

THE GLYPH SOFTWARE MATTEPAINTING TOOLKIT DOCUMENTATION v3.0

OVERVIEW

About

The Glyph Software Mattepainting Toolkit (`gs_mptk`) is a plugin suite for Autodesk Maya that helps artists build 2.5D and 3D environments from multiple camera projections. All functionality is controlled through a custom user interface that manages the shading networks, and a hardware shader specifically designed for modeling from camera projections provides feedback in the viewport.

Why use `gs_mptk`?

When texturing geometry in Maya, it is often preferable to use camera projections over UV placements, but the limited toolset Maya provides is unintuitive and labor intensive. Combining multiple projections is cumbersome and requires extra effort to paint holdout mattes to define explicit boundaries. Projection smearing, doubling on backfaces, and loss of resolution over large surface areas are common problems that take time to patch.

`gs_mptk` removes the technical burdens of setting up projections in Maya and allows artists to focus on the composition of the imagery. The advanced blending features of the toolkit are designed to target the challenges of integrating multiple projections, and reduce the number of mattes needed to isolate geometry.

`gs_mptk` was built for mattepainters and texture artists, not programmers. A lot of consideration went into designing a system that functions in an intuitive way, implements time-saving features, and minimizes repetition.

What's included in `gs_mptk`?

- `gs_mptk` consists of a UI that manages connections to custom Mental Ray and V-Ray shaders. It is lightweight and easily installed on multiple systems and render farms.
- `gs_projCamMix` is the dynamically-loaded mental ray shader that forms the foundation of the Mattepainting Toolkit and allows multiple projections to be blended based on a number of user-defined parameters.
- `gs_occlusionMatteVRay` and `gs_projCamMixVRay` together perform the same function for V-Ray as the `gs_projCamMix` mental ray shader.
- `gs_viewportProj` is the maya plugin that visualizes projections in the viewport using OpenGL.
- `gs_mptk_UI.mel` is the MEL script that loads the interface to manage connections into `gs_projCamMix` and provides additional features.
- `gs_const` is an optional constant shader that is connected at the end of the shading network by `gs_mptk_UI`.

What does it do?

Simply, it blends multiple camera projections, in the order they are assigned, based on the blending parameters given to each projection. `gs_mptk` uses occlusion masking to determine which areas of a model are unseen by a projection camera, and patches these areas with other projections, based on their order of priority.

Aside from the rendering functions, gs_mptk makes the process of setting up projections, and then managing them, as straightforward as possible through a custom user interface.

gs_mptk also includes features to assist modeling from projected images, including a Structure From Motion data importer to reconstruct camera positions from photographs, and an OpenGL shader that allows artists to get immediate feedback from their projections as they model.

Requirements

Maya 2012 Hotfix 4 or Maya 2013

V-Ray renderer to use the V-Ray gs_mptk shaders

Window, OSX, or Linux

A note about the V-Ray shaders

For Maya 2012, you will need at least stable version 2.10.01 from 4/9/2012

Maya 2013 does not have a version requirement

A note about the demo version

The gs_mptk demo has the following limitations:

- The gs_viewport_proj has a watermark in the viewport.
- Rendering with gs_projCamMix will display a red noise pattern over half the rendered image.

FEATURES

What's new in this release?

Features

- V-Ray integration
- Photosynth integration
- Animated sequences are now supported for projections.
- Multiple projection layering in the viewport.

Fixes

- gs_mptk_UI assumes images with alpha channels that are added to the projection list should set shader transparency by default.
- gs_mptk_UI will not crash when adding projection cameras that have constraints.
- Multiple projection groups now composite properly.
- Geometry can now self-occlude in masking operations.
- Camera import from SFM data now does a proper matrix decomposition for all camera orientations.

Deprecations and Limitations

- miLabel is not supported in masking operations.

INSTALLATION

The following paths are indicated as default Maya install locations. Alternative setups may require different install locations. Administrative privileges may be required to install, depending on your platform configuration.

OSX

Notes:

* \$USER in the paths below is the username on your machine.

copy contents of icons folder to:
/Users/Shared/Autodesk/maya/icons

copy contents of scripts folder to:
/Users/\$USER/Library/Preferences/Autodesk/maya/2013/scripts

copy contents of plug-ins folder to:
/Users/Shared/Autodesk/maya/plug-ins

copy contents of mentalray/include to:
/Applications/Autodesk/maya2013/mentalray/shaders/include

copy contents of mentalray/lib to:
/Applications/Autodesk/maya2013/mentalray/shaders

copy contents of vray/shaders to:
/Applications/Autodesk/maya2013/vray/shaders

copy contents of vray/vrayplugins to:
/Applications/Autodesk/maya2013/vray/vrayplugins

WINDOWS

Notes:

- \$USER in the paths below is the username on your machine.
- The paths below are given for Windows 7. Other versions of Windows may have different paths.

copy contents of **icons** folder to:
C:\Users\%USER%\Documents\maya\2013-x64\prefs\icons

copy contents of **scripts** folder to:
C:\Users\%USER%\Documents\maya\2013-x64\prefs\scripts

copy contents of **plug-ins** folder to:
C:\Program Files\Autodesk\Maya2013\bin\plug-ins

copy contents of **mentalrayinclude** to:
C:\Program Files\Autodesk\Maya2013\mentalray\shaders\include

copy contents of **mentalraylib** to:
C:\Program Files\Autodesk\Maya2013\mentalray\shaders

copy contents of **vray\shaders** to:
C:\Program Files\Autodesk\Maya2013\vray\shaders

copy contents of **vray\vrayplugins** to:
C:\Program Files\Autodesk\Maya2013\vray\vrayplugins

LINUX

Notes:

* \$USER in the paths below is the username on your machine.

copy contents of **icons** folder to:
/home/\$USER/maya/2013/prefs/icons

copy contents of the **scripts** folder to:
/home/\$USER/maya/2013/prefs/scripts

copy contents of **plug-ins** folder to:
/usr/autodesk/maya2013/bin/plug-ins/

copy contents of **mentalray/include** to:
/usr/autodesk/maya2013/mentalray/shaders/include

copy contents of **mentalray/lib** to:
/usr/autodesk/maya2013/mentalray/shaders/

LICENSING

Two license files can be found in the licensing folder:
gs_mptk_floating_license.lic and
gs_mptk_local_license.lic

NODE-LOCKED LICENSES

If you purchased a node-locked license, you only need to update gs_mptk_local_license.lic

- 1) Open gs_mptk_local_license in a text editor.
- 2) Replace the license key found in gs_mptk_local_license with your license. Make sure to leave the first line as "localhost"
- 3) Save the changes, and copy gs_mptk_local_license.lic to:
/Applications/Autodesk/maya2013/Maya.app/Contents/Resources

FLOATING LICENSES

If you purchased a floating license, you need to update both gs_mptk_local_license.lic and gs_mptk_floating_license.lic

- 1) Open gs_mptk_local_license in a text editor.
- 2) Replace the license key found in gs_mptk_local_license with your local license key.
- 3) Replace the first line, "localhost" with the server location for the floating license file, e.g.:
/Volumes/My HD/licenses/gs_mptk_floating_license.lic for OSX
The path should follow the syntax given by the Finder (use Get Info on a folder for specific location syntax).
or
\\192.168.0.155\my_license_location\gs_mptk_floating_license.lic for Windows
Make sure to include the filename gs_mptk_floating_license.lic at the end of the path.
- 4) Save the changes, and copy gs_mptk_local_license.lic to:
/Applications/Autodesk/maya2013/Maya.app/Contents/Resources for OSX
or
C:\Program Files\Autodesk\Maya2013\resources for Windows
- 5) Open gs_mptk_floating_license.lic in a text editor.
- 6) Replace the contents of the first line with your floating license key.
- 7) Save the changes, and copy gs_mptk_floating_license.lic to the location you specified in gs_mptk_local_license.lic

- 8) Make sure the floating license location is accessible from the machine you're running gs_mptk, or gs_mptk will revert to demo mode.
- 9) Make sure that both of the license files have read/write access, or gs_mptk will revert to demo mode.

TROUBLESHOOTING LICENSES

When you load the gs_mptk shaders, they will print info about the license status, either into the Output Window on Windows, or the shell you launched Maya from on OSX. If you run into a licensing error, gs_mptk will run in demo mode, and you should refer to the status printouts for more information. For node-locked licenses, you can check the status of your MAC address by typing ipconfig (windows) or ifconfig (OSX and linux) in a shell or command prompt.

For floating licenses, make sure the location of the license server is accessible from your local machine. Try to connect to the location directly and map the network drive if the license error printouts indicates issues connecting to the license server.

You can test whether the license error has been corrected by simply closing the scene file that is using gs_mptk, and re-opening it; you do not need to exit Maya altogether.

gs_mptk will run in demo mode when a license error has occurred, or if the number of available licenses are all in use.

To run gs_mptk:

- 1) launch Maya 2013
- 2) load both gs_projCamMix mental ray shader and gs_viewportProj maya plugin:
Window>Settings/Preferences>Plug-in Manager>gs_viewportProj
Window>Rendering Editors>mental ray>Shader Manager>gs_projCamMix
- 3) load the vray shaders:
Window>Settings/Preferences>Plug-in Manager>gs_occlusionMatteVRay.mll
Window>Settings/Preferences>Plug-in Manager>gs_projCamMixVray.mll
- 4) source gs_mptk_UI.mel from the script editor.

THE UI

The UI is loaded by sourcing gs_mptk_UI.mel through the script editor. Alternatively, you can add gs_mptk to a shelf and source it from there with the "source" command, e.g.:

```
source "/Users/Shared/Autodesk/maya/2013/scripts/gs_mptk_UI.mel";
```

The included hypershade icons can be used as shelf icons as well.

Make sure the gs_projCamMix shader and is loaded in Window>Rendering Editors>mental ray>Shader Manager, or the script will return the error:

Unknown object type: gs_projCamMix

Make sure also the gs_viewportProj plug-in is loaded in Window>Settings/Preferences/Plug-in Manager along with gs_occlusionMatteVRay and gs_projCamMixVray if you use V-Ray to render.

When the UI loads, all gs_projCamMix nodes existing in the current scene are loaded into a tabbed layout as projection groups. The projections and matte connected to each projection group are also displayed, along with their attributes and assigned object list.

Menus

File

Import... - will import SFM data coming from bundler, photosynth, etc., with the .out extension

New Shader - will create a new gs_projCamMix node.

RefreshUI - will refresh the UI to update any changes not made within it.

Create coverage map - will render a coverage map from the current viewport perspective that shows which areas of the selected geometry are visible to the selected camera over the time range specified in the timeline. Select a camera and a any number of objects before invoking this command. The resulting render respect the settings of the Render Globals.

Close - close the UI.

Options

VRay Rendering – when checked, vray shading networks will be created for all projection groups. The networks will be updated whenever a change is made to the projection attributes.

File Filtering – will set all files associated with the projection group to the selected filtering method.

Viewport Lin to sRGB – for projections in linear color space, this toggle will enable gamma conversion to sRGB color space.

Viewport Layering – will show up to 7 layered projections in the Projection List within the viewport.

Debug Mode - enable to print messages to the Script Editor for any modifications made to the projections through the UI.

Debug Step - enable to pause after each command is invoked during modifications made to the projections through the UI.

Help

About... - display the version of gs_mptk

Tabbed Layout

The tabbed layout has three buttons for creating, removing, and selecting projection groups. A projection group is comprised of a gs_projCamMix node and all of its incoming connections. Each gs_projCamMix node in the scene is represented in the tabbed layout.

- + Add a new projection group. This will create a gs_projCamMix node with a basic setup, including a file projection for the color and ramp for the mask.
- Remove a projection group. The projection group of the currently selected tab will be removed. All nodes with connections to the group, except cameras, will be deleted.
- ^ Select the projection group. This will select the gs_projCamMix node of the currently selected tab.

Projection List

The projection list represents all of the projections connected to the color inputs of the gs_projCamMix node. The images projected in this list will constitute the RGB of the render. The list is in a top-down priority, so that projections higher in the list have greater priority at render time. In other words, projections are layered on top of each other from the bottom of the list to the top.

Projections are made current by the > button. When a projection is made current, it is highlighted light gray, and all of its attributes, as well as its matte list, are displayed in the middle pane of the UI.

- + Add a new projection. A new file projection is added to the projection group, with priority over the current projection.
- Remove the current projection. The current projection is deleted.
- ^ Select the projection. The current projection is deleted.

Each projection in the list has a thumbnail preview on the left, a name that corresponds to the projection node itself (editable), the path to the image on disk (editable), a button labelled “...” to browse for images on disk, and a button labelled “>” to make the projection current in the list and display its attributes.

In Windows and OSX, the projection image can be edited by clicking on the thumbnail preview. This will launch the image editor specified by the user in Window>Settings/Preferences>Preferences>Applications. This feature is not available by default in Linux.

When a file texture with an alpha channel is added to the projection with the “...” browse button, its alpha channel is detected and the user has the option to add the alpha channel to the Additional Mattes list. Note that a file’s alpha channel is not detected when editing the path field directly.

Projections in the list can be reordered by middle-mouse dragging them to the desired position. Projections can be swapped by shift-middle-mouse dragging from one index to another. Note that the drag-drop area of the projections does not include the field areas.

When a projection is added to the list, a `gs_viewportProj` hardware shader is added to visualize the projection in the viewport. Similarly, when the “>” button is used to select a projection, it will be displayed in the viewport, overriding the previous viewport projection.

When Viewport Layering is enabled in the Options menu, up to 7 projections in the Projection List will be layered in the viewport. The current active projection determines the top projection visible in the viewport, the the 6 projections below it in the list will be layered underneath.

Projection Attributes

Camera

The + button will assign the currently selected camera to the current projection. The camera name will be assigned to the button on the right, which will in turn select the camera when it is pressed.

Color Offset

This color picker will add color to the current projection image. It is useful to help balance projections that have a slightly different value from others in the list, or to make radical changes that expose the projection’s contribution in a render.

Pass Through

This check box will bypass the current projection at render time, effectively removing its contribution to the projection group.

Matte Attributes

Distance Threshold

When this field is set > 0, the current projection will only project onto geometry that falls at a cm distance less than the value set. This value is always read as cm, and does not convert to other working units set in the preferences.

Use Shadow Occlusion

When checked, geometry not seen by the projection camera are masked at render time. These masked areas will be filled by the next projection in the list if it is visible to the camera of that projection. In this way, the `gs_projCamMix` shader works from the top of the projection list down to the bottom, filling in masked areas with the next projection that is able to “see” them. This feature is called “shadow occlusion” because the projection camera acts like a light to determine what areas of the geometry are shadowed. In order for this feature to work, raytracing must be enabled in the Render Globals. The following attributes are enabled with shadow occlusion:

Dilate

This attribute will expand the shadow area. Since it is often difficult to have a perfect correlation between the edges of a projected texture and geometry edges, the dilate attribute can conceal edge bleeding by expanding the shadow mask.

Samples

This attribute sets the number of samples per pixel for the shadow mask. It should be enabled only when Soft Edge is > 0 .

Soft Edge

This attribute creates adds feathering to the dilated shadow area. It is bound to a 0-1 range, where 1 is maximum feathering.

Power

This attribute adds density to the Soft Edge. It is often preferable to increase the Power when using Soft Edge to ensure that the dilated area produces a solid matte at the geometry’s shadow boundary.

You can think of the Shadow Occlusion attributes like this:

The geometry’s shadow boundary is the hard edge between the visible and invisible areas seen from the projection camera. When you dilate this shadow area, you are masking areas that are seen by the projection camera, and allowing other projections lower in the projection list to try to fill this area. By enabling Soft Edge, you are adding transparency into this dilated area, but not the hard shadow area that is not seen by the projection camera. With transparency in the mask, a percentage of the current projection’s contribution will be mixed with the projections lower in the list that are able to see this dilated area. The Power attribute weights the percentage blending in the favor of projections lower in the list. Increasing the Samples will produce a smoother (less noisy) blend at the expense of render time.

Use Facing Ratio

This attribute will prevent the current projection from projecting onto geometry backfaces when Angle Threshold = 90. If Angle Threshold < 90 , areas of the geometry visible to the projection will be masked as well. Facing Ratio produces a mask with a value of either 0 or 1, depending on the Angle Threshold.

Angle Threshold

The Angle Threshold extends the backface culling to include front faces, based on the angle between the camera view vector and the geometry normal. It is specified in degrees, from 0 to 90.

It is often advantageous to use backface culling with projections, and this is achieved by enabling Facing Ratio and setting the Angle Threshold to 90. Sometimes, however, it is also necessary to mask geometry that is visible to the camera at a grazing angle so that projected textures do not smear across the geometry. This is achieved by setting the Angle Threshold < 90 .

Label Exclude

This feature has been deprecated.

Premult

On by default; `gs_mptk` assumes users will want to multiply images in the Projection List by the mattes in the Additional Mattes list. This is useful for photographs, for example, where the RGB of the image does not contain a matte. For images in the Projection List that are already premultiplied by a holdout matte in the RGB channels, you will want to DISABLE Premult—otherwise your mattes will be double multiplied, and you will see darkened edges in your resulting render.

Additional Mattes

The Additional Mattes list is organized the same way as the Projection List, except that it does not have drag/drop functionality. All mattes in the list are multiplied together before they are connected to the `gs_projCamMix` node, so there is no need for order of priority like the Projection List.

When a matte file is loaded with the “...” browse button, the user has the option of choosing which channel in the image will be used for the matte. In this way, it is possible to have up to 4 separate mattes (R, G, B, and A) in each file. All mattes in the list project from the same camera as the current projection.

The Additional Mattes list applies only to the current projection, and is included as a way for users to generate custom mattes that mask areas not defined by the Matte Attributes.

- + Add a matte projection.
- Remove the current matte from the list.

Object List

This list displays the names of all objects (geometry) associated with the `gs_projCamMix` node. Since the `gs_projCamMix` node is identified as a Mental Ray texture, it does not have a shading engine and does not make direct shading assignments. Instead, an output connection is made between the `gs_projCamMix` node and another shader that is assigned to the geometry. In this way, the `gs_projCamMix` node can easily fit into a pipeline that has custom shaders.

It is necessary to add geometry to the Object List in order for them to render.

The Object List allows for multiple selections by either click-dragging, shift-clicking, or, for non-contiguous selections, ctrl-clicking (cmd-clicking on OSX). If shader assignments are made to geometry outside of the UI, it is necessary to refresh the UI in order to see these changes reflected in the Object List.

- + To add an object to the Object List, `gs_projCamMix` must have at least one outgoing connection to a shader connected to a shading engine. If no outgoing connections are found, a default `gs_const` shader is created and connected to `.outColor` of the current `gs_projCamMix` node. This button can also change shader assignments to objects already in the Object List. For example, if there are multiple outgoing connections from `gs_projCamMix` to different shaders, any object in the list can be assigned to a different shader because the list of connected shaders is invoked every time the + button is pressed.

Note that only shaders with incoming connections from `gs_projCamMix` and outgoing connections to shading engines are detected by the + button. Shaders are connected to shading engines by default when they are created through the Hypershade, so this is not usually an issue.

- This button will remove the shader assignment from the geometry selected in the list.

- ^ This button will select the geometry selected in the list.

USAGE AND TROUBLESHOOTING

The best way to get familiar with the Mattepainting Toolkit workflow is to watch the online videos at www.glyphfx.com/mptk.html. The following is a list of technical considerations for rendering. Check the website for the most up-to-date information on usage, issues, and bug reporting.

When enabling V-Ray Rendering in the Options of `gs_mptk_UI`, you may receive an error that a connection can not be made to `gs_mptkSGxx.vraySpecificSurfaceShader`. This can happen the first time a shading network is created. To fix the problem, simply un-check V-Ray Rendering from the Options menu, and then re-enable it.

`gs_mptk` will perform an Over operation when compositing images together. Take note of the Premult switch described above to avoid double multiplication of mattes.

Transparency operations are calculated with raytracing. Make sure raytracing is enabled in your renderer when calculating transparency.

When compositing multiple layers of transparency, make sure to have your raytracing limits set high enough to avoid early termination of the ray. Refer to Mental Ray and V-Ray documentation for more information on raytracing limits.

When using shadow occlusion with the Dilate option, be aware that render times can increase significantly. This is due to the increase in rays probing for occluding geometry, and is directly related to an increase in Dilate and Samples values. Keep these attributes as low as possible. Mental Ray and V-Ray use different algorithms for sampling, so there will be a visual difference in the mattes generated with this feature of the toolkit.

If you notice black edges in the V-Ray shadow occlusion of transparent images, disable Filter Maps under Render Settings>VRay tab>Global Options>Materials>Filter Maps

You do not have to use `gs_const` (Mental Ray) or the default Maya Surface Shader (V-Ray) that is added at the end of the shading network by default. To use other shading models, connect the relevant outputs of `gs_projCamMix` to your material shader of choice. The advantage of the default materials created by `gs_mptk_UI` is that they are fast and reliable. They do not, however, take lighting calculations into consideration. To get lighting evaluation, you will have to connect the outputs of `gs_projCamMix` to your shader of choice. Note that when using custom shaders, `gs_mptk_UI` will have no knowledge of these connections, and may therefore become unreliable. It is therefore suggested that changes to the shading network should only be performed as a last step before rendering.

When using custom shaders in place of `gs_const` (Mental Ray), make sure to connect the `outMatte` and/or `outTransparency` plugs to your custom shader, or Mental Ray may not evaluate transparency operations correctly.

At the time of writing, V-Ray does not evaluate Maya camera projection types and film gates when rendering. As a result, V-Ray requires that image aspect ratio match the camera resolution ratio. This is

different than Mental Ray, which will squash or stretch an image to fit the camera film gate, and can project images independent of the render resolution ratio. `gs_mptk` defaults to using native Maya projection capabilities since they are more versatile when mixing projections of different resolutions and ratios. When rendering in V-Ray, however, the projection type for all projections must be set to Fit Type = Match Camera Resolution and Fit Fill = Horizontal. You can use the included `gs_vray_pfit.mel` script to convert all projections in the scene for V-Ray compatibility. This should be done whenever a new projection is added to the Projection List, or a new `gs_projCamMix` shader is created. Note that this script is a one-way operation, and while Mental Ray renders will respect the changes, you will need to manually adjust the Camera Projection Attributes on the projection node to project with different ratios in Mental Ray.

To help V-Ray shadow Occlusion artifacts, select the mesh producing the artifacts, as well as the occluding object, and in the Attribute Editor, add Attributes>VRay>Subdivision and Displacement Quality, as well as Subdivision. Then lower Edge Length.

V-Ray transparency tracing can be slow to render. One option to increase render speed is to set the transparency cutoff to 1 in Render Settings>VRay>Global Options

In some cases, alpha channels are not detected by `gs_mptk_UI`. This is related to the Maya function `fileHasAlpha` returning 0. If an alpha channel of your projection is not detected by default, add it to the Additional Mattes list manually.

END