Appendix C

Camera Transfer Tools - User Guide

I. Background

These tools were "inspired" by a tutorial on SCAD's website called <u>'Maya to Houdini Camera Matching</u>'. It involves using a MEL script to save out Maya's frame values, setting up a CHOP network manually in Houdini, manually copying camera attributes like resolution and f-stop, etc and manually converting Maya's camera horizontal aperture into Houdini camera horizontal aperture.

I found the tutorial quite useful while doing a group project at Bournemouth University, but there was also room for improvement. I decided to make the process easier and more robust and to implement the reverse (Houdini->Maya camera transfer) as well. The project also was a good exercise in Python, HOM and Python for Maya. Last, but not least, I wanted to create tools that can be useful to anyone working with Houdini or Maya. It is a way for me to give back to the CG community.

II. Tools installation

1. Supported Houdini and Maya versions:

Houdini 9.5 and later, both 32-bit and 64-bit. Tested on both Windows and Linux (Ubuntu).
Maya 8.5 and later, both 32-bit and 64-bit. Tested on both Windows and Linux (Ubuntu).
Note: I don't have access to a Mac, so the tools have not been tested on OS X.

2. Installation:

1. Code and help installation: Copy the folder 'mt_tools' to your \$HOME directory. On Windows \$HOME is My Documents/ On Linux it is ~username/

2. Houdini shelf installation: Copy the included default.shelf file to \$HOME/houdiniX.Y/toolbar/, where houdiniX.Y is your Houdini version.

3. Maya shelf installation:

Copy shelf_MT_tools.mel to your \$HOME/maya/\$version/prefs/shelves/ folder. For example, on a Windows machine having a 32-bit installation of Maya 2008, this directory would be My Documents/maya/2008/prefs/shelves.

Note: This user guide demonstrates the use of the camera transfer tools by doing a "roundrip" transfer of a camera from Maya to Houdini and back to Maya. I have tested using the scene file provided in the tutorial mentioned above.

III. Exporting a Maya camera

IV. Importing a Maya camera in Houdini - CHOPs

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- VI. Exporting a Houdini camera
- VII. Importing a Houdini camera in Maya

III. Exporting a Maya camera

In essence, the tool saves the camera's shape node settings (aperture, f-stop, etc) as well as frame values to an external file. It supports both static cameras and cameras animated via keyframes, set driven keys, expressions and motion paths. Note that only channels with values that vary over the specified frame range are considered animated by the tool. You can have a camera animated on a motion path, that has all of its channels connected to the motion path curve, but only half the channels have values that actually change. The tool will consider the rest of the channels to be static and will export a single value for each of them, instead of saving an entire column of identical numbers.

Select a camera and click the icon of the Export Maya camera tool (xCam) in the custom shelf called MT_tools.

Py Py Py Py Py xCF xCam iCam			
Display Sh	Display Show Panels		
- 37	persp		
8	top		
8	front		
	side		
37	camera1		

If the selection is not a single camera, you will see an error message and the process will be aborted.



Upon selecting a single camera and clicking the tool's icon, you will see a dialog window, which asks for the frame range to be exported. The maximum allowed range is the current scene animation range.

Please	enter a frame range	
The ex	specify the frame range you want to pected format is: start-end, e.g. 1-120 irrent maximum range is 0-120.	
	OK Cancel	

The tool has built-in data validation and will cancel the export process if you enter an invalid range.



Assuming that valid a range has been entered, next the tool will display a standard file dialog window, which allows you to specify the name and path of the file in which the camera data will be saved. By default the tool points to Maya's home directory - My Documents/maya on Windows, ~/maya on Linux. If you don't type the expected file extension (.chan), the tool will include it automatically.

Save As		? 🗙
Save in: Recent Desktop My Documents	 maya m2008x32_camera1_bad h9.5.379x32_cam1_exp h9.5.379x32_camera1_keyframes m2008x32_camera1_keyframes m2008x32_camera1_chops scripts projects fbxpresets 	
My Network Places	File name: m2008x32_camera1 Save as type: Filtered Files [*.chan]	

If you cancel or try to save without entering a file name, the process will be aborted.



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IV. Importing a Maya camera in Houdini - CHOPs

There are 2 Houdini shelf tools which allow you to import a Maya camera:

- Import Maya Camera - CHOPs (iCam-chops)

- Import Maya Camera - Bake Keyframes (iCam-kf)

Create	Modify	Model	Polygon	Deform	Texture	Character	Auto Rigs	Animation	MT_tools	0
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Importing a Maya camera using CHOPs:

This tool automatically creates a CHOP network and maps the channels found in the file (each is stored in a separate column of numbers) to the camera's transform/rotate channels. If you delete a CHOP-driven camera, the next time you try to import a camera the tool will delete all orphaned CHOP networks, and then it will create the new camera. Orphaned CHOP networks are networks with Export CHOP nodes which reference non-existent cameras.

Begin by clicking the tool's icon (iCam-chops) on the custom shelf called MT_tools.

The tool will open a file dialog window which allows you to choose a camera data file (.chan) to import. By default it points to Maya's home directory.

Select a .chan file				
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🔜 Desktop	🛅 fbxpresets		23 Apr 2009 11:07 PM	
🛲 opdef:/	🛅 projects		22 Jul 2009 06:40 AM	
🛲 A: /	🛅 scripts		13 Aug 2009 04:01 AM	
🛲 c: /	ݽ h9.5.379x32_cam1_exp.chan	4 KB	20 Aug 2009 03:18 PM	
🛲 D: /	h9.5.379x32_cameral_chops.c	6 КВ	20 Aug 2009 02:10 PM	
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🚍 F: /	🔤 m2008x32_cameral.chan	4 KB	20 Aug 2009 02:33 PM	
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HD Non-Commercial Edition				4 14
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File	m2008x32 cameral.chan	Show files matchi	ng *.chan	
Preview			Accept	Cancel

If you cancel, the tool will show an error message and will abort the import process.



Assuming that a file was selected, the tool will check if the right keywords exist. They are used to store camera shape node settings, as well as global settings like Maya scene fps.

🕤 Invalid	setting(s)	
0	Invalid file: found keywords don't match expected keywords. Expected keywords: ['animated_channels', 'camera_name', 'export_end_frame', 'export_start_frame', 'f_stop', 'far_clipping', 'focal_length', 'focus_distance', 'fps', 'hor_aperture', 'hor_resolution', 'near_clipping', 'non_animated_channels', 'non_animated_values', 'pixel_aspect_ratio', 'ver_resolution'] Found keywords not in the list of expected keywords: ['xf_stop']	
		ок

If that is the case, the tool will compare the Houdini scene fps and the Maya file fps. If they don't match, it will display a warning and ask the user to choose whether to proceed or not. The default button is set to 'Cancel'.



If the user chooses to proceed, the tool will examine the frame records to check if they contain only numerical data.



If that too is passed, the tool will create the camera and the CHOP network. It will convert the horizontal aperture of the Maya camera into a Houdini horizontal aperture. The vertical aperture is calculated automatically by Houdini using the horizontal aperture, the device aspect ratio and the pixel aspect ratio. If there is a fps mismatch that the user chose to ignore, the tool will attach a Null to the camera's node with a comment matching the fps warning message. Finally, it will compare the scene frame range and the file frame range and will show a message if the file start frame precedes the scene start frame and/or the file end frame is greater than the scene end frame. It's just a reminder that some of the imported data is outside the current scene frame range.

Note that while in Maya the scene can start at frame 0, in Houdini it can start at frame at frame 1 or greater. If the Maya camera data includes values for frame 0, they will be ignored by the tool, as there is no frame 0 in Houdini to map them to.

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Pixel Aspect Ratio		
Projection	Perspective	
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Aperture	36	
Ortho Width	2	
Near Clipping	0.01	
Far Clipping	1000	
Screen Window X/Y	0	
Screen Window Size	1 1	
Left Crop		
Right Crop	1	
Bottom Crop		
Top Crop	1	
/obj 🙁 Tree View 🙁	Material Palette 😄 😮	
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	Operator type: null	
	cameral_warning contains 2 SOPs. Display SOP: controll	
	Render SOP: point1	
	No pre-transform.	
	fps mismatch found:	
	File fps is 25. Scene fps is 24.	
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cameral 🖾 Take List 🛛	8 0		= 0	
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Keep position when	parenting Pre-transform			
Transform Order	Scale Rot Trans 🍦 Rx Ry	/ Rz		
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Rotate	•27	Overridden by /ch/cameral	0	
Pivot	0	0	0	
Look At			近に	
Look At Up Vector	Use up vector 👙			
Path Object			- 本 ⁻	
Parameterization	Arc Length			
Orient Along Path				



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V. Importing a Maya Camera in Houdini - keyframes

A disadvantage of using CHOPs is that you can not modify the animation using traditional tools like the Channel Editor. You can use CHOP nodes, but users who work mostly in other applications can be intimidated. Therefore, I created a alternative tool, which is activated by the iCam-kf icon on the MT_tools shelf.

Create	Modify	Model Po	lygon l	Deform	Texture	Character	Auto Rigs	Animation	MT_tools	0
		H iCam-chop								

It bakes the frame values from the file as keyframes over the frame range specified in the file. Similarly to the CHOP camera import tool, this tool does the same data validation and displays the same error messages and a warning if it finds a fps mismatch (see previous chapter). At the end of the process, it too informs the user if the file's frame range is outside the scene frame range.

camera2 🙁 Take List 👔	3 O		= 0
🔄 🖒 🛒 obj			• 🕂 🧑
🛞 Camera camera2			🐥 Н 🕖 📀
Transform Render	View Sampling		
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Translate	• 3. 81553	14. 7203	17.4539
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Roll	o	1	
Position			
Parameterization	Arc Length		
Orient Along Path	i		



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VI. Exporting a Houdini camera

This tool is activated by the xCam icon on the MT_tools shelf in Houdini.



It works similarly to the *Export Maya camera* tool. It asks for a frame to export, which has to be within the scene frame range. The frame range is validated, if it's valid the tool displays a file dialog allowing the user to choose a folder and file where to save the camera data. The default folder is Maya's home folder.



🕤 Save Houdini camera as .chan f	ile			
🗢 🗢 🕇 Look	in C:/DOCUME~1/ADMINI~1/MYDOCU~1/maya/			New Folder
Locations	Name 🔺	Size		Last Modified
🛧 Home Folder	🦕		20 Aug	2009 03:03 P
🐱 Desktop	🚞 fbxpresets		23 Apr	2009 11:07 P
🛲 opdef:/	🛅 projects		22 Jul	2009 06:40 A
🛲 A: /	🔁 scripts		13 Aug	2009 04:01 A
🛲 c:/	M h9.5.379x32_cam1_exp.chan	4 KB	20 Aug	2009 03:18 P
🛲 D: /	M h9.5.379x32_cameral_chops.chan	6 KB	20 Aug	2009 02:10 P
🛲 E: /	M h9.5.379x32_cameral_keyframes.chan	4 KB	20 Aug	2009 02:33 P
🚍 F:/	🕅 m2008x32 cameral.chan	4 КВ	20 Aug	2009 02:33 P
릚 G: /	m2008x32_camera1_bad.chan	4 KB	20 Aug	2009 05:33 P
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□ \$HIP/				
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5 \$TEMP/				
		HD N	lon-Comi	mercial Edition
HD Non-Commercial Edition				
4 -	Show sequences as one entry			
File	h9.5.379x32 cameral chops.chan Show fil	es matching <mark>*.chan</mark>		
Preview			Accept	Cancel

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VII. Importing a Houdini camera

This tool is activated by the iCam icon on the MT_tools custom shelf in Maya.



It works similarly to the Import Maya camera - keyframes tool. It opens a .chan file, verifies that the required keywords are present and checks for mismatch between the Maya scene fps and the file's fps value.

Fps mismatcl	n warning 🔀
fps mismatch fo File fps is 30. Scene fps is 24 Proceed to impo	
ОК	Cancel

If the user ignores the warning, the tool validates the frame data and creates keyframes for the frame range specified in the file. Finally, if the file's frame range is outside the scene's frame range the tool informs the user.





Here is a snapshot with the original camera (camera1) and the camera that was exported to Houdini and then exported out of Houdini and imported into Maya (camera2). The frame values and the motion of the two cameras match.



Note that the vertical aperture of the imported camera will probably differ from the vertical aperture of the Maya camera. In Maya cameras are created with default apertures 1.417 and 0.945, which translates to a default aperture ratio of 1.5. However, the aperture ratio should depend on the device (resolution) aspect ratio and the pixel aspect ratio. For a scene with square pixels, the aperture ratio should equal the resolution ratio. E.g. for a 640x360 frame the aperture ratio should be 1.778, instead of the default 1.5, and as the horizontal aperture changes, the vertical aperture should change as well. However, in Maya by default changing the horizontal aperture does not affect the vertical aperture - it stays at 0.945.

My camera import tool calculates the vertical aperture using the relationship described above. This is why the vertical film aperture of camera2 is 0.797 (1.417/1.778), not the default 0.945. In my opinion this is the correct way to set the vertical aperture. I'd interested to hear arguments why the vertical aperture should remain unchanged. In any event, be aware that the framing of the imported camera will differ from that of the default Maya camera.

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Channels Object		Channels Object	
camera1		camera2	
Translate X	-3.816	Translate X	-3.816
Translate Y	14.72	Translate Y	14.72
Translate Z	17.454	Translate Z	17.454
Rotate X	-27	Rotate X	-27
Rotate Y	3.817	Rotate Y	3.817
Rotate Z	0	Rotate Z	0
Scale X	1	Scale X	1
Scale Y	1	Scale Y	1
Scale Z	1	Scale Z	
Visibility	on	Visibility	on
SHAPES		SHAPES	
cameraShape1		cameraShape2	
Horizontal Film Aperture	1.417	Horizontal Film Aperture	1.417
Vertical Film Aperture	0.945	Vertical Film Aperture	0.797
Focal Length	28	Focal Length	28
Lens Squeeze Ratio	1	Lens Squeeze Ratio	1
F Stop	5.6	F Stop	
Focus Distance	5	Focus Distance	5
Shutter Angle	144	Shutter Angle	144
Center Of Interest	30.823	Center Of Interest	5

Looking through cameral



Looking through camera2



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