Hayabusa Renderer 2.0 for Rhino

Operation Guide

Contents

1 Getting started

Hayabusa Renderer 2.0 for Rhino （hereafter it will be called Hayabusa Renderer 2.0 for Rhino or Hayabusa 2.0) is a "Real time renderer" which creates realistic 3DCG images from data you modeled with Rhino.
It reduces mockup creation on reviewing designs or presentation for customers and helps to save design lead time and costs.

Hayabusa Renderer 2.0 for Rhino enhanced its rendering function significantly by supporting multiple shadows, speeding up real time tracing and providing Offline renderer (optional function) which allows you to have global illumination. For animation, you can now set up with key frame for object motions and camera motions, and to change colors, parts and background.

We have been developing the product to make it as easy as possible to use, but please read this user guide carefully before starting to use it.

If you have any questions, please contact a local reseller, or contact the following phone number or E-mail address.

Also if you get any problems or opinions while using it, please let us know.
We will consider your opinions for future development to make it more productive for you.

Developed by
GRAPS Co.,Ltd.

〒150-0031 BEVERLY HILLS 203 Sakuragaoka-tyo Shibuya-ku Tokyo Japan

Business hours：10：00～17：00

TEL 03-5456-2680 FAX 03-5456-2681
E-mail Hayabusa@graps.co.jp

English language e-mail support is provided. However, telephone support is only in Japanese.

1.1 Main features

Hayabusa 2.0Main features

Renderer	
Rendering	Select one from these 3 rendering modes ・Standard rendering ・Advanced rendering ・Real time ray tracing
	HDR/IBL: Select one from these 3 modes ・No HDR/IBL ・HDR/IBL（without Bloom effect） ・HDR/IBL（with Bloom effect）
	Rendering mode on starting (HDR/LDR)Switchable
	Global illumination rendering enabled by 3DsmartRender（Option： Offline path tracer）
File	
Import/Save	Import/Save hyp2 file
	Import Hyp file（Hayabusa 1.0 Project）
	Import/Save Polygon, NURBS, Polygon&NURBS data
	Specify NURBS divided parameter
	Specify Unit, coordinate system
Reload function	Material/Camera/Light/Background Auto-setting when re-exporting data to Hayabusa after editing in Rhinoceros
Edit	
Camera	Switch camera
	Set position, orientation and target point by bird's eye camera
	Select projection method (perspective/parallel)
	Specify view angle (Vertical view angle/ Parallel view angle
	Import/Export Camera file(hcm2)
	You can use 3D mouse（3D Connexion products） to control the camera
Light	Light amount Up to 80
	Specify light type (Parallel light/ Point light/ Spotlight)
	Set light source color
	Set attenuation for Point light and Spotlight
	Set orientation and expansion of spotlight
	Set position and orientation by bird's eye light
	Set Ambient
	Set minus light
	Create shadow for parallel light and spotlight（up to 24）
	Specify self-shadow
	Specify shadow darkness and soft shadow
	Turn light on/off
	Import/Export light file (hlt2)
Material	Material (Lambert/Phong/Blinn/Clear coat/Glass/Metallic)
	Set Self Luminance
	lighting calculation from back ground image – IBL
	Metallic display method (Standard/Classic)
HDRI/IBL	Set Bloom
	Set Star
	Set exposure
	Set gamma
	Set Diffuse Environment light

Mapping	Mapping（Texture/Bump/Specular/Environment Mapping
	Projection（Plane/Sphere/Cylinder/Triplanar UV）
	Operation Setting (Multiplication/Decal/Stencil)
	Specify absolute Scale
	Repeat setting
	Specify Mapping direction (XYZ) and Reverse with Button
	Set Mapping with Posture
	Set Mapping display (position, rotation) with Number or Slider
	Display Handler (Frame)
	Display Mapping images as Thumbnail
Edit	
Background Scene	Import background image
	Switch background
	Background image display type（Sphere/Cube/Dome)
	Background image type (Cube/Spherical/Light probe)
	Change Floor Texture
	Specify background color to display it in single color
	Floor reflection
	Set Floor roughness
	Specify floor color to display it in single color
	Specify background size.
	Import/Export background file (hbg2)
Object	NURBS Polygon Subdivision (Tolerance, Topology ON/OFF, Topology Tolerance)
	Display/Create shadow/Dropped Shadow per Object or Group
Animation	Turntable motion
	Camera Motion
	Object Motion
	Change Material/Part/Background
Move/Rotate	Move/Rotate/Scale with Posture
	Move/Rotate/Scale with Conversion panel
	Global coordinate/Local coordinate
	Absolute/Offset
Variation	Change color by registering target object or color to change
	Change part, Show ON/OFF
Scene graph	Display Scene graph tree
	Edit model group, Edit tree structure by drag & drop
	Remove group or object
	List materials
Action History	Display Action History window
	Restore action by double click
Show	
Show	Show absolute size function
	Wireframe display
	Hardware Anti-aliasing
	Anti-aliasing (without motion)
	Display info
	Display Light Guide
	Display Camera Guide
	Display Shadow
	Set Auto-Exposure
	Tone Mapping

Library	
Material library	Display Material in material library data file as thumbnail
	Apply material by drag & drop thumbnail
Background library	Import background by drag & drop
Tools	
Camera matching	Camera matching calculation by specifying rectangle in still image with point.
Focus on object	Fit camera to selected object
Dropper function	Register/Apply material dropper
Copy object	Copy selected object
Export material	
Still image	Export Fixed camera at once
	Export Snapshot
	Export registered camera snap
	Export embedded Opacity（png, tif）
Movie	Export Animation movie
	Export Turntable animation
	Export camera motion movie
Others	
UI	Customize operation (keyboard)
	Customize move/rotate/enlarge camera (mouse)
Environment setup	Undo, Redo
	Rendering quality/Real time ray tracing/Set material/Display/Coordinate/View mode/Library/Conversion window/3D Device

1.2 System requirements

Hayabusa Renderer 2.0 for Rhino System Requirements

	Standard Renderer	High Quality Renderer	Ray tracing
Supported OS	Microsoft Windows 2000/XP/Vista (Does not work on Windows95/98/98SE/Me/NT）		
CPU	Minimum: Pentium Ⅳ 2.0GHz or higher Recommended: Dual core or higher		
Memory	2GB or higher recommended		
Web Browser	Internet Explorer Ver 6 or later		
Video card	<Minimum system requirements> DirectX9.0c VRAM32MB or higher NVIDIA Geforce2 ATI Radeon7500/8500 or higher For onboard video chip Intel 845 G or later Latest driver recommended	<Minimum system requirements> Supports DirectX 9.0c Shader2 NVIDIA Geforce FX 5900 ATI Radeon 9800 or higher <Recommended system requirements> Supports DirectX 9.0c Shader3 Geforce 6800, FX 3400 or higher recommended ■Activate HDR Mode Video memory 256MB or more recommended Latest driver recommended	<Minimum system requirements> Supports DirectX 9.0c Shader3 Geforce 8800 or higher Video memory 512MB or more Latest driver recommended
Network	1000 BASE/T recommended		
Mouse	3 button mouse (wheel available）		

1.3　Renderer

Haybusa Renderer 2.0 for Rhino can work with three types of real time rendering engine; High Quality renderer, Standard renderer and Real time ray tracing. Standard renderer can work on low-end PC, but High Quality renderer and Real time ray tracing need a video card above a certain performance level to work.

For System requirements for each renderer, please refer to the previous section "1.2 System requirements".

Functional comparison

Item		Standard Renderer	Advanced Renderer	Ray Tracing	Note
Shader type		Vertex Shader(*1)	Pixel shader	Pixel shader + Ray tracing	*1: Works on CPU
Shadow	Create	×	○	○	
	Self shadow	×	○	○	
Material	Lambert	○	○	○	
	Phong	○	○	○	
	Blinn	× (*2)	○	○	*2: Treated as Phong
	Glass	○	○	○	
	Clear coat	△ (*3)	○	○	*3: Phong base
	Metallic	× (*4)	○	○	*4: Flake display not available
Mapping	Texture	○	○	○	
	Bump	×	○	○	
	Specular	×	○	○	
	Reflection	○	○	○	
	Decal	△ (*5)	○	○	*5: No lighting influence on Decal texture
	Stencil	△ (*6)	○	○	*6: Combination of glass material and decal or stencil is not available
	Environment mapping	○	○	○	
Light	Number	No limitation (*7)	Up to80 (*7)	Up to80 (*7)	*7: or lower than it depending on your video card
	Parallel Light	○	○	○	
	Point Light	○	○	○	
	Spotlight	○	○	○	
Reflection on floor		○	○	○	
Ray Tracing	Reflection	×	×	○	
	Refraction	×	×	○	
HDR&IBL	VRAM 256MBor more recommended	×	○	○	
Luminance	Self Luminance	△ (*8)	○	○	*8: You can set it but no Bloom or Star effect.
Anti-aliasing	Hardware	○	○	○	
	Without motion	○	○	○	
Create Image	Export	○	○	○	

2 Installation

After installing Hayabusa 2.0, you can activate Hayabusa by licensing Hayabusa 2.0.
Even if the previous versionHayabusa 1.0 was installed, you can install Hayabusa 2.0 without uninstalling Hayabusa 1.0.

Here is how to install Hayabusa 2.0.
- Install Hayabusa 2.0 itself
- Rhinoceros Plugin
- DirectX 9.0 (Check DirectX version and install it if you need to update it.）

2.1　Install Hayabusa

Here is how to installHayabusa 2.0.

- Log in with Administrator privileges, and close all applications.

- Insert Hayabusa 2.0CD to CD-ROM drive.

- Open Hayabusa 2.0 CD, run Setup.exe in Hayabusa 2.0 Installer folder to start Setup wizard. Read message, then click Next

- Read Hayabusa user agreement, click Agree

- Specify a folder to install Hayabusa and click Install to start installation

- When installation is completed, Setup completed message appears. Read it and click OK
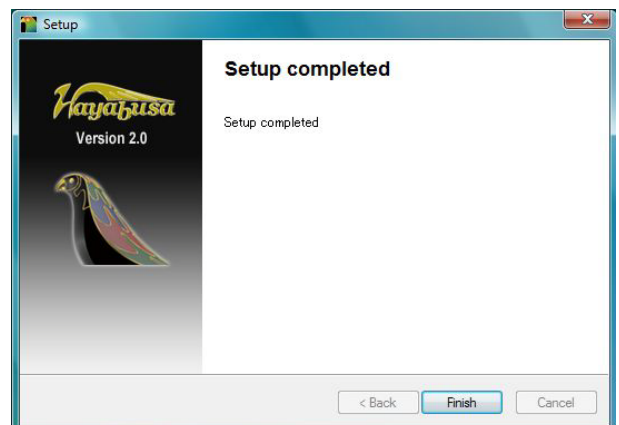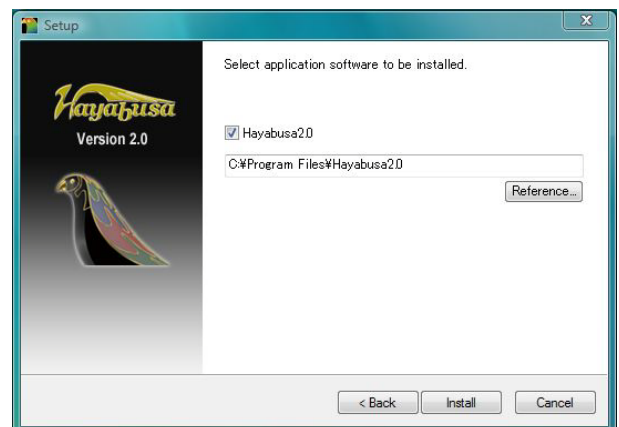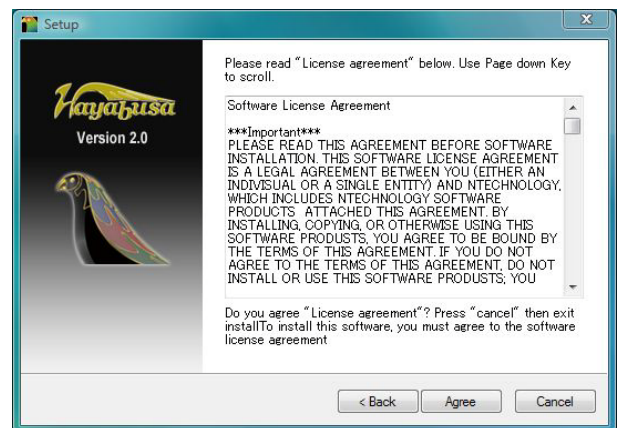
2.2 Software Structure

If Hayabusa 2.0 is installed correctly, the following folders and files are created.

2.2.1 Hayabusa 2.0 Folder

The following folders and files are created in the folder where Hayabusa is installed（e.g. C:￥Program Files￥Hayabusa2.0). The file surrounded by red rectangle is Hayabusa's executable file.
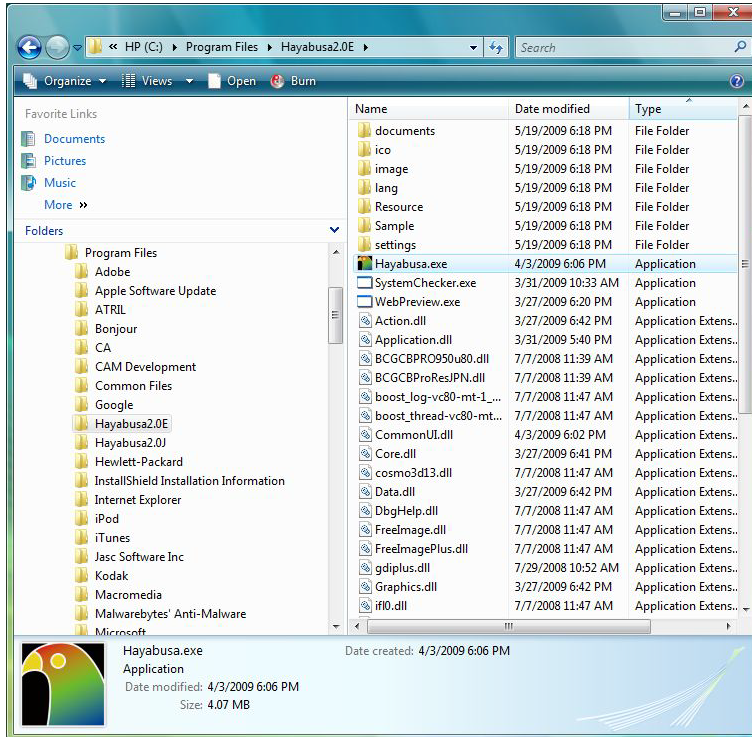
2.2.2 Rhino 4.0 Plugin folder

Hayabusa is installed and the following files are created in Rhino4.0Plugin folder（e.g. C:￥Program Files￥Rhinoceros 4.0￥Plug-ins）
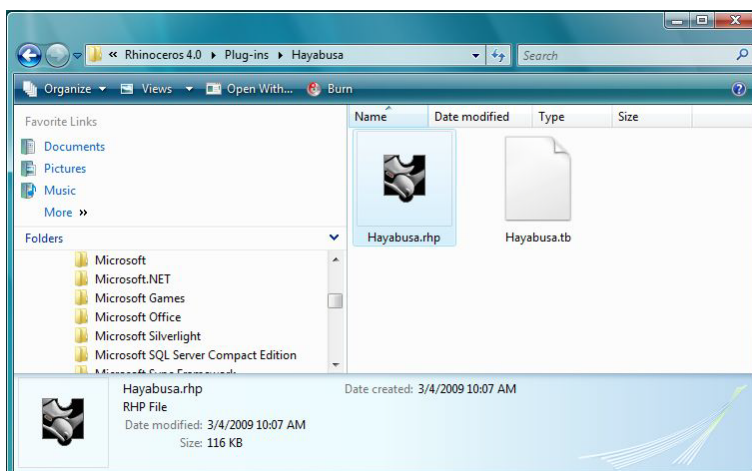
Hayabusa.rhp Plugin which exports Rhino models to Hayabusa2.0

Hayabusa.tb Toolbar file to place Hayabusa.rhp on Rhino menu.

Hayabusa.tb.bak a backup file of Hayabusa.tb. This file is created when Hayabusa.rhp is loaded.

2.2.3 Rhino Menu

When it is installed correctly, the following icon appears on Rhino menu bar.
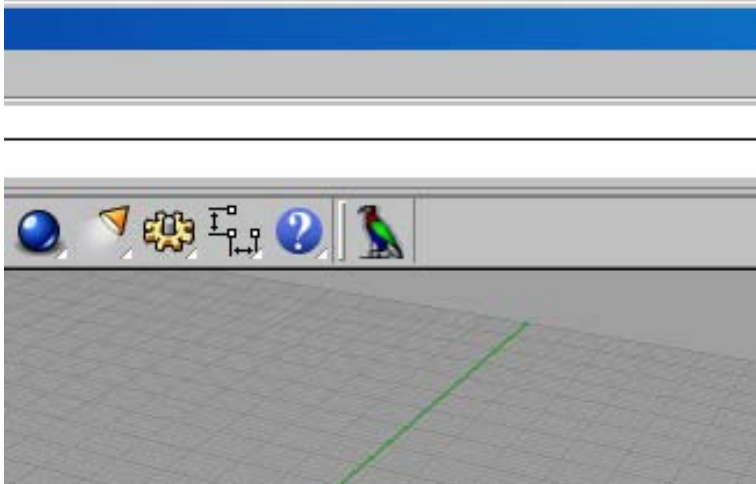
2.2.4 Troubleshooting

If Hayabusa 2.0 is not created on the Rhino menu, do the following steps.

■ When Hayabusa folder is not created in Rhino's Plug-in folder
First, create Hayabusa folder under the Rhino's Plug-in folder.
(Most of case , C:¥Program Files¥Rhinoceros 4.0¥Plug-ins)
You need to place Hayabusa.rhp and Haybusa.tb to this folder.

When Haybusa is not correctly installed, Hayabusa.rhp and Haybusa.tb are located under Hayabusa's Plug-ins¥Hayabusa folder.
(Most of case , C:¥Program Files¥Hayabusa2.0¥Plug-ins¥Hayabusa)
Copy Hayabusa.rhp and Haybusa.tb to the Rhino's Plug-ins folder.
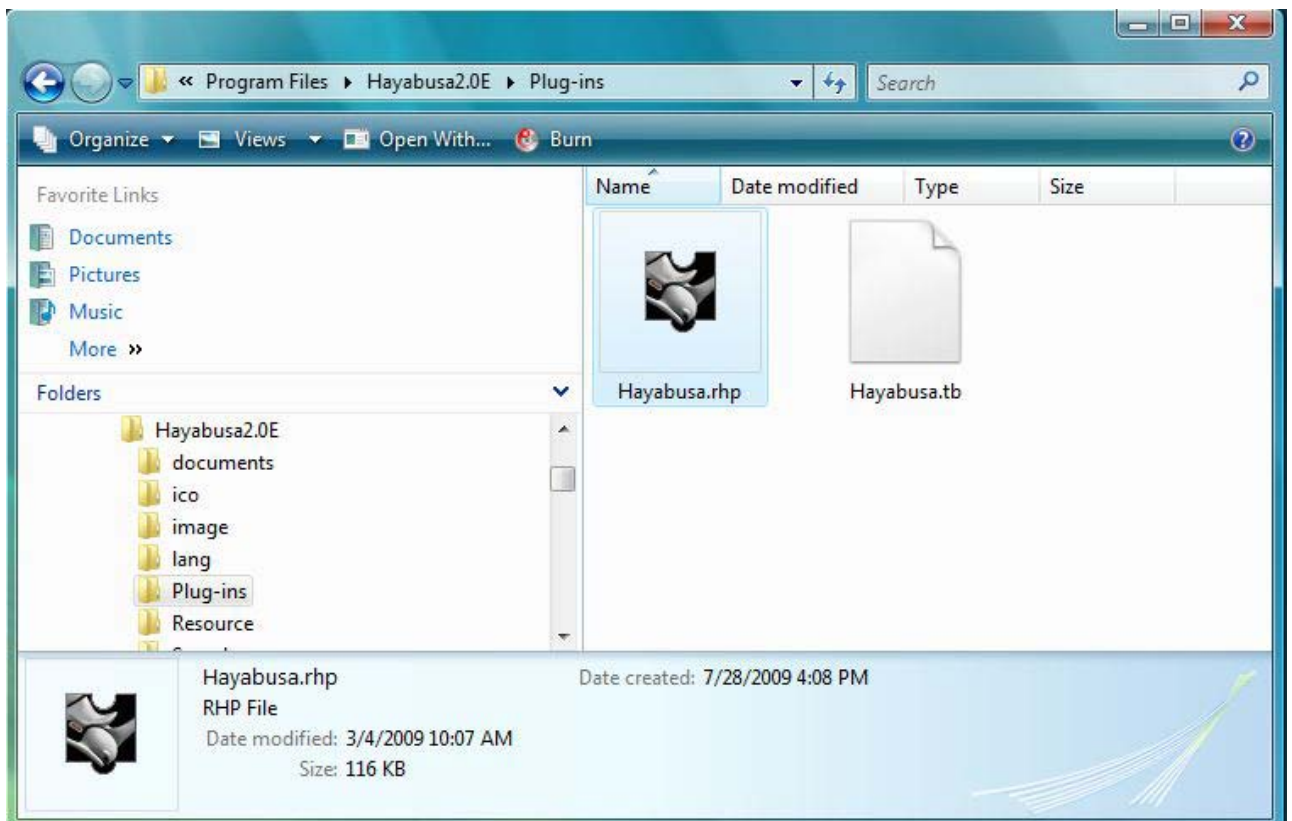
■ Load Hayabusa.rhp

Then start Rhino, open the Option menu to make sure if Hayabusa.rhp is in Plug-ins folder and install it.
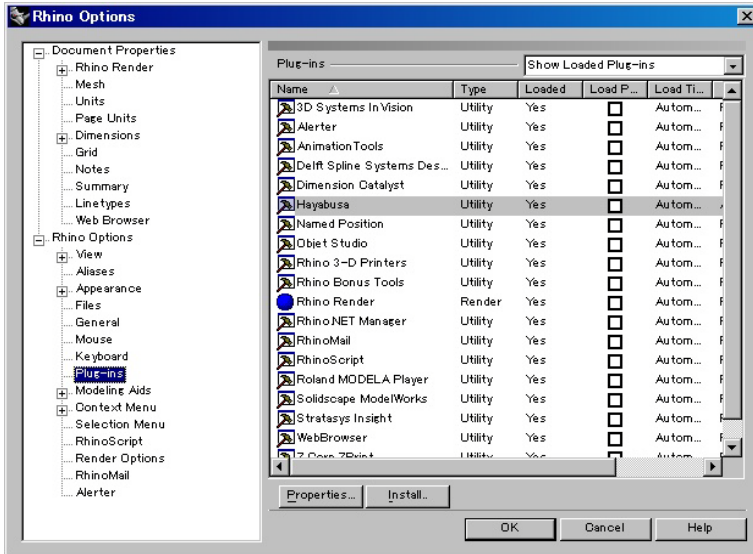
■ Create Hayabusa Icon menu

Click Rhino's Tools menu > Toolbar layout and select Hayabusa in the Toolbars dialog.

If Hayabusa is not found in the Toolbar collection files, open the Open toolbar collection dialog and select Hayabusa.tb to add to the Toolbar collection files, then select it in the Toolbar collection files.
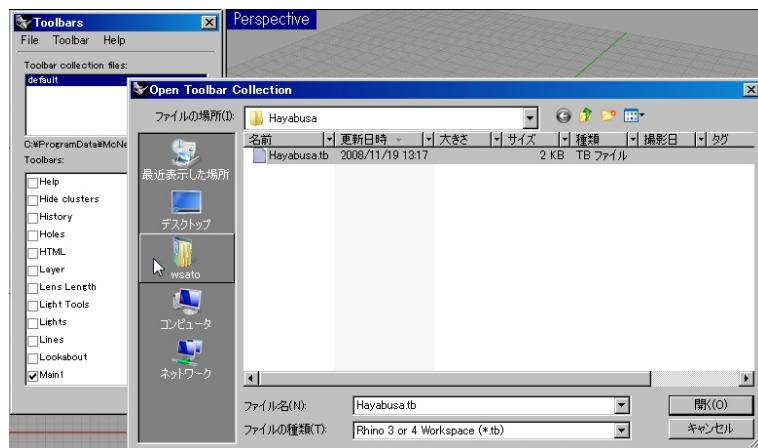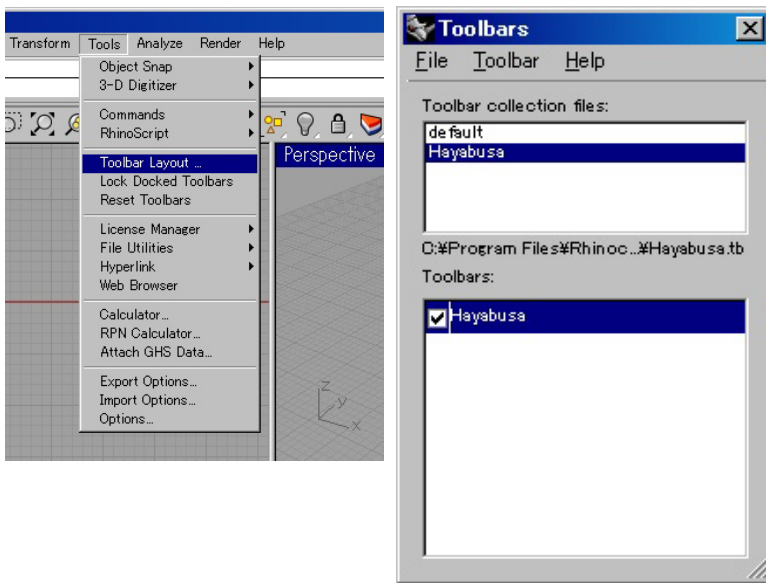
Hayabusa icon will appear in Rhino.

2.3　Set license

Here is how to set the license.
The license of Hayabusa 2.0 is a node lock license. You can use it only on the particular PC.
For obtaining a license, refer to 2.4 Apply for license on the next page.
A license is issued for the PC MAC address.
Here are the steps how to set a license.

■　　Create a directory on the c: drive called "glic".(C:¥glic)
　　　Copy the License file(.lic) to the directory.
　　　You can copy it to other folder, but in that case, you need to specify the folder where the license file is in when you use
Hayabusa for the first time.

■　　Start Hayabusa 2.0 by clicking the shortcut on the desktop or from the Program menu.
　　　When you copy the license file in C:¥glic, the license is obtained and Hayabusa is started.

■　　If you copy the license file to another folder other than C:¥glic,
　　　the dialog shown to the right is opened when you start Hayabusa
　　　for the first time, select [Setting the license folder] and click [OK].
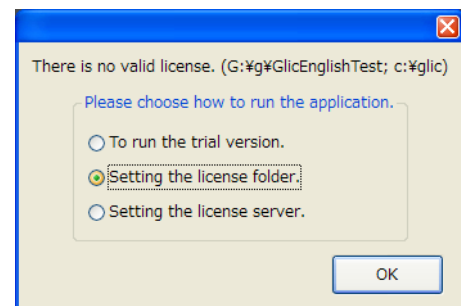
■　　The Specify the license file dialog is open for you to specify the location of the license file.
　　　Specify the folder where you copied the license file,and click [OK].

■　　When the license is certified, Hayabusa 2.0will start.
　　　You do not have to specify the location of the license file after the first time.

■　　If you copy the license file to another folder other than C:¥glic, the place of the license file is memorized in the registry of
　　　PC. When you change the license file from the place to the different directory,delete the registry key below.
　　　When Hayabusa2.0 is started after it deletes it, the directory of the license file is specified again.

　　　　HKEY_CURRENT_USER¥Software¥Graps¥Glic¥License¥Hayabusa2.0¥folder

2.4 Apply for license

To get license file for Hayabusa, please contact local reseller.

http://www.griffinds.jp/ contact/index.html

3 Basic operation

3.1　Start Hayabusa 2.0

There are two ways to start Hayabusa 2.0.

3.1.1　Start fromHayabusaModeler(Rhinoceros　4.0)

When Hayabusa is installed, with the following commands you can use the function of exporting to Hayabusa renderer as a Rhinoceros 4.0 plug-in.

- ■ AC-Hayabusa 　　　　　　（icon left click）
- ■ AC-HayabusaOption 　　　　（icon right click）

These commands can be performed by clicking Hayabusa icons which were placed on Rhino menu after installing.
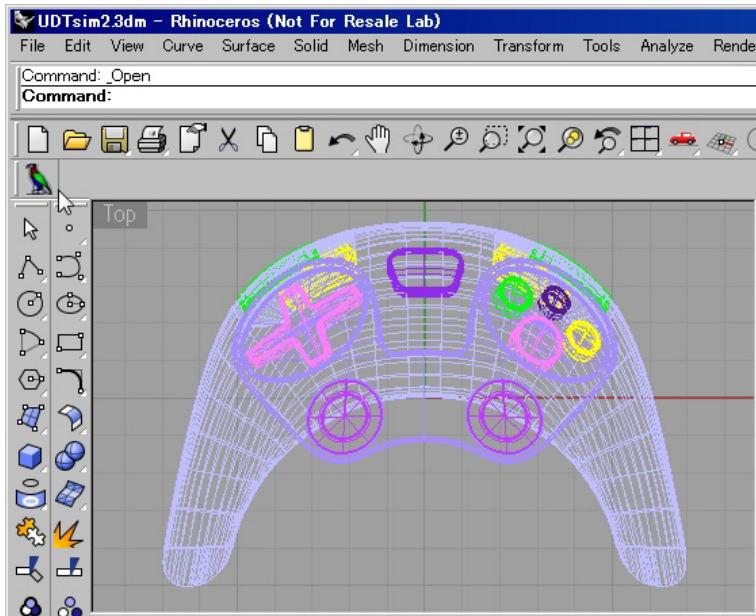
（※icon）

3.1.2   3.1.2   Parameter settings

For detail information on each parameter, please see "5.1 Import Rhinoceros data" – "5.1.1 Export from Rhinoceros".

3.1.3 From Start menu

■   When you click Start (Windows), the Start menu appears.

■   Select Program > Graps > Hayabusa 2.0

3.1.4 From Desktop short cut

■ Double click the Hayabusa 2.0 short cut which is created when Hayabusa is installed.
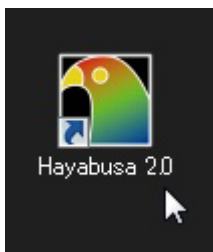
3.1.5 From Quick Start toolbar

■   If you register Hayabusa 2.0 on the Quick Start toolbar, you can start Hayabusa 2.0 by just clicking the Hayabusa 2.0 icon on the Quick Start toolbar.
You can register Hayabusa 2.0 on the Quick Start toolbar by dragging and droppingHayabusa 2.0icon to the Quick Start toolbar.

3.2　Exit

You can end Hayabusa 2.0 by selecting File on the menu bar > Exit.

You can also end Hayabusa 2.0 by clicking X（Close）in the top, right corner of the main window.

If the file has not been saved, a message appears to ask if you want to save it.

3.3　System checker

When you start Hayabusa, The system requirement program（System checker）is started on the PC where Hayabusa is installed. Please note that the red marked items are not the hardware or software recommended in the system requirements, so they may cause problems on starting system or showing data.

When you click the Solve problem button, nTtechnology,. inc. Support center web site opens.

System checker runs when you use Hayabusa for the first time, but after that it is not started any more.

If you want to check your PC's system environment again, start Hayabusa by selecting Start > Program > Rhinoceros 4.0 menu.
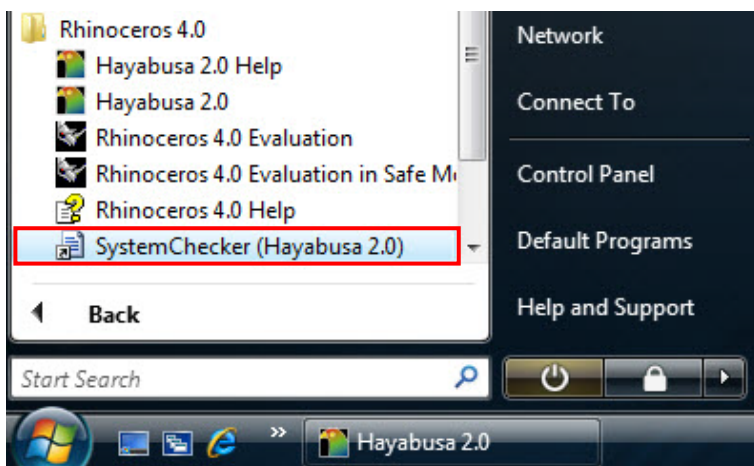
3.4   Window/Tab Operation

<Window type>

Main window

This displays models. The menu bar and the toolbar are displayed at the top.

Scene graph window

This displays the model tree and the material tree.

You can select data or edit models (objects)' structures.

Setup window

This is used to set up scenes.

You can set materials, cameras, lights, backgrounds, projects and animations.

Presentation window

All functions you need for presentation are put together here.

You can switch cameras, change colors, parts or backgrounds and control animations.

Library window

You can apply a material to the specified object by dragging and dropping it from the Material tab.

You can also take a background or a light set in a scene by dragging and dropping it from the Background tab.

Variation window

You can switch and hide/show materials and parts.

Action history window

Displays the history that you have performed in Hayabusa 2.0 and you can undo and redo the operations.

Conversion window

You can move, rotate and scale objects by entering number.

<Dock windows/tabs>

■ You can freely move and dock each window to the top, bottom, right and left side of the screen by dragging the top grey title bar. (The presentation window can be docked only to the top and bottom of the main window.)

■ The Docking guide appears when you drag a window to the top, bottom, right or left side of the screen. When you release dragging a window on the Docking guide, the window is docked to the side. If you do not want to dock a window to the side, drag it while pressing the Ctrl key.

■ You can also dock a window by double clicking the Title bar or the tab.
   And you can release docking by double clicking the Title bar or the tab of the docked window.

■ You can change the window to a tab by dragging the bar at the top of the window and dropping it to the other window. (Depending on the combination of the windows, some may not be changed to tabs.)

■ When the window is changed to a tab, the tab appears at the top of the window, and you can switch windows by clicking the tab. The window changed to a tab can be switched back to a window by dragging the tab.

3.5 Mouse operation

You can use your mouse to control cameras and lights and pick objects in Hayabusa 2.0.

<Control camera>

There are two kinds of modes for cameras, one is the Viewing mode where a camera is rotating around the target point, and the other is the Walkthrough mode where a camera is rotating or moving like walking in the 3D space.

You can set a view mode to each camera individually. You can switch modes by selecting Setup> Camera, from the Presentation window and by pressing F7 key.

Here is how a camera works in each mode.

You can customize the mouse operations for controlling cameras. (See "3.7 Customize operations")

【Viewing mode】

Rotation： Pressing the right mouse button while moving the mouse right and left or up and down rotates the camera around the target point.
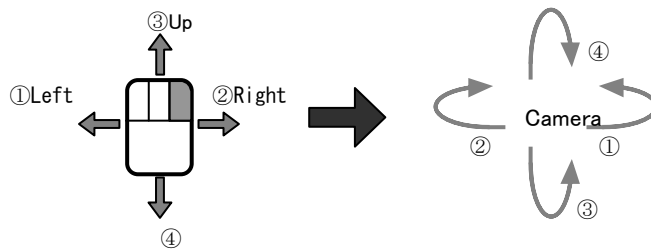
Move：Pressing the Shift key and the right mouse button while moving the mouse right and left or up and down moves the camera parallel.
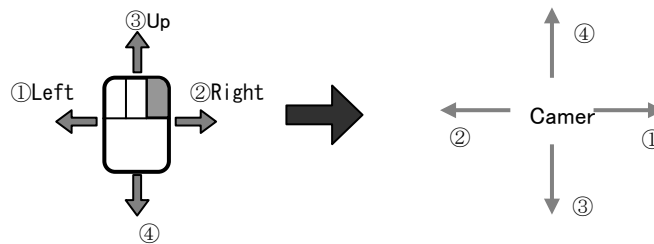
Forward/Backward： Pressing the Ctrl key and the right mouse button while moving the mouse right and left or up and down moves the camera back and forth. With a scroll wheel mouse, you can move the camera back and forth by moving the wheel back and forth.
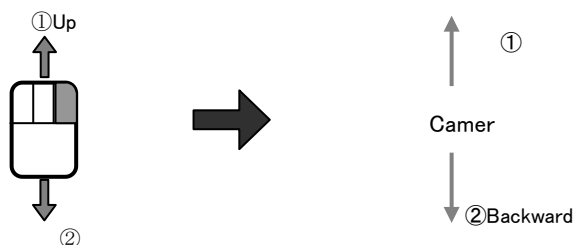
【Walkthrough mode】

Rotate: Pressing the left mouse button while moving the mouse right and left or up and down rotates the camera around itself.

③Up
① ②
Cam
④Down
④
②
①
Cam
③

Move: Pressing the Shift key and the right mouse button while moving the mouse right and left or up and down moves the camera parallel.

③Up
① ②
Cam
④Down
④
② Cam ①
③
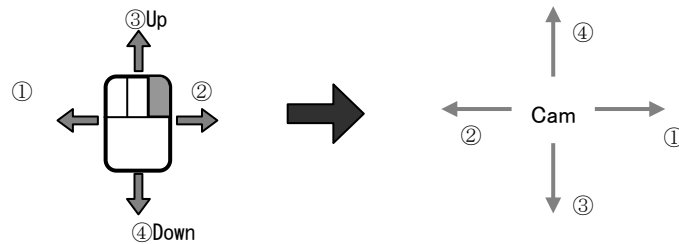
Forward/Backward: Pressing the Ctrl key and the right mouse button while moving the mouse up and down moves the camera back and forth. With a scroll wheel mouse, you can move the camera back and forth by moving the wheel back and forth.

①Up
②Down
①
Cam
②Backward

Here is how a camera rotates in the Viewing mode and the Walkthrough mode.

Model

Viewing mode

Model   Rotation

Rotation center =

Right

Walkthrough mode

Model

Rotatio

Rotation center =

22

<Select Object>
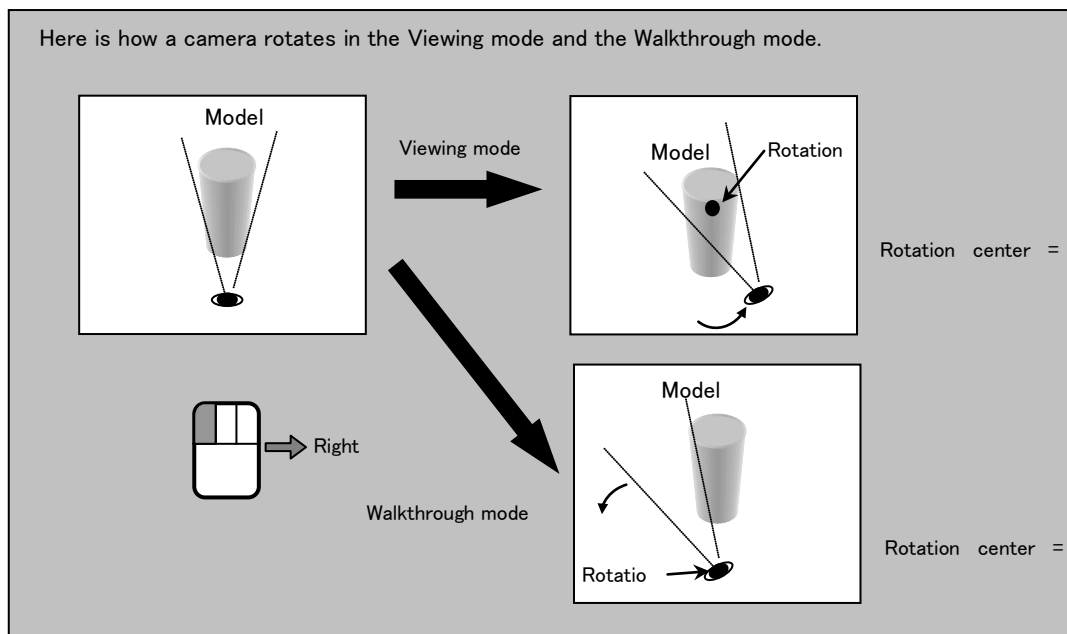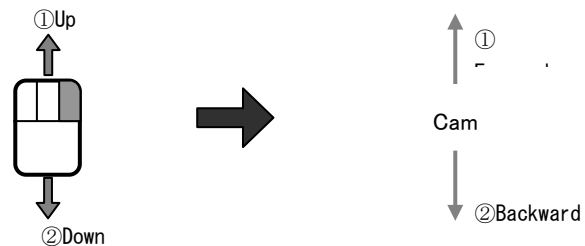
To select an object, place the mouse pointer on the object that you want to select and double click it.

By default, an object which is at the most front within the bounding box is selected, but if you double click again while pressing the Alt key, you can select another object behind the most front object.

Also, if you double click another object while pressing the Shift key, you can add the clicked object to the selection while maintaining the current selection.

When you click or press the Esc key in an area where no object is, the selection is released.

Double click

Select object

When selecting

[Alt]   +   **Double click**

In order from the front
Select the next object

When selecting

[Shift]   +   **Double click**

Add to the selection while maintaining the current selection
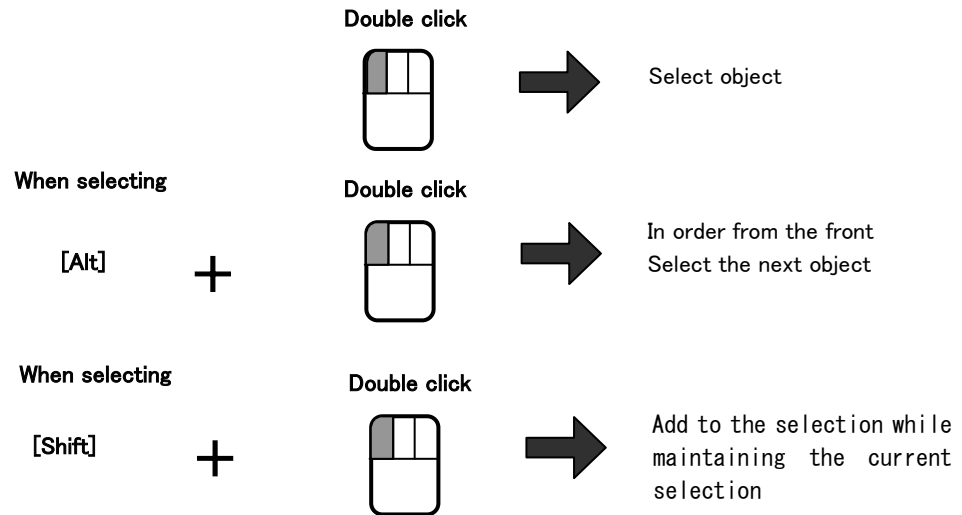
When an object is selected, the object is displayed in Shaded + Wireframe. (You can change the wire frame color displayed on selecting. To change the wireframe color, select Environment setup > Show tab > Wireframe color.

Also, the selected objects are displayed as "Selected" in the Scene graph tree.

The number of polygon and the tessellation info of the selected objects are displayed in the Object tab in the Setup window and the material info of materials attached to the selected objects is displayed in the Material tab.

3.6　Assign function to key

Hayabusa 2.0 can control the following functions with using the keyboard short cuts.

Keyboard short cuts

Category	Command	Assign to key
File	Open Project	Ctrl + O
	Save Project	Ctrl + S
	Save Project As	Ctrl +
	End	Ctrl +
Edit	Undo	Ctrl + Z
	Undo	Ctrl + Y
Show	Show shadow	Ctrl + K
	Camera Guide	Alt + C
	Light Guide	Alt + L
	Information	Ctrl + I
	Wireframe	Ctrl + W
	Show Still image with anti-aliasing	Ctrl + Shift +
	Full screen	Ctrl + F
Window	Show Presentation window	Ctrl + P
	Move window	F2
	Rotate window	F3
	Scale window	F4
Coordinate System	Local coordinate	F12
	World coordinate	F11
Show view	Save active Camera View	F5
	Retrieve View	F6
	Focus on the selected object	Ctrl + G
	Reset target point	Ctrl + Shift + G
Material	Select material group	Shift + Alt + Number
	Select material	Ctrl + Shift + M
	Apply Material	Ctrl + R
Camera	Switch Camera	Ctrl + Number
Background	Change Background	Ctrl + E
Animation	Stop animation(※)	Alt + S
	Pause/restart animation(※)	Alt + P
Switch rendering modes	Standard Renderer	Ctrl + F1
	High Quality Renderer	Ctrl + F2
	Real time renderer	Ctrl + F3

To customize, you can register key operations.
To register functions, use the Customize function. (See the next section "3.7 Customize operations")

※□Customizing is available only for the animations that are selected in the Animation tab (Setup window) or the Presentation window.

3.7 Customize operations

You can customize menu bar items, keyboard operations and mouse operations in Hayabusa 2.0.
To customize, select the menu bar **Window > Customize** and choose a tab which you want to customize in the Customize window.

<Customize menu bar/toolbar >

In the Command tab, you can add/remove icons and commands to/from the menu bar and the toolbar by dragging and dropping.

Categories:	Each category in the menu bar and all commands
Commands:	Command in each category
Description:	Descriptions of each command

<Add/Remove icon to/from menu bar and toolbar>
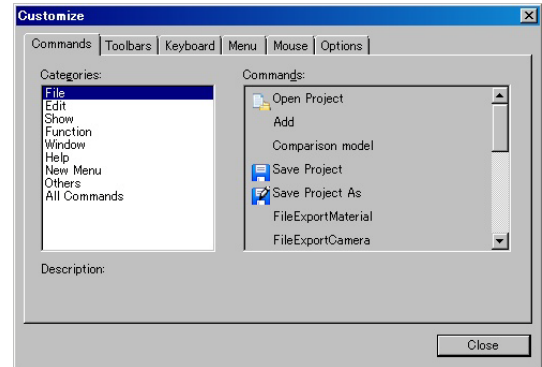
In the Commands column (D), select an icon (or command), which you want to add.
■ With the left mouse button, drag and drop the selected command in the menu bar or the toolbar to add.
■ When you want to delete an icon (or command), select it in the menu bar or the toolbar, and click Delete in the right click context menu.

Toolbars:	Toolbars and menu bars which are currently set
Reset:	Resets the changes which were selected in the Toolbars tab
Reset All:	Resets all changes
New:	Sets newly
Rename:	Changes toolbar names
Delete:	Deletes the toolbars that you set. You cannot delete the toolbars which are set as defaults.

<Keyboard short cut>
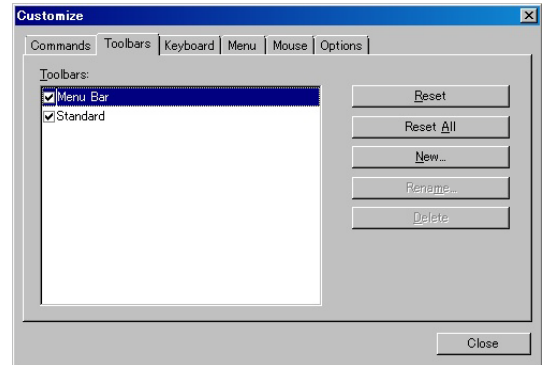
You can assign a menu bar command function to a short cut key in the Keyboard tab.

Category:	Each category in the menu bar(File/Edit/Function/Show/Window/Help)
Commands:	Shows commands in each category
Current Keys:	Shows the keys which are set as defaults and the keys are already set.
Press New Short Cut key:	You can set a short cut key in the field.
Assign:	Press when you assign the short cut key that you set.
Remove:	Removes short cut keys that you set.
Reset All:	Reset all keys to the default settings.

<To add a keyboard short cut>
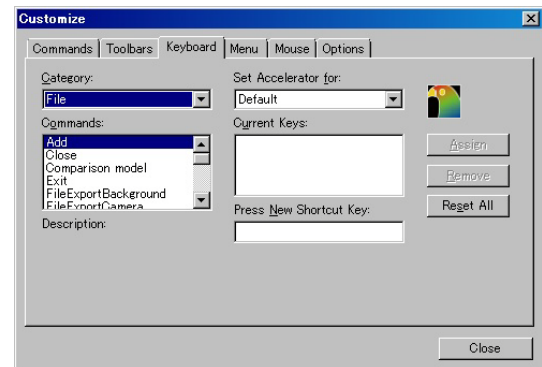
Example： Set up a short cut for the command to export a background (Select File > Export > Background)

■ In the Category column (C), select "File" and in the Commands column (D) select "FileExportBackground".
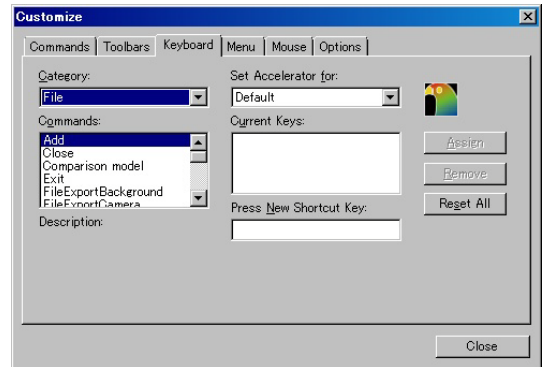
■ In the Press New Shortcut Key field (N), press the Alt key and B as the ones you want to assign. "Alt+B" is displayed in the field. When you select "Alt+B" in the Current keys (U), the Assign button appears. Press this button to set it as a short cut.
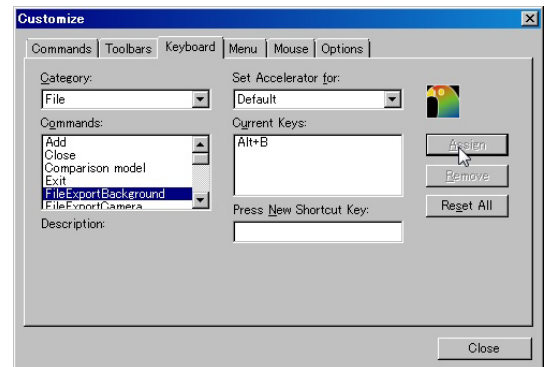
■ If the short cut key that you want to assign has already been assigned, the assigned command name is displayed below the field and you cannot assign it.

<To remove the assigned keyboard short cut>
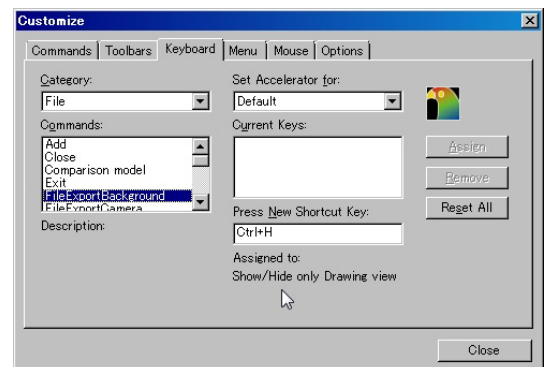
Example： Remove the short cut for the command to export a background (Select File > Export > Background)

■ In the Category field (C) select "File" and in the Commands field (D) select "FileExportBackground".When you select "Alt+B" in the Current keys field (U), the Remove button is appears. Press this button to remove it.

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＜Customize other operations＞
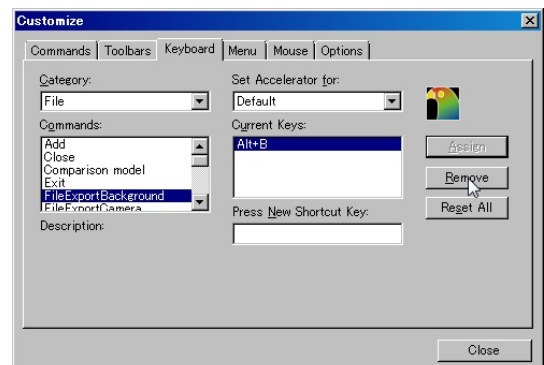
You can register functions to the toolbar in the Menu tab.

Show Menus for:	Shows the default menu
Reset:	Resets settings to the default status.
Select context menu:	You can set menus, which appear when clicking the right mouse button, by dragging and dropping to the toolbar.
Reset:	Resets settings to the default status.
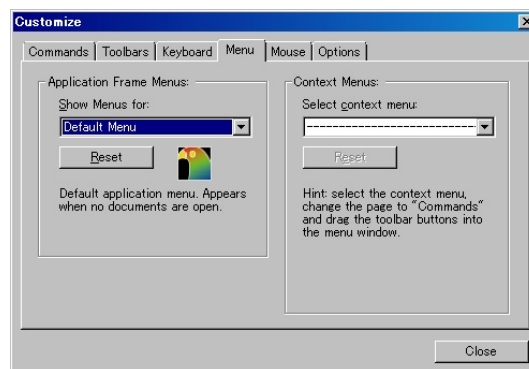
In the Option tab, you can customize how to display the toolbar and the menu bar.

Show Screen Tips on toolbars:	When you place the mouse on the toolbar icon, the name of the tool is displayed.
Show Shortcut keys in Screen tips:	Shows the short cut key
Menus Show recently used commands first:	Shows the commands, which you don't use recently, depressed
Show full menus after a short delay:	The commands which were used recently are displayed first and all commands are displayed after a short delay.
Reset my usage data:	Reset settings to the default status.
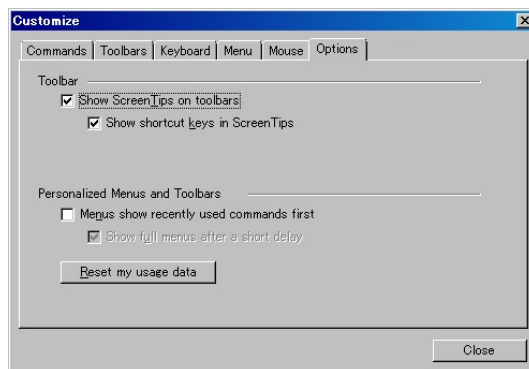
4 Environment setup

In the Environment setup dialog, you can set the PC environments and your preference items such as the rendering engine, the size of the posture and the time of jittering.

When you select the menu bar Window > Environment setup, the Environment setup dialog appears.
In the Environment setup dialog there are several tabs that you can switch.
Some items require you to restart Hayabusa or reload the project file to set up.
The settings are maintained and retrieved when you start Hayabusa the next time.

4.1   Rendering quality

This switches the rendering modes, the anti-aliasing ON/OFF and HDR modes.

Rendering mode:	This switches the rendering modes.
■Standard Renderer	Rendering that uses the DirectX standard functions
■High Quality Renderer	High quality rendering that uses a shader
■Real time Ray Tracing	High quality rendering by the shader which simulates reflection and refraction accurately
Hardware Anti-aliasing	Hardware anti-aliasing is available .Depending on the video card, the HDR rendering Bloom effect may be invalid.
Without motion Anti-aliasing:	Anti-aliasing is performed when the camera is without motion .Displacing (jittering) a viewpoint position little by little randomly when there is no camera and no motion makes less jaggy.
Jittering Quality:	This specifies the number of jittering. The more the number is, the stronger the anti-aliasing without motion will be.
The smallest jittering radius:	This specifies the maximum radius for jittering. If you set this greater than 0.5, it gets blurrily.
HDR/IBL:	This specifies whether or not to do the HDR/IBL process. ■Invalid: This does not the HDR/IBL process. ■Valid (without Bloom effect): This does the HDR/IBL process, but not the Bloom process. ■Valid (with Bloom effect): This does both the HDR/IBL process and the Bloom process.

4.2 Real time ray tracing

This sets the settings of the real time ray tracing.
This is enabled only when the rendering mode is Real time ray tracing.

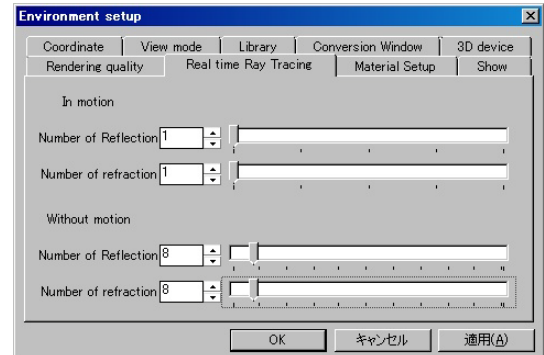|	
In motion: Number of Reflection:	This specifies the maximum number of the reflection calculation when the camera is moving. The reflection calculation by Real time ray tracing takes long time. A smaller value like 1-2 is recommended for better response.
	If ray tracing is not completed within the specified number (reflection or refraction is still continued), the surface of the object is displayed in black.
Number of Refraction:	This specifies the maximum number of the refraction calculation when the camera is moving. A smaller value like 1-2 is recommended for better response. If tracing is not completed within the specified number, the surface of the object is displayed in black.
Without motion: Number of Reflection:	This specifies the maximum number of the reflection calculation when the camera is not moving. If ray tracing is not completed within the specified number, the surface of the object is displayed in black. Setting the number about 10 is recommended, because even if you set much higher number, the next process will start anyway when the tracing is completed.
Number of Refraction:	This specifies the maximum number of the refraction calculation when the camera is not moving. If ray tracing is not completed within the specified number, the surface of the object is displayed in black. Setting the number about 10 is recommended, because even if you set much higher number, the next process will start anyway when the tracing is completed.
The smallest jittering radius	This specifies the maximum radius for jittering. If you set this greater than 0.5, it gets blurry.
HDR/IBL	This specifies whether or not to do the HDR/IBL process. ■Invalid: This does not the HDR/IBL process. ■Valid (without Bloom effect): This does the HDR/IBL process, but not the Bloom process. ■Valid (without Bloom effect): This does both the HDR/IBL process and the Bloom process.

4.3   Material Setup

This sets how to display metallic materials.

Show Metallic material:	For Metallic materials, you can choose from two display methods, Standard and Older format (Hayabusa 1.0). The default is Standard.
	With Standard, when you see the object, which is attached a metallic material, from a distance, the metallic flakes disappear. With Older format, the metallic flakes always appear regardless of distance.
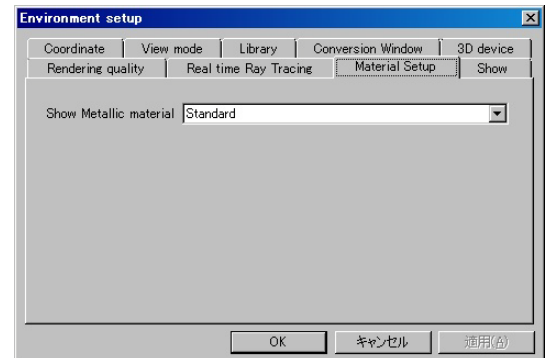
4.4   Show

This sets the wireframe color, the size of the posture and the color when the posture is selected.

Wireframe color:	This specifies the wireframe color to be shown when you select an object.
Posture scale:	This specifies the size of the posture.
Selected Posture color:	This specifies the color of the arrow or the circle which is selected when you are operating the posture.
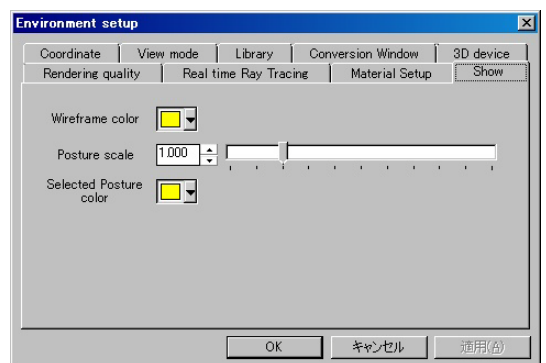
4.5   Coordinate

This specifies the coordinate direction and units.
The settings here are the defaults when the file is read, they are not applied to the current scene directly.
If you want to change the settings for the current scene, select Setup > Project and change the values in the dialog.

Coordinate System:	This specifies the default coordinate direction for importing a new model. The direction that you set here becomes the default one, but you can change it in the option settings in the open file dialog before importing a model.
Unit:	This specifies the default unit for importing a new model. As with the default coordinate, you can change this before importing a model.
Move scene to center:	When this is selected and you import a new model, the model is moved to the center of the scene automatically.
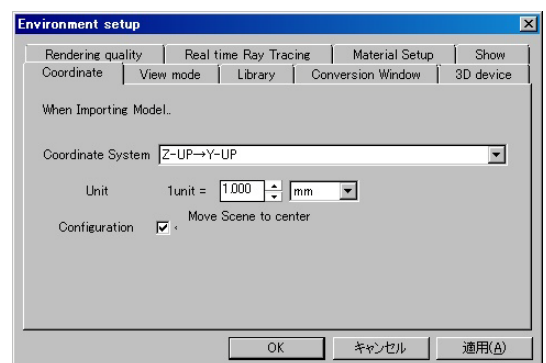
4.6　View mode

This sets the starting view mode (Viewing/Walkthrough).

Viewing mode:	This specifies the default coordinate direction for importing a new model . The direction that you set here becomes the default one, but you can change it in the Option settings in the Open file dialog before importing a model.
Walkthrough mode:	This specifies the default unit for importing a new model. As with the default coordinate, you can change this before importing a model.
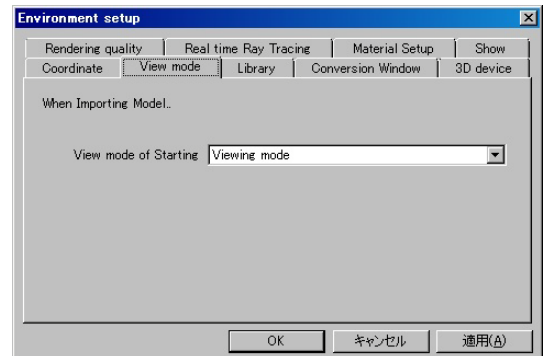
4.7　Library

This specifies the default paths for the material libraries and the background libraries.

Material:	This specifies the default path for the Material library window.
Background:	This specifies the default path for the Background library window.
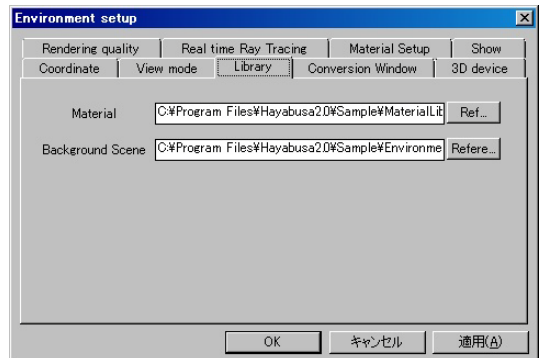
4.8　Conversion window

This sets the units for Move and Scale. In the Conversion window, you can set the positions of objects, cameras and lights.

Move:	This sets a unit for the Move conversion window. You can choose from mm, cm, m and inch.
Scale:	This sets a unit for the Scale conversion window. You can choose from Percent and Decimal number.
Associated with Posture:	When this is selected, the Conversion dialog is opened associated with the posture.
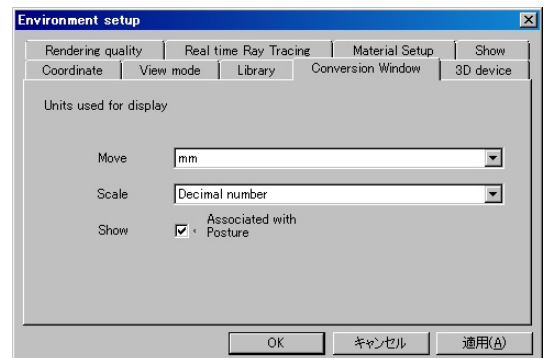
4.9 3D Device

Controlling cameras with 3D CONNEXION's SpaceNavigator is available.

When you want to use SpaceNavigator, connect your PC and the SpaceBall. For further information on SpaceNavigator, refer to SpaceNavigator's documentations.

Action:	This defines the directions of moving and rotating operations. The action for CAD systems is opposite to one for CG systems.
Move value:	This sets the distance of the Move operation.
Rotational value:	This sets the quantum of the Rotate operation.
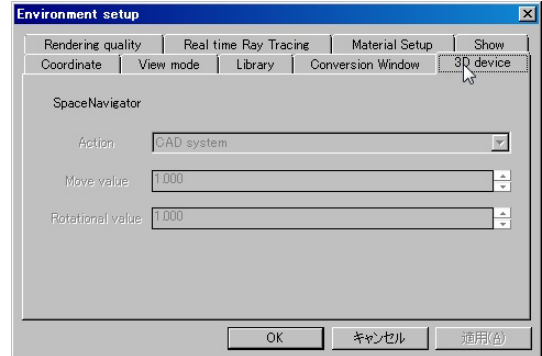
5 Import/Save files

5.1　Import Rhinoceros data

5.1.1　Export from Rhinoceros

- When you click Hayabusa button ▨ in the Rhinoceros tool bar with the left mouse button, the data in the Rhino scene will be imported to Hayabusa.
- When you click Hayabusa button with the right mouse button, the Output setting dialog appears for you to set the output settings. Since the setting data is saved, you do not have to set them every time when you output a file.

Material Type:	Rendering:	This exports the rendering color as a material.
	Layer:	This exports the layer color as a material.
	Shading:	This exports the shading color as a material.
Object type:	Polygon:	This exports after dividing into polygons in Rhinoceros.
	NURBS:	This exports to NURBS without dividing into polygons in Rhinoceros.
Vertex weld:	Select this when you want to export to polygons after welding the adjacent vertices. This is available only when you select Polygon as object type for exporting. This sets the Permissible range and the Smoothing angle.	
Export invisible layer	Not export:	This does not export the data in the invisible layers to Hayabusa.
	Export:	This exports the data in the invisible layers to Hayabusa.
Hayabusa Rendering Mode	HDR:	This starts Hayabusa in HDR mode.
	LDR:	This starts Hayabusa in LDR mode.
Show Option	When this is selected and you click the Hayabusa button, the Export Option dialog appears. Then when you click the OK button, the data will be exported.	
Reload setting	When this is selected and importing Rhinoceros data to Hayabusa, materials, backgrounds, lights and camera data in the scene will be reloaded.	
Wake-up setting	When exporting data, the specified Hayabusa.exe is run. When you click the Edit button, the Open file dialog appears for you to specify a Hayabusa program to run.	

＜Notes＞
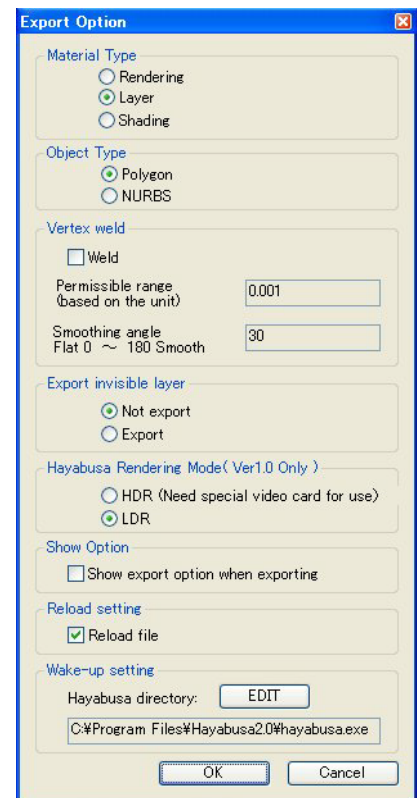
- Some errors may occur if you import the NURBS data, which was created with other CAD or 3D modeler programs, to Rhinoceros and output them to NURBS.
  In that case, you can avoid the error by outputting to Polygon when outputting the data from Rhinoceros.

5.2　Import project data

Start Hayabusa 2.0.

■ Select the menu bar File>Open Project.

■ Specify a file (.hy2) to import.

■ When you click Open, Hayabusa starts importing the file.
　The file is imported as it is when it was saved.

■ If you want to import a backup file, select Hayabusa2 backupfiles as a file type.
　At this time, specify a backup file to import and the location to place the file.
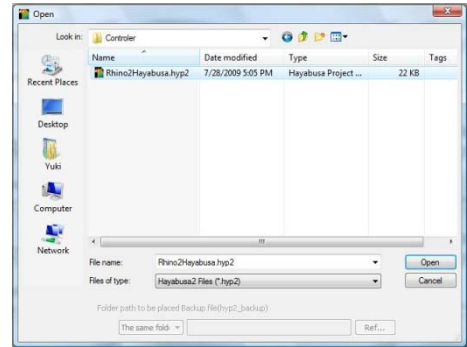
Do not develop:	The file is saved to a temporary folder, not saved to a particular folder.
The same folder:	The file is saved to the same folder as its backup file.
Specified folder	The file is saved to the specified folder. When you select "Specified folder", the Reference button is enabled for you to specify a folder to create the file.

<What is backup file?>

　When you select "Hayabusa backup file (hyp2_backup)" as a file type when saving the project file, not only does this save the model geometries, material data, lights, cameras and background data, but also the linked data such as mapping images and background images are saved together. This is helpful when you want to have the data in your notebook PC or backuplocation.

Backup file hyp2_backup
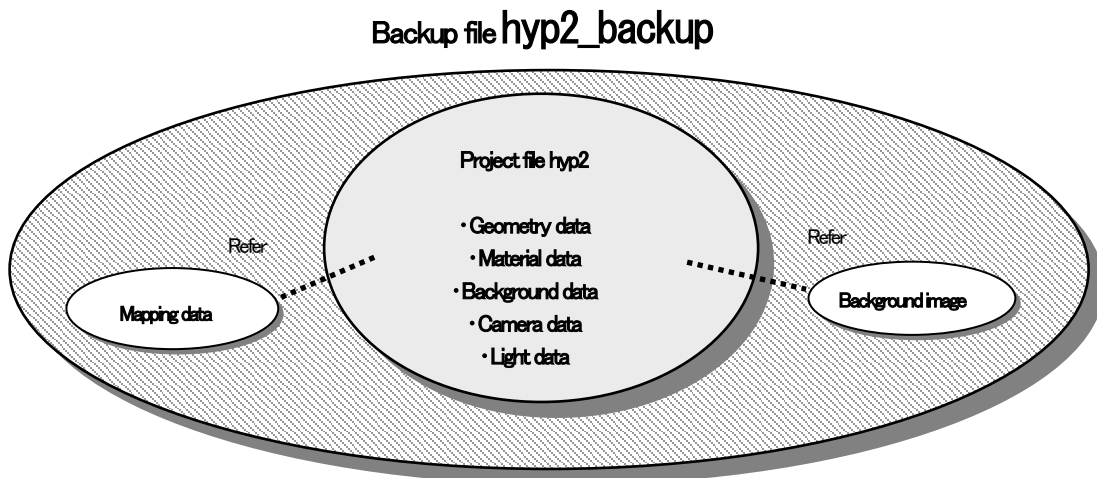
5.3　Open Model

Select the menu bar File > Open Model to import additional data or comparison models.

   Add   Adds a model to the current scene.
   Comparison model Imports models (or projects) for showing comparisons.

5.3.1　Add

This imports a model to the current scene additionally.

■　When you select the menu bar File > Open Model > Add, the Open file dialog appears.

■　Specify a project file to import(.hyp2, hyp2_backup)and click OK. The project file will be imported to the current scene additionally. The project file is displayed as a additional model in the Scene graph tree.

5.3.2　omparison model

This imports a current model and a model to be compared.

■　When you select the menu bar File > Open Model > Comparison model, the Open file dialog appears.

■　Specify a project file(.hyp2, hyp2_backup)to import and click OK. The project file is imported as a comparison model.

■　For how to show comparison models, see the section "Presentation/Show Comparison".

5.4　Open Hayabusa 1.0 project

■　Select the menu bar File > Import >Hayabusa 1.0 project.

■　Specify a file （.hyp） to import.

■　When you click Open, Hayabusa starts importing the file.

5.5 Save data

■ Select the menu bar File > Save Project As.

■ Enter a file name（.hyp2）to save as. When you select "Hayabusa backup file (hyp2_backup)" as a file type, not only does this save the model geometries, material data, lights, cameras and background data, but also the linked data such as mapping images and background images are saved together. This is helpful when you want to have the data in your notebook PC or backup location. For information on backup files, see 5.2 "Import project data".

■ Select one of the following three data types of saving and click Save.

Save as Polygon&NURBS:	This saves both data. Just after importing data, the saved polygon information is displayed. You can subdivide polygons after importing data, because NURBS is also saved.
Save as NURBS:	This saves data as NURBS. The polygon information displayed will be lost.
Save as Polygon:	Data is saved as a polygon. NURBS data will be lost, so the subdivision process cannot be performed after saving.

5.6 File output

You can export material, camera, light and background files by selecting the menu bar File > Export. The exported material files and background files can be used as a library.

5.7 Import file

You can import material, camera, light and background files and Hayabusa 1.0 project files （.hyp） by selecting the menu bar File > Import.

6 Setup

After importing the model data from Rhinoceros you can set up materials, lights and backgrounds in Hayabusa to improve the model data's quality for display and rendering.

6.1   Setup procedure

Setting up is done mainly in the Setup window and the Library window.
If you register materials and backgrounds which are used often, you can proceed the setup process effectively.

The Setup window has seven tabs (Object, Material, Camera, Light, Background, Animation and Project). To open the Setup window, select the menu bar Window > Setup. To open the Mapping dialog to set mapping properties, click a mapping button in the Mapping section in the Material tab.

The Library window has two tabs (Material and Background). You can drag and drop the data registered in the Library window to the scene. To open the Library window, select the menu bar Window > Library.

Also, you can change the model structure and group models in the Scene graph window, and move, rotate and scale objects with using the Conversion window or the Conversion guide.

6.2   Scene graph

In the Scene graph, you can show the scene structure, group models and edit the model structure. To open the Scene graph window, select the menu bar Window > Scene graph. The Scene graph has two trees (Scene tree and Material tree).

You can do the following operations in each tree.

⟨Scene tree⟩	
Change name:	To change the name, click the name and edit it.
Move group:	You can move a group by dragging and dropping it.
Switch Show ON/OFF:	You can switch ON/OFF by selecting/deselecting the check box.
Group selected geometries:	To group the selected object, select an object, click the right mouse button and select "Group selected geometries" from the right click context menu.
Create New Group:	From the right click context menu Create New Group creates a new group in the same level as the selected object.
Remove:	This removes the selected object.
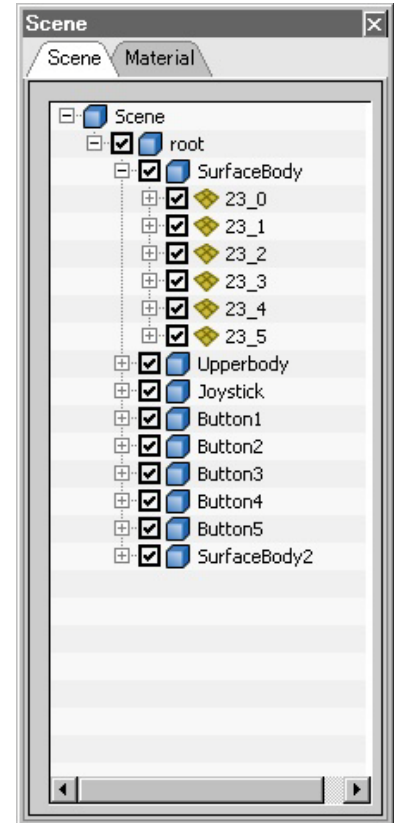
⟨Material tree⟩	
Change name:	To change the name, click the name and edit it.
Apply to object:	To apply a material to the selected object, select an object, select a material, click the right mouse button and select "Apply to Object" from the right click context menu.
Create New:	When you select "Create New" from the right click context menu, the New material dialog appears. Enter a name and a type, and click the OK button to create a new material.
Remove:	From the right click context menu Remove removes the selected object. You cannot remove materials in use.
Copy:	From the right click context menu Copy copies the selected material.
Select Object from Material:	To select all objects which have the same material, select the material and select "Select Object from Material" from the right click context menu.
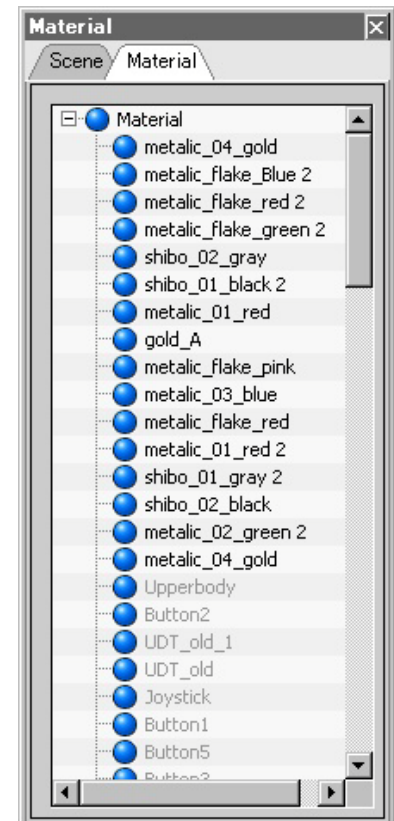
6.3   Set up project

This sets a coordinate and a unit for the project you are working on. To open the Project tab, select the menu bar Window > Setup > Project.

Select Scene:	This specifies the registration address for a newly created item.
Coordinate System:	The coordinate system is displayed in Yup in Hayabusa 2.0. This sets based on the coordinate used when the data was created. If you created the data in Zup, Zup→Yup is set. If you created the data in Yup, Yup→Yup is set.
Unit:	This sets a unit for data. Select the same unit as you used when the model was created. To show models in absolute size correctly and to calculate the camera matching and the attenuation for point lights accurately, set the units correctly.
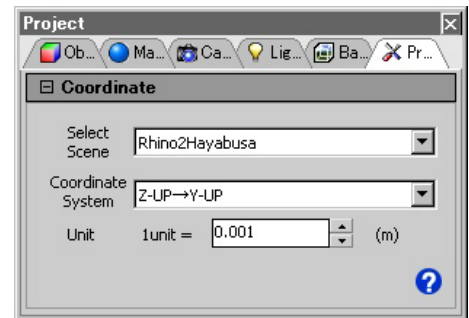
6.4　Set up object

This determines if objects are shown or hidden and shadows are created or not. Also, this sets the accuracy of polygon subdivision for NURBS data.

To open the Object tab, select the menu bar Window > Setup > Object.

⟨Name⟩	
Name:	This displays the name of the selected object. The name can be changed. You can also change it by clicking the name in the Model tab in the Scene graph.
⟨Show⟩	
Show:	When this is selected, the object is displayed. You can also show/hide an object by using the check box in the Scene graph Scene tab or Switch Show ON/OFF in the right click context menu.
Cast:	This specifies whether or not the selected object will create shadows. When it is selected, the object creates shadows.
Dropped:	This specifies whether or not the selected object will receive shadows from the other objects. When this is selected, this object receives shadows.
⟨Subdivision⟩	
Number of polygons:	The number of polygon of the selected object is displayed. When the object is polygon data, it is displayed in gray.
Subdivision Simple setting button: 【Rough】 【Fine】	When the selected object is NURBS data, you can change the subdivision number by clicking this button .If it's polygon data, you cannot do it.
NURBS Subdivision Tolerance:	Entering NURBS subdivision tolerance value and clicking Division button subdivides the polygon with the specified value. The smaller the value is, the smaller it will be .If it's polygon data, you cannot do it.
Apply topological processing:	When this is selected, the polygon is subdivided in relation to the phase (Topology) of the polygon vertices against the entire scene. When you press the Division button, the subdivision process will be started. This process may merge the adjacent vertices to represent the smoothness of the surface, but in some cases, depending on data, the polygon may be divided and result in an in unintended shape. In that case, divide it again without checking.
Topology tolerance:	When you want to perform a topological processing, set a tolerance for merging vertices. The greater the value is, the easier merging vertices will be, but depending on values or data, it may be divided in a different shape from the original.
Use global settings:	You can set ON/OFF for the NURBS subdivision tolerance and the Topology for each object. When this is selected, the polygon subdivision is performed with the conditions set above and the settings set individually on each object are ignored. (When the subdivision is performed with "Use global settings", the individual settings are cleared.)
Division button:	This subdivides NURBS data into polygons based on each setting value.
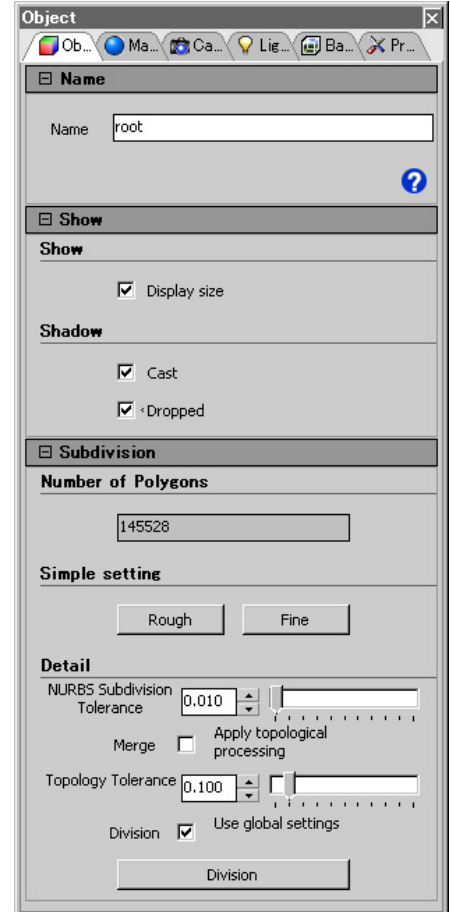
6.5　Move/Rotate/Scale operation

With using the posture or the Conversion window, you can move objects, cameras and lights and scale objects.

〈How to use the posture〉

■When you select an object and click the left mouse button on the toolbar Move, Rotate or Scale, the posture appears.

Move button　　　Rotate button　　　Scale button
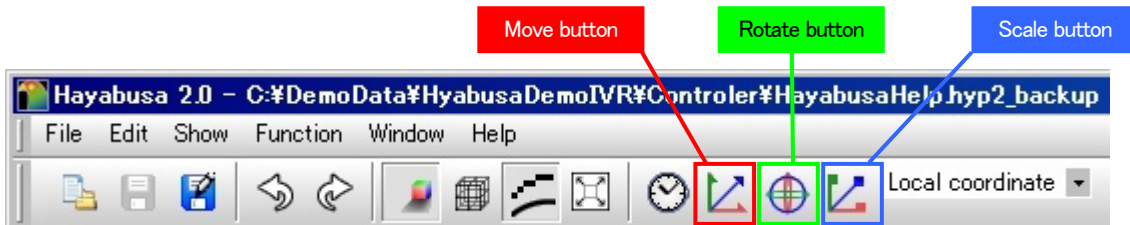
■You can move, rotate and scale the model by dragging the RGB arrow or the circle of the posture.
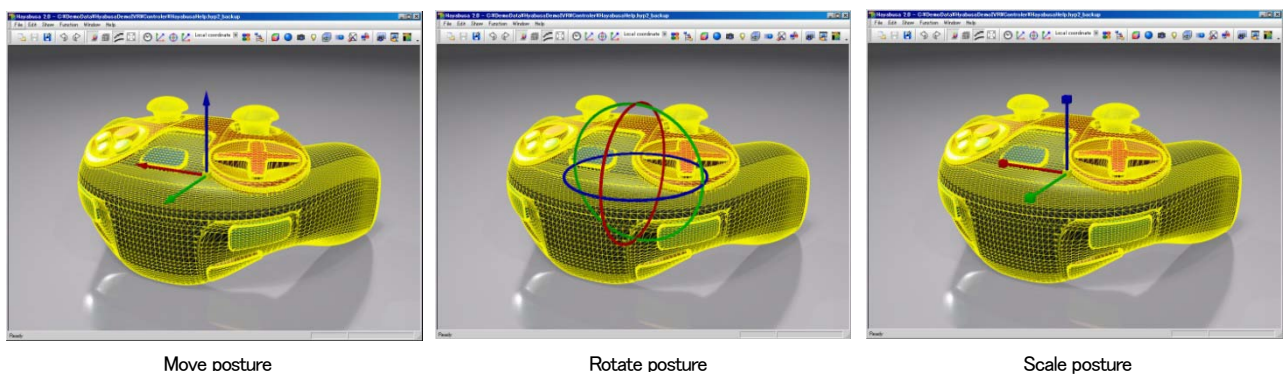
Move posture　　　　　　　Rotate posture　　　　　　　Scale posture

■You can change the posture position by switching the radio buttons in the Conversion dialog. If you choose "Center of object" and click "In select", the center of the posture is moved to the center of the currently selected object. If you click "Arbitrary selection", the pointer changes to a finger shape and the center of the posture is moved to the position where you clicked in the object.

■You can switch the conversion direction between World coordinate and Local coordinate in the pull-down menu in the toolbar. F11 key (World) and F12 key (Local) are also available to switch the conversion direction. However, you cannot scale in World coordinate.

World coordinate:	This operates move, rotate or scale along the scene orientation. Even if the target object has already been rotated, the coordinate system is not rotated and the object is converted along the coordinate orientation.
Local coordinate:	The orientation of the selected object. For example, If the object has already been rotated, the object is converted along the coordinate orientation placed after rotation.
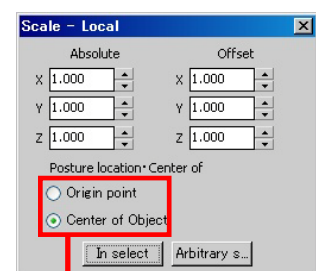
Specify the posture center

■If you select "Associated with Posture" in the Conversion dialog (Environment setup > Conversion window), you can associate the Conversion dialog with the posture to display.

■You can change the posture position by switching the radio buttons in the Conversion dialog. If you choose "Center of object" and click "In select", the center of the posture is moved to the center of the currently selected object. If you click "Arbitrary selection", the pointer changes to a finger shape and the center of the posture is moved to the position where you clicked in the object.

〈How to use the Conversion dialog〉

■When you select an object and right click the toolbar Move, Rotate or Scale, the posture appears.

■Enter values in the Absolute field or the Offset field to convert.

■If you select "Associated with Posture" in the Conversion dialog (Environment setup > Conversion window), you can associate the Conversion dialog with the posture to display.

6.6　Material Setup

Hayabusa 2.0 defines a model's texture by setting materials on objects.

These are the methods to set materials. Depending on the purpose, you can set materials effectively by using a particular method.

Operation	Invoke	Purpose	Target object
Material Setup tab	Setup window/Material	To set material's details	All objects that are applied the same material as the selected object's.
Material library	Material library window	To apply a material from the Material library to the current scene.	All objects that are applied the same material as the dropped object's.
Eyedropper	Right click context menu/Eyedropper	To extract only the necessary data from the material and apply it to the other.	All objects that are applied the same material as the selected object's.

6.6.1　Setup in Material tab

To open the Material tab, select the menu bar Window > Setup > Material

■ Select a material in the Scene graph tree or the Material list.

■ When you click the material tab in the Setup window, the material tab appears and shows the information of the selected material.

<Material list>	
Material list	The materials imported to the scene are listed. To change the name, click the name and edit it.
New button:	This creates a new material. When you click the button, the New Material dialog appears .Enter name and type, then click the OK button to add a material. You can also add a new material by selecting Window > Scene graph > Material and right click anywhere in the material tab and select create new.
Copy button:	To copy a material, click the Copy button while selecting the material.
Remove button:	To remove a material, click the Remove button while selecting the material. You cannot remove the material in use. You can also remove a material by selecting Window > Scene graph > Material and right click anywhere in the Material tab and select remove.
Apply new.	The following is the steps to assign material. 1. select an object 2. Select a material in the list in the Material tab or the Scene graph Material tab. 3. Click the Apply New button （You can also remove materials by using the Short cut Ctrl+R）
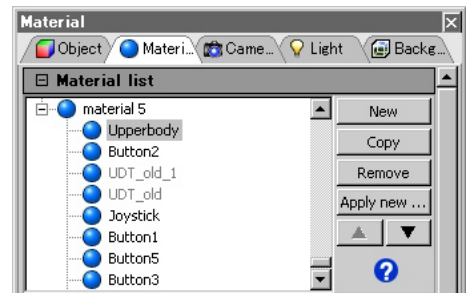
<Name&Type>	
Name:	The name of the selected material is displayed. The name can be changed.
Type:	These are the following six material types in Hayabusa. Set a type depending on the material.
Lambert	Appropriate for simulating the materials which do not reflect lights like rubber. This only uses diffuse reflection based on the reflection rule that incoming lights diffuse evenly in all directions.
Phong	Appropriate for simulating plastic. This diffuses components and mirror components separately for light ray, sight line and normal vector.
Blinn	Appropriate for simulating metal. This calculates diffuse light and reflection light components in relation to diffusion and direction of the model in addition to light rays, sight lines and normal vectors.
Clearcoat	Appropriate for simulating clearcoat paint. The surrounding environment is reflected by using Blinn + Clearcoat.
Glass	Appropriate for simulating glass or transparent plastic. The surrounding environment is reflected based on Phong.
Metallic	Appropriate for simulating metallic paint. The surrounding environment is reflected by using flake paint + Clearcoat.

Editable items for each type: Part 1

	Diffuse color	Environment color	Reflection color	Opacity	Mapping			Environment reflection	Shadow Drop
					Texture	Bump	Specular		
Lambert	O	O	×	O	O	O	×	×	O
Phong	O	O	O	O	O	O	O	×	O
Blinn	O	O	O	O	O	O	O	×	O
Clear coat	O	O	O	O	O	O	O	O	O
Glass	O	O	O	O	O	O	O	O	O
Metallic	O	O	O	O	O	O	O	O	O

Editable items for each type: part 2

	Highlight Sharpness	Highlight size	Highlight Strength	Clear coat Index	Scale	Bias	Reflection Roughness
Lambert	×	×	×	×	×	×	×
Phong	O	×	×	×	×	×	×
Blinn	×	O	O	×	×	×	×
Clear coat	×	O	O	O	O	O	O
Glass	O	×	×	O	O	O	O
Metallic	O	×	×	O	O	O	O

<Color setting>	
Diffuse color:	This sets diffuse reflection color. It becomes the basic color of the material. It is influenced by parallel light, point light and spotlight.
Environment color:	Unlike the direct reflection of light, this sets the color of the light reflected by the environment. It is influenced by environment light.
Reflection color:	This sets the mirror reflection color. It becomes the color of highlights. It is influenced by parallel light, point light and spotlight.
Self luminance color:	This sets the color of self emitting light. An example of this is the color of LED lights.
Opacity	The greater the value is, the more opaque it will be. The value of 0 results in completely transparency.
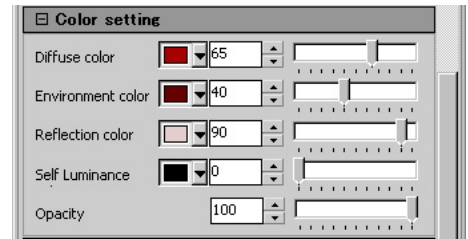
- If you click a color sample, the color editor shown as below appears. Set a color by moving the graduation slider or entering RGB or HSV value.
- If you click the Color Picker button in the Color editor, the eyedropper icon appears, then you can sample any colors you want in the screen with the icon while holding the left mouse button.
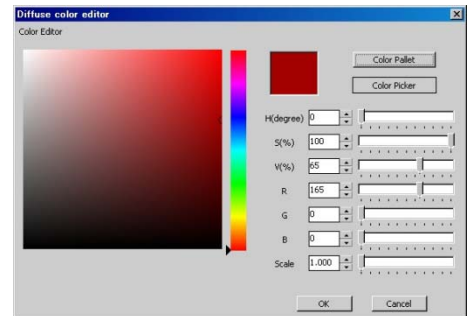
- When you click the Color palette button, the Color palette appears for you to select a color.

6.6.2　Setup in Material library

You can assign a material in an object by dragging and dropping the library registered material to the object.

When you select the menu bar Window > Library or the toolbar Library, the Library window appears.

Default：	When you click the Default button, the maker moves to the default folder. To set the default folder, select the menu bar environment setup > library.
Specify Folder area:	This specifies a material folder which contains material files. Material files in the folder are displayed in the file list.
Material file list：	All material files （.hmt2）in the selected folder are listed. If you select a material file here, the material data is displayed in the Material data list.
Material data list:	Material data in the selected material file is displayed as thumbnail.

<How to export Material library data>

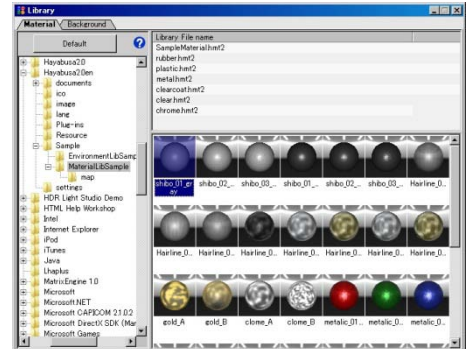If you select the menu bar File > Export > Material, you can export all materials in the scene as a material file (.hmt2).

You can use the material files as library data as they are.

<Manage library>

In the area where the library data is displayed, you can cut, copy, paste, delete or rename by using the right click context menu.

To paste, do the following procedure.

■ Select material data and select Copy or Cut
■ Specify a material file to paste
■ Click Paste in the right click context menu.

You can also select Rename or New in the right click context menu in the Material file list.

<Apply to scene>

Select a material and drag & drop on the object in the scene. At this time, the material is applied to the all objects which are assigned the same material of the object that you dropped. In the Scene graph Model tab (not 3D view) you can also drag & drop a material in the group or the object.

After selecting an object, you can assign a material by selecting a material and selecting the right click context menu Apply to scene.

It is useful for assigning a material only to certain objects.

<Apply only mapping data>

You can apply only mapping data by dragging & dropping a material while pressing the Alt key .When you drop the data in the scene while pressing the Alt key, the Apply Mapping dialog appears. If you select mapping data to apply and click the OK button, you can assign the specified mapping data only.

6.6.3 Eyedropper function

You can extract an arbitrary data from the selected material and apply it to the other materials.

〈Register eyedropper〉

This extracts a particular data of the material.

When you select Register Eyedropper in the right click context menu while selecting a material, the Register Eyedropper dialog appears. After making sure items that you want to extract, click Register.

〈Apply eyedropper〉

When you select Apply eyedropper in the right click context menu while selecting an object, the Apply eyedropper dialog appears. After making sure items that you want to apply, click Apply, the material parameter is applied to the object that is registered the eyedropper.
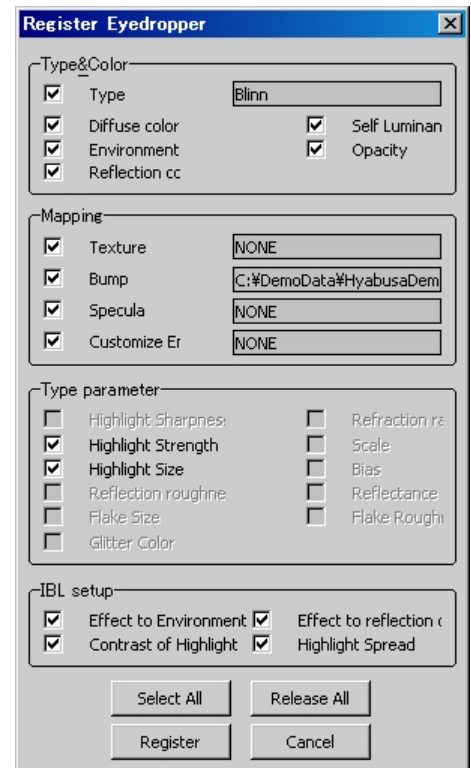
6.7 Setup texture

Hayabusa supports three kinds of mapping such as Textures, Bumps and Specular. You can add texture easily by using images for mapping. You can superimpose textures, bumps and specular to maps. Hayabusa supports five types of mapping format such as Plane, Cylinder, Sphere, Triplanar and UV.

6.7.1 Texture Mapping

This pastes an image as a pattern of the material. To set a texture map, click the Texture mapping button in the Material tab (Setup > Material) to open the Mapping dialog. First, specify an image with the Image button in the Image setting section (the default is None), and adjust the mapping settings.

Operation:	This is only available for texture mapping. You can choose from Multiplication, Decal and Stencil. If you want to paste with decal or stencil, set alpha to the texture. For decal, depending on the alpha value, the color of the base material will be blended. For stencil, this makes it transparent according to the alpha value.
Image setting:	If you click the button, the Open file dialog appears for you to specify a mapping image. To change the image, click this button as well. An extremely large image will use a lot of your computer's video memory. Depending on your video card, up to 2048 x 2048 is recommended.
Remove:	This removes images.
Display image:	The window opens for you to see the image.
Image direction:	This reverses UV.
Reset Reverse:	This resets the reverse to restore the initial status.
How to paste:	Select one from Plane, Cylinder, Sphere, Triplanar or UV. ・Plane This maps as if projecting to a plane. ・Cylinder This maps as if projecting to a cylinder. ・Sphere This maps as if projecting to a sphere. ・Triplanar This map in the x, y or z axis or whichever is closest to the normal. ・UV This maps along the UV direction of NURBS.
Show guide:	This shows a guide of how to paste depending on the options you choose.
Move:	When you click this with the left mouse button, the translation posture appears .Drag the posture to move the mapping. If you click this with the right mouse button, the translation dialog appears for you to specify the translation amount in number.
Rotation:	When you click this with the left mouse button, the rotation posture appears. Drag the posture to move the mapping. If you click this with the right mouse button, the rotation dialog appears for you to specify rotation amount in number.
Scale:	When you click this with the left mouse button, the scale posture appears. Drag the posture to adjust the scale. If you click this with the right mouse button, the scale dialog appears for you to specify scale value.
Size category:	There are two kinds: Relative and Absolute .If you select Absolute, this maps a specified size according to the unit setting. If you select Relative, the size of the boundary box which contains objects with the mapped material will be 1.The greater you set, the bigger it maps and if you set it smaller than 1, the image is mapped repeatedly. (When Repeat is enabled)
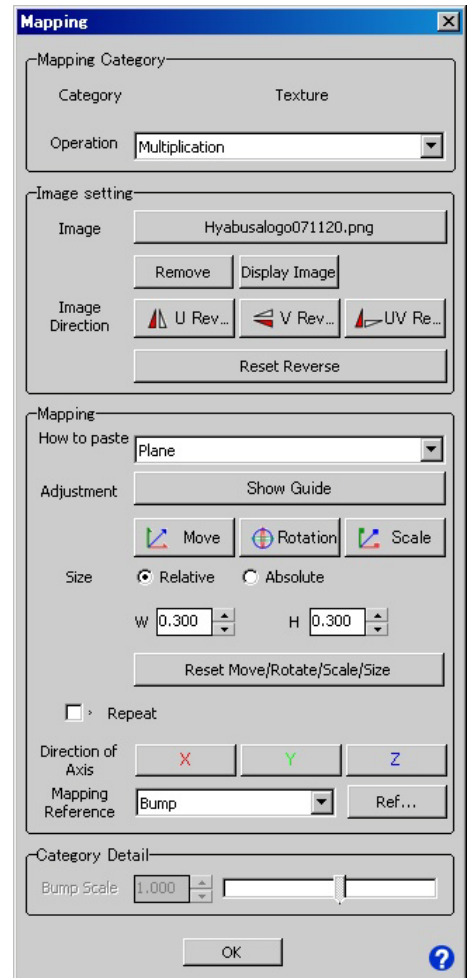
Move mapping posture example

Specify W/H:	This specifies the width and the height of mapping in number. The greater you set, the bigger it maps.
Rest Move/Rotate/Scale/Size:	This restores the initial settings of Move, Rotate, Scale or Size.
Repeat:	If you turn Repeat off, Hayabusa does not map the same image repeatedly even if the size is smaller than 1.
Initial direction of axis:	Specify the mapping axis direction.
Mapping reference:	You can map with the same settings as other mapping's by the Mapping reference. This is used to match mappings perfectly when you want to use the same image for texture and bump.
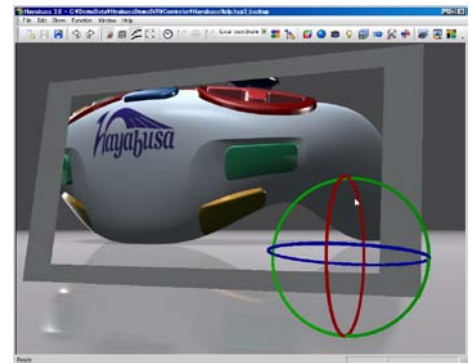
Rotate mapping posture example

6.7.2   Bump Mapping

Bump mapping uses images to simulate bumps. You can simulate bumps on the model surface or engraved letters easily. You can set a bump in the Mapping dialog. To open the Mapping dialog, select Setup > Material tab and click the Bump button in the Mapping section.

First, specify an image with the Image button in the Image setting section (the default is None), and adjust the mapping settings.
Set the mapping by the same procedure as Texture mapping's. You can change the depth of the bump by changing the bump scale.

6.7.3   Specular Mapping

Specular Mapping uses images to simulate colors and patterns in the gloss area. This is used to simulate the fine gloss of materials. You can set a bump in the Mapping dialog. To open the Mapping dialog, select Setup > Material tab and click the Bump button in the Mapping section.

First, specify an image with the Image button in the Image setting section (the default is None), and adjust the mapping settings.
Set the mapping by the same procedure as Texture mapping's.

6.7.4   Customize Environment mapping

You can set environment data to reflect on Clear coat, Glass and Metallic materials individually.
Set this by the following procedure.

■ When you click the Customize Environment map in the Mapping section in the Material tab (Setup > Material), the Open file dialog appears for you to specify an environment map image. Specify an image then click Open.

■ Click the Adjust button next to the Custom adjust button in the Mapping section in the Material tab (Setup > Material).
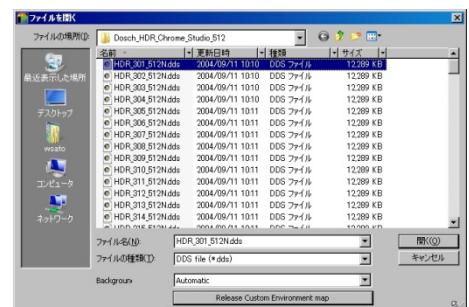
■ Adjust reflection with X, Y, Z slider. If you click the Guide button, the posture appears. You can adjust the posture by dragging it.
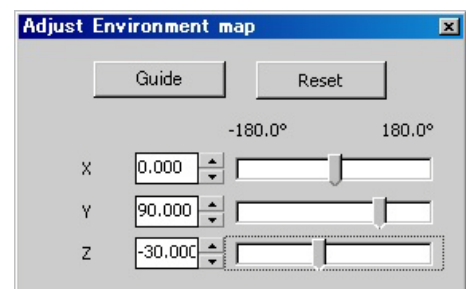
■ If you want to release the Custom environment map, click the Release custom environment map button in the dialog (Setup > Material > Mapping section > Customize Environment map button).

6.8 Camera setup

You can create a camera which has an arbitrary position, orientation and view angle. There is no limit in the number.
To open the Camera tab, select Window > Setup > Camera.
When you select a camera in the Camera list, the information of the selected camera is displayed.

⟨Camera list⟩	
Camera list:	The cameras imported to the scene are listed. To change the name, click the name and edit it. To switch the cameras, select/deselect the check box.
New button:	This creates a new camera. When you click the button, the New Camera dialog appears. Entering a name and clicking the OK button will create a camera.
Copy button:	To copy a camera, click the Copy button while selecting the camera.
Remove button:	To remove a camera, click the Remove button while selecting the camera. You cannot remove the camera in use.

| ⟨Project&View Angle⟩	
Projection method:	This selects the method of projection. Perspective projection uses perspective. Parallel projection does not use perspective.
View angle:	Specify a camera view angle (Vertical View/Horizontal View) .If you make the view angle bigger, the image may look more perspective like looking through a wide angle lens. If you make it smaller, the image may look less perspective like looking through a telephoto lens.
Standard value setting:	This sets the view angle equal to the focal distance of a 35mm film camera lens.
Mode:	This sets view mode. There are two kinds of view modes, one is the Viewing mode where the camera is rotating around the target point, and the other is the Walkthrough mode where the camera is rotating or moving like walking in the 3D space. You can switch between these two modes with the F7 key.
Perpendicular axis fix:	When this check box is selected and you move the camera with the mouse, the Roll angle is always set to 0.Therefore, the horizontal line does not bend. This fixes to Perpendicular axis as the default.
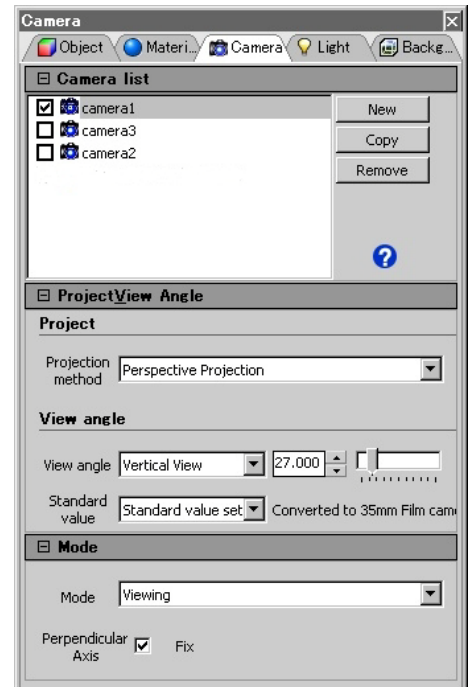
⟨Adjust camera's position⟩

When you select the camera and left click the toolbar Move or Rotate, the conversion guide appears. You can adjust the guide by dragging it with the mouse. When you right click the toolbar Move or Rotate, the conversion window appears. You can adjust numerically.
The camera guide can be shown by pressing Alt+C.

Camera guide display example

⟨Save/Retrieve Camera View⟩
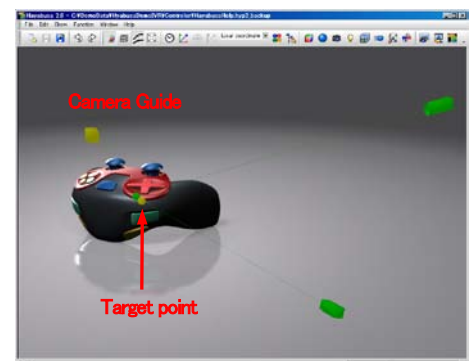
If you select "Save current view" from the right click context menu, the position, orientation and view angle of the current camera are saved and become as the default for the next time when you switch the camera. You can also get the position and orientation of the current camera back to the default by selecting "Retrieve view" from the right click context menu.

6.9 Setup light

You can set a light in the arbitrary position and orientation of the scene.

You can set up to 80 lights. To open the Camera tab, select the menu bar Window > Setup > Camera.

When you select a light in the Light list, the information of the selected light is displayed.

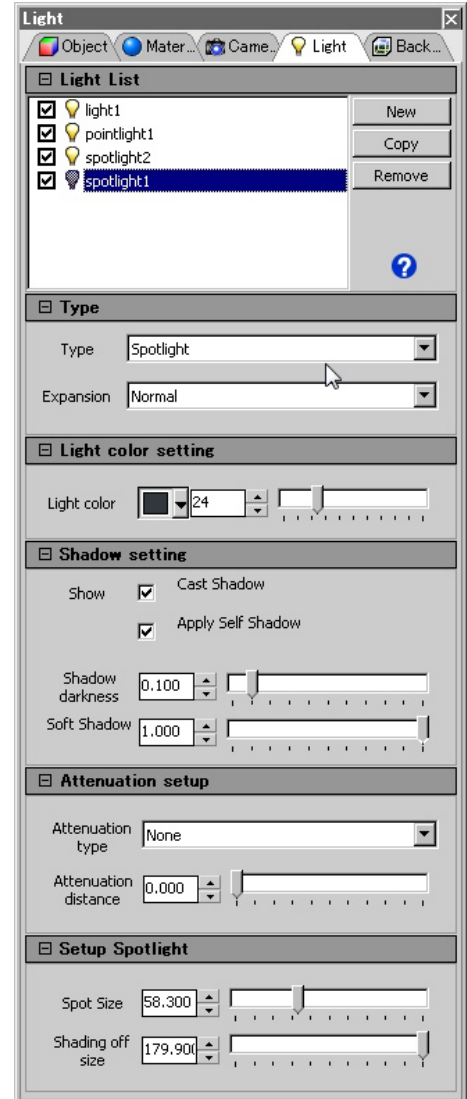| ⟨light list⟩	
Light list:	The lights imported to the scene are listed. To change the name, click the name and edit it. You can switch turning the light ON/OFF by selecting/deselecting the check box.
New button:	This creates a new light. When you click this, the New Light dialog appears. Enter a name and click the OK button to add a light.
Copy button:	To copy a light, click the Copy button while selecting the light.
Remove button:	To remove a light, click the Remove button while selecting the light. You cannot remove the light in use.
⟨Type⟩	
Type:	There are three kinds of light.
	■Parallel light A light source which emits lights unidirectionally. .Shadows can be created from this light. ■Point light A light source which emits lights in all directions from a single point. Attenuation can be set. Shadows cannot be created from this light. ■Spotlight This is a point light, but you can set the irradiation angle and the outline blur. Shadows can be created from this light. There is another light that is Environment light, but this is set in the Background tab.
Expansion:	This option provides the expansion type for lights. You can select either normal or minus light .Normal light makes things look lighter when it illuminates. Minus light makes things look darker when it illuminates. Minus lights are suitable when you want to make a particular area darker.
⟨Light color setting⟩	
Light color:	When you click a color sample, the color editor appears for you to set a light color by moving graduation slider or entering RGB or HSV value.
⟨Shadow setting⟩	
Cast shadow:	When this is selected, shadows are calculated. It is available only for the Parallel light and the Spotlight. However, if the rendering mode is set to standard, the shadow calculation is not performed.
Apply self shadow:	When this is selected, shadows are cast on the model itself and not only cast on the floor.
Shadow darkness:	The grater the value you enter, the darker the shadow will be.
Soft shadow:	The edge of the shadow is blurred when the camera is not moving. if the value is 0, blurring is not performed. The higher the value is, the bigger the blur will be. This process is performed with jittering .If you want to blur widely, select the menu bar Environment setup > Rendering quality tab and set more than 128 in the jittering quality.

<Attenuation setup>	
Attenuation type:	It is available to set attenuation for point lights and spotlights. You can select either from None/Linear/Quadratic. If you choose None, the attenuation calculation for point lights is not performed. For Linear, the attenuation is proportional to the distance. For Quadratic, it is proportional to the square of the distance.
Attenuation distance:	When you select Linear or Quadratic as the attenuation type, set a distance from the light where the attenuation calculation starts.
<Spotlight>	
Spot size:	This adjusts the size of the irradiation area for the spotlight. The higher the value is, the bigger the irradiation area will be.
Shading off size:	The higher the value is, the bigger the edge blur in irradiation area will be.

<Adjust light's position>

When you select the camera and left click the toolbar Move or Rotate, the conversion guide appears. You can adjust the guide by dragging it with the mouse. When you right click the toolbar Move or Rotate, the conversion window appears. You can adjust numerically.
The light guide can be shown by pressing Alt+L.
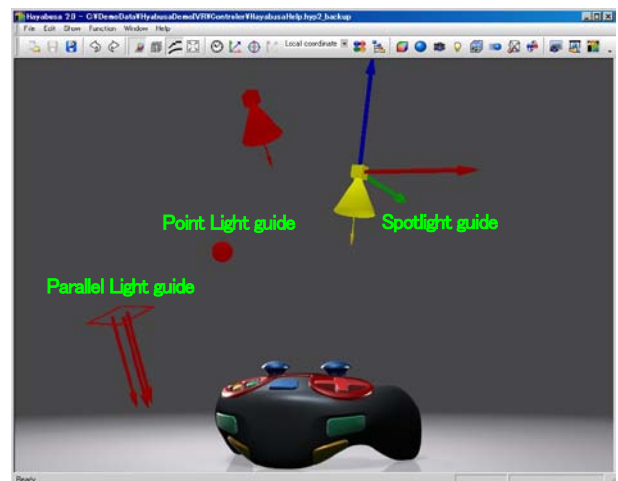
Light guide display example

<Number of lights that create shadows>

Hayabusa 2.0 can calculate shadows for up to 24 lights. However, the shadow calculation may significantly reduce performance. Also, if your video card performance is low or your video memory is small, only a few shadows can be calculated.

<Solar position calculation>

With the Solar position calculation, you can calculate the solar position by using a parallel light to resemble the sun.
For information on the Solar position calculation, see "15.5 Solar position calculation".

6.10 Set background scene

You can set more than one background. There is no limit in the number of backgrounds. Backgrounds are associated with lights, so when you switch the background, the light is automatically switched to the corresponding one.

6.10.1 Setup in Background tab

To open the Background tab, select the menu bar Window > Setup > Background. When you select a background in the Background list, the information of the selected background is displayed.

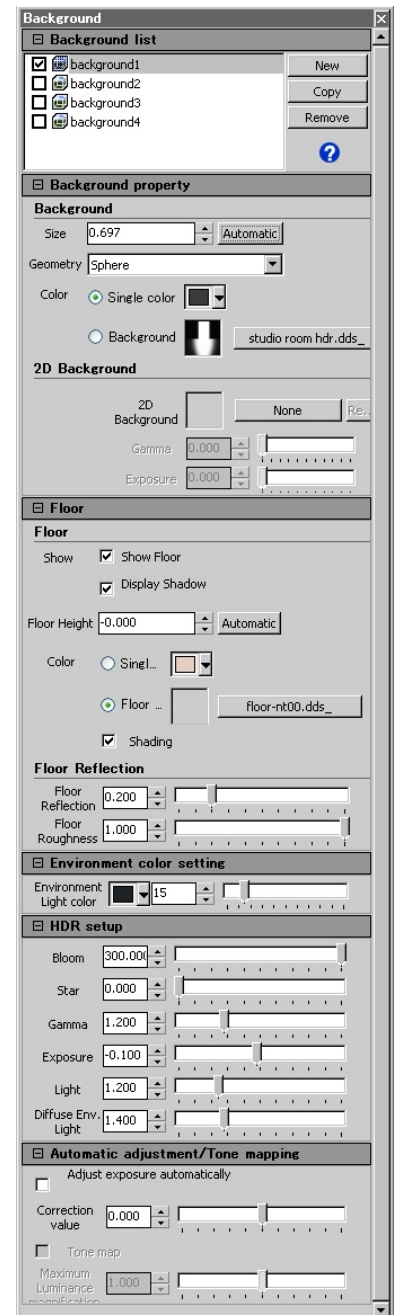|	
\<Background list\>	
Background list:	The backgrounds imported to the scene are listed. To change the name, click the name and edit it. To switch the backgrounds, select/deselect the check box.
New button:	This creates a new background. When you click the button, the New Background dialog appears. Entering a name and clicking the OK button will create a background.
Copy button:	To copy a background, click the Copy button while selecting the background.
Remove button:	To remove a background, click the Remove button while selecting the background. You cannot remove the background in use.
\<Background property\>	
Size:	This sets the size of a background. When you click the Automatic button, it updates the size of the background automatically.
Geometry:	This specifies how to display the background. You can choose either of cube/sphere/dome.
Single color:	Select this when you want to display the background in a single color. After selecting the radio button, specify a background color to display. When you click a color sample, the color editor appears for you to set a color for the background by moving graduation slider or entering RGB or HSV value.
Import image button:	If you click the button, the Open file dialog appears to specify a background image. The specified image will be used for the background reflecting the clear coat, metallic or glass materials. Also, when you select the Background radio button, the image is displayed as a background in the scene. Background textures use 360 degree all-sky image. Use either format of Cube (dds), Sphere or Light Probe. If you use non all-sky image, the reflection may look unnatural and the image may look distorted when displayed as a background, as well.
	If you use a HDR image as a background texture, the reflection looks natural with high contrast, and you can use effects such as Bloom and Star for HDR images to represent high luminance materials. When you use a HDR image, select the menu bar Environment setup > Rendering quality tab and enable HDR. Note that you must have a higher performance video card than a regular one to enable HDR.
2DBackground image:	This specifies 2D background image to be the background for the model .If you click the None button set by default, the Open file dialog appears, from where you can specify an image. The specified image will be used as a background like wall paper. It will not be a part of the reflection calculation. If you select Background texture as display method, the image is displayed in the background. To delete it, click the Remove button. You need to adjust the image to match the camera position so as not to look unnatural, since a 2D image is not an all-sky image. With the Camera matching function, you can combine a 2D background image and the model naturally.
Gamma correction:	This corrects the gamma of 2D background images. The greater the value you enter, the weaker the contrast will be and vice versa.

Exposure correction:	This performs exposure correction for 2D background images. The greater the value you enter, the brighter it will be and vice versa.
<floor>	
Show floor:	When this is selected, the floor is displayed.
Display shadow:	When this is selected, shadows are displayed on the floor.
Floor height:	This sets the height of the floor .If you make the value greater, the floor position gets higher.
Single color:	Select this when you want to display the floor in a single color.
Floor image:	Select this when you want to map images to the floor.
Floor color:	This specifies the floor color. If a single color is specified for the floor color, the floor is displayed in the specified color. If you want to display textures on the floor, the textures are also blended with the specified color.
Specify image button	If you click the button with the floor texture name, the open file dialog appears for you to specify a floor texture image.
Shading:	Select this, if you want the floor is influenced by lights (calculate shading), select this. included)
Floor reflection:	This reflects a model on the floor. The higher the value is, the stronger reflection will be.
Floor roughness:	This adjusts how rough the reflection on the floor will look. The grater the value is, the more the reflection blurs. As it processes with jittering, when the camera is not in motion, the reflection on the floor has a gradual blur.
<Environment color setting>	
Environment light color:	This sets the intensity and the color of environment light. The Environment Light color affects only the environment color of materials.
<HDR setup>	
Bloom:	This simulates bright lights. The smaller the value you enter, the bigger bloom will be.
Star:	This displays star shaped glare for strong lights. The greater the value you enter, the bigger the glare will be. When it's0, there will be no glare.
Gamma:	This sets a gamma value on rendering. The greater the value you enter, the weaker the contrast will be and vice versa.
Exposure:	This sets an exposure value on rendering. The greater value you enter, the brighter it will be. The smaller the value you enter, the darker it will be.
Light:	This sets the brightness of lights. Adjusting this value affects the brightness of all lights used in the scene.
Diffuse environment light:	This calculates diffuse environment lights from the background data and renders them. The greater the value you enter, the more the diffuse environment light will affect.
Gamma correction:	This corrects the gamma of 2D background images. The greater the value you enter, the weaker the contrast will be and vice versa.
Exposure correction:	This performs exposure correction for 2D background images. The greater the value you enter, the brighter it will be and vice versa.
<floor>	
Show floor:	When this is selected, the floor is displayed.
Display shadow:	When this is selected, shadows are displayed on the floor.
Floor height:	This sets the height of the floor .If you make the value greater, the floor position gets higher.
Single color:	Select this when you want to display the floor in a single color.
Floor image:	Select this when you want to map images to the floor.
Floor color:	This specifies the floor color. If a single color is specified for the floor color, the floor is displayed in the specified color. If you want to display textures on the floor, the textures are also blended with the specified color.
Specify image button	If you click the button with the floor texture name, the open file dialog appears for you to specify a floor texture image.

|	
Shading:	Select this, if you want the floor is influenced by lights (calculate shading), select this. included)
Floor reflection:	This reflects a model on the floor. The higher the value is, the stronger reflection will be.
Floor roughness:	This adjusts how rough the reflection on the floor will look. The grater the value is, the more the reflection blurs. As it processes with jittering, when the camera is not in motion, the reflection on the floor has a gradual blur.
<Environment color setting>	
Environment light color:	This sets the intensity and the color of environment light. The Environment Light color affects only the environment color of materials.
<HDR setup>	
Bloom:	This simulates bright lights. The smaller the value you enter, the bigger bloom will be.
Star:	This displays star shaped glare for strong lights. The greater the value you enter, the bigger the glare will be. When it's0, there will be no glare.
Gamma:	This sets a gamma value on rendering. The greater the value you enter, the weaker the contrast will be and vice versa.
Exposure:	This sets an exposure value on rendering. The greater value you enter, the brighter it will be. The smaller the value you enter, the darker it will be.
Light:	This sets the brightness of lights. Adjusting this value affects the brightness of all lights used in the scene.
Diffuse environment light:	This calculates diffuse environment lights from the background data and renders them. The greater the value you enter, the more the diffuse environment light will affect.

Cube   sphere   light probe

6.10.2 Setup in Backgrond library

You can set a background easily by dragging & dropping a library-registered background file in the scene.
When you select the menu bar Window > Library or the toolbar Library, the Library window appears.

Default:	When you click the Default button, the maker moves to the default folder. To set the default folder, select the menu bar Environment setup > Library.	
Show background file area:	Background files （.hbg2）in the selected folder are listed.	
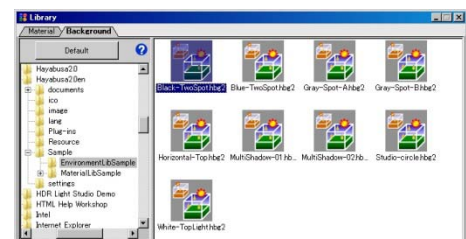
<How to export material library data>
Select the menu bar File > Export > Background, all backgrounds in the scene are exported as background files （.hbg2）.
You can use the background files as library data.

<Apply to Scene>
When you select a background and drag & drop it in the scene, the background and the related light information are imported in the scene.

6.11 Animation setup

If you set key frames in an animation, you can switch object motions, camera motions, materials, parts and backgrounds in the animation.
You can do real time viewing and export an animation as a movie as well.
To open the Animation tab, select the menu bar Window > Setup > Animation.
The Timeline window appears in conjunction with the Animation tab.

<Animation creation process>

■ Click New in the Animation tab to create a new animation.

■ Select the created animation.

■ Set the time in the Timeline window. Click the Update button in the Create frame to
   register the key frame .If there is a selected object when you click the button, the object
   is registered as a motion object. Also, if you select "Register Camera Info" in the
   Timeline window, the current camera is registered as a camera motion key.

■ When you select the key ▼, the information of the key is displayed in the Animation tab.
   Set an animation to the key where you can switch parts or backgrounds as required.

■ Set the animation length in the Timeline window. When you start the animation, it is
   played in the time that you set with or without frames.

■ Set a short cut for starting the animation or Repeat as required.

■ Check how to work the animation with using the Control buttons in the Timeline window.
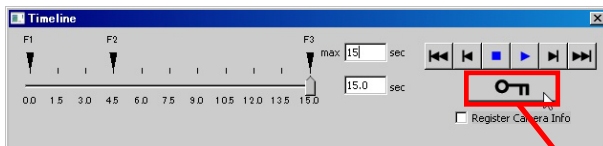

Create key frame/Update button

<Play animation>
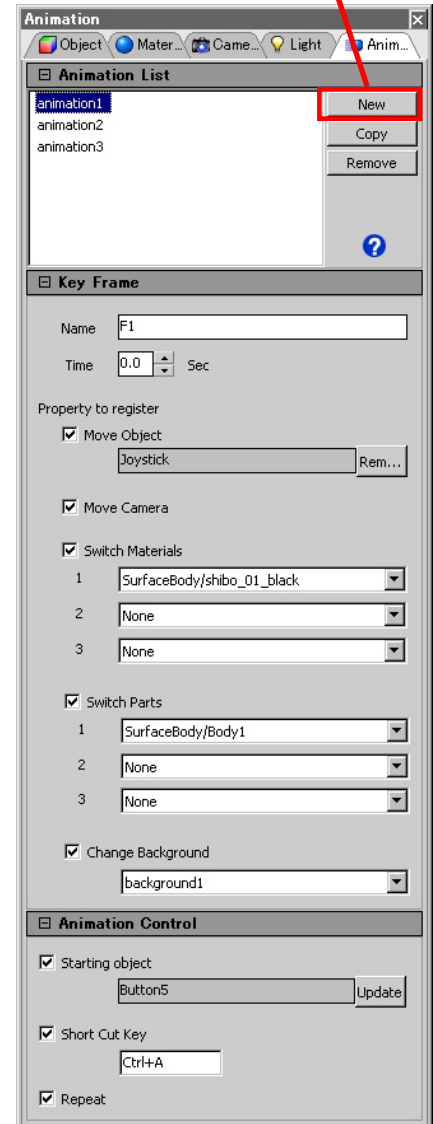
■ If you set a particular object as a starting animation object, when you click the object with holding the Alt key, the animation starts. When the
   mouse pointer is placed on the particular object, the shape of the pointer becomes a finger shape.

■ With the following short cuts, you can stop or pause the animation.
   ・Alt+S :Stop
   ・Alt+P :Pause (animation starts again from this point when pressing Alt+P once again.)
   However, it is available only for animations selected in the Animation tab (Setup > Animation) or in the list in the Presentation window.

■ If the Repeat is selected, the animation is repeated.

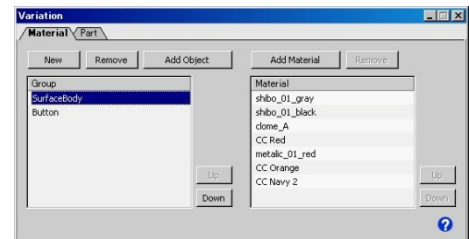| **<Animation list>**	
List:	The animations imported to the scene are listed. To change the name, click the name and edit it.
New button:	This creates a new animation. When you click the button, the New Animation dialog appears. Enter name and type, then click the OK button to add an animation.
Copy button:	To copy an animation, click the Copy button while selecting the animation. The registered key frames also can be copied.
Remove button:	To remove an animation, click the Remove button while selecting the animation.
<Key frame>	
Name:	Name of the selected frame is displayed.
Time:	Time of the selected frame is displayed. You can change the time here. You cannot change the time in the timeline.
Move object:	Object motions and camera motions are interpolated with curve (spline).However, if there is no change between frames, curve interpolation is cut at that point. For example, when you define frames like F1→F2→F3→F4→F5→F6 and register the exact same positions and poses for F3 and F4, interpolation is cut between F4 and F5.Using this method, you can set an animation in linear motion by registering frames as the same position and the pose intentionally.
	You can register only one moving object (or group) for each frame. If you want to move several objects together, you need to group them first or define them in a different frame.
Move camera:	Select this, when you want to control the camera. Camera data is registered or updated when you click the Register/Update key frame button in the Timeline. View angle info is not maintained.
Switch Materials:	When this is selected, materials are switched in the frame. Specify a replacement material after switching in the list box. The material groups and the material are combined and displayed in the list box. To set a material group or a material , select Variation > Material tab.
Switch parts:	When this is selected, parts are switched in this frame. Specify a replacement part after switching in the list box. The part groups and the part are combined and displayed in the list box. To set a part group or a part, select Variation > Part tab.
Change Background	When this is selected, backgrounds are switched in this frame. Specify a replacement material after switching in the list box.
<Animation control>	
Starting object:	When this is selected and you click the specified object (or group), the animation starts. After selecting this when you select an object and press the Update button, the object is registered .If you place the mouse pointer on a starting object, the mouse pointer icon turns to a finger shape, so you can tell that the animation is set on the object. The animation starts when you click with holding the Alt key. If you click the starting object when an animation is done, the animation starts to play in reverse.
Short Cut Key:	When this is selected, if you press the specified key, the animation starts. If you set the same key to several animations, when you press the short cut key, all animations start at the same time If you press a short cut key when an animation is done, the animation starts to play in reverse.
Repeat:	When this is selected, Hayabusa repeats playing the animation. To stop the animation, click the Stop button on the Timeline or press the short cut key.
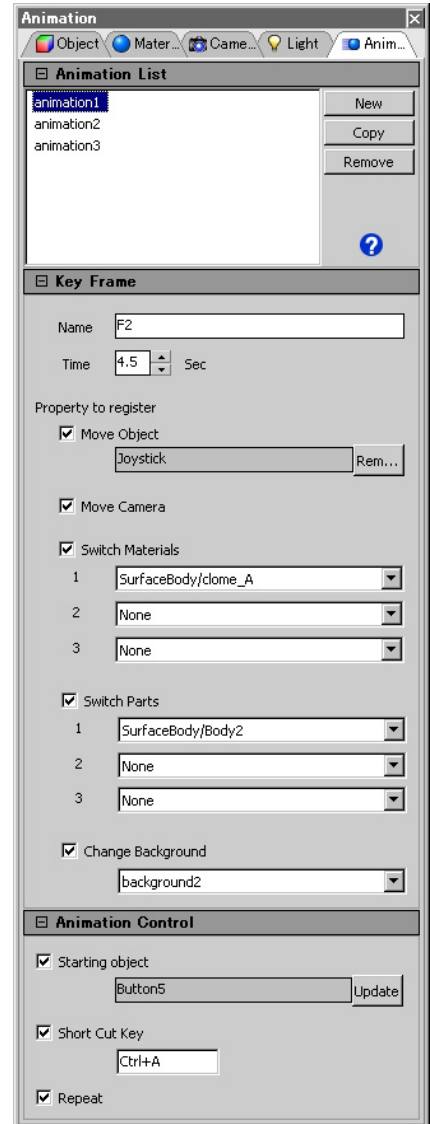
7 Variation

If you group materials or parts and associate them with an object, you can switch materials or parts with one-click.
You can setup the variation in the Variation window. To open the variation window, select the menu bar Window > Variation or the toolbar Variation.

7.1　Setup material variation

In the Material tab in the Variation window, specify in which object you change the material and a material to be applied.

|	
Create material group:	When you click the New button, a "New Group" is added to the list. You can change the name of the group by highlighting it and clicking on it again.
Remove material group:	Select a material group in the list and click the Remove button, the material group is removed.
Add (Remove) object:	Here is the procedure to add an object. ◆Select an object on the 3D view or the Scene graph. ◆When you click the Add Object button, the Object list appears. ◆When you highlight an object in the list and click the Add selected button, the selected object is added to the Object list. To remove the object, select it in the list and click the Remove from list button. In some cases, it may be hard to determine the object by the name in the list .In those cases, select the object in the3D view first, then click the Remove selected button.
Add material:	Here is the procedure to add a material. ◆ When you click the Add Material button, the Material group member list appears. ◆ This specifies materials to be displayed in the list. Show selected materials —>Display only currently selected materials in the scene. Show all materials —> Display all materials registered in the scene. ◆ Select a material to be registered from the materials in the list and click the OK button. That's all for the process to register a material. Registered materials are displayed in the material list. To open the Material list, select Variation > Material tab.
Change material:	When you double click a material in the Material list (Variation > Material tab), the material for the specified object is switched.

<Example: Switch the wristwatch dials by changing the material.>

7.2　Setup parts variation

In the Part tab in the Variation window, specify a part and an object.

|	
Create part group:	When you click the New button, a "New Group" is added to the list. You can change the name of the group by highlighting it and clicking on it again。
Remove part group:	Select a part group in the list and click the Remove button, the part group is removed.
Add part:	When you click the New button, a "New Group" is added to the list. You can change the name of the group by highlighting it and clicking on it again.
Remove part:	Select a part and click the Remove button, the part is removed.
Add object:	Here is the procedure to add an object to the part. ◆ First, select an object in the 3D view or the Scene graph to add. ◆ Select a part in the Part list. ◆When you click the Add object button, the Object list appears. ◆ When you highlight an object in the Object list and click the Add selected button, the selected object is added to the object list. To remove the object, select it in the list and click the Remove from list button. In some cases, it may be hard to determine the object by the name in the list. In those cases, select the object in the3D view first, then click the Remove selected button.
Add "Not to show" to list:	If this is selected, "Not to show" is added to the list. When you double click "Not to show", all objects in this part group are hidden. 〈Example〉 In the case that the group contains Part A–C, and you add "Not to show" to the list 1. Part A —〉 Shows the objects belong to AB and C are not displayed. 2. Part B —〉 Shows the objects belong to BC and A are not displayed. 3. Part C —〉 Shows the objects belong to CA and B are not displayed. 4. Not to show —〉 does not show neither A, B nor C.
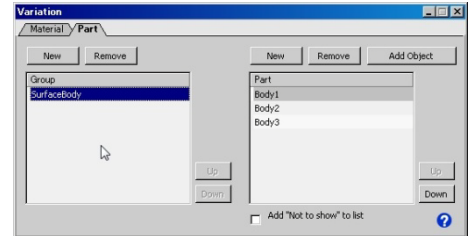
8 Reload

After editing data in Rhinoceros and exporting it back to Hayabusa, Hayabusa 2.0automatically reloads materials, backgrounds and lights that are used in the current scene.(＊)

(＊)For materials, Hayabusa reloads them based on the IDs that are exported for each object from Rhinoceros, so if an ID is changed, Hayabusa cannot reload the material of the ID.

As above, Hayabusa automatically reloads the data when they are exported from Rhinoceros to Hayabusa, you can reload them manually too. To reload manually, do the following steps.

■When you select the menu bar Function ＞ Reload, the Reload dialog appears.
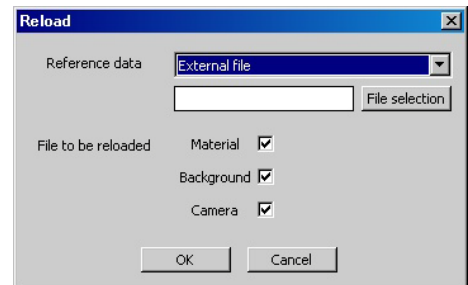
■When you click the File selection button after selecting "External file" as a reference data, the Open file dialog appears.

■To load Specify a Hayabusa project file (hyp2)and Click the Open button.
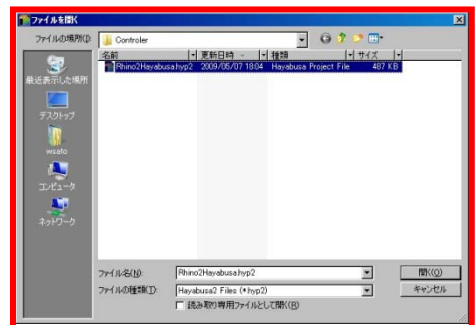
■In the Reload dialog, select Material, Background, Camera check boxes to make them files to be reloaded.

■When you click the OK button, the reload process starts and the specified data will be imported to the scene.
 You can switch the imported background and camera data by selecting them in the Background list or the Camera list.

9 Presentation

The Presentation window has all switch functions required for presentation and seven tabs such as Camera, Material, Part, Background, Animation, Rotational motion and Show Comparison. To open the Presentation window, select the menu bar Window > Presentation.You can also show/hide the window with Ctrl+P.

9.1   Switch camera

| Arrow buttons:	You can switch to the regular position cameras (front/back/right/left/up/down) by clicking the left arrow button.
List area:	Cameras created in the Camera tab (Setup > Camera) are displayed as thumbnails. When you click a thumbnail, the current camera is switched to the clicked one.
Triangle buttons:	If you click either of the triangle arrows on the right and left of the title, the panel is switched. Here, you can change the view mode (Viewing/Walkthrough) and the project type (Perspective/Parallel) and fix the Perpendicular axis.
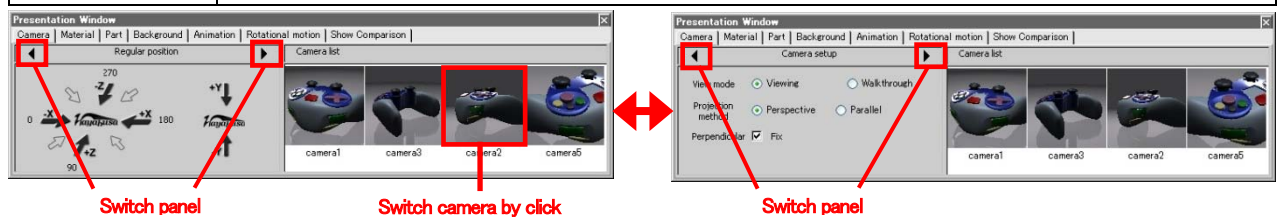
9.2   Switch material

Select group:	Select a material group created in the Select group box in Material tab (Variation > Material tab) to list material members.
List area:	When you click a material thumbnail, the material is switched.
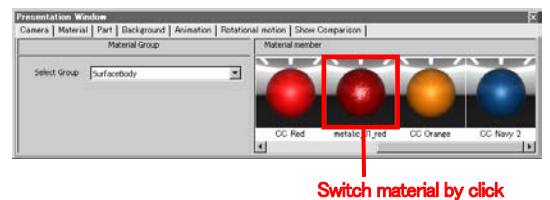
9.3   Switch part
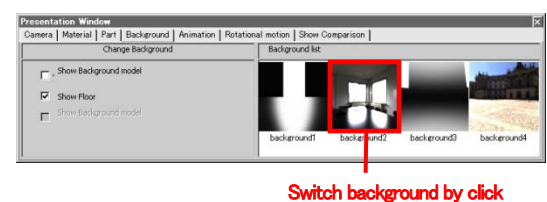
| Select group:	Select a part group created in the Part tab (Variation > Part tab) to list part members.
List area:	When you click a thumbnail, the part is switched.
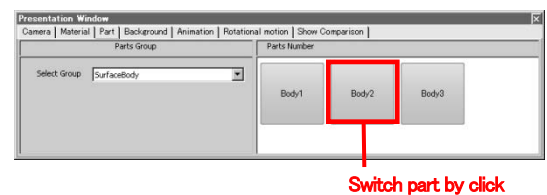
9.4   Switch background

| List area:	Backgrounds created in the Background tab (Setup > Background) are displayed as thumbnails. When you click a thumbnail, the background is switched.

9.5   Play animation

List area:	Animations created in the Animation tab (Setup > Animation) are displayed as thumbnails. Click to select an animation.
Control buttons:	You can play and stop the animation and jump to the beginning, end, previous frame or next frame. Operate after selecting an animation in the list.

Select animation by click
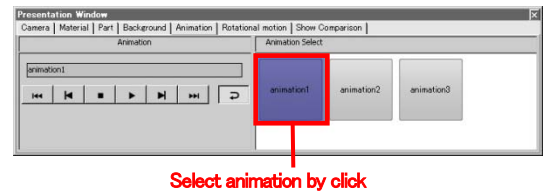
9.6   Play rotational motion

Arrow buttons:	You can play a turntable animation or camera animation by click the arrow button. To pause the animation, click the Pause button.
Detail:	If you click the detail button, the dialog is opened, from where you can change each rotation speed.
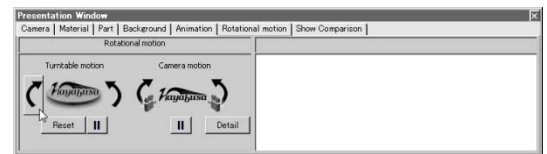
9.7   Show Comparison

Here is the procedure to show comparison.

■ Select the menu bar File > Open Model > Comparison model to import a model to be compared. When the model is imported, the file name of the model is displayed in the list in the Show Comparison in the Presentation window.

■ Specify how to divide the screen.

■ When you drag & drop the comparison model from the list to the divided window in the 3D view, the comparison model is displayed in the specified window.

■ If you double click in the window while the window shows the comparison, the window is magnified. When you double click the window again, you return to the comparison.

■ If you want to remove the comparison model, click the Remove button. However, you cannot remove a model which is currently used for showing comparison.
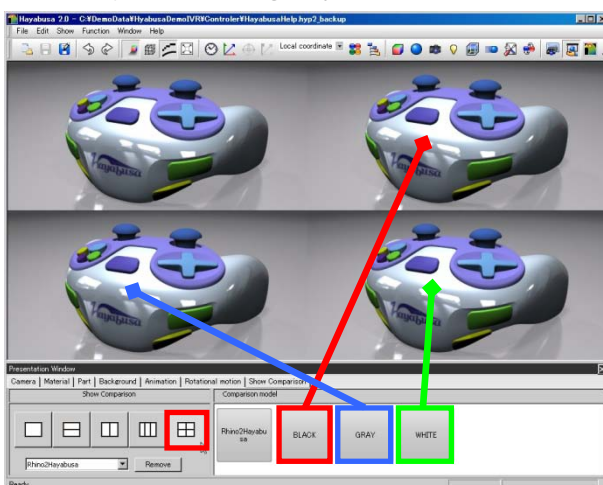
Specify how to divide the   Drag & Drop

10 Create Image

With Hayabusa 2.0, you can create snapshots and movie files easily and quickly. You can export in the higher resolution than the display resolution. You can render with the real time renderer and the offline renderer 3DsmartRender (option)as well.

10.1 Snapshot

Hayabusa exports still images in the camera angle displayed in the 3D view.
Export from the Create Image dialog. To open the Create Image dialog, select the menu bar Function > Create Image.

When you click the Start button after setting up the following parameters, the Save As dialog shows up. When you click the Start button after specifying a file name, file type and quality, Hayabusa starts the process.

Jittering quality:	Hayabusa superimposes CG more than once by displacing a viewpoint position little by little randomly to make the curves less jaggy (Jittering). Here, you can specify how many times to repeat the jittering process .If you select offline in the rendering type, jittering is disabled.(For the Offline rendering, define the rendering quality with the Number of Sampling.)	
Pixel size:	This specifies a pixel size for rendering. You can specify this regardless of the display resolution of your monitor.	
Pixel size　Standard value setting:	This specifies the pixel size with the standard value.	
Size:	This specifies a paper size. Hayabusa calculates the pixel size from size x resolution.	
Size Standard value setting:	This specifies the pixel size with the standard value.	
Resolution:	his specifies the resolution in DPI (dots per inch). Hayabusa calculates the pixel size from size x resolution.	
Fix aspect ratio:	When this is selected, the aspect ratio is fixed.	
Rendering type:	Selects a renderer. Select either Real time or Offline by clicking the radio button. The Offline render is an option feature. You cannot select it if the license is not set. For further information on Offline renderer, refer to the section "Offline rendering".	
Setup 3DsmartRender:	This is enabled when you select the Offline renderer .If you click the button, the 3DsmartRenderer setting dialog appears.	
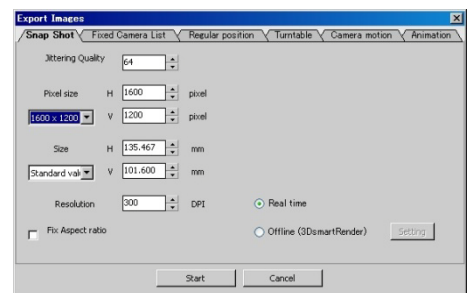
<Export after applying transparency to background>
If you want to export to PNG or TIFF, you can export after making the background transparent by selecting "Apply transparency to Background". When you export a file to PNG after applying transparency to the background and open the file in Photoshop, the background is displayed with transparency. If you want to export with a transparent floor as well, turn the Show Floor off in the Background tab.

<Limitation>
With the real time renderer, you can export in up to 12,000 x 12,000 pixel size. The resolution limitations vary depending on your computer's video memory. If you want to export an image with big pixels, divide the screen vertically and horizontally and render it in the small rectangle unit. If you use Bloom or Star, you might see the border lines of the rectangle. In that case, give Bloom the greater value and set 0 for Star to make the border lines less noticeable.

10.2 Camera at once

Choose one from the registered cameras and export still images at once. Export from the Create Image dialog. To open the Create Image dialog, select the menu bar Function ＞ Create Image.
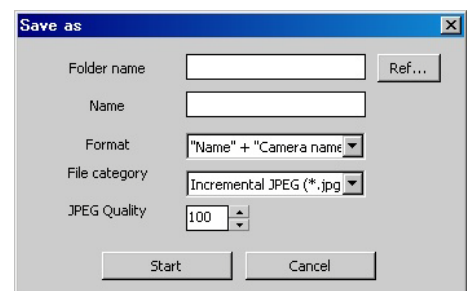
■ Select a camera to export images in the Camera list.

■ As with the snapshot, specify the pixel size, rendering type and so on.
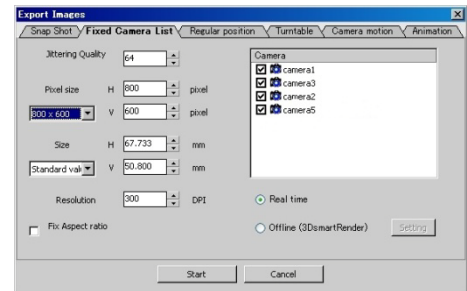
■ When you click the Start button, the Save As dialog appears. Set a folder name, file name, format, file type and quality.

■ When you click the Start button, Hayabusa starts the process.

10.3 Fixed Camera

Export still images in six directions such as Front & Back, Right & Left, and Up & Down to the model. Export from the Create Image dialog. To open the Create Image dialog, select the menu bar Function ＞ Create image.

■ Check a camera or cameras to export images in the Camera list.

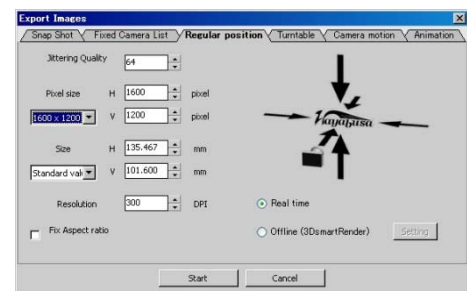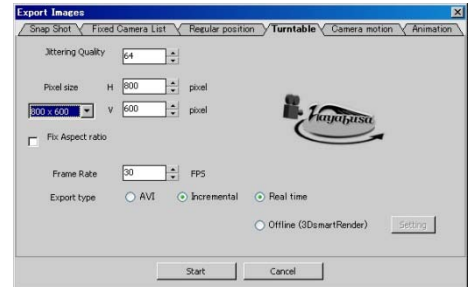■ As with snapshot, specify a pixel size, rendering type and so on.

■ When you click the Start button, the Save As dialog appears. Set a folder name, file name, format, file type and quality.

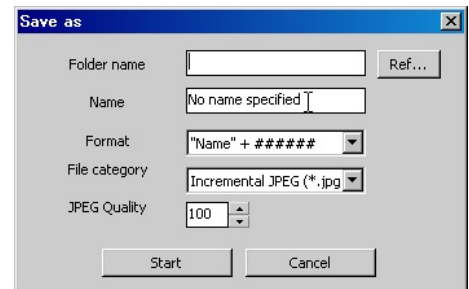■ When you click the Start button, Hayabusa starts the process.

10.4 Turntable

This exports a movie (AVI or sequence number files) which rotates in 360 degree in one minute. Export from the Create Image dialog. To open the Create Image dialog, select the menu bar Function > Create Image.

|	
Jittering quality:	Hayabusa superimposes CG more than once by displacing a viewpoint position little by little randomly to make the curves less jaggy (Jittering). Here, you can specify how many times to repeat the jittering process. If you select offline in the rendering type, jittering is disabled.
Pixel size:	This specifies a pixel size for rendering. You can specify this regardless of the display resolution of your monitor.
Pixel size Standard value setting:	This specifies the pixel size from the list to render with the standard value setting.
Fix aspect ratio:	Select this when you want to specify the number of pixels by fixing the aspect ratio.
Rendering type:	Selects a renderer. Select either Real time or Offline by clicking the radio button. The offline render is an option feature. You cannot select it if the license is not set. For further information on Offline renderer, refer to the section "Offline rendering".
Setup 3DsmartRender: (*Paid option)	This is enabled when you select the offline renderer. If you click the button, the 3DsmartRenderer setting dialog appears.
Frame rate:	This specifies the number of frames per one second.
Export type:	This specifies either between outputting to AVI or outputting an incremental file.
Start button:	When you click the Start button, the Save As dialog appears. When you specify a file name and folder name and click the start button, the process is started.

When you click the Start button after setting up parameters from above, the Save As dialog appears. When you click the Start button after specifying a file name, file type and quality, Hayabusa starts the process.

10.5 Camera Motion

This exports a movie (AVI or sequence number files) which rotates around the model in 360 degree in one minute. Export from the Create Image dialog. To open the Create Image dialog, select the menu bar Function > Create Image.

■ As with the Turntable, specify a pixel size, frame rate and so on.

■ When you click the Start button, the Save As dialog appears .Set a folder name, file name, format, file type and quality.

■ When you click the Start button, Hayabusa starts the process.
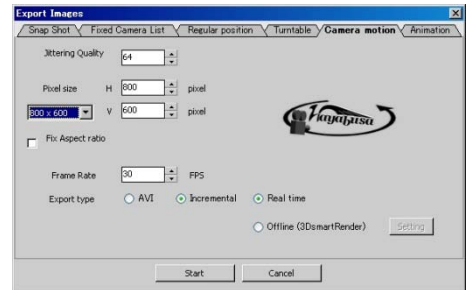
10.6 Animation

Choose one from the registered animations and export a movie (AVI or sequence number files). Export from the Create Image dialog. To open the Create Image dialog, select the menu bar Function > Create Image.

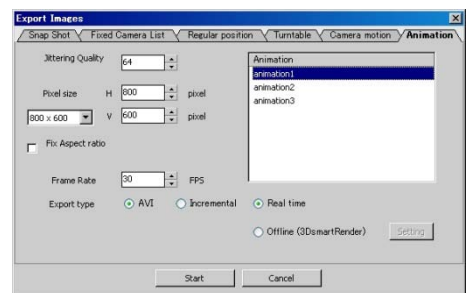■ Select an animation to export the movie in the Animation List.

■ As with the Turntable, specify a pixel size, frame rate and so on.

■ When you click the Start button, the Save As dialog appears. Set a folder name, file name, format, file type and quality.

■ When you click the Start button, Hayabusa starts the process.

11 HDR Rendering

You can simulate realistic textures by rendering in the HDR（High Dynamic Range）mode because of the natural contrast and the effect from Bloom and Star for the high brightness. Also, you can do the lighting calculation from background images in the IBL（Image Based Lighting）mode.

11.1 Switch to HDR mode

You can enable the HDR in the Rendering quality tab. To open the Rendering quality tab, select the menu bar Window＞Environment setup.

Valid（without Bloom effect）: This does the HDR/IBL process, but not the Bloom process.
Valid（with Bloom effect）: This does both the HDR/IBL process and the Bloom process.

HDR rendering is only available with a 32 bit floating decimal point video card (NVIDIA/Geforce 6800 GT, Quadro FX 3400 or later).
HDR rendering uses more video memory than the regular rendering does. Use a video card which has 256MB or more video memory.

11.2 Processing in HDR/IBL mode

You can get the following effects in the HDR mode and the IBL mode.

◆ To make shading and contrast natural （HDR）
◆ The exposure can be adjusted. （HDR）
◆ To simulate glare （HDR）
◆ Lighting calculation from background images is available. （IBL）

You can set HDR parameters in the Background tab.

Bloom:	This simulates bright lights.
Star:	This displays star shaped glare for strong lights.
Gamma:	This sets the Gamma value to adjust the contrast for rendering.
Exposure:	This adjusts the exposure.
Light:	This scales the local lights.
Diffuse environment light:	This calculates the diffuse environment light from the background data.
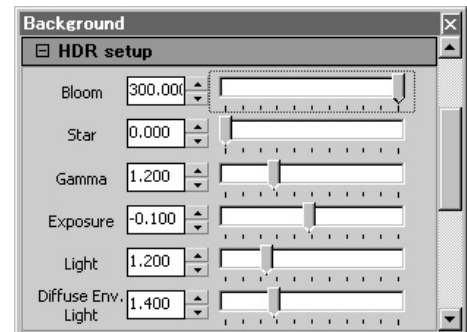
You can set IBL parameters in the Material tab.

Effect to environment color:	This calculates lights for the material's environment color.
Effect to reflection color:	This calculates lights for the material's reflection color.
Highlight spread:	This adjusts the highlight spread.
Contrast of highlight:	This adjusts the contrast of highlight.
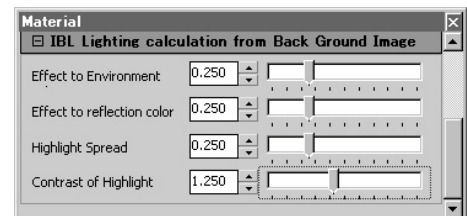
12 Real time ray tracing

Ray tracing is a rendering method that casts a sight line from the view point to every pixel of the display and renders in relation to light reflection and transparency on 3D models. It can represent objects realistically as it traces light paths emitted from a light source accurately according to reflections, refractions or transparency, however, since the calculation amount is enormous, it usually needs a very long time for the calculation. Hayabusa 2.0 uses your computer's GPU（Graphics Processing Unit: semiconductor chip for 3D drawing equipped on a video card), not your computer's CPU, to perform the real time ray tracing.

In the Ray tracing mode, image files, movie files and Flash images are exported to ray tracing images.

Rendering comparison 1

Without Real time ray tracing	With Real time ray tracing

Rendering comparison 2

Without Real time ray tracing	With Real time ray tracing

12.1 Switch to Real time ray tracing mode

Select the rendering mode "Real time ray tracing (Real time ray tracing + Shader)" in the Rendering quality tab. To open the Rendering quality tab, select the menu bar Window ＞ Environment setup. You can also switch to the Real time ray tracing mode with using the short cut Ctrl+F3.

12.2 Limitations

<Supported video card>

Hayabusa 2.0's processing speed highly depends on GPU performance, as Hayabusa's real time ray tracing is performed by GPU equipped on your video card (not CPU). Also, enough video memory is required. When you use ray tracing mode, you must use it under the following environment. It may be able to work in the insufficient environment, but you cannot expect enough performance of it and it may work unsteadily.

	Requirements
Video card:	NVIDIA Geforce8800 or higher
Video memory:	512MB or higher
Video driver:	Strongly recommended to use the latest one

<Drawing speed>

In the Ray tracing mode, the rendering time is proportional to the rendering area (vertical pixel numbers by horizontal pixel numbers). If the rendering is slow and your editing work is not productive, it would be better to make the rendering area (the 3D screen area) smaller.

<Preprocessing>

When you switch to the Ray tracing mode or move an object (including animation), there will be some delay until the ray tracing image is displayed since Hayabusa does the preprocessing for real time display. Time required to perform the preprocessing depends on the complexity of the model or the scene.

<Refraction calculation>

Accurate calculation is performed only on models created in relation to thickness same as real world. If the model was created without considering of thickness or has a hole on the plane, the refraction calculation won't be accurate. Or if it was created in relation to thickness but the object connected to it has different refraction rate, you need to define it as separate model.

The followings are requirements to perform accurate refraction calculation.

Requirements to perform accurate refraction calculation

■ Create a model considering the thickness and the refraction rate difference, between adjacent objects.

■ If adjacent objects have different refraction rates, explode the model so that you can apply different materials to objects.

■ When you set up a material, set its refraction rate and the adjacent objects' refraction rates correctly.

Example: In the image below, the different color plane has to be created as a different model so that you can apply a different material on it.

Transparent container (Refraction rate:1.8) which has some liquid
(Refraction rate:1.2)

<Refracted image noise>
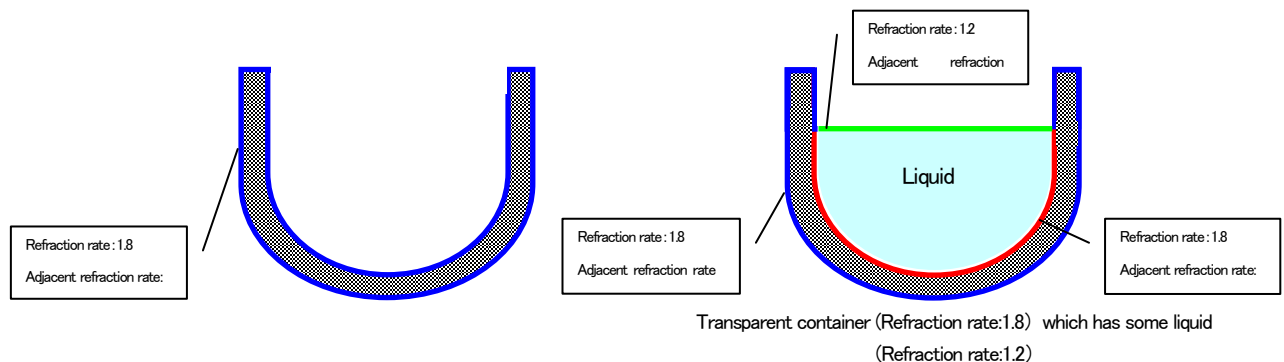
For the complicated shape models or when reflection and refraction are repeated because of the view point position even if the model shape is simple, some noise may occur. The higher the refraction rate is, the more the noise occurs .If you are concerned about the noise when exporting an image, export it in high resolution because high resolution makes the noise less noticeable relatively.

When the Real time ray tracing mode is selected, Hayabusa performs the attenuation calculation on transparent materials according to the distance. The attenuation here is the one that a ray which passes through gets color depending on the material's diffuse color. The attenuation (absorption) factor increases in proportion to the opacity. The attenuation is not considered in the other rendering modes, so the degree of transparency is different from one in the ray tracing mode.

13 Automatic adjustment/ Tone mapping

When you select adjust exposure automatically or tone mapping, images are displayed without over exposure or under exposure in consideration of the entire screen brightness.

Example Auto-exposure OFF, Tone mapping OFF

Example Auto-exposure ON, Tone mapping ON

13.1 Auto-exposure

This simulates a pupil by determining appropriate exposure from the entire screen brightness. Hayabusa uses the same algorithm as the camera's auto exposure. Auto-exposure and tone mapping are set in the Background tab in the Setup dialog. You can set it for each background, not each project.

| Adjust exposure automatically:	When this is selected, Hayabusa performs the auto-exposure calculation.
Correction value:	If you set this positive, it will be over exposure (brighter) and if negative, it will be under exposure (darker).The brightness becomes two times higher (correction value.
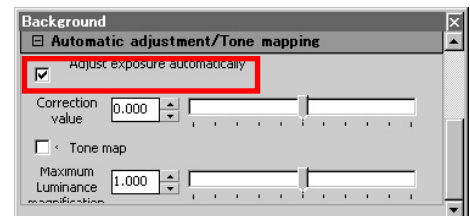
To perform the auto exposure calculation correctly, the HDR mode must be turned on. Adjust the brightness with the Correction value as required.

13.2 Tone mapping

The Tone mapping gets the maximum luminance in the scene and protects images from over exposure. The Tone mapping is available only when the Auto-exposure is turned on.

Tone map:	When this is selected, Hayabusa performs the tone mapping.
Maximum luminance magnification:	You can change the maximum luminance (white point) to adjust the contrast of the image. If you set the Maximum Luminance magnification smaller than 1, the Maximum Luminance will get low and all the luminance higher than it will have over exposure. If you set the Maximum Luminance magnification greater than 1, the Maximum Luminance will get high and the area that had over exposure will get darker.
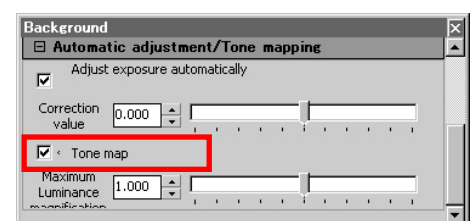
To perform the tone mapping correctly, the HDR mode must be turned on.

14 Other functions

14.1 Show absolute size

With the Show absolute size function, you can display models in the absolute size in addition to displaying them according to the size of display device like a screen or the observation position.

Here is the procedure to show the absolute size.

■ Define a unit to be used in the scene in the project tab. to open the project tab, select setup > project. Set a unit used to create the model.

■ Select the menu bar Function > Show absolute size to open the Show absolute size dialog.

■ Set a height from bottom to top of a display device like a screen.

■ Set a height from the floor to the bottom of the screen.

■ Set a distance from the screen to the observation point.

■ This sets the height of the view point.

■ When the Move Camera in front of object is selected, the camera location is displayed in front of either of X,Y or Z axis direction (the closest one to current direction) when calculating.

■ When you click the Calculation button, the model is displayed in absolute size. While the image is displayed in the absolute size, the screen is opened in full size automatically. To release the Full screen, close the Show absolute size dialog or press the short cut Ctrl+F.
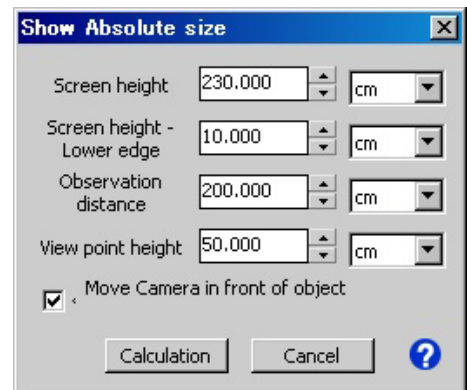
14.2 Move scene to center

When you select the menu bar Edit > Move scene to center, the model is moved to make the center of current scene to be center of the floor and make the scene to be above the floor.
When you select the menu bar Environment setup > Coordinate and select Move Scene to center, this process is performed automatically when you import a model.

14.3 Fit to selected object

If you select the Fit to selected Object from the right click context menu while selecting an object in the 3D view or the Scene graph, the camera is moved to the place where it can see the selected object at the front.

14.4 Camera matching

With the Camera matching function, you can create composite images from 2D images taken with a digital camera and CG created in Hayabusa. If the camera locations of the 2D image and CG image are not matched, the composite image will look unnatural. Hayabusa uses the camera matching calculation to create a natural looking composite image.

14.4.1 Create camera matching image

For camera matching, the following two requirements must be met.

◆ Requirement 1　　You should know the lens perpendicular view angle (can be calculated from focal distance) of the camera used to take the image.

◆ There should be a known rectangle size taken in the 2D image.

Here is the procedure how to do camera matching.

■ Set the right unit for the model in the Project tab. To open the Project tab, select Setup > Project.

■ Select a 2D background in the Background tab (Setup > Background). When you specify a background, the selected image is displayed as a background. There should be a size known rectangle taken in this image.

■ In the Camera tab (Setup > Camera), match the camera view angle with the one that was used when the 2D background was taken.

■ Select the menu bar Function > Camera matching to open the Camera matching dialog.

■ Specify the Size of maker in the Camera matching dialog. Enter height and width of the rectangle marker (Right image ①).

■ Next, Click the Start marker point button (Right image ②) and click the screen to create the 1st, 2nd, 3rd and 4th vertices for the rectangle. You can get vertex data by placing the mouse pointer on any vertices and clicking the left mouse button. Enter values for Point 1 to 4 in order. To redo entering, click the Clear marker button to clear data and enter values for Point 1 to 4 again.

■ When you click the Calculate Camera location button (Right image ③), the calculation starts and the camera will be moved to make the origin of the scene be displayed in the center of the marker. Since Hayabusa uses the method that repeats calculations to make tolerance smaller, you can save time by moving a camera to the location where you think it is appropriate before starting the calculation.
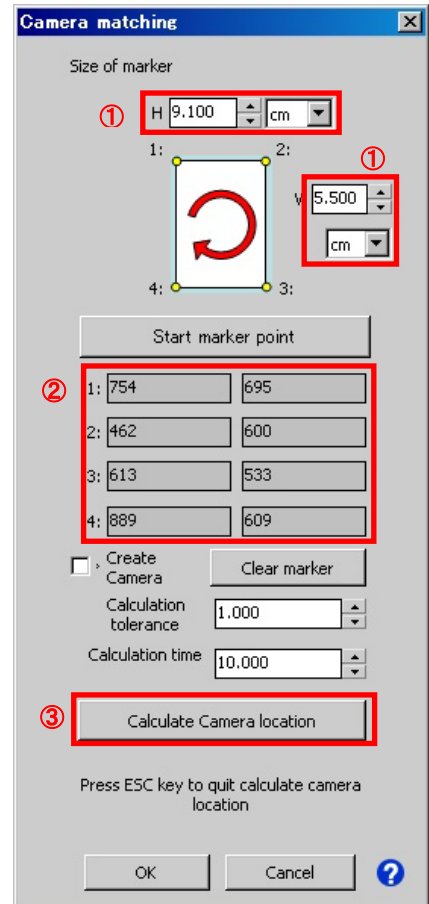
■ You can set Calculation tolerance and Calculation time. The calculation finishes when the result becomes within the specified calculation tolerance or the specified calculation time is over.

■ To stop the calculation, press the Esc key.

■ When you want to modify how to show a model after the calculation, move the model not the camera.

Pick 4 vertex of the marker

Calculate Camera location button
Model is moved onto the marker
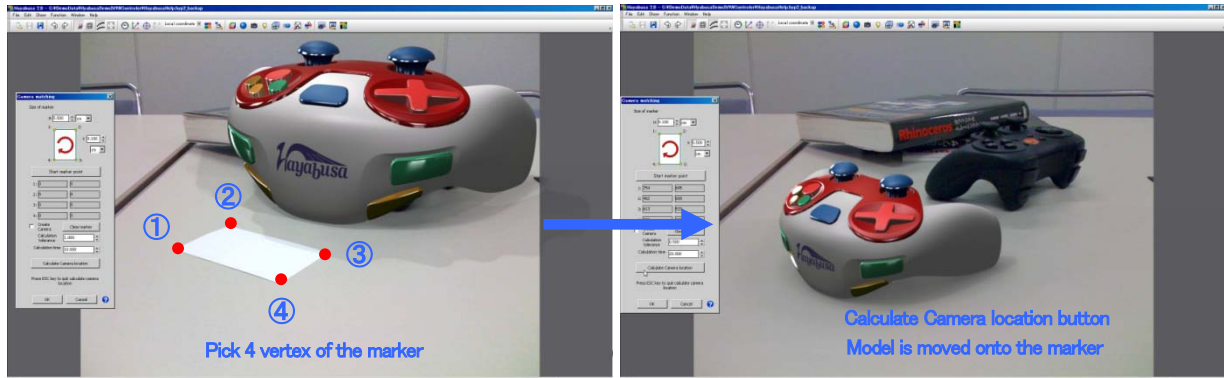
14.4.2 Camera lens and Perpendicular view angle

Camera lens and the corresponding Perpendicular view angle

Lens focal distance		Perpendicular view angle
35mmCamera	Digital single-lens camera	
16mm	10.5mm	74degree
18mm	12mm	67degree
20mm	13mm	62degree
24mm	16mm	53degree
26mm	17mm	50degree
28mm	18mm	46degree
30mm	20mm	44degree
32mm	21mm	41degree
34mm	23mm	39degree
36mm	24mm	37degree
38mm	25mm	35degree
40mm	27mm	33degree
42mm	28mm	32degree
44mm	29mm	31degree
46mm	31mm	29degree
48mm	32mm	28degree
50mm	33mm	27degree
52mm	35mm	26degree
54mm	36mm	25degree
56mm	37mm	24degree
58mm	38mm	23degree
62mm	41mm	22degree
66mm	44mm	21degree
70mm	47mm	19degree
74mm	49mm	18degree
78mm	52mm	17degree
82mm	55mm	17degree
86mm	57mm	16degree

14.5 Solar position calculation

With the solar position calculation, you can calculate the solar position based on latitude, longitude and time with using the parallel light as sun. You can choose the Southern direction from the four directions (X, −X, Y and −Y) in the Hayabusa 2.0Solar position calculation. Adjust the Southern direction by rotating the model as required.

Here is the procedure to calculate the solar position.

■   Select a parallel type light in the Light list. Or open the light guide and select a parallel light.

■   When you select the menu bar function ＞ solar position calculation, the solar position calculation dialog appears.

■   Specify date, time, latitude, longitude and the southern direction in the dialog.
For Time, specify time in Japan time (UTC+9).
The slider can be used to change the Time.
If you specify a registered location name in the preset, you can set the location's latitude and longitude to the calculation.

■   If you click the calculation button, the selected light direction is changed to fit the specified value.

■   If you select the Automatic calculation check box, the light direction is automatically changed when you set each value.

15 Contact

If you have any questions, please contact us with the following phone number or E-mail address.
We will consider your opinions for future development to make it more productive for you

For sales questions, contact Griffin Design Systems Co., Ltd. (Distributer).
For technical questions, contact GRAPS Co.,Ltd. (Developer).

Distributed by
Griffin Design Systems Co., Ltd.
〒150-0031 BEVERLY HILLS 203 Sakuragaoka-tyo Shibuya-ku Tokyo Japan
TEL 03-5456-2680 FAX 03-5456-2681
E-mail info@griffinds.jp

Developed by
GRAPS Co.,Ltd.

〒150-0031 BEVERLY HILLS 203 Sakuragaoka-tyo Shibuya-ku Tokyo Japan
TEL 03-5456-2680 FAX 03-5456-2681
E-mail Hayabusa@graps.co.jp

Supporting on the phone is limited to regarding installation.
For technical questions other than regarding installation, please contact us with E-mail.
Business hours: 10:00 AM -5:00 PM

Data contributed by: Mr. Jiro Katayama, Tetsutaro Design, AppliCraft Co. Ltd., solidThinking Japan and Mr. Higuchi in STYLING3D.
This software uses the FreeImage open source image library. See http://freeimage.sourceforge.net for details.
FreeImage is used under the FIPL, version 1.0.

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〒150-0031 BEVERLY HILLS 203 Sakuragaoka-tyo Shibuya-ku Tokyo Japan

TEL 03-5456-2680
FAX 03-5456-2681