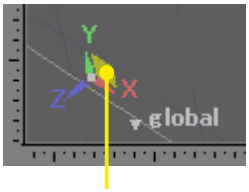
Perspective View (screen plane)



Bottom View (XZ plane)



Side View (YZ plane)



Front View (XY plane)

Perspective View (screen plane):

Click ■ in the middle.

Bottom View (XZ plane):

Click the yellow area in the viewport.

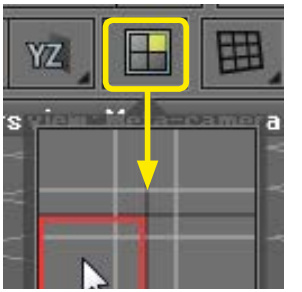
Side View (YZ plane):

Click the yellow area in the viewport.

Front View (XY plane):

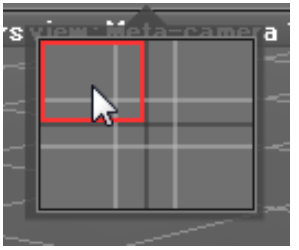
Click the yellow area in the viewport.

Changing Views with the View Switcher

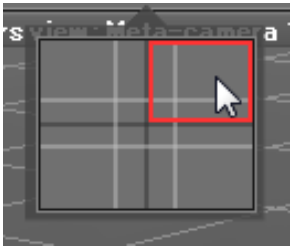


You can change the style of a split view list by selecting one of the nine patterns. Clicking the **Split View** button of the Control Bar displays the View Switcher. If you position the mouse to **View Switcher**, the red-framed combinations will change.

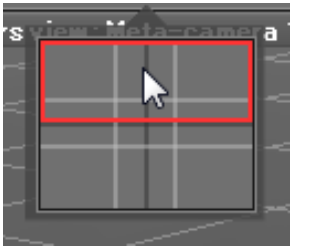
If the Control Bar does not display the **Split View** button, right-click on an empty area of the Control Bar and then select an item. This allows you to show or hide any of the Control Bar buttons.



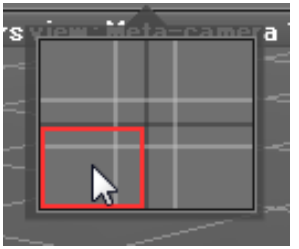
Upper Left



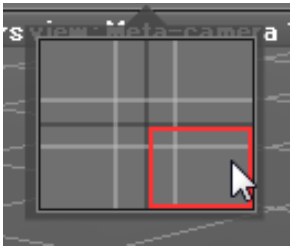
Upper Right



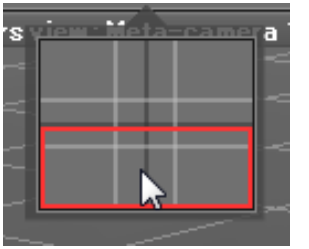
Upper Left and Upper Right



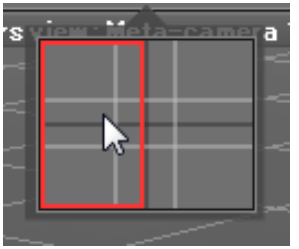
Lower Left



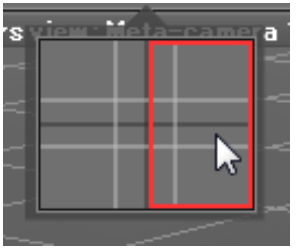
Lower Right



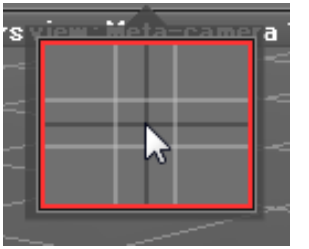
Lower Left and Lower Right



Upper Left and Lower Left



Upper Right and Lower Right



Split View

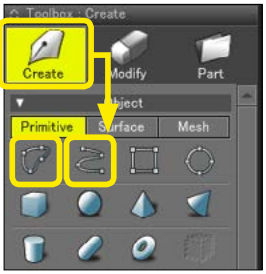
Line Objects

■Creation Types

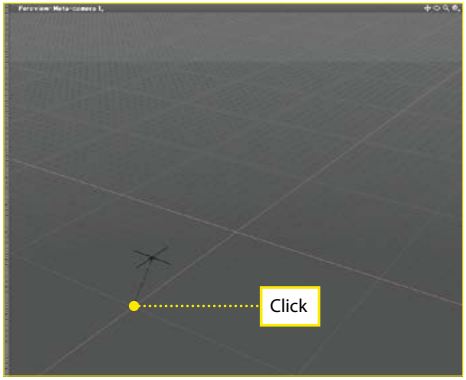
Select an object type from **Primitive**, **Surface**, and **Mesh**. The table below shows the types of objects that can be created and types to which the objects to be created belong.

	Primitive	Surface	Mesh
Creation	○	○	×
Object to be created	Line object	Line object	-

1 From **Create** under **Toolbox**, select **Closed Line** or **Open Line** to start the creation process.

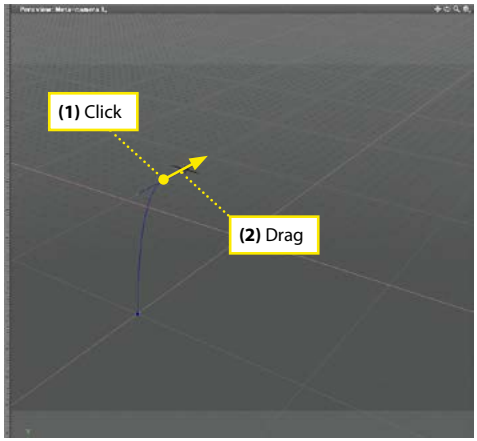


2 When you click the viewport, a control point will be created.

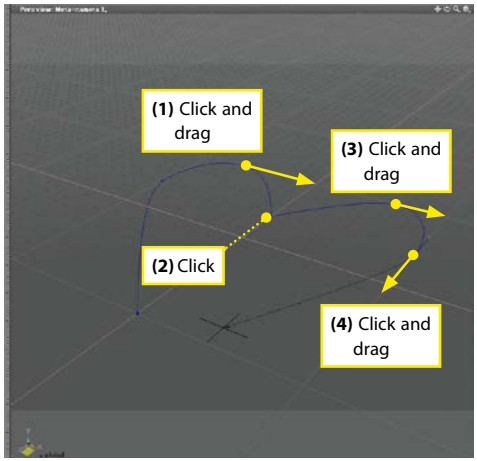


3 If you click and then drag the viewport, a line handle whose length equals the drag length is created before and after the direction of the dragging, starting from the control point.

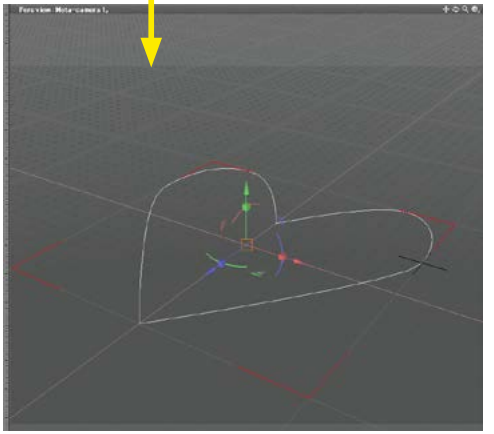
Once the line handle has been created, the control point comes a curved line.



4 To create a line object, continue clicking for the straight line, and continue to click and drag for the curved line.



5 Click **Apply** under **Tool Parameters** to complete the creation process.



TIP

You can also finish the creation process by double-clicking the end point of the line object or by pressing Enter (Windows) or Return (Mac OS).

TIP

You can bend the handle during the creation process, by holding down z (Windows) or option (Mac OS).

TIP

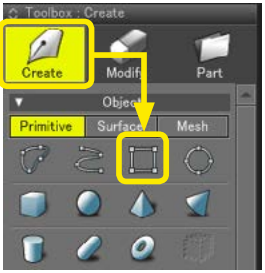
Changing a view to a orthogonal view other than the Perspective View allows you to easily understand an object.

Rectangles

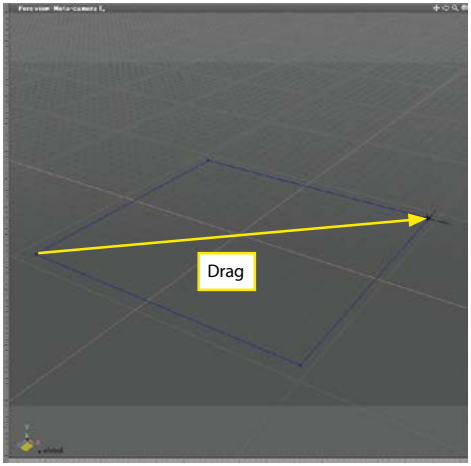
■**Creation Types**

	Primitive	Surface	Mesh
Creation	○	○	○
Object to be created	Closed line	Closed line	Polygon mesh

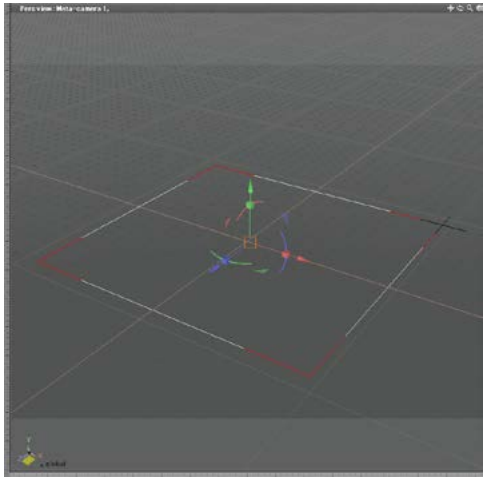
1 From **Create** under **Toolbox**, select **Rectangle** to start the creation process.



2 Drag by an amount equal to the distance of the diagonal of the rectangle to be created, and then create the rectangle.



3 Finish dragging to complete the creation process.



TIP

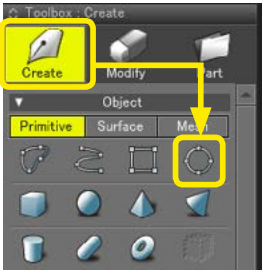
Selecting **Rectangle** and then clicking in the Figure Window creates a rectangle of the same size as the previous one.

Disks

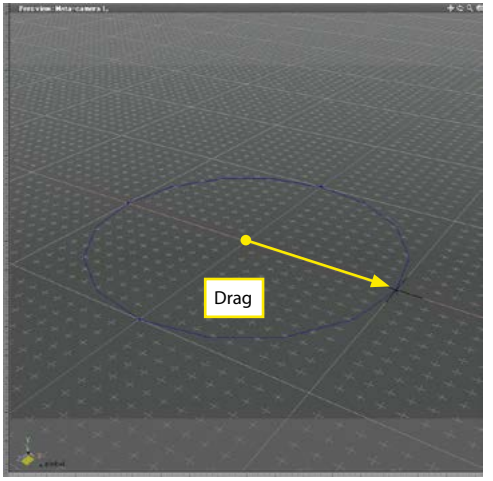
■**Creation Types**

	Primitive	Surface	Mesh
Creation	○	○	×
Object to be created	Disk	Disk	-

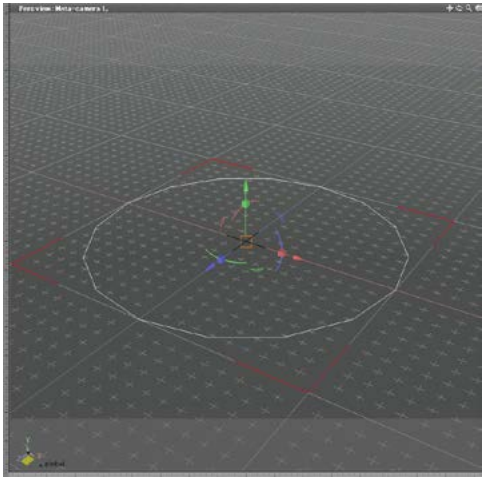
1 From **Create** under **Toolbox**, select **Disk** to start the creation process.



2 Drag by an amount equal to the radius of the disk to be created, and then create the disk.



3 Finish the dragging to complete the creation process.



TIP

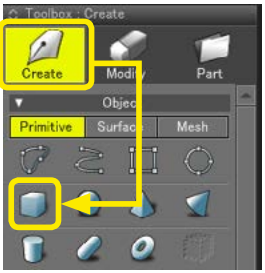
Selecting **Disk** and then clicking in the Figure Window creates a disk of the same size as the previous one.

Boxes

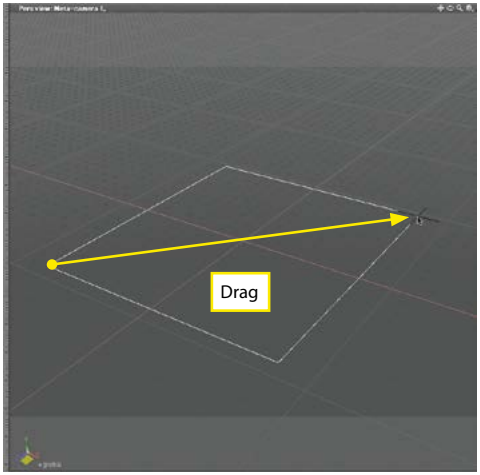
■Creation Types

	Primitive	Surface	Mesh
Creation	○	○	○
Object to be created	Extruded closed line	Curved surface	Polygon mesh

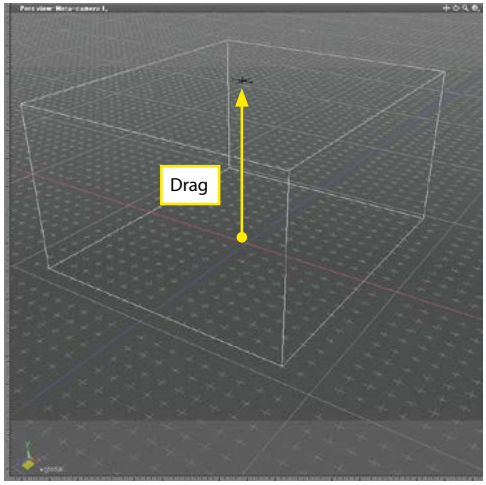
1 To begin creating a box, in the **Toolbox** select **Create** > **Box**.



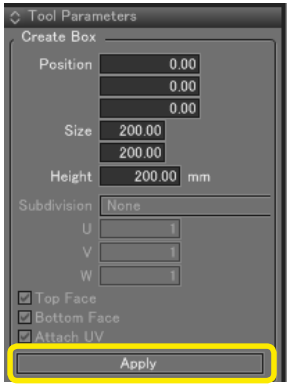
2 Click and drag in the Figure Window to first draw a rectangle.



3 Next, drag in a direction perpendicular to the rectangle to add a third dimension to the shape, creating a box.



4 In the **Tool Parameters**, click **Apply** to complete the creation process. To make fine adjustments to a shape's position or size, enter numeric values in the Tool Parameters before clicking Apply.

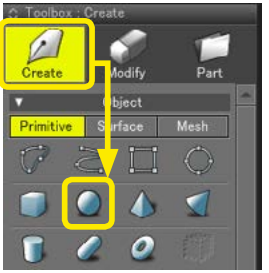


Spheres

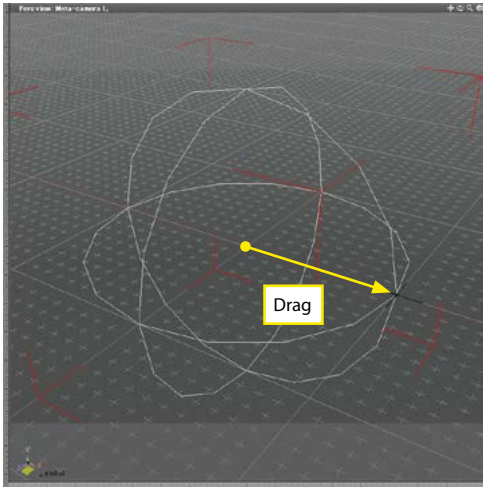
■**Creation Types**

	Primitive	Surface	Mesh
Creation	○	○	○
Object to be created	Sphere	Curved surface	Polygon mesh

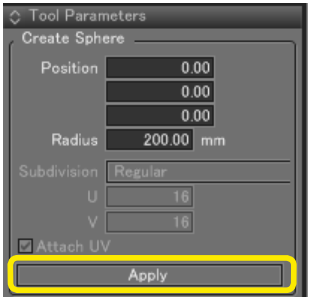
1 To begin creating a sphere, in the **Toolbox** select **Create** > **Sphere**.



2 Click and drag in the Figure Window to draw a sphere with radius equal to the distance dragged.



3 In the **Tool Parameters**, click **Apply** to complete the creation process. To make fine adjustments to a shape's position or size, enter numeric values in the Tool Parameters before clicking Apply.



TIP

Selecting **Sphere** and then clicking in the Figure Window (without dragging) creates a sphere of the same size as the previous one.

NOTE

Using Tool Parameters

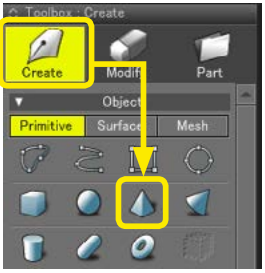
You can also create a sphere, box, pyramid, cone, cylinder, capsule, and torus by entering numerical values in **Tool Parameters**.

Pyramids

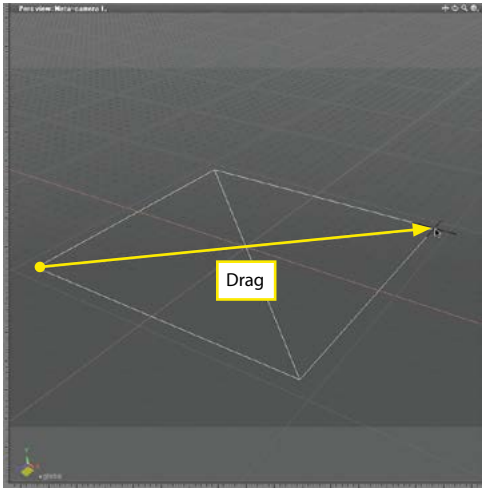
■Creation Types

	Primitive	Surface	Mesh
Creation	○	○	○
Object to be created	Curved surface	Curved surface	Polygon mesh

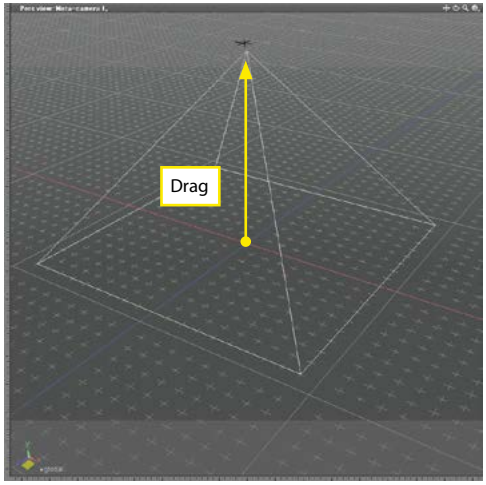
1 To begin creating a pyramid, in the **Toolbox** select **Create** > **Pyramid**.



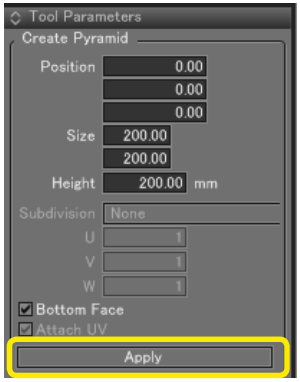
2 Click and drag in the Figure Window to first draw a rectangle.



3 Next, drag in a direction perpendicular to the rectangle to add the height.



4 In the **Tool Parameters**, click **Apply** to complete the creation process. To make fine adjustments to a shape's position or size, enter numeric values in the Tool Parameters before clicking Apply.

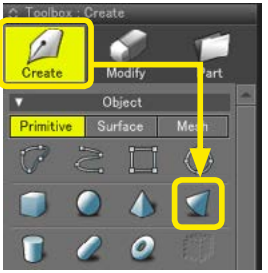


Cones

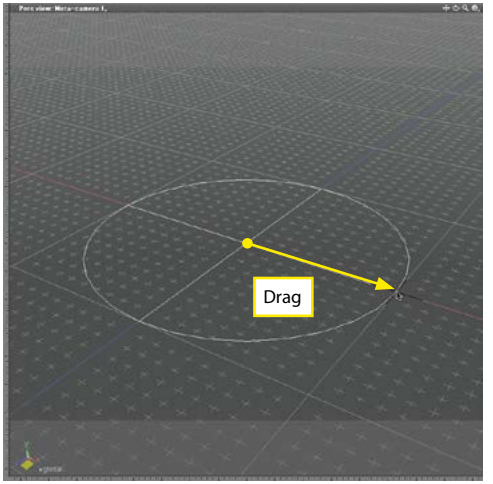
■**Creation Types**

	Primitive	Surface	Mesh
Creation	○	○	○
Object to be created	Curved surface	Curved surface	Polygon mesh

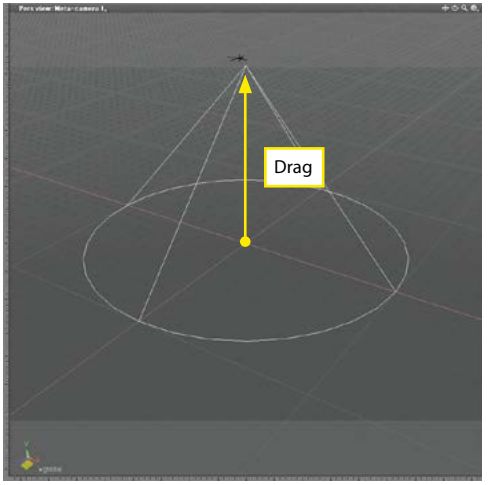
1 To begin creating a cone, in the **Toolbox** select **Create** > **Cone**.



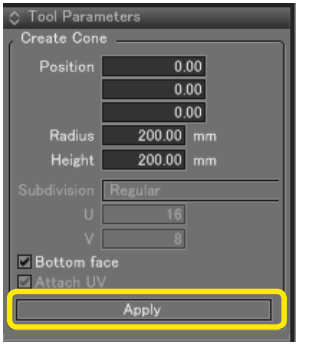
2 Click and drag in the Figure Window to first draw a disk.



3 Next, drag in a direction perpendicular to the circle to add the height.



4 In the **Tool Parameters**, click **Apply** to complete the creation process. To make fine adjustments to a shape's position or size, enter numeric values in the Tool Parameters before clicking Apply.

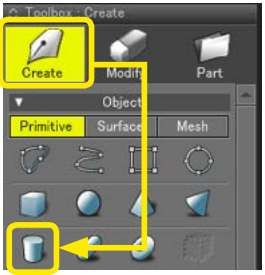


Cylinders

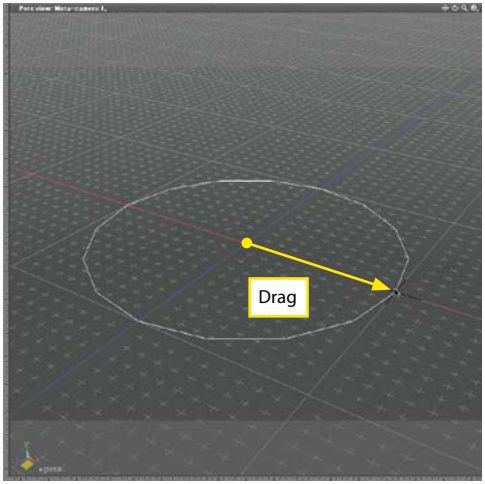
■Creation Types

	Primitive	Surface	Mesh
Creation	○	○	○
Object to be created	Extruded disk	Curved surface	Polygon mesh

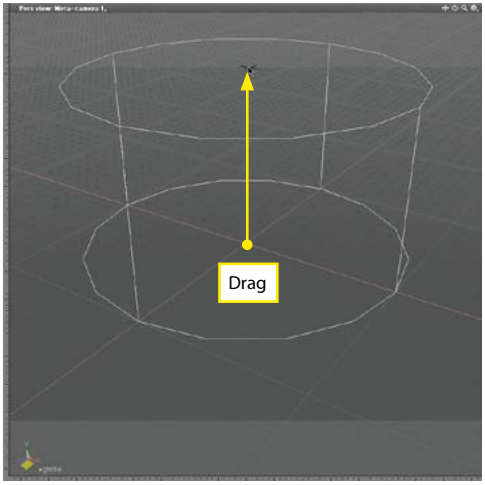
1 To begin creating a cylinder, in the **Toolbox** select **Create** > **Cylinder**.



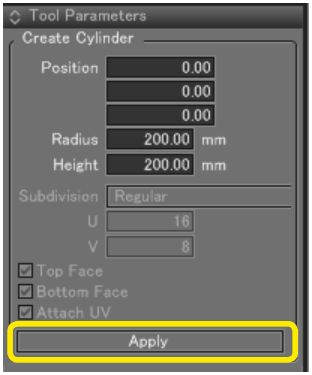
2 Click and drag in the Figure Window to first draw a disk.



3 Next, drag in a direction perpendicular to the disk to add the height.



4 In the T**ool Parameters**, click **Apply** to complete the creation process. To make fine adjustments to a shape's position or size, enter numeric values in the Tool Parameters before clicking Apply.

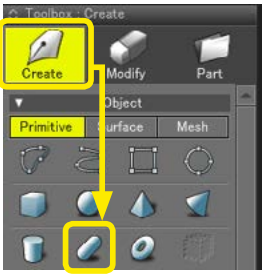


Capsule Objects

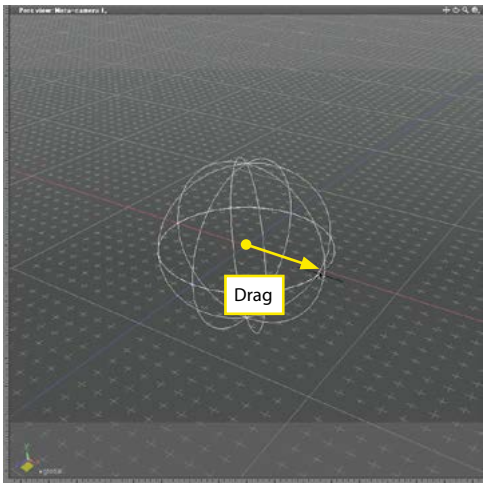
■**Creation Types**

	Primitive	Surface	Mesh
Creation	○	○	○
Object to be created	Revolved open line	Curved surface	Polygon mesh

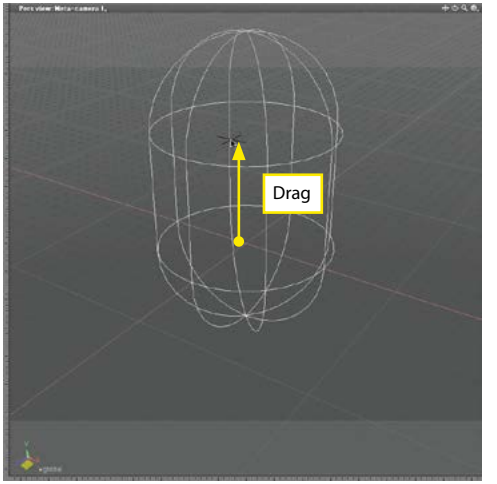
1 To begin creating a capsule, in the **Toolbox** select **Create** > **Capsule**.



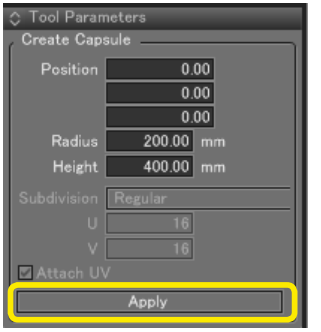
2 Click and drag in the Figure Window to first draw a sphere.



3 Next, drag in any direction to create the capsule.



4 In the **Tool Parameters**, click **Apply** to complete the creation process. To make fine adjustments to a shape's position or size, enter numeric values in the Tool Parameters before clicking Apply.

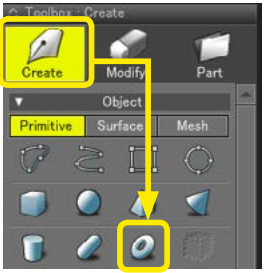


Torus Objects

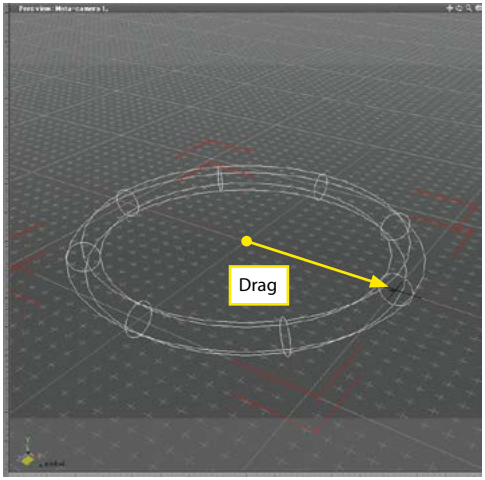
■Creation Types

	Primitive	Surface	Mesh
Creation	○	○	○
Object to be created	Revolved closed line	Curved surface	Polygon mesh

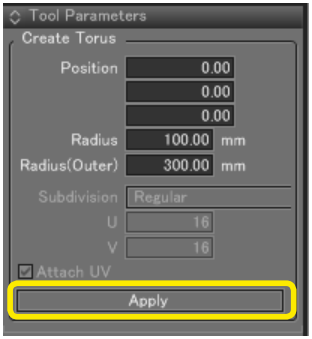
1 To begin creating a torus, in the **Toolbox** select **Create** > **Torus**.



2 Click and drag in the Figure Window to draw a torus.



3 In the **Tool Parameters**, click **Apply** to complete the creation process. To make fine adjustments to a shape's position or size, enter numeric values in the Tool Parameters before clicking Apply. Here you can also adjust the cross section radius of the torus.



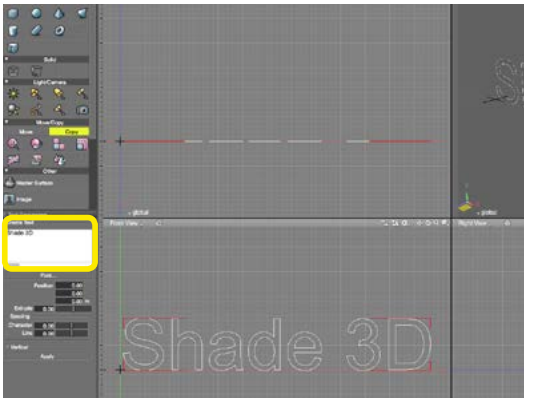
Text Primitives

The Text Primitive tool is a powerful creation tool for 3D letters. Both OpenType and TrueType fonts are supported.

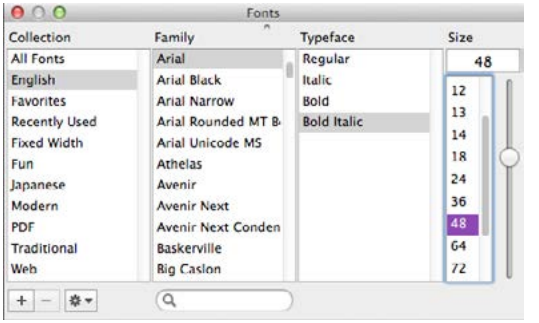
Using this tool it is possible to directly enter and edit 3D text within the Figure Window, much like you would in a word processor. You can intuitively create and edit properties such as the extrusion height and letter spacing using an interactive, real-time slider.

1 From the Toolbox, select Create > Primitive > Create Text

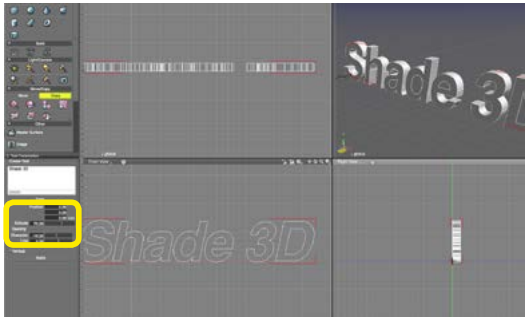
2 In the Tool Parameters, enter text in the Create Text box.



3 . Click the Font... button to open the system fonts dialog box for selecting a different font, text style, and size.



4 The Extrude distance and Spacing properties can be changed by moving the sliders. The position of the 3D text can be specified using the Position text boxes for the X, Y, and Z coordinates. Changes can be viewed in the Figure Window in real-time.



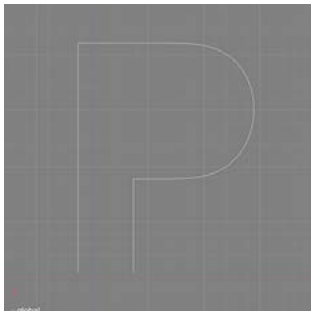
Add text and adjust the properties until you are satisfied with the result, and then click the Apply button in the Tool Parameters.

The 3D letters created are spline based so that many editing and processing adjustments can be done even after the 3D letters are generated.

Offsetting a Line

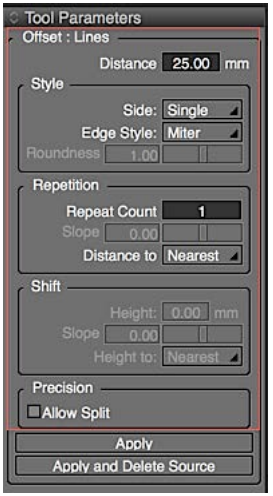
In order to create a copy of existing geometry at a uniform distance from the original, you can use the Offset tool. The distance to offset can be specified An offset line is a secondary line offset from the original line by a specific distance. Both lines and curved surfaces can be offset. If a curved surface is selected, an offset curved surface will be created..

1 Create a line object.

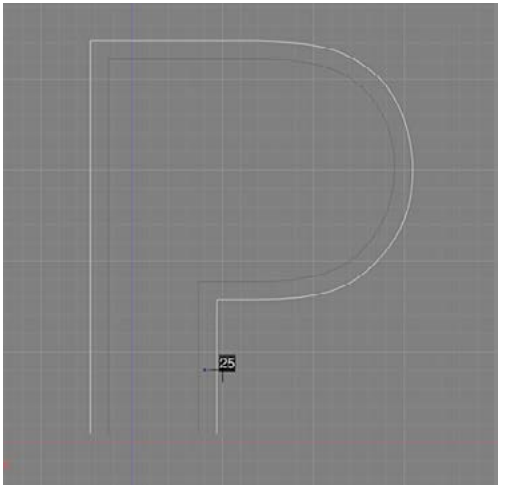


2 From the Menu Bar, select Tools > Modify > Offset. Offset is also available from the Toolbox, under Modify > Surface > Offset.

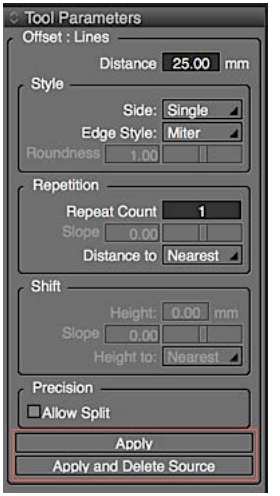
3 Adjust the settings in Tool Parameters as needed.



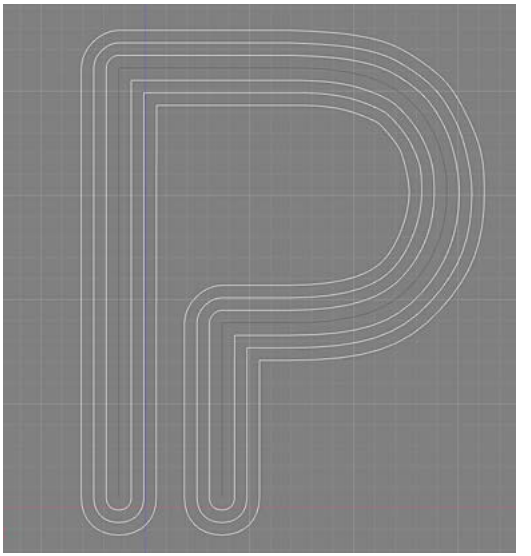
4 Create the offset line by clicking and dragging in the appropriate viewport of the Figure Window, or enter a value directly in the Distance text box in the Tool Parameters window. Increasing the Repeat value to greater than 1 will repeat the offset, resulting in multiple, stepped offsets.



5 In the Tool Parameters select Apply or Apply and Delete Original. Alternatively, press the Enter or Return key.



6 The style of corners can be set to Miter, Bevel, Round 1, or Round 2. Try experimenting with each style before applying the offset.

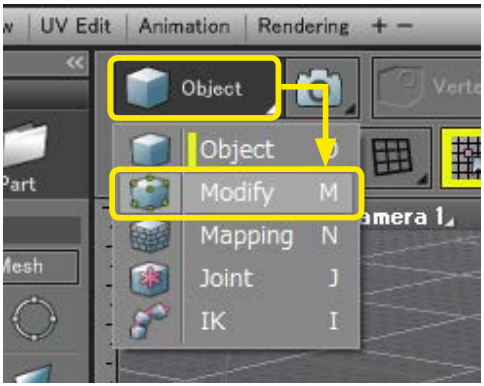


5. Editing Objects

Selecting and Converting Objects

To edit only part of an object, you must first switch the editing mode to **Modify Mode**.

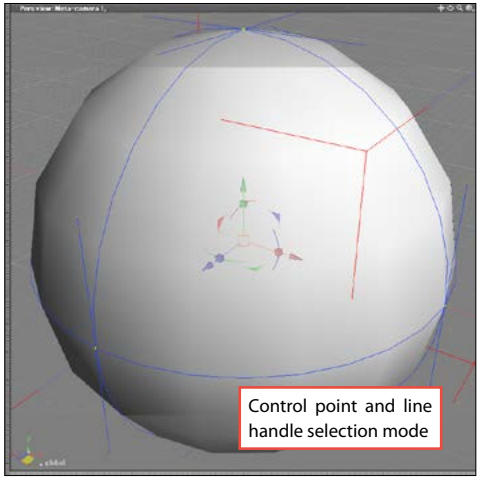
1 From the **Edit Mode** menu on the Control Bar, select **Modify**.



2 Select the part of the object to edit. The selection method differs between line objects and polygon objects.

Selecting and Converting Line Objects

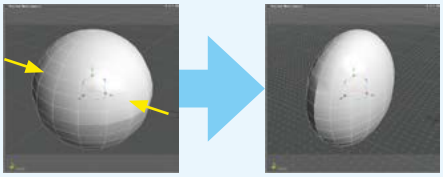
A line object is edited by selecting a control point or line handle.



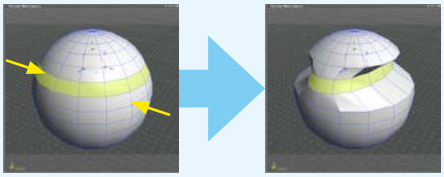
NOTE

Object Edit Mode vs. Modify Mode

If you edit an object in **Object mode,** the entire object changes.

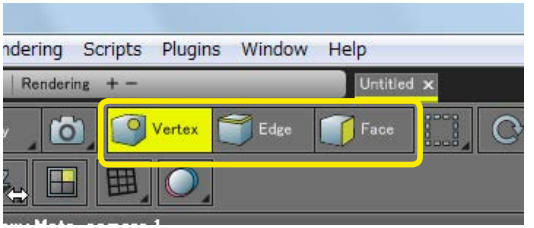


You can edit only a selected part of the object in **Modify Mode.**

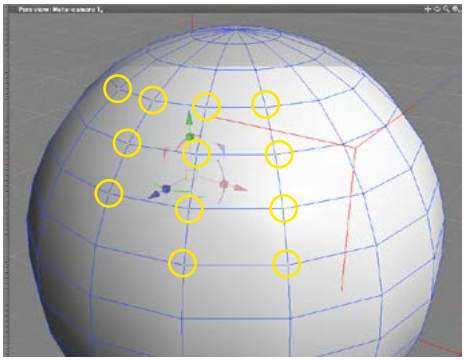


Selecting and Converting Polygon Meshes

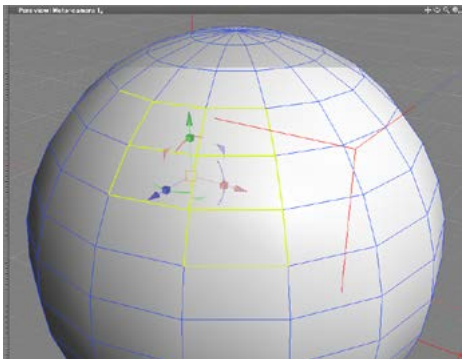
From the **Mesh Editing** options on the Control Bar, change the selection target to a polygon mesh.



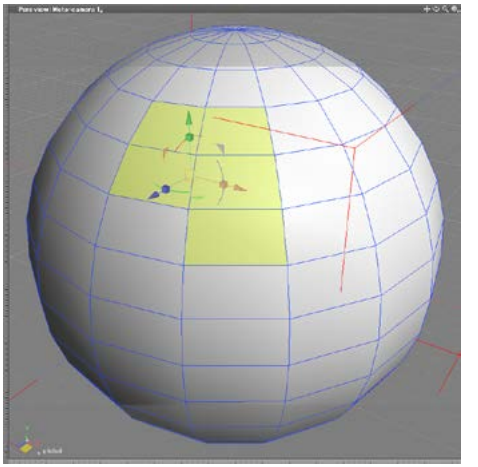
◆ **Vertex Editing Mode**



◆ **Edge Editing Mode**



◆ **Face Editing Mode**



Click to Select

Select, by clicking, a control point, line handle, vertex, edge, or face.

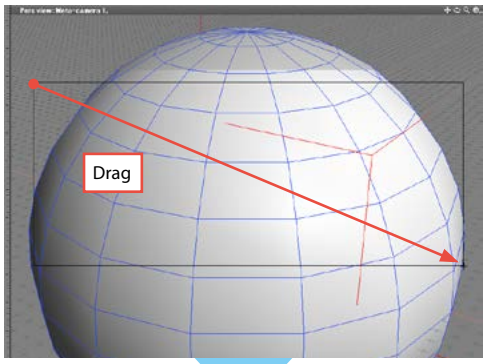
TIP

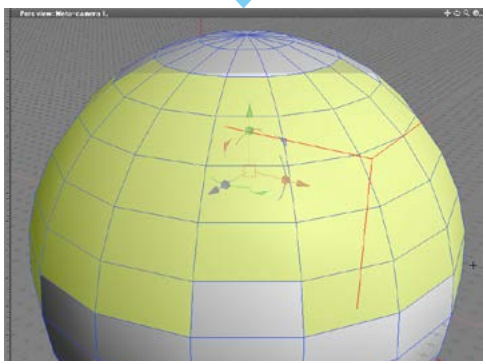
You can select two or more editing targets by holding down the Ctrl (Win) or ⌘ (Mac) key.

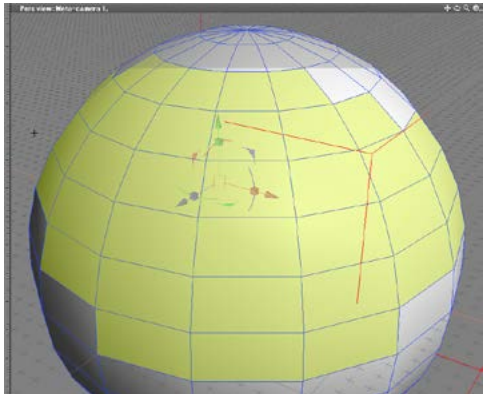
Drag to Select

From the **selection** options on the Control Bar, change the selection method.

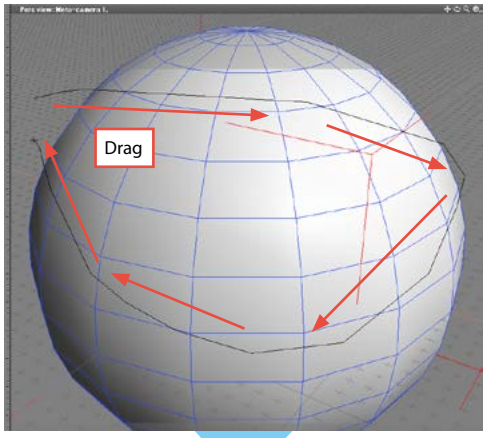
Box Selection



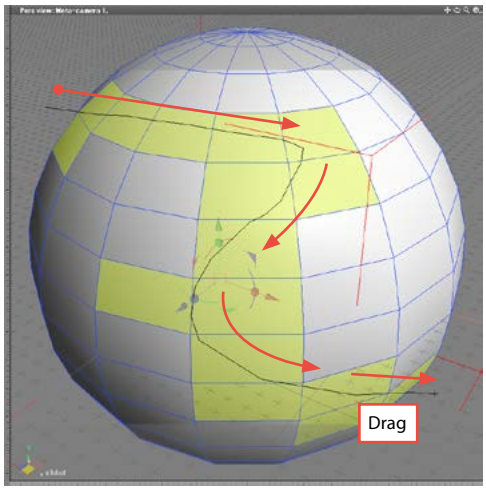




Lasso Selection



Trace Selection



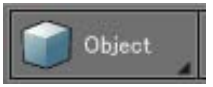
TIP

To cancel the selection, click outside of the object while holding down the Ctrl (Windows) or option (Mac OS) key.

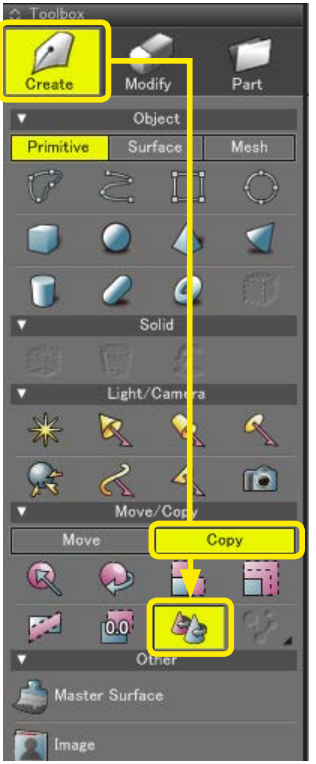
Creating a Link Object

A link object can be created from other objects. A link object only contains the same information as the original object. If you edit the original object, the result is reflected on the link object. Unlike a copy, the link object occupies no space in memory, thus reducing the amount of data.

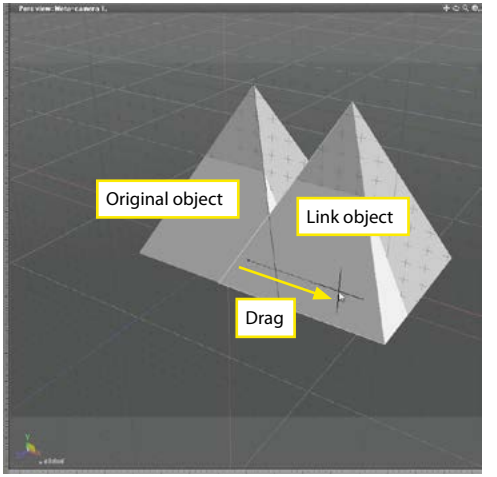
1 Switch to Object mode.



2 From **Toolbox**, select **Copy** > **Link**.



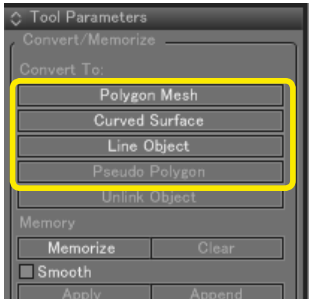
3 Drag to create the link object from the selected object.



Converting an Object Type

An object can be converted to another type. By converting the type of an object, you can edit object properties based on the new object type.

1 Select the object to be converted and then from **Tool Parameters**, select a conversion option.



Tool Parameters indicates that **Disk** has been selected. For the selected object, the corresponding **Tool Parameters** options are active. From **Tool Parameters,** you can convert one object type to another by selecting an active option.

■Convertible Object Types

		Object to which object is converted			
		Polygon Mesh	Curved Surface	Line Object	Pseudo Polygon
Object to be converted	Disk	○	○	○	—
	Sphere	○	○	—	—
	Polygon mesh	—	—	○	—
	Curved surface	○	—	—	○
	Closed line object	○	○	—	—
	Pseudo polygon	○	—	—	○
	Extruded object	○	○	—	—
	Revolved object	○	○	—	—

NOTE

Reconversion after Conversion

Once you have converted an object, you cannot restore the original object.

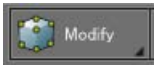
You can undo the conversion by using the **Undo** command on the **Edit** menu.

5–1. Editing Line Objects

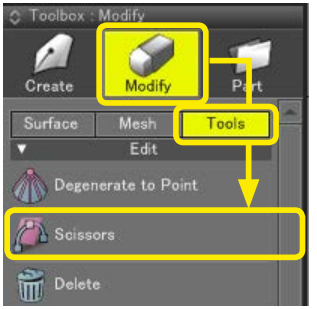
Adding Control Points

You can increase the complexity and detail of an object by increasing the number of control points that make up the line object.

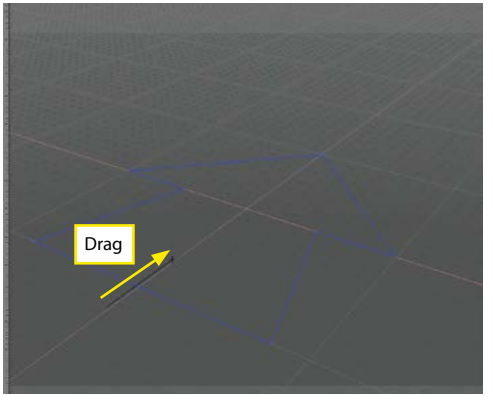
1 Switch to Modify Mode.



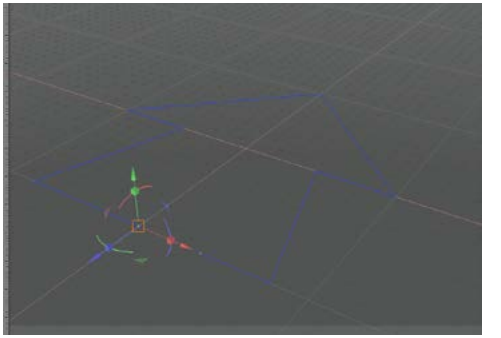
2 From **Toolbox** select **Modify** > **Tools** > **Add Point**.



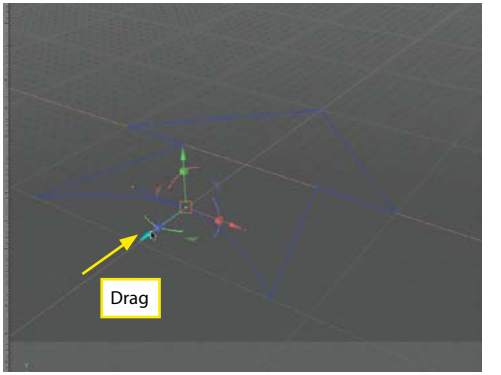
3 Drag across the position on a line object where you want to include a new control point.



4 The control point is added at the position.



5 Drag to edit the added control point.



TIP

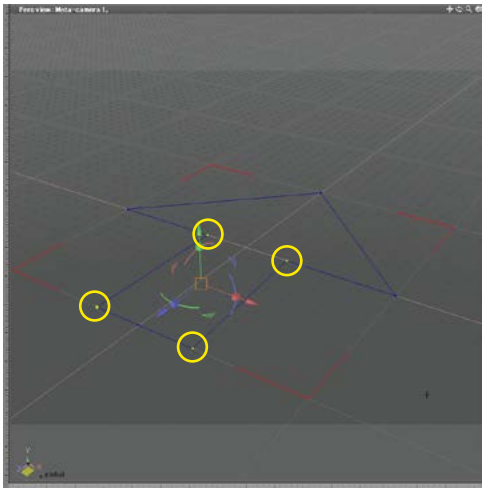
You can also add a control point by dragging while holding down the z + x (Windows) or ⌘ + option (Mac OS) keys.

Deleting Control Points

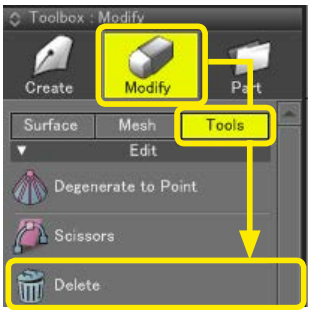
You can delete the control points constituting a line object.

1 Switch to Modify Mode.

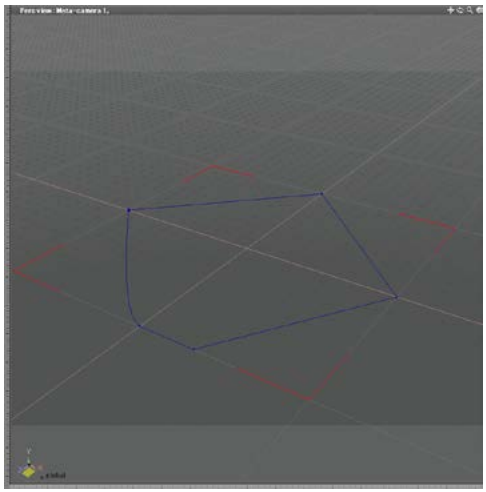
2 Select the control points to be deleted.



3 To delete the control points, from **Toolbox**, select **Modify** > **Tools** > **Delete**.



4 The control points are deleted.



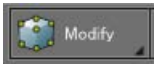
TIP

You can also delete control points by clicking them while holding down the z + x (Windows) or ⌘ + option (Mac OS) keys.

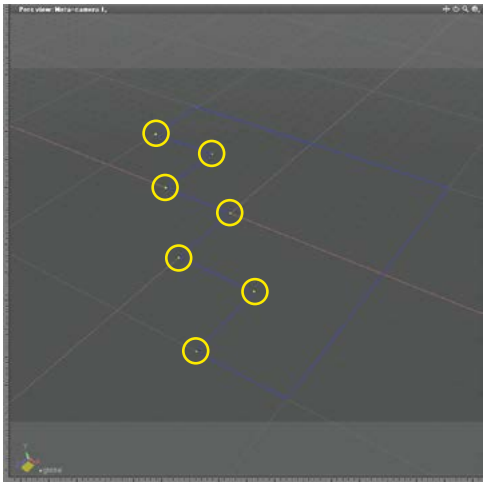
Averaging Control Points

You can average the control points constituting the line object, smoothing the progression of a line.

1 Switch to Modify Mode.

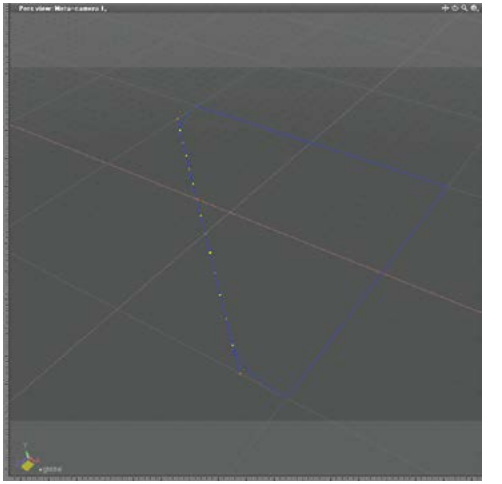


2 Select the control points to be avaraged.



3 From **Toolbox**, select **Modify** > **Surface** > **Iron**.

4 Move the control points.



TIP

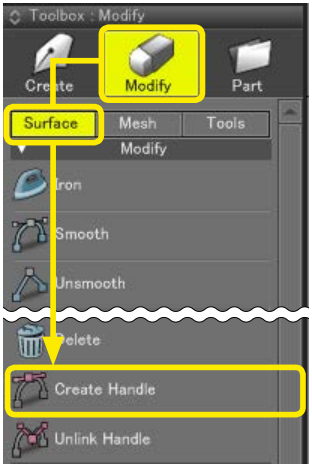
In Object mode, this function is applied to an entire line object.

Creating a Line Handle to Modify Curved Lines

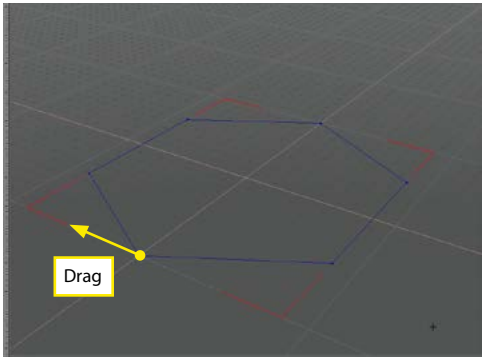
You can create a line handle to control and modify a curved line.

1 Switch to Modify Mode.

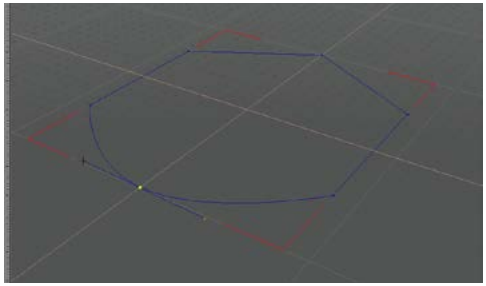
2 From **Toolbox**, select **Modify** > **Surface** > **Scissors**.



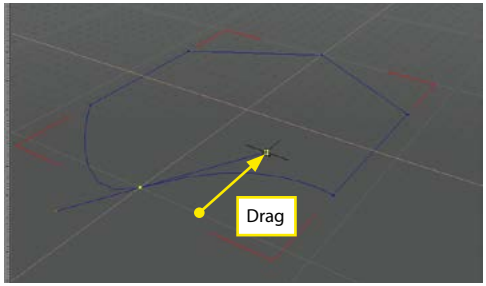
3 Drag from the control point in the direction of the point to create the line handle.



4 A line handle of a length equal to the length of the drag is created before and after the direction of the drag, and the line passing through the control point becomes a curved line.



5 When you drag the line handle, the curved line changes.



TIP

From **Toolbox**, select **Modify** > **Surface** > **Smooth** to create a line handle at the control point being selected.

TIP

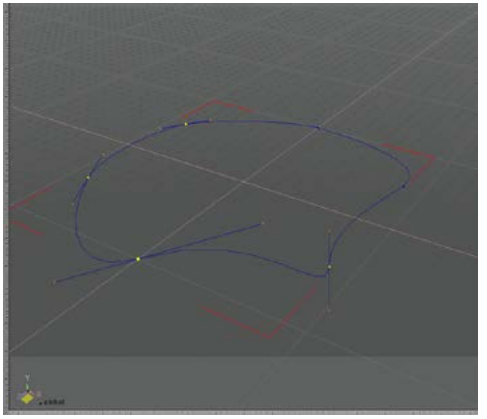
You can create a line handle for the entire line object by switching the editing mode to **Object Mode** and then selecting **Toolbox** > **Modify** > **Surface** > **Smooth**.

Deleting a Line Handle to Straighten a Line

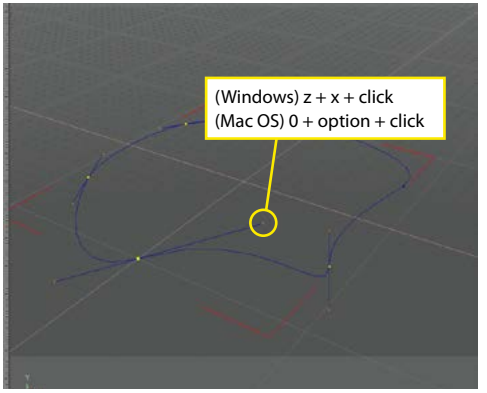
You can delete a line handle and thus turn it into a straight Line.

1 Switch to Modify Mode.

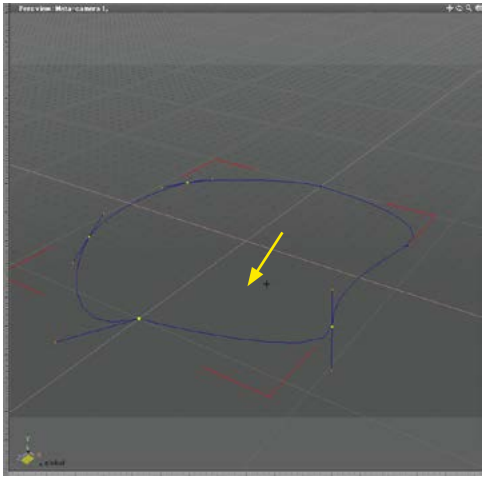
2 Select the control point at which to delete the line handle.



3 Delete one side and then the other side of the line handle by clicking it while holding down the z + x (Windows) or 0 + option (Mac OS) keys.



4 One side of the line handle is deleted.



TIP

To delete the line handle of the selected control point, from **Toolbox**, select **Modify** > **Surface** > **Unsmooth**.

TIP

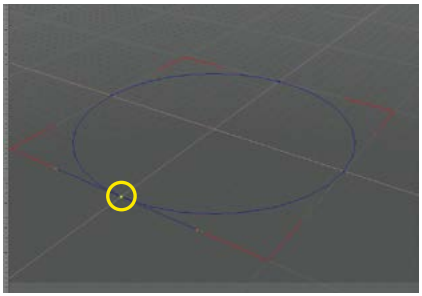
To delete the line handles of an entire line object, set the editing mode to **Object Mode** and then, from **Toolbox**, select **Modify** > **Surface** > **Unsmooth**,

Unlinking the Line Handle Connection and Bending a Curved Line

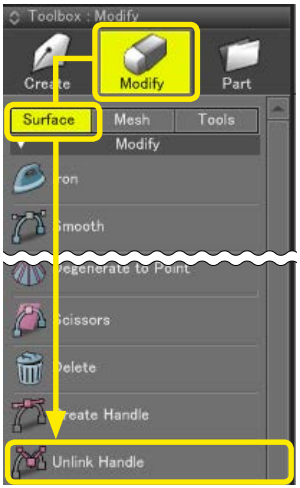
You can unlink a line handle connection and bend a curved line based on only the area influenced by the portion of the line handle on one side of a control point.

1 Switch to Modify Mode.

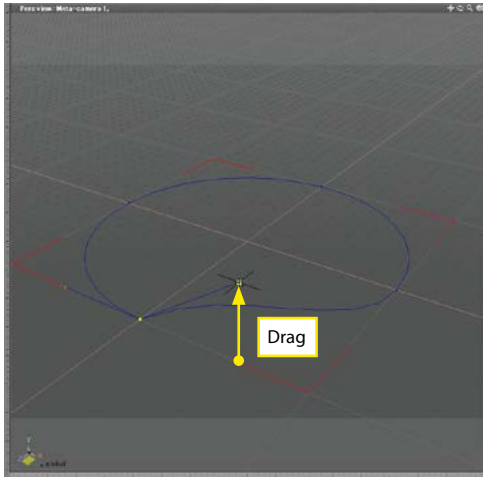
2 Select the control point at which to bend the line handle.



3 From **Toolbox**, select **Modify** > **Surface** > **Unlink Handle**.



4 When you drag the line handle, only the dragged line handle moves and the curved line is bent.



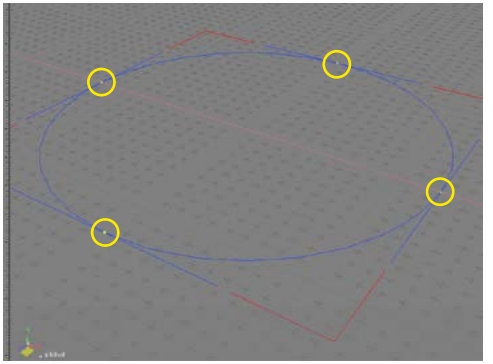
TIP

You can also bend the line handle by dragging it while holding down the z (Windows) or option (Mac OS) key.

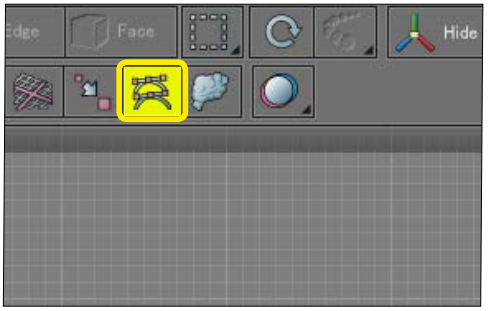
Editing Multiple Line Handles as a Group

You can collectively edit multiple line handles all at the same time.

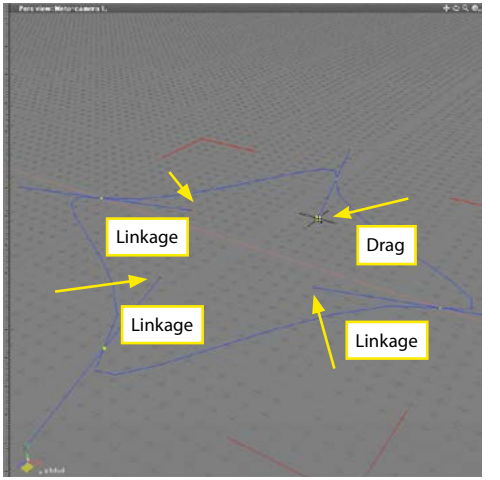
1 Select the control points to edit.



2 On the Control Bar, select Multi-handle.



3 If you drag a single line handle, all the other handles you have selected move in the same way as that line handle.



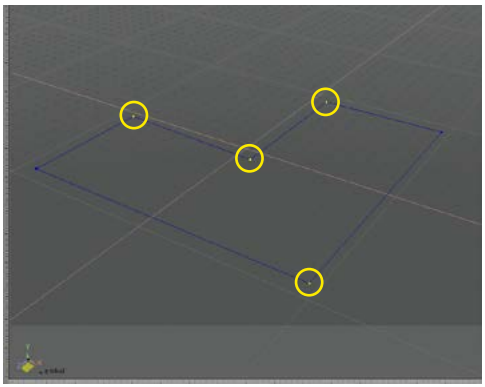
Rounding or Trimming Corners

You can perform radius rounding or cutting down for control points to round or trim corners.

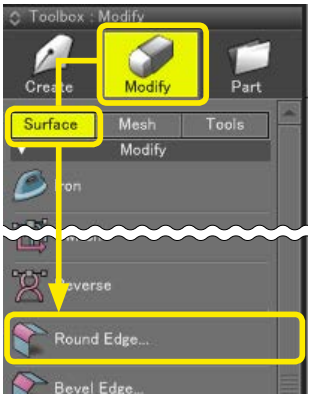
Rounding Corners

1 Switch to Modify Mode.

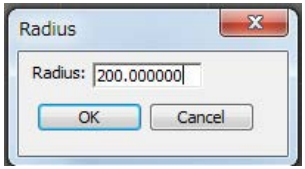
2 Select the control points at which the corners are to be rounded.



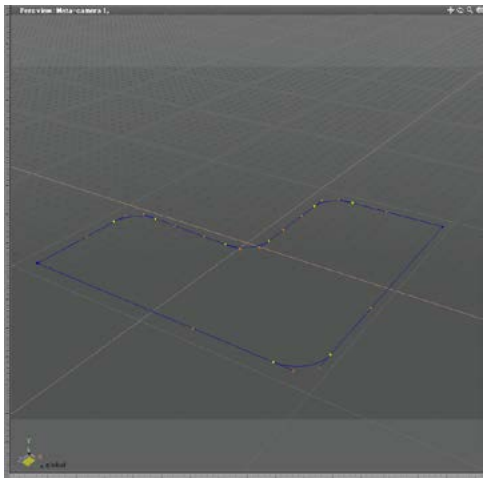
3 From **Toolbox**, select **Modify** > **Surface** > **Round Edge**.



4 Specify the radius used for rounding, as a numerical value.

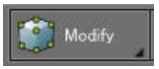


5 The corners are rounded.

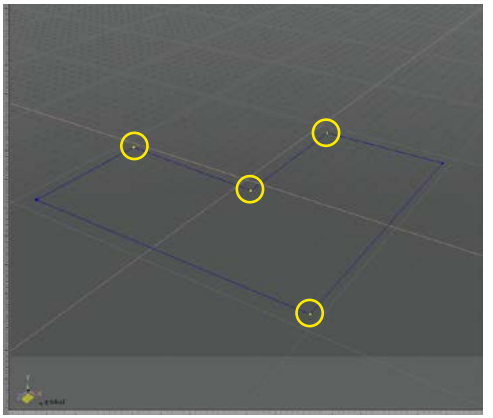


Trimming Corners

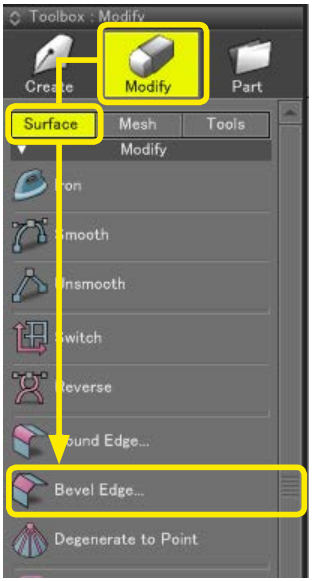
1 Switch to Modify Mode.



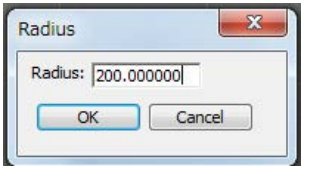
2 Select the control points at which the corners are to be cut down.



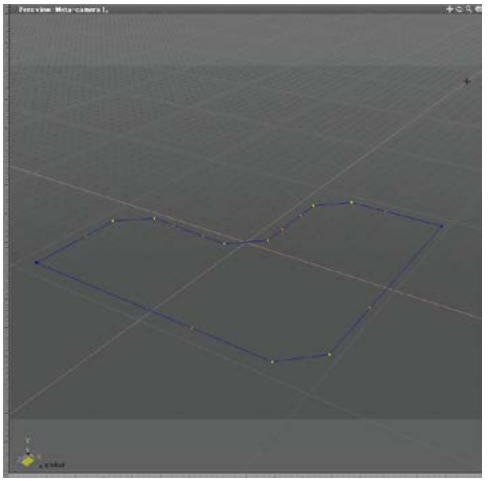
3 From **Toolbox**, select **Modify** > **Surface** > **Bevel Edge**.



4 Specify the radius used for cutting down, as a numerical value.



5 The corners are trimmed.



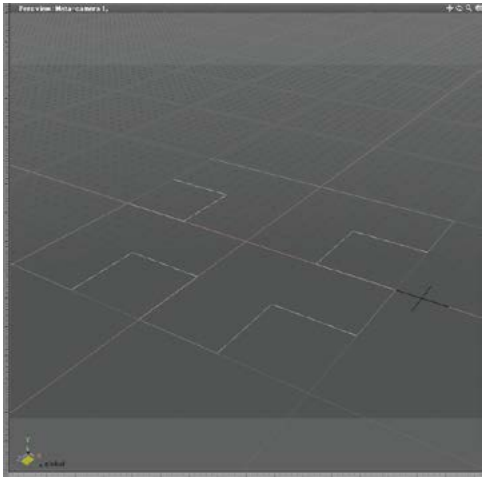
TIP

In Object mode, rounding and cutting down are applied to all the control points for a selected object.

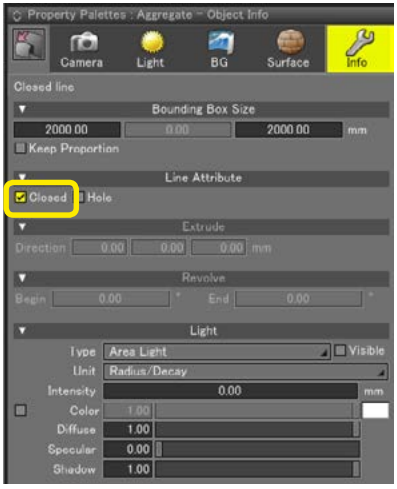
Creating or Deleting a Face on a Line Object

You can set the presence or absence of a face by opening or closing the line object.

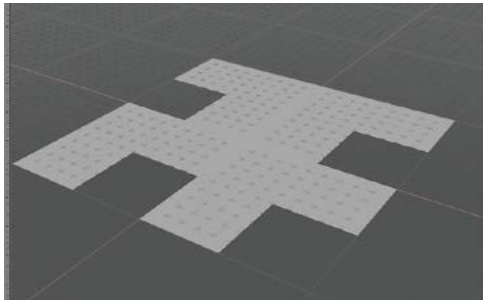
1 Select an open line object on which to create a face.



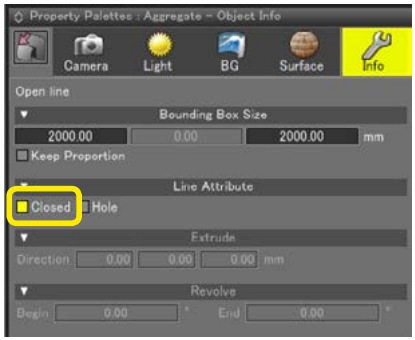
2 Check the **Closed** checkbox in the **Object Info** Window of the Aggregate.



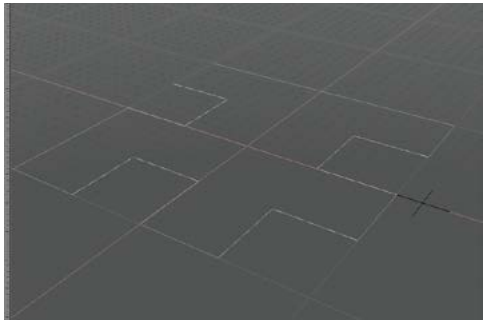
3 The open line object is closed and a face is created on it.



4 Uncheck the **Closed** checkbox of the **Object Info** Window.



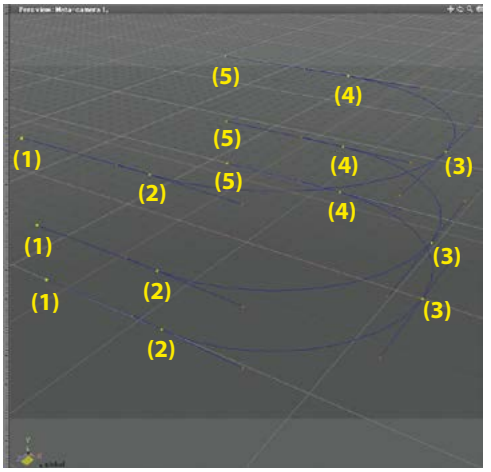
5 The closed line object becomes open and the face is deleted.

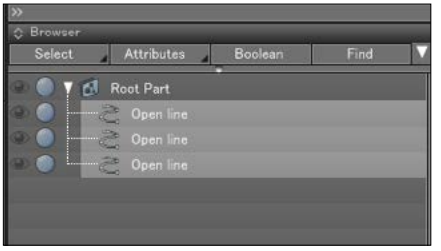


Converting to a Curved Surface

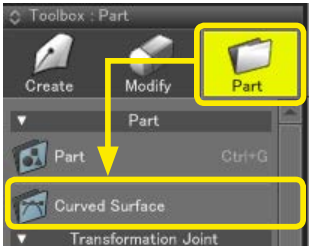
You can create a curved surface from a line object and create a face on that surface.

1 Create line objects having the same number of control points.

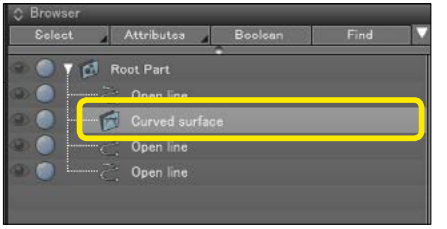




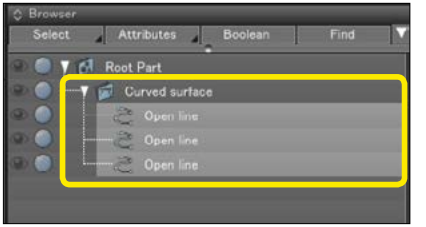
2 From **Toolbox**, select **Part** > **Curved Surface**.



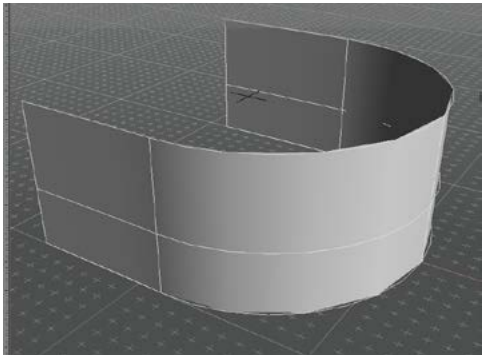
3 The **Curved Surface** part appears in the **Browser**.



4 Within the **Browser**, drag the line objects into the **Curved Surface** part.



5 The control points of the line object are connected to one another to create the face.



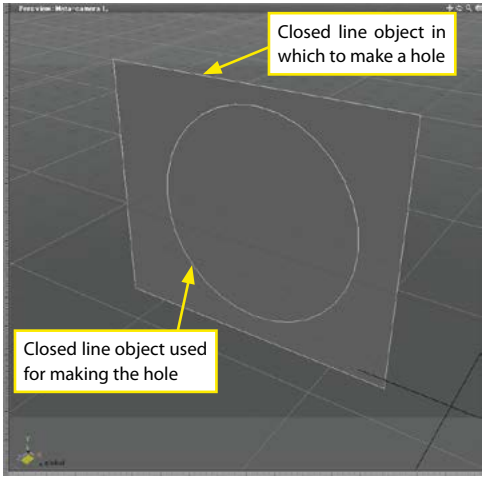
TIP

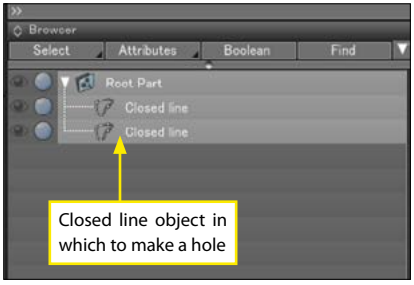
The line objects constituting a curved surface must all have the same number of control points.

Making a Hole in a Closed Line Object

You can open a hole in any position of a closed line object with another closed line object.

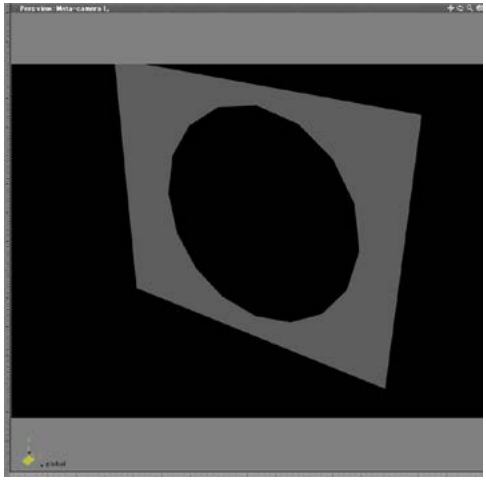
1 Within the Browser, arrange the closed line object in which to make a hole, just below the closed line object used for making the hole.





2 From the Object Info Window of the Aggregate, check the **Hole** checkbox while the closed line object in which to make the hole is selected.

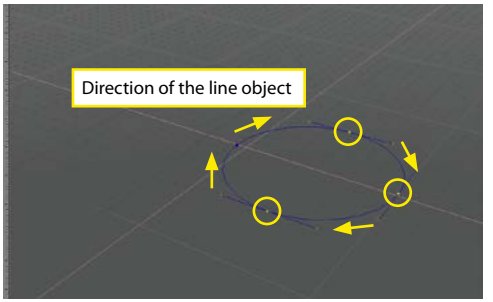
3 The hole is made in the closed line object. You can confirm the result in the rendering process.



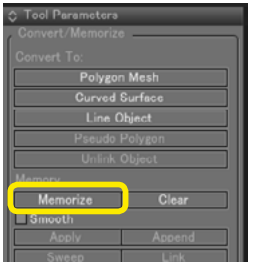
Rearranging the Order of Control Points

This function memorizes the control point positions and line handle positions and applies the memorized positions to other control points.

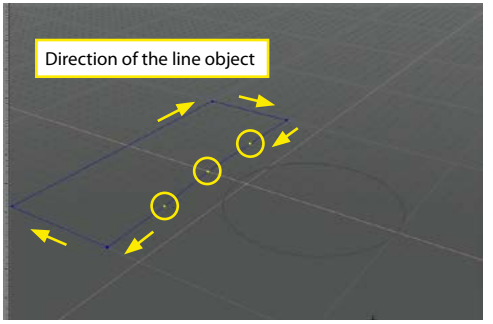
1 Select the control points to be memorized.



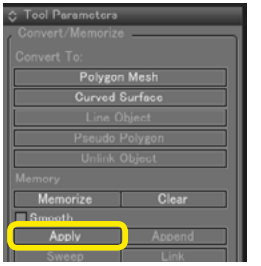
2 Click **Tool Parameters** > **Memorize**.



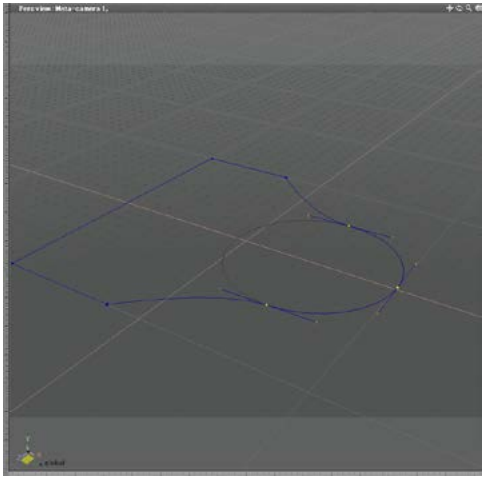
3 Select the control points in turn to establish the order.



4 Click **Tool Parameters** > **Apply**.



5 The control points return to their original positions.



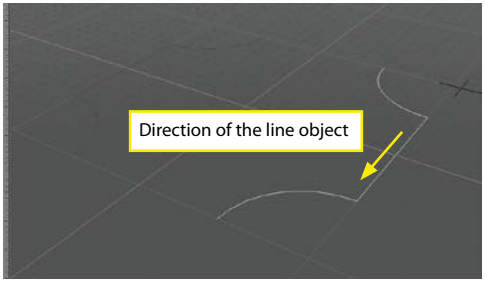
TIP

If the line object direction is different, the line object will be twisted. You can change the line object direction by selecting **Toolbox** > **Modify** > **Surface** > **Reverse**.

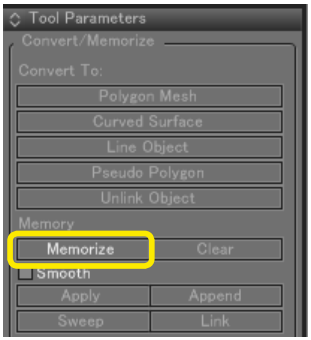
Connecting Line Objects

This function memorizes a line object and connects it to another line object to create a single line object.

1 Select a line object.

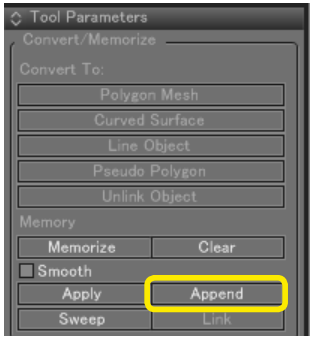


2 Click **Tool Parameters** > **Memorize**.

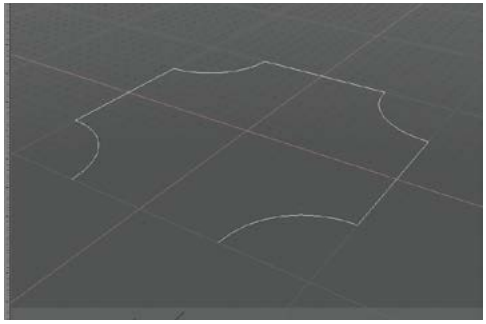


3 Select the line object to be connected.

4 Click **Tool Parameters** > **Append**.



5 The start point of the **memorized** line object and the end point of the **appended** line object are connected to each other to create a single line object.



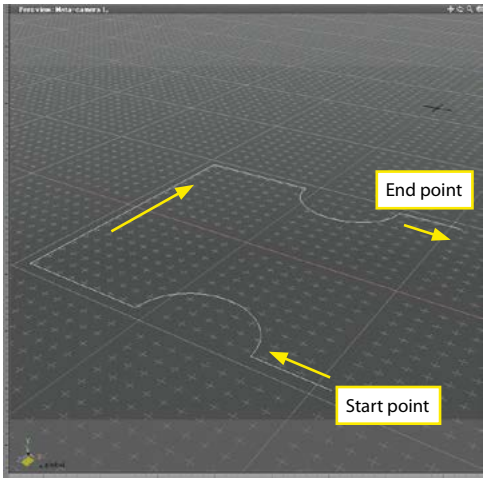
TIP

Executing this **Memorize/Append** creates a new single line object to which an **appended** line object has been connected. The **memorized** line object still exists. You can delete it if it is not necessary.

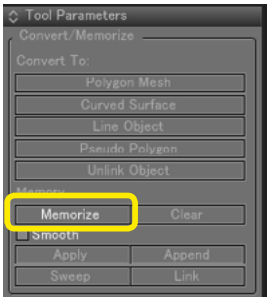
Creating a Curved Surface Using a Line Object as a Guide

Using closed or open line objects as a guide, this function extrudes another line object to create a curved surface using the Sweep function.

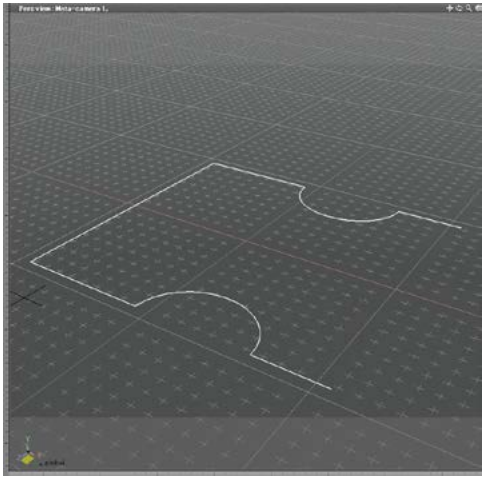
1 Select the line object to be used as a guide.



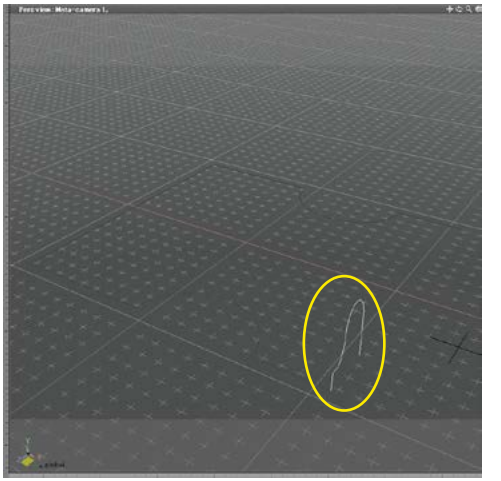
2 Click **Tool Parameters** > **Memorize** to memorize the line object being selected.



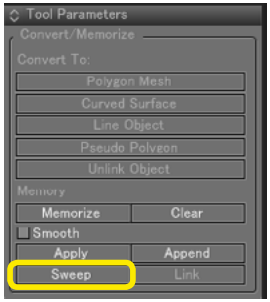
3 The memorized line object is displayed as a thick line.



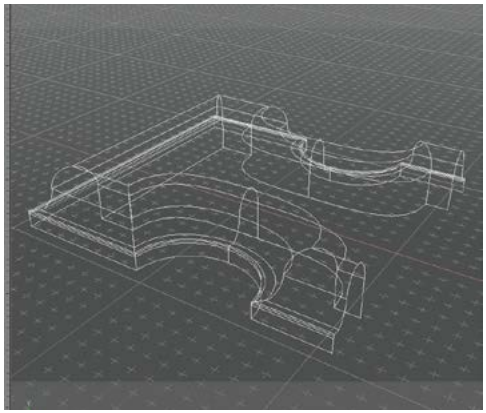
4 Arrange the line object to be extruded at the start point of the line object being used as a guide.



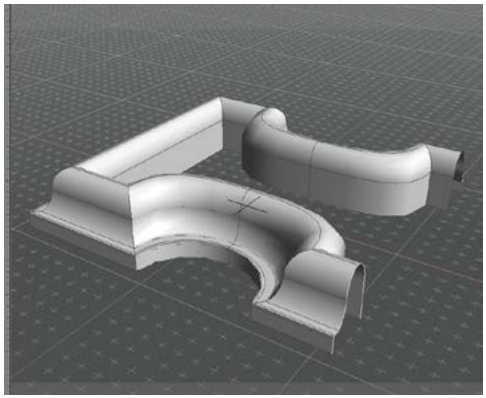
5 Click **Tool Parameters** > **Sweep** to extrude the line object.



6 The curved surface has now been created.



To check the object, change the display mode to Shading and Wireframe.



TIP

If you arrange the line object such that it is **swept** vertically at the start point of the **memorized** line object and then execute extrusion, the curved surface to be created will be difficult to twist.

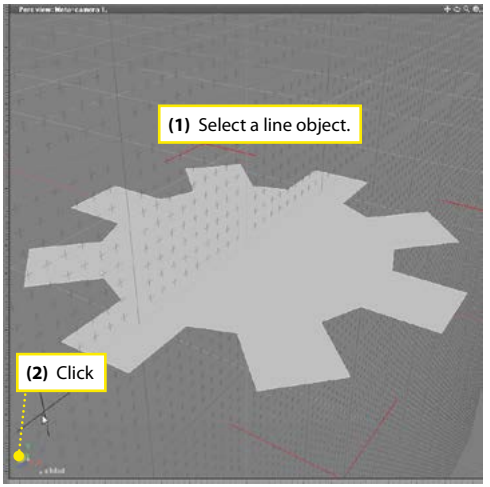
TIP

If the line object to be **swept** has a right-angled corner, the curved surface to be created may be twisted. You may be able to avoid this problem by slightly rounding the right-angled corner with **Round Edge**.

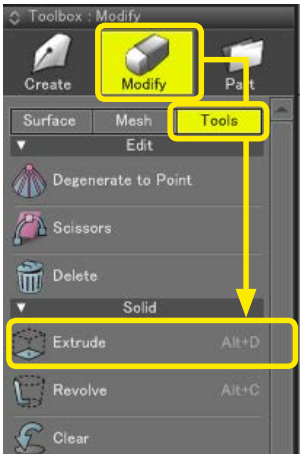
Extruded Solids

This function turns a closed or open line object into an extruded object.

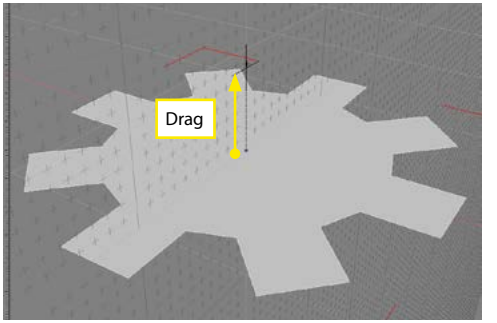
1 Select the line object to be turned into an extruded object **(1)** and then select the face in the height direction in the Work Plane Controller **(2)**.



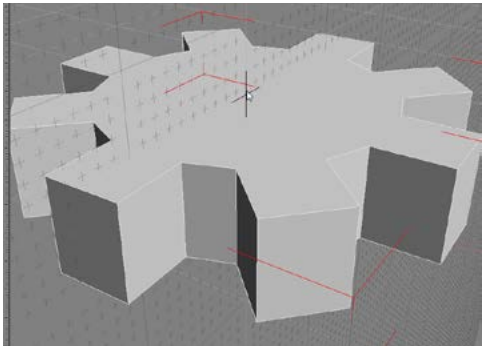
2 From **Tool Box**, select **Modify** > **Tools** > **Extrude**.



3 Drag in the height direction to create an extruded object.



4 An extruded object is created, in which the thickness is of the drag distance and direction.



TIP

When dragging in the height direction, if you switch to the orthogonal view (Right View here), you can easily perform a straight drag.

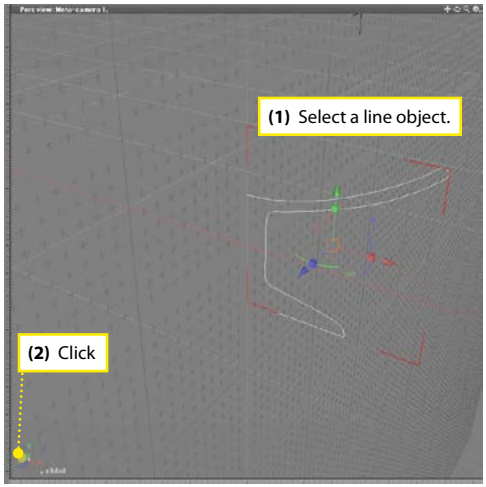
TIP

From **Toolbox**, select **Modify** > **Tools** > **Solid** group > **Clear**. This restores the revolved object to the original line object.

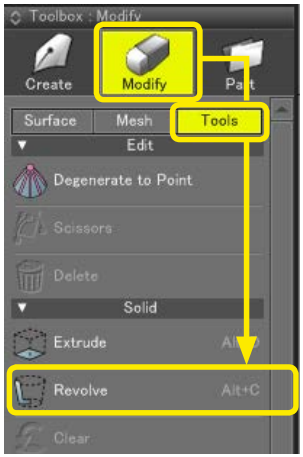
Revolved Solids

This function turns a closed or open line object into a revolved object.

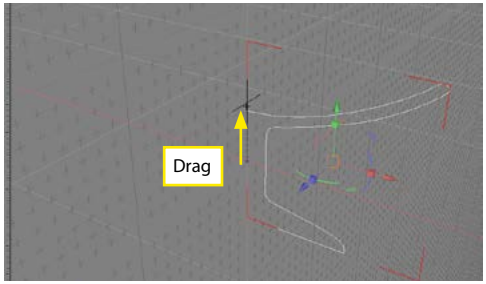
1 Select the line object to be turned into a revolved object **(1)** and then select the face in the axis direction in the Work Plane Controller **(2)**.



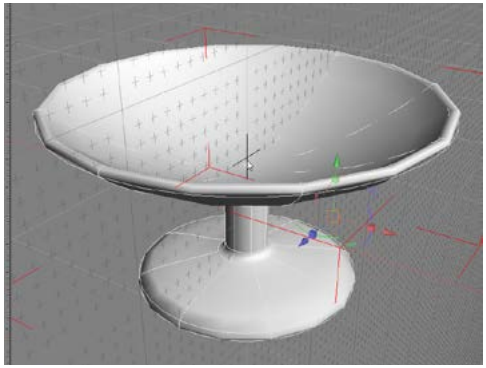
2 From **Toolbox**, select **Modify** > **Tools** > **Revolve**.



3 Drag in the direction of the position that will become the rotation axis, to create a revolved object.



4 The revolved object is created using the dragged axis as a reference.



TIP

Note that, if the rotation axis is deviated or slanted, the revolved object will be deformed.

TIP

From **Toolbox**, select **Modify** > **Tools** > **Solid** group > **Clear**. This restores a revolved object to the original line object.

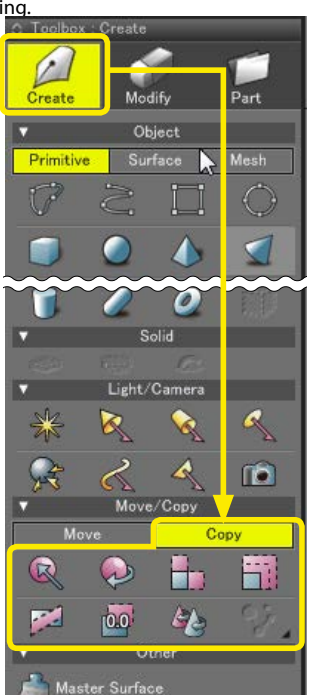
5–2. Editing Curved Surfaces

Adding Lines

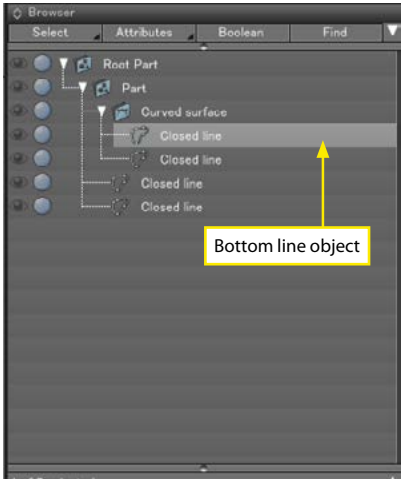
This function adds a line object consisting of a curved surface so that a finer object can be represented.

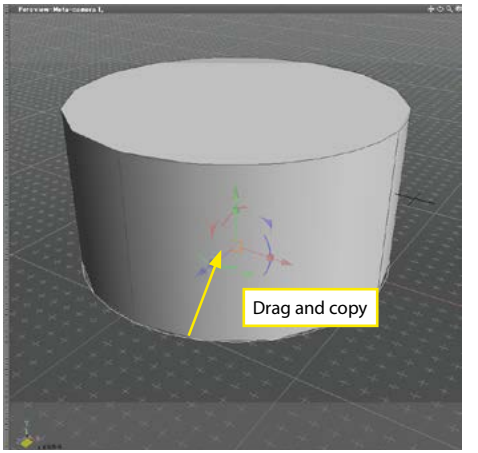
1 Switch to Object mode.

2 Using the **Copy** tool of **Toolbox** or the like, copy the line object from inside the curved surface. Alternatively, create a line object having the same number of control points inside the curved surface and then perform editing.

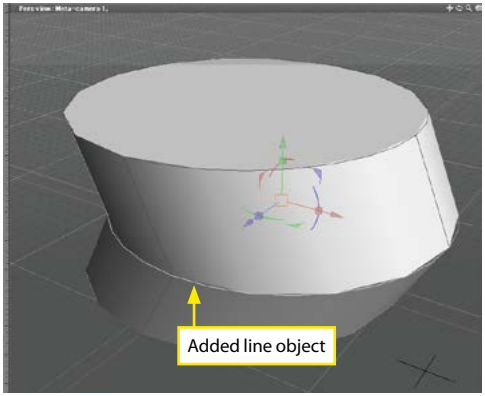


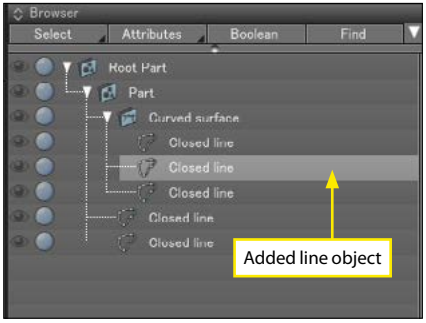
3 After selecting the bottom line object, select **Copy** > **Move** to perform movement and copying.





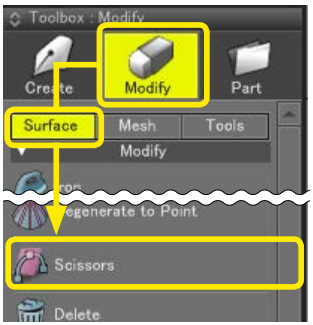
4 The line object is copied and the details are added.



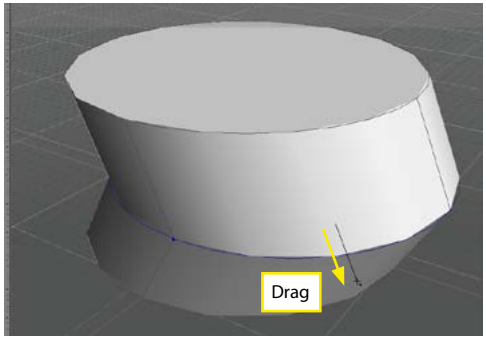


5 Switch to Modify Mode.

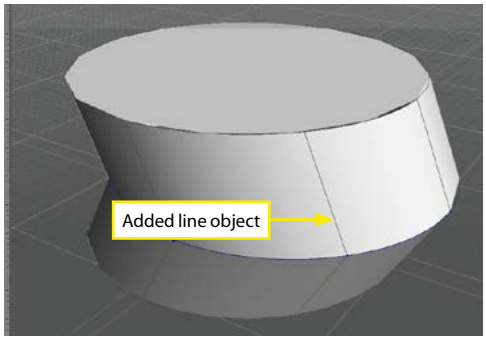
6 From **Toolbox**, select **Modify** > **Surface** > **Scissors**.



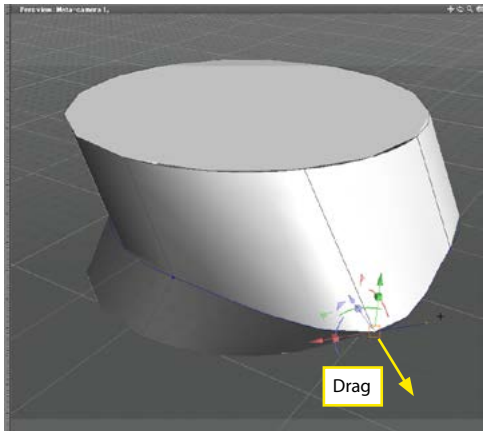
7 Drag such that the position at which to add the line object is included.



8 The line object is created in the cross direction.



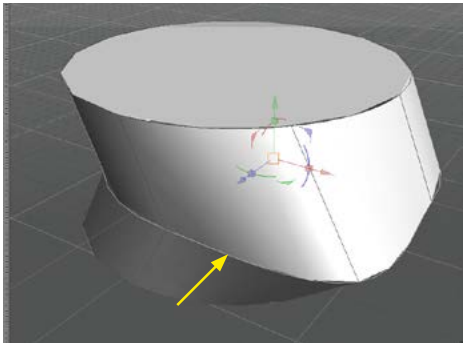
9 Manipulate the control point to edit the details of the object.



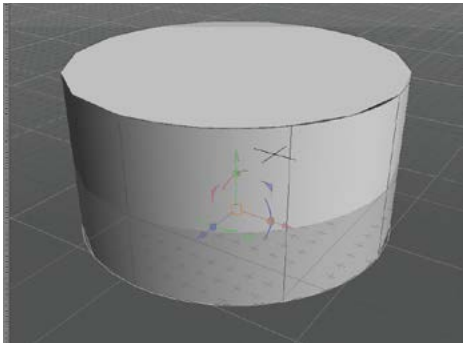
Deleting Lines

This function deletes line objects constituting the curved surface to simplify the object.

1 Select the line object to be deleted.



2 Delete the line object using the Backspace or Delete (Windows) key, or the delete (Mac OS) key, or the like.



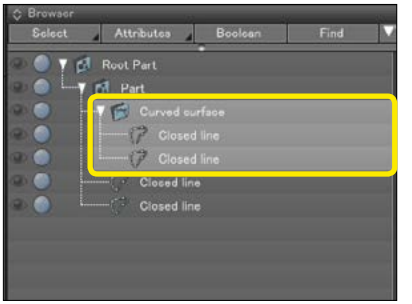
TIP

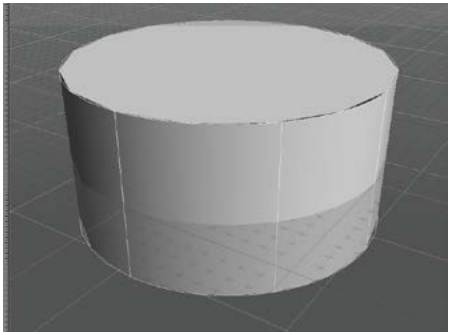
If you delete a control point, the number of control points becomes uneven, such that the object becomes deformed. Be sure to delete control points in units of the line object.

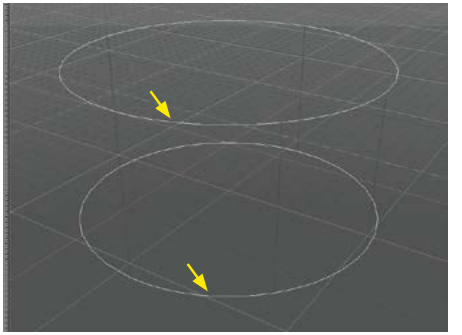
Switching to the Cross Direction

Of the line objects constituting a curved surface, this function switches the line objects to be edited to those in the cross direction.

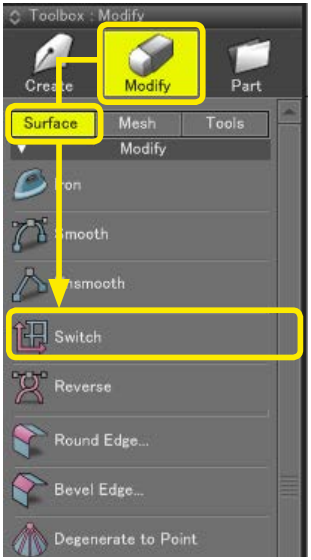
1 From **Browser**, select the curved surface to be switched.



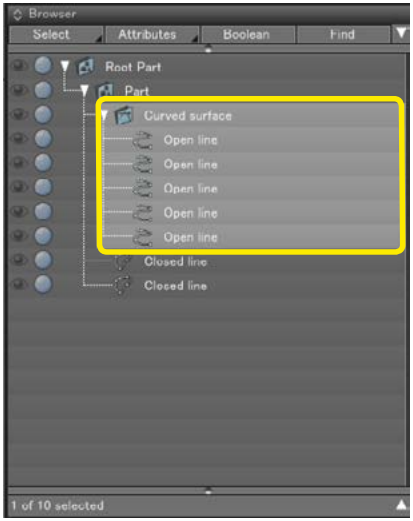


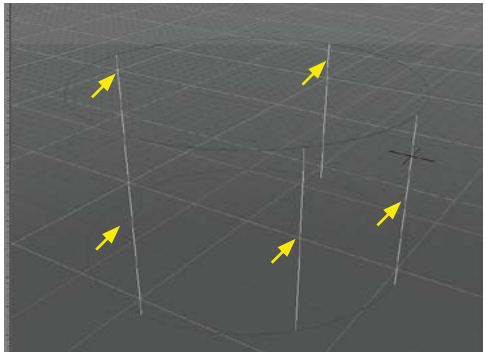


2 From **Toolbox**, select **Modify** > **Surface** > **Switch** to switch the curved surface.



3 The line object directions are switched to the cross direction.





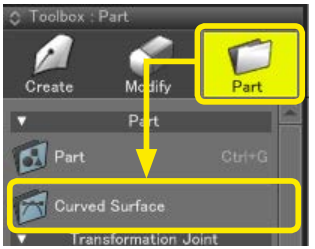
TIP

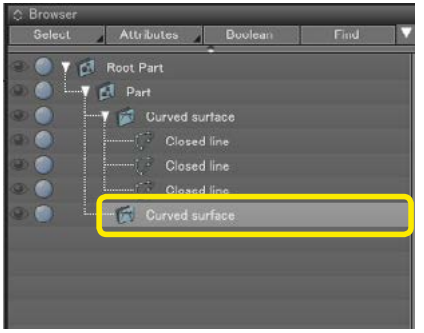
In addition to switching using the **Browser**, you can make this switch by selecting the line objects in the cross direction displayed.

Dividing a Curved Surface

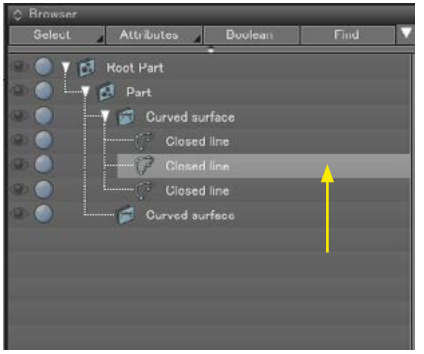
This function copies a single line object constituting the curved surface and turns it into another curved surface.

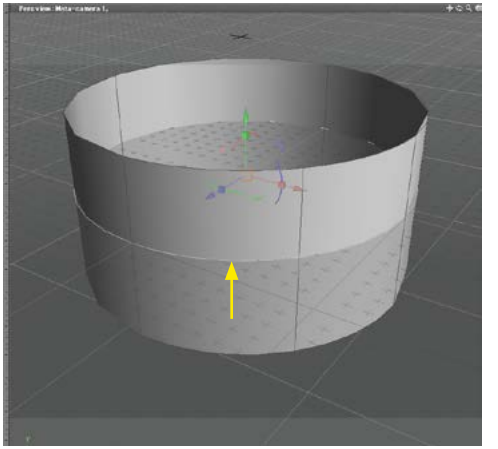
1 From **Toolbox**, select **Part** > **Curved Surface** to create a curved surface part.





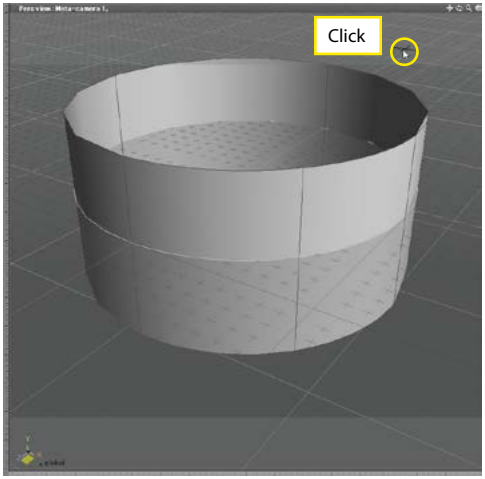
2 Select the line object from which the curved surface is to be divided.



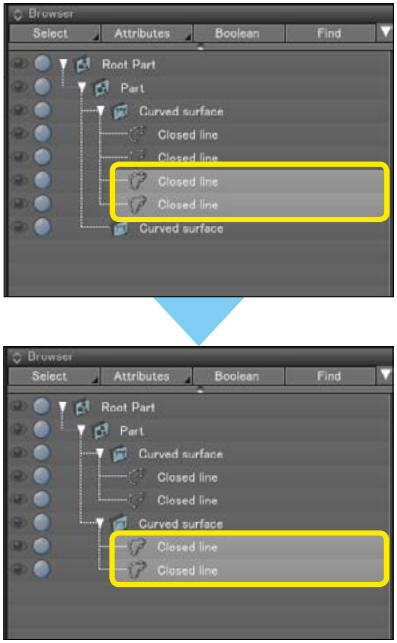


3 From **Toolbox**, select **Create** > **Copy** > **Translate**.

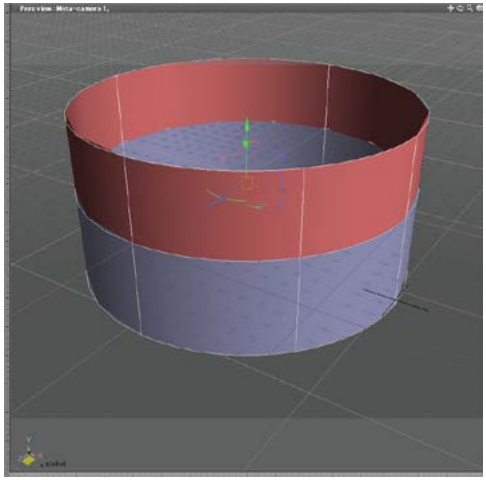
4 Click the position where no object exists in the viewport to copy the selected line object onto the same position.



5 Drag and move the copied line object and all the line objects below that line object, inside the newly created curved surface.



6 The curved surface has now been divided. The curved surfaces are shown in different colors for ease of understanding.



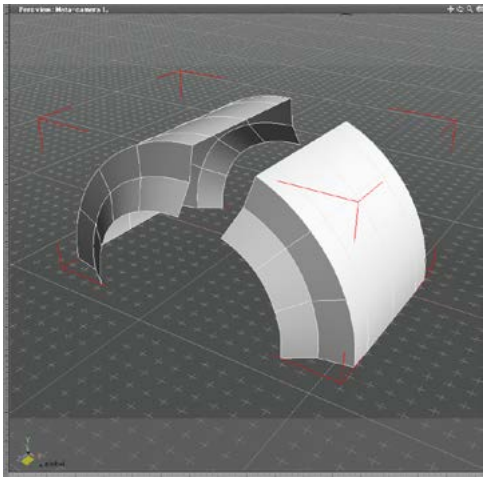
TIP

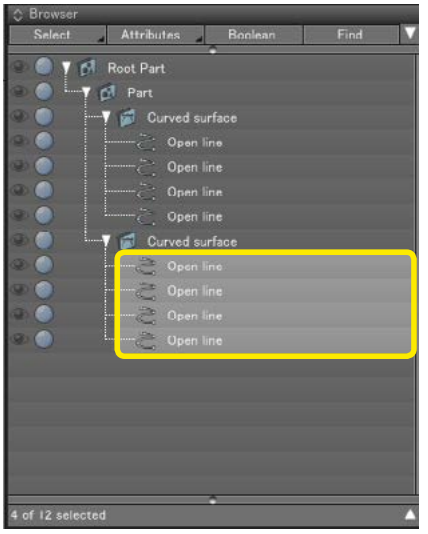
You can divide a curved surface by copying a curved surface onto the same position and by deleting unnecessary line objects from each curved surface.

Merging Curved Surfaces

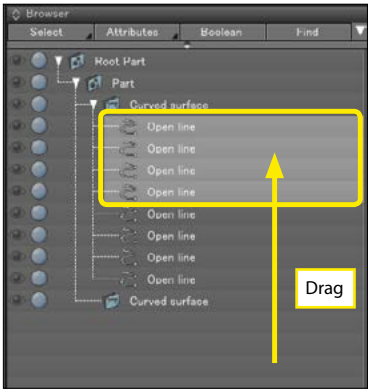
This function unifies multiple curved surfaces having the same number of control points as the line objects constituting each curved surface, into one curved surface.

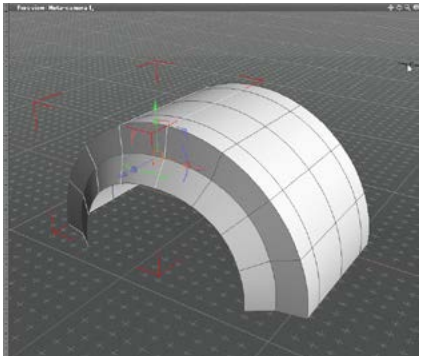
1 Select all the line objects on a one-sided curved surface.





2 Drag all the line objects inside the other curved surface to unify the curved surfaces into one.





TIP

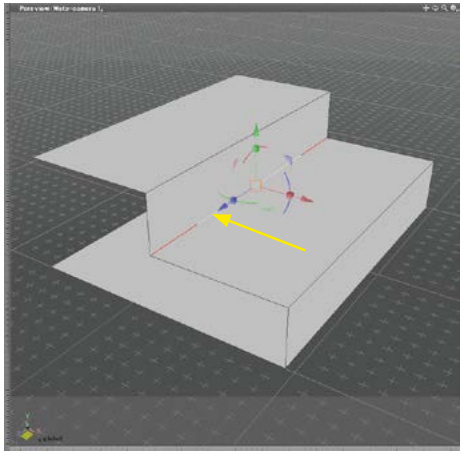
- Unless the curved surfaces each have the same number of control points as line objects, the object will be deformed.
- If the line object directions are not the same, the object will be twisted.
- Note the line object list (in the cross direction) so that the start and end points of the line objects are connected to each other.

Rounding or Trimming Corners

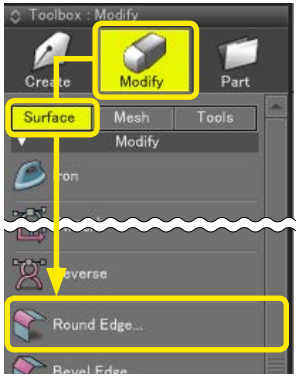
This function performs radius-based rounding and cutting down for a single line object constituting a curved surface in order to round or cut down corners.

Rounding Corners

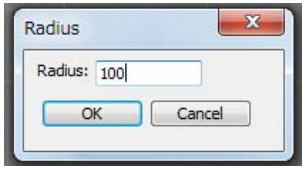
1 Select the line object for which the corner is to be rounded.



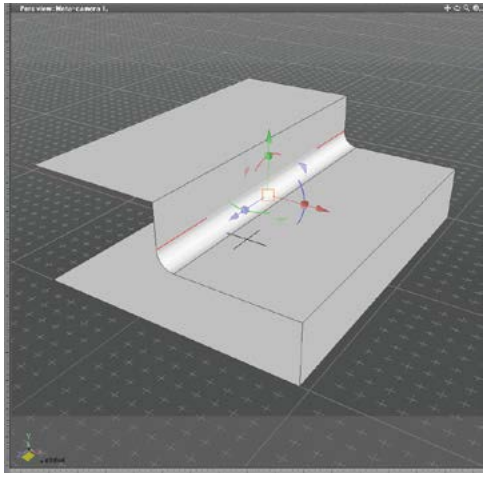
2 From **Toolbox**, select **Modify** > **Surface** > **Round Edge**.



3 Specify the radius used for rounding, as a numerical value.



4 The corners are rounded.

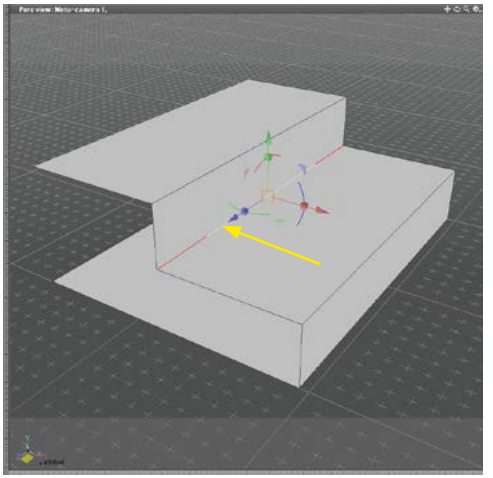


TIP

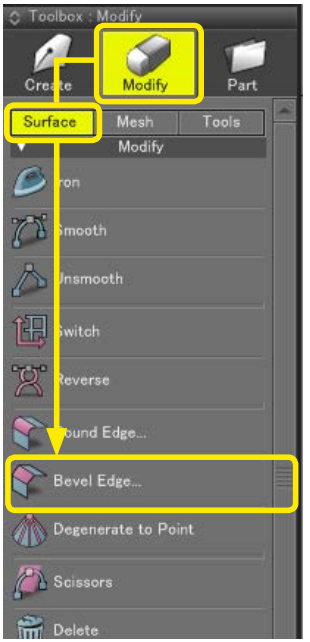
To apply **Round Edge** to a line object on the curved surface, it is necessary to satisfy the condition indicating that the line object is not the outer circumference of that curved surface.

Trimming Corners

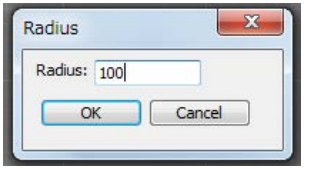
1 Select the line object for which the corner is to be cut down.



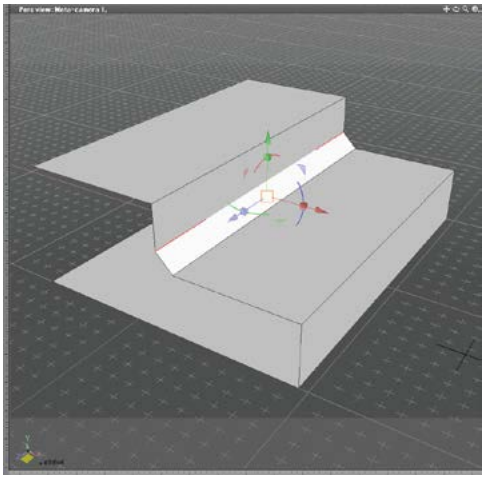
2 From **Toolbox**, select **Modify** > **Surface** > **Bevel Edge**.



3 Specify the radius used for cutting down, as a numerical value.



4 The corner is trimmed.



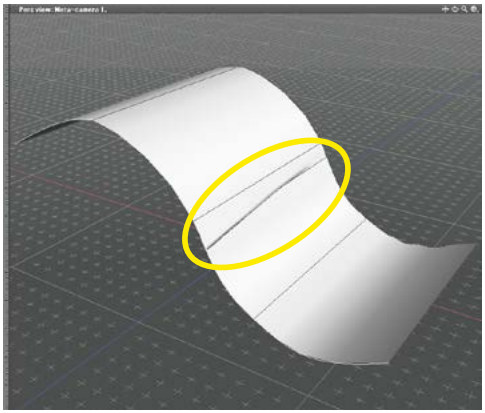
TIP

To apply **Bevel Edge** options to a line object in a curved surface, it is necessary to satisfy the condition indicating that the line object is not the outer circumference of that curved surface.

Eliminating Wrinkles

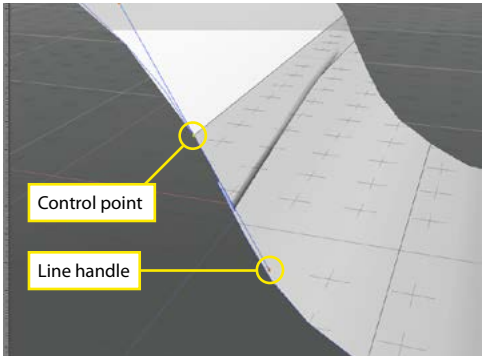
This function adjusts the handle length to eliminate or minimize wrinkles in the curved surface.

1 This curved surface has a fold in the front-center part. This fold is caused by the front control point having an extremely long line handle.

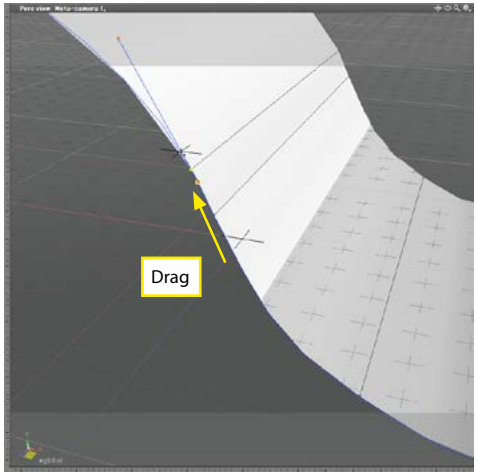


2 Switch to Modify Mode.

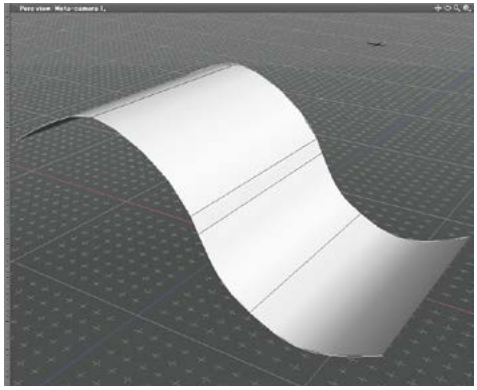
3 Select the line object of the S-shaped side and then select the control point of the fold part.



4 Drag the handle while holding down the Shift key and position the handle near the control point. You can make the line handle length equal to about 1/3 of the distance to the following control point.
You can change only the length without changing the line handle direction by dragging while holding down the Shift key.



5 The length of the line handle is corrected and the fold is reduced.



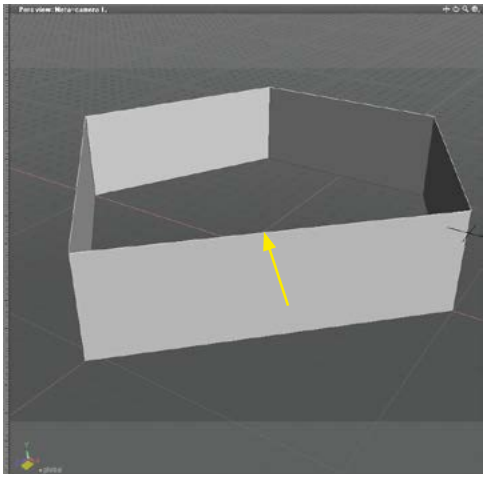
Closing an Edge Hole

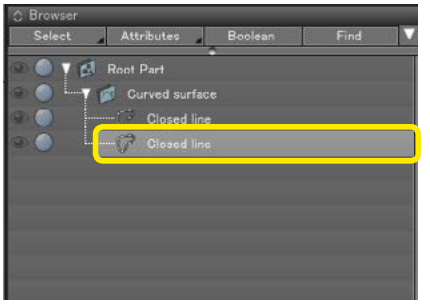
There are several methods of closing a hole on the edge of a curved surface. Before performing processing, select an appropriate method according to the object.

Closing a Hole by Copying a Line Object onto the Same Position

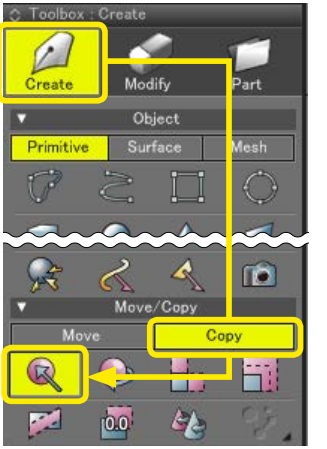
1 Switch to Object mode.

2 Select the line object at the position where the hole cover is to be created.

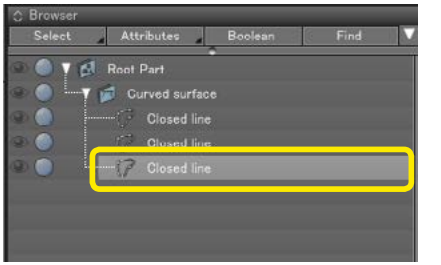




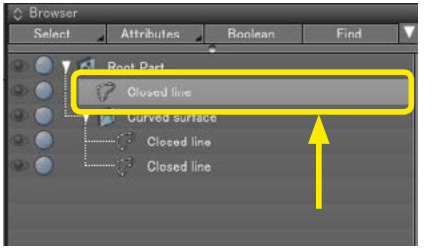
3 From **Toolbox**, select **Create** > **Copy** > **Translate**.



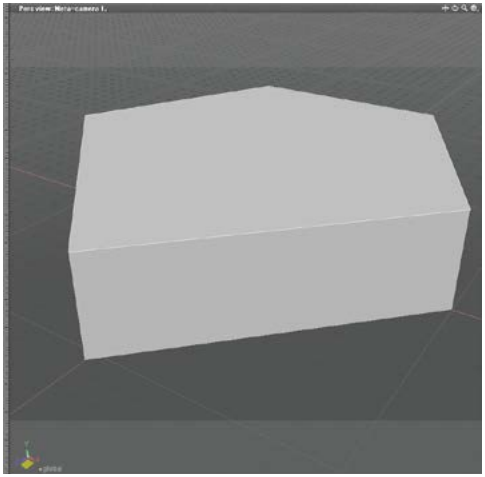
4 Click the viewport and then copy the line object onto the same position.



5 Place the copied line object outside the curved surface part.



6 The cover has now been created with the closed line object.



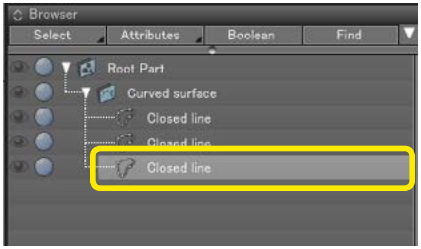
TIP

To cover a curved surface with the closed line object, the line object of the cover must be a level surface. Otherwise, rendering will not be performed correctly.

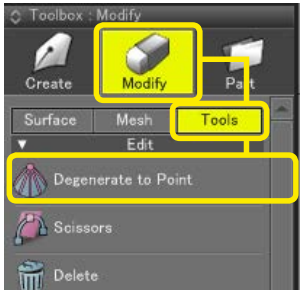
Closing a Hole by Making Control Points Converge to a Point

1 Switch to Object mode.

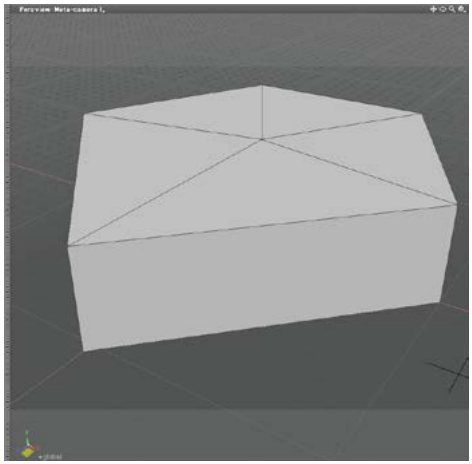
2 Copy the line object at the position at which the cover was first created, onto the same position.



3 From **Tool Box**, select **Modify** > **Tools** > **Degenerate to Point**.



4 The control points of the line object will converge at a point to make the cover.



TIP

A line object that converges at a point is the top or bottom one inside the curved surface part. If you have copied the top line object onto the same position, select the top line object and then aim for convergence to a point.

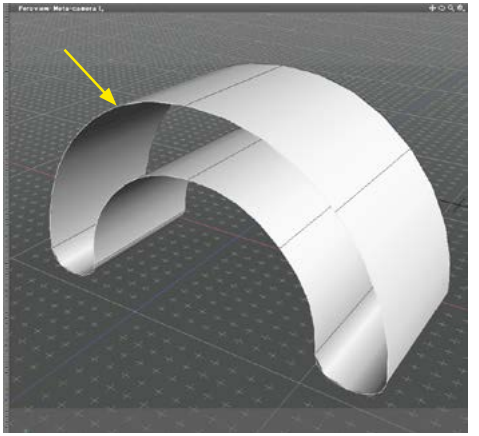
TIP

Creating a cover through convergence to a point allows you to perform corner rounding and cutting down in the vicinity of the cover.

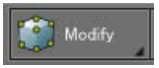
Making a Cover on a Complicated Face by Making Control Points Converge to a Point

1 Switch to Object mode.

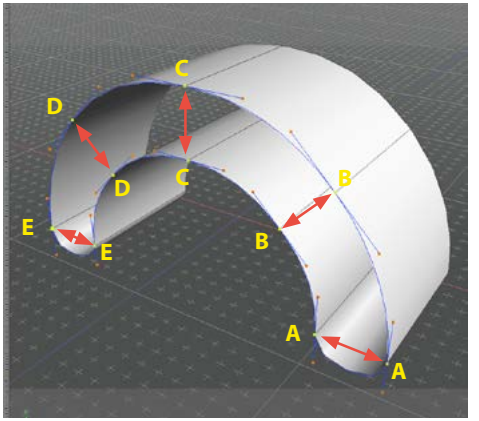
2 Copy the line object to be turned into the cover, onto the same position.



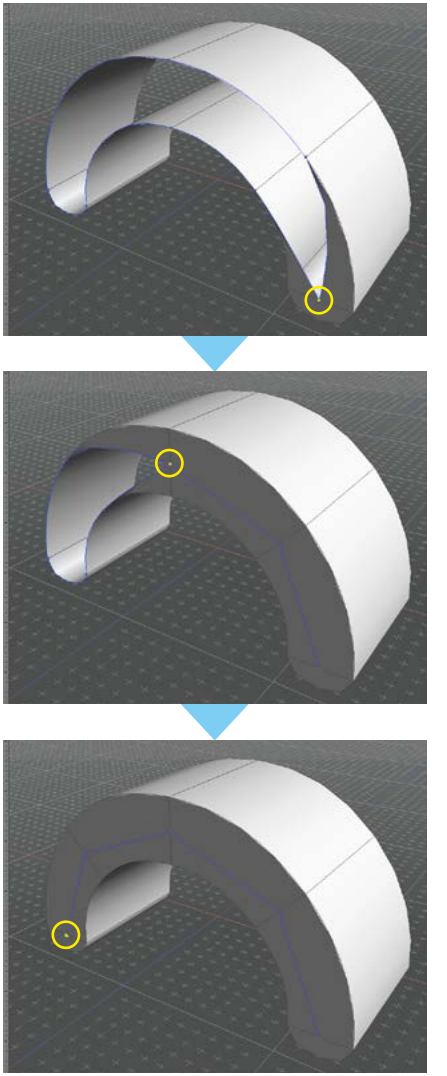
3 Switch to Modify Mode.



4 Select the control points of the copied line object for each associated alphabetic letter. Each letter group will converge at a point.



5 Make all groups A, B, C, D, and E converge at a point to create a cover. All groups will converge at a point.



TIP

If the cover is not created properly through convergence at a point, create the cover through convergence so that the convergence part is inside the object.

5–3. Editing Polygon Meshes

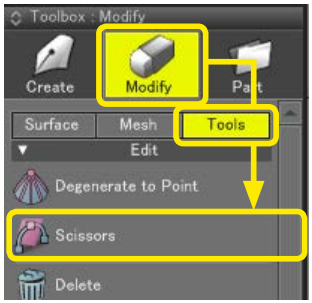
Adding Vertices, Edges, and Faces from Vertexes and Edges

This function adds vertices, edges, and faces from the vertices and edges constituting a polygon mesh.

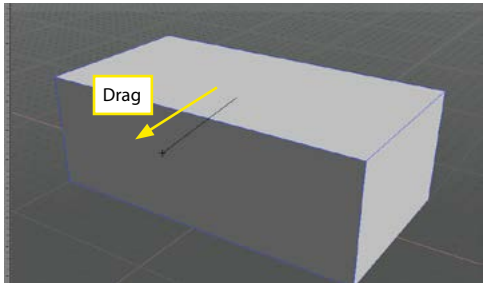
Adding a Vertex to Edges

1 Switch to Vertex Editing Mode.

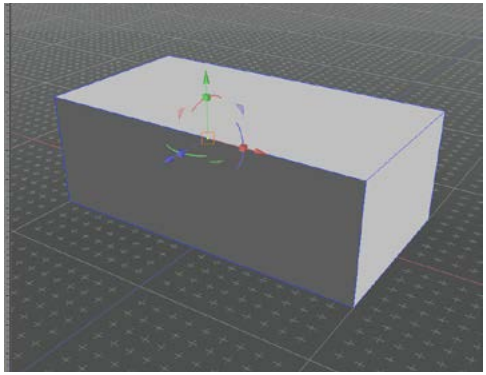
2 From **Toolbox**, select **Modify** > **Tools** > **Scissors**.



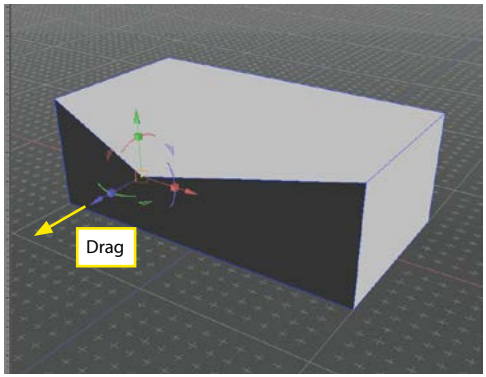
3 Drag so that the position at which the edge vertex is to be added is included.



4 The vertex is added at the position included by the drag.



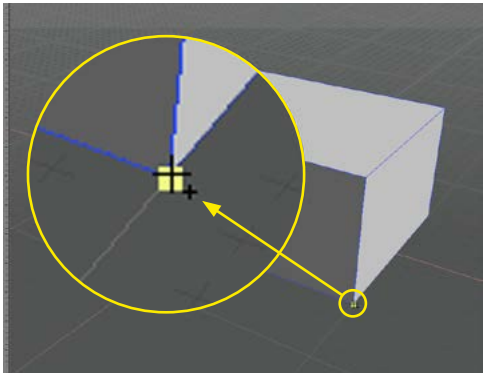
5 Edit the vertex and add the details.



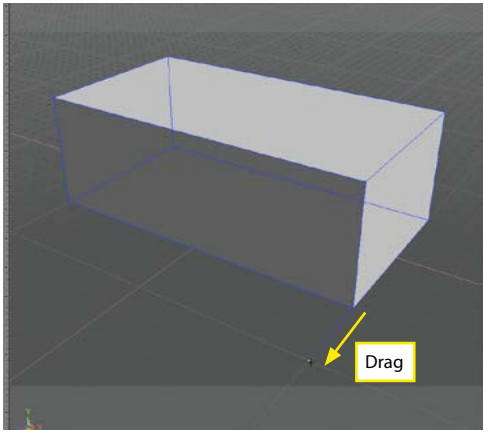
Adding a Vertex and Edge Using a Vertex

1 Switch to Vertex editing mode.

2 While holding down the z (Windows) or option (Mac OS) key, position the cursor to the vertex. When the + mark appears beside the cursor, perform dragging.



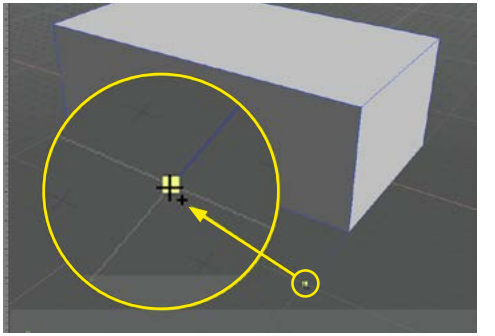
3 An edge of a length equal to the drag length is added in the drag direction, and a vertex is added to the end.



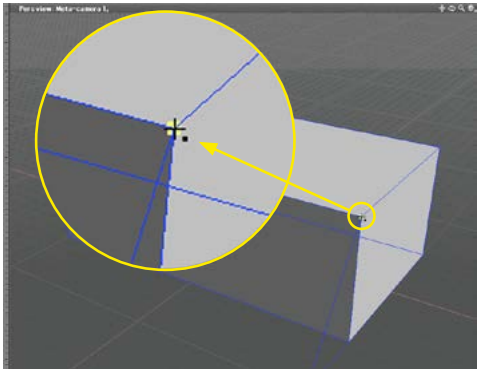
Adding an Edge and Face Between Vertexes

1 Switch to Vertex editing mode.

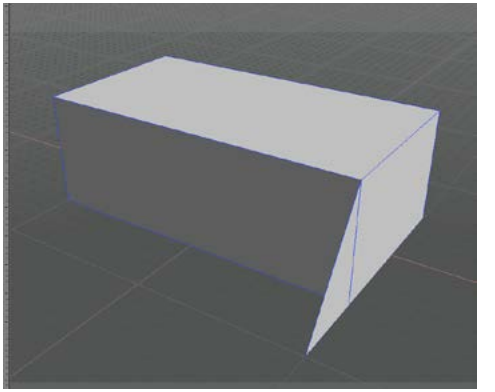
2 While holding down the z (Windows) or option (Mac OS) key, position the cursor to the vertex. When the + mark appears beside the cursor, perform dragging.



3 Perform dragging up to the vertex connecting edges. When the ■ mark appears beside the cursor, stop dragging.



4 The vertex is connected through the edges. If the edge connection forms a square or triangle, a face will be created.



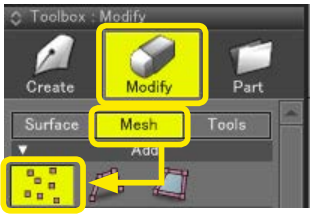
Adding Vertices, Edges, and Faces

This function adds vertices edges, and faces constituting a polygon mesh to enable the finer representation of an object.

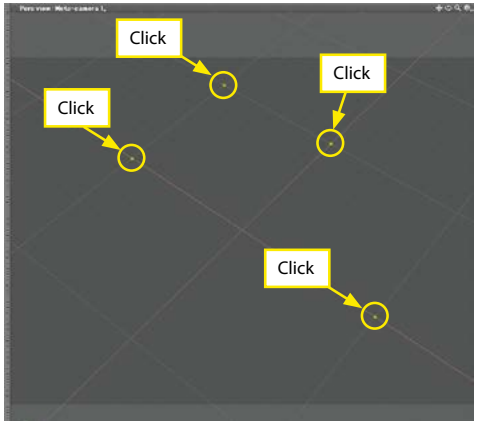
Adding Vertexes

1 Switch to Modify Mode.

2 From **Toolbox**, select **Modify** > **Mesh** > **Append Vertices**.



3 Click the viewport to add vertices. Confirm the created vertices in Vertex editing mode. Press the Enter (Windows) or return (Mac OS) key to complete the creation process.

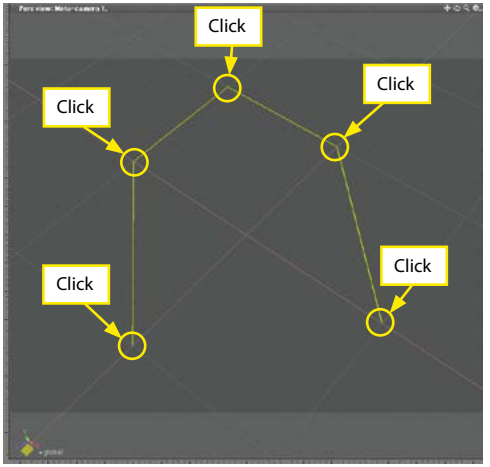


Adding Edges

1 Switch to Modify Mode.

2 From **Toolbox**, select **Modify** > **Mesh** > **Append Edges**.

3 Click the viewport or control points to create edges connecting the clicked positions. Press the Enter (Windows) or return (Mac OS) key to complete the creation process.

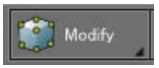


TIP

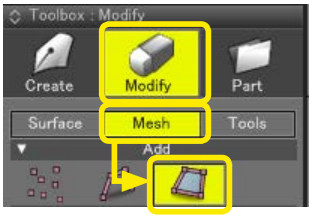
By clicking while holding down the Ctrl (Windows) or ⌘ (Mac OS) key, you can specify the start point of an edge at a noncontinuous position.

Adding Faces

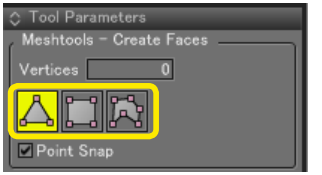
1 Switch to Modify Mode.



2 From **Toolbox**, select **Modify** > **Mesh** > **Append Faces**.

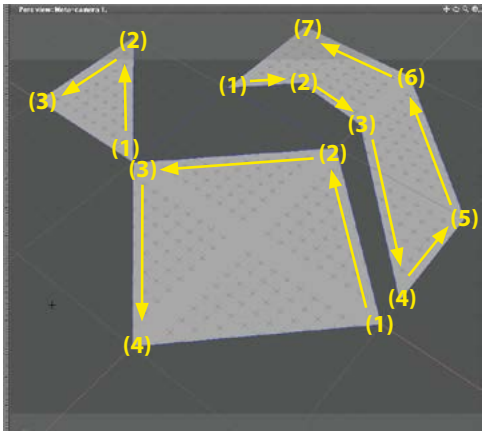


3 From **Tool Parameters**, specify the number of control points of the face to be added.



3-sided, **4-sided**, and **Unlimited** from the left

4 Click the viewport as many times as the specified number of control points. If you have specified **Unlimited**, click the viewport by the required number of times, and then press the Enter (Windows) or return (Mac OS) key.



TIP

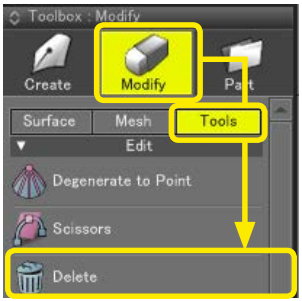
The two sides of the face change in the direction in which the control points are specified. For a polygon mesh, once you specify control points counterclockwise, the visible face becomes the right side. If you specify the control points clockwise, the visible face becomes the reverse side.

Deleting Elements

Points (vertices), edges, and faces of a polygon mesh can be removed.

1 Switch to Modify Mode.

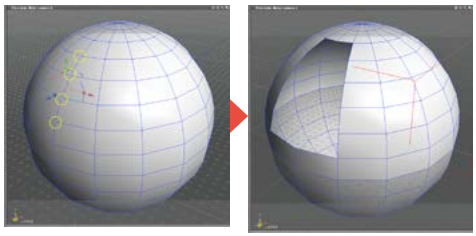
2 Select the elements to be deleted. From **Toolbox** select **Modify** > **Tools** > **Delete** to delete them.



Deleting Vertices

This function selects and deletes vertices to be deleted in Vertex editing mode.

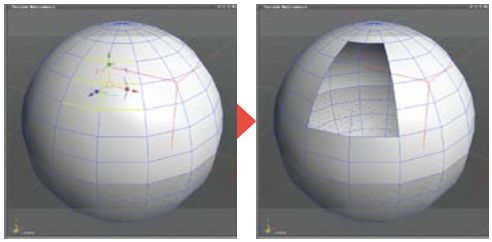
The vertices, edges including the vertices, and face are deleted.



Deleting Edges

This function selects and deletes edges to be deleted in Edge editing mode.

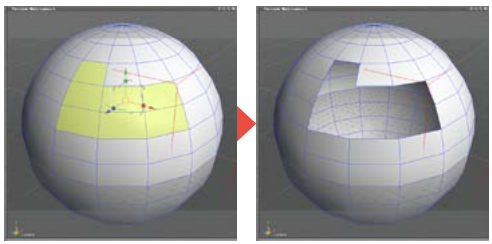
The edges, vertices including the edges, and faces are deleted.



Deleting a Face

This function selects and deletes a face to be deleted in Face editing mode.

The face, vertices constituting the face, and edges are deleted.



TIP

You can also delete elements using the Backspace or Delete keys (Windows) or delete key (Mac OS).

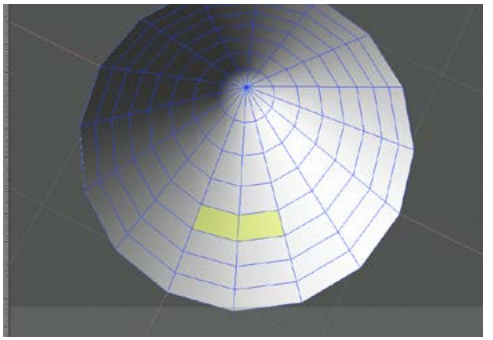
Selecting Elements

This function selects the faces and edges of a polygon mesh according to predefined types found in the Tool Box.
Use the tools accessed from **Toolbox** by selecting **Modify** > **Mesh** > **Select** group.

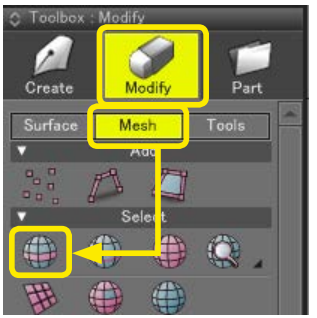
Selecting a Belt

This function selects continuous faces in a belt-shaped form. Moreover, if continuous edges are smooth on a sphere or the like, selecting one edge and then executing **Belt** allows you to select continuous edges.

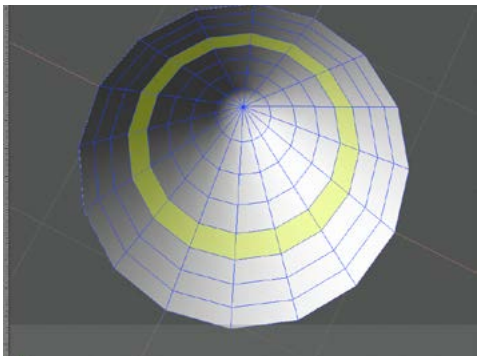
1 Connect and select two faces.



2 From **Toolbox**, select **Modify** > **Mesh** > **Belt**.



3 Continuous, belt-shaped faces are selected.



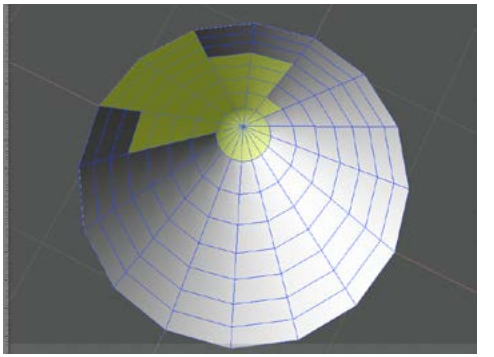
TIP

If continuous edges are not smooth on a box or the like, selecting two continuous edges and then executing **Belt** allows you to select continuous edges.

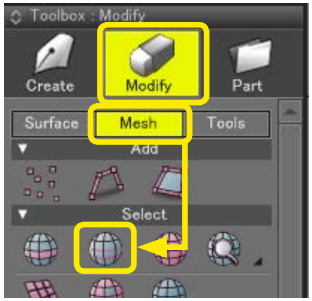
Selecting a Loop

This function selects edges that become the outer circumference of a selected face.

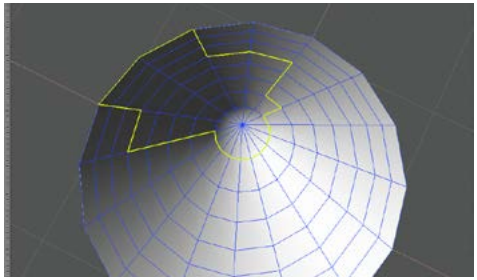
1 Select the faces.



2 From **Toolbox**, select **Modify** > **Mesh** > **Loop**.



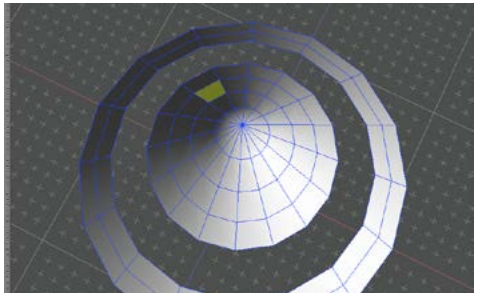
3 This selects the edges that will become the outer circumference of the selected face.



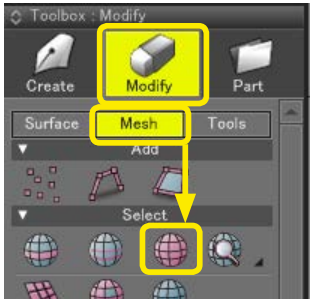
Selecting Continuous Faces

This function selects all the faces connected to the selected face.

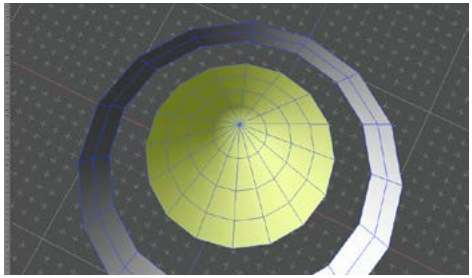
1 Select the faces.



2 From **Toolbox**, select **Modify** > **Mesh** > **Continuous Surface**.



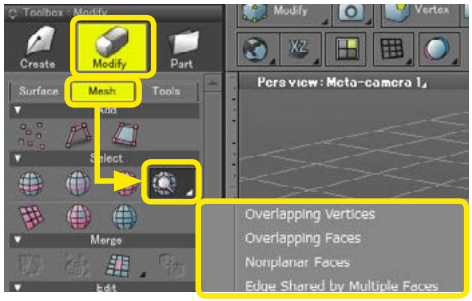
3 The selected face and all the faces connected to it are selected.



Selecting Vertices and Edges with Options

This function selects overlapping vertices, an edge shared by multiple faces, or the like.

1 To select the items from **Toolbox**, select **Modify** > **Mesh** > **Detect** and then select the items from the pop-up menu.

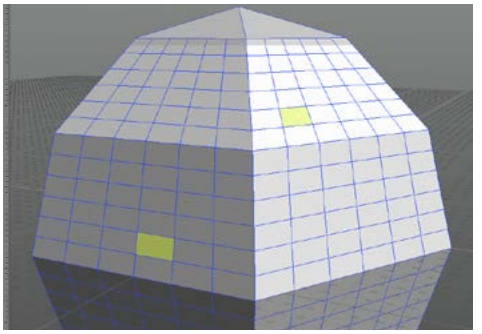


2 The relevant vertices, edges, and faces are selected.

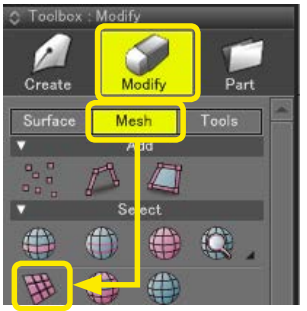
Selecting the Same Plane

This function selects continuous faces that are in the same normal line direction as that of the selected face.

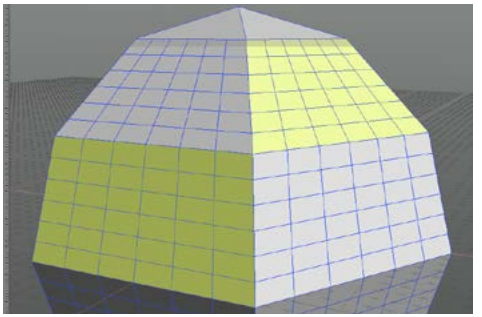
1 Select the faces.



2 From **Toolbox**, select **Modify** > **Mesh** > **Select Plane**.



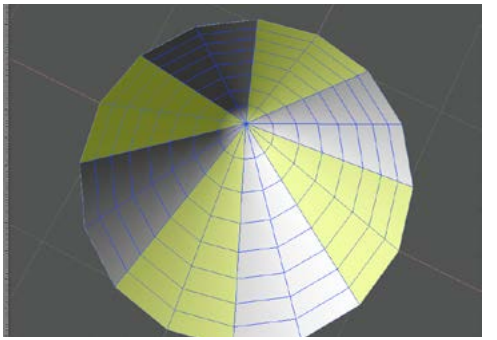
3 Those faces which are continuous in the same direction are selected.



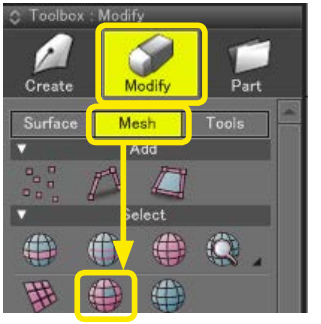
Reversing Selected Elements

This function reverses the selection of vertices, edges, and faces.

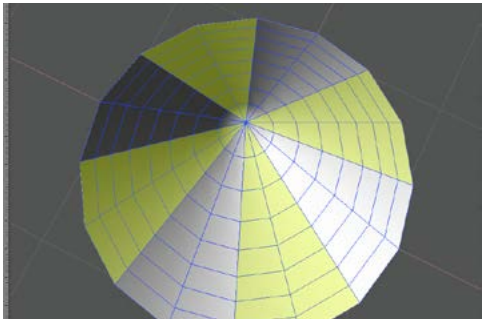
1 Select the vertices, edges, and faces.



2 From **Tool Box**, select **Modify** > **Mesh** > **Invert**.



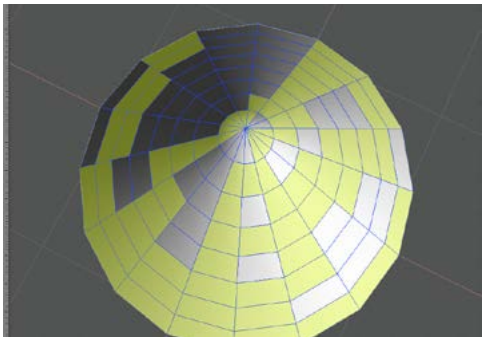
3 The selected statuses are reversed.



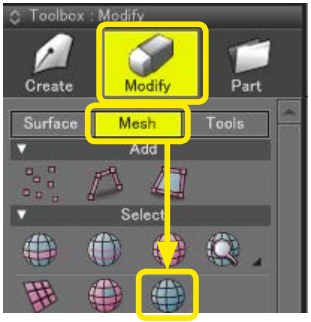
Deselecting the Selection

This function deselects the selection and restores the non-selected state.

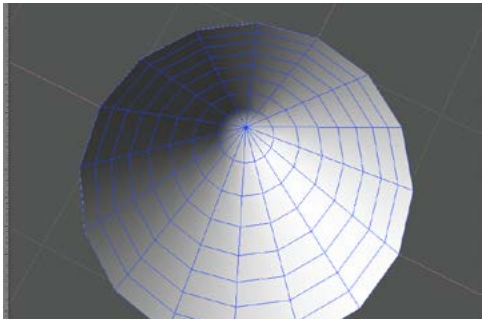
1 Select the vertices, edges, and faces.



2 From **Toolbox**, select **Modify** > **Mesh** > **Deselect**.



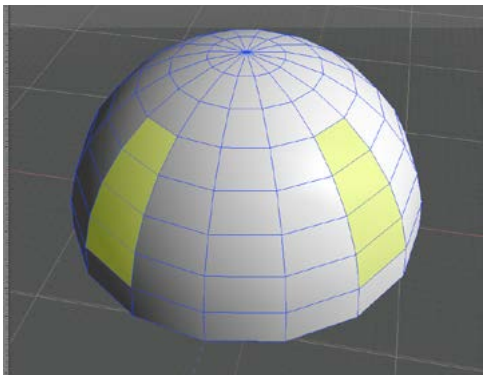
3 The selection is deselected.



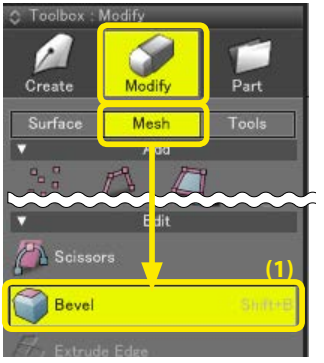
Extruding Faces

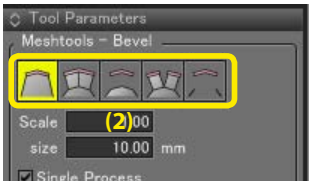
This function extrudes five types of face when you select **Toolbox** then **Modify** > **Mesh** > **Edit** > **Bevel**.

1 Select the faces to be extruded.



2 From **Toolbox**, select **Modify** > **Mesh** > **Bevel** **(1)** and then select the extrusion mode from **Tool Parameters** **(2)**.

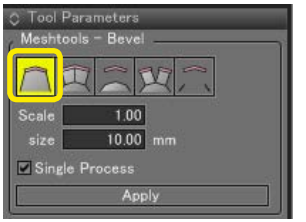




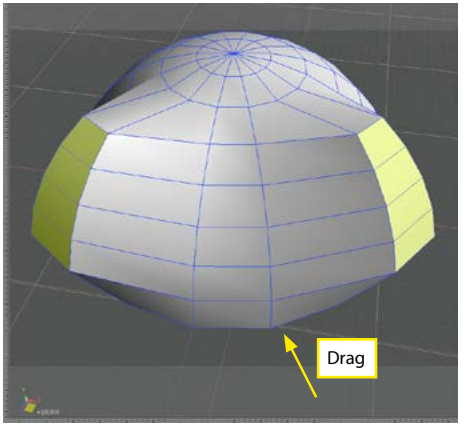
Bevel: Offset

This function moves a face in the offset direction.

3 Select **Tool Parameters** > **Offset**.



4 Drag the viewport to extrude faces. The faces are extruded if the viewport is dragged up; while they are retreated if it is dragged down. At the same time, the excluded faces are reduced if dragged left; while they are enlarged if it is dragged right.



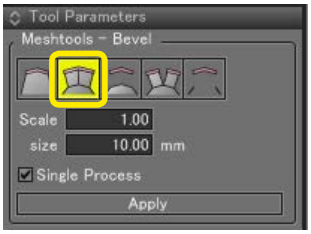
TIP

The drag operation for extrusion (dependent on up, down, left, or right movement) is common to other mesh tools.

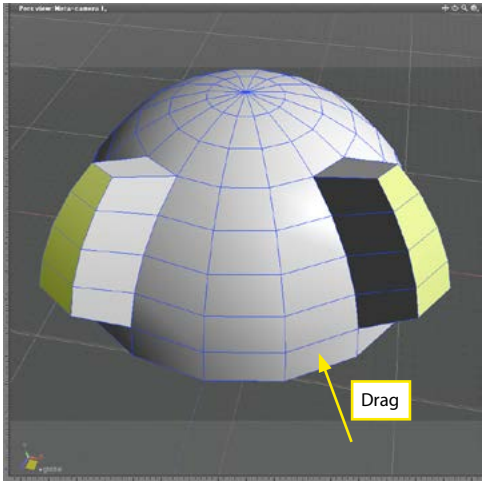
Bevel: Extrude

This function extrudes faces in the offset direction.

3 From **Tool Parameters**, select **Extrude**.



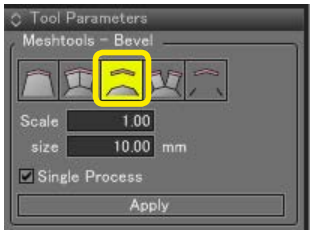
4 Drag in the Figure Window to extrude faces.



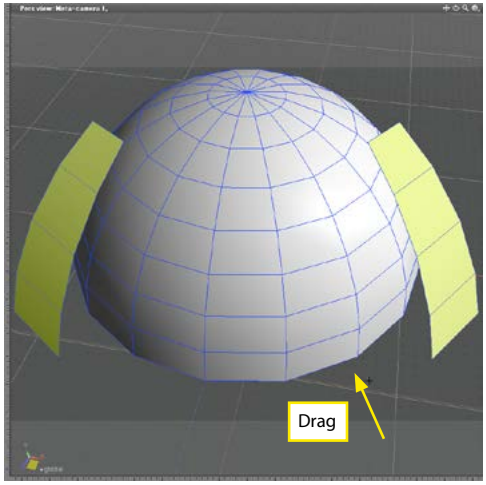
Bevel: Duplicate

This function duplicates faces in the offset direction.

3 From **Tool Parameters**, select **Duplicate**.



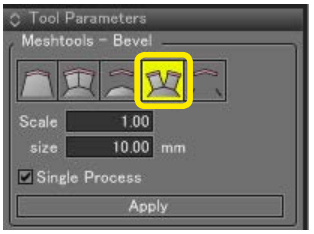
4 Drag in the Figure Window to extrude faces.



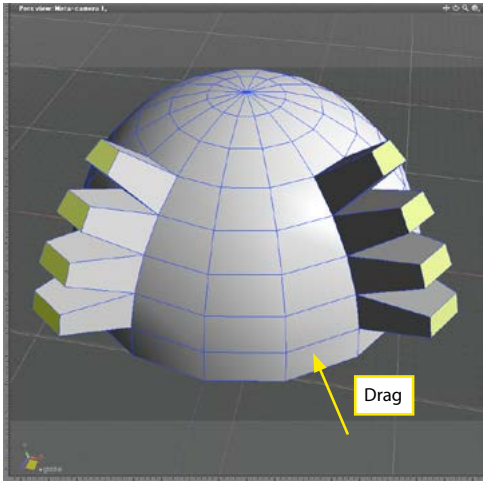
Bevel: Bevel

This function extrudes faces individually in the offset direction.

3 From **Tool Parameters**, select **Bevel**.



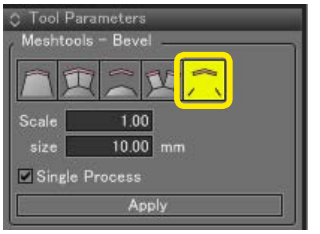
4 Drag in the Figure Window to extrude faces.



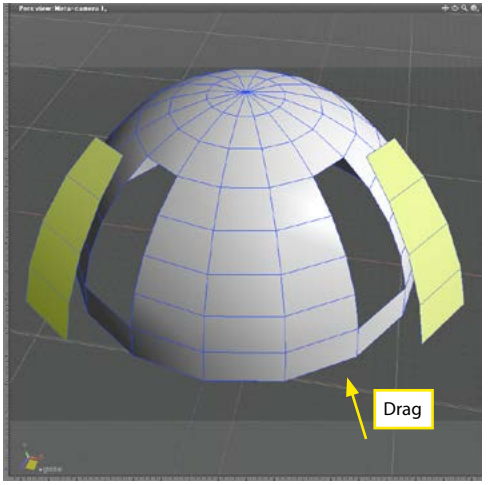
Bevel: Detach

This function detaches faces in the offset direction.

3 From **Tool Parameters**, select **Detach**.

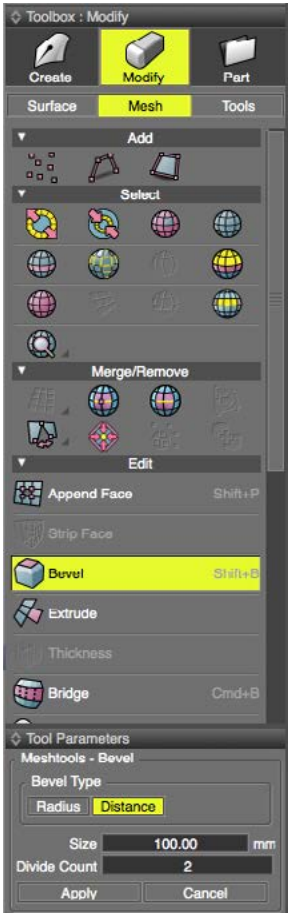


4 Drag in the Figure Window to extrude faces.

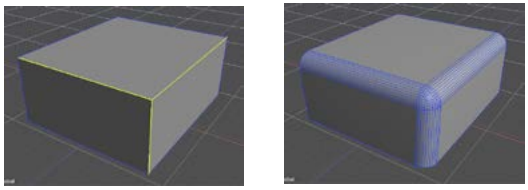


Vertex and Edge Bevel

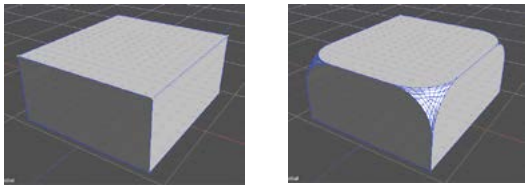
To bevel vertices or edges of a polygon mesh, first select the vertices or edges you wish to bevel and then choose Modify > Mesh > Bevel from the Toolbox.



In Tool Parameters, the degree of beveling can be specified in the Size text box, and the number of subdivisions can be specified by Divide Count. Dragging in the Figure Window will also change the bevel amount..



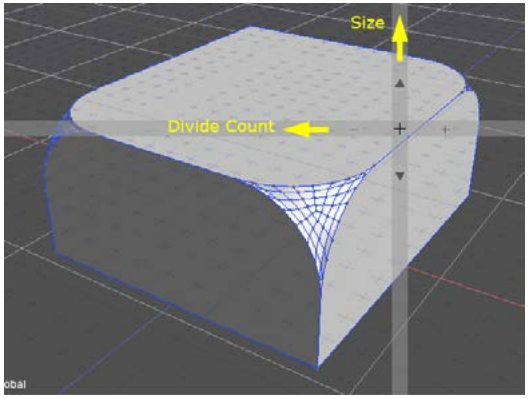
Edge Bevel



Vertex Bevel

Adjusting the Bevel in the Figure Window

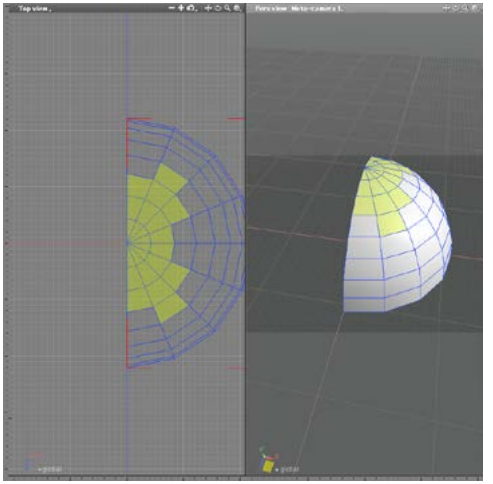
After selecting Bevel from the Toolbox, the degree of beveling and the number of subdivisions can also be set by dragging in the FIgure Window. Drag up and down to change the Bevel Size, and/or left and right to change the Divide Count.



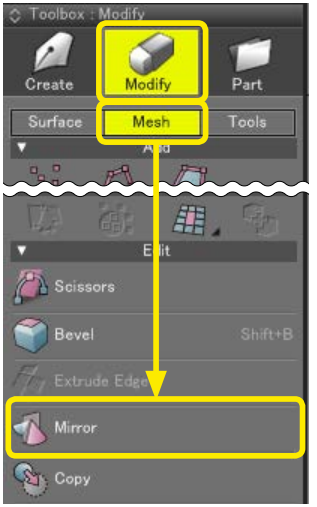
Copying a Face to Create a Mirrored Form

This function copies the selected face as a mirror-image, using the clicked point as the axis.

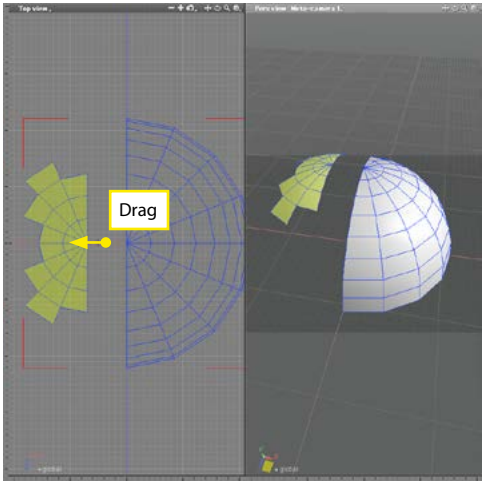
1 Select the face to be reversed.



2 From **Toolbox**, select **Modify** > **Mesh** > **Mirror**.



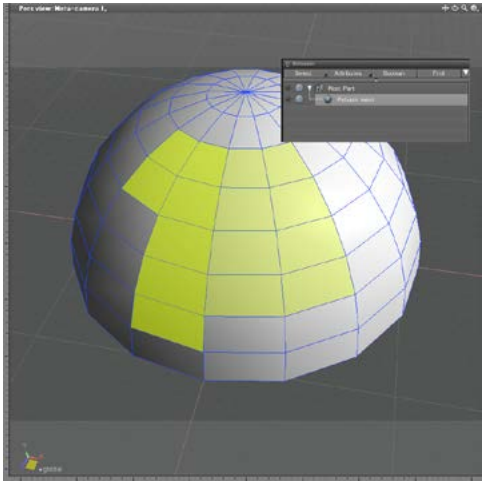
3 Click the center of the mirror copy and drag in the reverse direction.



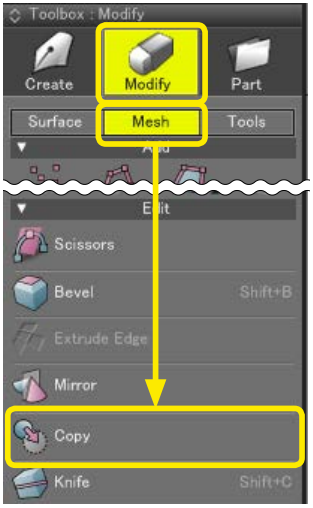
Copying a Face as Another Object

This function copies the face as another object in the same position.

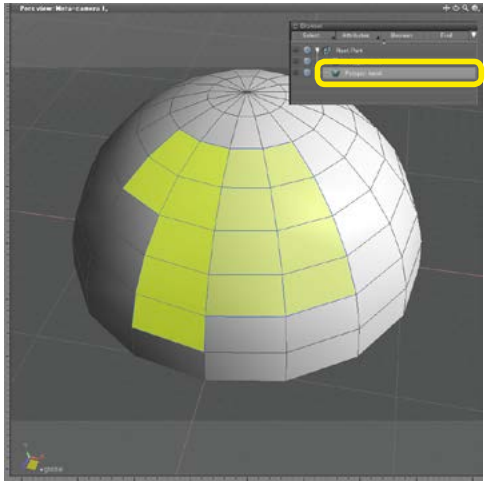
1 Select the face to be copied.



2 From **Toolbox**, select **Modify** > **Mesh** > **Copy**.



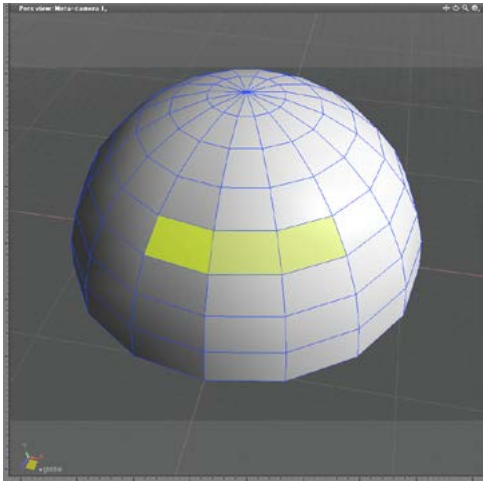
3 The selected face is copied as another face in the same position.



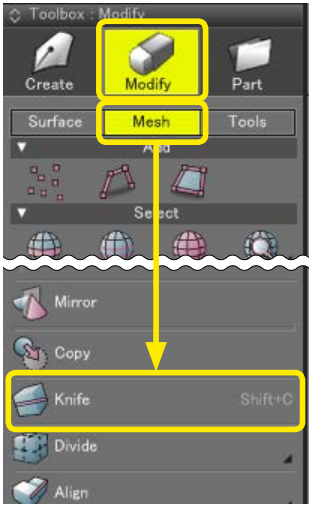
Cutting and Dividing the Face with a Drag Line

This function cuts and divides the face with a drag line.

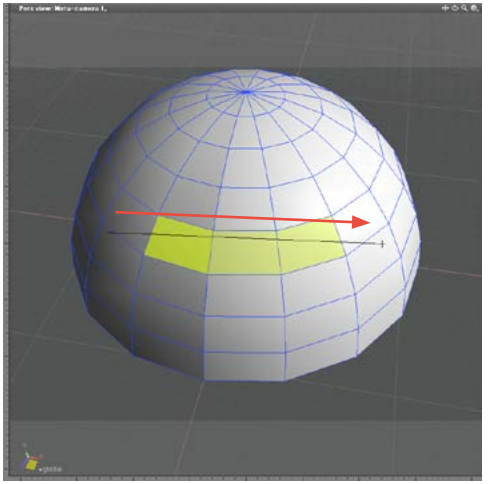
1 Select the face to be cut



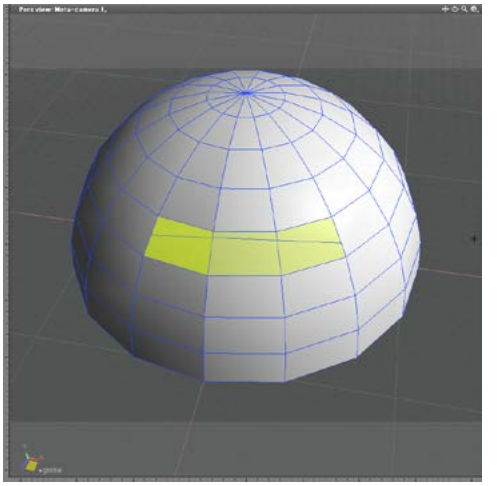
2 From **Toolbox**, select **Modify** > **Mesh** > **Knife**.



3 Drag the place to be cut.



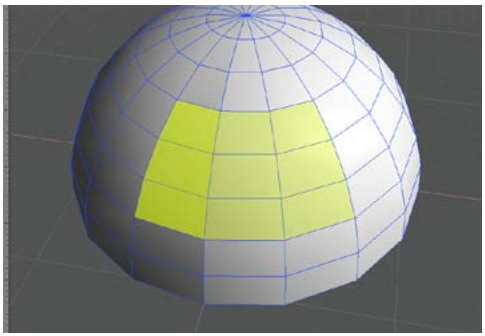
4 The selected face is cut and divided in the dragged place.



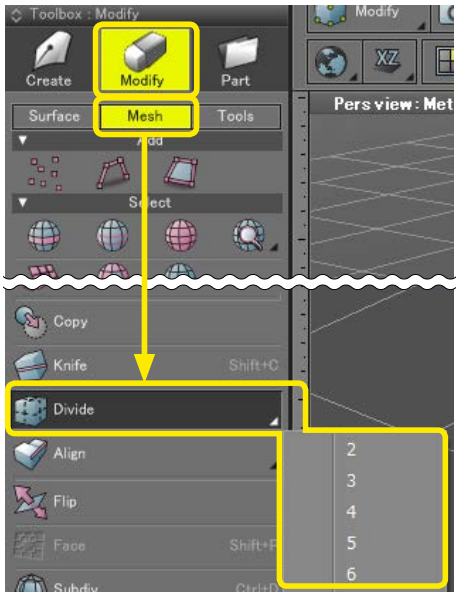
Dividing Faces

This function divides a face into two to eight sections. Alternatively, it divides the face into triangle forms.

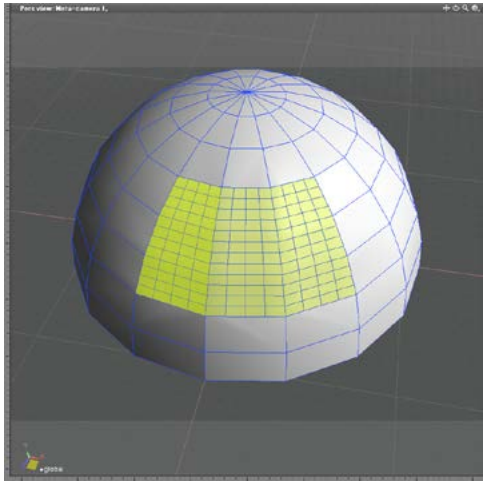
1 Select the face to be divided.



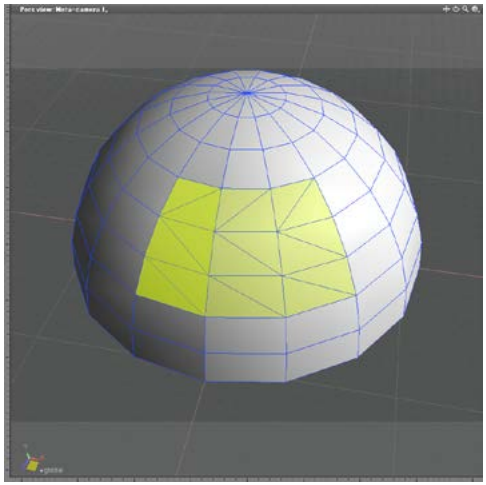
2 From **Toolbox**, select **Modify** > **Mesh** > **Divide** and then select the number of divisions or triangle division from the pop-up menu.



◆ **4-Division**



◆ **Triangle Division**



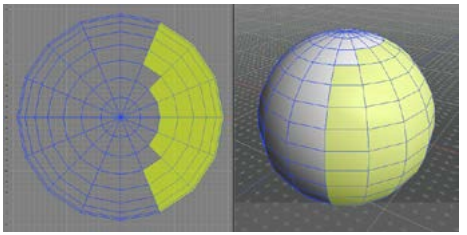
Aligning Vertices and Normal Lines

This function aligns the vertices. Moreover, it unifies the normal lines of a face.

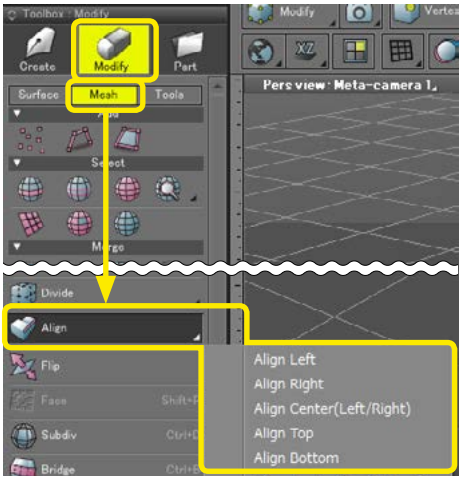
Aligning Vertices

This function aligns the vertices with the outermost specified position.

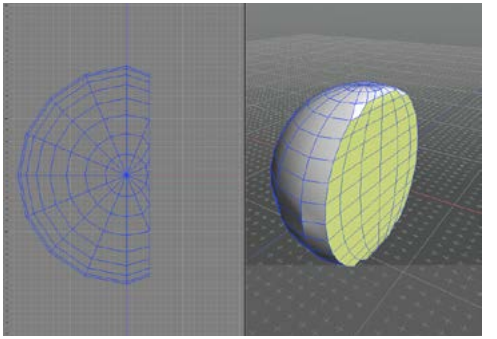
1 Select the vertices, edges, and faces to be aligned.



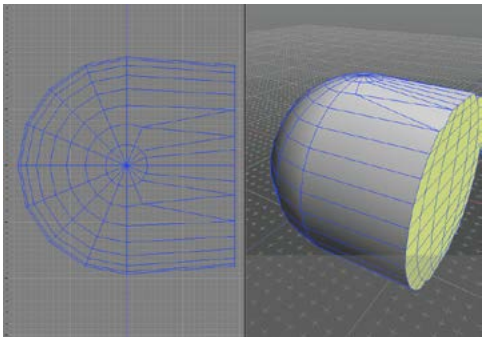
2 From **Toolbox**, select **Modify** > **Mesh** > **Align** and then select the alignment position from the pop-up menu.



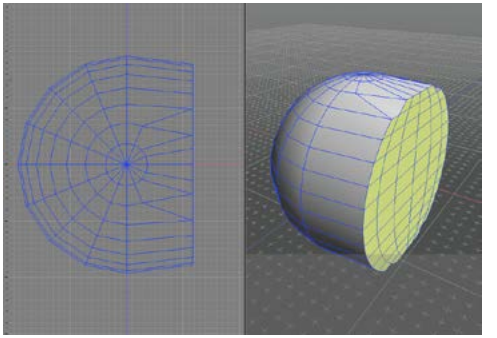
◆ **Align Left**



◆ **Align Right**

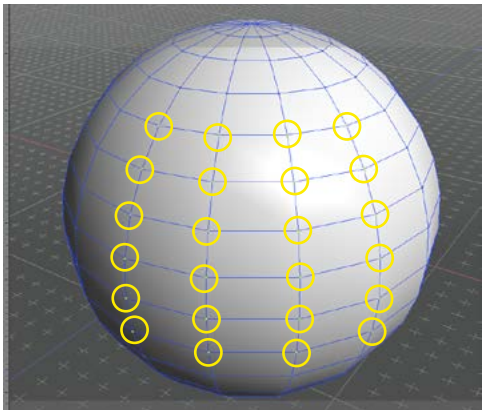


◆ **Align Center(Left/Right)**

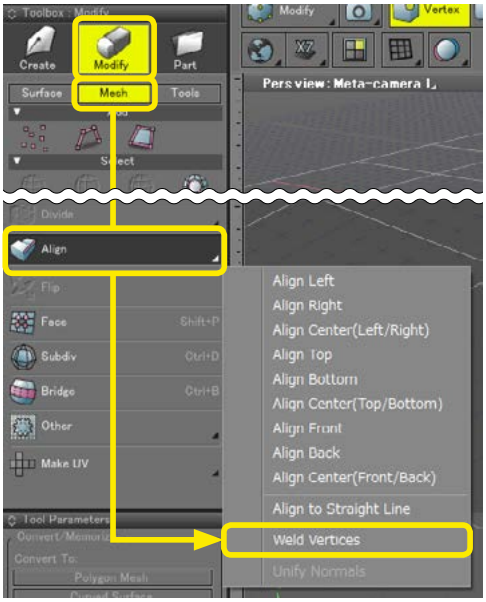


Making Vertices Converge at a Point

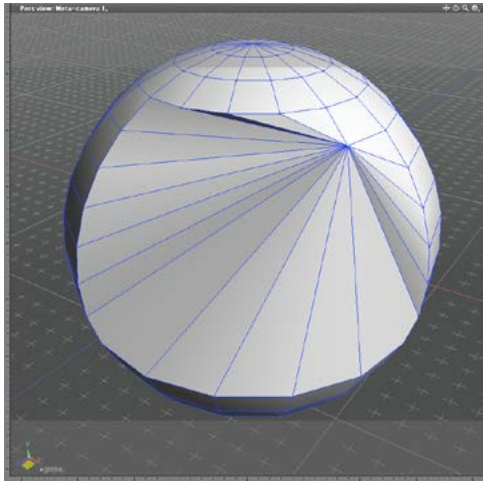
1 Select the vertices that converge at a point.



2 From **Toolbox**, select **Modify** > **Mesh** > **Align** and then select **Weld Vertices** from the pop-up menu.

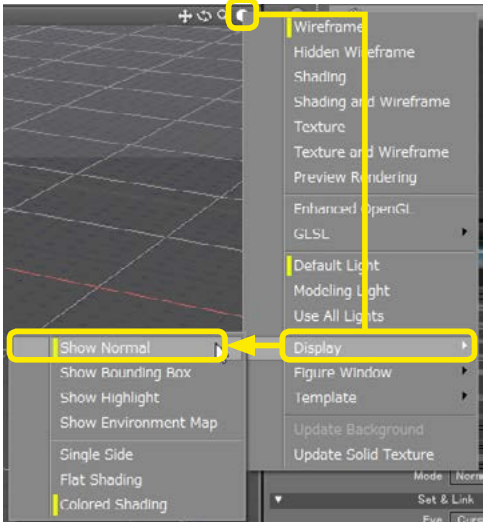


3 The other vertices converge at one of the selected vertices. The vertices are not connected to one another.

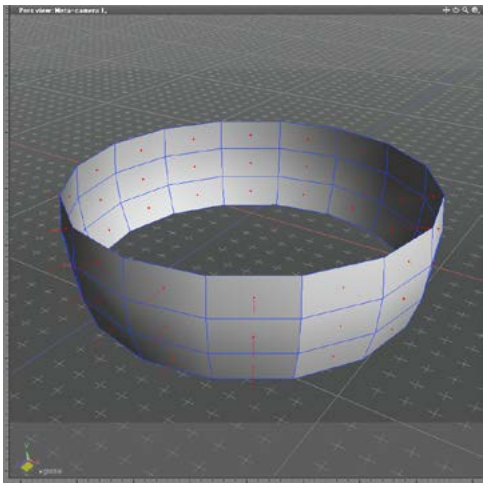


Unifying Normal Lines

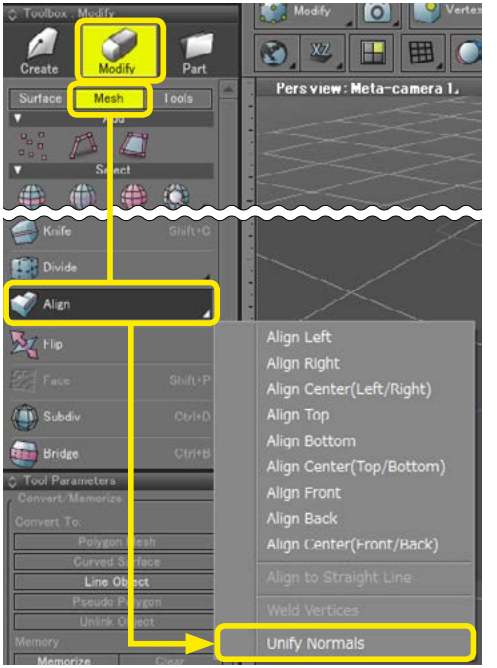
1 From the Display pop-up menu in the upper-right corner of the viewport, select **Display** and turn on **Show Normal** to display the normal lines.



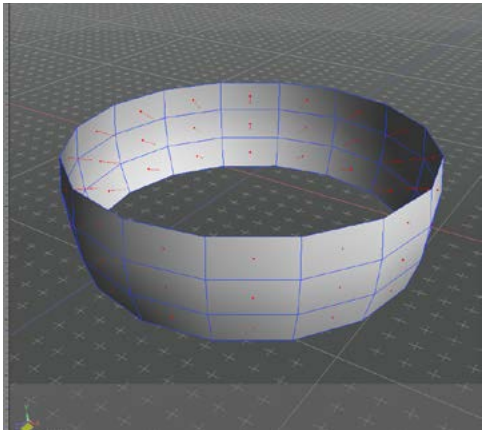
2 Select the face on which the normal lines are to be unified.



3 From **Toolbox**, select **Modify** > **Mesh** > **Align** and then select **Unify Normals** from the pop-up menu.



4 The normal line directions are unified.

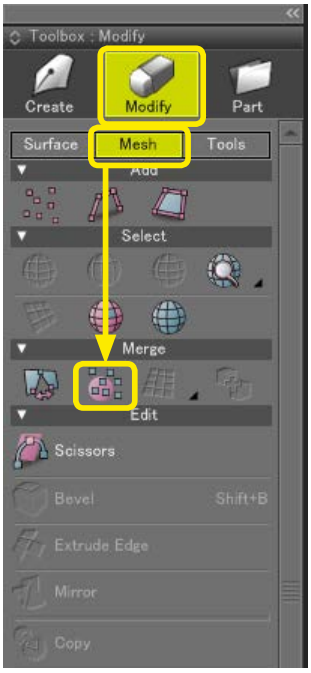


Merging Overlapping Vertices

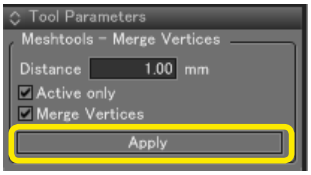
This function merges overlapping vertices into one vertex.

1 Select the object containing overlapped vertices.

2 From **Toolbox**, select **Modify** > **Mesh** > **merge vertices**.



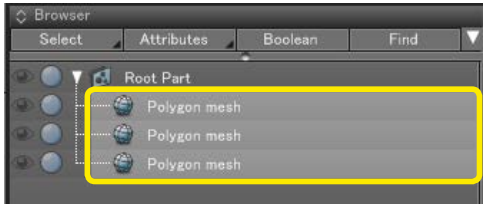
3 Click **Tool Parameters** > **Apply** to collect the overlapped vertices.



Merging Multiple Objects

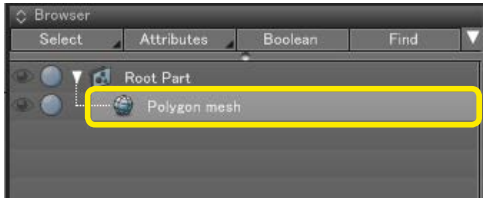
This function collects multiple polygon meshes into one.

1 Select the objects to collect.



2 From **Toolbox**, select **Modify** > **Mesh** > **Merge Objects**.

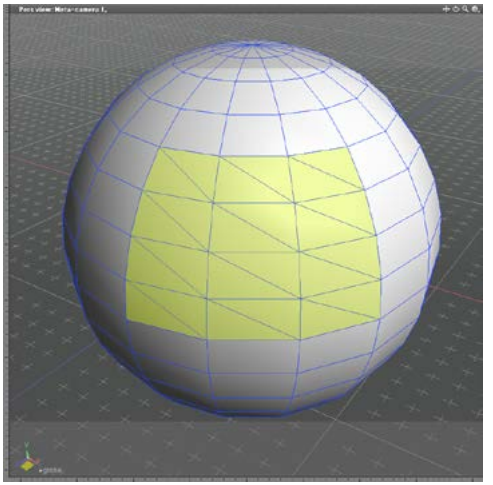
3 Multiple polygon meshes are collected into one.



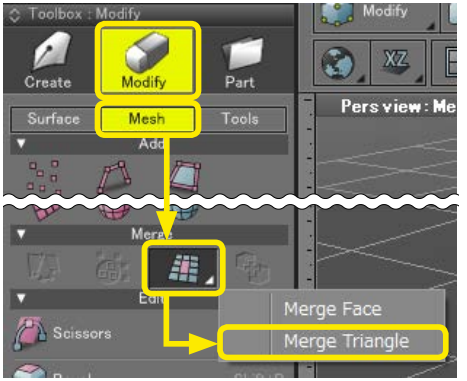
Merging Overlapping Faces

This function merges overlapping faces into one face. Alternatively, it merges two triangle polygons into a quad polygon.

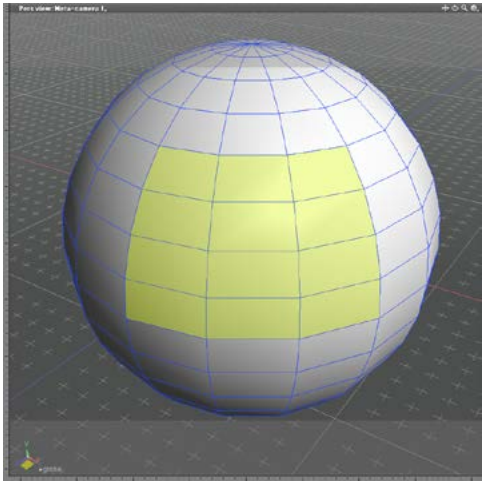
1 Select the faces of the triangle polygons that are to be merged into quad polygons.



2 From **Toolbox**, select **Modify** > **Mesh** > **Merge Face** and then select **Merge Triangle** from the pop-up menu.



3 The triangle polygons are collected into quad polygons.



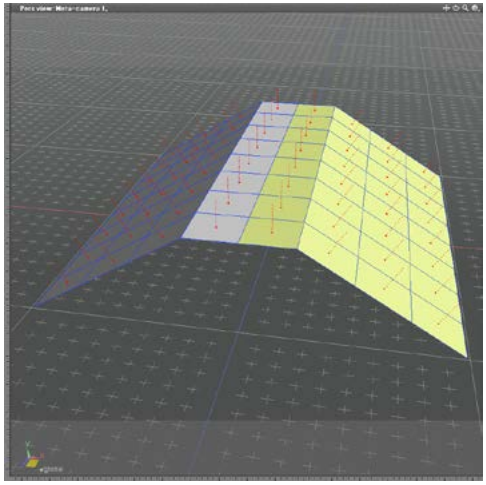
TIP

Only the triangle polygons on the same plane are collected into quad polygons.

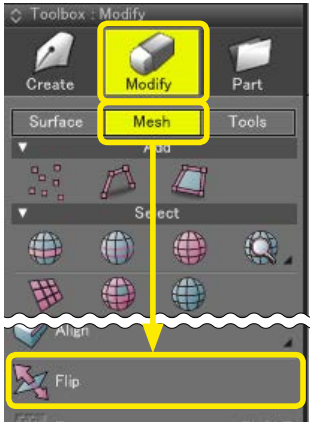
Flipping Faces

This function reverses the two sides of a face.

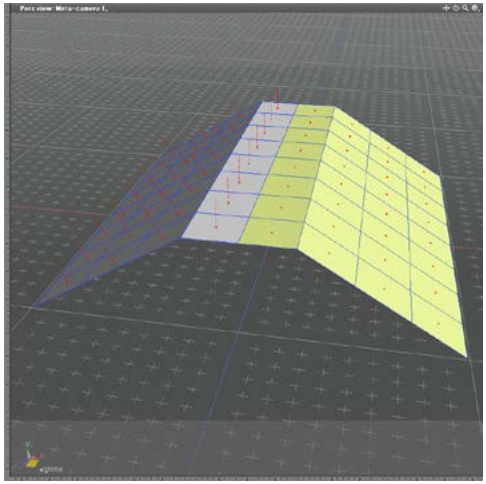
1 Select the faces to be reversed. Here, the normal lines are displayed to indicate the face directions.



2 From **Toolbox**, select **Modify** > **Mesh** > **Flip**.



3 The selected faces are reversed.

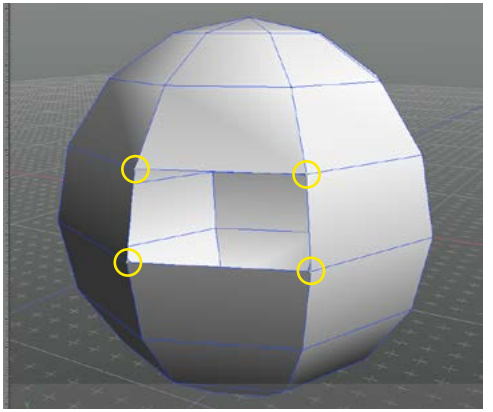


Creating a Face on Vertices or Edges

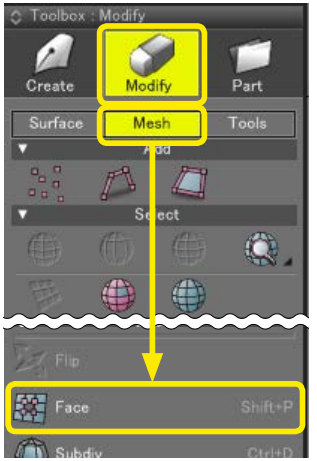
This function creates a face having the selected vertices. Alternatively, it creates a face that connects two edges.

Creating a Face from Vertexes

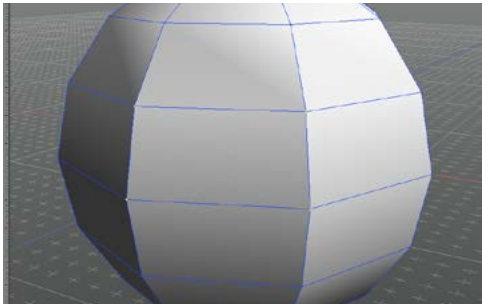
1 Select the vertices in the position at which a face is created.



2 From **Toolbox**, select **Modify** > **Mesh** > **Face**.

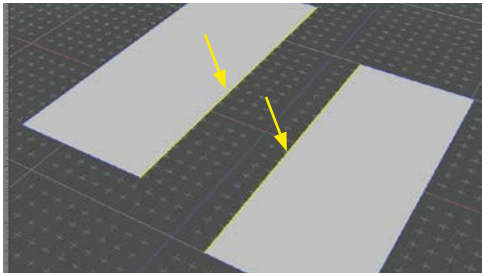


3 A face is created containing the selected vertices.

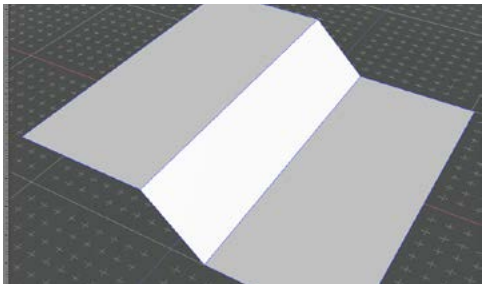


Creating a Face from Edges

1 Select two edges where a face is created.



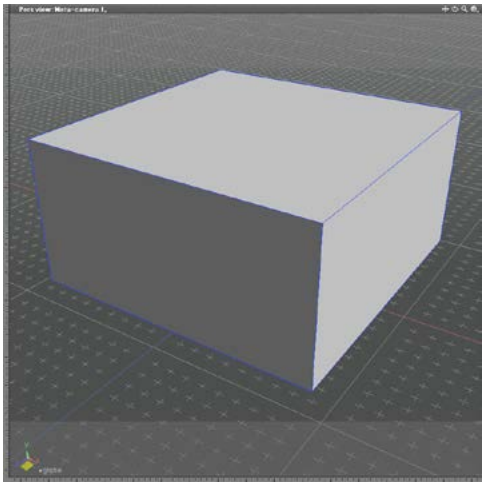
2 From **Toolbox**, select **Modify** > **Mesh** > **Face** to create the face connecting edges.



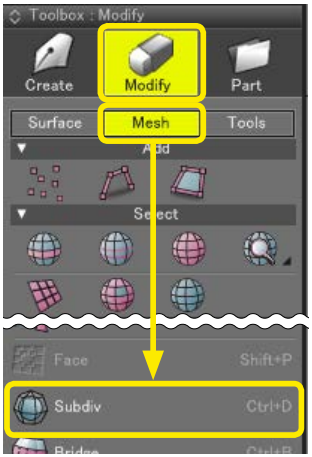
Displaying a Polygon Mesh with Rounded Corners

This function rounds the corners of a polygon mesh with subdivision surfaces.

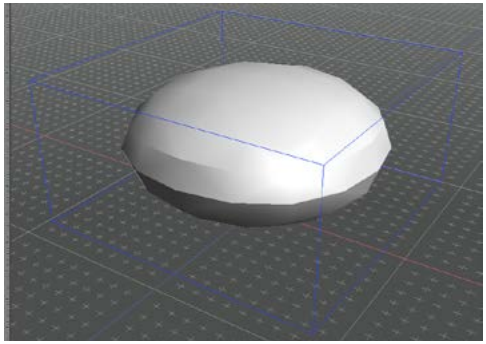
1 Select the polygon mesh to be displayed with its corners rounded.



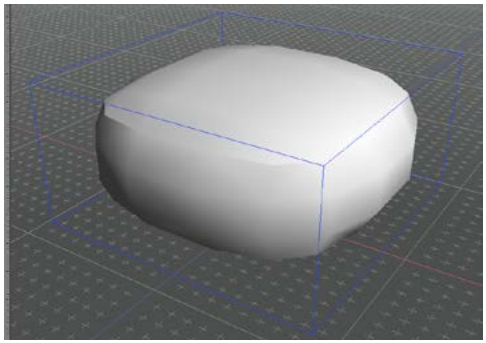
2 From **Toolbox**, select **Modify** > **Mesh** > **Subdiv**.



3 The polygon mesh is displayed with its corners rounded. The vertex positions of the object remain unchanged.



4 If you click **Subdiv** again with the polygon mesh with rounded corners selected, the corner rounding method changes from the **Catmull-Clark method** to **Doo-Sabin method.** If you click **Subdiv** again, rounding is released.



TIP

You can adjust the intensity of rounding using **Weight** in the **Object Info** Window. Moreover, you can change the corner rounding method from the **Round Edge** pop-up menu.

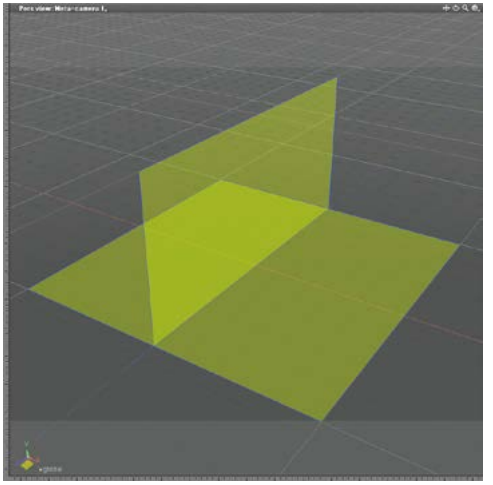
Using Other Editing Tools

Learn how to remove an edge shared by multiple faces, selects the same plane, performs movement by extrusion, extrudes edges, rearranges triangles, and performs edge loop slice.

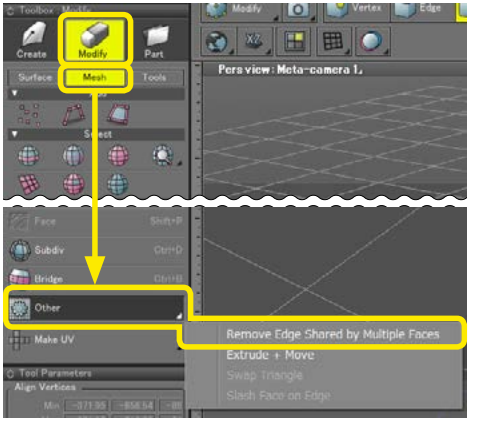
Removing an Edge Shared by Multiple Faces

This function separates three or more faces sharing one edge.

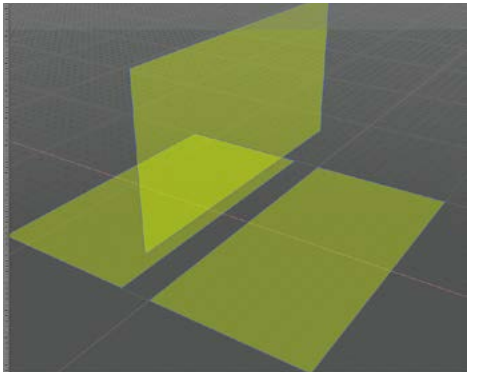
1 Select the faces sharing one edge.



2 From **Toolbox**, select **Modify** > **Mesh** > **Other** and then select **Remove Edge Shared by Multiple Faces** from the pop-up menu.



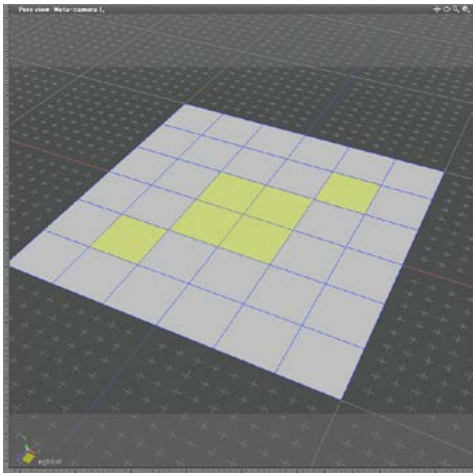
3 An edge shared by three or more faces is removed to separate the faces. The figure below shows each face moved, so that you can easily see that the faces are separated.



Moving Faces by Extrusion

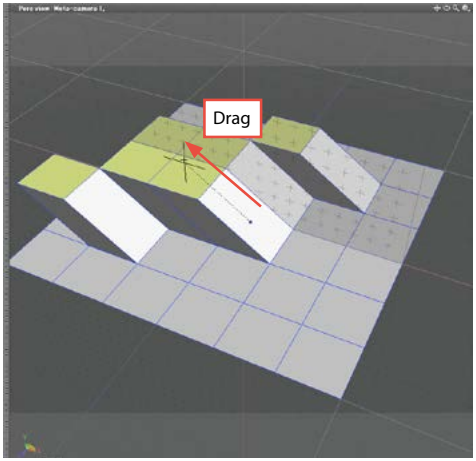
This function extrudes the selected faces in the drag direction.

1 Select the faces.



2 From **Toolbox**, select **Modify** > **Mesh** > **Other** and then select **Extrude + Move** from the pop-up menu.

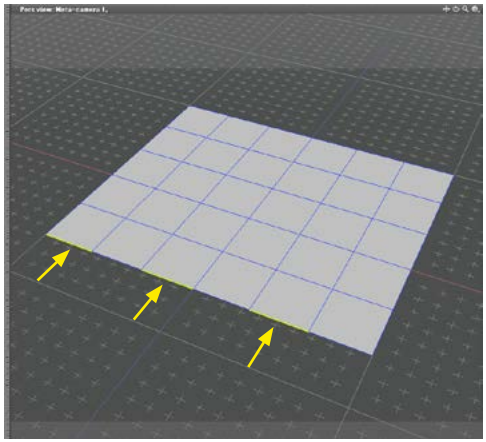
3 Drag to extrude the faces.



Extruding Edges

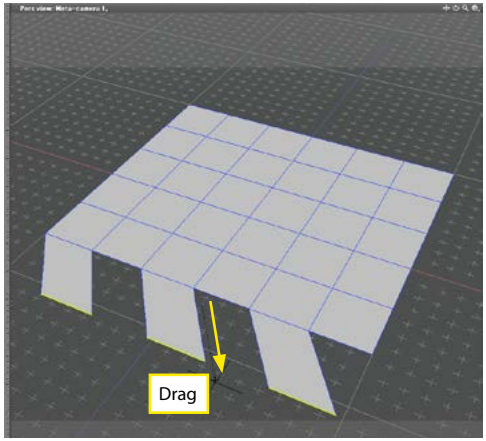
This function extrudes the selected edges in the drag direction.

1 Select the edges.



2 From **Toolbox**, select **Modify** > **Mesh** > **Other** and then select **Extrude Edge** from the pop-up menu.

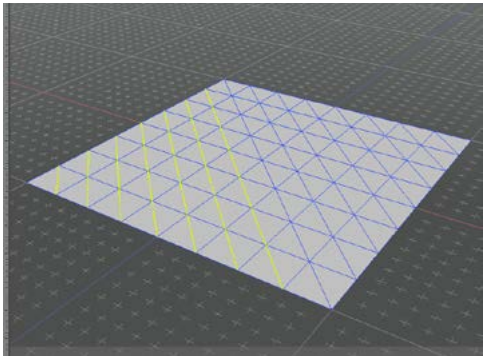
3 Drag to extrude the edges.



Switching Triangle Direction

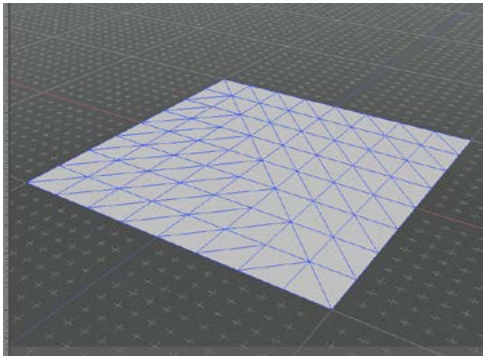
This function rearranges the division positions of the quad polygons, each of which is divided into triangles.

1 Select the diagonals of the triangle polygons to be rearranged.



2 From **Toolbox**, select **Modify** > **Mesh** > **Other** and then select **Swap Triangle** from the pop-up menu.

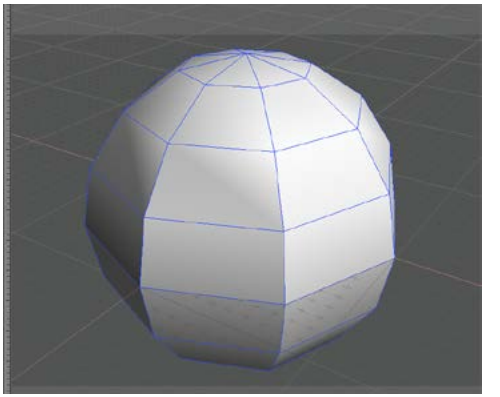
3 The division positions of the triangle polygons are rearranged.



Performing Edge Loop Slice

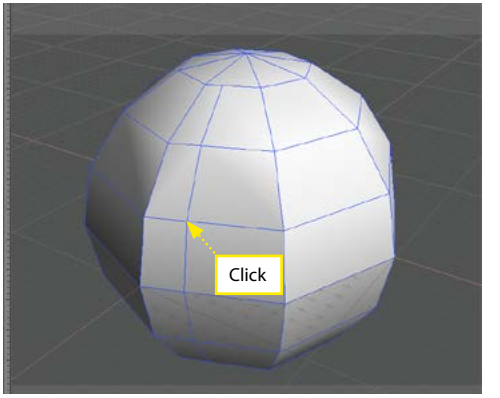
This function divides edges. If square faces are stretched out, the edges are continuously divided by the same ratio.

1 Select the object whose edges are to be divided.



2 From **Toolbox**, select **Modify** > **Mesh** > **Other** and then select **Edge Loop Slice** from the pop-up menu.

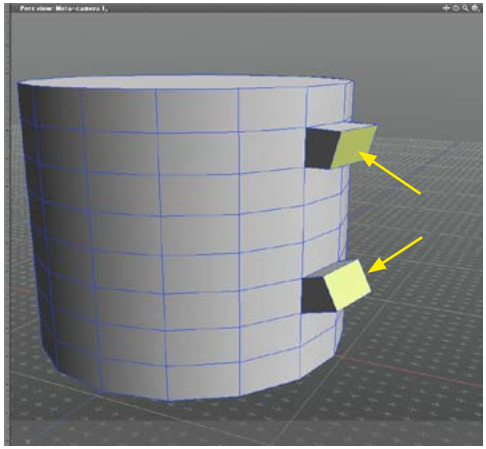
3 If you click on an edge of the polygon mesh, the edge is divided at the clicked point.



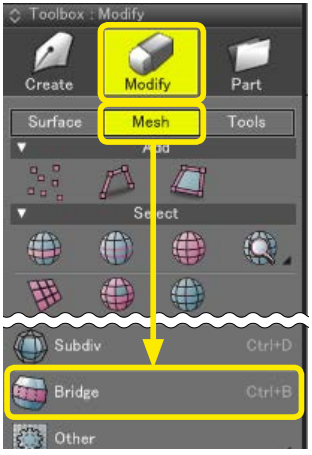
Bridging Faces

This function creates faces used to connect distant faces.

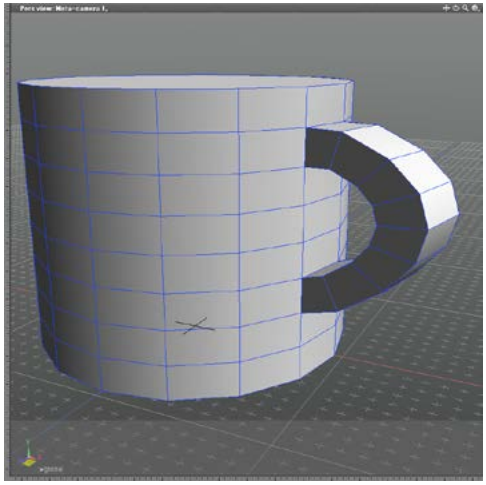
1 Select two faces containing edges so that three or more vertices are included.



2 From **Toolbox**, select **Modify** > **Mesh** > **Bridge**.



3 The faces connecting the two faces are created.



4 From **Tool Parameters**, specify the number of divisions **(1)** and then select **Apply** **(2)**.

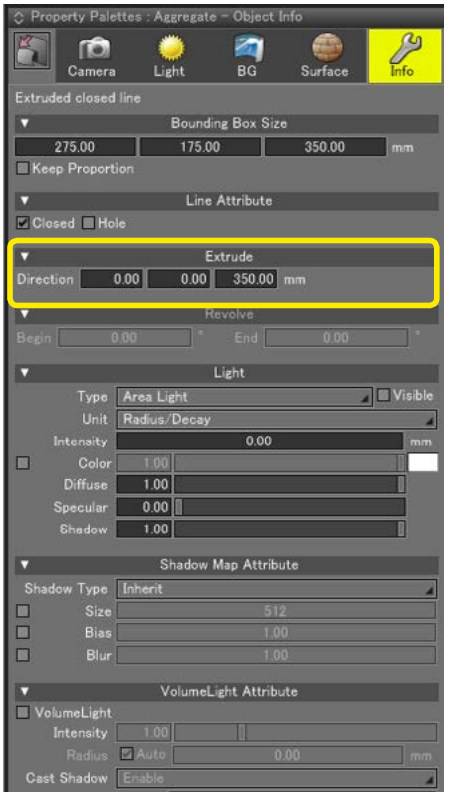
5–4. Editing Extruded Objects and Revolved Objects

Changing the Extrusion Direction, Amount and Rotation Angle

You can select the extruded object or revolved object to be edited, display the **Object Info** Window, and specify, as a numerical value, the extrusion direction of the extruded object and the rotation angle of the revolved object.

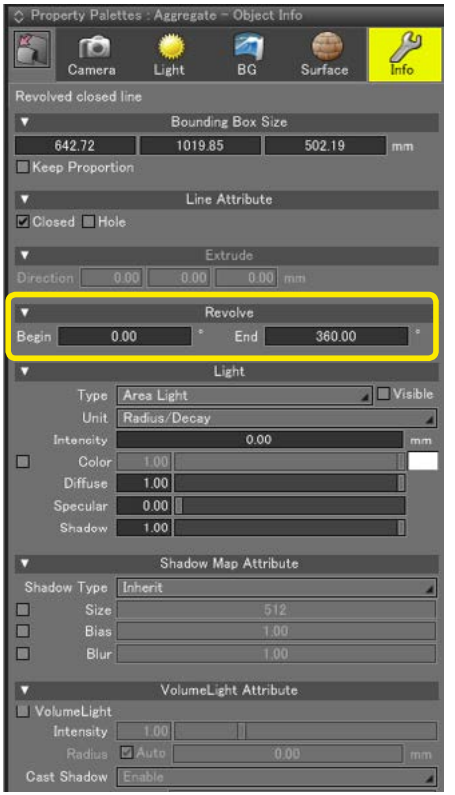
Extrusion Amount of the Extruded Object

Enter the X, Y, and Z values, in this order, from the left in the **Direction** text box of **Extrude** of the **Object Info** Window.



Start and End Angles of the Revolved Object

Enter the start and end angles in the **Begin** and **End** text boxes of **Revolve** of the **Object Info** Window.

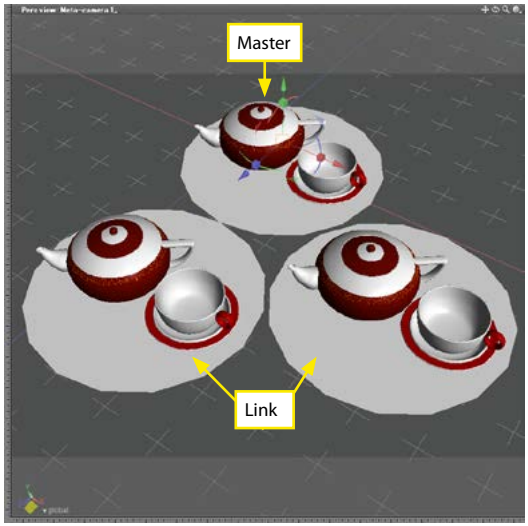


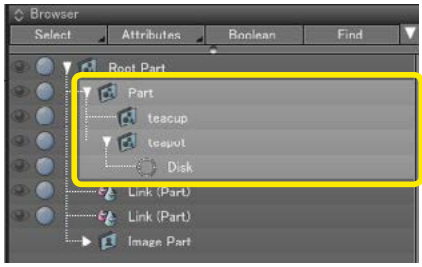
5–5. Editing Link Objects

Editing Link Objects

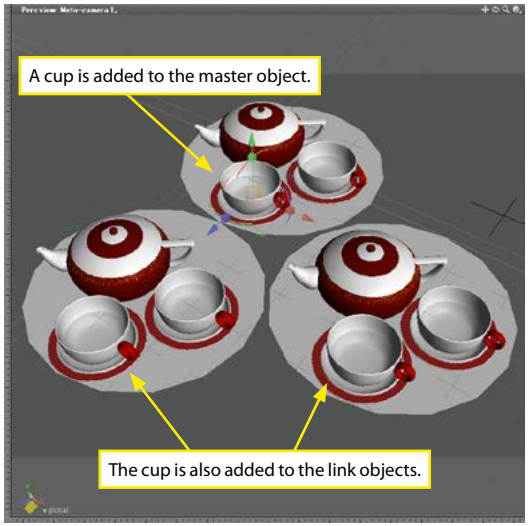
Editing Link objects is possible only when editing using **Move** and **Copy** under **Toolbox**.
The result of editing the master object is reflected on all the child link objects.

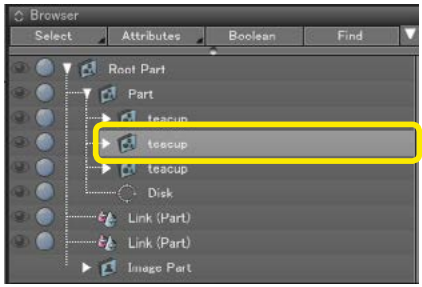
Two link objects are created from the master part.





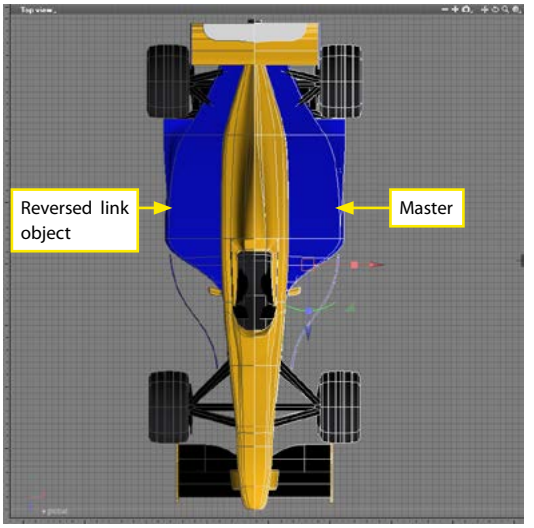
If any change is made to the master part, it is reflected on the link objects.



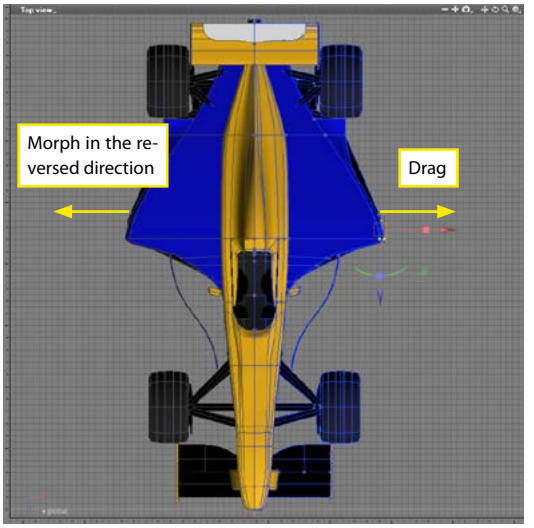


Reversed Link Object

The master object is on the right and the reversed link object is on the left.



If you edit the master object, the result is reflected on the link object on the left with its reversed status retained.

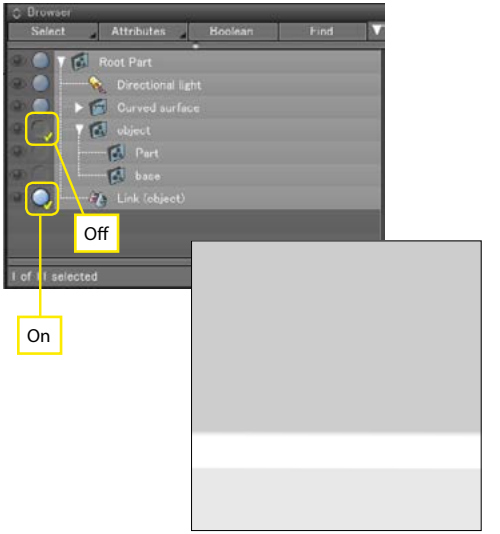


Setting Attributes in the Browser

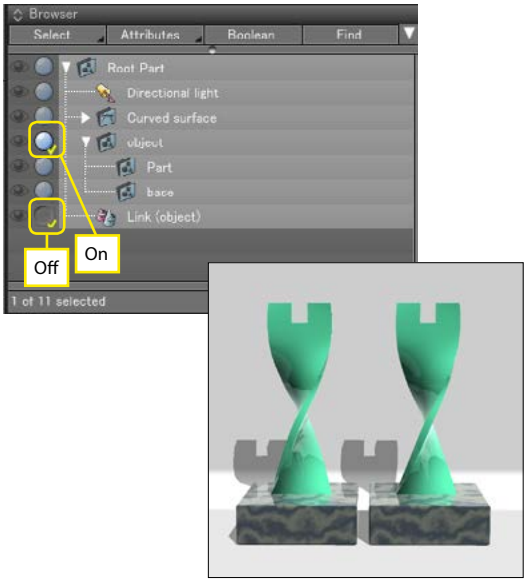
The setting of attributes for the master object on the Browser is given priority over that for the link object. If **Normal** (inheritance) is set for the master object, the attribute setting for the link object is enabled. If **On** or **Off** is set for the master object, the attribute setting for the link object is disabled. This results in the following reflection.

The master object is on the left and the link object is on the right.

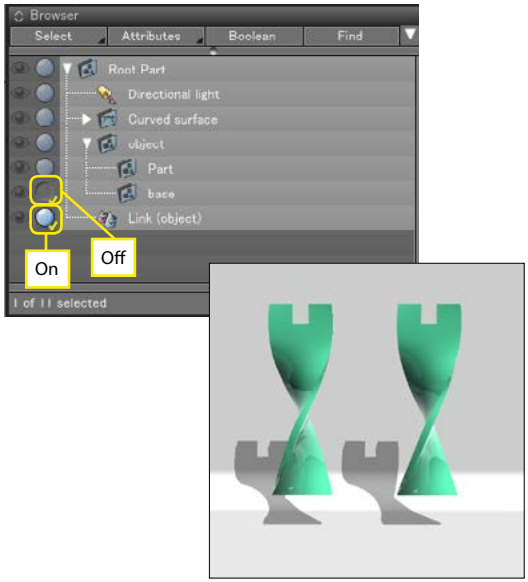
If **Rendering** for the master object is **Off**, both the master and link objects are not rendered even if the link object is **On**.



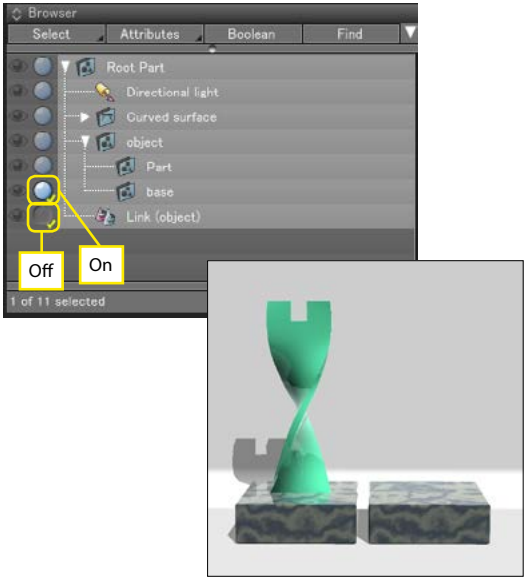
If the master object is **On**, both the master and link objects are rendered even if the link object is **Off**.



If the pedestal of the master object is **Off**, the pedestals of both the master and link objects are not rendered even if the link object is **On**.



If the pedestal of the master object is **On**, the pedestal of the link object is rendered even if the link object is **Off**.

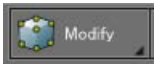


5–6. Other Editing Functions

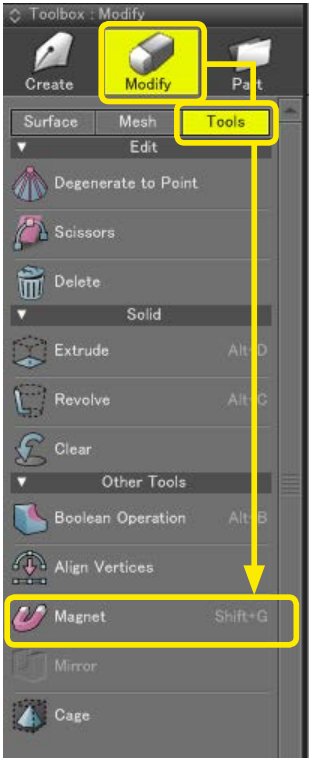
Morphing Objects with the Magnet Tool

You can drag the vicinity of the drag point with the magnet tool so that it rises smoothly.

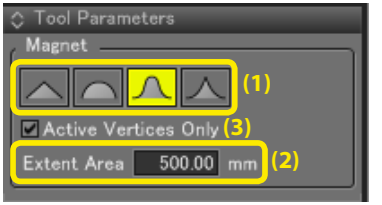
1 Switch to Modify Mode.



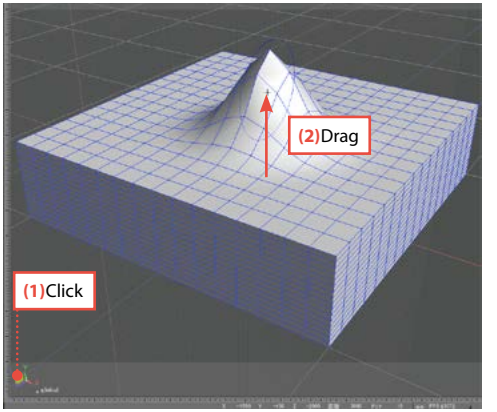
2 From **Toolbox**, select **Modify** > **Tools** > **Magnet**.



3 From **Tool Parameters**, select the shape that rises when dragged **(1)** and specify the morph range in **Extent Area (2)**. If you wish to morph the entire object without selecting vertices, uncheck the **Active Vertices Only** checkbox **(3)**.



4 Switch the Work Plane Controller to the face in the drag direction **(1)** and drag the object to make it rise **(2)**.



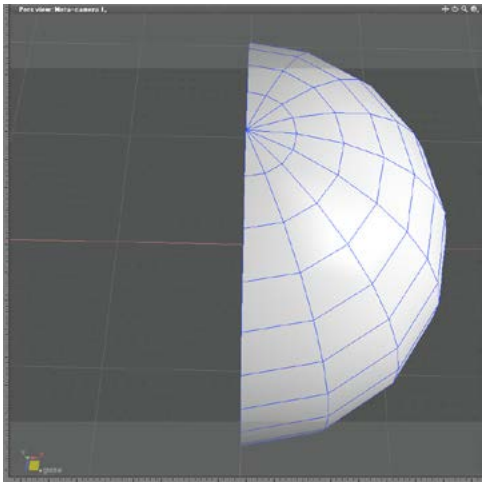
TIP

You can change the value of **Extent Area** by right clicking (Windows) or while holding down the control key.

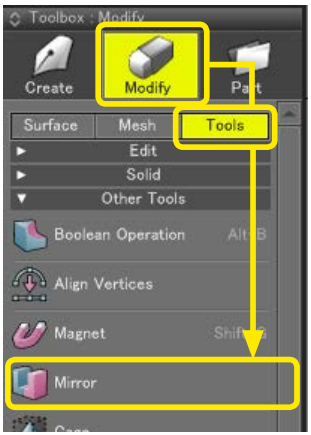
Displaying a Mirror Object Axis–Reversed

This function always displays the mirror object axis-reversed by mirroring. Changes in the original object are immediately reflected on the mirror image. The mirror image is displayed as a list other than the wireframe format.

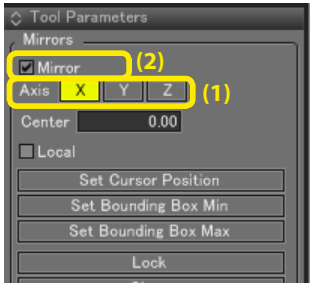
1 Select the object to be mirrored.



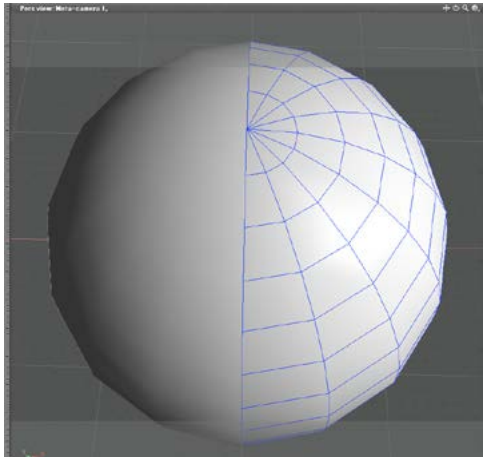
2 From **Toolbox**, select **Modify** > **Tools** > **Mirror**.



3 Select the target axis from **Tool Parameters** (1) and check **Mirror**.(2).



4 The mirror object is displayed axis-reversed.



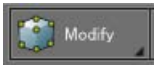
TIP

The mirror object is not displayed in wireframe format. It is convenient to edit the mirror object in shading/texture view mode.

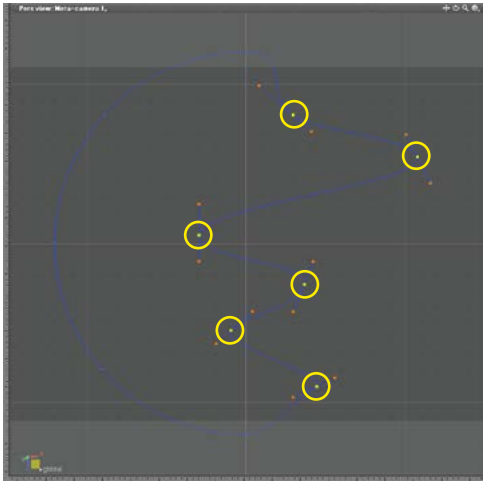
Aligning Vertexes

This function aligns the selected vertices, control points, and line handles to the specified position.

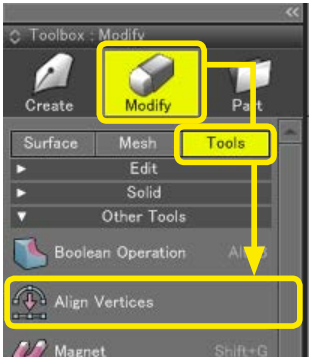
1 Switch to Modify Mode.



2 Select the control points to be aligned.

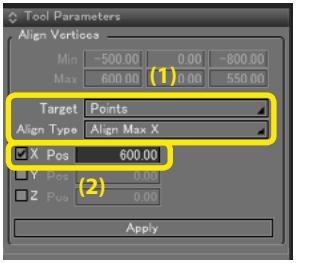


3 From **Toolbox**, select **Modify** > **Tools** > **Align Vertices**.

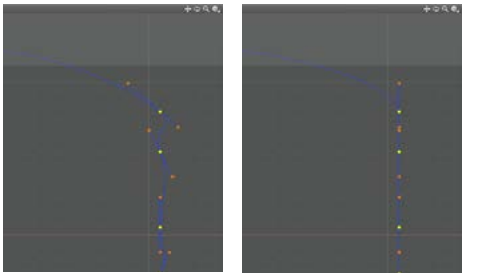


4 From **Tool Parameters**, specify the targets to be aligned and the alignment type **(1)**.

The specified coordinate axis is checked and the coordinate is displayed in the text box. If you have selected **Align Max X**, **X** is checked and the maximum coordinate **600** is displayed in the text box **(2)**.



5 If you click **Apply**, the control points align to the specified coordinate.



Left figure: Alignment of only points (Maximum of X)

Right figure: Alignment of points and handles (Maximum of X)

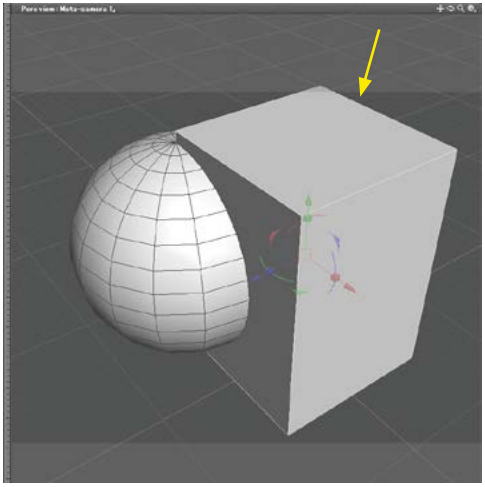
TIP

You can align elements to any coordinate by checking X, Y, or Z or by changing the numerical values in the text box.

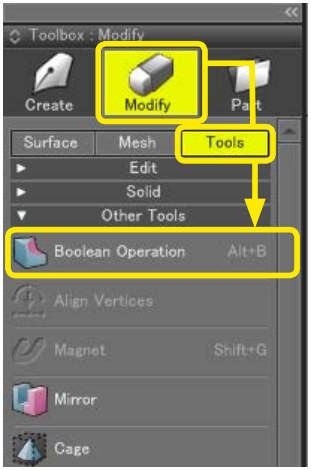
Boolean Operations

This function combines two objects through Boolean operations or cuts a one-sided object with the other one.

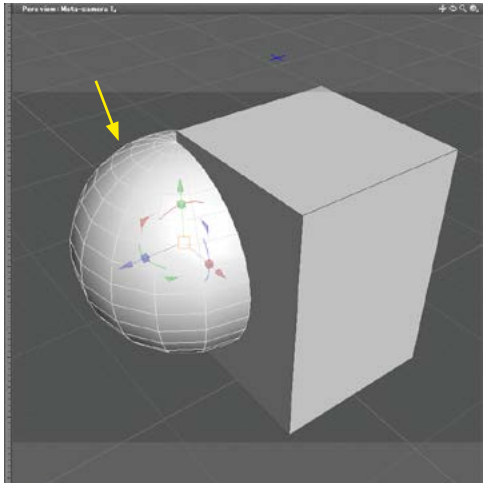
1 Select the object that cuts the other one.



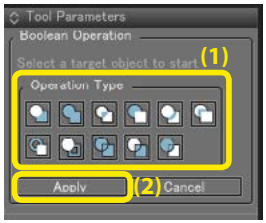
2 From **Toolbox**, select **Modify** > **Tools** >**Boolean Operation**.

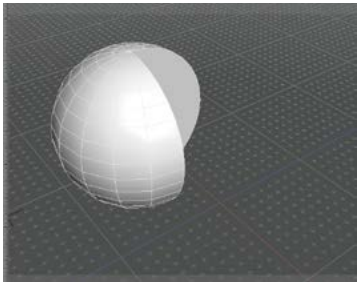


3 Select the object to be cut.

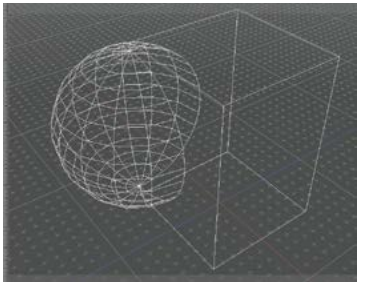


4 From **Tool Parameters**, select the Boolean operation **(1)** and click **Apply** **(2)**.

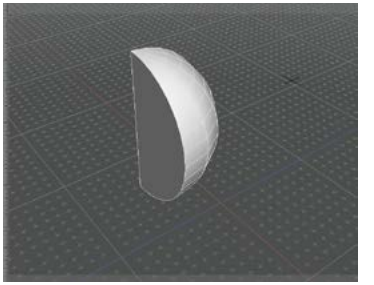




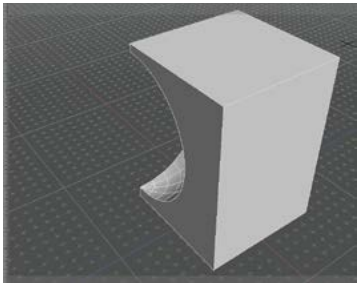
Target cut by source



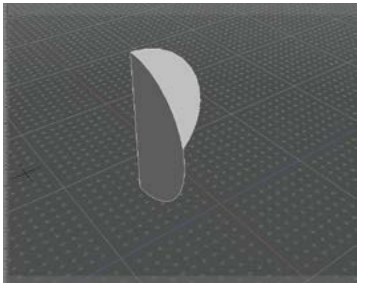
Target union source



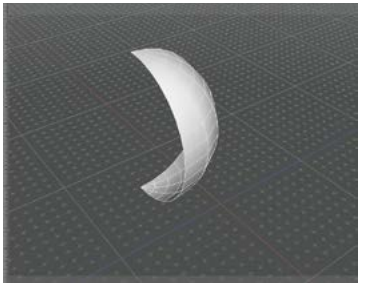
Target intersect source



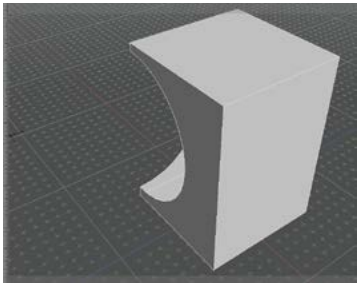
Source cut by target



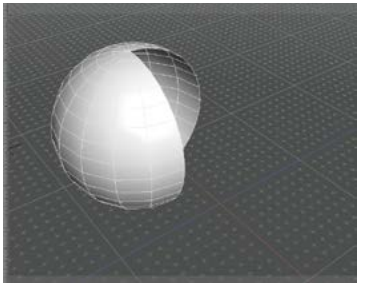
Source surface intersect target



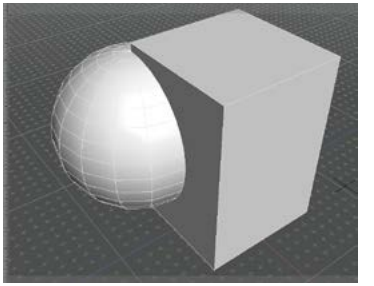
Target surface intersect source



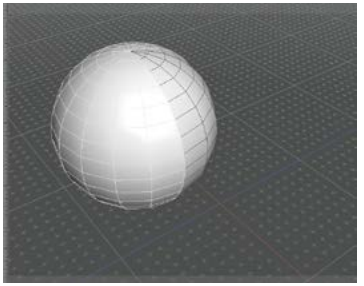
Source surface cut by target



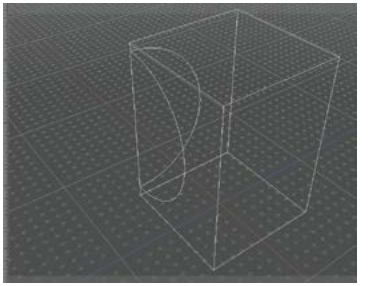
Target surface cut by source



Boolean all parts



Boolean all parts in target

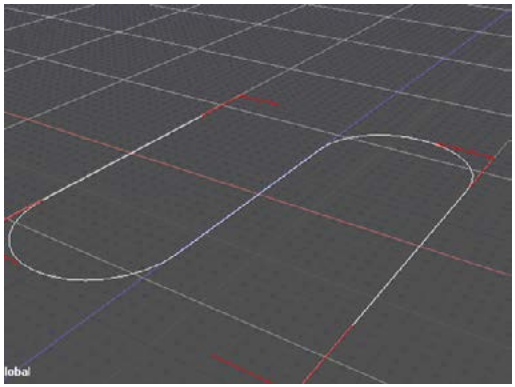


Boolean all parts in source

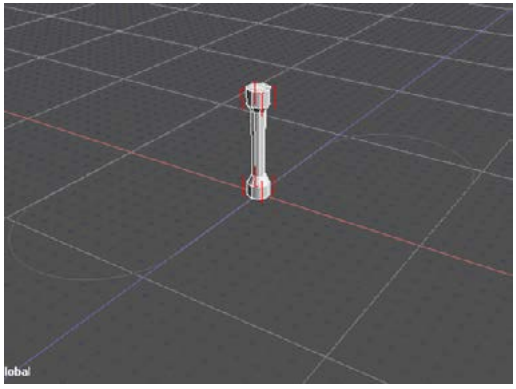
Path Replicator

Path Replicator makes it easy to place multiple objects along the path specified by a line object. The number of objects to place can be specified, or alternatively, the spacing between each.

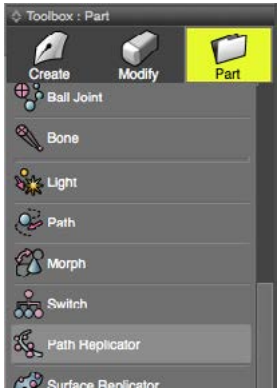
1 First, set up the line object to use as the path.

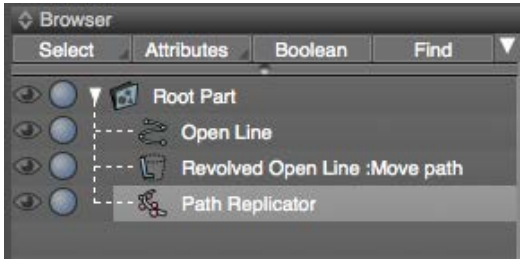


2 Next, model the object you wish to place along the path. Using the default settings, the object should be placed at the origin (0, 0, 0). Here we have placed the object with the center of its bottom surface at the origin.

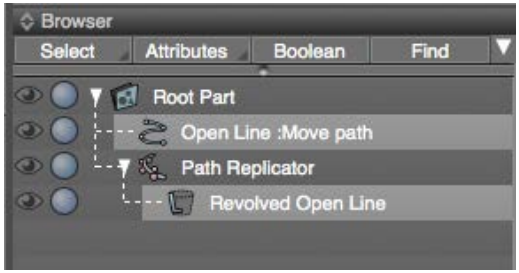


3 From the Toolbox, choose **Part** > **Path Replicator**. You can see that the path replicator is added to the Browser.

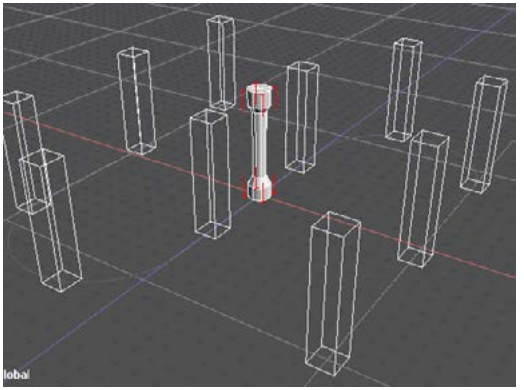




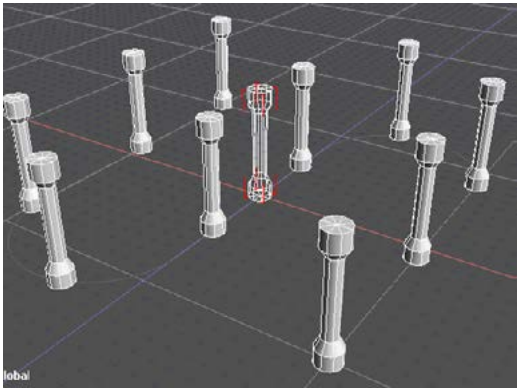
4 In the Browser, move the line object to use as the path directly above the path replicator, and move the object to replicate inside the path replicator part, as shown below.



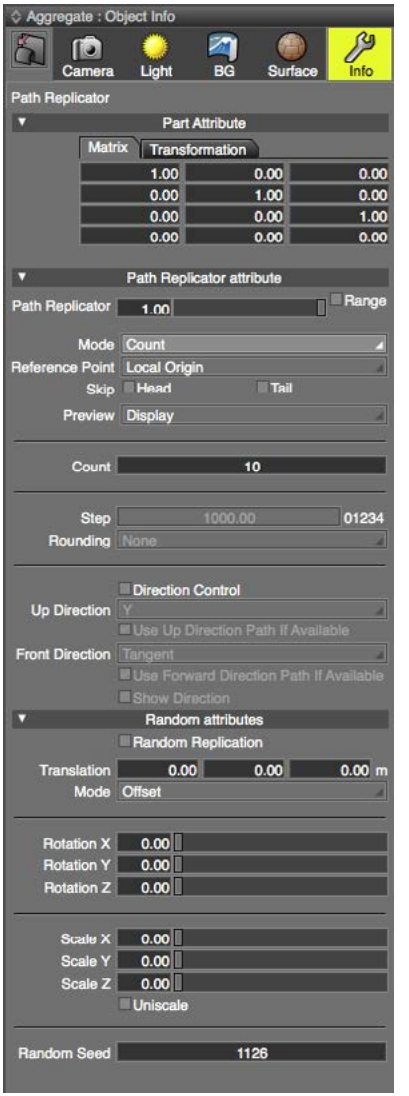
5 The object is placed along the path according to the Path Replicator settings in the Object Info Window. By default, the object is replicated 10 times along the path.



6 To change these settings, select the Path Replicator part in the Browser and open the Object Info Window. To change the number of replicas, edit the **Count** text box. To place the replicas a certain distance apart from one another rather than specifying the number replicated, change the **Mode** to **Step**, and enter a value in the **Step** text box. To view the geometry of the replicas, select **Display** from the **Preview** pop-up menu.



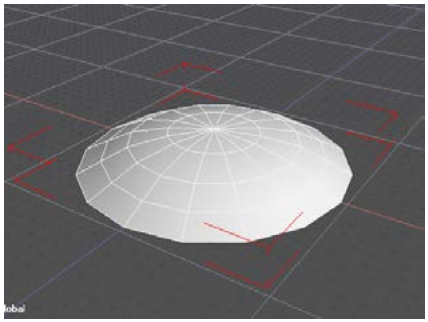
For additional details on Path Replicator settings, please see the **Shade3D Online Documentation**.



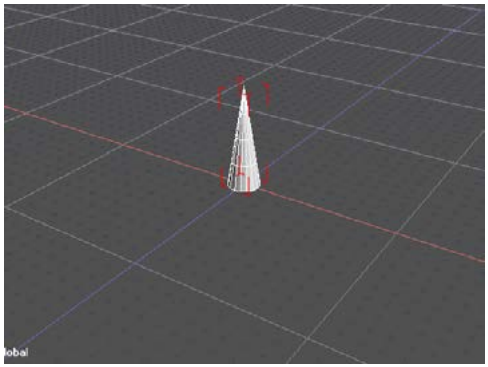
Surface Replicator

Surface Replicator is used to place copies of an object along the surface of another object.

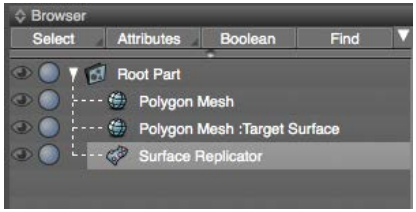
1 First model a polygon mesh surface.



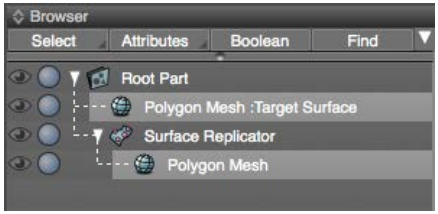
2 Next model the object you wish to replicate. Using the default settings, the object should be placed at the origin (0, 0, 0). Here we have placed the object with the center of its bottom surface at the origin.



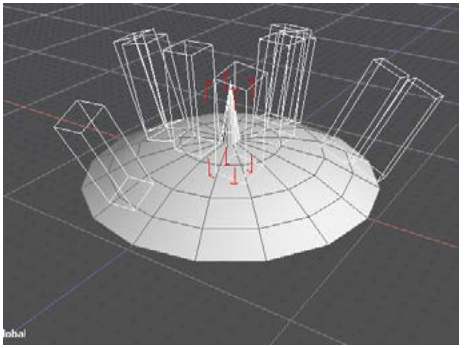
3 From the Toolbox, choose **Part** > **Surface Replicator**. You can see that the path replicator is added to the Browser.



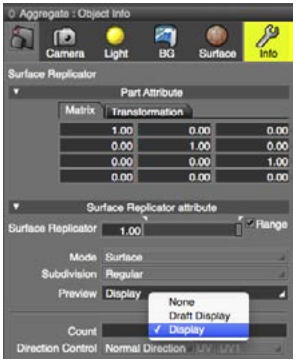
4 In the Browser, move the polygon mesh to use as the surface directly above the surface replicator, and move the object to replicate inside the surface replicator part, as shown below.

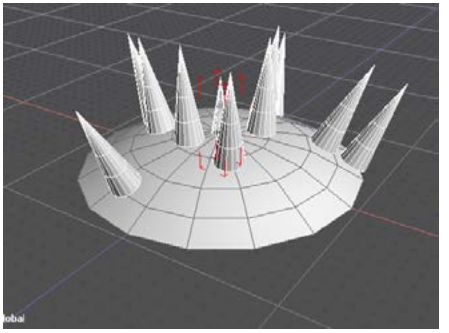


5 The object is placed along the surface according to the Surface Replicator settings in the Object Info Window. By default, the object is replicated 10 times.

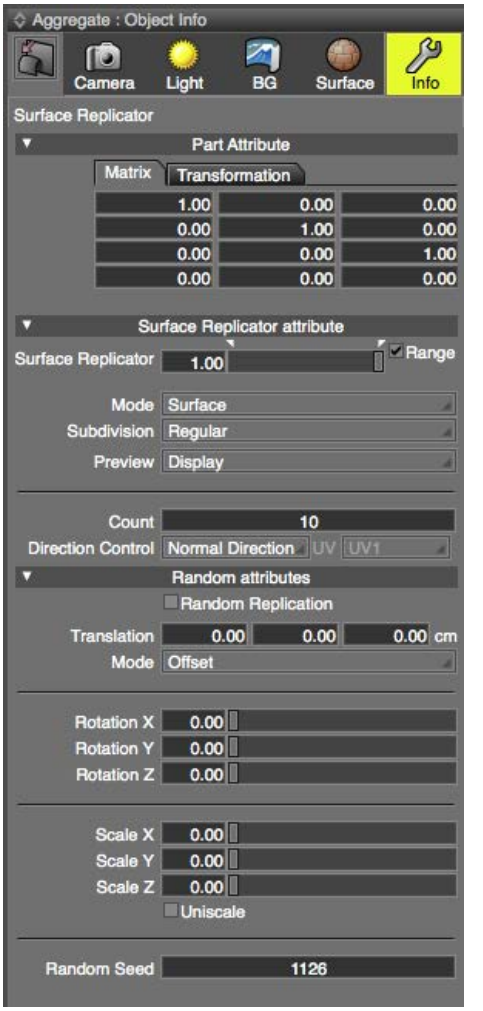


6 With the Surface Replicator selected in the Browser, open the Object Info Window and select Display from the Preview pop-up menu to view the geometry of the replicas.





For additional details on Surface Replicator settings, please see the **Shade3D Online Documentation**.



Entering Exact Values

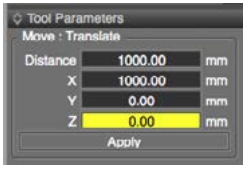
When moving and copying objects, using Round Edge, Bevel Edge and other tools, in many cases numeric values for the operation can be entered in the Tool Parameters Window, making it possible to work very precisely.

Tool Parameter values can be changed any number of times until you click Apply or press the Enter or Return key.

Move and Copy Tools

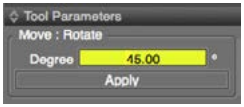
Translate

Values can be entered for the distance along a straight line, and the distance along each axis.



Rotate

A value can be entered for the angle of rotation.

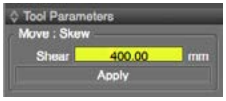


Scale and Uni-Scale

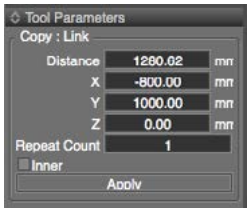
Values for the ratio to scale the object can be set.

Skew

A value can be entered for the distance to skew the object.



Placing Link Objects



Values can be set for the distance along a straight line, and the distance along each axis. Because this is a copy operation, **Repeat** and **Divide Distance by Repetitions** options are also available (see below).

Repeating the Operation

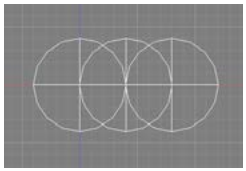
When copying (as opposed to moving) an object, multiple copies can be made simultaneously by using the following options in the Tool Parameters.

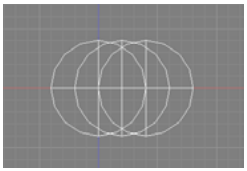
Repeat

The number of times to repeat the copy operation (i.e., how many new objects to create).

Divide Distance by Repetitions

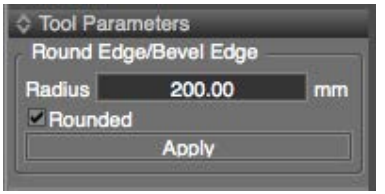
When selected, the specified distance values are divided by the number of repetitions. For example, if the X distance is set to 1000 mm and Repeat is set to 2, normally the total distance spanned would be 2000 mm (below left image). If this checkbox is selected, both copies fit within the X distance of 1000 mm (below right image).





Round Edge and Bevel Edge Tools

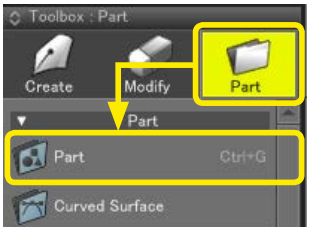
You can specify the radius for rounding or beveling, and also enable or disable rounding.



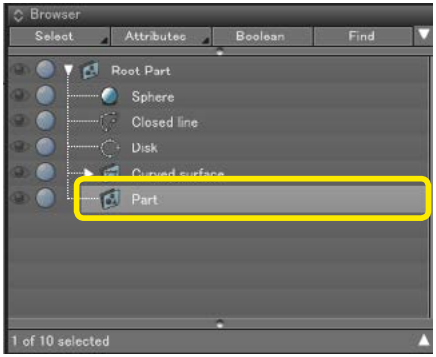
Managing Objects

When there are more than just a few objects in the scene, it can be easier to manage related objects by putting them in a part. Doing so also allows you to work with them together, as if they were a single object.

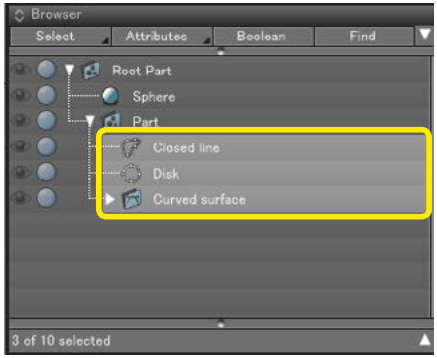
1 From **Toolbox**, select **Part** > **Part**.



2 **Part** is created in the **Browser**.



3 To move the objects to be collected together, drag them into the part.



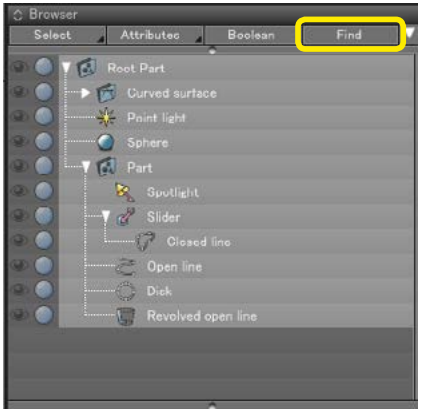
TIP

By selecting and manipulating the part, you can collectively move the objects within that part, perform editing, collectively set surface attributes, and perform other processing.

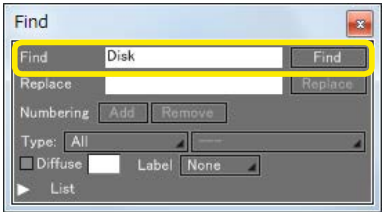
Searching for an Object by Name

You can search for an object by entering its name in the **Find Window**. The search is only performed on selected objects or those lower in the hierarchy. The objects to be searched are either the selected objects or those in the part.

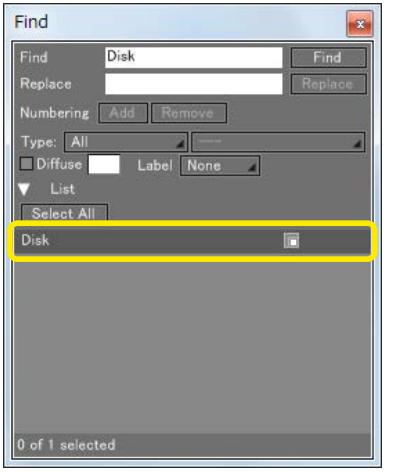
1 Click **Find** to display the **Find** window.



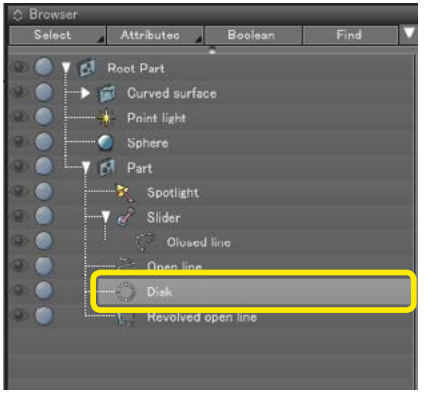
2 Enter the object name in the **Find** text field and click the **Find** button to start the search.



3 The search results are displayed as a list.



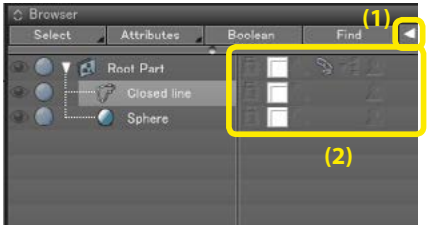
4 Click an object in the search results to select it.



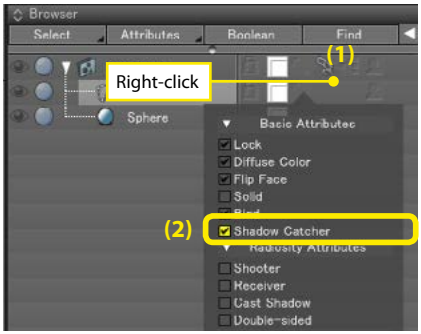
Rendering Only Shadows Cast on Objects

If you wish to render shadows cast on an object without rendering that object itself, use the Shadow Catcher property checkbox in the Browser.

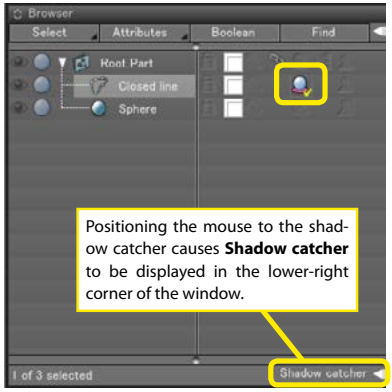
1 Click the ▼ **(Show/Hide button)** icon in the upper-right or lower-right corner of the **Browser** **(1)** to display the property checkboxes **(2)**.



2 Right-click (Windows) or control-click (Mac) in the checkbox area **(1)**, and then select **Shadow Catcher** in the displayed list **(2)**. The **Shadow Catcher** checkbox is added to the **Browser**.

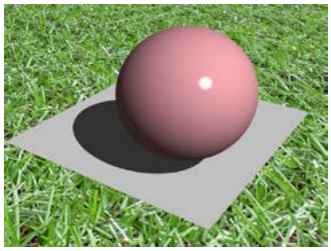


3 Let's set the shadow catcher in **Closed line** as the floor. Select **Closed line** and then click the **Shadow Catcher** checkbox twice to enable it.

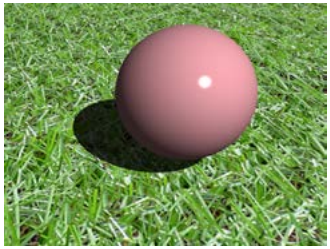


4 When you render the scene, only shadows cast on the closed line are rendered.

◆ **Shadow catcher: Off**



◆ **Shadow catcher: On**



(The lawn is set as a background.)

7. Cameras

Changing the Camera Angle

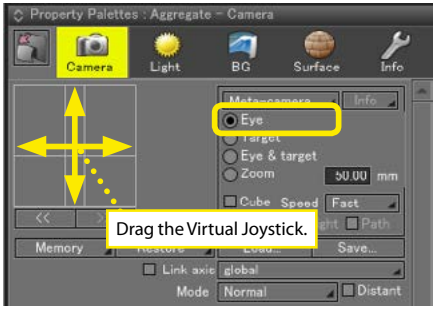
You can change the camera position, the field of view, and zoom settings.

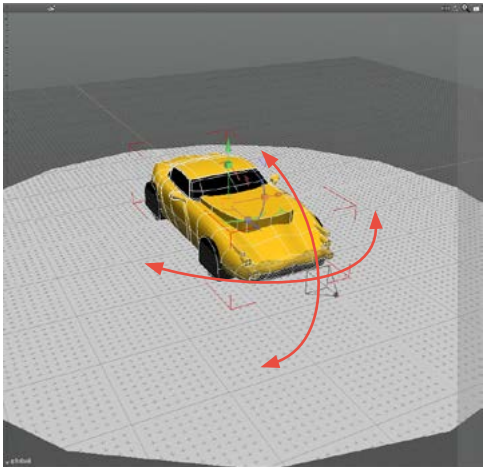
Using the Camera Window

You can select the movement target with the **Eye**, **Target**, **Eye & Target**, or **Zoom** radio button and operate the camera by dragging up, down, right, or left, relative to the center.

◆ **Eye (Camera Position)**

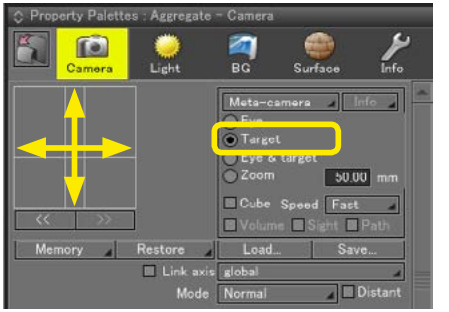
You can change the camera position while the point on which the camera is focused remains fixed.

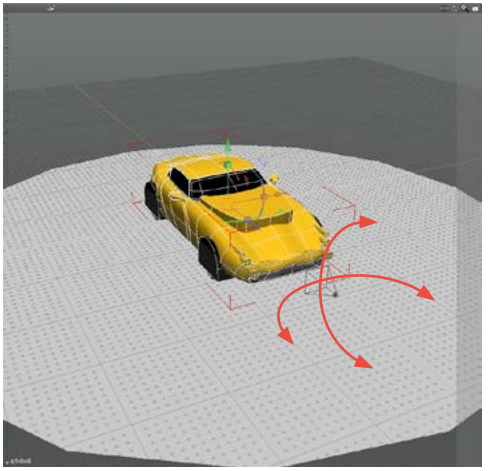




◆ **Target (Point on Which the Camera Is Focused)**

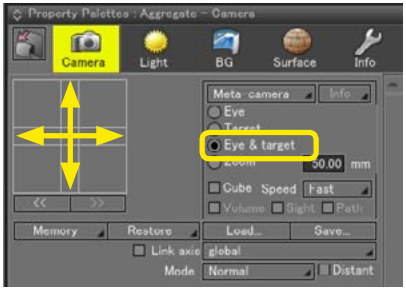
You can change the point on which the camera is focused while the location of the camera remains fixed.

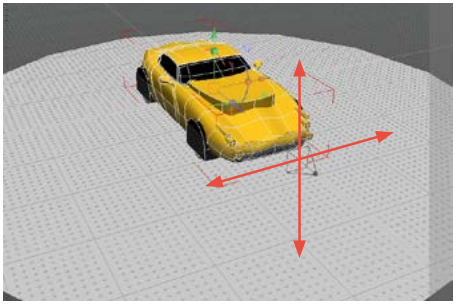




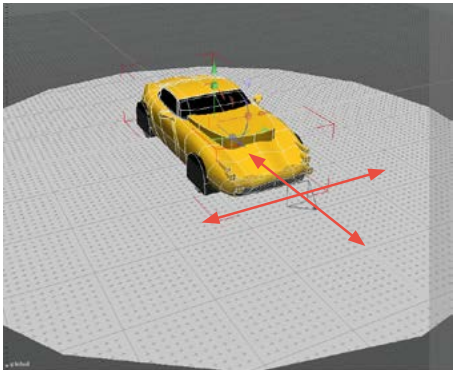
Eye & Target

You can move the camera and the target point either vertically or laterally while maintaining the relative distance between the subject and the camera.



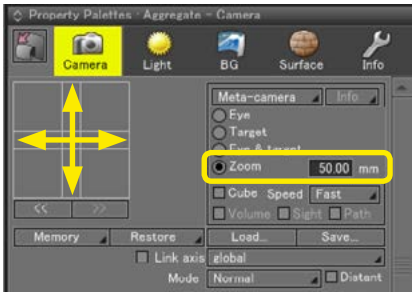


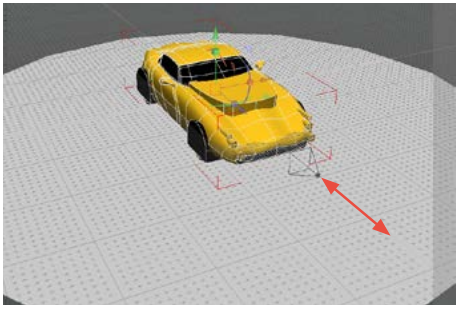
You can drag up or down while holding down the Ctrl or Z (Windows) key or the option (Mac OS) key to move the position back and forth parallel to the surface.



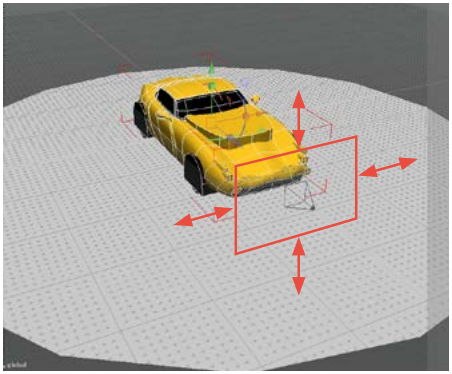
Zoom

You can drag up or down to move the camera position back and forth along the line of sight.

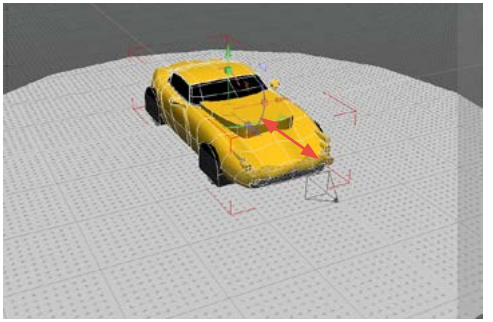




You can drag left or right to adjust the focal length (field of view).

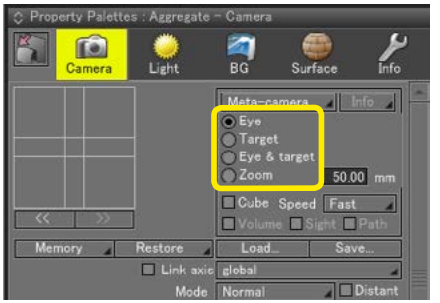


You can drag the Virtual Joystick up or down while holding down the Ctrl or Z (Windows) key or option (Mac OS) key to move the target point back and forth along the line of sight.



Operations in Perspective View

You can drag the Perspective View while holding down the Space key to enable camera operation corresponding to the radio button selected in the Camera Window.



TIP

It is convenient to register a shortcut for the switching of the **Eye**, **Target**, **Eye & target**, and **Zoom** radio buttons in the Camera Window.

TIP

You can also perform some camera operations by using the Perspective View's **navigation tool**.

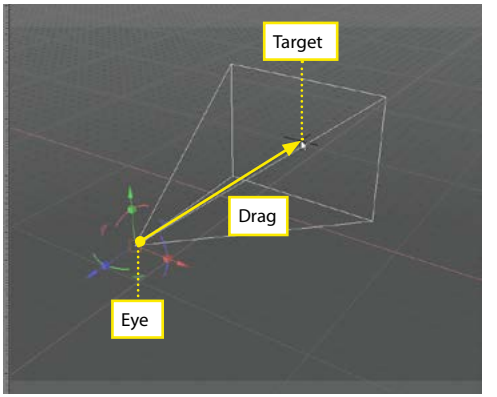
Creating Camera Objects

You can create camera objects that are controlled by the manipulator or the **Move** tool.

Create Cameras by Dragging

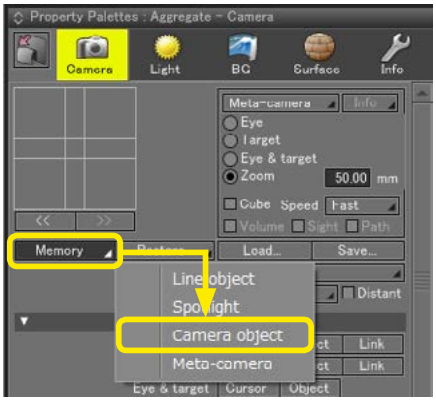
1 From the **Toolbox**, select **Create** > **Light/Camera** > **Camera**.

2 Drag to create a camera object. The drag start position will become the Eye point, while the drag end point will become the Target point

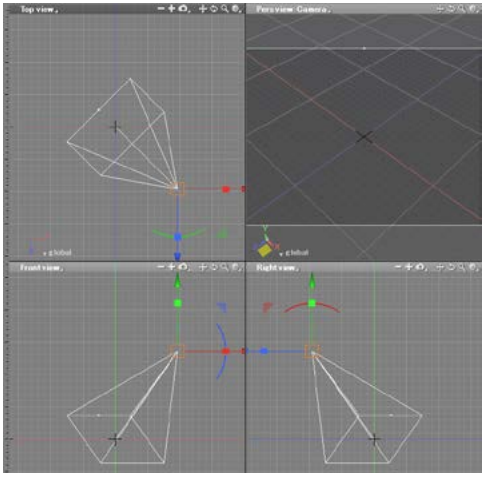


Creation from the Camera Window

1 Select **Camera object** from the **Memory** pop-up menu of the Camera Window.



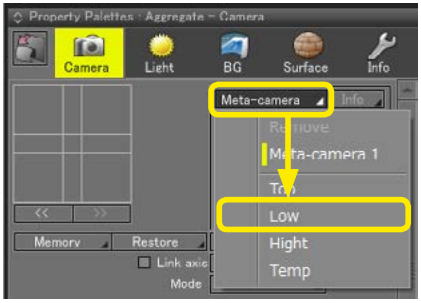
2 A camera object, configured in the same way as the current camera, will be created.



Switching Cameras

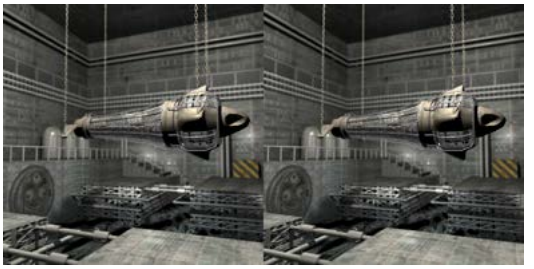
You can switch between different cameras for viewing the scene.

1 Select the camera to use from the **Select Camera** pop-up menu in the Camera Window.

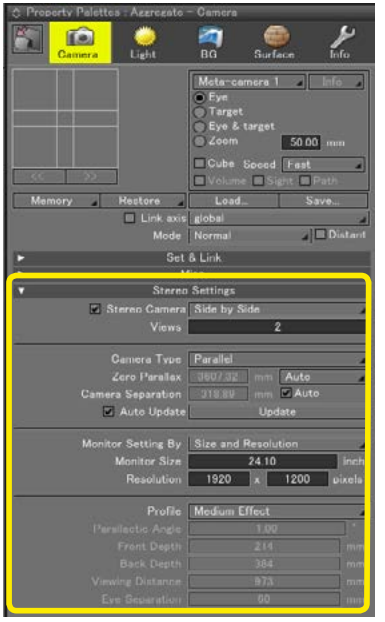


Stereo Vision

Stereo Vision creates stereo images by combining the images captured by multiple cameras with different eye points.



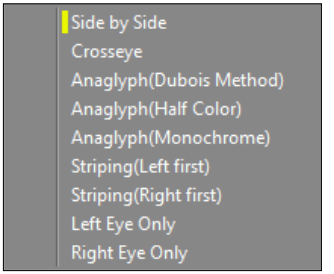
To create a stereo image, first enable the stereo camera function by checking the **Stereo Camera** checkbox in the **Stereo Settings** group of the Camera Window.



Stereo Settings

◆ **Stereo Camera**

When this checkbox is checked, a stereo image will be formed when you perform rendering. Moreover, you can select a stereo method from the pop-up menu.



◆ **Views**

You can set the number of views.

◆ **Camera Type**

You can set different camera arrangements. To obtain stable results, select **Parallel**. To obtain stronger stereoscopic effects, select **Convergence**.

◆ **Monitor Setting**

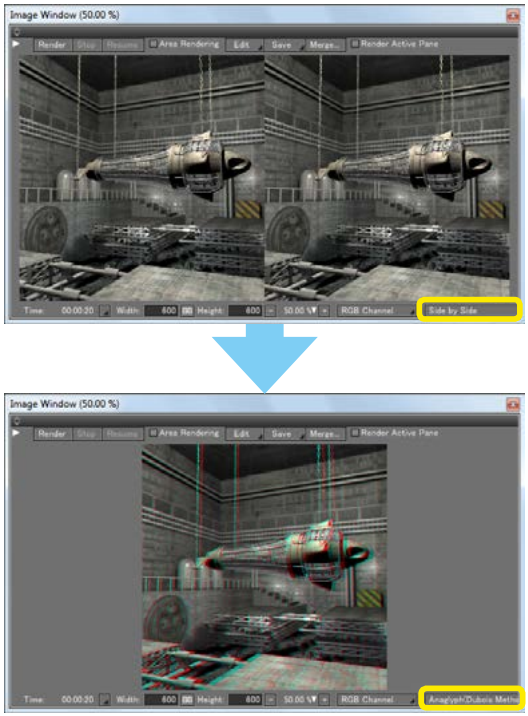
You can set the physical size and resolution of the display equipment.

◆ **Profile**

You can adjust the stereoscopic effects. You can also perform custom adjustment by numerical input, in addition to preset for automatically setting values according to the monitor setting.

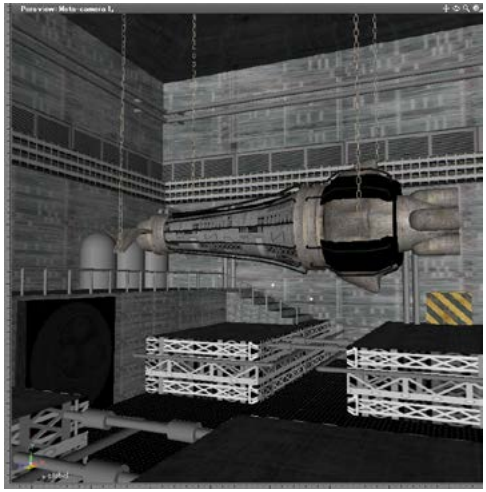
Switching the Stereo Images

Once you perform rendering with the stereo function, you can change the image arrangement from the **Stereo Settings** pop-up menu at the bottom of the Image Window without having to perform rendering again.

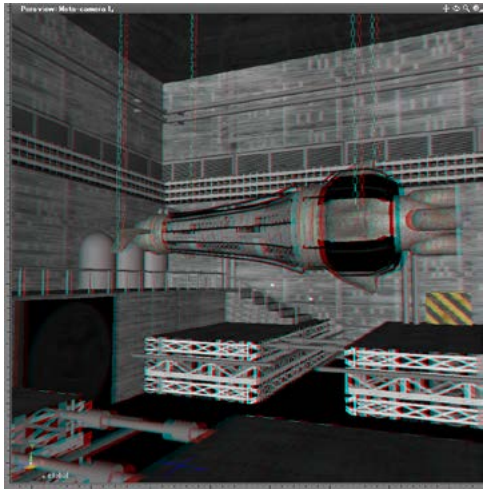


Moreover, you can perform the work with the viewport displayed in stereo mode, by turning on the **Switch Stereo** button on the **Control Bar.** The default is the anaglyph display seen through the bluish red glasses. When using the NVIDIA 3D VISION PRO, however, the work can be done in full-color stereo mode. (This mode is supported only by the Windows versions.)

Stereo: Off



Stereo: On (anaglyph display)



TIP

When using NVIDIA 3D VISION PRO, it is necessary to update settings on the NVIDIA control panel. Moreover, settings are required for some 3D glasses and displays. The contents of individual settings may differ. Refer to the manual for each piece of machinery.

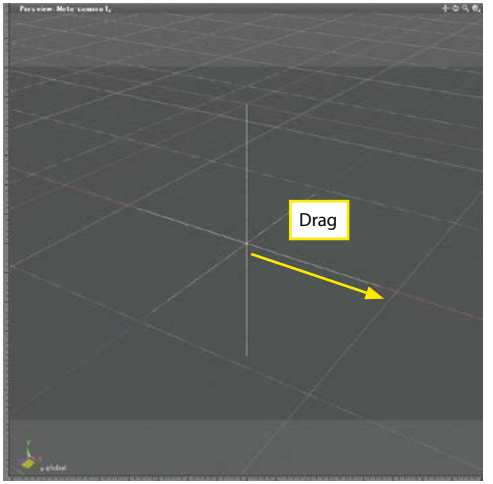
Creating Lights

Point Lights

A point light represents a small light such as a light bulb.

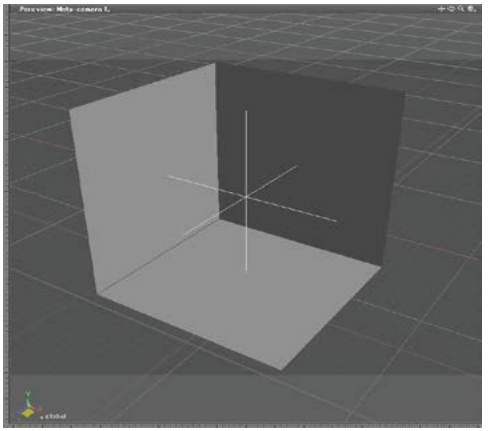
1 From the **Toolbox**, select **Create** > **Light/Camera** > **Point Light**.

2 Drag to create a point light. The radiation intensity (brightness) depends on the amount of dragging.

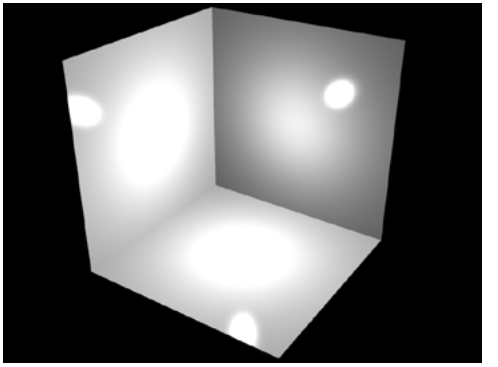


3 The following shows the result of applying ray tracing to the space incorporating the floor and two walls.

◆ **Point Light Placement**



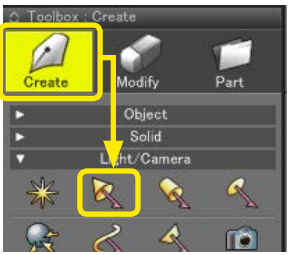
◆ **Result of Ray Tracing**



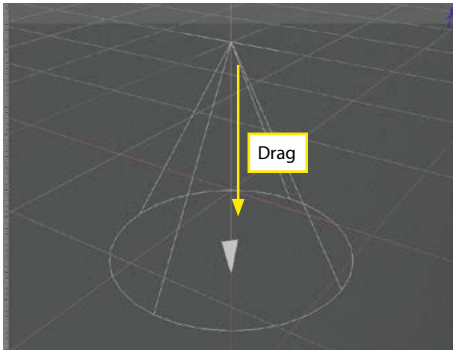
Spotlights

Spotlight is achieved by limiting the irradiation angle of the point light.

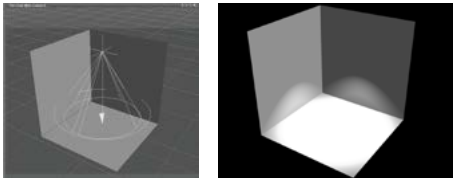
1 From the **Toolbox**, select **Create** > **Light/Camera** > **Spotlight**.



2 Drag to create a spotlight.
The spotlight casts illumination in the drag direction, with the radiation intensity (brightness) depending on the amount of dragging.



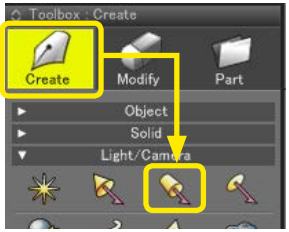
3 The following shows the result of applying ray tracing to the space incorporating the floor and two walls. You can apply a softness to the space.



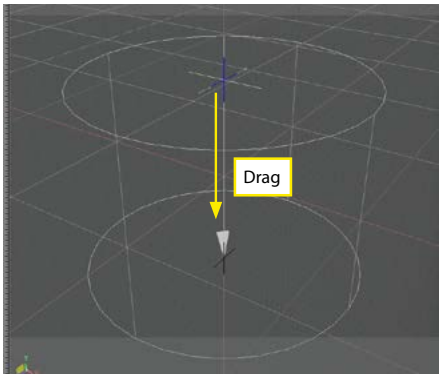
Directional Lights

Directional Light reproduces a light that mimics a light at a considerable distance, such as the sun, or whose rays are parallel and non-divergent, such as a laser pointer.

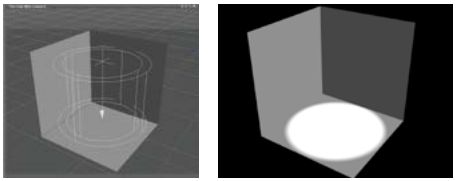
1 From the **Tool Box**, select **Create** > **Light/Camera** > **Directional Light**.



2 Drag to create a directional light. The directional light casts illumination in parallel to the drag direction.



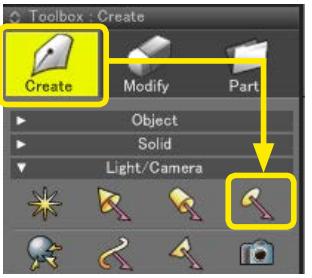
3 The following shows the result of applying ray tracing to the space incorporating the floor and two walls. You can apply a softness to the space.



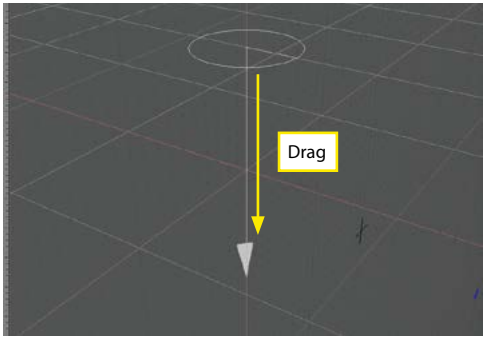
Distribution Lights

With the Professional version, you can create a **Distribution Light** that reproduces the amount of irradiation from an actual lighting fixture. You can download distribution light data (IES) from the lighting fixture manufacturer and so on.

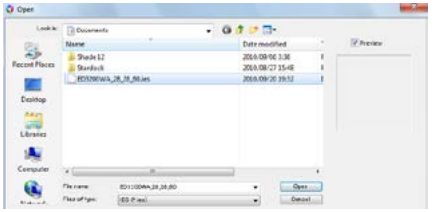
1 From the **Toolbox**, select **Create** > **Light/Camera** > **Distribution Light**.



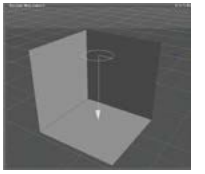
2 Drag the viewport to create a distribution light. The distribution light casts illumination in the drag direction.

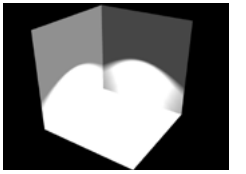


3 Select the distribution light data to be used, from the window for selecting distribution light data (IES).



4 The following shows the result of applying ray tracing to the space incorporating the floor and two walls. The way in which the distribution light actually casts illumination depends on the distribution light data which was read.

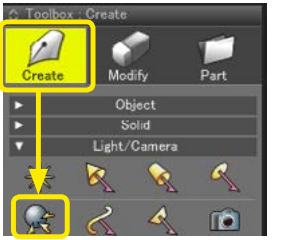




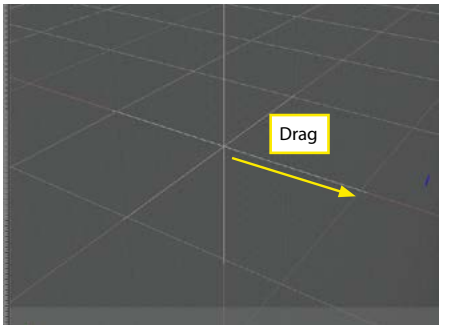
Ambient Lights

Ambient Light is a light that illuminates an entire scene with an even degree of brightness. Ambient Light reproduces light that is evenly reflected in all directions in the same way as when light is scattered by particles of air in the atmosphere.

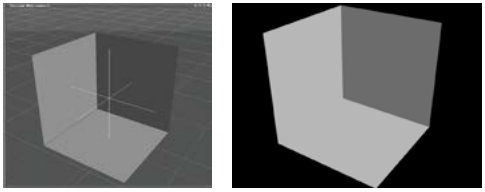
1 From the **Tool Box**, select **Create** > **Light/Camera** > **Ambient Light**.



2 Drag the viewport and create an ambient light.



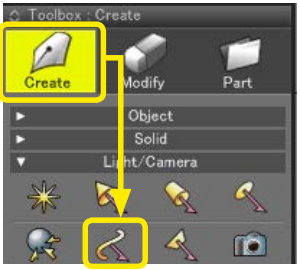
3 The following shows the results of applying ray tracing to the space incorporating the floor and two walls. Only the brightness and colors of the ambient light are reflected, rather its scale and position.



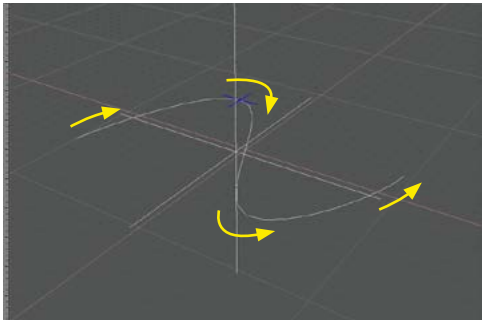
Linear Lights

Linear Light reproduces a light consisting of a line with a certain width (length).

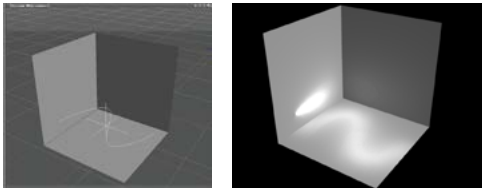
1 From the **Tool Box**, select **Create** > **Light/Camera** > **Linear Light**.



2 Click or drag the viewport to create a line object that will become the linear light. Create the line object in the same way as any other line object.



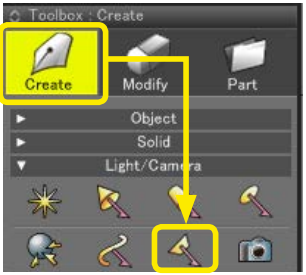
3 The following shows the results of applying ray tracing to the space incorporating the floor and two walls.



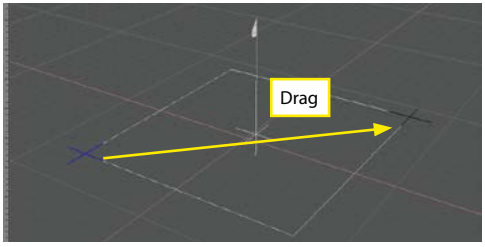
Area Lights

Area Light reproduces a light consisting of a plane of a certain size (area).

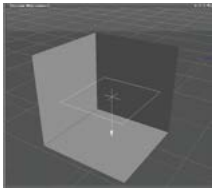
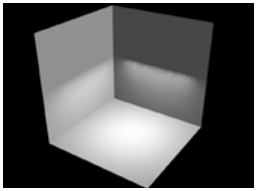
1 From the **Tool Box**, select **Create** > **Light/Camera** > **Area Light**.



2 Drag in the viewport and create a rectangle to create an area light. Create the rectangle in the same way as any other rectangle. If you create the rectangle on the XZ plane, the light will be aimed upwards. To aim the light downwards, rotate the rectangle downwards. Alternatively, reverse the direction of the rectangle from the **Flip Face** checkbox.



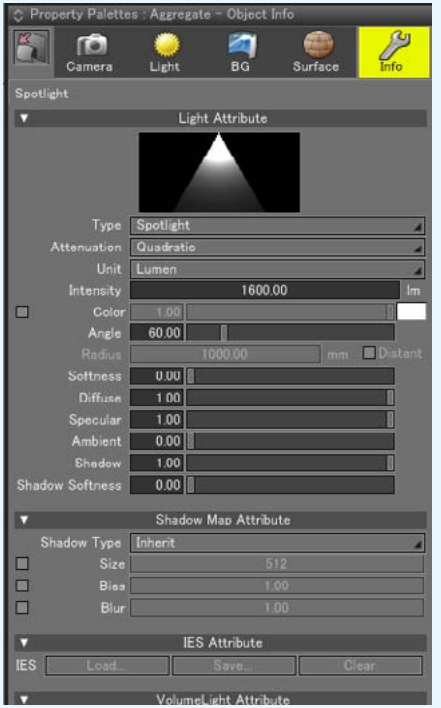
3 The following shows the result of applying ray tracing to the space incorporating the floor and two walls.

TIP

You can confirm and edit detailed light information using the Object Info Window.

Select a light from the **Browser** to display information on that light. The settings that can be modified depend on the type of light.



For a **spotlight**

TIP

You can switch between point lights, spotlights, directional lights, and distribution lights using the **Type** pop-up menu of the Object Info Window.

TIP

You can convert a line object into a **Linear Light** or **Area Light**. To do this, select the line object to be converted into a light and then enter a numerical value for **Brightness** of the **Light Attribute** group in the **Object Info** Window.

You can switch between **Linear Light** and **Area Light** from the **Type** pop-up menu. You can create an area light from **Closed Line** having a face.

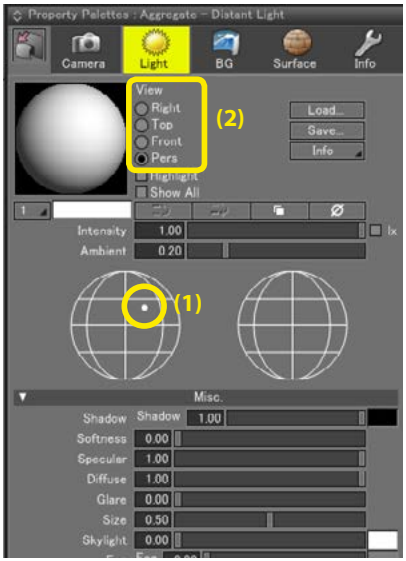
TIP

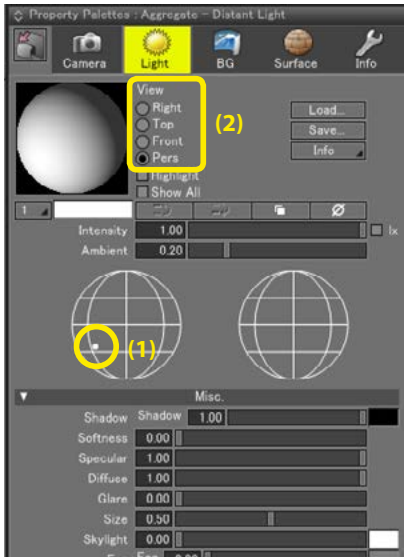
Check the **Visible** checkbox under the Light Settings of the Object Info Window to enable a linear light or area light to be rendered.

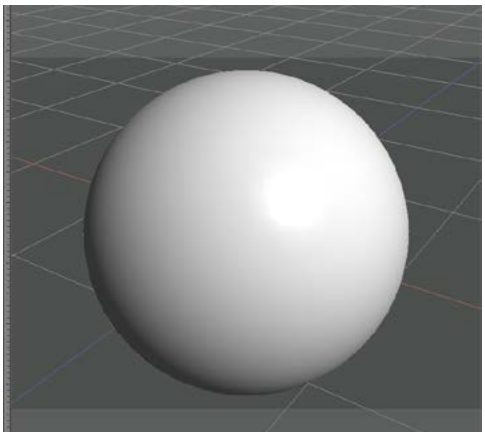
Using a Distant Light

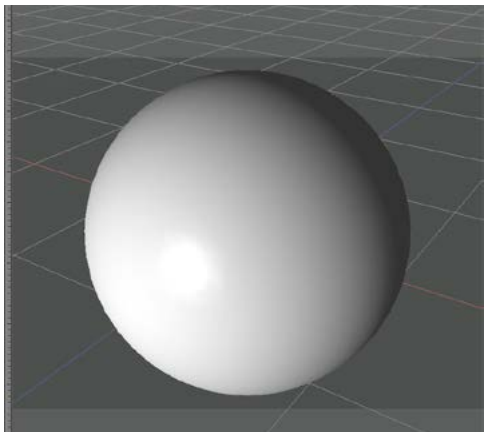
You can manipulate the direction of **Distant Light,** which mimics a light at a considerable distance, such as the sun, and which illuminates everything in the scene equally.

1 Click the light direction setting hemisphere in the Distant Light Window and set the position of the distant light **(1)**. Switch the reference level of the hemisphere with the **View** radio button **(2)**.





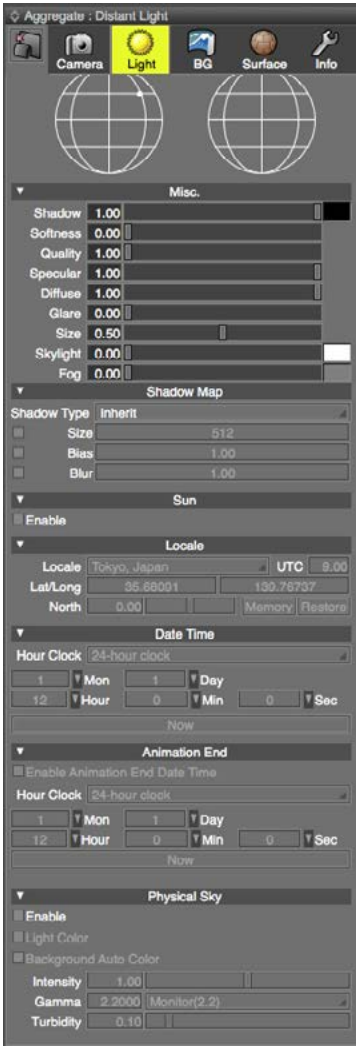




Physical Sky

Physical Sky is available in Shade3D Standard and Professional.

Physical Sky enables you to automatically generate the Background Upper Base Color based on the distant light direction and color settings. By combining this with the sun settings, the distant light color can also be calculated automatically.



Sky in Tokyo on November 26:

7:30 AM

12:00 Noon

3:30 PM

Enable

When selected, a sky pattern is used for the Background Upper Base Color based on the time, date and locale. When enabled, the Upper Base Color in the Background Window cannot be modified.

Light Color

When selected, the sunlight color, calculated from the light direction, is used as the color of the first distant light.

Background Auto Color

When selected, the Background Window's Lower Base Color and Cloud and Haze layer settings are corrected according to the angle of the setting sun. As the sun goes down below the horizon, the sky is adjusted to appear darker.

Intensity

The brightness of the sky. Lowering this value mutes the background; raising it makes it brighter.

Since our eyes naturally adjust to the different light levels of day and night, the intensity setting should be adjusted for day versus evening or early morning times.

Intensity does not affect the calculation of the color of the distant light when the Light Color checkbox is selected.

Gamma

Sets the inverted gamma value of the Background and Light Color.

Select from Linear(1.0), Monitor(1.0/2.2) or select Numeric to enter a custom value in the text box.

Turbidity

The degree of haziness and cloudiness of the atmosphere.

Smaller values result in less brilliant sunsets, but can reduce excessive white light around the sun when rendering daylight.

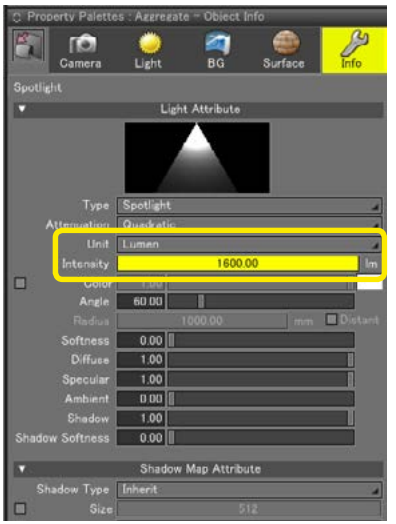
The turbidity value affects the calculation of the color of the distant light when the Light Color checkbox is selected.

Brightness Values for Common Light Types

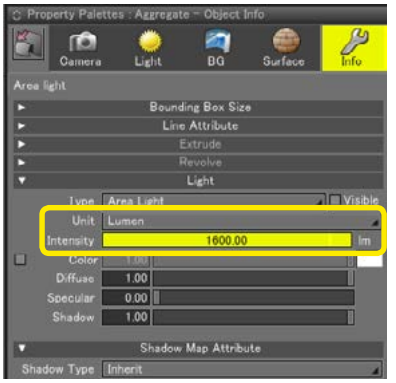
This section provides lumen values for general lights.

Select a light. Then, from the **Object Info** Window, set **Lumen** from the **Unit** pop-up menu and set a table value in the **Brightness** text box.

Point Light, Spotlight, Directional Light, and Distribution Light



Area Light and Linear Light



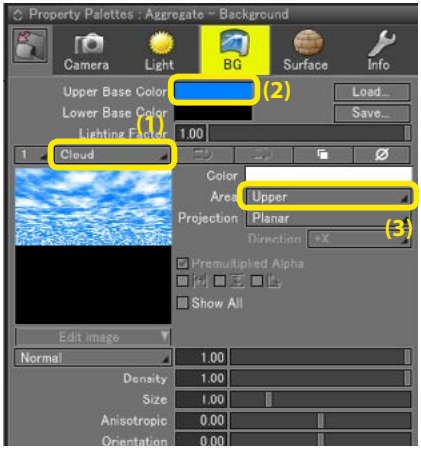
Light type	Total luminous flux (Unit: Lumen)
60 W incandescent light bulb (white-coated)	810
100 W incandescent light bulb (white-coated)	1520
50 W tungsten halogen lamp	1000
100 W tungsten halogen lamp	1600
15 W compact self-ballasted fluorescent lamp (daylight)	780
10 W straight fluorescent lamp (white, 330 mm in length)	460
15 W straight fluorescent lamp (white, 436 mm in length)	820
20 W straight fluorescent lamp (white, 580 mm in length)	1160
30 W straight fluorescent lamp (white, 630 mm in length)	1700
40 W straight fluorescent lamp (white, 1198 mm in length)	3000

9. Background

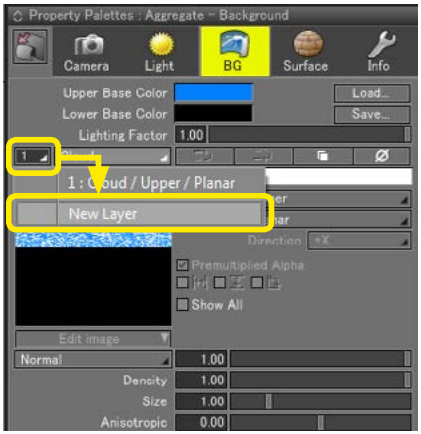
Cloud and Ocean Patterns

You can set clouds and/or the ocean as a background.

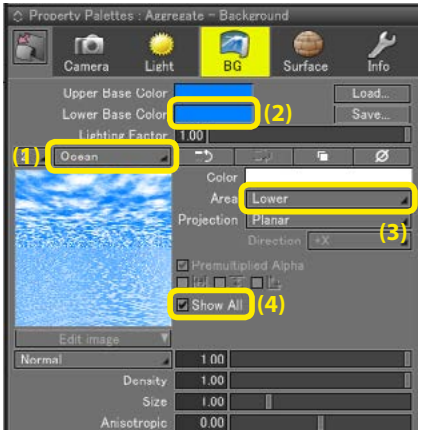
1 Select **Cloud** from the pattern pop-up menu of the **Background** Window **(1)**. Set blue for **Upper Base Color** **(2)**. From the **Area** pop-up menu, select **Upper** **(3)**.



2 From the **Layer** pop-up menu, select **New Layer** and then create a new layer.

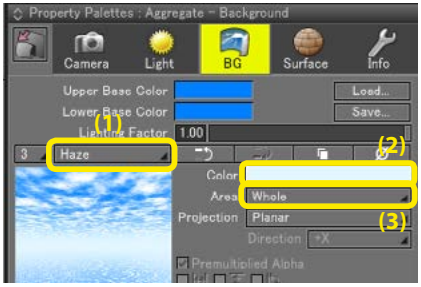


3 From the pattern pop-up menu, select **Ocean** **(1)**. Set blue for **Lower Base Color** **(2)**. From the **Area** pop-up menu, select **Lower** **(3)**. Check the **Show All** checkbox **(4)**.

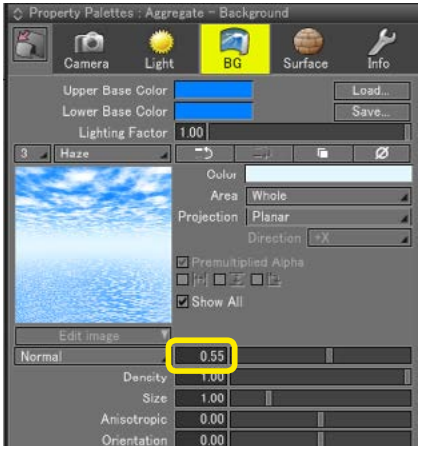


4 From the **Layer** pop-up menu, select **New Layer** and then create a new layer.

5 From the pattern pop-up menu, select **Haze** **(1)**. Set light blue in the pattern color box **(2)**. From the **Area** pop-up menu, select **Whole** **(3)**.



6 Enter **0.55** in the mapping text box.

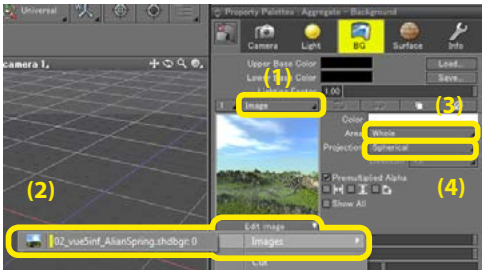


7 Confirm the background by rendering the scene.

Using an Image as the Background

You can set an image as the background.

1 Select **Image** from the pattern pop-up menu of the **Background** Window **(1)**. Select a previously loaded image from **Edit image**. Or, load a new image using **Load (2)**. From the **Area** pop-up menu, select one of **Whole**, **Upper**, or **Lower** as the area to be used **(3)**. From the **Projection** pop-up menu, select the projection method **(4)**.



5 From the **Display** pop-up menu of the viewport, select **Figure Window** > **Show Background** to check the background.

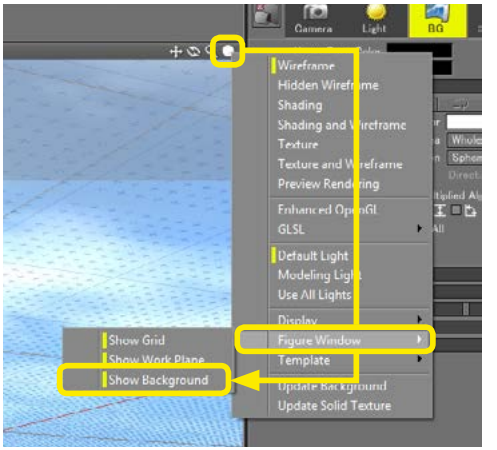
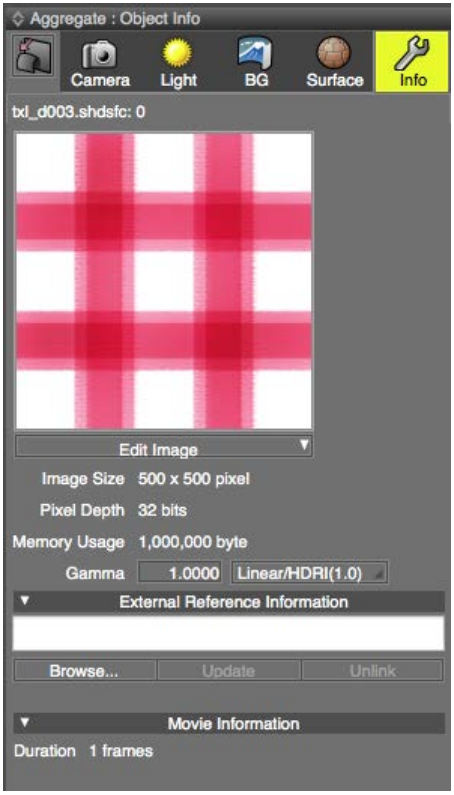


Image Gamma Correction

Images created in image-editing software for use as textures or backgrounds sometimes need gamma correction to render correctly (particularly when using global illumination).

With the image selected in the Browser, switch to the Object Info Window to apply gamma correction. LDR images in 32 bit color should be set to **Monitor (1.0/2.2)**. HDR images such as OpenEXR should be set to **Linear/HDRI (1.0)**. Additionally, setting the gamma value to 2.2 in the Color Correction Window can give more realistic rendering results.



Gamma

The gamma correction value. Choose Linear/HDRI (1.0) or Monitor (1.0/2.2), or choose Numeric to enter a different value in the text box.

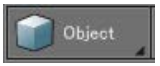
Move, Morph, and Copy

You can use the following methods to move, morph, and copy selected objects and control points.

- From **Toolbox**, select **Move/Copy** > **Move** or **Copy** to perform movement, morph, and copy.
- Specify numerical values for movement, morph, and copy.
- Use **Manipulator** to perform movement, morph, and copy.

Operational Differences that Depend on the Editing Mode

If you perform movement, morph, or copy in Object mode, the result is applied to the entire object. The copy operation can be used only in Object mode.

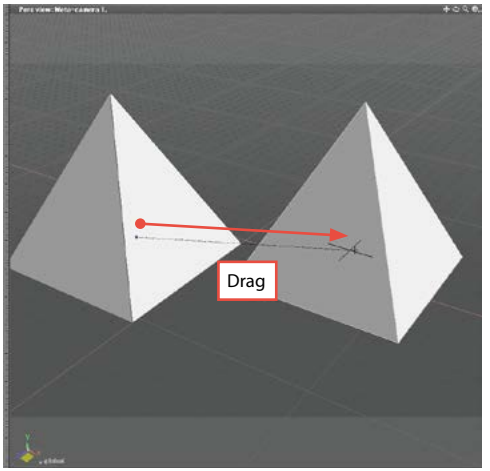


Modify Mode allows move, morph, and copy to be applied to selected control points, vertices, edges, and faces.

Move, Morph, and Copy from the Toolbox

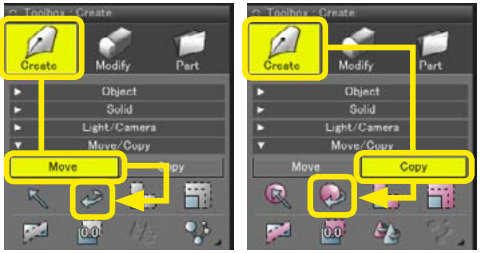
You can select a tool and drag in the viewport to move, morph, or copy objects.

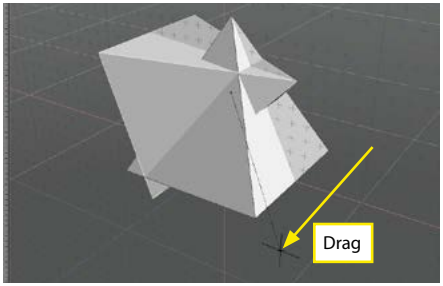
◆ **Translate**



Example of dragging on the Bottom (XZ Plane)

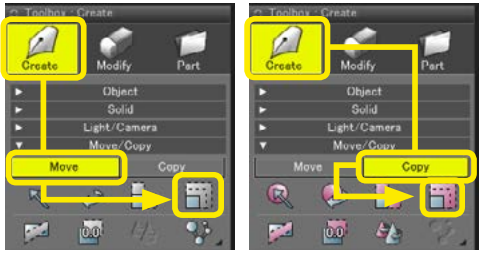
Rotate

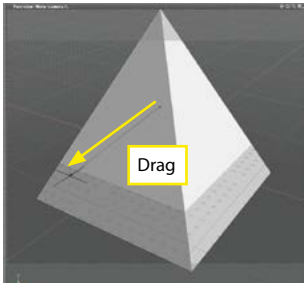




Example of Dragging on the Front (XY Plane)

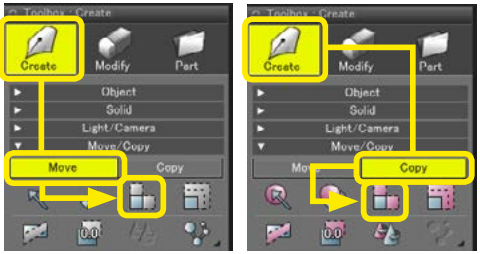
Uni-Scale

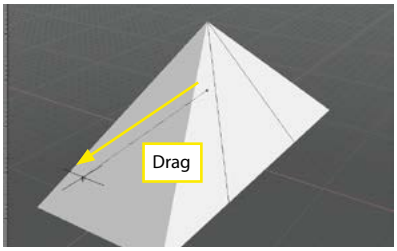




Example of Dragging on the Bottom (XZ Plane)

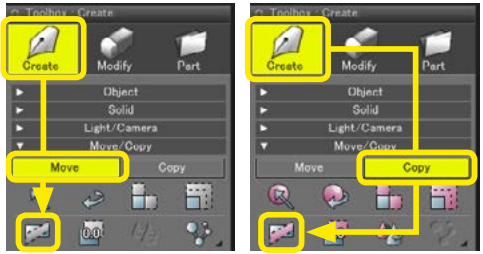
Scale

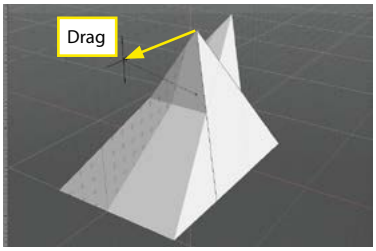




Example of Dragging on the Bottom (XZ Plane)

Skew





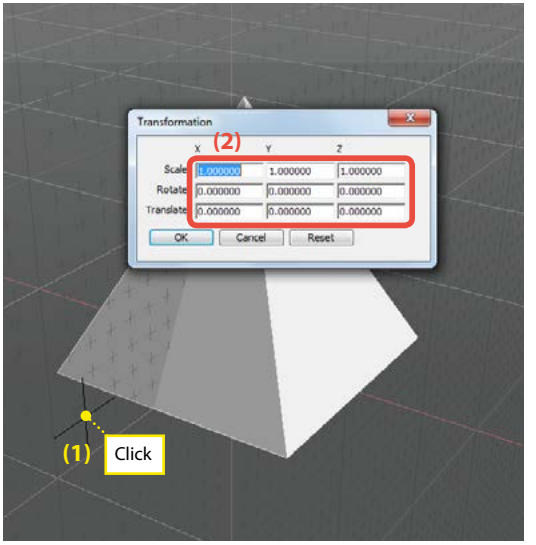
Example of Dragging on the Side (YZ Plane)

TIP

- For tools other then the translate tool, reference points are set in the center of a selected object or point.
- For tools other then the translate tool, you can change their reference points by clicking the viewport.
- If you drag while holding down the Shift key, you can limit mouse movement to 45 degrees.

Move, Morph, and Copy by Specifying Values

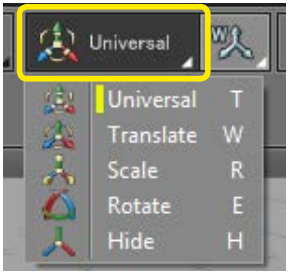
Select a tool, click the viewport, and then set the reference point **(1)**. Then, from the **Transformation** dialog enter numerical values in the **Scale**, **Rotate**, and **Translate** text boxes **(2)**.



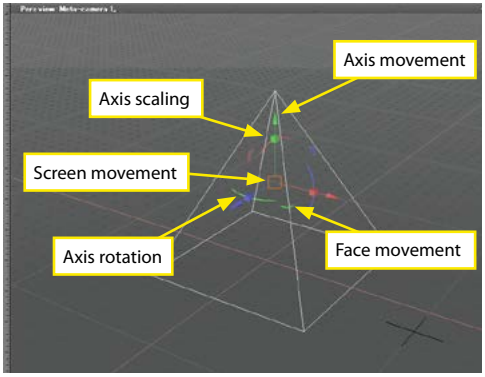
Move, Morph, and Copy Using the Manipulator

From the **Control Bar**, click the **3D Manipulator** button to switch to a manipulator that is suitable for the application, and then move each part of the manipulator for move and morph.

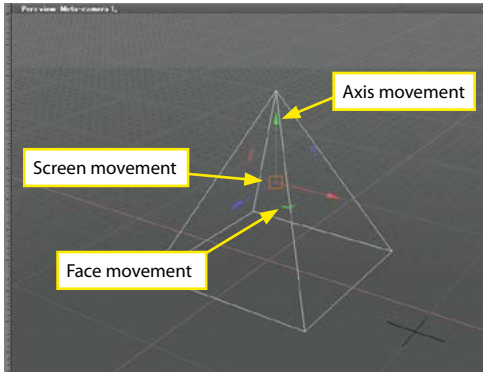
Moreover, if you drag while holding down the **Z** (Windows) or option (Mac OS) key, an element is copied. If you drag while holding down the Shift key in the same way as for move/copy with a tool, you can limit mouse movement to 45 degrees.



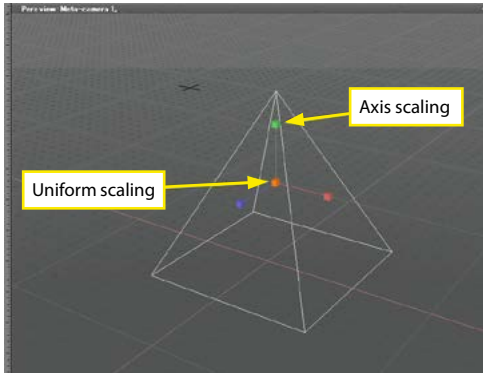
Universal Manipulator



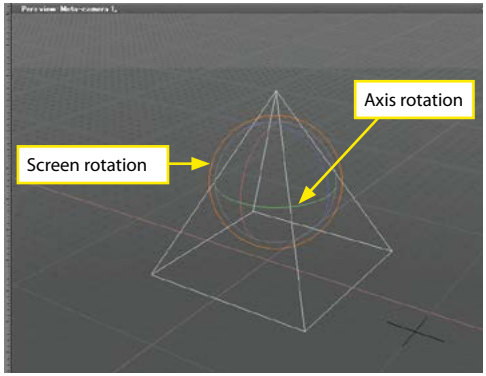
Translate Manipulator



Scale Manipulator



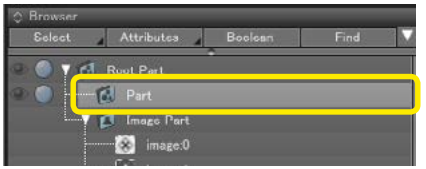
Rotate Manipulator



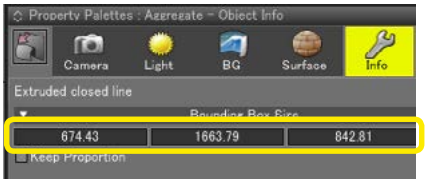
Changing External Dimensions with Numeric Values

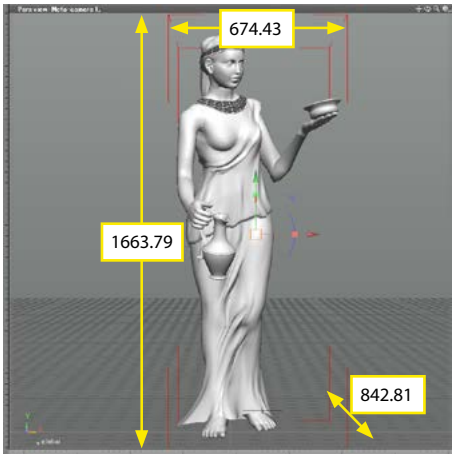
You can change the external dimensions of a selected object by using the bounding box.

1 Select the object to be changed. If the object consists of multiple objects, collect them into the part and then select it.

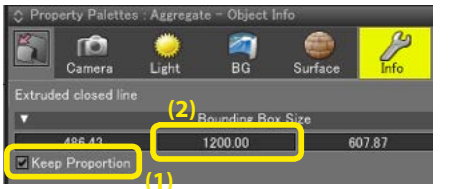


2 Switch to the Object Info Window. In **Bounding Box Size**, you can check the object size to be changed. **Bounding Box Size** contains numeric values for **X, Y,** and **Z,** in order from the left.

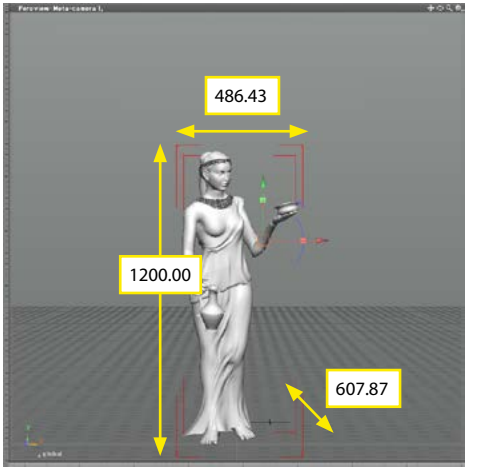




3 Enter numerical values in **Bounding Box Size** to change the outer dimensions of the selected object. Check the **Keep Proportion** checkbox **(1)** and enter **1200** in **Y (2)**. **X** and **Z** are automatically changed.



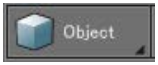
4 The object is proportionally reduced in size, when **1200** is set for **Y.**



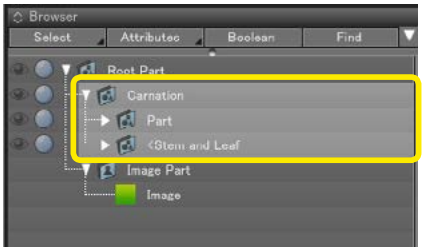
Copying an Object in the Same Position

Selected objects can be copied without moving them, creating a duplicate in the same position.

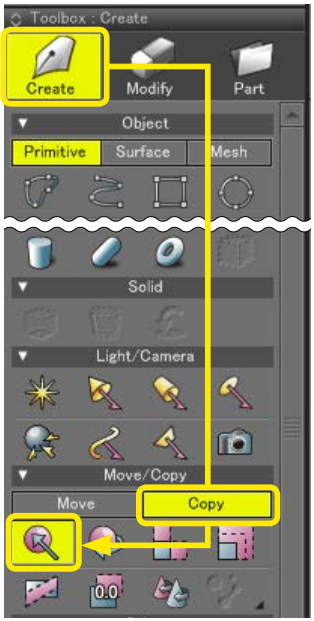
1 Switch to Object mode.



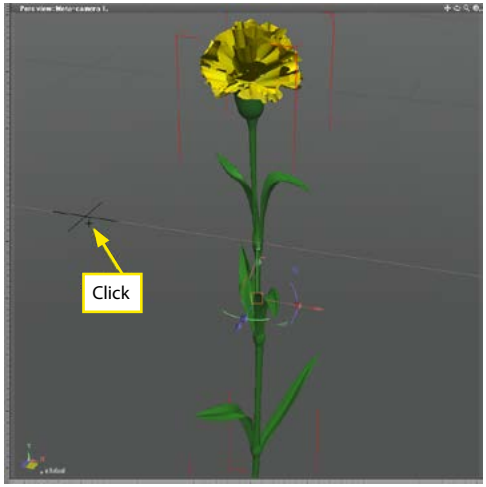
2 Select the object to copy.



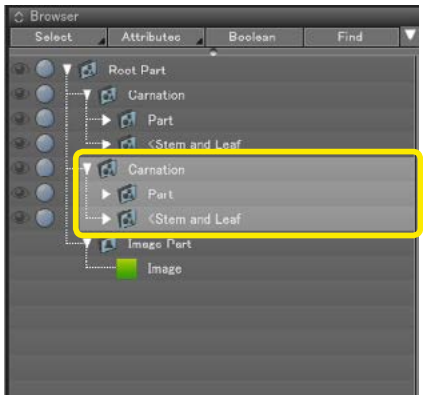
3 From the **Toolbox**, select **Create** > **Copy** > **Translate**.



4 Click the margin of the viewport.



5 The object is copied in the same position.



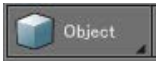
TIP

You can copy the selected object into the same position by clicking while holding down the Shift + z (Windows) key or the Shift + option (Mac OS) key.

Creating a Mirror Copy of Objects

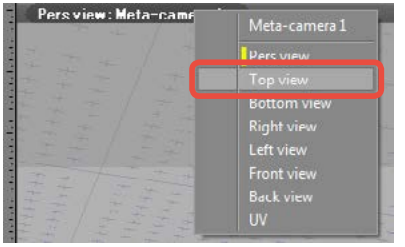
You can create a mirror copy of a selected object.

1 Switch to Object mode.



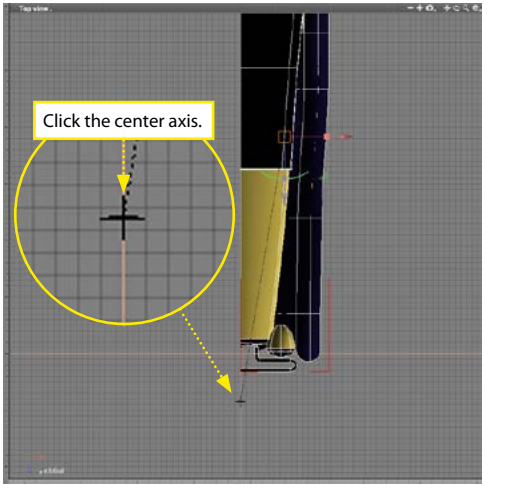
2 Turn on **Snap** in the Control Bar.

3 Switch the viewport to **Top View**.

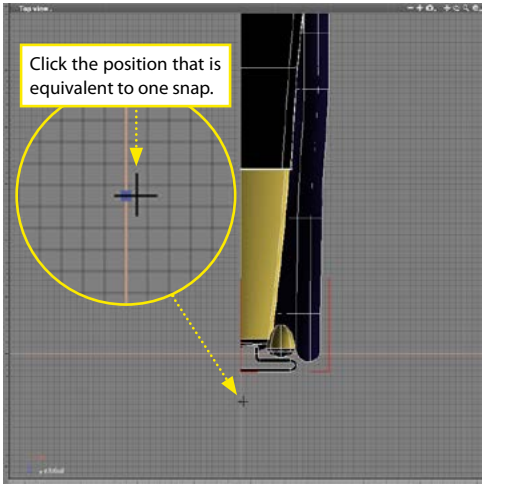


4 From the **Toolbox**, select **Create** > **Copy** > **Scale**.

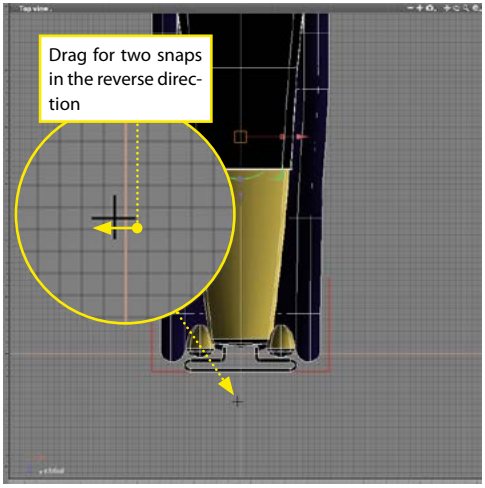
5 Click the position in the viewport to be used as the reference point for the mirror copy.



6 Move the mouse by one snap (half a square) in the opposite direction (object direction) to the reverse direction and then click the position.



7 To make a mirror copy, drag for two snaps (one grid square) in the direction to mirror the object.



TIP

The reference point for the mirror copy is the distance clicked in the opposite direction (toward the object) to the mirror direction from the **reference point** that was clicked initially. The object is copied, mirrored but at the same magnification, by dragging for the same amount as the reference but in the mirror direction.

TIP

When making a copy by specifying numeric values, you can make a mirror copy by entering **-1** in the **Scale** text box of the axis that will be reversed, in the **Transformation** dialog box.

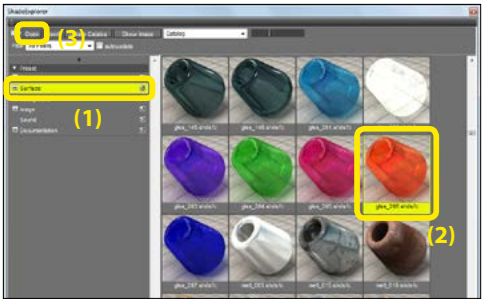
11. Surface Attributes

Applying Surface Attributes

From ShadeExplorer

1 Select the object or part for which surface attributes are to be set. Once you select a part, the same surface attributes are assumed by all the objects constituting that part.

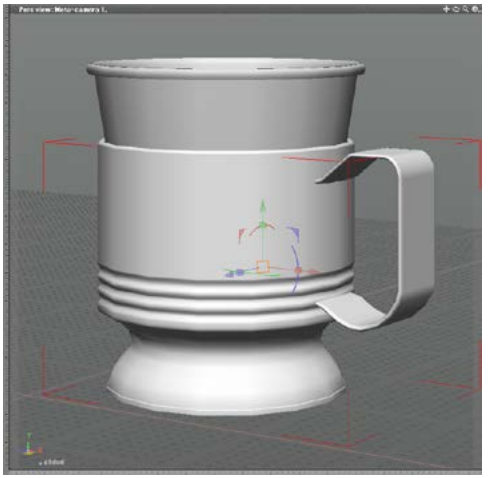
2 Open ShadeExplorer and then select **Surface** from the browser area (1). Select the surface attribute from the preview area (2) and then click **Open** (3).



From the Surface Window

1 Select the object or part for which the surface attributes are to be set.

2 Click the **Create** button of the Surface Window and then create a surface attribute. The white-base basic surface attribute is set. Set it as required.



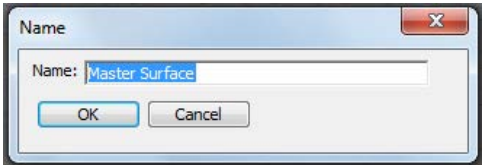
Setting Common Surface Attributes for Multiple Objects

Using a **Master Surface**, you can set the same surface attributes for multiple objects. When you change the master surface setting, the change is reflected on all the objects to which that setting applies.

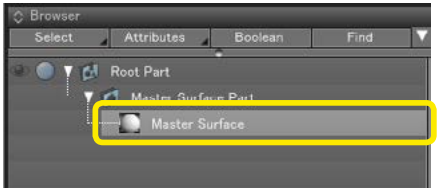
Creating a New Master Surface

1 From the **Toolbox**, select **Create** > **Other** > **Master Surface**.

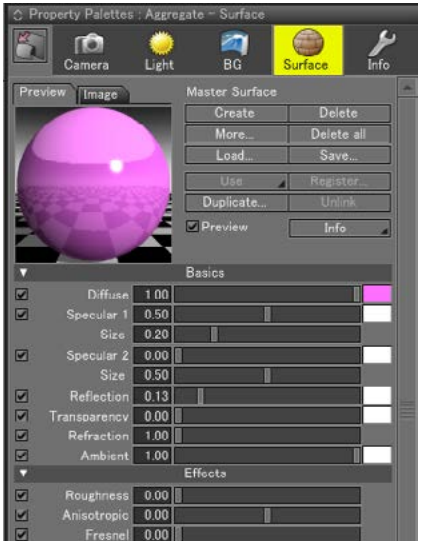
2 Set the name of the master surface in the displayed **Name** dialog.



3 The master surface is created in **Master Surface Part**.



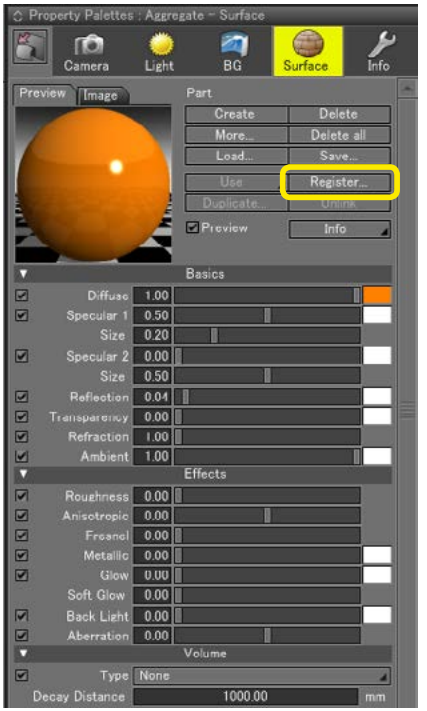
4 Set the surface attributes for the master surface in the Surface Window.



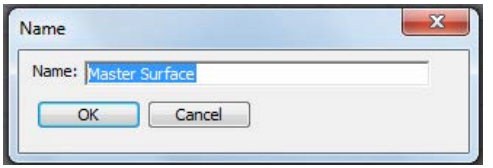
Saving a Surface as a Master Surface

1 Select the object for which the surface attribute to be registered as the master surface is set, and then display the **Surface** Window.

2 From the **Surface** Window, click **Register**.



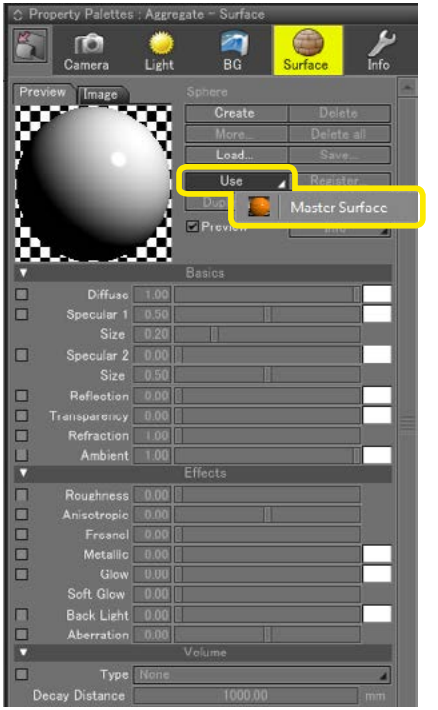
3 Enter a name and then register the surface attribute as the master surface.



Applying the Master Surface

1 Select the object for which the master surface is to be set.

2 From the **Use** pop-up menu of the **Surface** Window, select and set the created master surface.



Surface Attribute Types

Basic Settings

You can set the basic settings and their values for surface attributes.

Diffuse

Set the diffuse color and weight of an object.

Diffuse Color

Weight: 1.0, 0.6, and 0.3 from the left

Specular 1 and Size, Specular 2 and Size

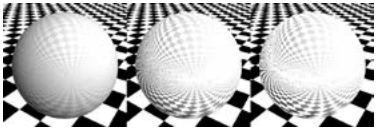
Set the specular color, intensity, and size.

Intensity: 0.0, 0.5, and 1.0 from the left

Size: 0.2, 0.5, and 0.8 from the left

Reflection

Set the reflection intensities and colors from other objects and the background.



Reflection ratio: 0.1, 0.5, and 0.9 from the left

Transparency

Set the transparency intensities and colors of objects.

Transparency: 0.2, 0.5, and 0.8 from the left

TIP

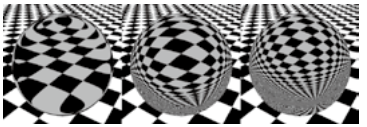
If you use Reflection and Transparency and if other items such as Diffuse are bright, highlight clipping may occur. You can easily distinguish the effect by adding the weights of Diffuse, Reflection, and Transparency so that the addition result is 1.0.

Transparency: 0.8

Diffuse: 1.0, 0.5, and 0.0 from the left

◆ Refraction

Set the refraction ratio by which an image or objects are visible through the object.



Diffuse Color: 0.0, Transparency: 0.8

Refraction: 1.02, 1.33, and 1.5 from the left

◆ Ambient

Set the color and intensity of the ambient light for each object.

0.25, 0.5, and 0.75 from the left

Effects

Set effect settings and values for the surface attributes.

◆ Roughness

Set the degree of surface roughness on the surface of the object for which reflection and transparency have been set. This setting item is valid for path tracing.

Roughness: 0.0, 0.5, and 1.0 from the left

◆ Anisotropic

Set the ratio of specular and roughness that stretch in a given direction. For PolygonMesh_Roughness, the direction changes according to the UV value assigned to UV1 (parameter UV).

Anisotropic: -1.0, -0.5, and 1.0 from the left

◆ Fresnel

Set the ratio by which the reflection ratio changes according to the viewing angle. This attibute is valid for an object for which transparency, reflection, and specular were set.

Reflection: 1.0

Fresnel: 0.6, 0.8, and 0.94 from the left

◆ Metallic

Set the intensity with which a pseudo metallic effect is applied.

Diffuse color: Dark gray

Metallic: 0.2, 0.5, and 1.0 from the left

◆ Glow

Set the intensity with which an object is irradiated.

Glow: 0.2, 0.5, and 1.0 from the left

◆ **Soft Glow**

Set the degree of blur of radiation.

Diffuse Color: 0.0, Transparency: 1.0, Glow: 1.0

Soft Glow: 0.1, 0.5, and 1.0 from the left

◆ **Back Light**

Set the intensity at which light from the rear is reflected by an object.

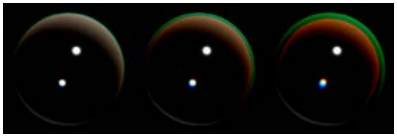
Point light in the center of the sphere, Transparency: 0.3

Back light: 0.2, 0.6, and 0.8 from the left

◆ **Aberration**

Set the intensity of any color aberration.

This setting item is valid for an object for which transparency and refraction are set.



Transparency: 1.0

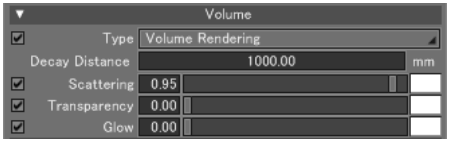
Aberration: 0.2, 0.5, and 1.0 from the left

Volume Settings

You can use the volume options to set up textures of the object interior with volumetric properties. Use **Volume Rendering** to represent a translucent body, meaning that the object is textured with a semi solid set of attributes. **Subsurface Scattering** is used to simulate how light is scattered on an object surface or perceptually right below the initial surface. This item enables a soft texture on a surface to be represented.

All of the settings are common to **Volume Rendering** and **Subsurface Scattering** of **Type**.

However, **Volume** is supported only by the Professional and Standard versions. Moreover, **Subsurface Scattering** is supported only by the Professional version.



◆ **Type**

As the type, you can select from **Volume Rendering**, **Subsurface Scattering** and **None**.

The result of volume rendering depends on whether the object to be configured is a transparent or opaque body. For a transparent body, the volume rendering calculation result is multiplied by the transparent color. The refraction ratio and the color of the object inside the volume are also reflected. For a opaque body, the volume rendering results are added as is. The refraction ratio and any object inside the volume are not reflected.

◆ **Decay Distance**

Set the density for the volume. The brightness falls to 0 when light enters an object and travels for this distance.

◆ **Scattering**

Set the volume color and weight.

◆ **Transparency**

Use the color of the part that becomes translucent, as well as the color of the shadow cast by the volume. Decay distance varies with the color.

◆ **Glow**

Set the glow color and weight of the volume.

For Volume Rendering

(Shade3D Standard and Professional)

◆ **Decay Distance (opaque)**

▼Basic setting

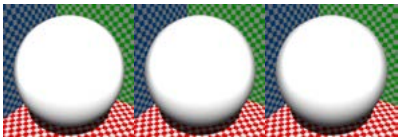
Transparency: 0.0

▼Volume setting

Transparency color: None

Glow: None

Decay distance: 1000, 2000, and 3000 from the left



◆ **Decay Distance (transparent)**

▼Basic setting

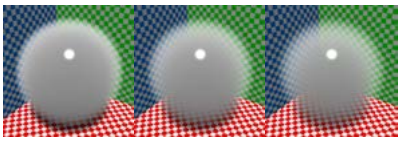
Transparency: 1.0

▼Volume setting

Transparency color: None

Glow: None

Decay distance: 1000, 2000, and 3000 from the left



◆ **Scattering (opaque)**

▼Basic setting

Transparency: 0.0

▼Volume setting

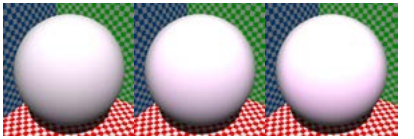
Decay distance: 2500

Scattering (color): R255, G128, and B255

Transparency color: None

Glow: None

Scattering (weight): 0.25, 0.5, and 0.75 from the left



◆ **Scattering (transparent)**

▼Basic setting

Transparency: 0.0

▼Volume setting

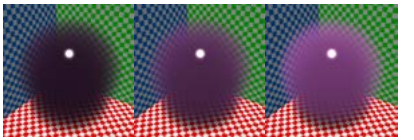
Decay distance: 2500

Scattering (color): R255, G128, and B255

Transparency color: None

Glow: None

Scattering (weight): 0.25, 0.5, and 0.75 from the left



◆ **Transparency (opaque)**

▼Basic setting

Transparency: 0.0

▼Volume setting

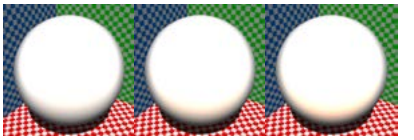
Decay distance: 2500

Scattering: None

Transparency (color): R255, G128, and B0

Glow: None

Transparency (weight): 0.25, 0.5, and 0.75 from the left



◆ **Transparency (transparency)**

▼Basic setting

Transparency: 1.0

▼Volume setting

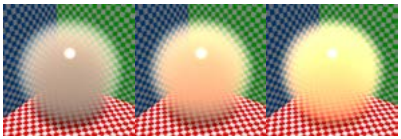
Decay distance: 2500

Scattering: None

Transparency (color): R255, G128, and B0

Glow: None

Transparency (weight): 0.25, 0.5, and 0.75 from the left



◆ **Glow (opaque)**

▼Basic setting

Transparency: 1.0

▼Volume setting

Decay distance: 2500

Scattering: None

Transparency color: None

Glow (color): R255, G255, and B0

Glow (weight): 0.25, 0.5, and 0.75 from the left

◆ **Glow (transparency)**

▼Basic setting

Transparency: 1.0

▼Volume setting

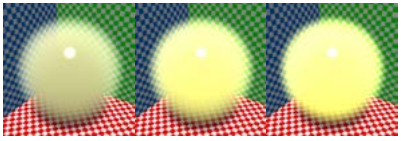
Decay distance: 2500

Scattering: None

Transparency color: None

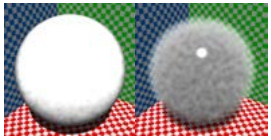
Glow (color): R255, G255, and B0

Glow (weight): 0.25, 0.5, and 0.75 from the left



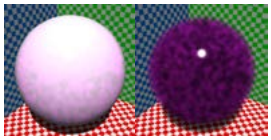
You can control the parameters used for volume rendering by using mapping. From the **Attribute** pop-up menu of the **Mapping** group in the surface attribute window, select and set the associated parameters.

◆ **Spotted + Volume Decay Distance**



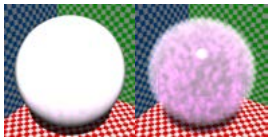
Left: opaque body, right: transparent body

◆ **Spotted + Volume Color**



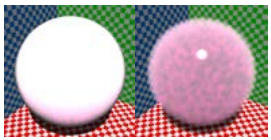
Left: opaque body, right: transparent body

◆ **Spotted + Volume Transparency**



Left: opaque body, right: transparent body

◆ **Spotted + Volume Glow**



Left: opaque body, right: transparent body

For Subsurface Scattering (Shade3D Professional)

◆ **Decay Distance (opaque)**

▼Basic setting

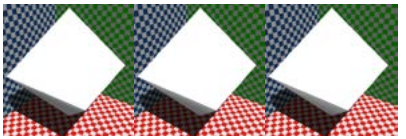
Transparency: 0.0

▼Volume setting

Transparency color: None

Glow: None

Decay distance: 1000, 2000, and 3000 from the left



◆ **Decay Distance (transparent)**

▼Basic setting

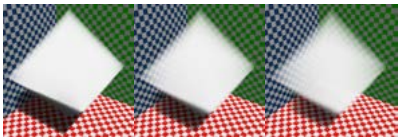
Transparency: 1.0

▼Volume setting

Transparency color: None

Glow: None

Decay distance: 1000, 2000, and 3000 from the left



◆ **Scattering (opaque)**

▼Basic setting

Transparency: 0.0

▼Volume setting

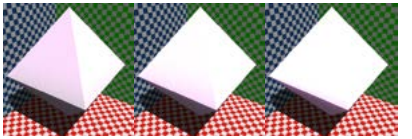
Decay distance: 500

Scattering (color): R255, G128, and B255

Transparency color: None

Glow: None

Scattering (weight): 0.25, 0.5, and 0.75 from the left



◆ **Scattering (transparent)**

▼Basic setting

Transparency: 0.0

▼Volume setting

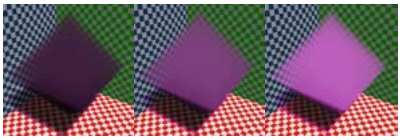
Decay distance: 500

Scattering (color): R255, G128, and B255

Transparency color: None

Glow: None

Scattering (weight): 0.25, 0.5, and 0.75 from the left



◆ **Transparency (opaque)**

▼Basic setting

Transparency: 0.0

▼Volume setting

Decay distance: 500

Scattering: None

Transparency (color): R255, G128, and B0

Glow: None

Transparency (weight): 0.25, 0.5, and 0.75 from the left

◆ **Transparency (transparency)**

▼Basic setting

Transparency: 1.0

▼Volume setting

Decay distance: 500

Scattering: None

Transparency (color): R255, G128, and B0

Glow: None

Transparency (weight): 0.25, 0.5, and 0.75 from the left

◆ **Glow (opaque)**

▼Basic setting

Transparency: 1.0

▼Volume setting

Decay distance: 500

Scattering: None

Transparency color: None

Glow (color): R255, G255, and B0

Glow (weight): 0.25, 0.5, and 0.75 from the left

◆ **Glow (transparency)**

▼Basic setting

Transparency: 1.0

▼Volume setting

Decay distance: 500

Scattering: None

Transparency color: None

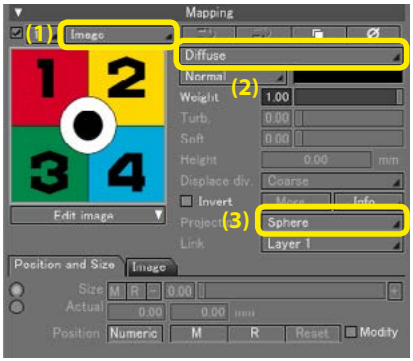
Glow (color): R255, G255, and B0

Glow (weight): 0.25, 0.5, and 0.75 from the left

Mapping

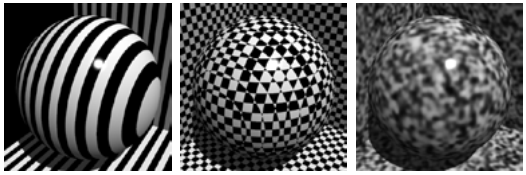
You can set the mapping settings and values of surface attributes.

This section introduces the application results with regard to **Pattern** (1), **Attribute** (2), **Projection** (3) as images.

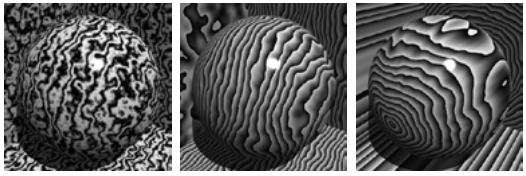


◆ **Pattern**

You can set patterns such as stripes and checks.



Striped Checked Spotted



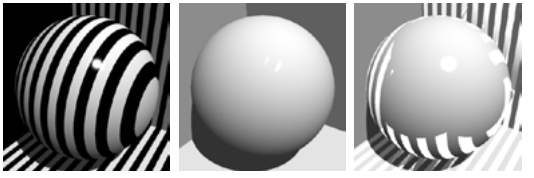
Marble Wood Log

Wave Ocean Cloud

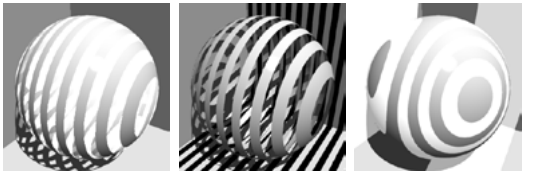
Image (the right image is actually a mapped one.)

◆ Attribute

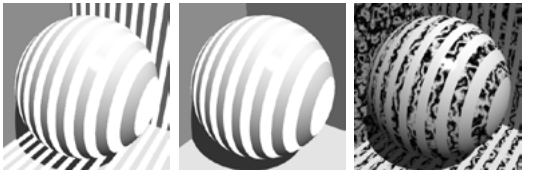
Specify the surface attribute for the pattern. The following shows the attributes set with the stripe pattern:



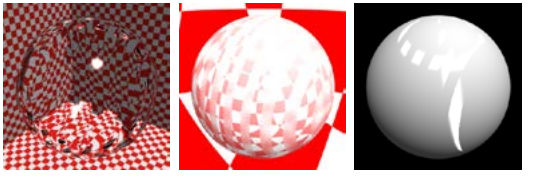
Diffuse | Specular 1 and Specular 2 | Reflection



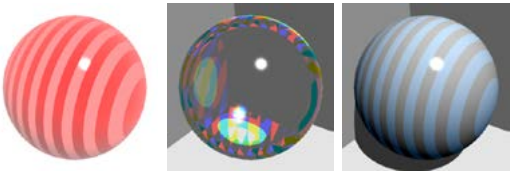
Transparency | Mask | Environment



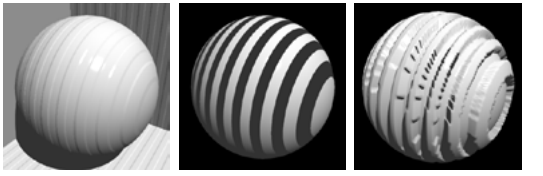
Glow | Back Light | Weight



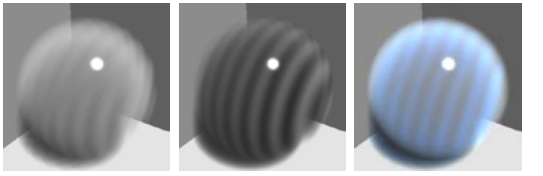
Refraction | Roughness | Anisotropic



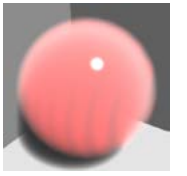
Fresnel | Aberration | Ambient Light



Bump | Normal | Displacement



Volume Decay Distance | Volume Scattering | Volume Transparency



Volume Glow

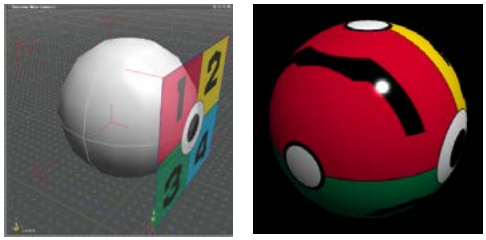
* **Normal** is available in Shade3D Professional.
* **Displacement**, **Volume Decay Distance**, **Volume Scattering**, **Volume Transparency**, and **Volume Glow** are supported only by Shade3D Standard and Professional.

Projection

Set how to project mapping onto an object. The availability of the projection methods depends on the pattern.

X

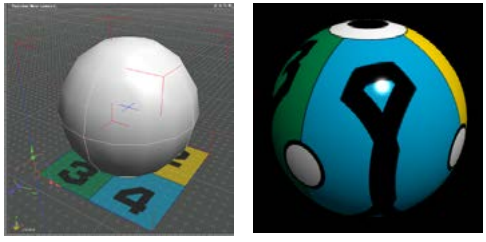
Mapping is projected in parallel from the X direction.



(Left: edit screen, right: rendering result)

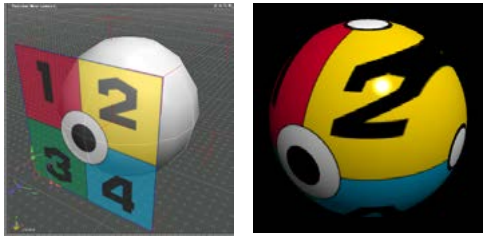
Y

Mapping is projected in parallel from the Y direction.



Z

Mapping is projected in parallel from the Z direction.

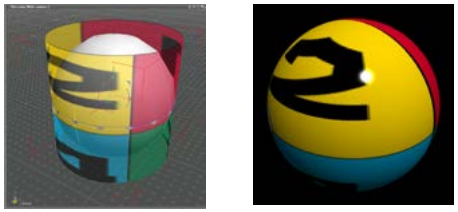


Wrap

Mapping is projected while the four corners of an object and those of the image match.

Cylinder

Mapping is projected in parallel through 360 degrees from the central axis.

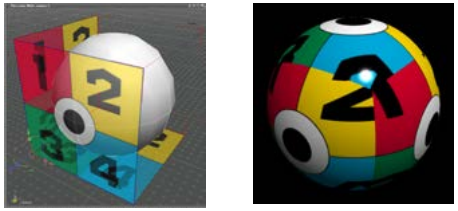


Sphere

Mapping is projected vertically and horizontally through 360 degrees from the central axis.

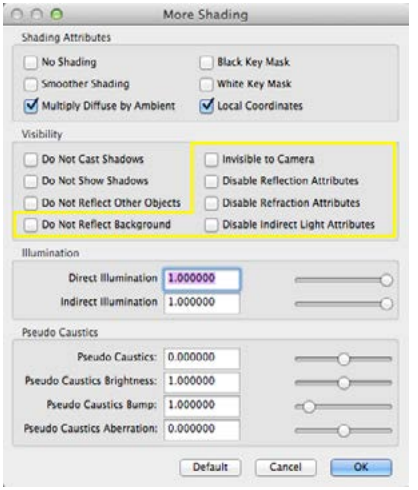
Box

Mapping is projected in parallel from all three directions, X, Y, and Z.



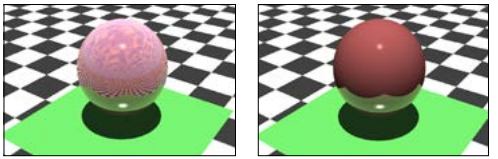
Other Surface Attribute Settings

Click the **More** button at the top of the Surface Window to open the More Shading dialog box.



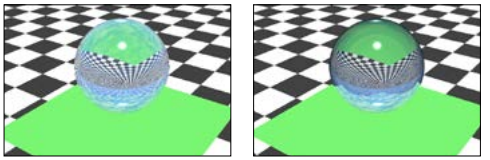
Do Not Reflect Background

When selected, the background is not reflected onto the surface. This means it is not included in Transparency, Refraction, or Fresnel attributes. This is effective when background reflection is undesirable, such as when using ShadowCatcher.



Reflection + Fresnel

left: checkbox off; right: checkbox on

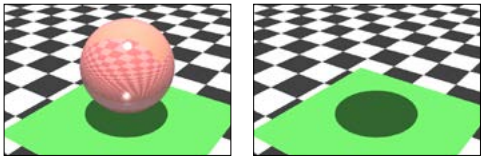


Transparency + Refraction + Fresnel

left: checkbox off; right: checkbox on

Invisible to Camera

When selected, all objects with this surface will not be seen by the camera. Shadows, reflections on other objects, refraction, and indirect energy used for global illumination are unaffected.

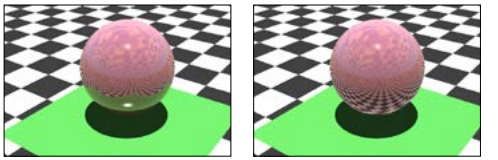


Transparency + Refraction

left: checkbox off; right: checkbox on

Disable Reflection Attributes

When selected, all objects with this surface will not be reflected onto other objects. This setting is ignored by the Ray Tracing (Draft) rendering method.

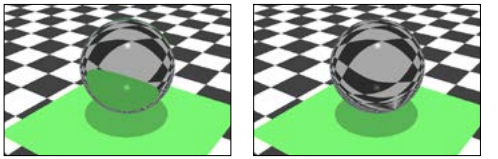


When Reflection is applied to the floor

left: checkbox off; right: checkbox on

Disable Refraction Attributes

When selected, all objects with this surface will not be seen by other objects when refracted light passes through them.

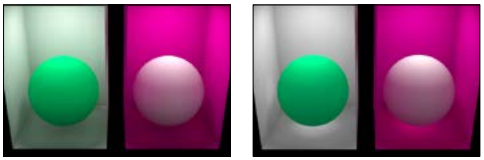


When applied to the floor

left: checkbox off; right: checkbox on

Disable Indirect Light Attributes

When selected, all objects with this surface are ignored when calculating indirect energy for global illumination. This setting only applies to Path Tracing and Photon Mapping. It is not compatible with Radiosity. (When using Radiosity, similar settings can be applied with the Radiosity Attributes checkboxes in the Browser.)

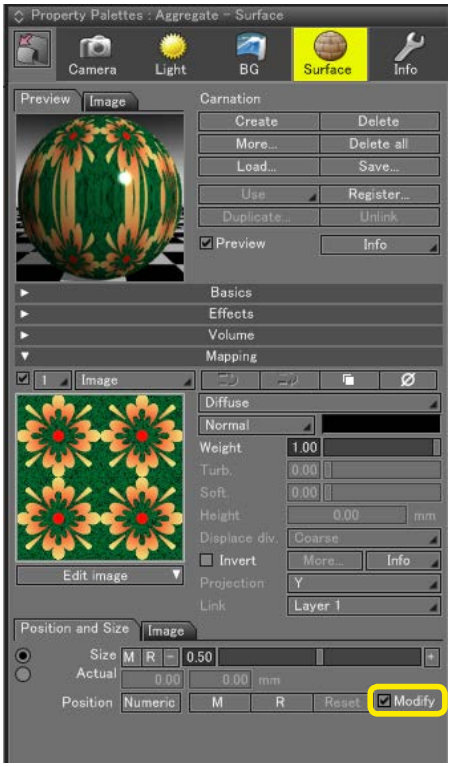


When applied to the spheres
left: checkbox off; right: checkbox on

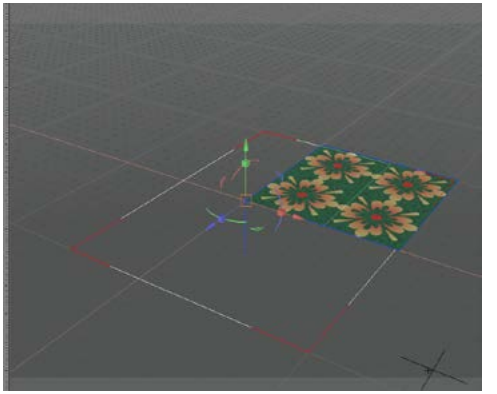
Setting the Size and Position of an Image

You can set the image application size and the position at which the image starts.

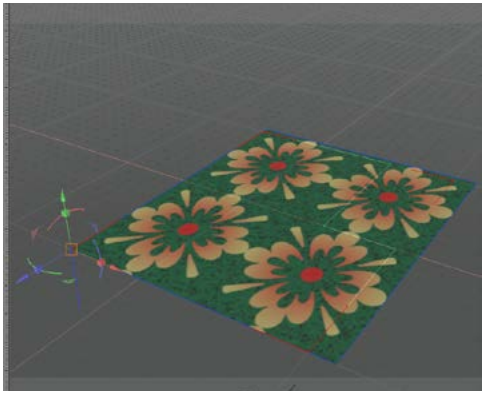
1 From the **Surface** Window, check the **Modify** checkbox in the **Mapping** group.



2 The mapping image is displayed in the viewport.



3 Drag the manipulator to set the image position and size.



TIP

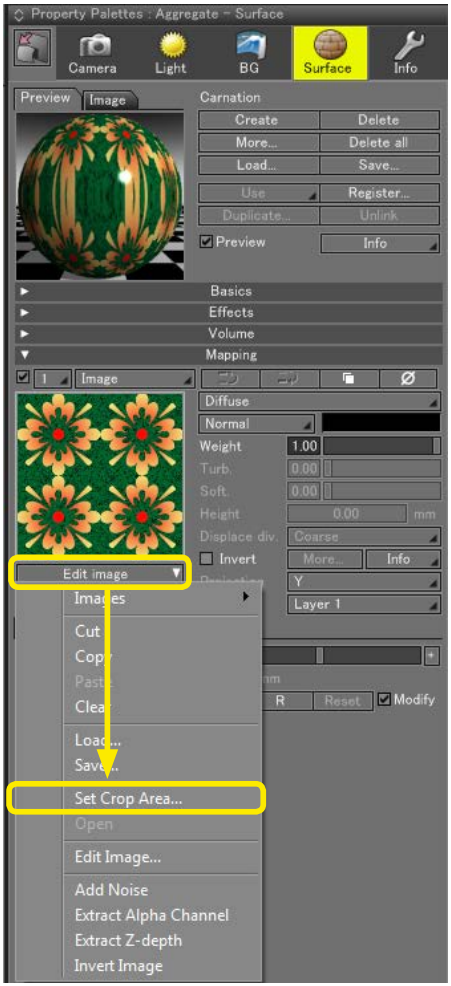
For the projection mapping for the **X**, **Y**, and **Z** axes and **Cylinder** and **Box** mappings, you can adjust the image size from the **Position and Size** tab of the **Surface** Window.

Specification of actual sizes is supported only in Shade3D Standard and Professional.

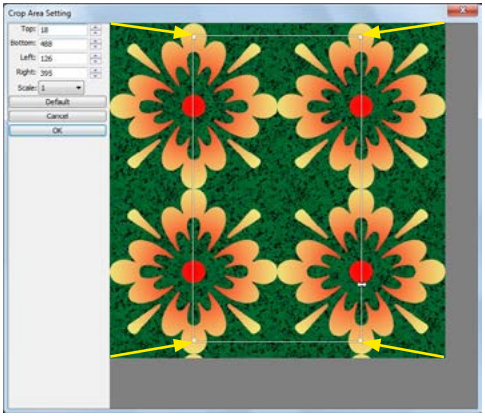
Trimming an Image

You can modify the area over which an image set in the pattern is used.

1 From the **Surface** Window, select **Mapping** group > **Edit image** > **Set Crop Area...**.



2 In the **Crop Area Setting...** dialog, enter a numerical value in the text box, or drag the trimming handle to set the range to be used.



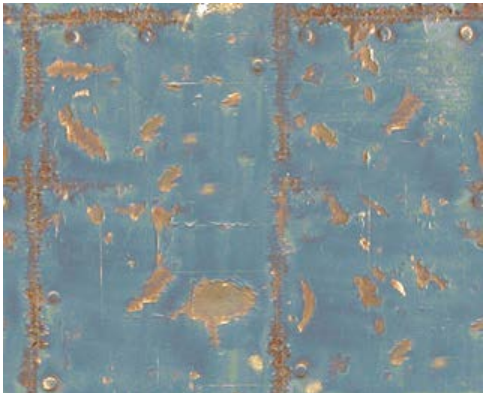
TIP

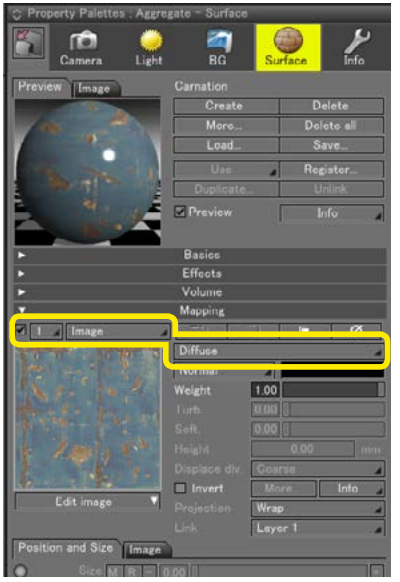
If you set a range larger than the image in the text box, the image will have margins. For a 500 x 500 image, if you set top to **-10,** bottom to **510,** left to **-10,** and right to **510,** a 10 margin is added to the top, bottom, left, and right sides.

Overlapping Multiple Maps

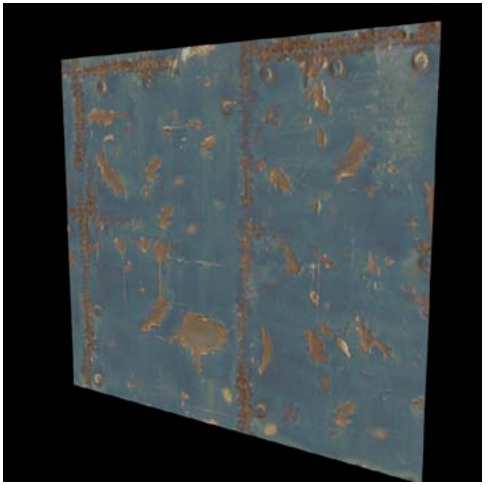
You can overlap map layers and set complicated surface attributes. This set of steps demonstrates overlapping two images using three layers.

1 Set the Mapping Layer to 1, and the layer option to **Diffuse**. Load the image map.

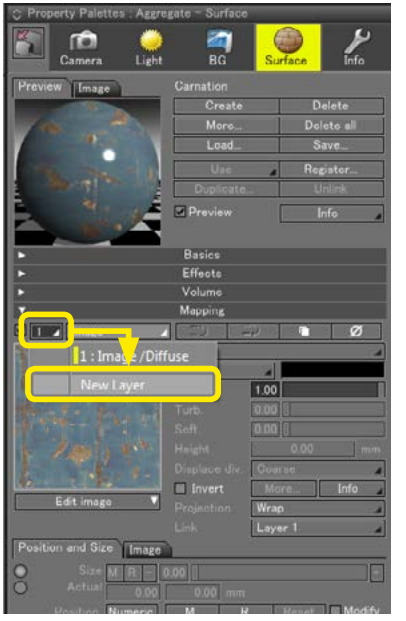




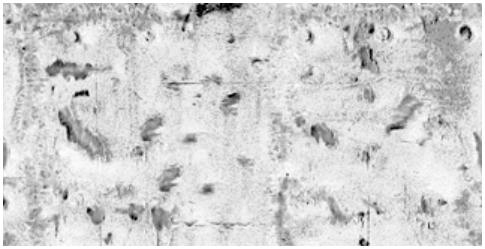
2 Render the scene to confirm that it looks like this.

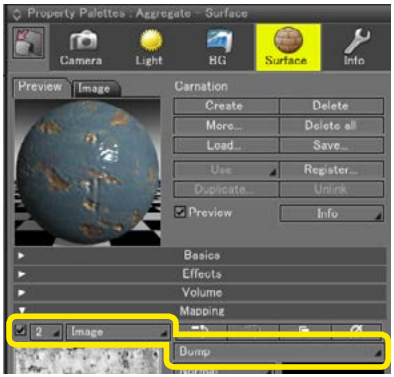


3 Create a new layer.

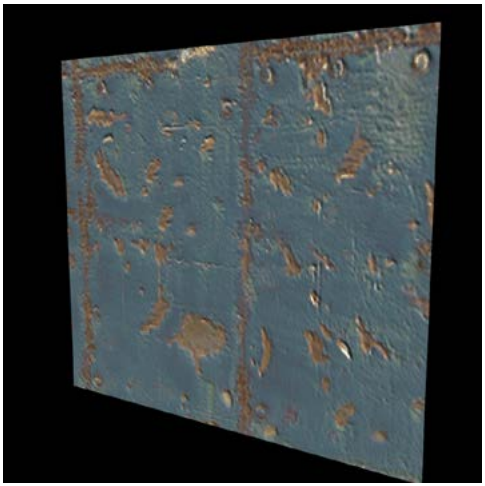


4 Set the Mapping Layer to 2, and the layer option to **Bump**. Load the image map.

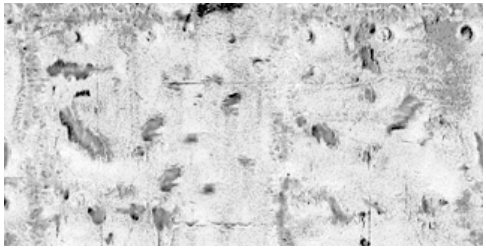


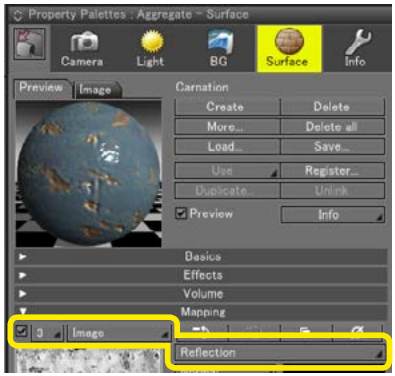


5 The following is the rendering image obtained by overlapping and setting two layers. The rusty parts appear as dents while the blue-painted parts protrude.

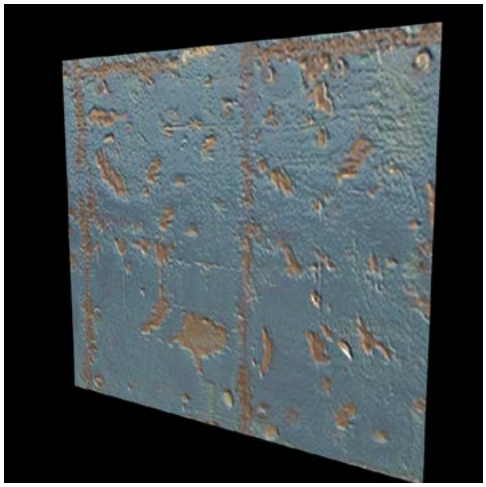


6 Create a new layer as layer 3, set the layer option to **Reflection** and import the image. (Basic setting reflection: 0.16)





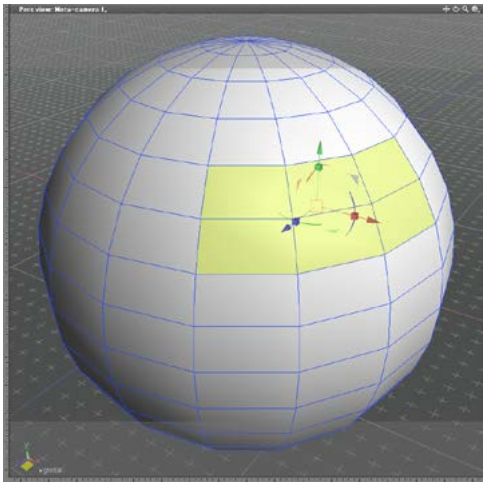
7 The following is the rendering image obtained by overlapping and setting three layers. Only the blue-painted parts reflect the background.



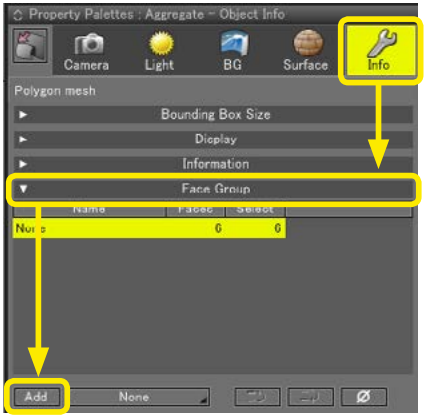
Surfacing Individual Polygon Mesh Faces

You can set the master surface of a selected face of a polygon mesh. This allows you to set multiple surface attributes on a single polygon mesh.

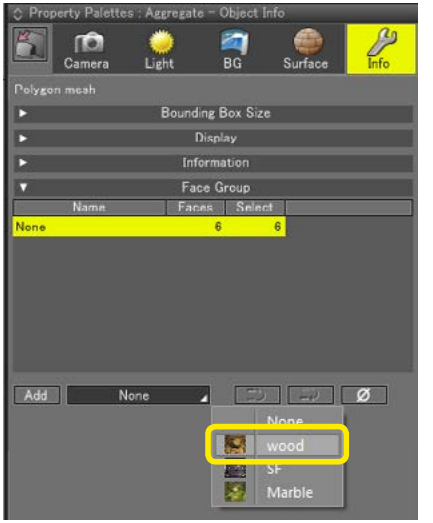
1 Select the face of a polygon mesh.

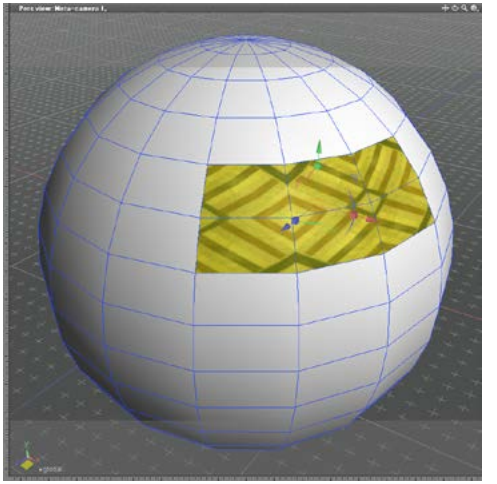


2 From the Object Info Window, open the **Face Group** settings, and click the **Add** button to add a new **Face Group**.

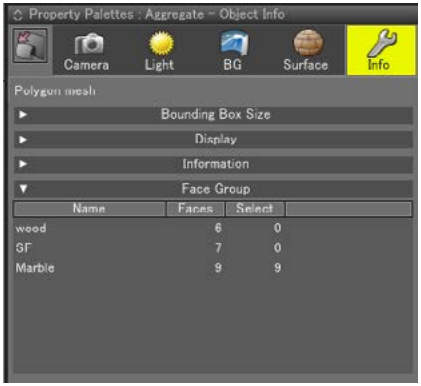


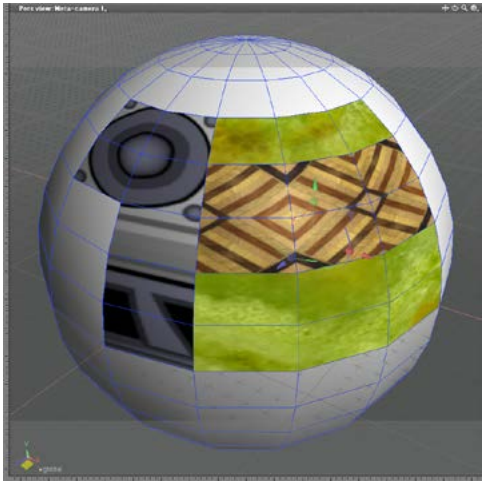
3 From the selector, select a previously added master surface to assign it to the **Face Group**.





4 Repeat steps 1 to 3 to individually set master surfaces on multiple faces.



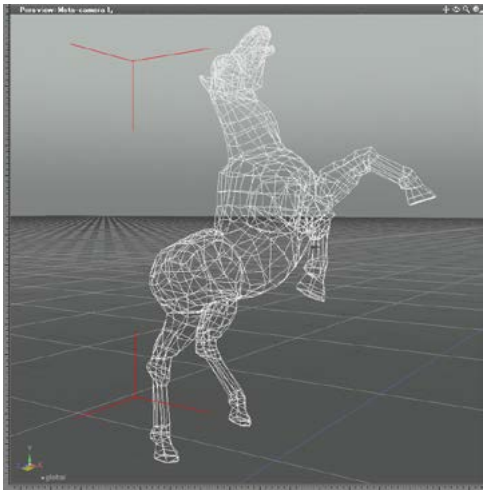


Volume Rendering

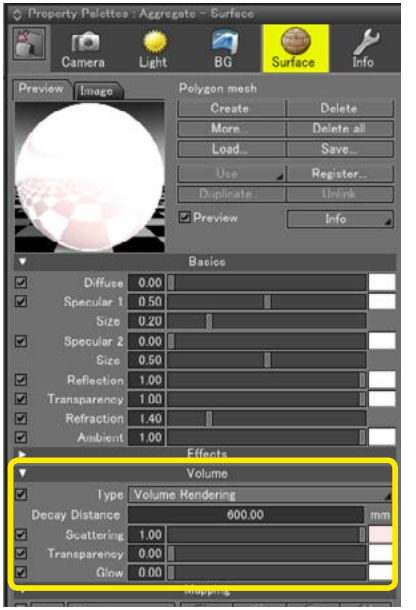
Standard and Professional Only

Volume Rendering represents the texture of an object interior. This function can represent a translucent body having thick particles such as smoke or cream.
Volume Rendering is available in Shade3D Standard and Professional.

1 Select the object for which volume rendering is to be set.

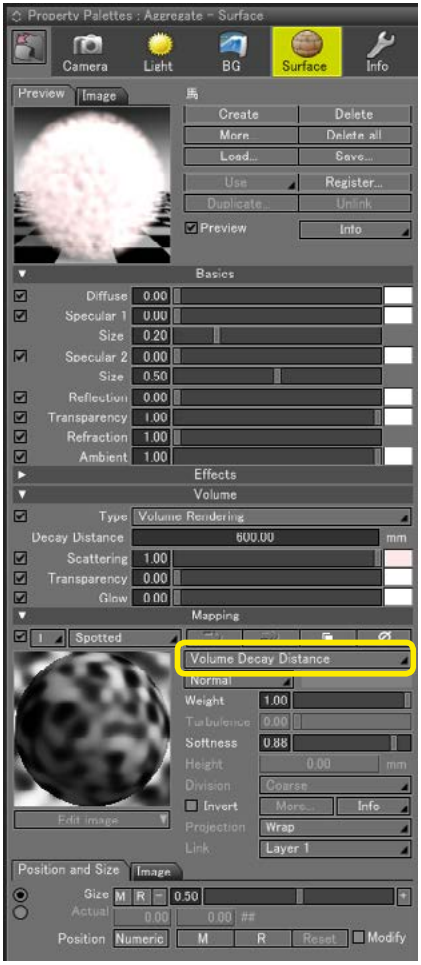


2 From the **Type** pop-up menu in the **Volume** settings of the **Surface** Window, select **Volume Rendering** and then set **Decay Distance**, **Transparency**, **Transparency color**, and so on.



3 Once you perform rendering, the texture of the object interior will be represented with volume rendering.

4 You can also represent clouds, sponges, and the like by setting **Volume Decay Distance** or other options from the **Attribute** pop-up menu of the **Mapping** settings.



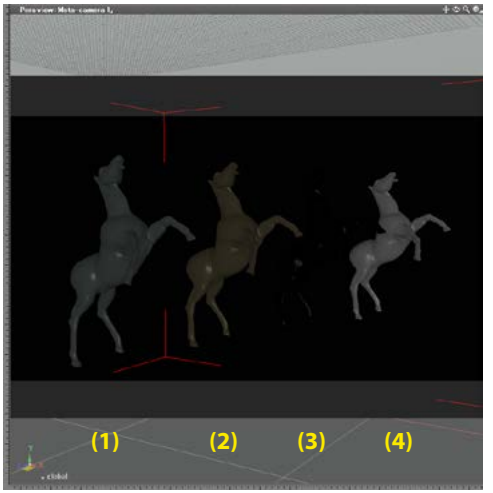
Subsurface Scattering

Professional Only

Subsurface Scattering can be used to represent the effect whereby light that enters an object is diffused. This function can be used to represent complicated hues and shadows such as those associated with jade, marble, plastics, and human skin.

Subsurface Scattering is available in Shade3D Professional.

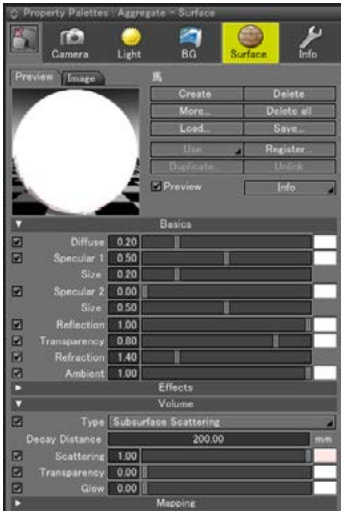
1 Select the object for which subsurface scattering is to be set applied.



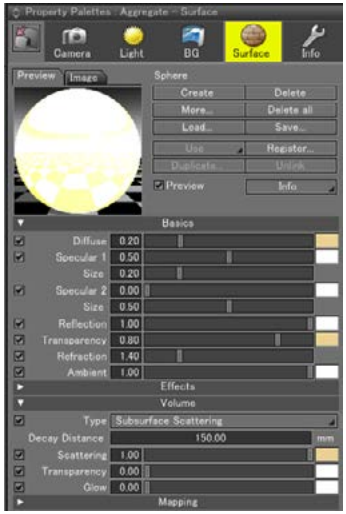
2 From the **Type** pop-up menu in the **Volume** settings of the Surface Window, select **Subsurface Scattering** and then set **Decay Distance**, **Transparency**, and so on.

Here, let's set the following for the objects for four horses:

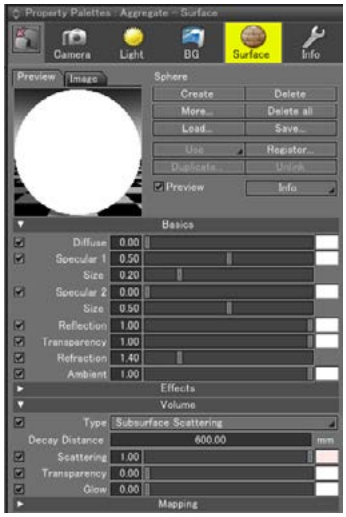
Surface Setting (1)



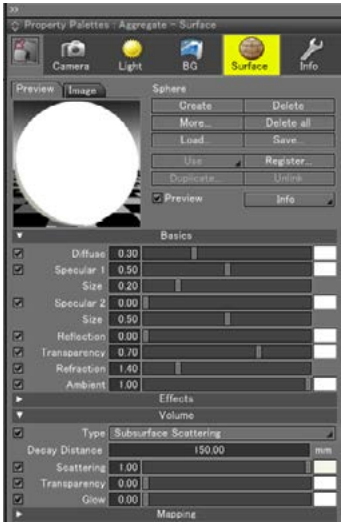
Surface Setting (2)



Surface Setting (3)



Surface Setting (4)



3 When the objects are rendered, the diffused reflection inside the objects is represented with subsurface scattering.

(1) (2) (3) (4)

Displacement Mapping

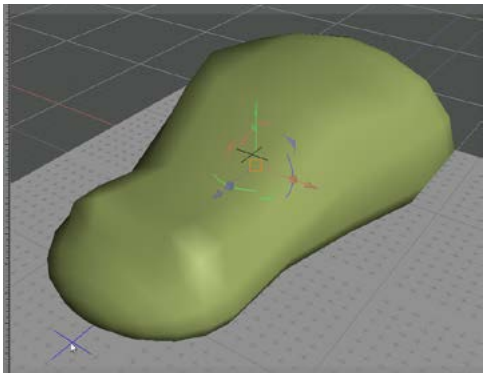
Standard and Professional Only

Displacement Mapping uses texture maps to represent the unevenness of an object. Unlike bump mapping or a normal map, this function does not use pseudo mode to represent unevenness by changing the slant of the object surface (normal line direction). It actually deforms the object. For this reason, unevenness is reproduced using shadow shapes. Moreover, this function can save a displaced version as an actual object.

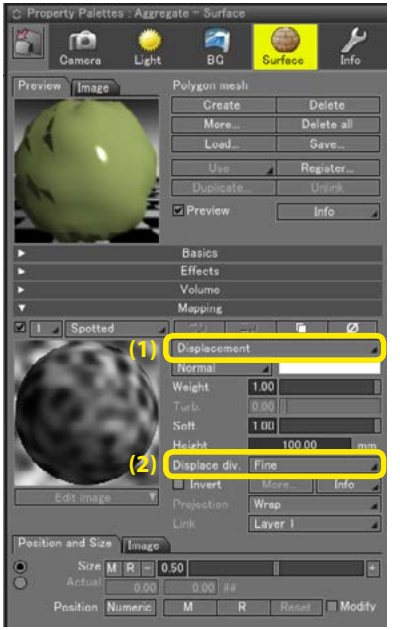
Displacement Mapping is available in Shade3D Standard and Professional.

Setting the Displacement Map

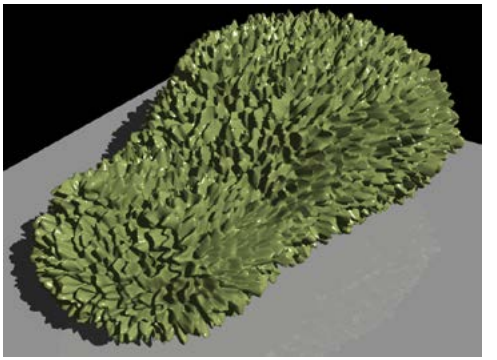
1 Select the object for which the displacement map is to be set.



2 Set the pattern in the **Mapping** settings of the Surface Window and then set the **Displacement** in the **Attribute** pop-up menu **(1)**. According to the object fineness or mapping pattern fineness, set the fineness of the displacement from the **Displace div.** pop-up menu **(2)**. Here, **Fine** has been set.



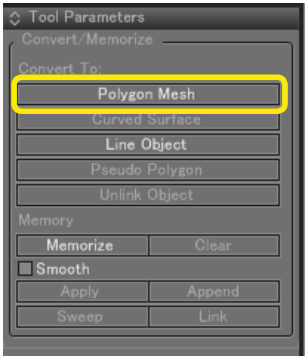
3 Once you perform rendering, the density of the pattern is represented as being uneven.



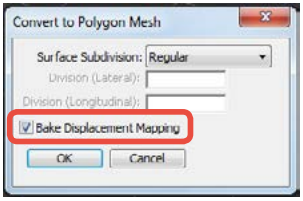
Conversion to an Actual Object

This function converts the result of displacement to an actual object.

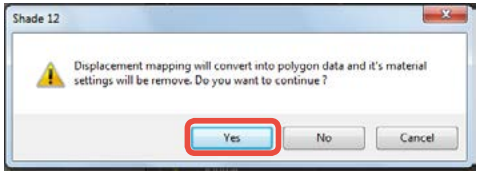
1 Select the object for which the displacement map is set and then from the **Tool Parameters**, click Convert to **Polygon Mesh**.



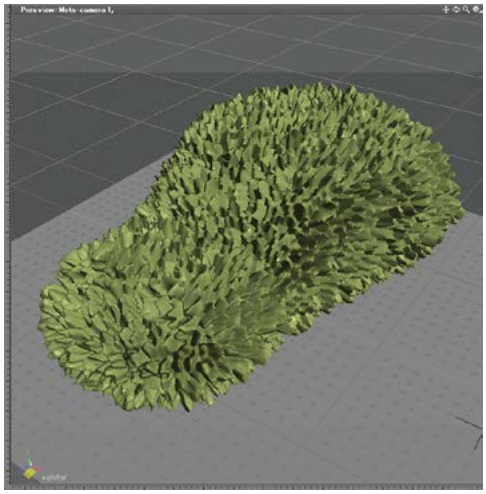
2 From the displayed dialog, check the **Bake Displacement Mapping** checkbox.



3 A confirmation dialog is displayed. Click **Yes**.



4 Conversion is performed to convert the displacement map to an actual object.



TIP

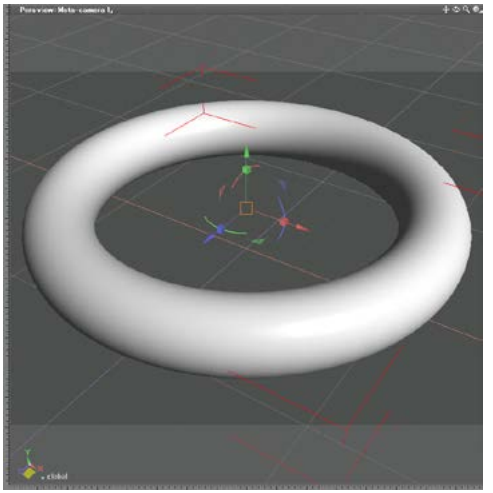
In comparison with bump mapping and normal mapping, a displacement map consumes much more memory during rendering, resulting in a longer rendering time.

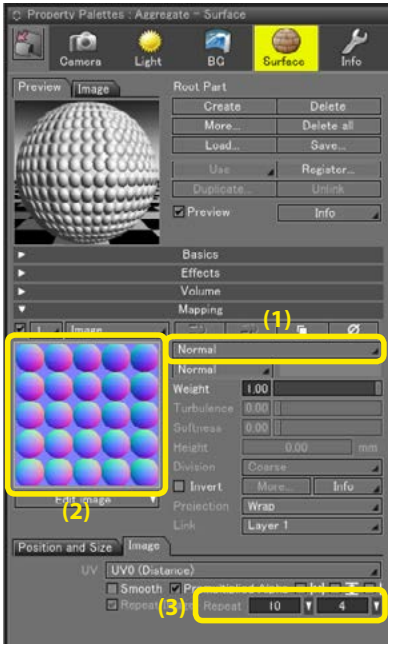
Normal Mapping

Professional Only

Normal Mapping uses an RGB based image to produce distorted surfaces on 3D faces or surface normals to enhance details on otherwise low polygon models.
Normal mapping is available in Shade3D Professional.

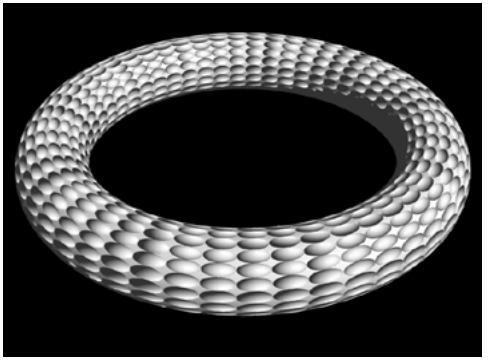
1 Select the object for which the normal map is to be set.





2 From the **Mapping** settings of the Surface Window, select **Image** from the **Pattern** pop-up menu and **Normal** from the **Attribute** pop-up menu **(1)**. Set the RGB image drawn with the normal lines, in Image **(2)**. If necessary, set the pattern repetition count **(3)**. Here, let's set the horizontal direction of **Repeat** to **10** and the vertical direction to **4.**

3 When you render, the RGB image will give the appearance of distortion.

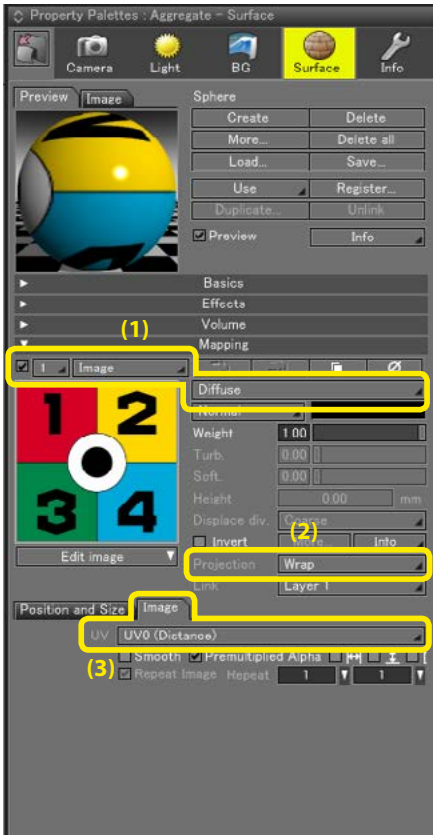


12. UV Mapping

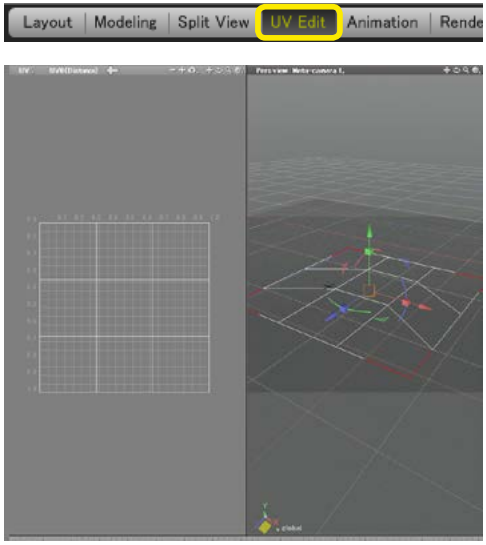
Setting Up UV Mapping

You can use the following steps to set up UV mapping for a polygon mesh.

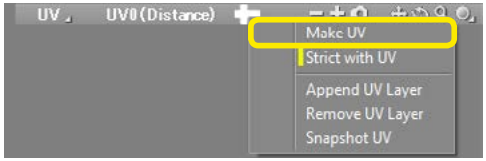
1 Set a UV image. Select the polygon mesh for which UV mapping is to be performed and then set the image used for **Mapping Pattern** from the Surface Window **(1)**. Select **Wrap** from the **Projection** pop-up menu **(2)**. From the **UV** pop-up menu of the **Image** tab, select **UV1 (Distance)** **(3)**.



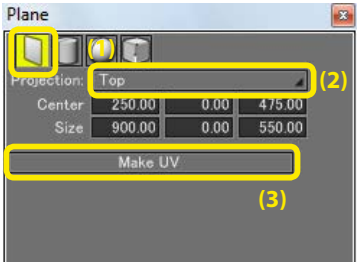
2 Switch the workspace to **UV Edit** to enter **Modify Mode**.



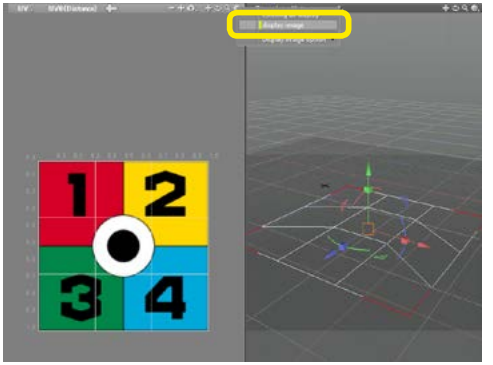
3 Select **Make UVs** from the UV menu on the left side of the UV View's title bar., and then display the **Projection** window.



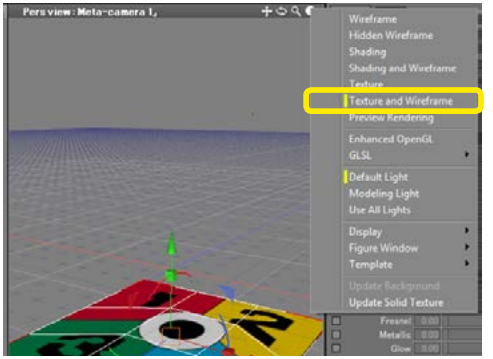
4 Use **Projection** as is as the projection method **(1)**, set **Top** for **Projection (2)**, and then click the **Make UV** button to create UV **(3)**.



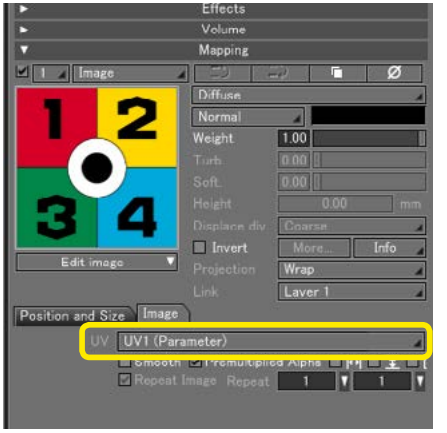
5 From the Display pop-up menu, select **Show Mapped image** to display the image.



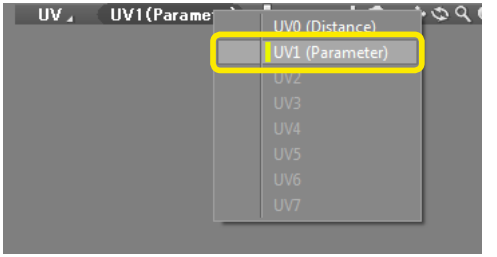
6 Switch the Perspective View to the **Texture and Wireframe** display and then confirm the image (mapping status).



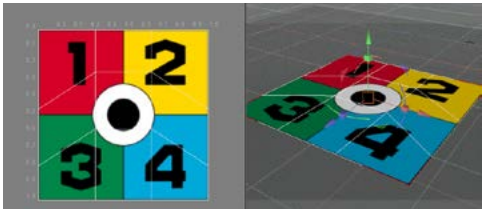
7 Since UV is distorted according to the inclination of the face, change the **UV** pop-up menu to **UV1 (Parameter)** from the **Mapping** group of the Surface Window.



8 Change the left-side UV view display to **UV1 (Parameter)** such that the setting is the same as for **UV** of the Surface Window.



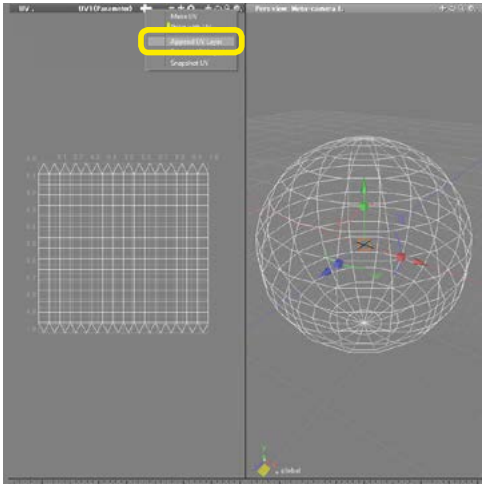
9 UV is displayed properly.



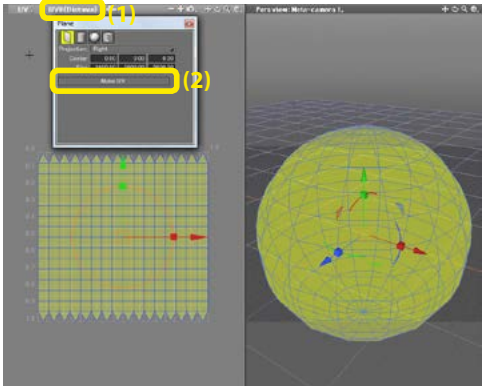
Multi–Layer Mapping

You can add multiple UV layers to a polygon mesh using the following steps.

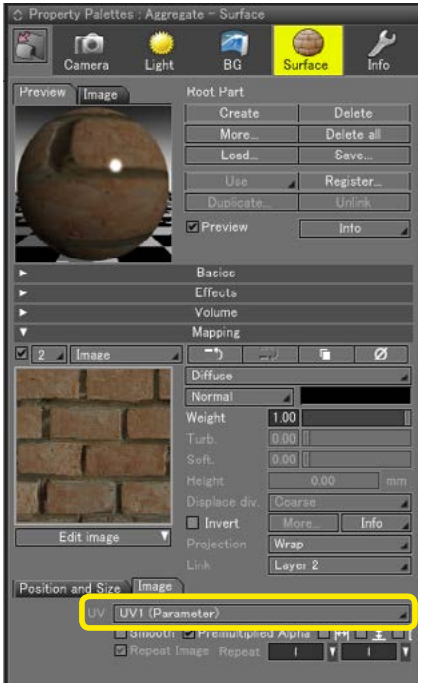
1 Select a polygon mesh and then switch the viewport to display the UV View. From the UV pop-up menu, select **Append UV Layer** and then add the UV layer.



2 Select the UV layer **(1)**, then from the UV pop-up menu select Make UV to create the UV map **(2)**.



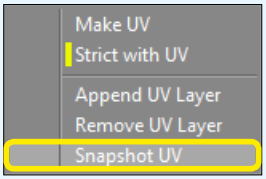
3 From the Surface Window, you can finalize and customize the image options.



4 Repeat the procedure to set multiple UV layers.

TIP

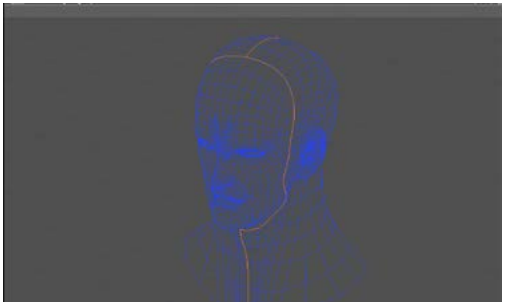
You can output the created UV as an image by selecting **Save UVs into Image** from the UV menu.



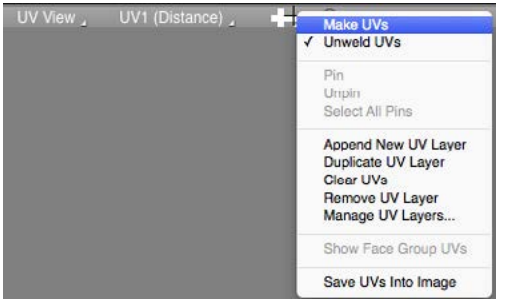
LSCM UV Map Creation

Least Squares Conformal Map (LSCM) is an indispensable UV unwrap methodology for using arbitrary edges for seam placement when separating and unfolding a UV mesh. Using LSCM, you can achieve much better results when bringing together a UV map and polygon mesh.

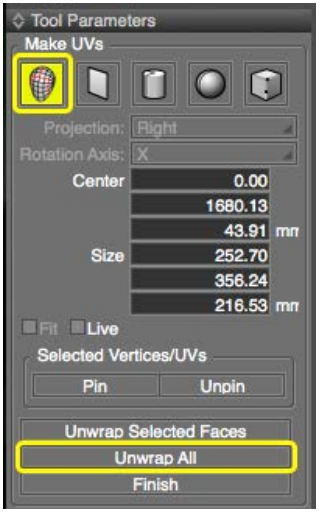
1 In the polygon mesh that you would like to unfold, select the edge you would like to become a seam. If you are in Face Selection Mode, then it will automatically split into groups.



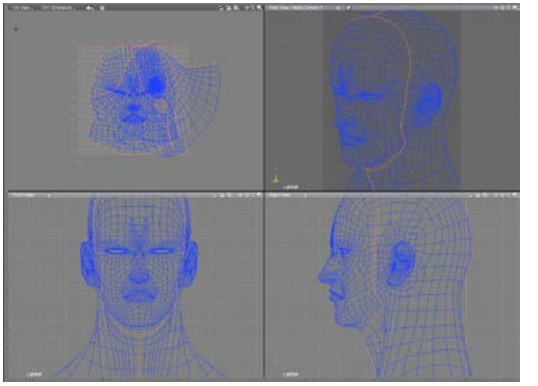
2 From the UV menu, select **Make UVs**.



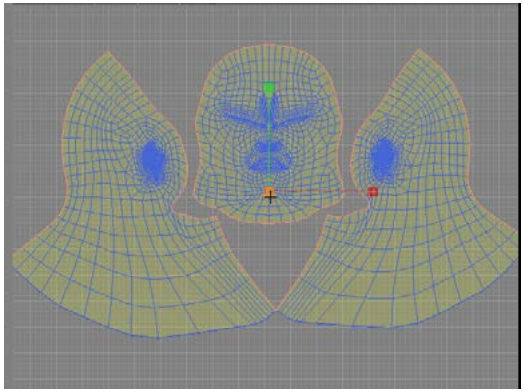
3 Check Tool Parameters: Make UVs to see that the LCSM option is selected. Click **Unwrap All**. In the example, the two sides of the head and the face are unwrapped into three separate groups.



4 The three UV mappings appear, but may be overlapping.

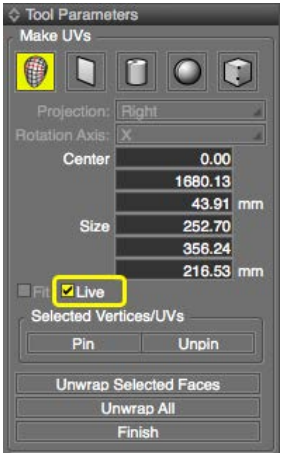


5 Select a portion of one of the groups, then from the main menu choose **Selection** > **Select Contiguous Surface**. That group is now selected. Drag the group so that it is not overlapping any other group. Repeat until you have a clear view of the UV maps.



Pin and Live Transformation

All features of LSCM can be utilized directly within the Figure Window. You can use the Pin tool to affix vertices of a group so that they do not move during editing. Also, you can select the Live checkbox to enable interactive modification.

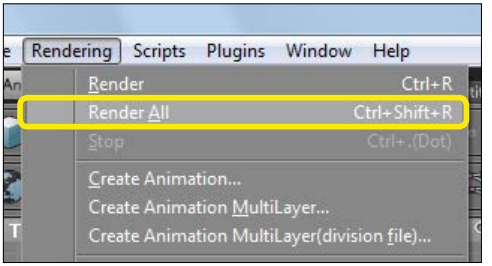


Selecting Objects to Render

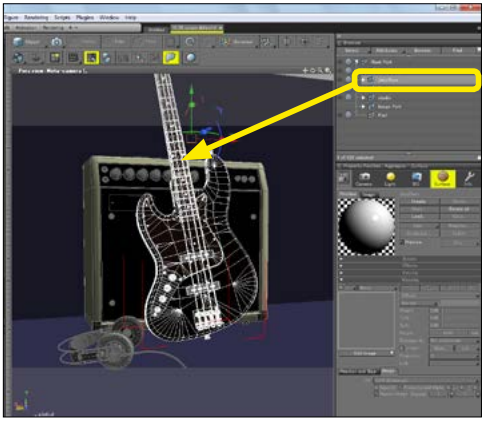
Rendering All Objects

You can render all the objects in a scene using the following steps.

1 From the **Rendering** menu select **Render All** and then start rendering.



2 All the objects that can be rendered are rendered, regardless of whether they are selected with the Browser. The figure below shows that only the base has been selected but the entire scene has been rendered.

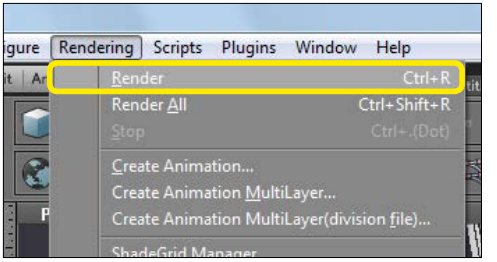


(Image by Syuzo)

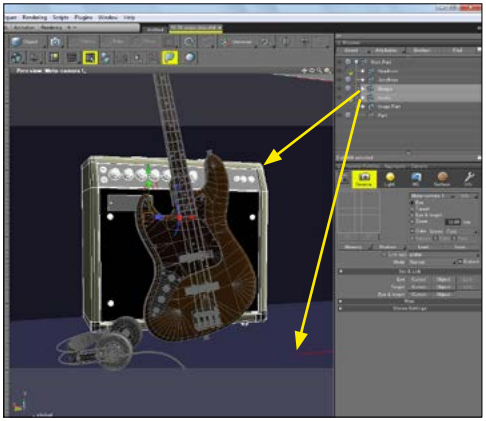
Rendering Only Selected Objects

You can render only selected objects.

1 From the **Rendering** menu select **Render** to start rendering.



2 Of the objects selected with the Browser, only those that can be rendered are rendered.



Rendering Result

(Image by Syuzo)

Rendering Specific Objects

You can set whether each object is rendered from within the Browser. Use the **Render** checkbox of the **Browser** to do this.

Each time you click the **Render** checkbox, its status loops in the order of (Inherit) -> (Off) -> (On) -> (Inherit).

(Inherit)

Assumes the settings of the upper layers. This status is the default value.

(Off)

The object is excluded from rendering, regardless of parent settings. The selected object is not rendered, even with the **Render All** command.

(On)

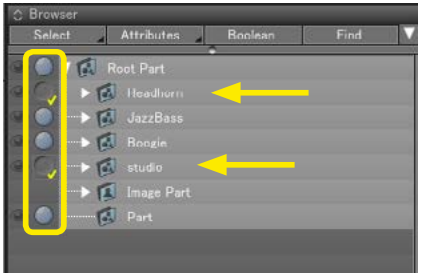
The object is rendered regardless of parent settings. Unselected objects are also rendered.

The following table summarizes whether objects are rendered:

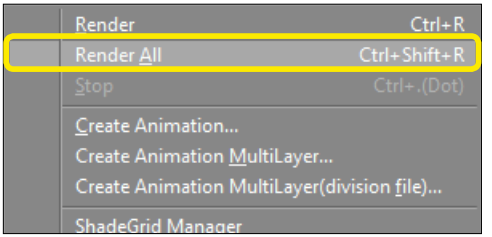
	Inherit	Off	On
Render (All Objects)	○	×	○
Render (Selected Objects Only) + object is selected	○	×	○
Render (Selected Objects Only) + object is unselected	×	×	○

○: Rendered
×: Not rendered

1 The **Render** checkboxes for **Headhorn** and **studio** are unchecked.



2 Objects are rendered with **Render All**.



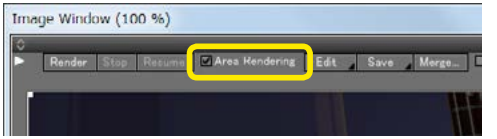
3 Only **JazzBase** and **Boogie (amplifier)** are rendered.

(Image by Syuzo)

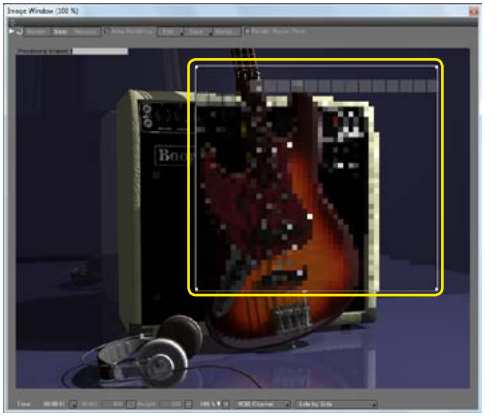
Rendering Part of the Scene

Before doing the final render it is sometimes necessary to do several practice renders while adjusting the object or scene settings. Rather than rendering the entire scene each time, use Area Rendering to select only part of the scene to render.

1 In the Image Window, select the **Area Rendering** checkbox.



2 The Image Window displays a frame for selecting the area to render. Click and drag on this frame to move it, or click and drag outside of the frame to draw a new frame.

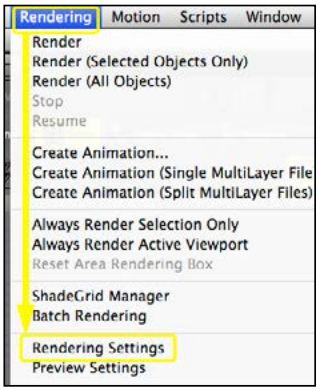


(Image by Syuzo)

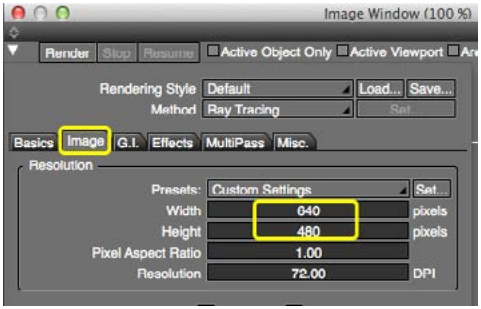
Basic Rendering Settings

Setting the Size of the Rendered Image

1 From the main menu, select Rendering > Rendering Settings to open the Rendering Settings in the **Image Window**.



2 Click the Image tab to switch to the image settings. Enter values for the desired width and height of the rendered image.



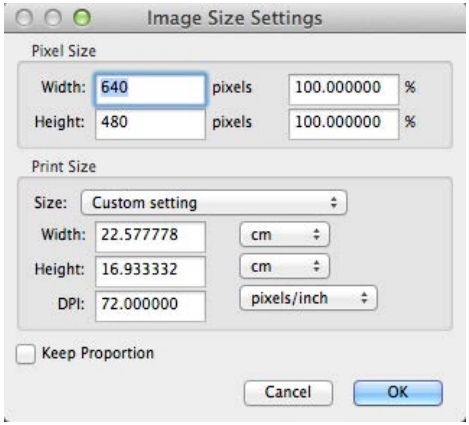
The size of the rendered image can also be specified by:

- entering values in the **Width** and **Height** text boxes at the bottom of the Image Window
- dragging the Image Window frame while holding the Shift key

Determining Image Size by Print Dimensions

If you know the dimensions of the final printed image and the desired resolution, the image size to render can be calculated automatically.

1 On the Rendering Settings Image tab, click the **Set...** button. The Image Size Settings dialog box opens.



2 Select the print size for the image from the Size pop-up menu. Alternatively, you can specify a custom print size by entering width and height dimensions in either centimeters or inches.

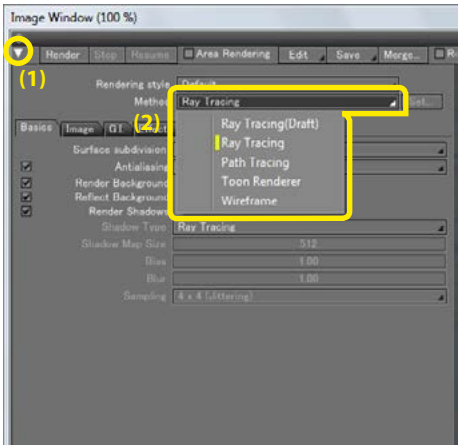
3 Enter the desired print resolution in the DPI text box. This can be specified in either pixels/inch or pixels/cm. The Pixel Size width and height values change based on the print size and resolution.

4 Click OK to close the Image Size Settings dialog box.

Rendering Methods

Scenes in Shade3D can be rendered as 2D images using a variety of methods. The rendering method can be selected from the Rendering Settings.

1 Click ▼ in the upper-left corner of the **Image Window** to display the **Rendering Settings** **(1)** and then select the rendering method from the **Method** pop-up menu **(2)**.



(Data provided by Syuzo)

1. Ray Tracing (Draft)

Ray Tracing (Draft) is a fast, high-quality preview rendering method.

Ray Tracing (Draft) does not support soft shadows with Distribution Lights, Point Lights or Spot Lights. However, it can create soft shadows using Shadow Maps.

Compared with Ray Tracing, Ray Tracing (Draft) has the following limitations:

*No refractions with transparent objects

*No reflections of objects

*No Global Illumination settings for Path Tracing

*No Global Illuminatino settings for Photon Mapping

2. Ray Tracing

Ray Tracing provides very high-quality rendering using ray casting and space sharing. It enables simulation of reflection and refraction. The Ray Tracing technique, as compared with the Path Tracing technique, cannot express roughness of reflection, roughness of transparency for refraction, correct rendering of the area generated by the area light source (light source attributes), nor the depth of field effect for the camera . Soft shadows cannot be expressed with Ray Tracing, but are available using the Shadow Map Blur. Indirect light and sky light conditions can be achieved using the Radiosity feature .

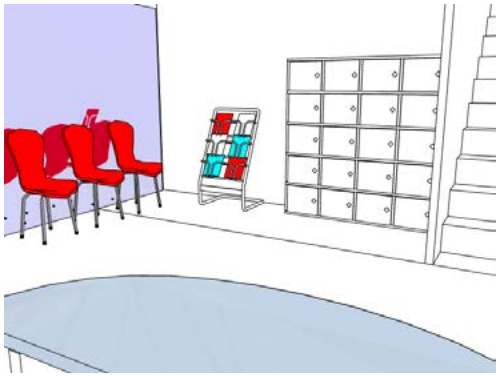
Objects rendered using the Ray Tracing method with the Render Shadows checkbox on, the type of shadow set to Ray tracing, and Regular selected in the Surface Subdivision pull-down menu. With Ray Tracing, the surface subdivision pro-

cessing is not performed for spheres, which saves memory.
Note: Shadow Maps with Ray Tracing or Path Tracing are only available in Shade3D Professional.

3. Path Tracing

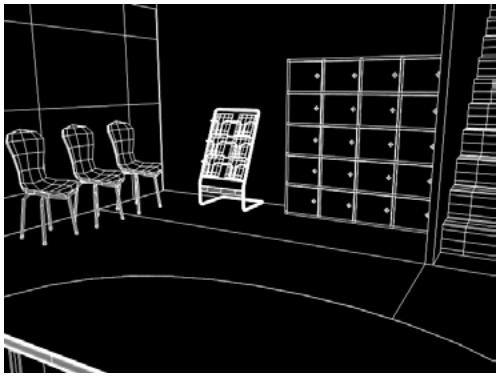
Path Tracing provides extremely high-quality rendering using a developed Ray Tracing technique that allows you to express indirect light using global ilumination.

4. Toon Renderer



Toon Renderer is used to create cel animation and cartoon-like (non-photorealistic) images. In Shade3D Professional, outlines created with Toon Renderer can be exported to Adobe Illustrator format (*.ai) and Flash format (*.swf).

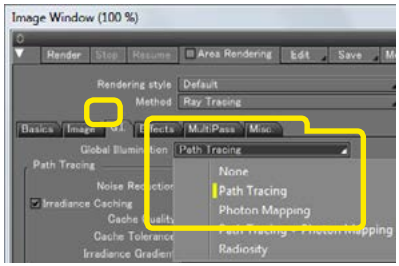
5. Wireframe



This method renders objects as wireframes. It uses a process called "Hidden Line Removal" (the wireframe or planes in the back are hidden behind the front surface), and "Depth Cue" (the brightness of the wireframe or surface is gradually changed with depth), as well as the antialiasing. The wireframe corresponds to the borderlines of the subdividing surface when Flat Shading is performed with the Scan Line method. Care must be taken since the wireframe displayed in the Figure window looks different for curved surfaces. Surface subdivision and antialiasing settings are made in the Rendering Settings. Additional options are available by clicking the Settings... button next to the **Method** pop-up menu.

Using Global Illumination

1 To use global illumination, go to the **G.I.** Tab, and select the method from the **Global Illumination** pop-up menu.



Reducing Rendering Time

The most effective way to reduce rendering time is to use a fast computer. This means a computer that can process floating point calculations quickly. This generally is a computer with a newer, fast CPU. It is also important to have plenty of memory (RAM). If the computer runs out of physical memory it will use virtual memory. This is an area of the hard disk used for memory, and compared to the speed of the CPU, using virtual memory is extremely slow. Using virtual memory when rendering is very impractical. If you computer is constantly using virtual memory, it is highly recommended to install additional physical memory (RAM).

A fast graphics card will speed up drawing in the Figure Window but will have little benefit when rendering.

Below are some ways in which you may be able to reduce render times at the software level. Of course, the trade-off with rendering higher-quality images is always longer render times.

Reducing CPU Load

- To the extent possible use the default values for all settings.
- Switch the rendering method from Path Tracing to Ray Tracing, or from Ray Tracing to Ray Tracing (Draft). Path Tracing takes several times longer to complete than Ray Tracing.
- Avoid using higher antialiasing, Ray Cast Level, and Ray Tracing Quality settings unnecessarily.
- When possible, avoid using the Reflection, Transparency, Refraction, and Roughness surface attributes, and the Solid Texture Turbulence attribute.
- Try not to use too many lights in the scene. Alternatively, set Shadows for extra lights to 0. (Leave shadows on for the main light source.) Setting the shadows to zero is very effective at reducing the CPU load.
- Regarding background settings, when not reflecting the background on objects or using transparency, consider using a composite or backdrop.
- Instead of using antialiasing, rendering a large image and then reducing its size in image editing software may also reduce the render time.
- When rendering animations, skip antialiasing or use lower-quality antialiasing.

Reducing Memory Requirements

- Reduce the level of surface subdivision. Just one level lower will cut the amount of memory used by approximately three-fourths. Put another way, Very Fine requires about 64 times more memory than Coarse.
- By lowering the subdivision level for the scene as a whole in the Rendering Settings and adding the < character to the front of the name of only those shapes that need to be rendered in finer detail, surface subdivision can be used very efficiently.
- When using displacement maps, lower the level of subdivision.
- As much as possible avoid converting spheres and revolved solids to curved surfaces. There is a considerable difference in scenes with many spheres or revolved solids.
- Avoid creating lots of unnecessary parts.
- When using image maps, avoid using unnecessarily-large images. When mapping the same image to multiple shapes, put the shapes inside a part and apply mapping to that part. If the shapes cannot be put inside a single part, use a master surface.
- Decrease the size of the rendered image.
- Close other applications that are not in use.

MultiPass Rendering

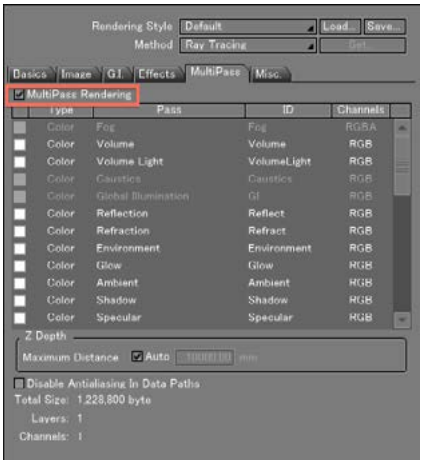
MuliPass rendering makes it possible to separately calculate different elements of a scene, such as diffuse color, shadows, and indirect energy, saving each of those results to a separate image.

Each image can be saved as a separate layer in a single file (a MultiLayer file), or as separate files. Post-processing can then be done in an image editing application.

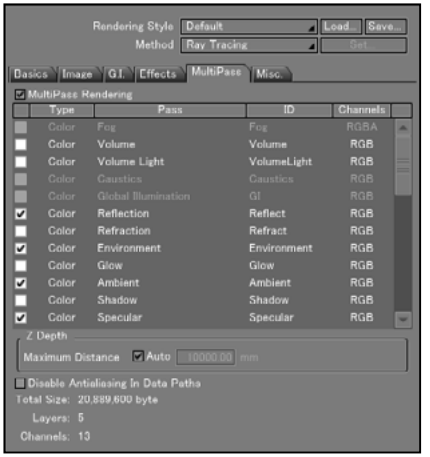
How to Set Up MultiPass Rendering

1 Open the Rendering Settings by selecting Rendering > Rendering Settings or clicking the expand button in the top left of the Image Window.

2 Switch to the MultiPass tab, and select MultiPass Rendering.



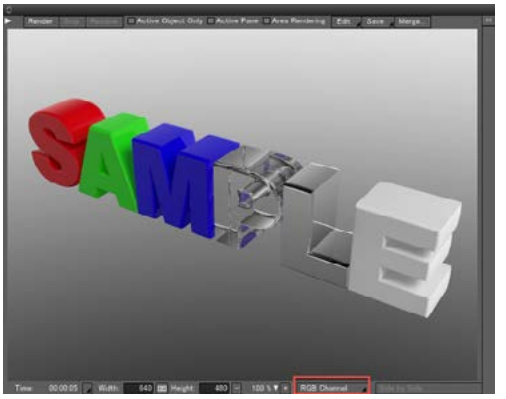
3 Select the passes you wish to render. MultiPass rendering information for the selected passes is displayed at the bottom of the MultiPass tab. If many passes are selected rendering may consume an extremely large amount of memory; check the Total Size listed at the bottom of the MultiPass tab, and only select passes you need to render.

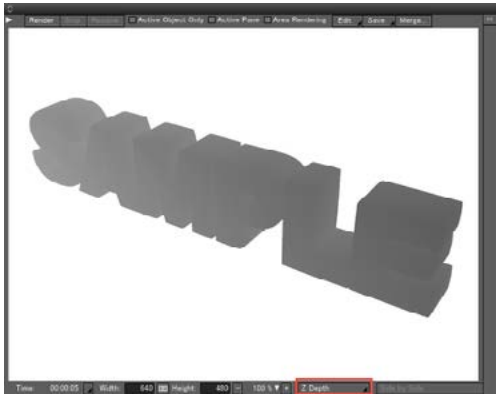


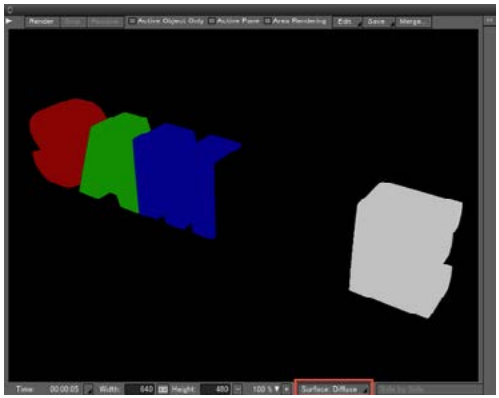
4 Render the scene.

Viewing Individual Rendered Passes

The images generated by each pass during rendering can be viewed from the Channel pop-up menu in the Image Window.



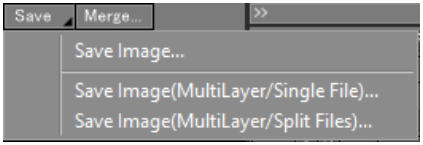




Saving Passes in Photoshop Format

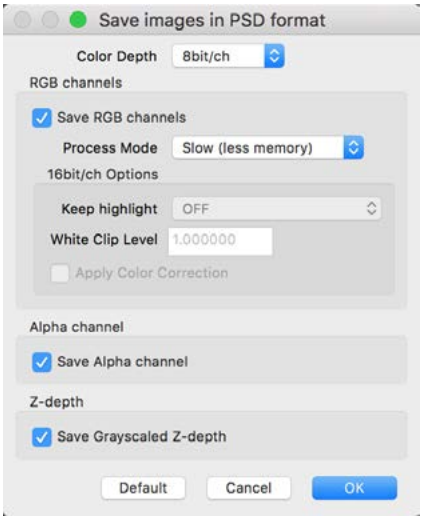
Select either MultiLayer or MultiLayer (Split Files) to save all the passes in the image together. Selecting MultiLayer will save each pass to a layer in a single file. The OpenEXR (.exr), Photoshop (.psd), TIFF (.tif), and Epix (.epx) file formats can be used for MultiLayer files. Selecting MultiLayer (Split Files) will save each pass in a separate file.

1 From the Save... pop-up menu in the Image Window, select Save Image (MultiLayer/Split Files)...



2 From the list of file formats, select Photoshop, and click Save.

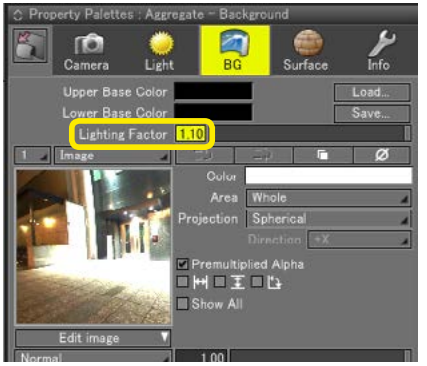
3 A dialog box appears with additional options.



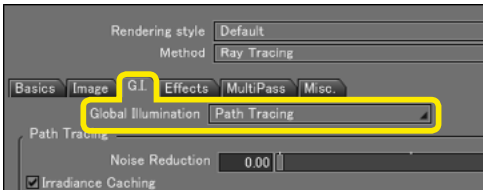
IBL Rendering

IBL (Image Based Lighting) rendering can reproduce lighting that more closely approximates reality because it uses the color and brightness of the image set as the background as the light.

1 Set the image in the **Background** Window and set **Lighting Factor**. The numeric value is a relative value obtained by setting the image brightness as 1.



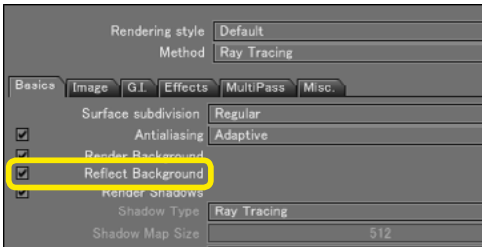
2 From **Rendering Settings**, select the **G.I.** tab and then select **Global Illumination** > **Path Tracing** or **Path Tracing + Photon Mapping**.



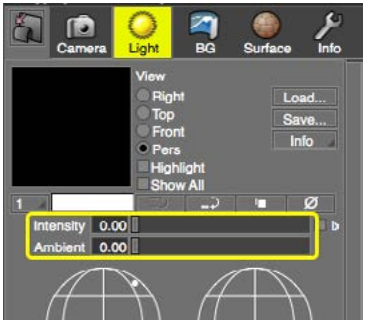
TIP

The **Path Tracing + Photon Mapping** function of **Global Illumination** is available only in Shade3D Standard and Professional.

3 From the Image Window, select the **Basics** tab and then select the **Reflect Background** checkbox.



4 If you set the distant light **Intensity** to 0, it is easy to see the IBL effect.



5 Check the result by rendering the scene. If the image is too dark or too bright, adjust **Lighting Factor** in the **Background** Window.

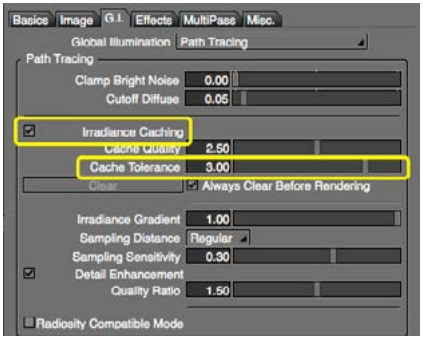
(Image by Syuzo)

Irradiance Caching

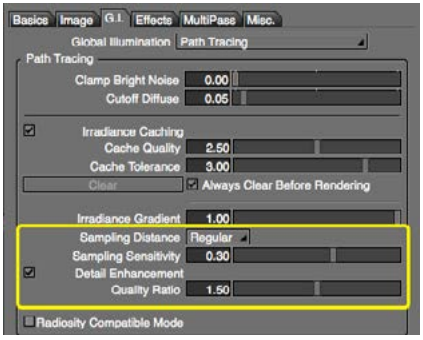
When using Path Tracing Global Illumination, irradiance caching can reduce rendering time by simplifying sampling calculations. This is because by calculating a subset of drawing points, irradiance information can be interpolated for the remaining points.

When rendering the scene, the first phase generates the irradiance cache, and once that finishes the progressive phase begins in which the rendered image is generated.

1 When using irradiance caching, adjust the Cache Tolerance setting to change the irradiance caching resolution. Larger values results in lower quality path tracing, but reduce rendering time.



2 To achieve finer results, adjust the following options:



◆ **Sampling Distance**

The size of the final blocks in the irradiance caching phase. Smaller values can express fine surface irregularities but significantly increase rendering time. If the rendered image contains fine 1 or 2 pixel wide stepped differences, setting the Sampling Distance to Fine can sometimes improve results.

◆ **Sampling Sensitivity**

The sampling sensitivity with regard to areas with large changes in shadows, such as near walls and at the base of objects. Larger values make it possible to express fine shadow differences but result in longer rendering time. This value affects the density of all samples.

◆ **Details Enhancement**

Automatically adjusts the filter width for areas with large changes in shadows, such as near walls and at the base of objects. This achieves an effect similar to partially decreasing the cache tolerance.

◆ **Quality Ratio**

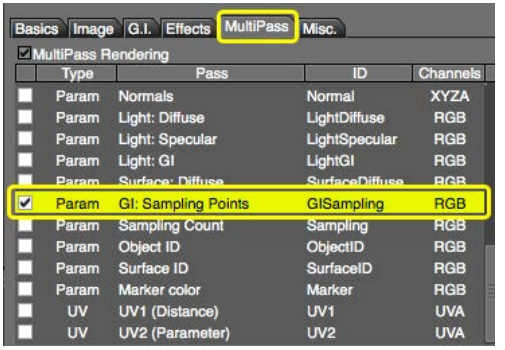
The quality of Details Enhancement. Raise this value to improve the quality if the Details Enhancement option results in added noise near walls and at the base of objects.

Saving Global Illumination Samples as a Pass

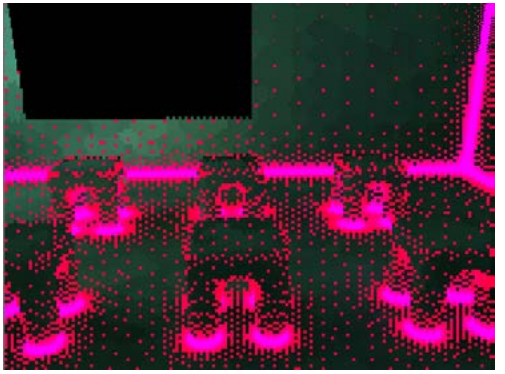
Global Illumination sampling points can be saved as the GI: Sampling Points pass with MultiPass Rendering. This allows for easier comparison of renders with different irradiance cache settings.

The GI: Sampling Points pass is available in Shade3D Standard and Professional.

Select the **MultiPass** tab of the Rendering Settings, and select **GI: Sampling Points** from the list of passes.



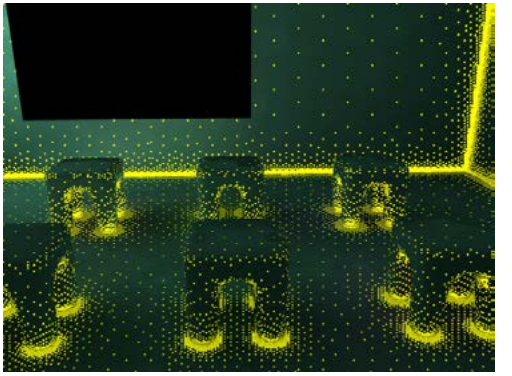
◆ **Irradiance Caching Phase**



Red: areas with generated irradiance cache

Purple: areas with generated irradiance cache and Detail Enhancement applied

◆ **Progressive Phase**



Red: areas added to generated irradiance cache

Purple: areas added to generated irradiance cache and Detail Enhancement applied

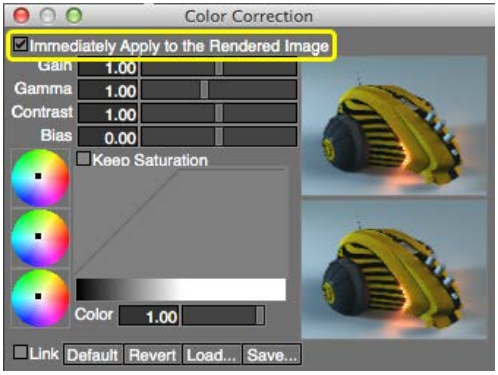
Yellow: cached points

Real–time Color Correction

Color correction settings made in the Color Correction window will be applied to the rendered image displayed in the Image Window or to the preview render in the Perspective View in real time.

Enabling Real-time Color Correction

Open the Color Correction window by selecting View > Color Correction. Select Immediately Apply to the Rendered Image.



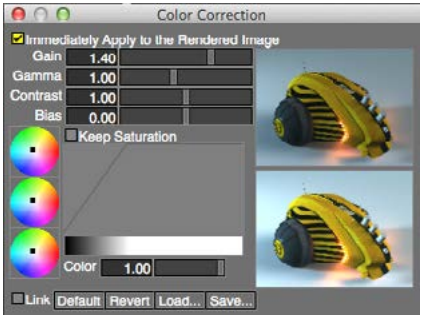
In order to use real-time color correction, the pixel depth specified on the Image tab of the Image Window must be 128 bits.

Pixel depths of 32 or 64 bits require rendering the scene before color correction can be applied.

Applying Color Correction to Rendering

1 Display the rendered image, or if you have not done so already, render the scene.

2 Adjust the settings in the Color Correction window.



3 The color correction is applied to the rendered image immediately. Color correction is also applied to Preview Rendering.

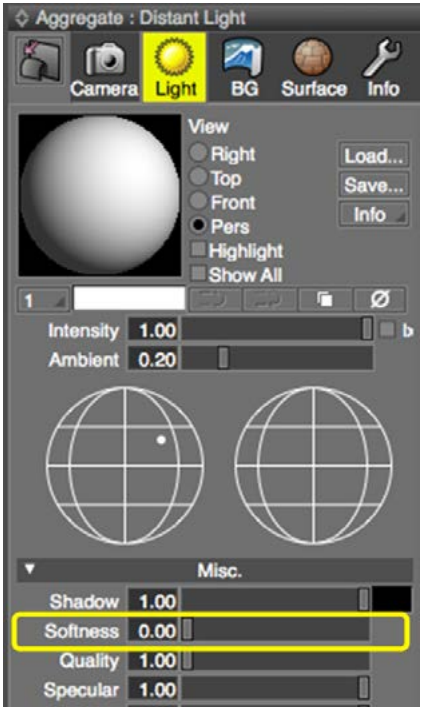
Other Rendering Features

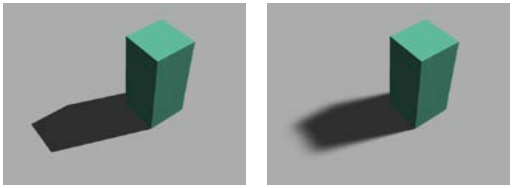
Zooming the Image Window

You can zoom in or out of the rendered image by holding Alt (Win) or option (Mac) while spinning the mouse wheel when the pointer is over the Image Window.

Adjusting Shadow Softness with Ray Tracing

When rendering with ray tracing the softness of shadows can be adjusted for each light. For distant lights, the Softness setting can be found in the Distant Light Window under Misc. For object lights, adjust the Shadow Softness value located in the Object Info Window.





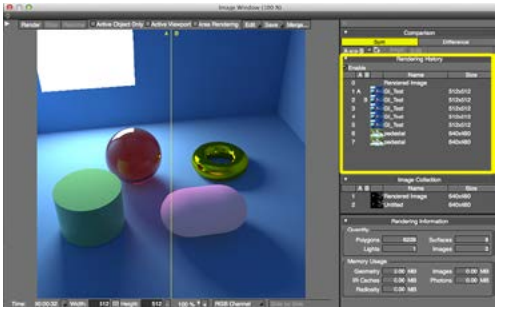
Left: Softness 0.0; right: Softness 0.05
(no global illumination used)

`

Rendering History

A list of previously rendered images is saved in the Image Window. Two rendered images can also be compared using a split view or by showing the absolute differences between the two.

To view a past rendered image saved in the Rendering History, simply select the appropriate thumbnail icon next to the scene file name from the list.



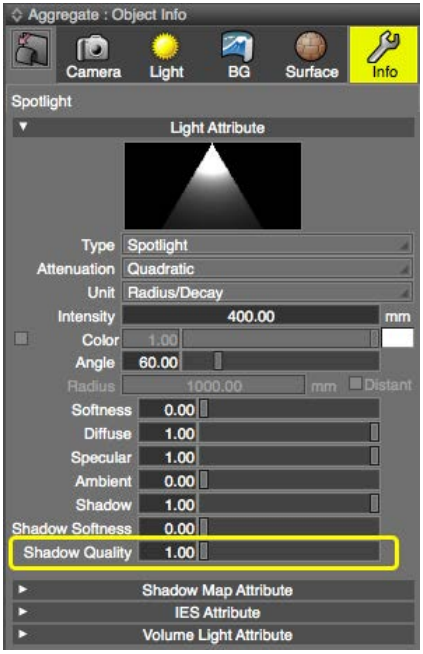
To compare two images, first click in the A and B columns to specify the A and B images. Next select the comparison method, either Split or Difference.

This feature is only available in Shade3D Professional.

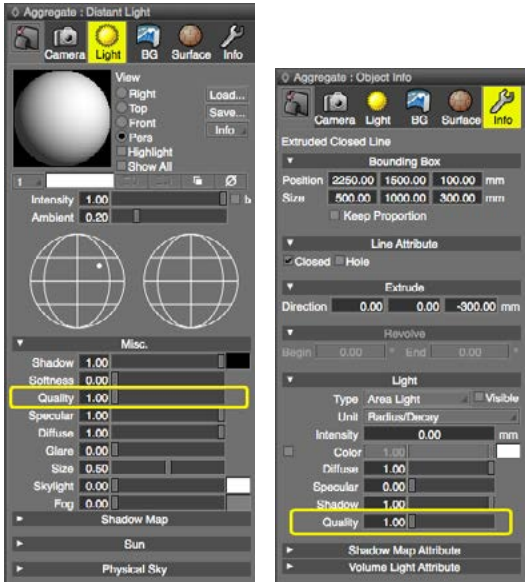
Adjusting Shadow Quality Per Light

The quality of shadows cast in the scene can be adjusted separately for each light source, allowing you to raise the quality of only the most crucial lights rather than all lights. This can greatly reduce rendering time in some cases. This feature is available in Shade3D Professional.

The shadow quality settings for typical light sources are shown below.

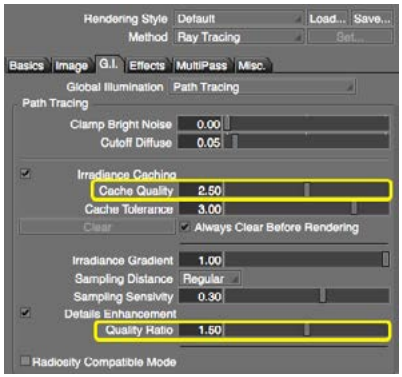


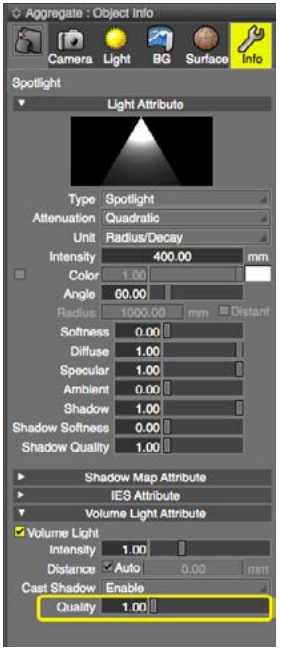
Shadow Quality for a spotlight

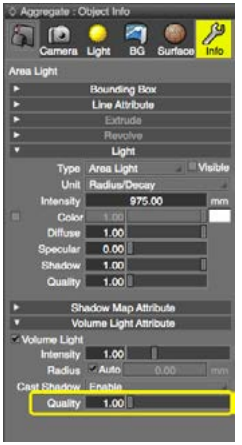


Left: Shadow quality for a distant light;
Right: shadow quality for an area light

The Quality Ratio setting in the Rendering Settings and Quality setting in the Object Info Window for volumetric lights is a ratio of the Ray Tracing Quality.

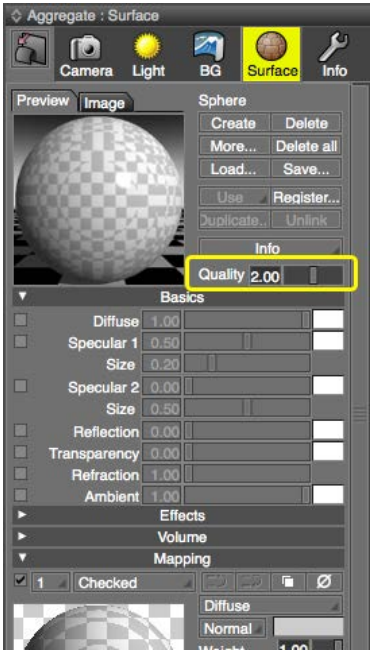






Adjusting Render Quality Per Surface

Adjust the **Quality** slider in the Surface Window to select the Ray Tracing render quality of the selected surface.



This allows you to maximize quality where it is important without unnecessarily increasing the ray tracing quality of the entire scene, and thus keep rendering time down. If you can tolerate a little noise in some objects but not in others, adjust the quality per surface. This affects basically all attributes Ray Tracing Quality affects, including reflection, anti-aliasing, volume, global illumination path tracing, and depth of field.

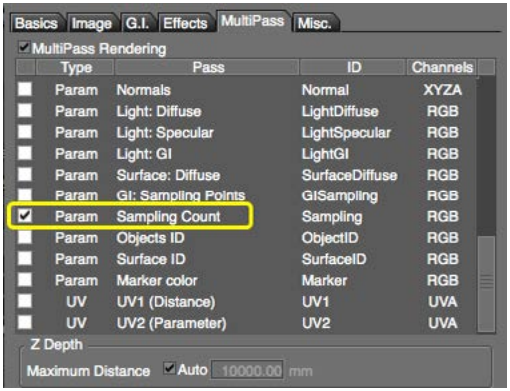
If the viewport display is set to a mode other than Wireframe, and Use All Lights is enabled, you can see the effect of changes to the quality in real-time.

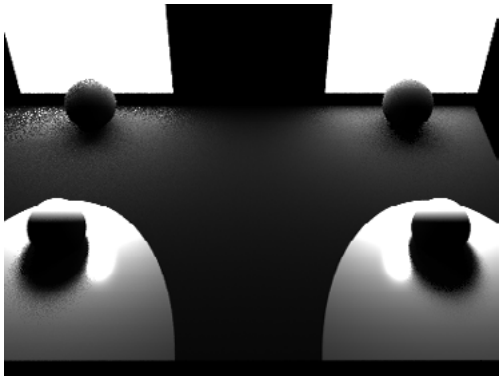
This feature is available in Shade3D Professional.

Sampling Count for MultiPass Rendering

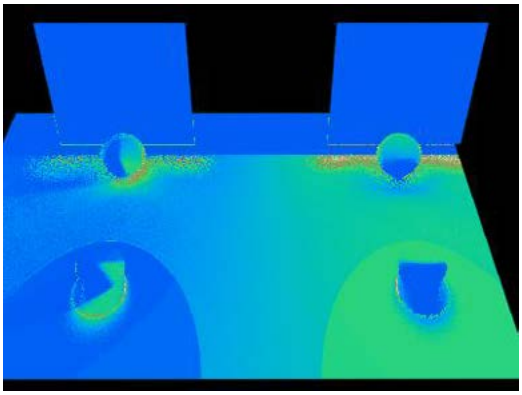
Particularly when adjusting the shadow softness or render quality per surface, it can be useful to know which areas of the scene require the most intensive calculations during rendering. A visual representation of this information can be seen using the Sampling Count pass.

On the MultiPass tab of the Rendering Settings, select the checkbox for **Sampling Count**. (You may have to scroll down to see it.)





Light Settings: This scene has been rendered with the light on the left set to low quality, and the light on the right to high quality.



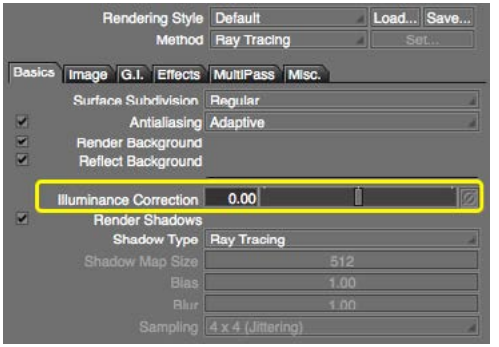
Result of the Sampling Count pass

This feature is available in Shade3D Standard and Professional.

Illuminance Correction

Illuminance correction is available as a slider on the Basics tab of the Rendering Settings. This allows a global adjustment of all light sources within the scene, relative to each other on a per-render basis.

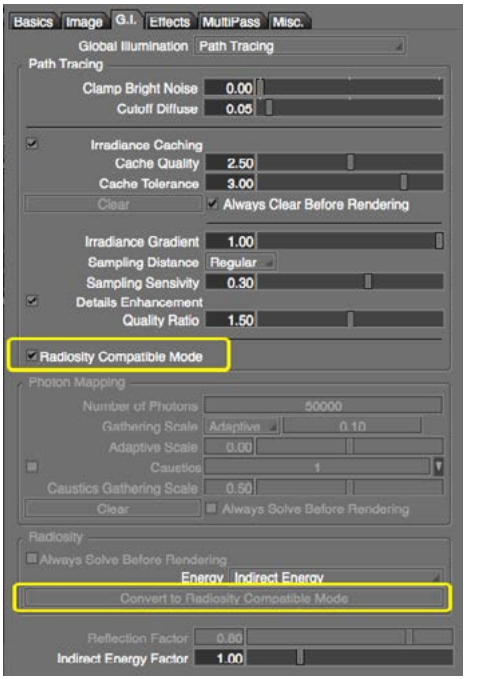
If the viewport display is set to a mode other than Wireframe, and Use All Lights is enabled, you can see the effect of changes to the quality in real-time.



This feature is available in Shade3D Standard and Professional.

Radiosity Compatible Mode

This feature enables certain Radiosity options for working with indirect and direct energy when rendering using Path Tracing.



This feature works in tandem with Illuminance Correction.

This feature is available in Shade3D Standard and Professional.

14. Animation

14–1. Joints

Using Joints to Move, Rotate, and Morph Objects

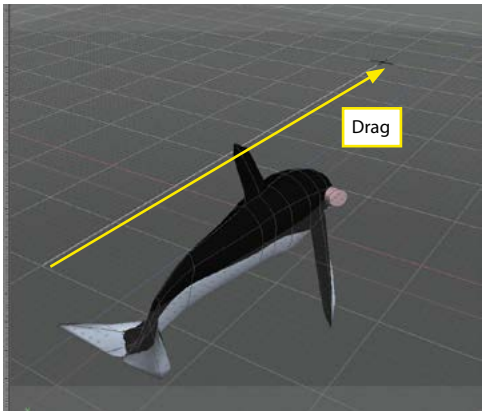
You can use joints for animating most objects in Shade3D. If you insert an object into the created joint, or set a skin and then change a joint value, the object will be animated.

Slider Joints

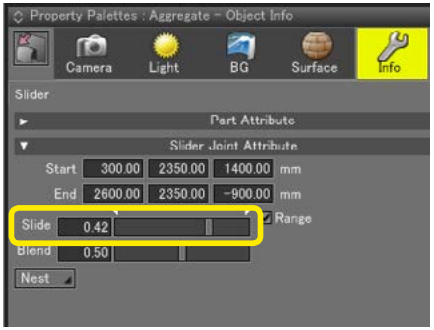
This joint is used to move an object in a straight line and is displayed as a straight line from the start point to the end point.

1 From **Toolbox**, select **Part** > **Transformation Joint** > **Slider**.

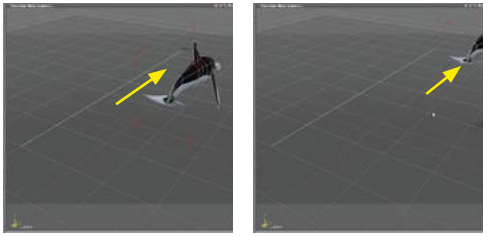
2 Drag the cursor to create a slider joint. You can move the object in a straight line in the drag direction, from the drag start point (base point) to the end point.



3 Manipulate the joint value. From the **Browser**, select the created **Slider** joint and then open the **Object Info** Window to expose the **Slider Joint** slider for further customization.



4 The object moves in a straight line along the joint.



TIP

You can also manipulate joint values from the Motion Window.

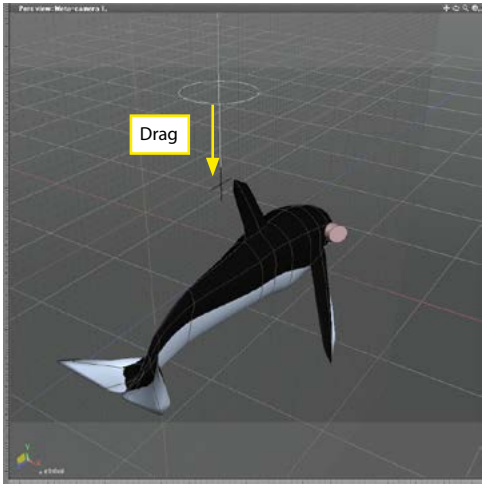
Rotator Joints

This joint is used to rotate an object and is displayed in the Figure Window as an axis of a straight line and a circle in the direction of rotation.

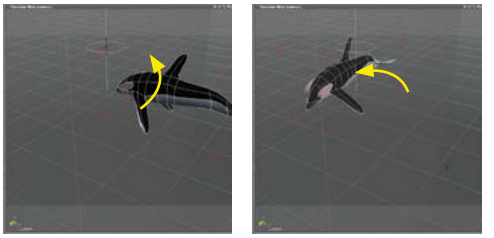
1 From **Toolbox**, select **Part** > **Transformation Joint** > **Rotator**.

2 Drag the cursor to create a rotator joint.

You can rotate the object using the range from the drag start point to the end point as the rotation axis.



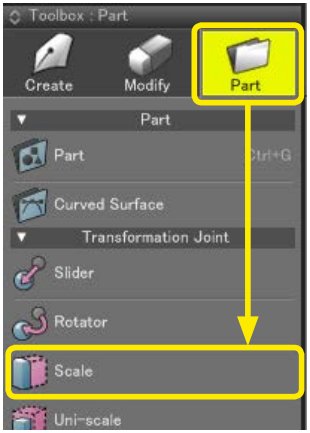
3 When you manipulate the joint value, the object rotates.



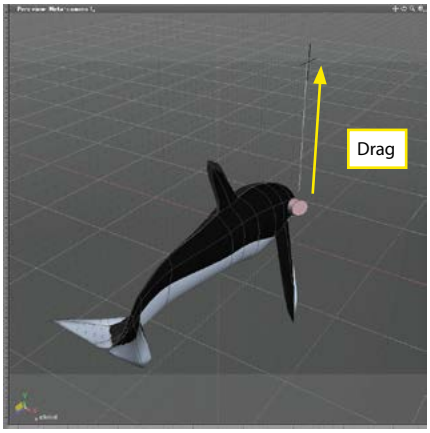
Scale Joints

This joint is used to enlarge or reduce the size of an object and is displayed in the Figure Window as a point and a straight line in the direction of enlargement.

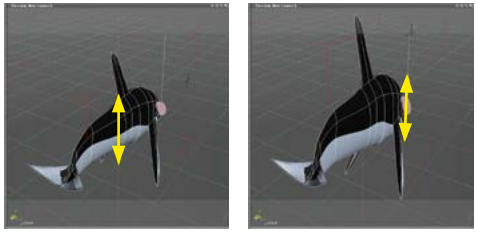
1 From **Toolbox**, select **Part** > **Transformation Joint** > **Scale**.



2 Drag the cursor to create a scale joint. You can enlarge or reduce the size of an object in the drag direction, within the range from the drag start point to the end point.



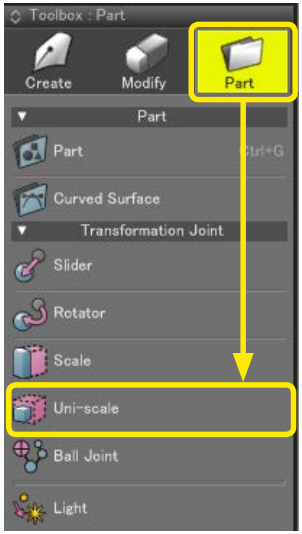
3 If you manipulate the joint value, the object is enlarged or reduced.



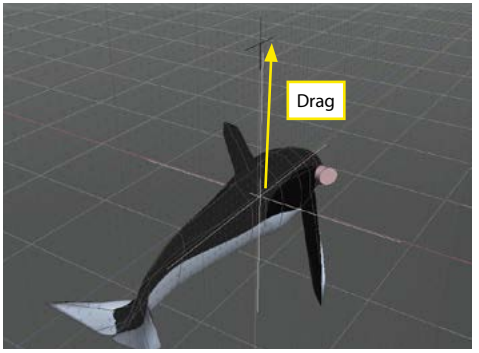
Uni-Scale Joints

This joint is used to evenly enlarge or reduce the size of an object in all directions and is displayed in the Figure Window using the basic point and straight lines in the directions of all three axes.

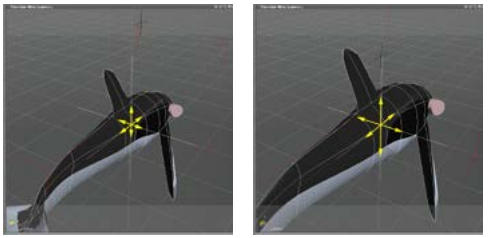
1 From **Toolbox**, select **Part** > **Transformation Joint** > **Uni-Scale**.



2 Drag the cursor to create a uni-scale joint. You can evenly enlarge or reduce the size of an object in all directions, within the range from the drag start point to the end point.



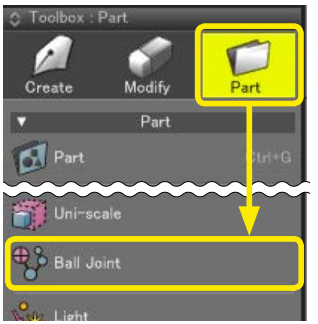
3 When you manipulate a joint value, the object is evenly enlarged or reduced in the directions of all three axes.



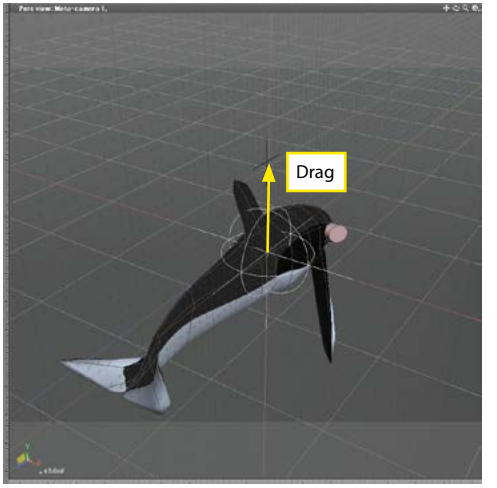
Ball Joints

This joint is used to rotate an object through 360 degrees and is displayed as a wireframe sphere.

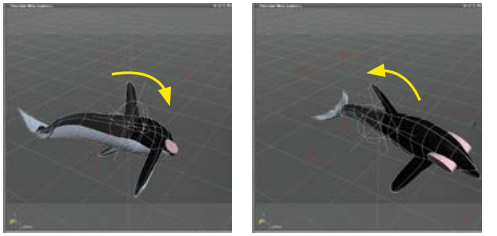
1 From **Toolbox**, select **Part** > **Transformation Joint** > **Ball Joint**.



2 Drag the cursor to create a ball joint. You can move the object in all directions by using the drag start point as the basic point.



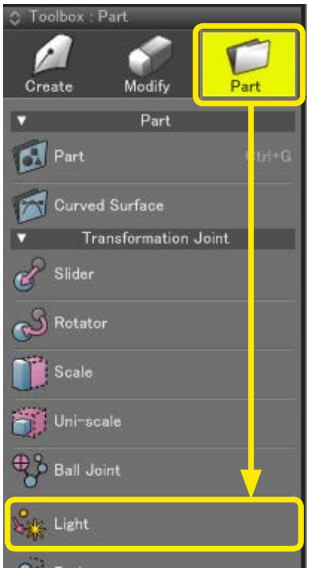
3 When you manipulate the joint value, the object rotates.

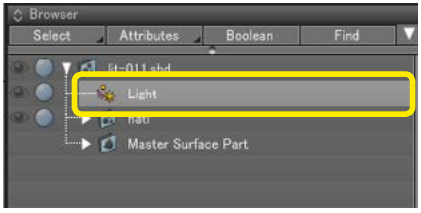


Animating Lights

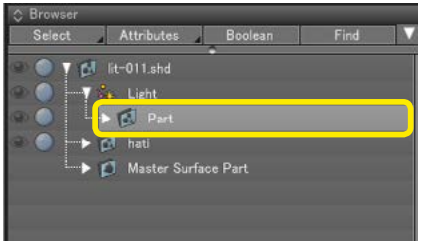
To animate a change in the brightness of a light, use a **Light Joint**. If you include multiple light objects within a **Light Joint**, you can collectively increase or decrease the brightness of all those light objects at the same time.

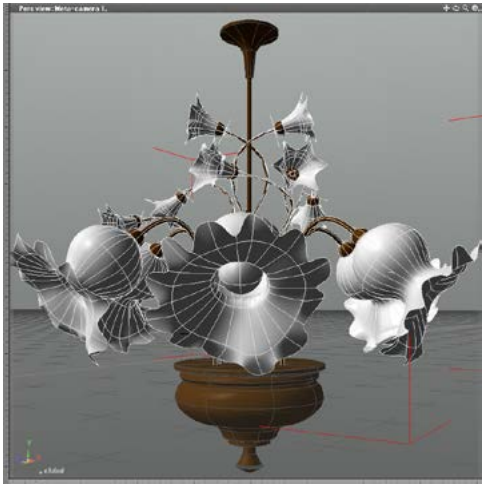
1 From the **Toolbox**, select **Part** > **Transformation Joint** > **Light** to create a light joint.





2 Insert the light object into the light joint. Below, a part containing multiple light objects has been inserted into the light joint.



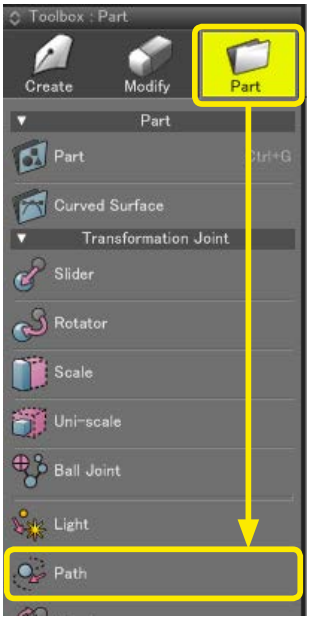


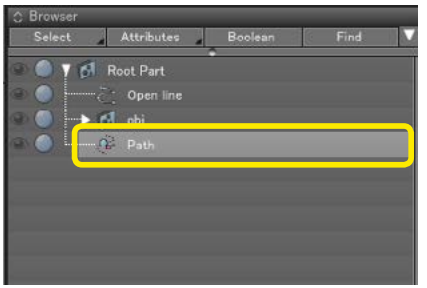
3 Manipulate the light joint value to change the light brightness.

Moving an Object Along a Path

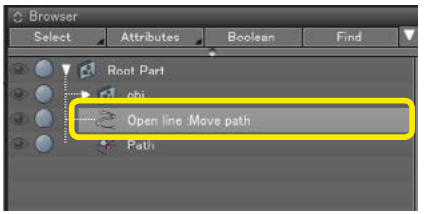
You can create a path joint for moving an object from the start to end point of a line. If you insert an object into the path joint, or apply skin settings and then change the joint value, the object moves along the path.

1 From the **Toolbox**, select **Part** > **Transformation Joint** > **Path** to create a path joint.

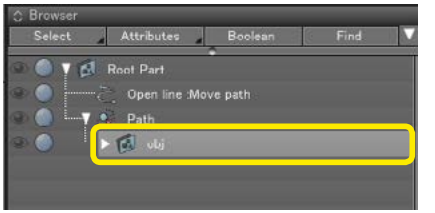




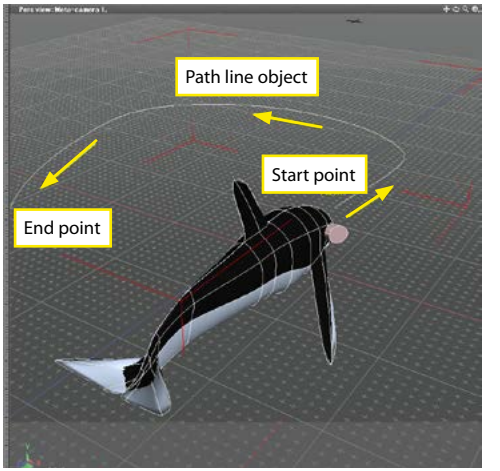
2 From the Browser, place the line object to be used as the path just above the path joint. **:Move path** is added after the name of the open line object. This indicates that the line object has been specified as the path.



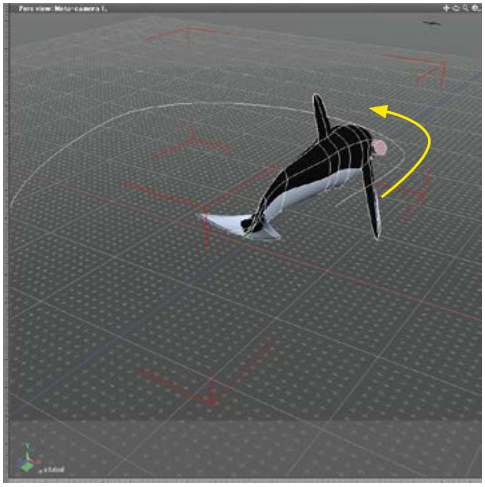
3 In the Browser, add an object to the path joint so it is nested inside.

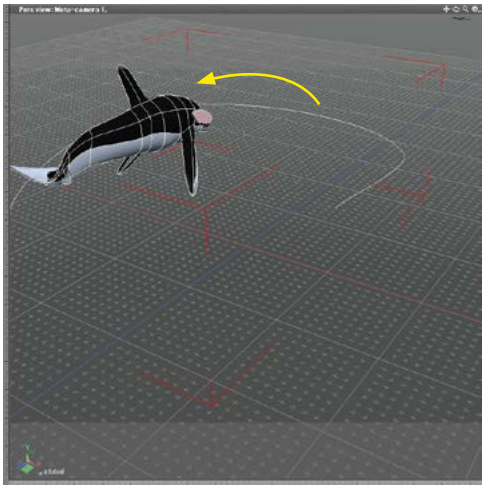


4 Place the object to move at the **Start point** position of the line object to be used as the path.



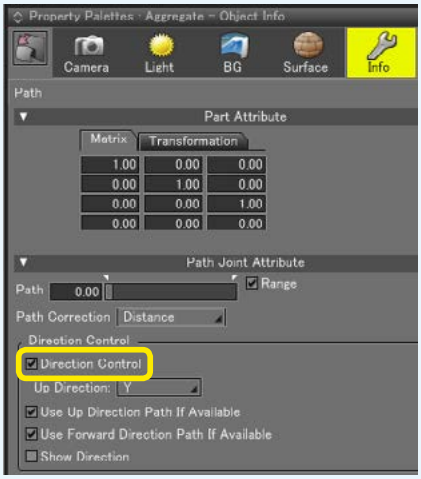
5 Manipulate the path joint value to provide animation.

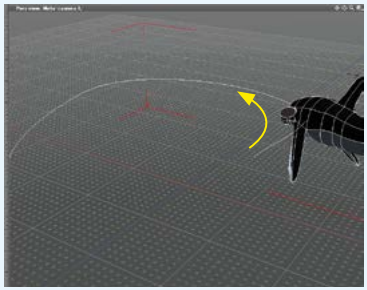


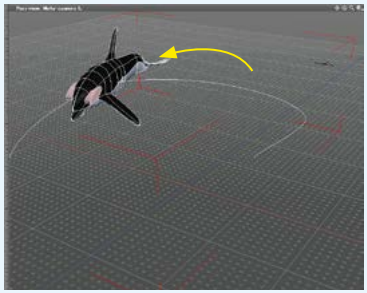


TIP

In Shade3D Standard and Professional, you can adjust the direction of the object to be moved with the **Direction Control** settings under **Path Joint Attribute** of the **Object Info** Window.



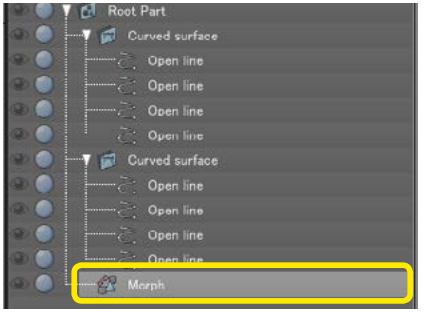




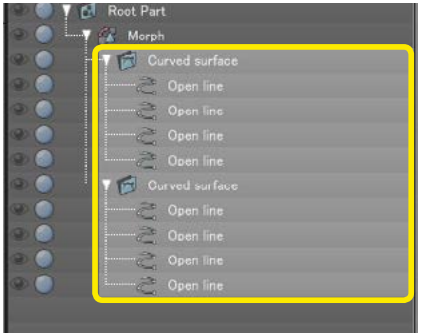
Morphing the Shape of an Object

You can create a morph joint for morphing two objects, so long as each has the same number of control points.
If you insert two objects, each having the same number of control points, into the morph joint and then change a joint value, the objects and surface attributes will be morphed from one shape to another.

1 From **Toolbox**, select **Part** > **Transformation Joint** > **Morph** and then create a morph joint in Browser.



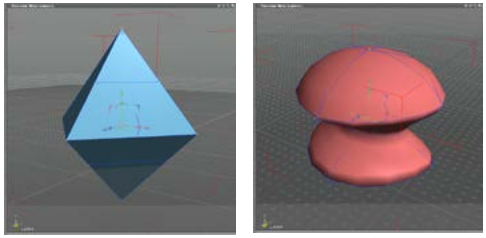
2 Enter two objects, each having the same number of control points, in the morph joint.



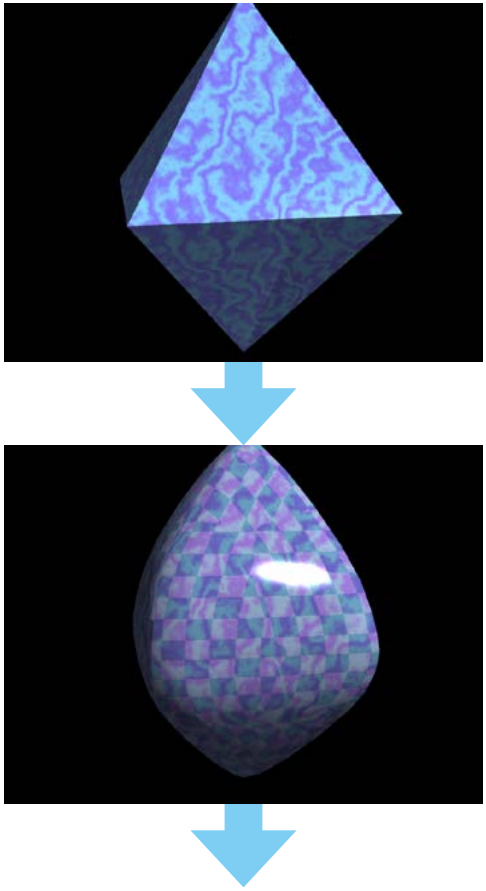
TIP

The morph joint can control two or more objects. If, for example, you morph three objects, joint value: 0 becomes the status of the top object, joint value: 0.5 the status of the second, and joint value: 1.0 the status of the third.

Two objects having 4 x 3 = 12 control points



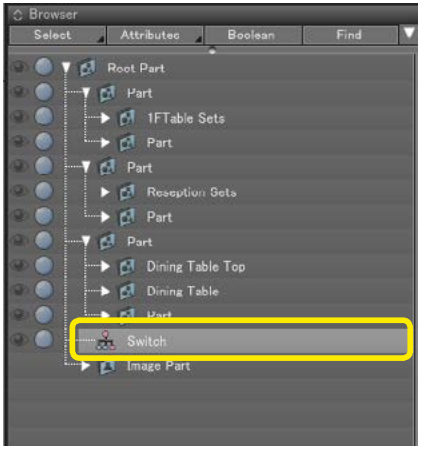
4 Manipulate the morph joint value to provide animation.



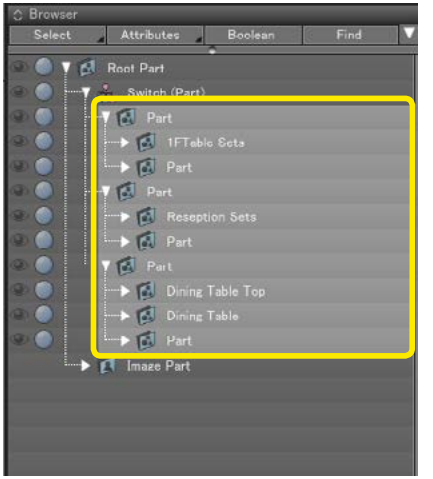
Switching Between Multiple Objects

You can use a switch joint to switch between multiple objects, first displaying one and then another. This change can be animated or used to quickly switch between different models, such as when presenting possible ideas to a client. Switching between objects inside the switch joint is done by changing the switch joint's value.

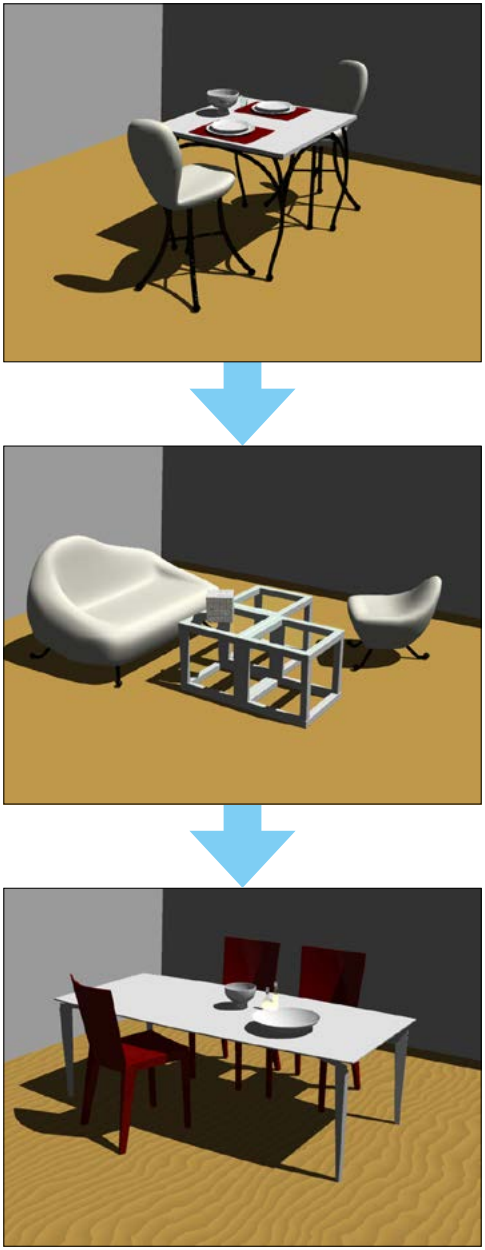
1 From the **Toolbox**, select **Part** > **Switch** to add the switch joint to the Browser.



2 In the **Browser**, insert the objects into the switch joint.

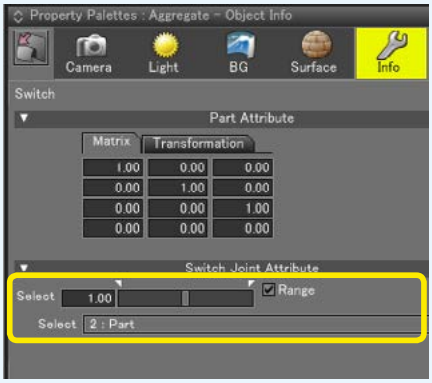


3 Manipulate the switch joint value to change the objects displayed in the scene.



TIP

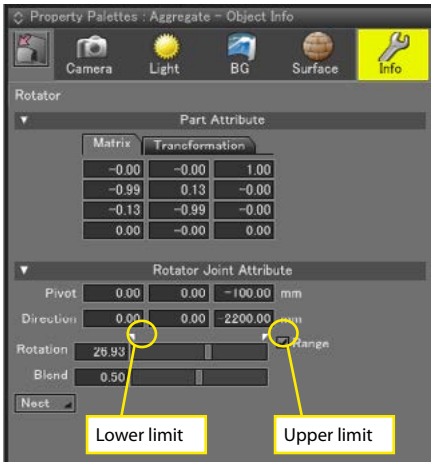
You can switch between objects in the switch joint from the **Select** pop-up menu in the **Switch Joint Attribute** group of the **Object Info** Window.



Limiting the Range of a Joint

You can set the upper and lower limits of the movable range of the joint.

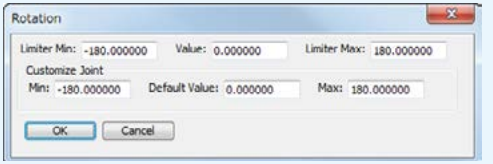
1 With the joint selected, drag one of the small triangles above the joint value slider in the **Object Info Window**. The joint can move only between these limits.



TIP

Click the joint slider while holding down the Ctrl (Windows) or option (Mac OS) key to display the numeric input dialog box.

From this dialog you can change the input width of the slider as well as enter joint limits numerically.

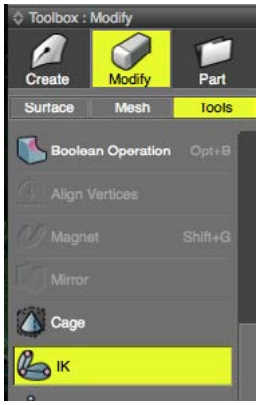


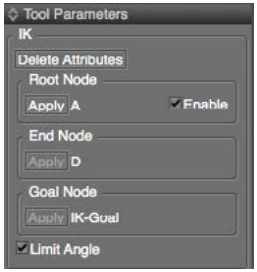
Inverse Kinematics

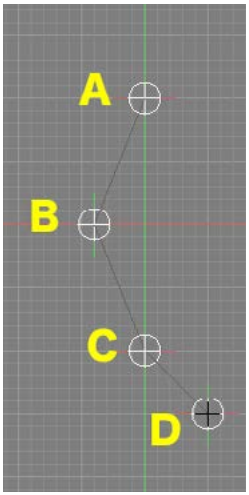
Inverse kinematics (abbreviated to "IK" below) uses a specified starting point (Root Node), ending point (End Node), and goal point (Goal Node) to correctly handle movement of ball joints and bones, such as the bending of a joint.
The IK structure is compatible with other tools and animation formats, such as FBX.

Applying IK

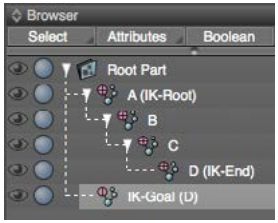
Here we have created a chain of four ball joints to which we will apply inverse kinematics. Check that the joints are nested in the Browser, and select the top-most joint. From the Toolbox, choose **Modify** > **Tools** > **IK**. This opens the IK options in the Tool Parameters Window.





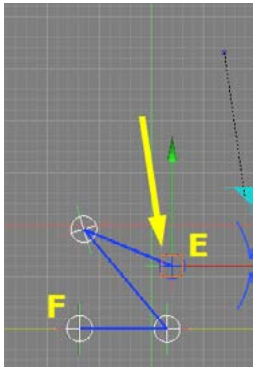


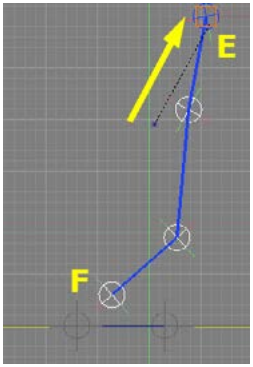
We want to apply the IK Root Node to joint A, so under the Root Node settings in Tool Parameters, click Apply. Next select joint D in the Browser, and under the End Node settings in Tool Parameters, click Apply to make joint D the end node. The IK Goal is generated automatically.



Moving the IK Goal

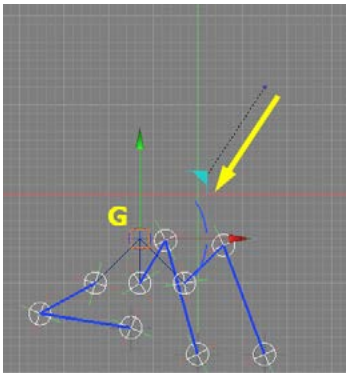
As you move the IK-Goal object, the IK chain reacts to this movement such that the IK-End object stays as close to the IK-Goal object as possible, and the intervening space is interpolated accordingly. Alternatively, you can move the base of the IK chain (the top of the IK hierarchy), with a similar effect. Below, raising joint E high enough results in the toes (F) lifting off the ground.

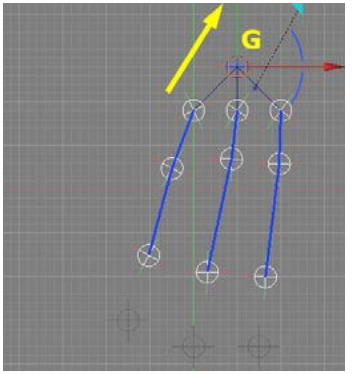




Branched Joints

Multiple IK joints can be connected to a single upper joint. In the images below, moving joint G causes each of the IK joints in the fingers to follow naturally.

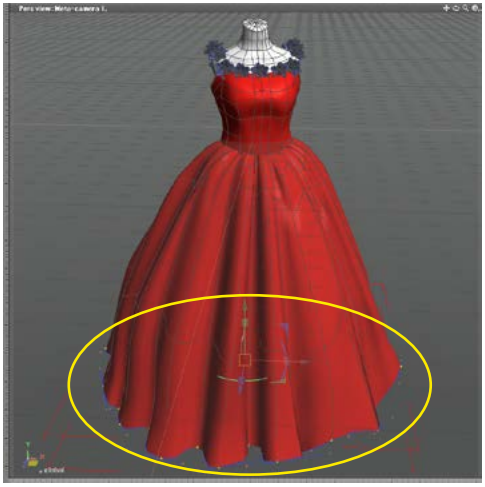


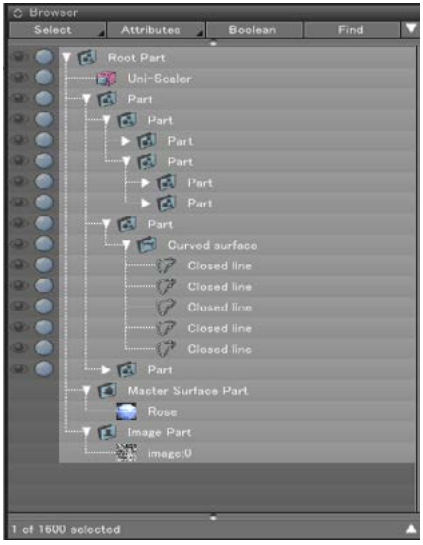


14–2. Skin

You can apply a skin to control points of an object.

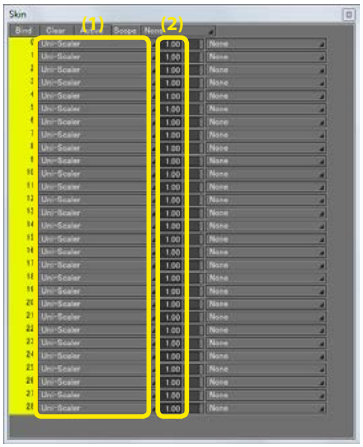
1 Select the control points to apply the skin.



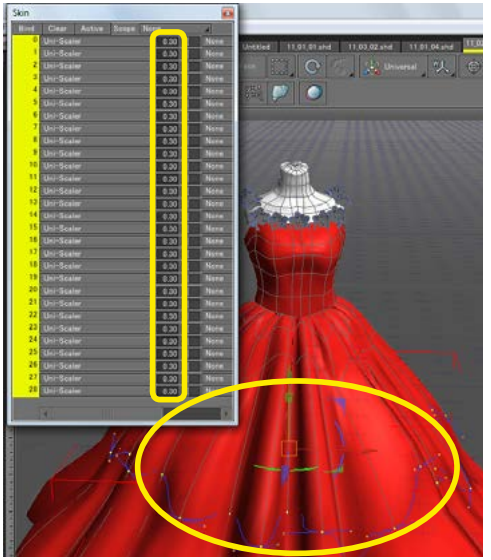


2 From the **View** menu, select **Skin** to display the **Skin** window.

3 Set the joint from the **Joint** pop-up menu of the **Skin** window **(1)** and then set the joint application value **(2)**. Here, the **Uni-Scale** joint has been set with application value **1.0.**



4 Similarly, set the skin for the control points just above the line object with an application value of **0.30.**



5 Manipulate the configured joint value to animate it.

TIP

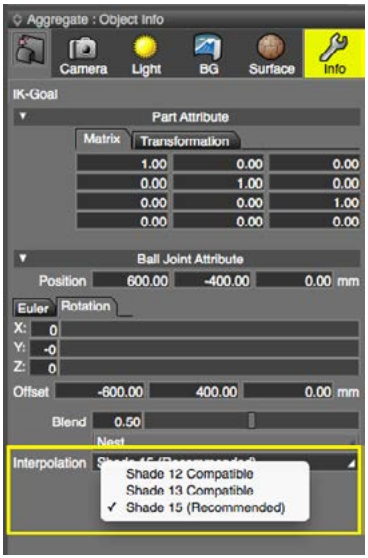
If the joint has a hierarchical structure (bones), pressing the **Bind** button automatically assigns the the joints to affect.

TIP

You can set the joint values individually by clicking the left-most number in the **Skin** window and by selecting a control point.

Tips for Editing Skin

If you run into problems when working with skin, sometimes the solution is to switch the **Interpolation** mode for the joint from the default setting of **Standard** to **Shade 13 Compatible** or **Shade 12 Compatible**. The interpolation setting is found in the Object Info Window.



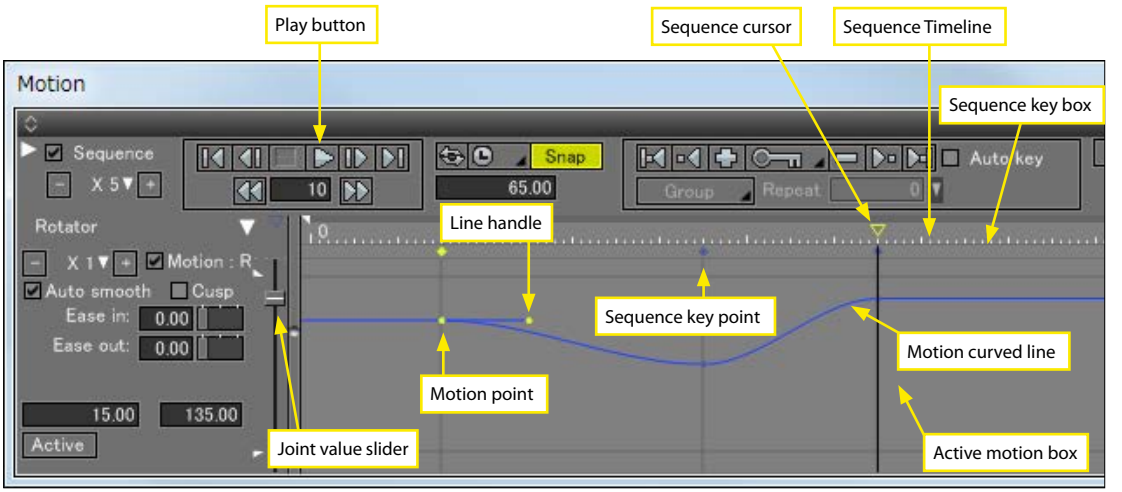
If any of the following occurs, try changing the interpolation method to Shade 13 Compatible.

- When a ball joint initial value is non-zero, editing the skin value causes the object to collapse.
- After applying skin to a rotated ball joint, setting the weight value causes vertices to rotate incorrectly.

14–3. The Motion Window

Parts of the Motion Window

The Motion Window is used to collectively manage all the joints in a scene when creating an animation, and to set joint values according to a sequence. This section introduces the names of the basic parts of the Motion Window.



●Sequence Cursor

Displays the current sequence position.

●Sequence Key Point

Displays the sequence position for which the motion is set.

●Sequence Timeline

Changes the sequence position by clicking or dragging.

●Sequence Key Box

Displays the sequence key point. Creates or moves the sequence key point.

●Joint Value Slider

Changes a joint value.

●Motion Point

Displays the joint value set for the sequence.

●Active Motion Box

Displays the motion point for the selected joint.

●Line Handle

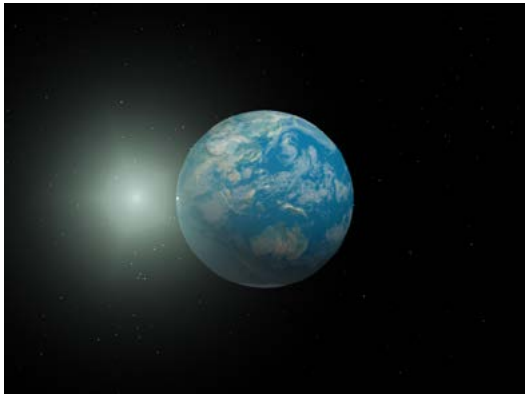
Changes the motion curved line.

●Motion Curved Line

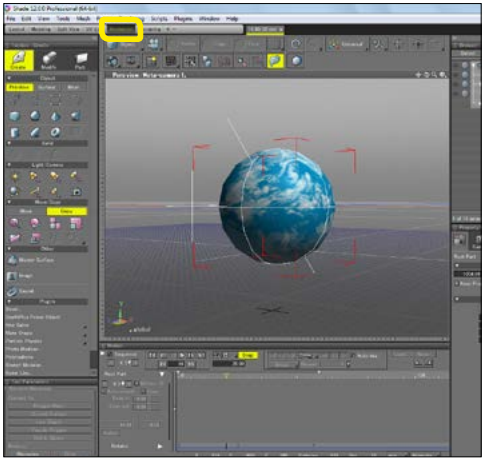
Displays joint value changes through the motion point connection line.

Animate by Changing Joint Values

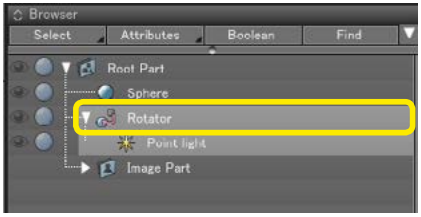
You can create a motion point in the sequence to provide animation. Let's create an animation in which the light rotates around the Earth.



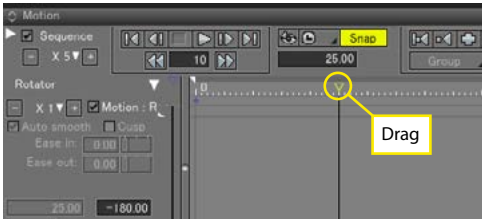
1 Click **Animation** in the Workspace Bar to switch the workspace to Animation.



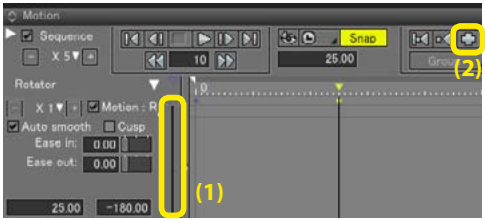
2 Select the joint to be set.



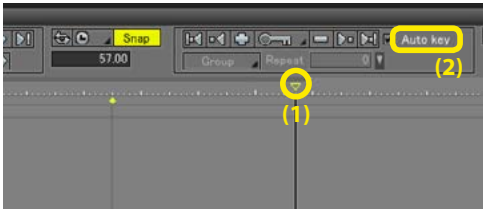
3 Click or drag the sequence ruler to set the sequence position from which animation will start.



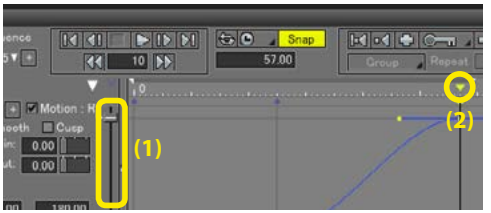
4 While operating the joint value slider, set the joint value **(1)**, and then click the **+** button to create a motion point or keyframe **(2)**.



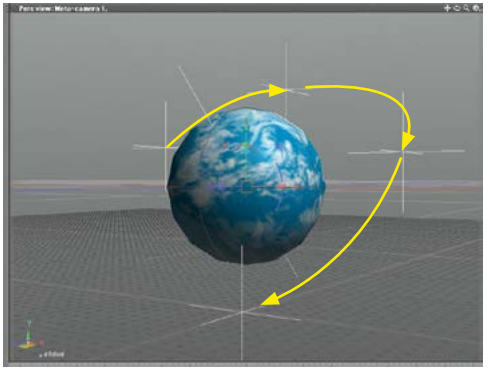
5 Set the sequence position at which the sequence ruler ends (1) and then check **Auto Key** (2).



6 While operating the joint value slider, set a joint value (1). A motion point is automatically created (2).



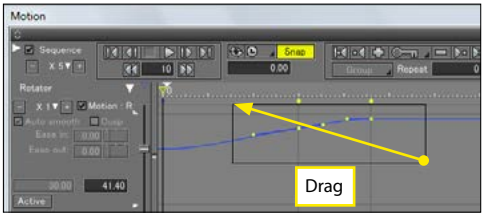
7 While operating the sequence ruler, return to the start position and then click the **Play** button to check the created animation.



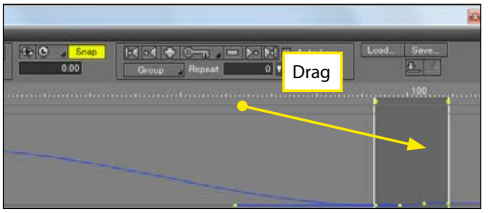
Changing Animation Timing

You can change the joint value and sequence position of a created motion point to adjust timing.

1 Select the motion point to be changed.

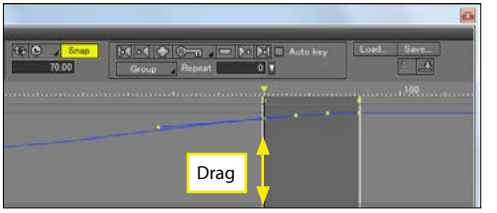


2 You can drag the selected area to change both the sequence position and joint value at the same time.



3 You can drag the sequence key point to change only the sequence position.

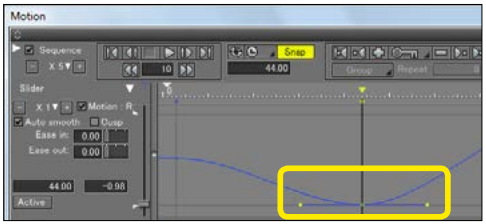
4 You can drag the motion point vertically to change only the joint value.



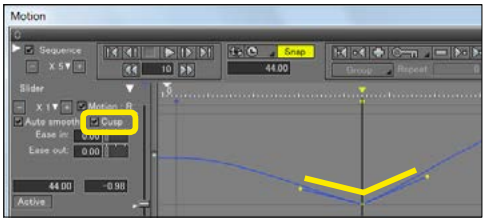
Making Joint Values Change Abruptly

You can bend the line handle of the motion point to make an abrupt change to a joint value.

1 Select the motion point where the line handle is to be bent.



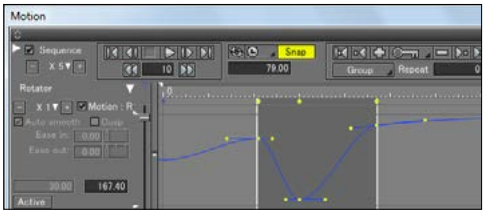
2 Check the **Cusp** checkbox. The motion curved line is bent.



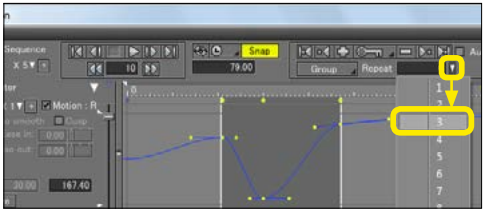
Looping Animation

You can repeat a selected sequence range to create a looping animation.

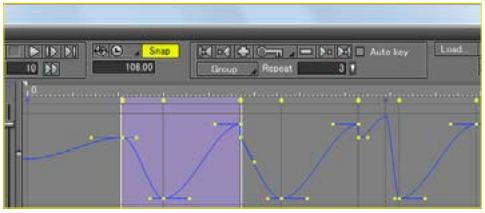
1 Select two or more motion points that are continuous to each other.



2 Set the repetition count in the repeat text box or pull-down menu.



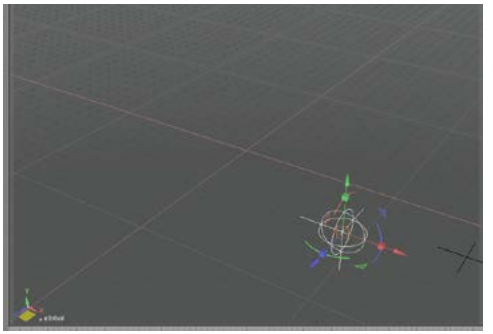
3 The animation is repeated backwards from the selected range, as many times as the specified repetition count.



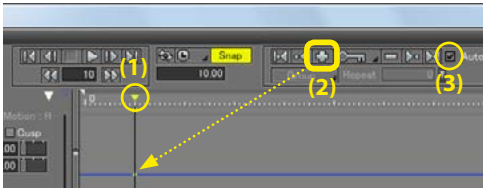
Moving a Ball Joint and Camera Along a Path

You can set an offset movement for a ball joint or camera object in the animation path. Here is an example using a ball joint.

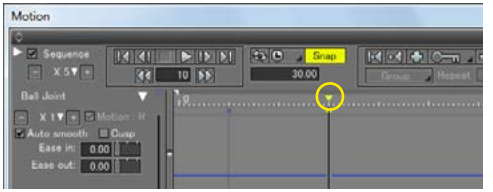
1 Select a ball joint.



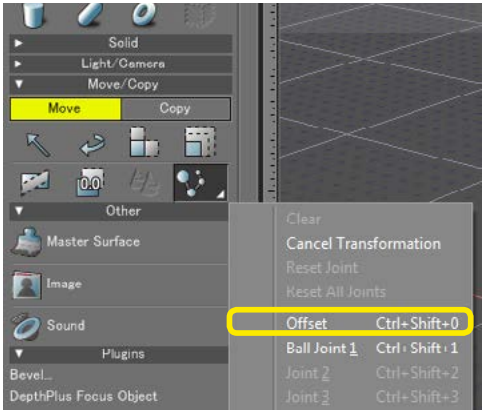
2 Select the first sequence position **(1)**. Click the + button to create the first motion point **(2)**. Check **Auto Key (3)**.



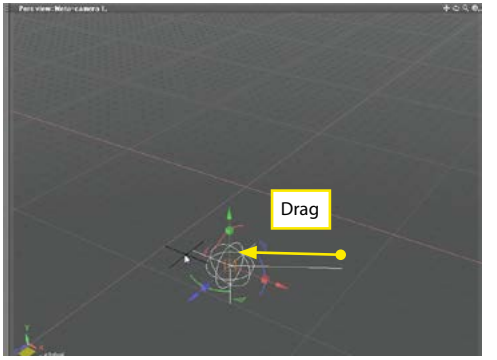
3 Select the sequence position at which the next motion point is to be created.

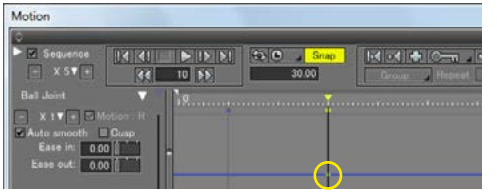


4 From the Toolbox, select **Create** > **Move/Copy** > **Joint Operation** > **Offset**.

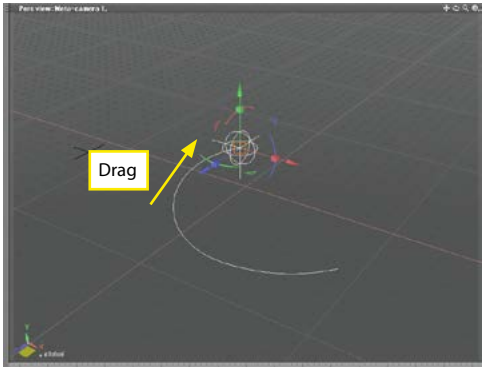


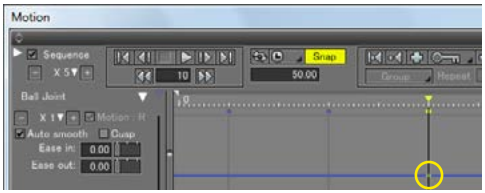
5 Drag the ball joint in the Figure Window to create a motion point.

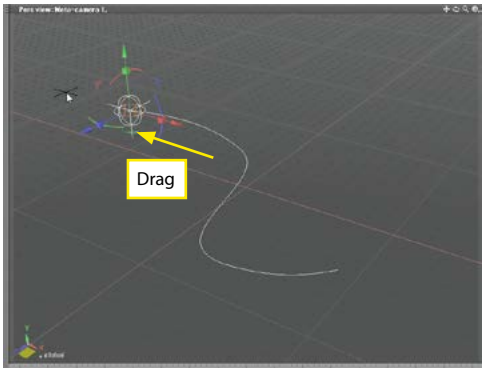


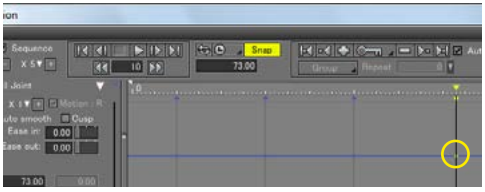


6 Repeat the procedure to create an offset movement path.









TIP

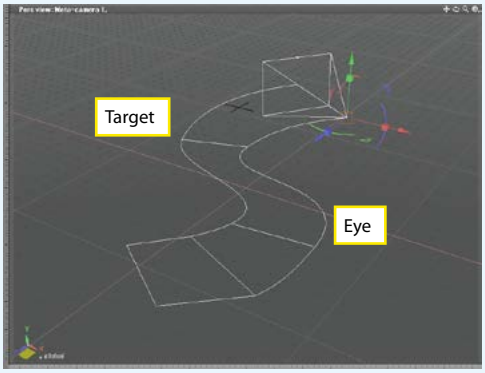
You can edit the created path by dragging the control point.

TIP

By setting the rotation of the ball joint itself at the same time, you can create an animation that moves along the path while rotating.

TIP

The camera object path is created for each of the eye and target points.

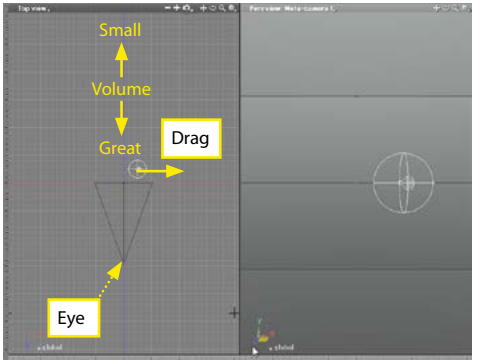


Adding Sound

You can create and append sound to create 3D audio effects in an animation.

1 From the Toolbox, select **Create** > **Other** > **Sound**.

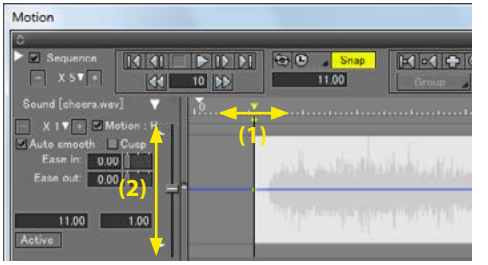
2 Drag or click in the Figure Window to create a sound object. The eye position of the camera becomes the mike. The nearer the sound approaches the eye point, the louder it is when reproduced; the further the sound moves away from the eye point, the quieter it is when reproduced.



3 From the opened **Open** window, select the sound to be reproduced.

4 In the Motion Window, drag the sequence key point of the sound or drag the left end of the waveform to set the sequence position at which the sound will be reproduced **(1)**.

Set the playback volume with the joint value of the motion point **(2)**.



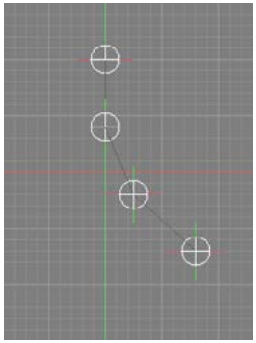
Motion Effects

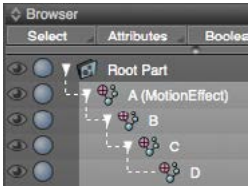
Motion Effects are effects such as gravity, wind, and elasticity that can be simulated on a joint chain composed of ball joints.

Bones are also supported.

Applying Motion Effects

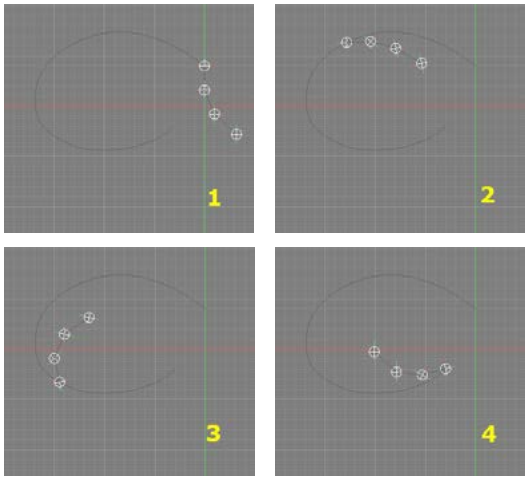
Select the ball joint chain hierarchy in the Browser, and in the Toolbox, choose **Modify** > **Tools** > **Motion Effects**.





Simulating Gravity

Moving the root object in the Motion Effects chain causes the child joint objects to following the path of motion, but with a gravity effect pulling down on them.



Simulating Elasticity

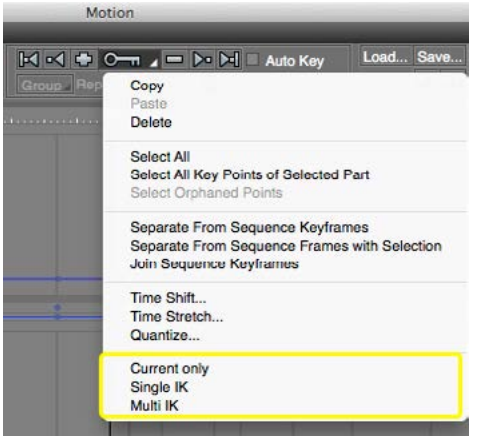
In Tool Parameters, select the **Enable** checkbox under Elasticity and adjust the **Strength** slider to set the degree to which the joint chain tends to return to its initial position.

Simulating Wind

In Tool Parameters, select the Enable checkbox under Wind to generate a random wavering effect on the motion of a joint chain. The maximum distance objects are moved by the wind effect in the X, Y, and Z directions is determined by the Translation values. A larger Frame Count results in a slower wavering effect.

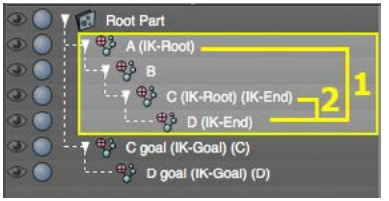
Adding Keyframes in the Motion Window

When adding or removing keyframes in the Motion Window, you can specify which joints receive a key point. This is done by selecting one of several options from the Edit Keys pop-up menu.



Range of Keys Affected

Here we will use an example with two IK chains: the first with ball joints A-B-C, and the second with ball joints C-D.



Current Only

Create Point and Delete Point operations affect only the selected joint itself.

By default, all IK chains are affected by key point operations.

Single IK

The Create Point and Delete Point operations affect the Single IK chain containing the joint. If the selected joint is part of multiple IK chains, a key point is also added to affected joints.

The following table shows which IK chain in our example gets key points when Single IK is selected.

Selected Joint	Key Point Added to:					
	A	B	C	D	C goal	D goal
A	1	1	1		1	
B	1	1	1		1	
C	1	1	1 2	2	1	2
D			2	2		2
C goal	1	1	1		1	
D goal			2	2		2

Multi IK

Create Point and Delete Point operations affect all IK chains linked to the selected joint. If child elements in the selected IK chain have been assigned other IK settings, the other IK chain(s) also receives key points. However, parent elements in the IK chain are unaffected.

The following table shows which IK chain in our example gets key points when Multi IK is selected.

Selected Joint	Key Point Added to:					
	A	B	C	D	C goal	D goal
A	1	1	1	1	1	1
B	1	1	1	1	1	1
C	1	1	1	1	1	1
D			2	2		2
C goal	1	1	1	1	1	1
D goal			2	2		2

14–4. Plugin–Enhanced Animation

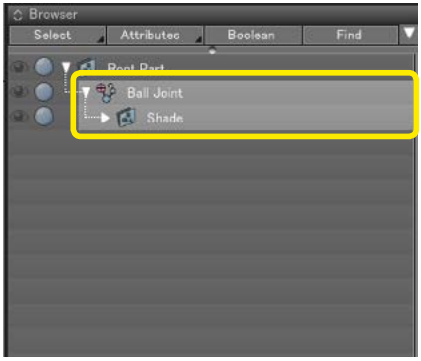
Constraining the Camera Direction

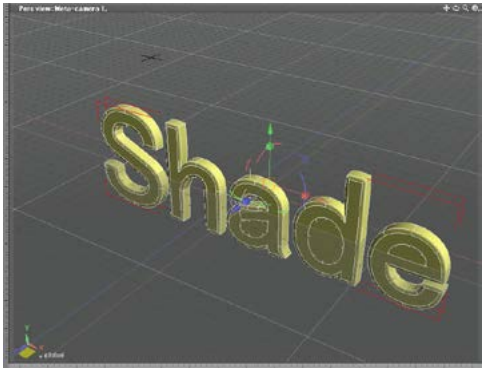
Standard and Professional Only

Using **Set AimConstraints Camera Attributes**, you can create animation in which an object inserted into a rotator or ball joint always faces the front of the camera.

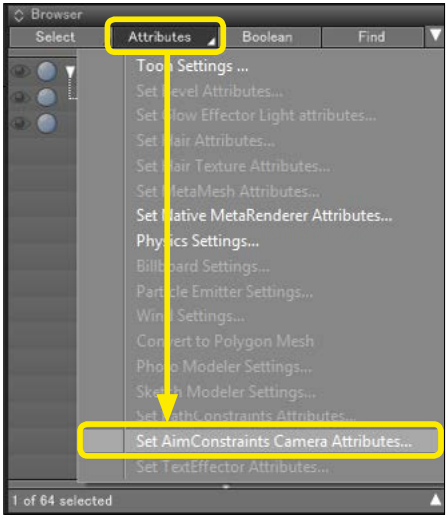
Set AimConstraints Camera Attributes is available in Shade3D Standard and Professional.

1 Select the ball joint containing the object that is made to face the front of the camera.

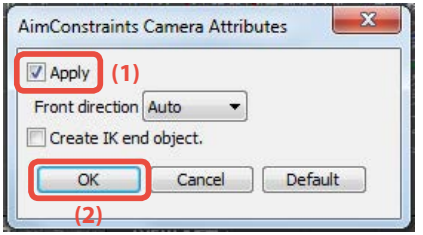




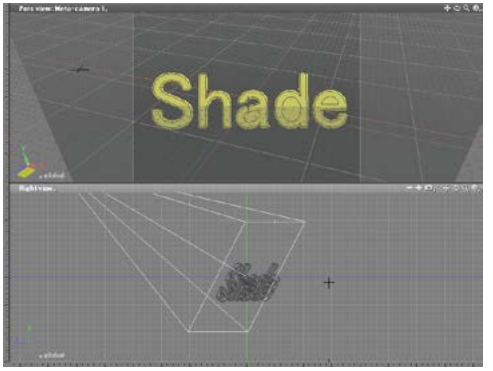
2 From the **Attributes** pop-up menu of the Browser, select **Set AimConstraints Camera Attributes**.

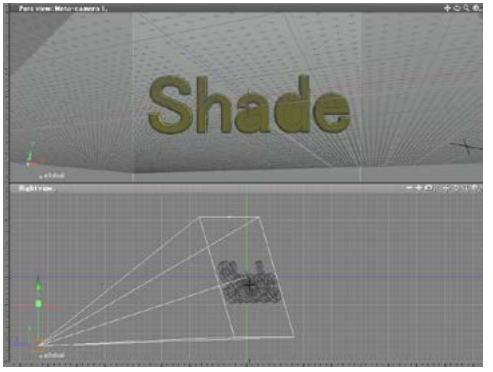


3 From the displayed dialog, check the **Apply** checkbox **(1)** and then click the **OK** button **(2)**.



4 While operating the camera, confirm that the object always faces the front of camera as the camera moves.





Constraining Joints with SmartKinematics

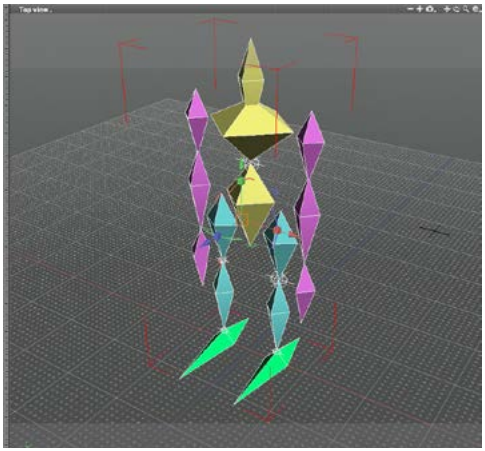
Standard and Professional Only

Using **SmartKinematics**, you can restrict the movement of the ends of the multiarticular joints.

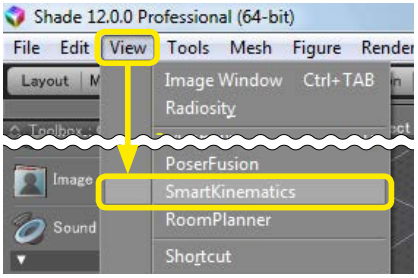
SmartKinematics is available in Shade3D Standard and Professional.

1 From ShadeExplorer, open **smartkinematics_robo.shd** included in the Documentation folder.

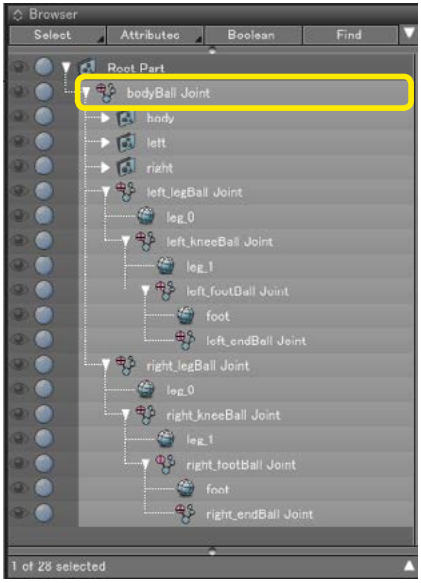
When the body of this doll is moved with joints, restrain the doll so that its ankles always remain in their original positions.



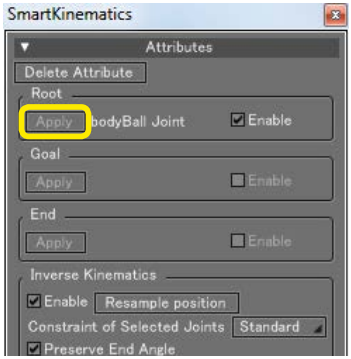
2 From the **View** menu, select **SmartKinematics**.



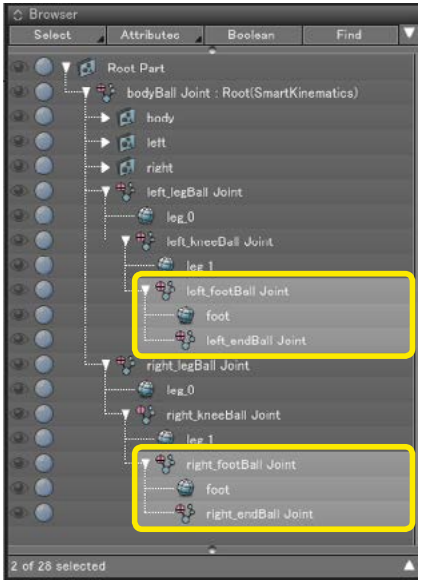
3 From the Browser, select the top ball joint **bodyBall Joint**.



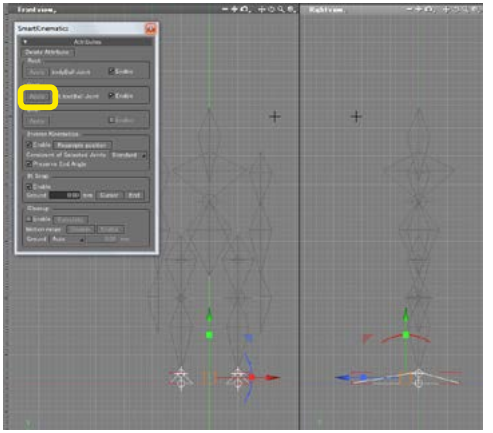
4 From the **SmartKinematics** window, click the **Apply** button of the **Root** group to register this ball joint in the root.



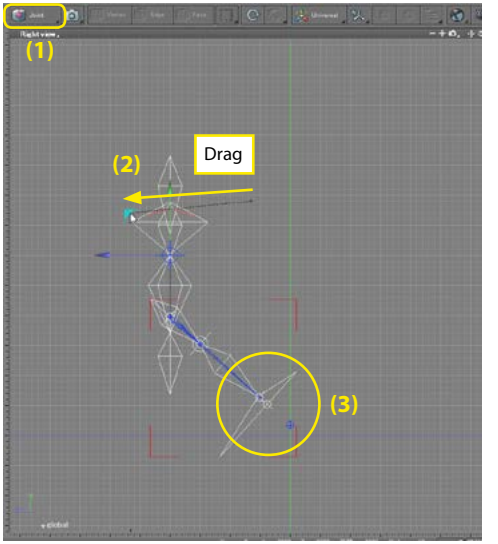
5 Next, select both the ankle ball joints, namely **left_foot Ball Joint** and **right_foot Ball Joint**.

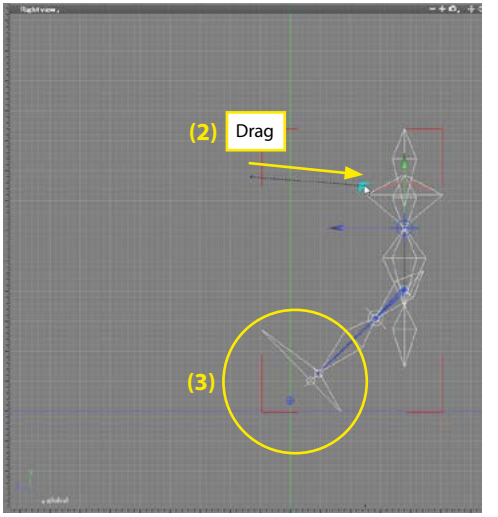


6 From the **SmartKinematics** window, click the **Apply** button of the **Goal** group to register these ball joints in the Goal.



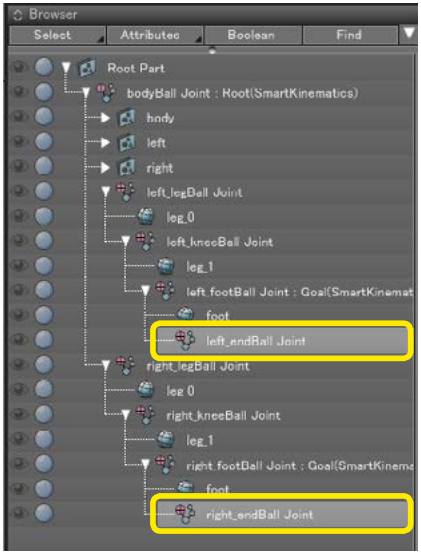
7 Switch to **Joint Mode** (1). Select the top **body Ball Joint** and then operate the manipulator (2). The shape from the ankle to the end is restrained so that it always faces the original position (3).



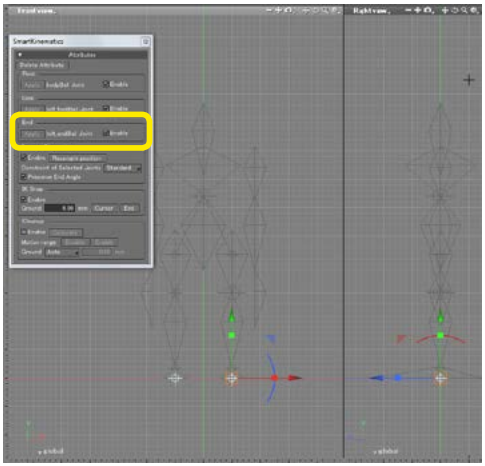


8 From the **Edit** menu, select **Undo** to return that shape to its original position.

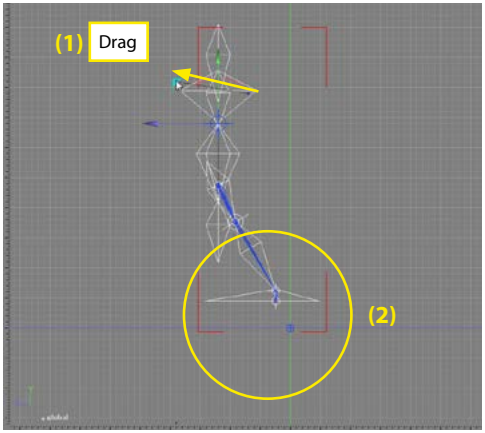
9 Next, restrain the shapes from the ankles to the ends so that they do not move. Select **left_end Ball Joint** and **right_end Ball Joint** of the ankle ends.

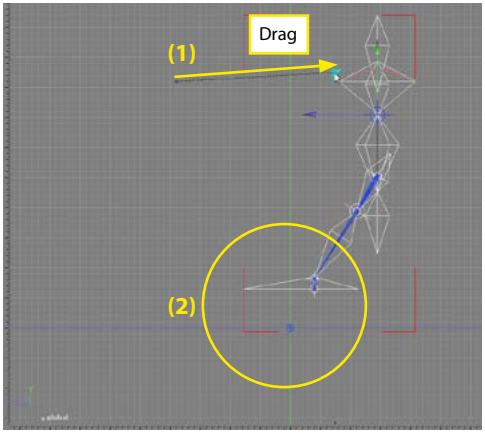


10 From **SmartKinematics**, click the **Apply** button of the **End** group to register this ball joint in the End.



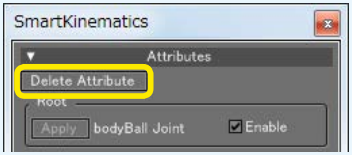
11 Select **body Ball Joint** and then operate the manipulator **(1)**. The position relationship between the ankles and their ends is restrained **(2)**.





TIP

To cancel a registration, select the joint and then click **Delete Attribute** in the SmartKinematics window.



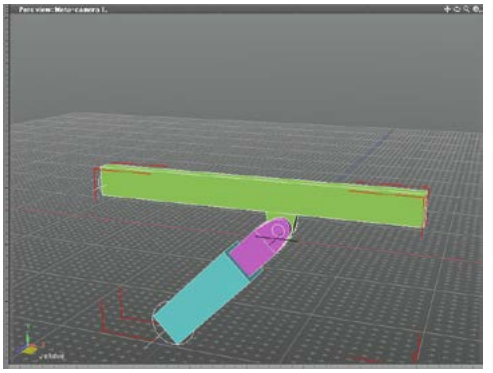
Linking the Movements of Multiple Joints

Standard and Professional Only

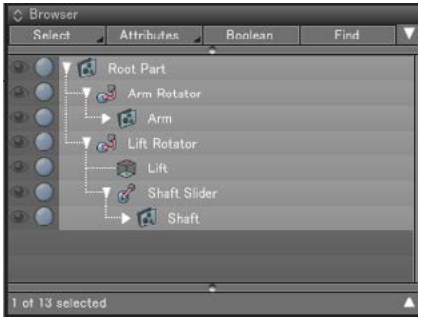
Using **AimConstraints**, you can link the movements of multiple joints together to represent complicated movement. AimConstraints automatically runs after the target position is configured.

AimConstraints is available in Shade3D Standard and Professional.

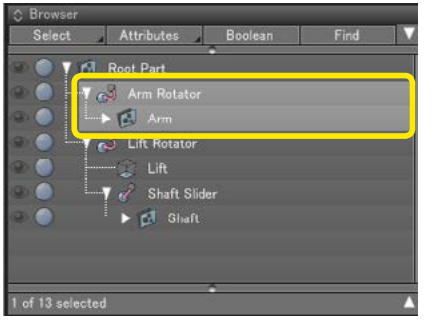
1 From ShadeExplorer, open **animation_target.shd** included in the documentation folder.

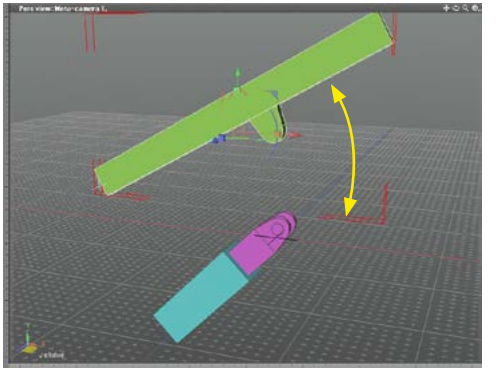


This scene incorporates two rotator joints and one slider joint.

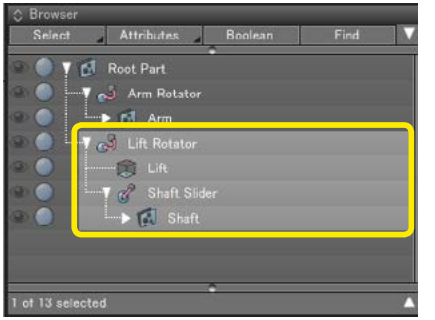


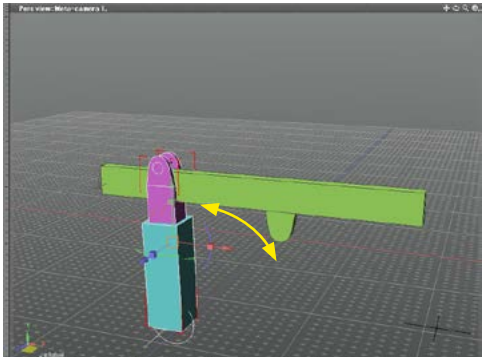
The joint named **Arm Rotator** rotates the upper arm.



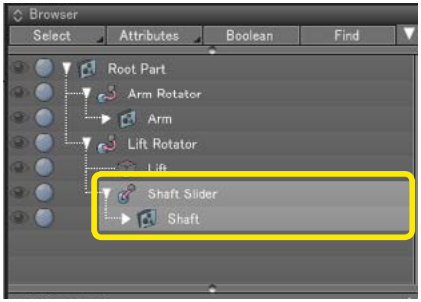


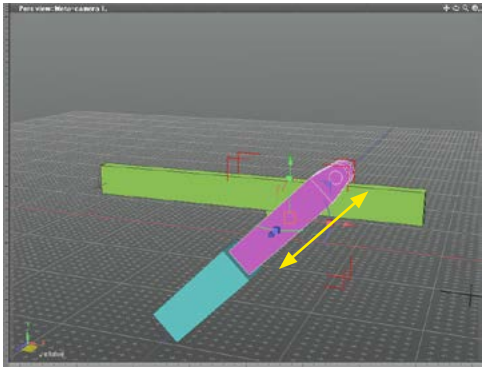
The **Lift Rotator** joint rotates the lower lift pedestal.





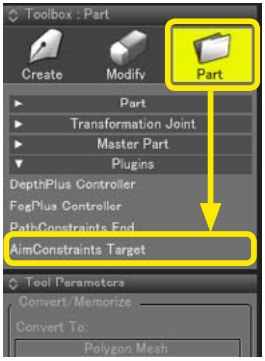
The **Shaft Slider** joint moves the shaft part in a straight line.



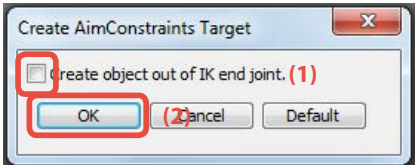


2 First, link the **Lift Rotator** to the **Arm Rotator**.

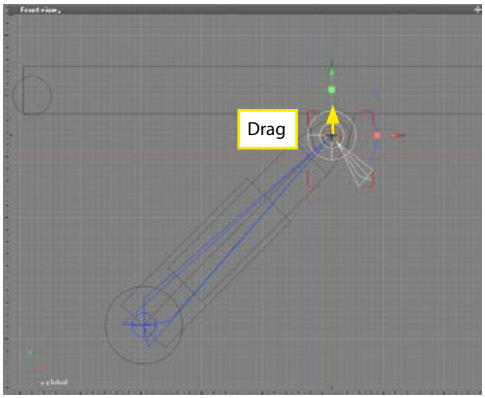
Select the **Lift Rotate** joint and, from **Toolbox**, select **Part** > **Plugins** > **AimConstraints Target**.

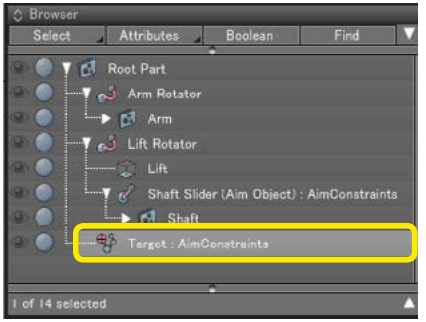


3 From the displayed dialog, uncheck the **Create object out of IK end joint.** checkbox **(1)** and then click the **OK** button **(2)**.

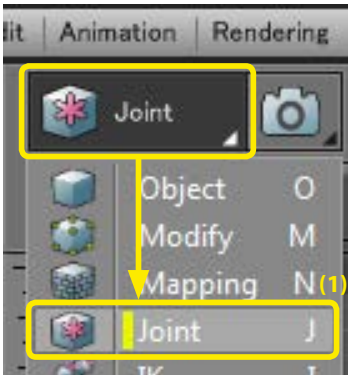


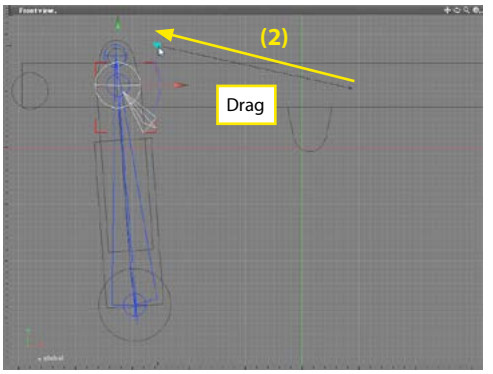
4 Switch to the front view, click or drag the linkage between the arm and shaft, and then create **Target:AimConstraints**.



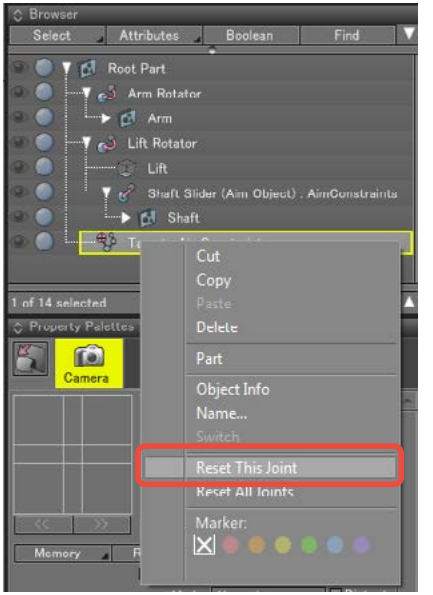


5 Switch to **Joint Mode** **(1)** and operate the manipulator to confirm that **Lift** follows the target movement **(2)**.

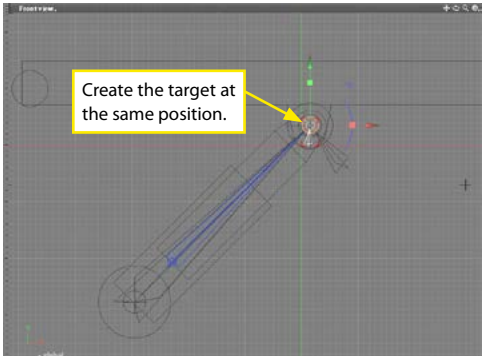


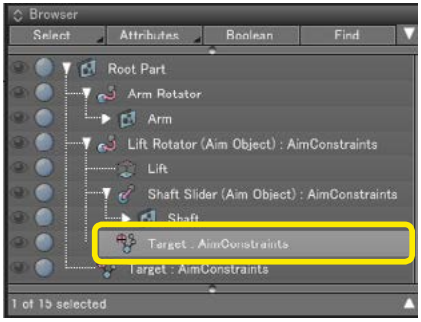


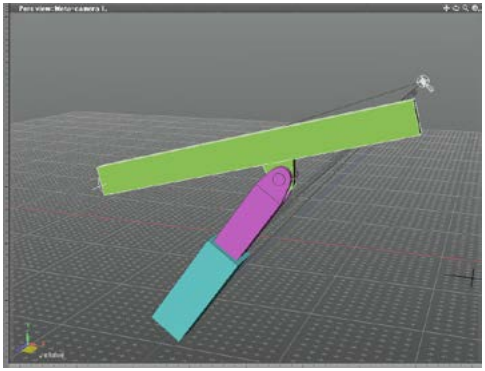
6 From the Browser, right-click **Target:AimConstraints** and then select **Reset This Joint** to return the joint to its original position.



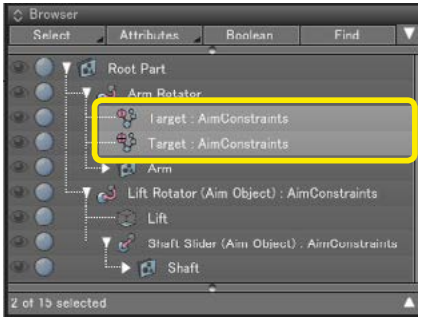
7 Next, from the Browser, select **Shaft Slider** and create the target in the same position.

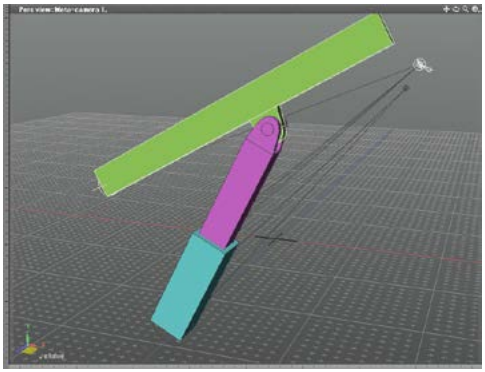




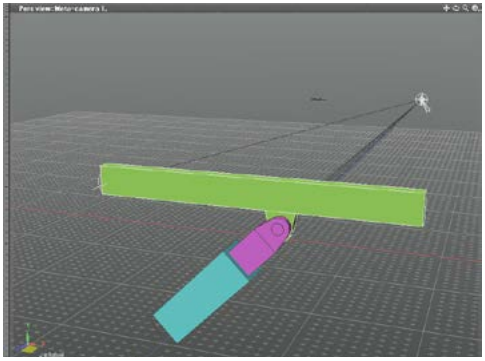


8 Insert the two created targets into the **Arm Rotator** joint.





9 Operate the **Arm Rotator** joint to confirm that the two joints are linked to the **Arm Rotator** joint, that the lift rotates, and that the shaft stretches.



TIP

To unlink the linkage setting, delete the **Target:AimConstraints** object.

Reproducing the Movement of a Train

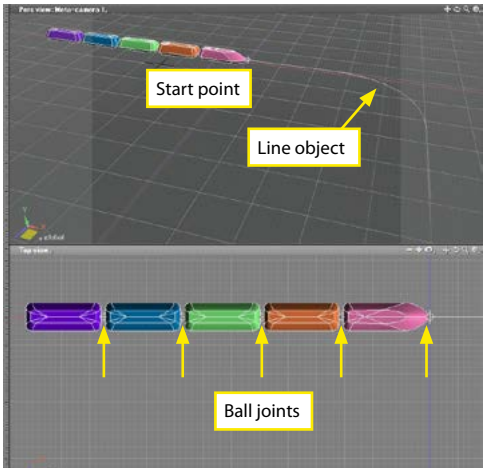
Standard and Professional Only

Using **PathConstraints**, you can move multiarticular joints along a path.

PathConstraints is available in Shade3D Standard and Professional.

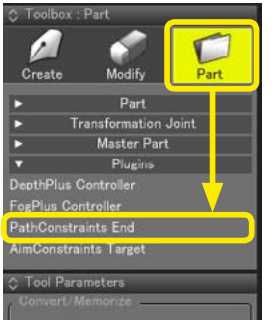
1 From ShadeExplorer, open **pathconstraints_train.shd** included in the documentation folder.

Five railway cars are linked by the ball joints and an open line object that will become the path stretches out from the head of the train (start point).

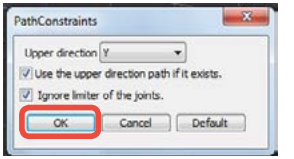


The linked railway cars are in the path joint and the path of the open line object exists above the path joint.

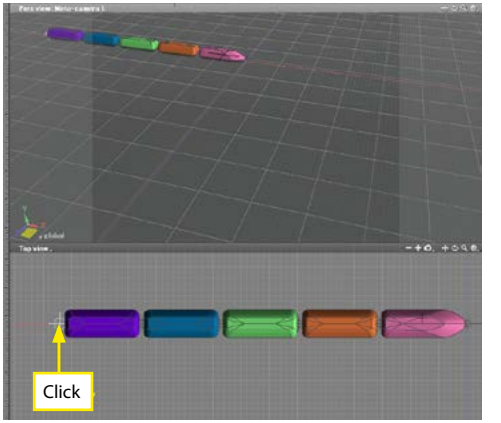
2 Select the path joint and, from **Toolbox**, select **Part** > **Plugins** > **PathConstraints End**.

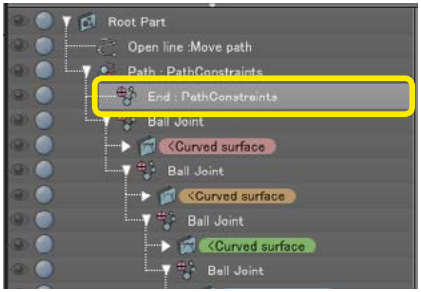


3 Click the **OK** button of the displayed dialog.

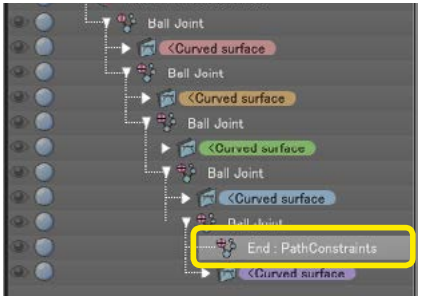


4 Click the tail of the train and then create **End:PathConstraints**.

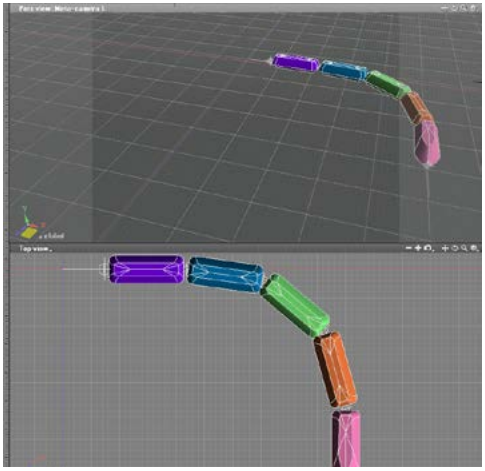




5 Move **End:PathConstraints** inside the lowest layer ball joint.

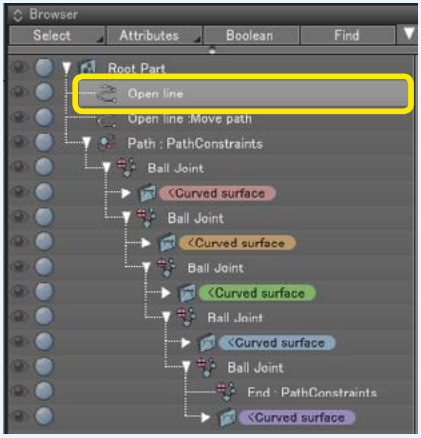


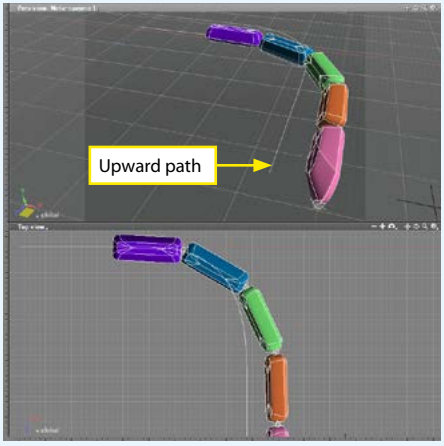
6 Operate the path joint to confirm that the train moves along the path.



TIP

You can achieve diagonal movement by creating an upward path for setting the upward direction for the path. Copy the path, move it onto the train, and then place the upward path whose end point has deviated slightly within the curve. The train will thus slant inwards along the curve.





15. Plugins

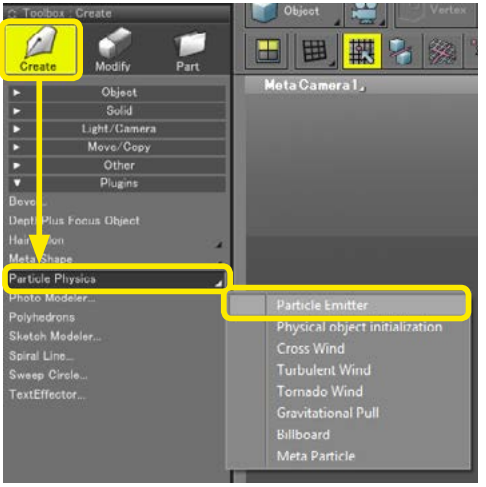
15–1. Particle Physics

Standard and Pro Only

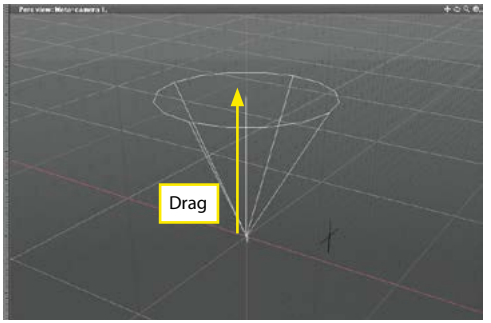
Generating Smoke or Flame

You can use the following steps to create smoke rising from a burning source.

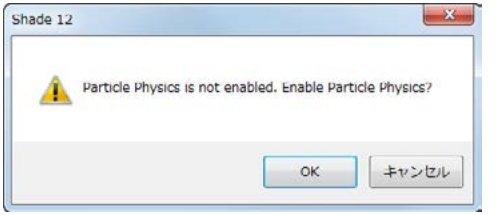
1 From **Toolbox**, select **Create** > **Plugins** > **Particle Physics** > **Particle Emitter**.



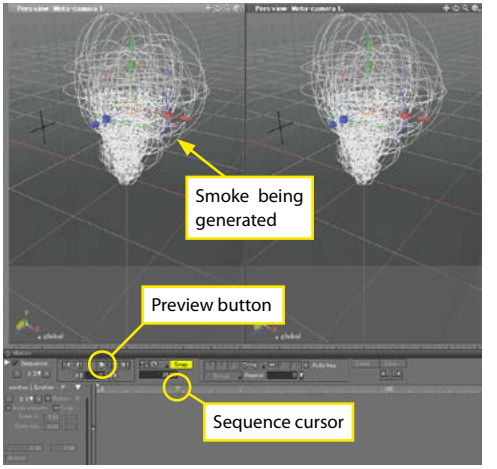
2 Drag in the Figure Window to create the source.



3 If the settings for drawing particles have not yet been made, a dialog is displayed. Click **OK**.

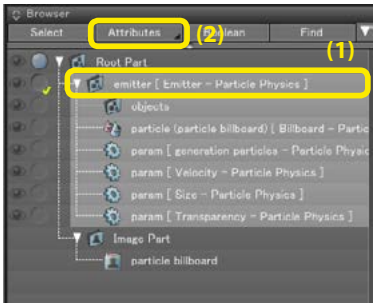


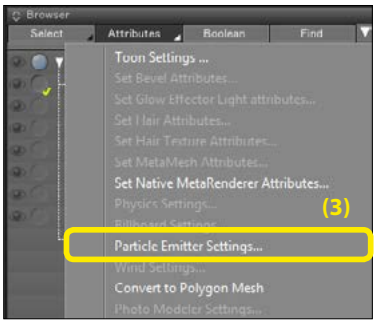
4 Switch the workspace to Animation and preview the smoke generation animation with the **Play** button of the **Motion** window. Alternatively, check the animation by advancing the sequence position while operating the sequence cursor.



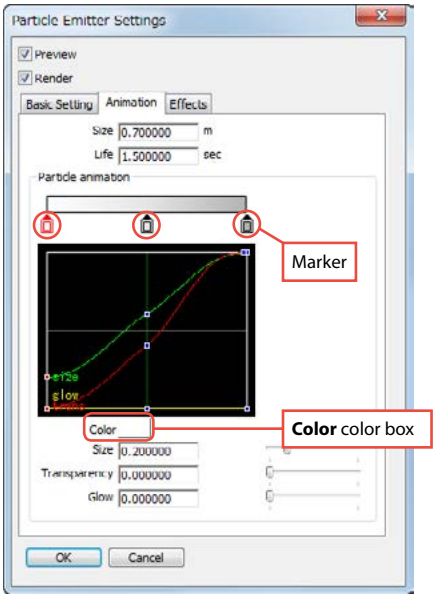
5 From **Browser**, select the root part then do a test render to see that the smoke is rising correctly. If you perform rendering on the still image, you must set the sequence to greater than 0.

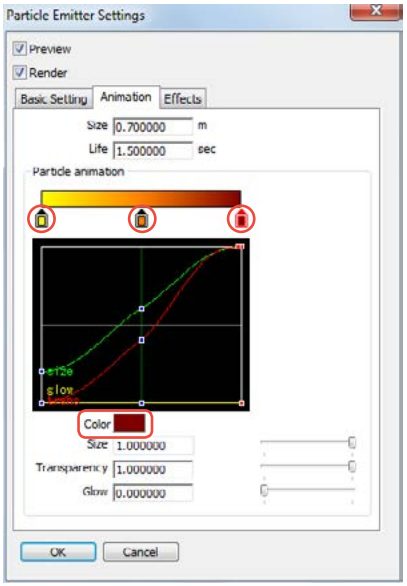
6 Add color to the smoke in **Set Particle Attributes**. Select the **emitter [Emitter - Particle Physics]** part **(1)** and, from the **Attributes** pop-up menu **(2)**, select **Particle Emitter Settings... (3)**.





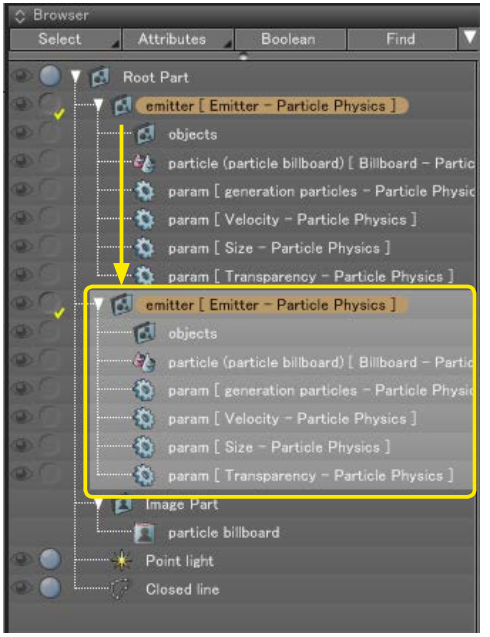
7 From the **Particle Emitter Settings** window, click the **Animation** tab and then click each marker of the smoke generation position, middle position, and end position. Then, set a color in the color box.



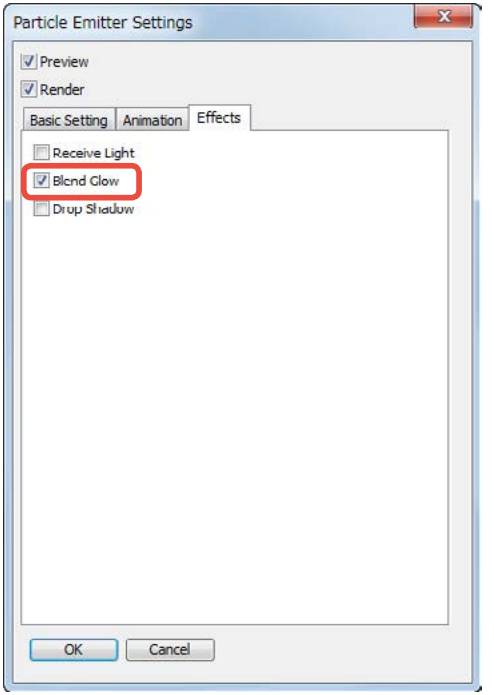


8 Click the **OK** button and then check the result obtained through rendering.

9 Overlap the emitters to represent a frame. Copy **emitter [Emitter - Particle Physics]** onto the same position.



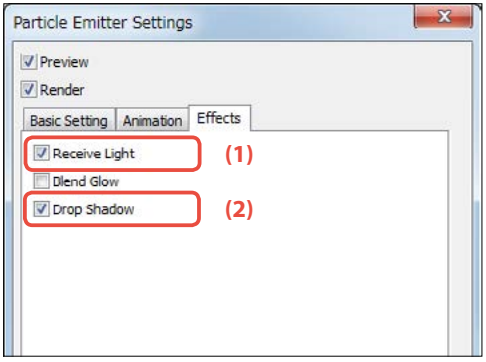
10 Select the element copied in **Browser**, select **Particle Emitter Settings...** from the **Attributes** pop-up menu, click the **Effects** tab of the **Particle Emitter Settings** window, and then check **Blend Glow**.

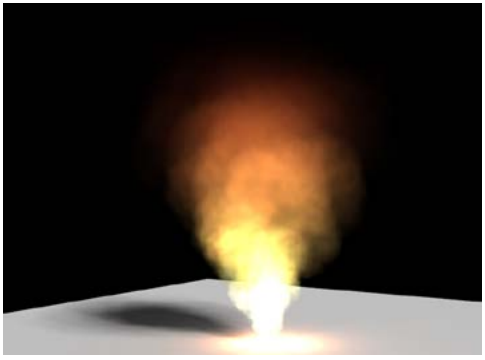


11 Render your image to produce something that looks like this.

12 Perform rendering, including the original emitter, to represent flame and smoke.

13 Place a colored point light in the root of the emitter and add effects of **Receive Light** (1) and **Drop Shadow** (2) to the first emitter. In this way, you can create a more realistic scene.

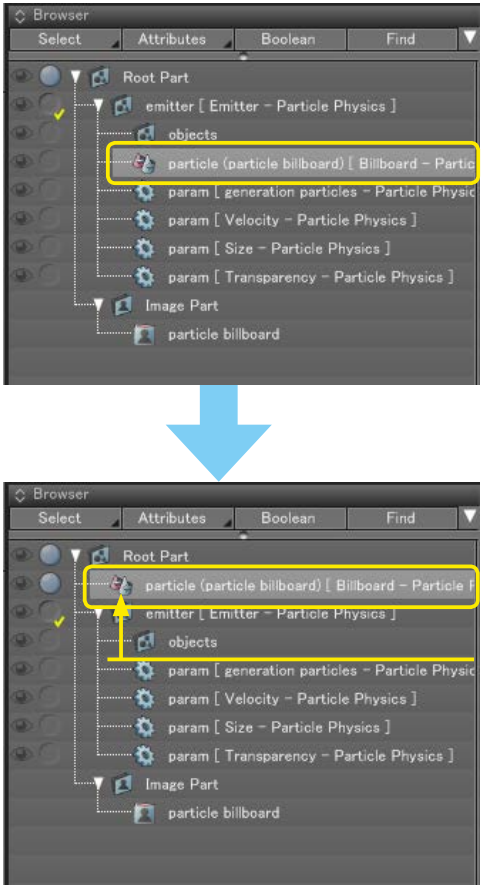




Extinguishing Smoke

This function prevents the rendering of the smoke that is generated with the particle physics.

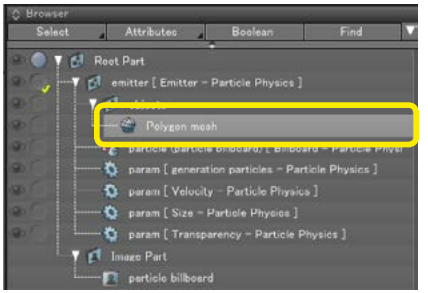
1 From **Browser**, place **particle (particle billboard) [Billboard - Particle Physics]** outside the **emitter [Emitter - Particle Physics]** part. Or, simply delete it.



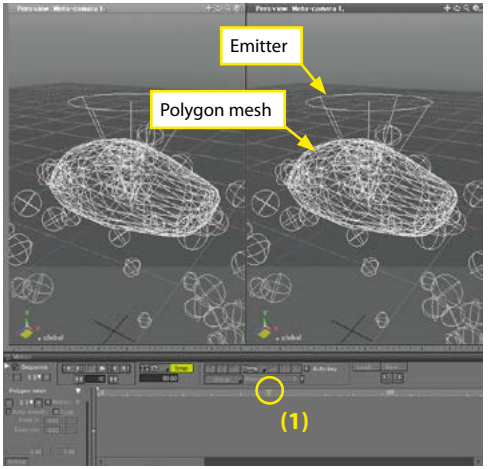
Generating Particles from an Object

This function generates particle elements from an object surface.

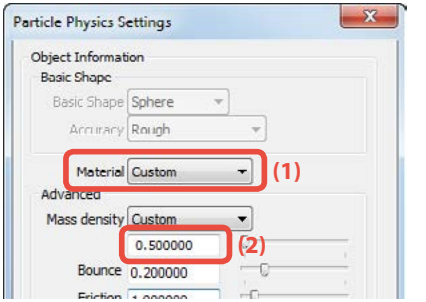
1 Delete the billboard, from the previous example, then prepare the emission source where you input meta particles into the emitter, and then insert the object into the **objects** part. In this example, we will insert a polygon mesh created with MagicalSketch.



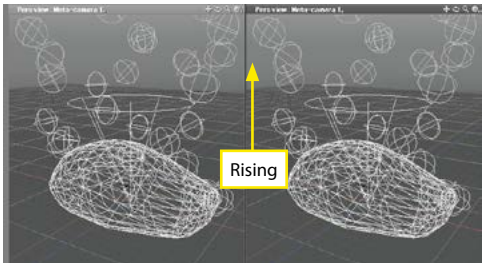
2 From the **Motion** window, advancing the sequence position **(1)** generates particles from the polygon mesh.



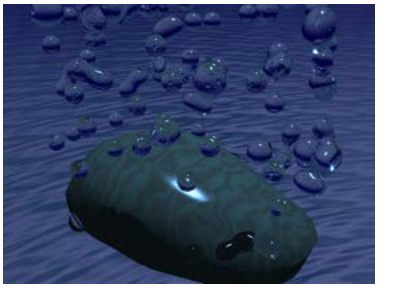
3 Since particles have been dropped, open **Physics Settings...** of meta particles. Set **Material** to **Custom** **(1)** and negative value **-0.5** to **Mass density** **(2)** to create rising particles instead.



4 Advance the sequence again to confirm that the particles are rising.



5 Setting the number of particle generations and the surface attributes allows you to represent bubbles that are being generated from rocks.

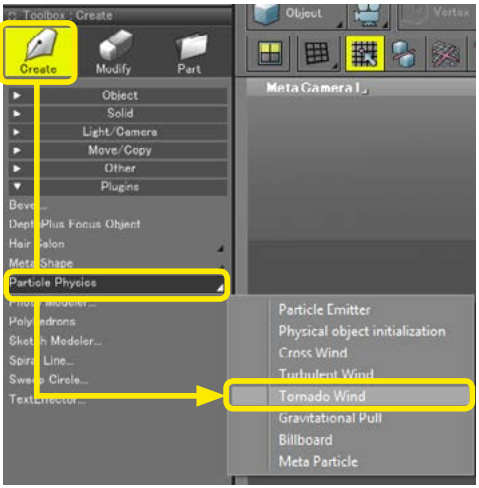


Generating Tornados

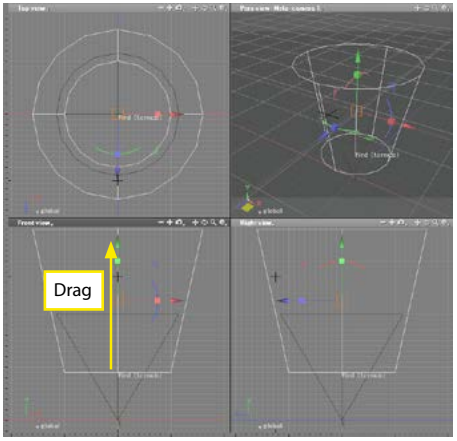
You can create tornadoes that are swirling and rising from a source.

1 From **Toolbox**, select **Create** > **Plugins** > **Particle Physics** > **Particle Emitter** to create a particle generation source.

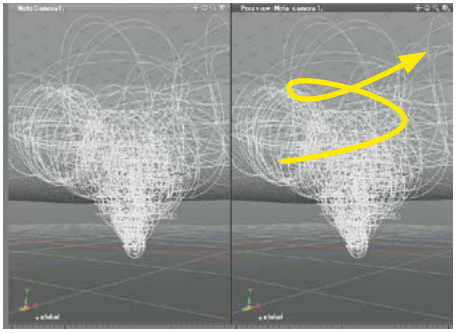
2 From **Toolbox**, select **Create** > **Plugins** > **Particle Physics** > **Tornado Wind**.



3 Drag to create the area to be influenced by the tornado.



4 Preview the created area to confirm tornado generation.

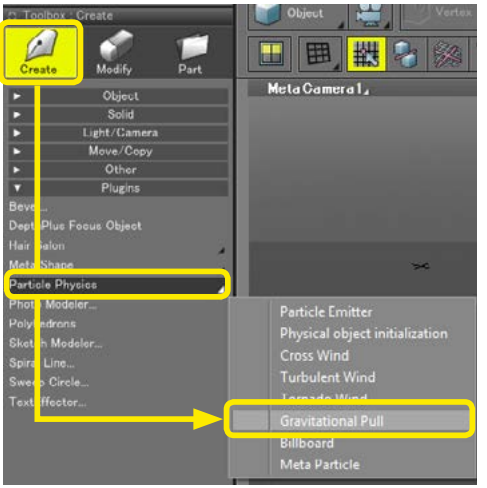


Drawing in Smoke in the Direction of Gravity

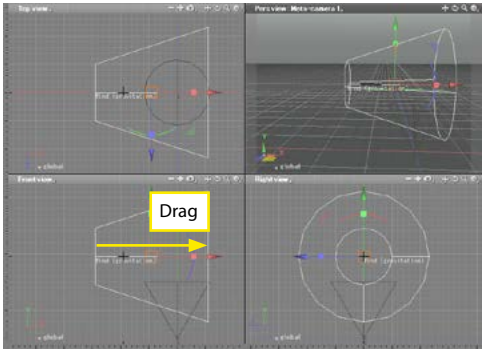
This function applies a gravitational force and a range of influence in which the smoke will be drawn in to a contained area.

1 From the Toolbox, select **Create** > **Plugins** > **Particle Physics** > **Particle Emitter** to create a particle generation source.

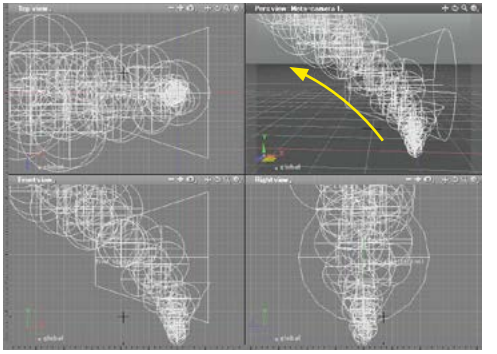
2 From the Toolbox, select **Create** > **Plugins** > **Particle Physics** > **Particle Physics** > **Gravitational Pull**.

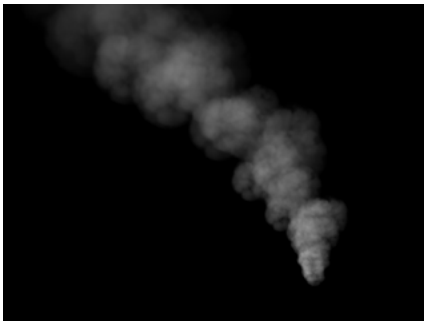


3 Drag and create the area to be influenced by gravity.



4 Preview the created range to confirm that smoke is being drawn in the direction of gravity.

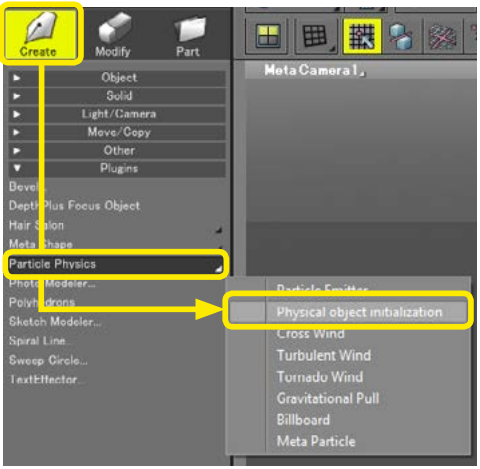




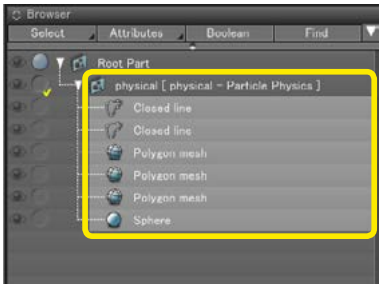
Making Objects Collide with One Another

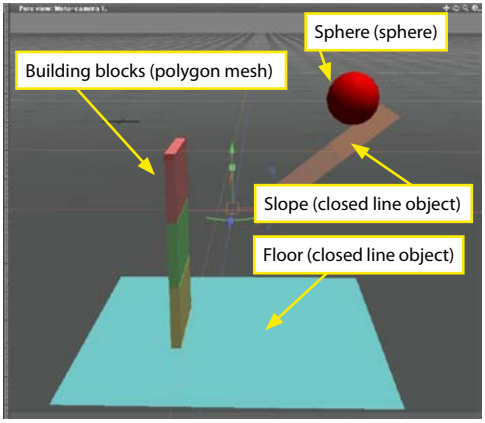
This function arranges multiple objects and performs physical settings such as rolling, colliding, and rebounding, often referred to as collision detection.

1 From the Toolbox, select **Create** > **Plugins** > **Particle Physics** > **Physical object initialization**.



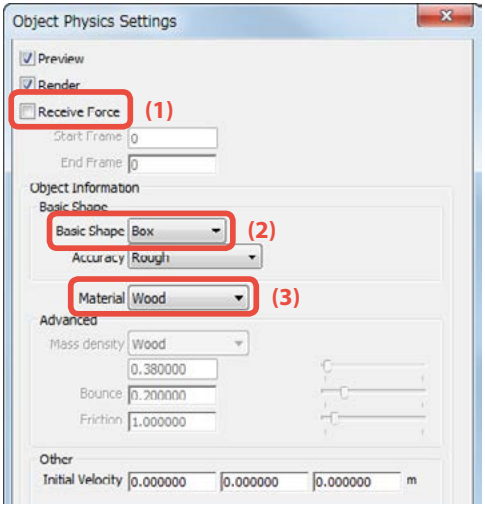
2 Insert the object to be subject to the physical setting in the **physical [physical - Particle Physics]** part. Here, let's prepare a floor, a slope, a rolling sphere, and three building blocks.



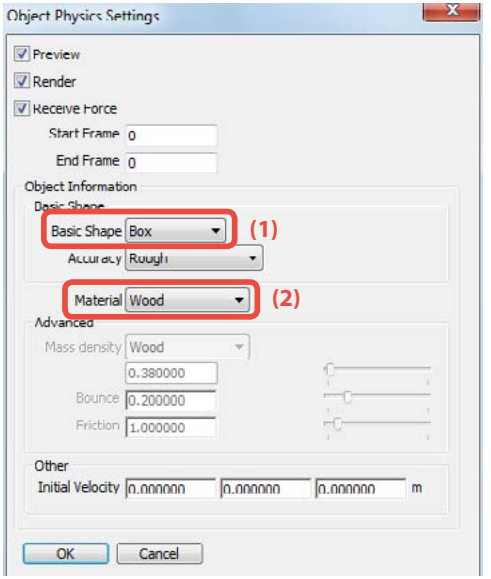


3 From the **Browser**, select each object, open **Physics Settings...** from the **Attributes** pop-up menu and make the physical settings.

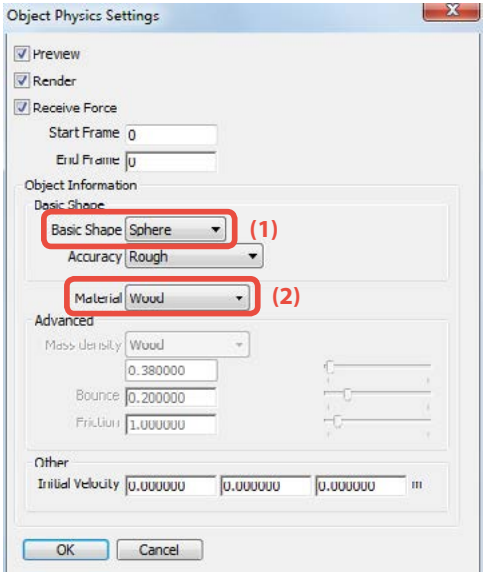
To fix the floor and slope within the scene, uncheck **Receive Force** (1). Set **Basic Shape** to **Box** (2) and **Material** to **Wood** (3).



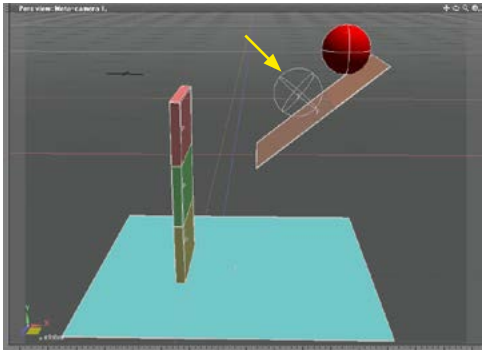
For the three building blocks, set **Basic Shape** to **Box** (1) and **Material** to **Wood** (2).



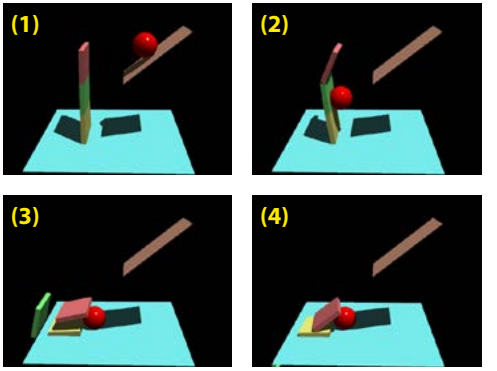
For the sphere, set **Basic Shape** to **Sphere** (1) and **Material** to **Wood** (2).



4 While previewing the result, you can confirm the animation from the physics object where **P** is written on the wireframe.



5 Render the animation, confirm that the sphere rolls down the slope, strikes the blocks, and then falls onto the floor.



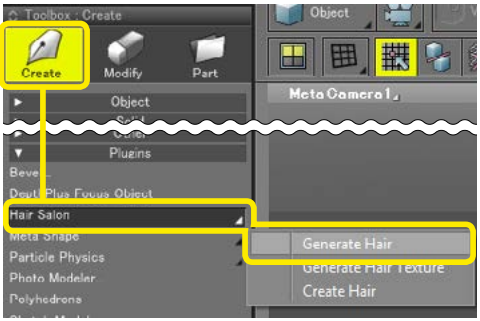
15–2. Hair Salon

Standard and Professional Only

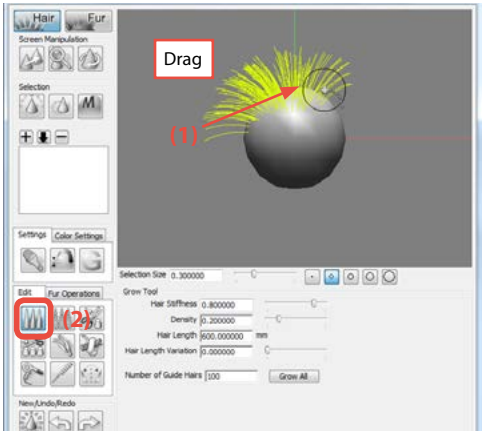
Creating Parted Hair

Using Hair Salon and the Mirror tool, you can create realistically parted hair.

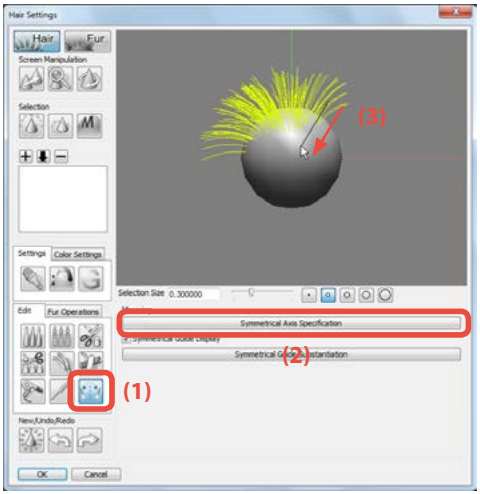
1 Select the target object on which the hair is to be created. From the Toolbox, select **Create** > **Plugins** > **Hair Salon** > **Generate Hair** and open **Hair Salon**.

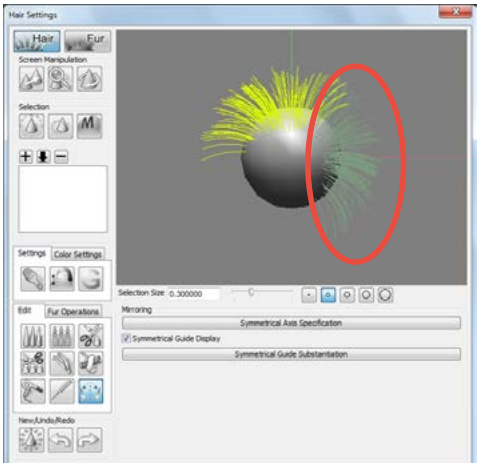


2 The **Grow Tool** button has been selected **(1)**. Trace the sphere as is to create **Guide Hairs** **(2)**.

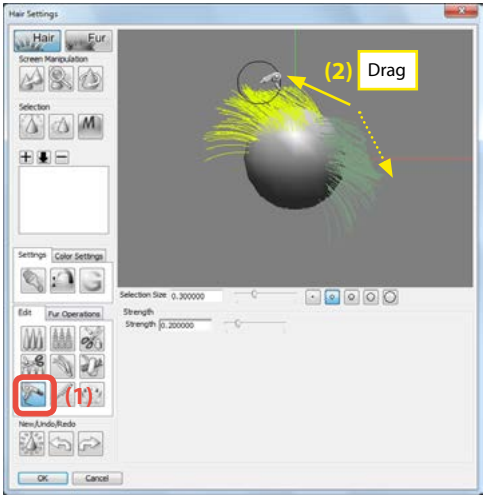


3 Select the **Mirror** button **(1)**, click **Symmetrical Axis Specification** **(2)** and then drag and specify that the portion as a hair part **(3)**.

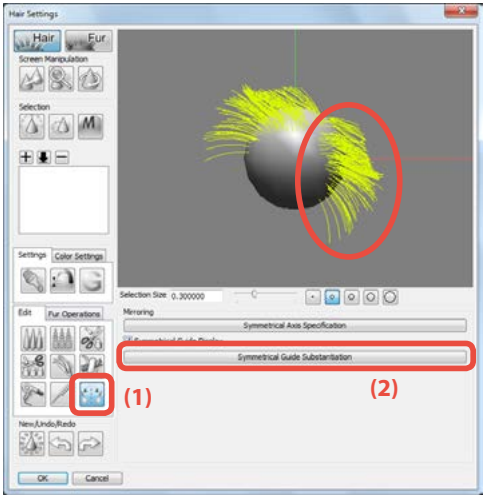




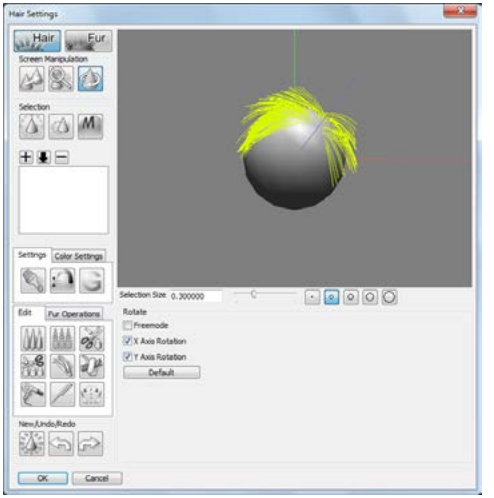
4 Using the **Dryer** button **(1)**, style one side of the sphere to create a hair part **(2)**. The mirrored portion is simultaneously styled, but in the opposite direction.

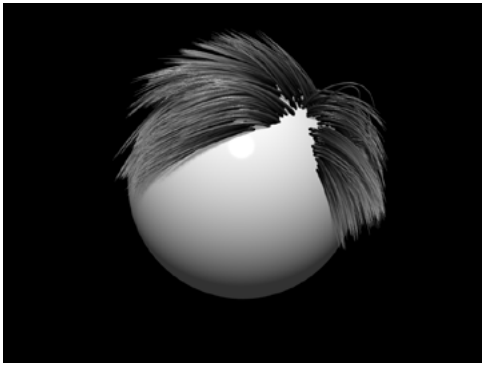


5 Select the **Mirror** button **(1)** and then click the **Symmetrical Guide Substantiation** button to perform substantiation **(2)**.



6 Complete the styling by performing any final edits, such as deleting any unnecessary parts.

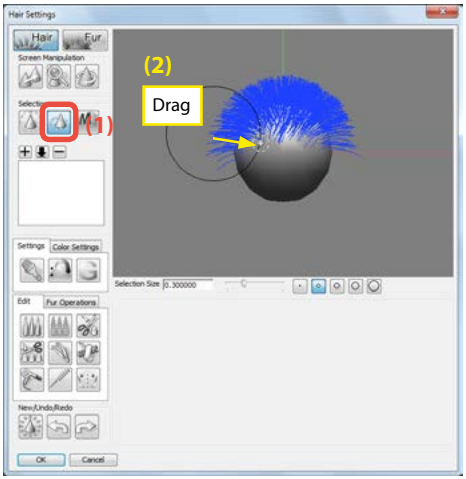




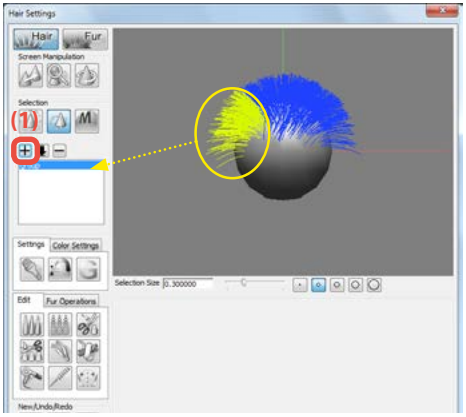
Creating a Layered Hair Style

You can perform partial styling through selection and layer separation.

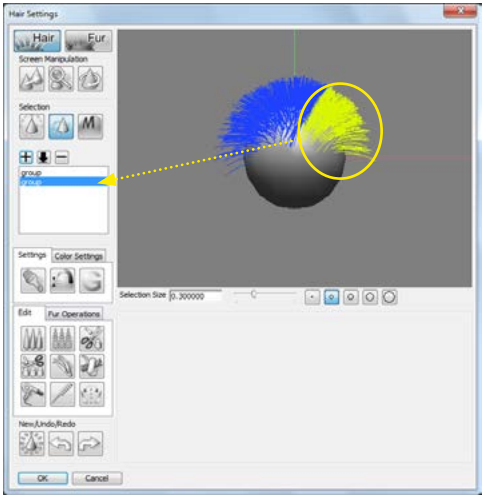
1 Click the **Select** button **(1)**, drag on to the hair guide, and then select the portion to be styled with the range circle **(2)**.

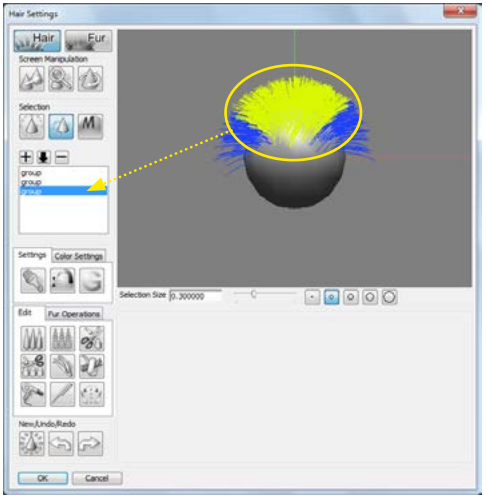


2 Click the **+** button **(1)** to assign the selected portion to a layer or group.

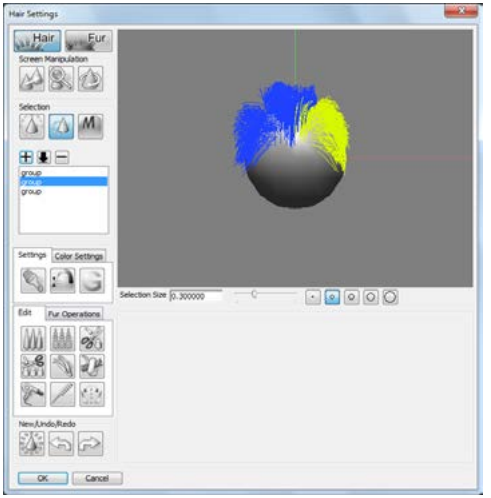


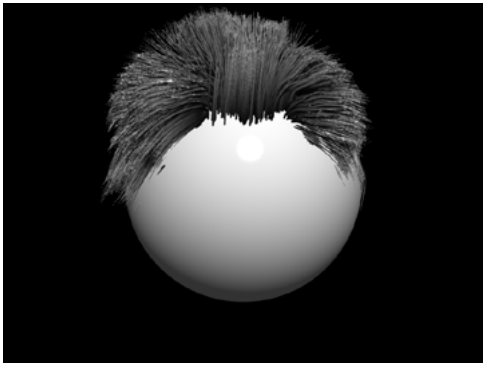
3 Repeat the procedure to create multiple layers.





4 Select a layer for styling.

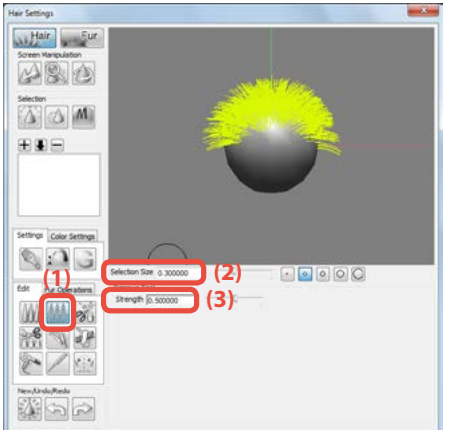


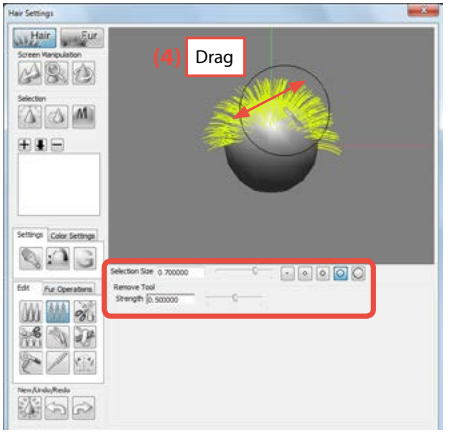


Cutting Long Hair

Using the **Remove hair** button, you can adjust the amount on a hair guide.

1 Select the **Remove hair** button **(1)**, adjust the **Selection Size** to a somewhat larger size **(2)**, adjust the strength with **Strength** of the **Remove Tool** group **(3)** and then gradually drag the portion where hair amount is to be reduced **(4)**. Here, let's set **Selection Size** to **0.7** and **Strength** to **0.3.**

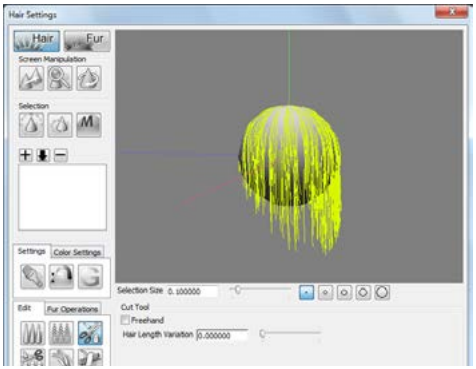




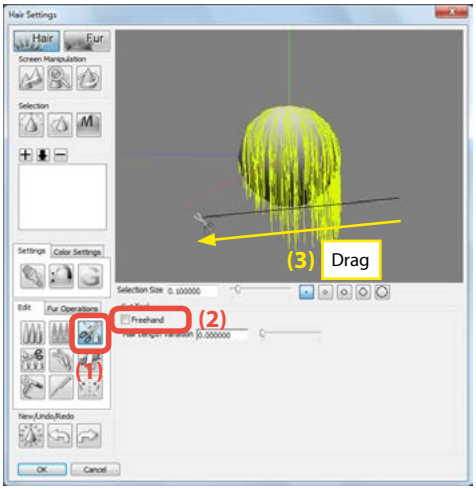
Cutting Hair

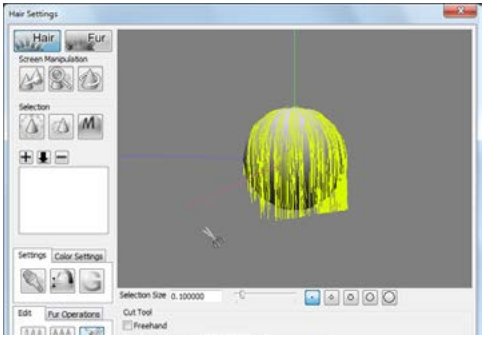
You can perform hair styling with either a straight line cut or freehand cut by checking or unchecking the **Freehand** checkbox.

1 The model is turned, with the left side turned to the front.

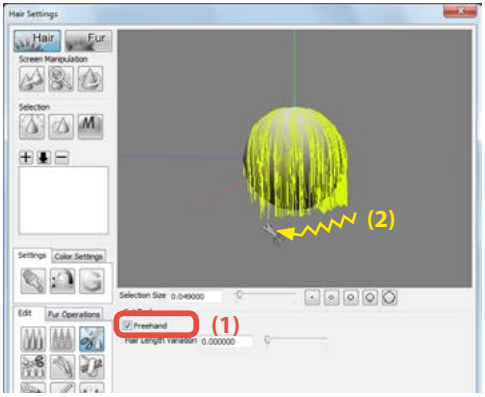


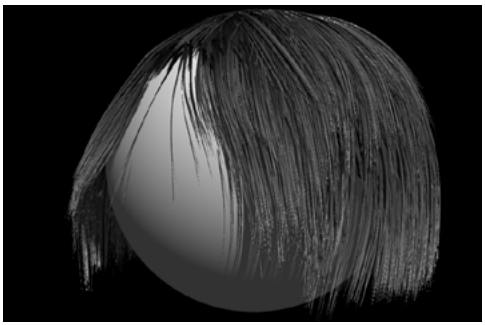
2 Select the **Cut hair** button **(1)**, uncheck the **Freehand** checkbox **(2)** , and then drag across to perform cutting **(3)**.





3 Next, check the **Freehand** checkbox **(1)** and drag in a zig-zag motion, so as to cut hair into a shaggy, natural style **(2)**.

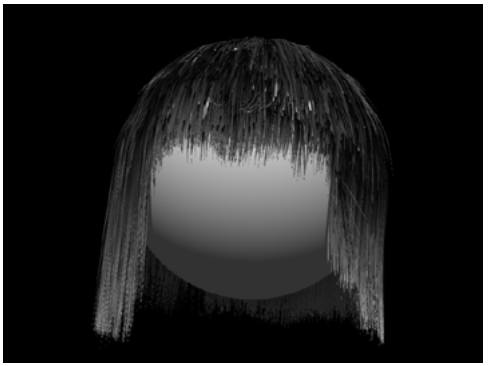




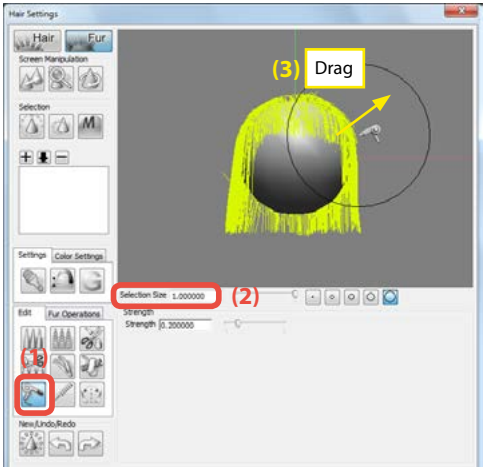
Lifting and Styling Hair

Using the dryer, you can lift up flattened hair or malformed hair on an object.

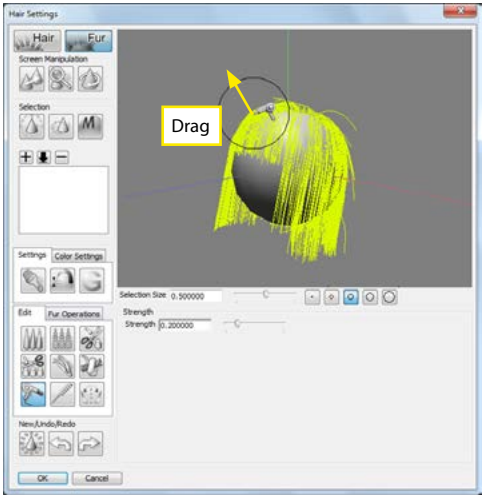
1 The following shows hair styling where the hair sticks to the scalp where the hair is shorter.

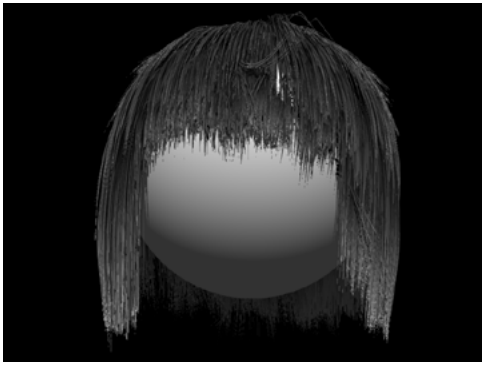


2 Select the **Dryer** button **(1)** and then set **Selection Size** to a somewhat larger size **(2)**. Here, let's set **1.0.** Lift up the hair slightly while dragging in the upward direction **(3)**.



3 Rotate the model and repeat the procedure to adjust the overall hair volume.

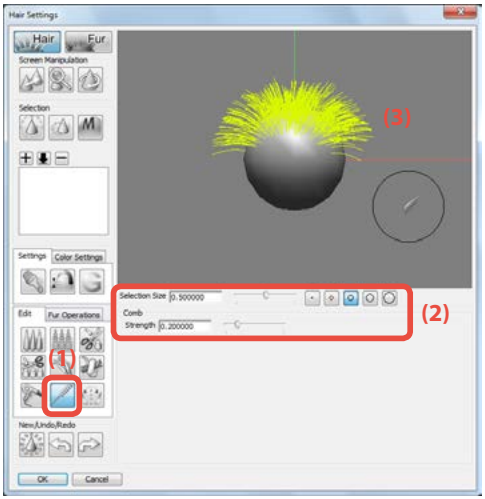


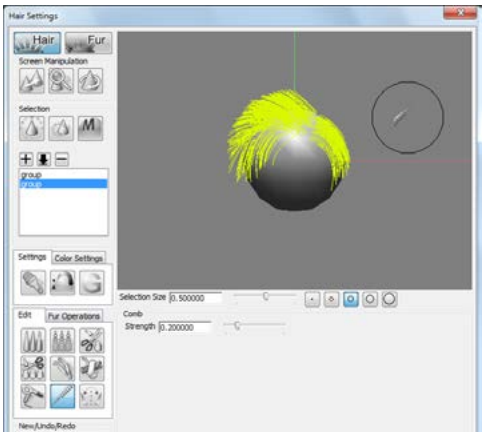


Combing Hair for Flow and Tip Creation

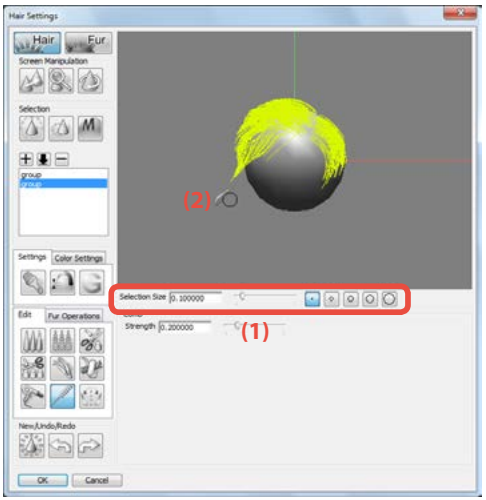
Using the **Comb** button, you can bring together large hair flows and create hair tips.

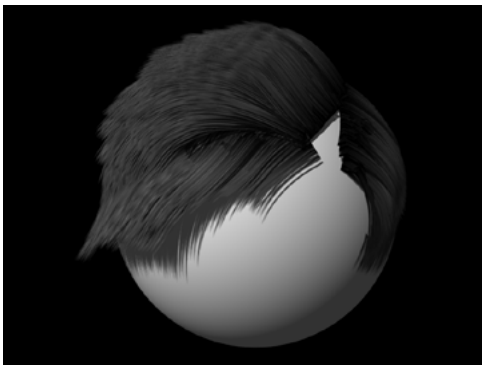
1 Select the **Comb** button **(1)**. Set **Strength** to a weak setting and **Selection Size** to a large value **(2)** to represent the overall hair flow **(3)**. Here, let's set **Selection Size** to **0.5** and **Strength** to **0.2.**





2 Reduce the **Selection Size** setting **(1)** and bring the hair tips together **(2)**. Here, let's set **0.1.**

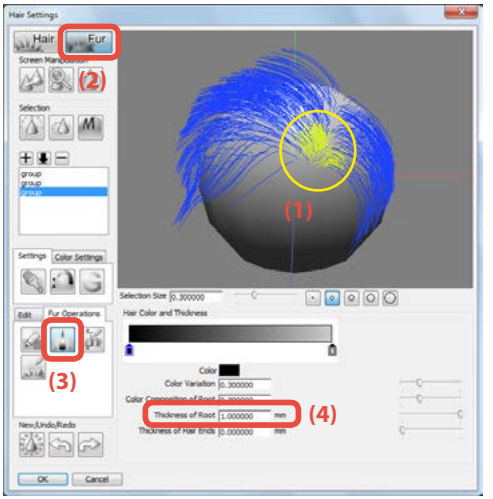




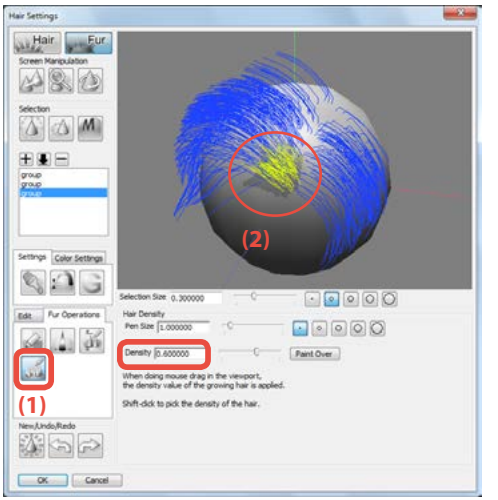
Creating Fluffy Hair and Hair Borders

Using the **Fur** mode setting of Hair Salon, you can set the hair thickness and density to represent downy hair and hair borders.

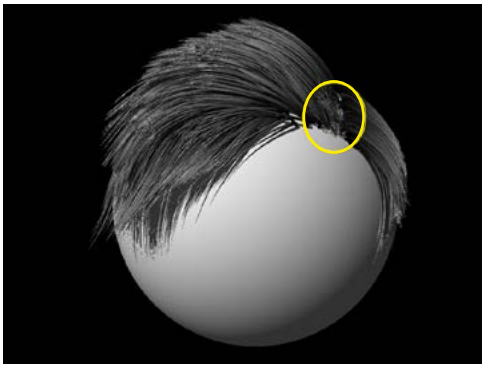
1 Select the downy hair guide **(1)**. Click the **Fur Mode** button to switch to **Fur** mode **(2)**, select the **Hair Color and Thickness** button of the **Fur Operations** tab **(3)**, and then set **Thickness of Root** to **1.0** **(4)**.



2 Similarly, select the **Hair Density** button of the **Fur Operations** tab **(1)** and paint and set the growing density **(2)**. Here, the growing density has been painted gradually and separately within a range of **0.6** to **0.3.**

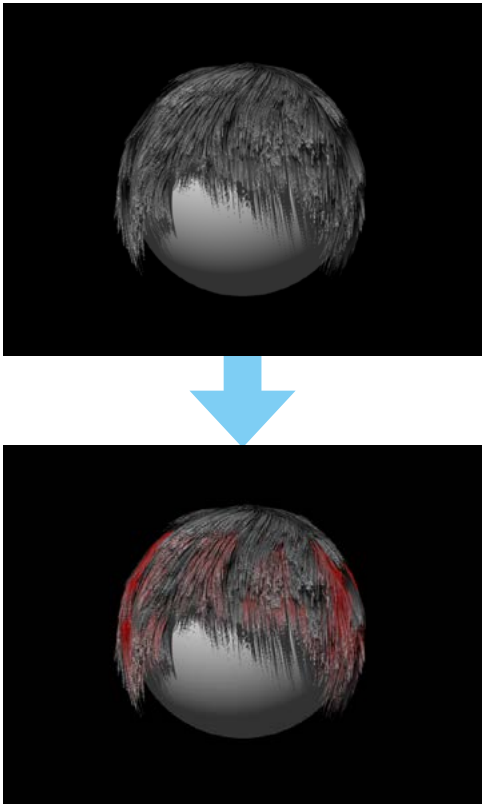


3 The hair in the hair part has turned to downy hair.

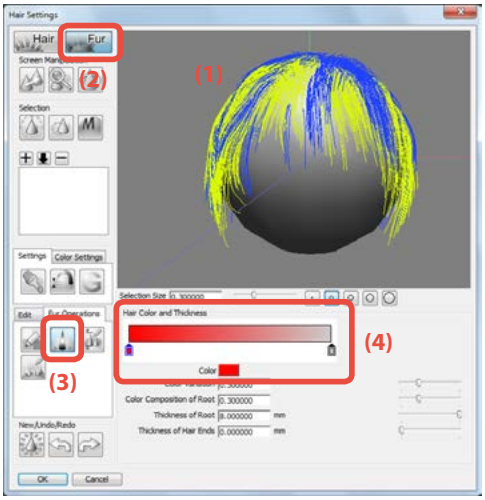


Adding Color

You can add color to hair using the **Hair Color and Thickness** button of **Fur** mode.



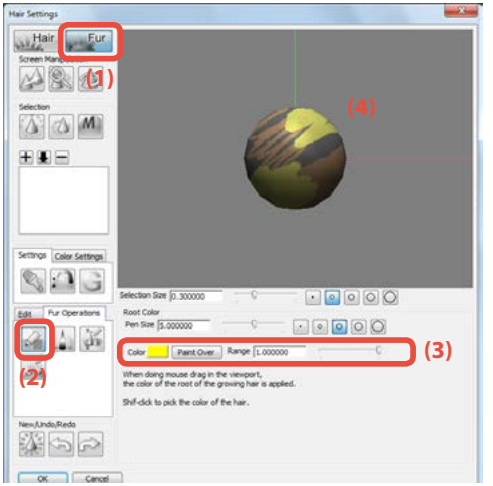
1 Select the color change hair guide **(1)**. Click the **Fur Mode** button to switch to **Fur** mode **(2)**, select the **Hair Color and Thickness** button of the **Fur Operations** tab **(3)** and then set the root color and hair-tip color in **Hair Color and Thickness** **(4)**. Here, **red** has been set for the root.



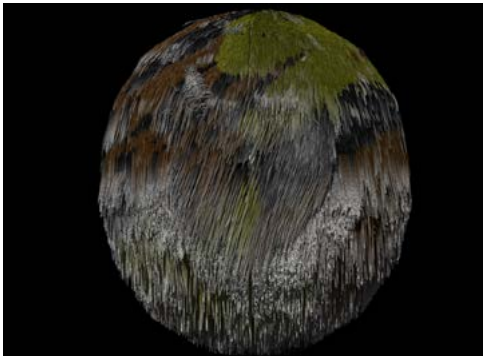
Creating a Tortoiseshell Style

Using the **Root Color** button of **Fur** mode, you can represent the speckle patterns that look like those of a tortoiseshell cat.

1 Click the **Fur Mode** button to switch to **Fur** mode **(1)**, select the **Root Color** button of the **Fur Operations** tab **(2)**, select a color in the **Color** color box **(3)**, and then paint the object **(4)**.



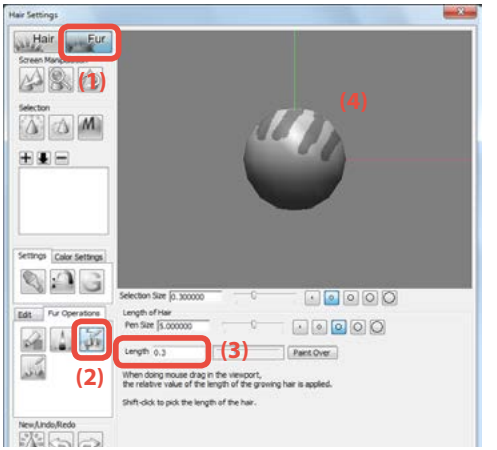
2 When you have created the hair guide, the painted color becomes the color of the root.



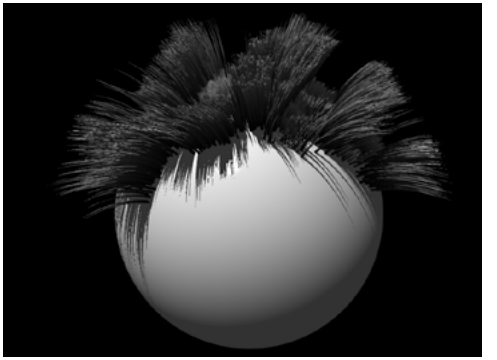
Creating a Punk Hair Style

Using the **Hair Length** button of **Fur** mode, you can represent a pruning hair style.

1 Click the **Fur Mode** button to switch to **Fur** mode **(1)**, select the **Hair Length** button of the **Fur Operations** tab **(2)**, set the hair length in **Length** **(3)**, and then paint the object **(4)**. Here, the object has been painted with the **0.3.**



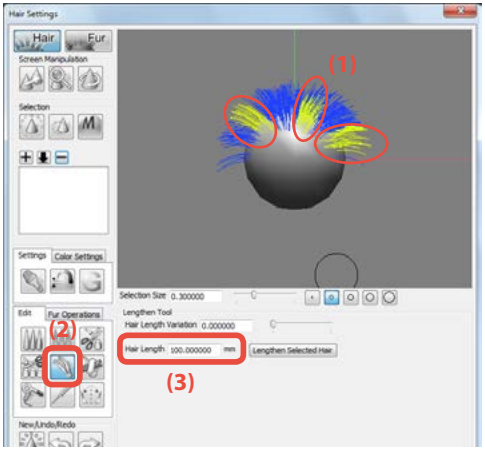
2 Once you have created the hair guide, the painted length becomes the length of the hair.



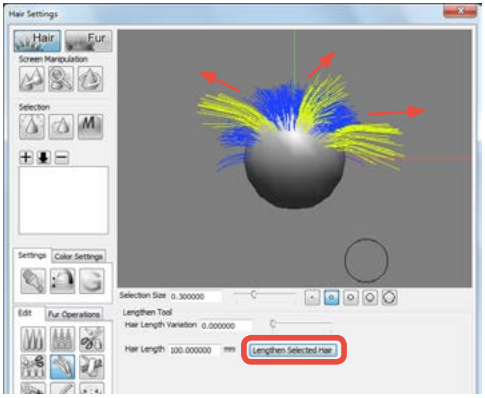
Lengthening Selected Portions of Hair

Using the **Lengthen Tool** button, you can extend the length of the selected part of the hair guide or that of the entire hair guide.

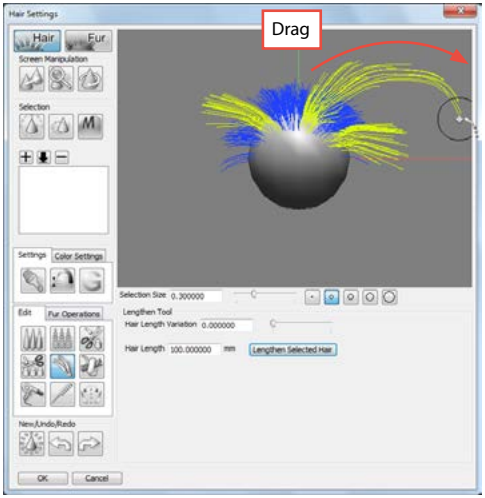
1 Select the hair guide to be extended **(1)**, select the **Lengthen Tool** button **(2)**, and then set **Hair Length (3)**. Here, let's set **100.**



2 Click the **Lengthen Selected Hair** button. Each time you click the button, the hair guide is extended by the specified length.



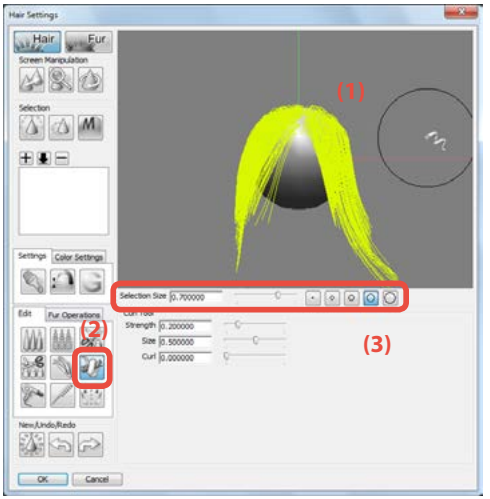
Moreover, by dragging the hair guide, you can extend it to the dragged form.



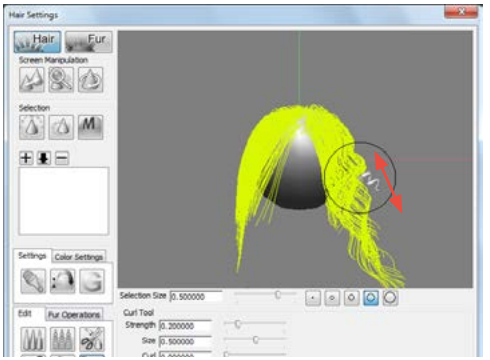
Curling Hair

Using the **Wave** button, you can create natural and unnaturally curly hair.

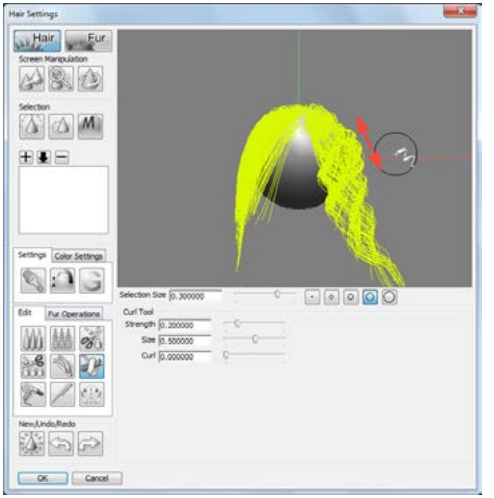
1 Select the hair guide to be curled. **(1)**. Select the **Wave** button **(2)** and then set the size of the brush in **Selection Size**.

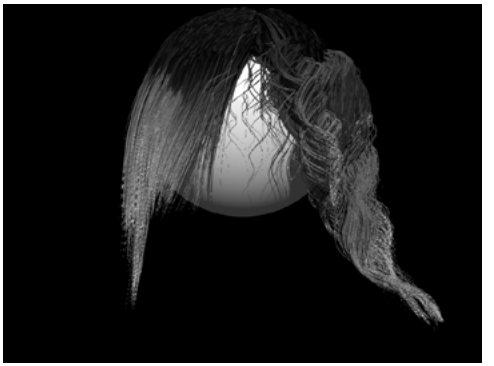


2 Drag and curl the hair guide toward the root of the hair guide.



3 Complete the curled hair while adjusting the brush size and drag time.





16. Quick Reference

Many commands and operations in Shade3D ver. 16 that are available from the main menu and/or tool palettes can also be executed via keyboard shortcuts. In some cases you must hold down one or multiple keys and click or drag using the mouse. The following charts, sorted thematically, list each action with shortcuts for Windows and Mac OS X.

Figure Window

Action	Windows	Mac OS X
Zoom out (Shrink)	Ctrl + **[**	⌘ + **[**
Zoom in (Magnify)	Ctrl + **]**	⌘ + **]**
Zoom out centered on the 3D cursor	(Ctrl or **Z**) + Toolbox Zoom Out button	option + Toolbox [Zoom Out] button
Zoom in centered on the 3D cursor	(Ctrl or **Z**) + Toolbox [Zoom In] button	option + Toolbox [Zoom In] button
Zoom out centered on the mouse cursor	Space + (Ctrl or **Z**) and click	option + Space and click
Zoom in centered on the mouse cursor	Space + **X** or Space + Alt and click	⌘ + Space and click
Restrict the direction of the 3D cursor	Shift + move cursor in viewport	Shift + move cursor in viewport
Scroll	Space + drag in viewport	Space + drag in viewport
Scroll with the angle restricted	Space + drag along Ruler	Space + drag along Ruler
Turn on Rotate function	Shift + Space + drag in viewport	Shift + Space + drag in viewport
Turn off Rotate function	Shift + Space + click in viewport	Shift + Space + click in viewport
Toggle Snap	**S**	**S**
Toggle Grid	**G**	**G**
Toggle Large Cursor display	**A**	**A**
Hide selected objects	Ctrl + **/**	⌘ + **/**
Hide unselected objects	Ctrl + **-**	⌘ + **-**
Show selected objects	Ctrl + *****	⌘ + *****
Show all objects	Ctrl + **+**	⌘ + **+**
Fit all visible objects in viewports	Select **Fit to Window** from Zoom tool	Select **Fit to Window** from Zoom tool
Show only the Top view	Ctrl + Shift + **T**	⌘ + control + **T**
Show only the Front view	Ctrl + Shift + **G**	⌘ + control + **G**
Show only the Side view	Ctrl + Shift + **H**	⌘ + control + **H**
Show only the Perspective view	Ctrl + Shift + **Y**	⌘ + control + **Y**
Show the Shared view	Ctrl + Shift + **F**	⌘ + control + **F**

Mouse Wheel Operations

Action	Windows	Mac OS X
Zoom out the Figure Window	Roll the mouse wheel down	Roll the mouse wheel down
Zoom in the Figure Window	Roll the mouse wheel up	Roll the mouse wheel up
Scroll a window or tool palette	Roll the mouse wheel	Roll the mouse wheel
Scroll a window or tool palette horizontally	Shift + roll mouse wheel	Shift + roll mouse wheel
Zoom the Image Window in or out	Alt + roll the mouse wheel	option + roll the mouse wheel

Numeric Input

Action	Windows	Mac OS X
Enter a numeric value for a slider (Numeric input dialog)	Ctrl + click the slider	option + click the slider
Enter a numeric value for a slider (Direct input)	Click text box adjacent to the slider	Click text box adjacent to the slider

Objects

Action	Windows	Mac OS X
Set cursor position without making a selection	(Ctrl or **Z**) + click in the viewport	option + click in the viewport
Add to or subtract from the selection	Ctrl + select using a selection box	⌘ + select using a selection box
Select multiple objects with a selection box	Enclose with a selection box while holding down Ctrl	Enclose with a selection box while holding down ⌘
Translate selected objects	Shift + **X** + drag Release **X** while dragging to restrict to 45° angles	⌘ + Shift + drag Release ⌘ while dragging to restrict to 45° angles
Copy and translate selected objects	(Ctrl or **Z**) + Shift + drag Release (Ctrl or **Z**) while dragging to restrict to 45° angles	option + Shift + drag Release option while dragging to restrict to 45° angles
Copy selected objects at the same position	(Ctrl or **Z**) + Shift + click in viewport	option + Shift + click in viewport
Inverse Kinematics operation on joint hierarchy	Ctrl + Shift + (**1 to 9**)	⌘ + Shift + (**1** to **9**)
Offset-move the ball joint path or camera path	(Alt + **0**	⌘ + control + **0**
Use same tool repeatedly (Create/Move/ Copy)	(Ctrl or **Z**) + choose tool	option + choose tool
Create a disk or sphere with the same radius as the previous disk/sphere	Select Disc/Sphere from the Create tool and click in viewport	Select Disc/Sphere from the Create tool and click in viewport
Create point light with same radius as previous point light	Select Point Light from the Create tool and click in viewport	Select Point Light from the Create tool and click in viewport

Create a part which contains the selected objects	(Ctrl or **Z**) + select Part from the Part tool	option + select Part from the Part tool
Create a curved surface containing the selected line objects	(Ctrl or **Z**) + select Curved surface from the Part tool	option + select Curved surface from the Part tool

Manipulating Control Points in Modify Mode

Action	Windows	Mac OS X
Enter Modify mode	Ctrl + **M**	⌘ + control + **M**
Exit Modify mode	**Finish** button or **Enter**	**Finish** button or **Return** or **Enter**
Select a control point	Click the control point	Click the control point
Add or subtract control point from selection	Ctrl + click the control point	⌘ + click the control point
Select all control points	Ctrl + **A**	⌘ + **A**
Deselect all control points	(Ctrl or **Z**)+ click an empty area without any control points	option + click an empty area without any control points
Bevel polygon mesh	Shift + Ctrl + drag in viewport	Shift + option + drag in viewport
Select control points with a selection box	Drag to enclose the control points	Drag to enclose the control points
OR selection	Shift + drag to enclose the control points	Shift + drag to enclose the control points
AND selection	Ctrl or **Z** + drag to enclose the control points	option + drag to enclose the control points
SUBTRACT selection	**X** + drag to enclose the control points	⌘ + drag to enclose the control points
Select the next control point	With one control point selected, press **M**	With one control point selected, press **M**
Select the previous control point	With one control point selected, press Shift + **M**	With one control point selected, press Shift + **M**
Move the selected control points (1)	Drag one of the selected control points	Drag one of the selected control points
Move the selected control point (2)	Shift + **X** + drag in area without control points. Release the **X** key while dragging to restrict direction to 45° angles	⌘ + Shift + drag in area without control points. Release ⌘ while dragging to restrict direction to 45° angles
Delete the selected control points	**Backspace** or **Delete**	**Delete**
Add a control point	**X** + **Z** + drag across a line object	⌘ + option + drag across a line object
Delete a control point	**X** + **Z** + click the control point	⌘ + option + click control point
Add or re-create a tangent handle	**Z** + drag the control point	option + drag the control point

Change the length of a tangent handle with the direction fixed	Shift + drag the tangent handle	Shift + drag the tangent handle
Release the linkage of the tangent handles	(Ctrl or **Z**) + click or drag tangent handle	option + click or drag tangent handle
Delete the tangent handle	**X** + click the tangent handle	⌘ + click the tangent handle
Add a vertex to an edge of a polygon mesh	**X** + **Z** + drag across the edge	⌘ + option + drag across the edge
Add an edge and vertex to a polygon mesh	**Z** + click and drag from a vertex toward empty space	option + click and drag from a vertex toward empty space
Add an edge between two vertices of a polygon mesh	**Z** + click and drag a line connecting the two vertices	option + click and drag a line connecting the two vertices

Browser Window

Action	Windows	Mac OS X
Select parent part	←	←
Select child object or part	→	→
Select child object or nested part	Ctrl + →	option + →
Select sister object or part	↑	↑
Select brother object or part	↓	↓
Rename an object or part	Double-click the object or part	Double-click the object or part
Expand or hide the hierarchy of a part	Ctrl or **Z** + click Expand/Hide icon for the part in the Browser	option + click Expand/Hide icon for the part in the Browser
Select multiple objects/parts	Click an object or part, then Shift + click to mark the selection end	Click an object or part, then Shift + click to mark the selection end
Select/deselect additional object or part	Ctrl + click the object to add to or subtract from the selection	⌘ + click the object to add to or subtract from the selection

Rendering

Action	Windows	Mac OS X
Start rendering	Ctrl + **R** or **Render** button in Image Window	⌘ + **R** or **Render** button in Image Window
Render all objects	Ctrl + Shift + **R** or Shift + **Render** button in Image Window	⌘ + Shift + **R** or Shift + **Render** button in Image Window
Area rendering (render a portion of the scene)	Ctrl or **Z** + drag in Image Window	option + drag in Image Window

Image Window

Action	Windows	Mac OS X
Zoom out centered on clicked point	Ctrl or **Z** + Space + click in Image Window	option + Space + click in Image Window
Zoom in centered on clicked point	Space + **X** + click in Image Window	⌘ + Space + click in Image Window
Scroll	Space + drag in Image Window	Space + drag in Image Window

Control Windows

Action	Windows	Mac OS X
Show/Hide Control Bar	Ctrl + **0**	⌘ + **0**
Show/Hide Toolbox	Ctrl + **1**	⌘ + **1**
Show/Hide Aggregate Window	Ctrl + **2**	⌘ + **2**
Show/Hide Camera Window	Ctrl + **3**	⌘ + **3**
Show/Hide Distant Light Window	Ctrl + **4**	⌘ + **4**
Show/Hide Background Window	Ctrl + **5**	⌘ + **5**
Show/Hide Surface Window	Ctrl + **6**	⌘ + **6**
Show/Hide Object Info Window	Ctrl + **I**	⌘ + **I**
Show/Hide Motion Window	Ctrl + **7**	⌘ + **7**
Show/Hide Tool Parameters	Ctrl + **8**	⌘ + **8**
Show/Hide Browser	Ctrl + **9**	⌘ + **9**
Show/Hide ShadeExplorer	Ctrl + **E**	⌘ + **E**
Show/Hide Alignment Window	Ctrl + **L**	⌘ + **L**

Aggregate Window

Action	Windows	Mac OS X
Split/Integrate all Control Windows	**Z** + click Split/Integrate button of Aggregate Window	option + click Split/Integrate button of Aggregate Window

Distant Light Window

Action	Windows	Mac OS X
Enter numeric value for Distant Light direction	Ctrl + click hemisphere for direction of light to set	option + click hemisphere for direction of light to set

Camera Window

Action	Windows	Mac OS X
Create a line object/spot light/camera connecting Eye point	Select each from the [Memory] pop-up menu in the Camera Window	Select each from the [Memory] pop-up menu in the Camera Window
Load a line object/spot light as Eye point/Target point	Select Object from the Restore pop-up menu in the Camera Window	Select Object from the Restore pop-up menu in the Camera Window
Change the Eye point position/Target point position/ang	Select Eye & Target, then Space + drag in the Perspective view	Select Eye & Target, then Space + drag in the Perspective view
Move the target point parallel to the line of sight without changing the field of view	Ctrl or [Z] + drag vertically while Zoom button is enabled (Camera palette virtual joystick only)	option + drag vertically while Zoom button is enabled (Camera palette virtual joystick only)
Move the Eye point and Target point parallel to the XZ plane	Ctrl or [Z] + drag while Eye & target button is enabled (Camera virtual joystick only)	option + drag while Eye & target button is enabled (Camera virtual joystick only)

Motion Window

Action	Windows	Mac OS X
Add a motion point (corner OFF)	[Z] + click in the Motion Box	option + click in the Motion Box
Add a motion point (corner ON)	Shift + [X] + [Z] + click in the Motion Box	⌘ + option + Shift + click in the Motion Box
Add a sequence Key Point (corner OFF)	[Z] + click in the Sequence Key Box	option + click in the Sequence Key Box
Add a sequence Key point (corner ON)	[X] + [Z] + click in the Sequence Key Box	⌘ + option + click in the Sequence Key Box
Create a point only for the joints changed	[Z] + click in the Sequence Ruler	option + click in the Sequence Ruler
Create a Sequence Key (Motion point is not created)	Shift + [X] + [Z] + click in the Sequence Key Box	⌘ + option + Shift + click in the Sequence Box
Delete a Sequence point/motion point	[-] button in the Motion Window	[-] button in the Motion Window
Delete the selected Motion Point(s) (Sequence Points remain)	[X] + [-] button in the Motion Window	⌘ + [-] button in the Motion Window
Select additional points or deselect the selected points	Ctrl + click or Ctrl + drag and enclose points	⌘ + click or ⌘ + drag and enclose the points

Select multiple points	Select a point and then Shift + click other points	Select a point and then Shift + click other points
Select all points	Choose [Select all] from the Motion Window's Selection pulldown menu	[Select all] from [Group] pop-up menu in the Motion Window
Deselect all points	Click an empty space in the Motion Box	Click an empty space in the Motion Box
Select all stray points	Select Stray points from the Motion Window's Selection pulldown menu	Select Stray points from the Motion Window's Selection pulldown menu
Move the selected points	Drag a point or Shift + [X] + drag an empty space without any points Release [X] key while dragging to restrict the direction to up and down	Drag a point or ⌘ + Shift + drag an empty space without any points Release ⌘ while dragging to restrict the direction to up and down
Translate and copy the selected points	(Ctrl or [Z]) + Shift + drag an empty space other than a point	option + Shift + drag an empty space other than a point
Zoom in a sequence	Space + [X] + click or [Zoom in] button	⌘ + Space + click or [Zoom in] button
Zoom out a sequence	(Ctrl or [Z]) + Space + click or [Zoom out] button	option + Space + click or [Zoom out] button
Zoom in/Zoom out (x2)	(Ctrl or [Z]) + ([Zoom in] button or [Zoom out] button)	option + ([Zoom in] button or [Zoom out] button)
Reset Zoom factor to x1	Shift + [Zoom in] button or [Zoom out] button)	Shift + [Zoom in] button or [Zoom out] button)
Scroll sequence	Space + drag	Space + drag

Color Operations

Action	Windows	Mac OS X
Clear base colors of all objects within a part	(Ctrl or **Z**) + click Diffuse Color checkbox	option + click Diffuse Color checkbox
Specify a color with the Color Picker	Click the color box	Click the color box
Edit the color name list	Double-click the color box in the Color list	Double-click the color box in the Color list

Prefix and Part Special Characters

Boolean Operation Characters

*	Cuts out the portion that overlaps another object and applies the surface attributes of the object (the * object itself is not rendered)
-	Cuts out the portion that overlaps another object (the - object itself is not rendered)
=	Applies the surface attributes of the = object to the portion of another object that is overlapped (the = object itself is not rendered)
\\	Logical sum (the portion where another object overlaps the \\ object is not rendered)
$	Logical product (only the portion where another object overlaps the $ is rendered
&	Same effect as the = sign (affects only objects in the same hierarchy). Provides the effect of local application when combined with other Boolean operation characters.
+	Not affected by the *, -, \\ and $ characters
!	Not affected by the *, -, =, \\ and $ characters
^	Not affected by the = sign (but is affected by the *, -, \\ and $ characters)

Curved Surface Subdivision Characters

@	No surface subdivision during rendering
>	Subdivide one level coarser during rendering
<	Subdivide one level finer during rendering

Other

#	Exclude from rendering
%	Not affected by Inverse Kinematics
~	Exclude from selection using the mouse in the Figure Window
|	Target for importing and exporting pose data
_	Part used for Plug & Socket function