# Maya and Alias MotionBuilder in a Production Pipeline

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## OVERVIEW

This course covers a typical pipeline using both Maya® and MotionBuilder®. Whether you need to produce a feature film or come up with the latest game, most likely you will need a place for animation in your pipeline. Animation is the process of taking 3D characters or objects and moving them over time. This procedure usually takes time due to many artistic and technical issues. Typical technical issues can be a model's weight in geometry, hardware limitation or poor playback speed. This is where MotionBuilder can come in very handy.

*Our example characters from the Outlaw Golf game by Hypnotix*

First, we will go over some features of MotionBuilder, and then, with a practical example, we will explore how to use Maya and MotionBuilder together.

# I. Maya and MotionBuilder United

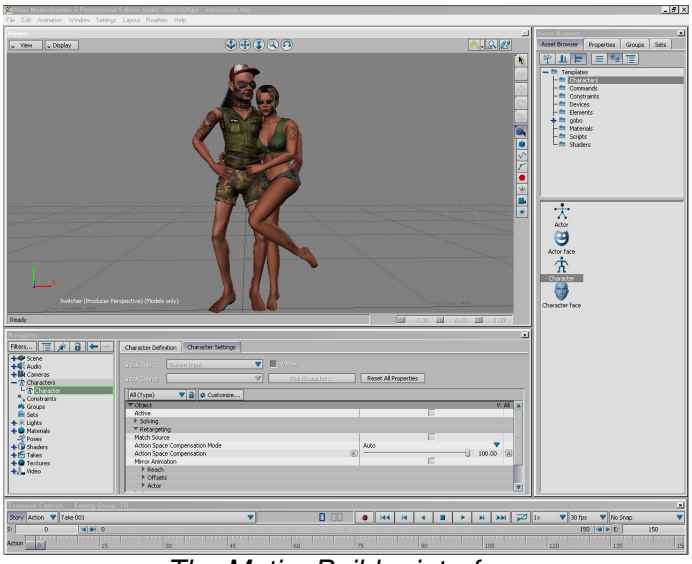
While Maya was made to take care of an entire pipeline, MotionBuilder was designed to deal mostly with animations. Since one enhances the other, it is possible to unite them into a single pipeline.

## PART I What is MotionBuilder?

### Main Differences and Advantages

#### Interface

The most striking difference between Maya and MotionBuilder is that MotionBuilder doesn't have as many tools as Maya. For example, there are no modeling tools.
You might think that this is a drawback at first, but you will soon come to realize that MotionBuilder is able to much more efficiently handle heavier models than Maya, since it doesn't have all the variety of history, modeling, dynamic and deformer nodes to evaluate.

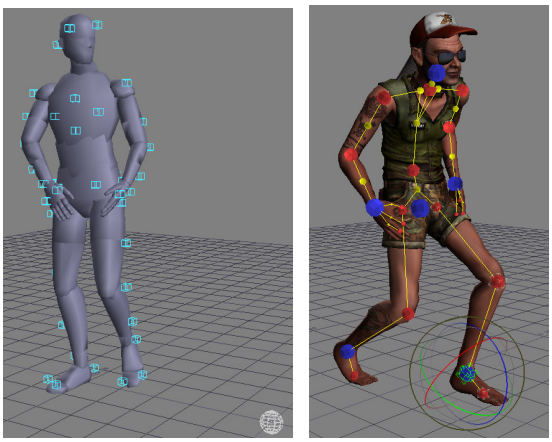


*The MotionBuilder interface*

#### Animation Method

Another great difference is how MotionBuilder handles animation. There are two basic animation techniques: keyframe animation and device animation. With keyframe animation, you will have to animate manually from scratch. With device animation, such as motion capture, you will need to record a performance, which will then be applied onto your character.

Both Maya and MotionBuilder exploit those techniques, but MotionBuilder has many powerful tools to help you tweak animations.



*Motion capture animation / keyframe animation*

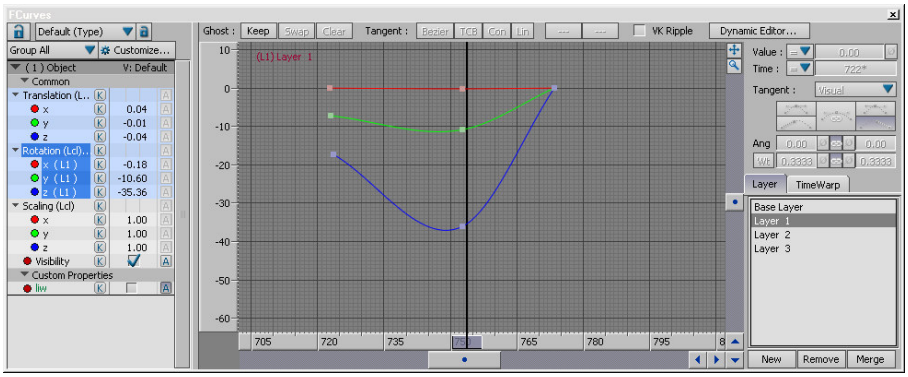
**Takes**

A scene in MotionBuilder can have multiple animation takes. Each take contains a whole new animation for all the models in your scene. It is not possible to have multiple takes in Maya; different animations need to be in different files.


*Scene takes menu*

**Layers**

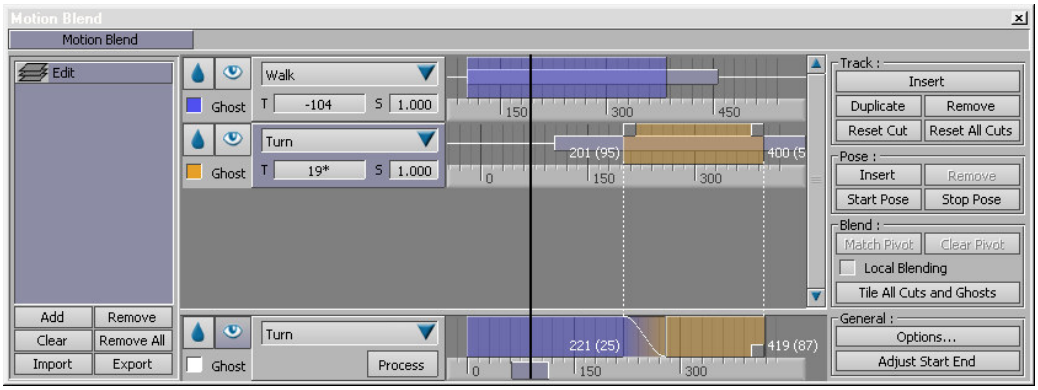
You can use animation layers in MotionBuilder, which can greatly speed up any modifications. Once you are done tweaking your animation, you can merge all the layers together into the base layer. This whole process also makes it easy to refine a motion when used in conjunction with a character rig.




*Layers in FCurves window*

## Motion Blend Tool

Maya has Trax, as MotionBuilder has Motion Blend. These tools are similar, but the Motion Blend tool can give you much more control over your animation.

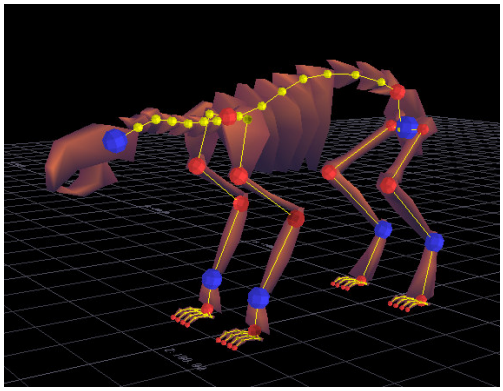



*Motion Blend window*

**Note:** Make sure to select and drag only the appropriate nodes in the Motion Blend window. A common error is to drag a top node not intended for animation.

## Control Rigs

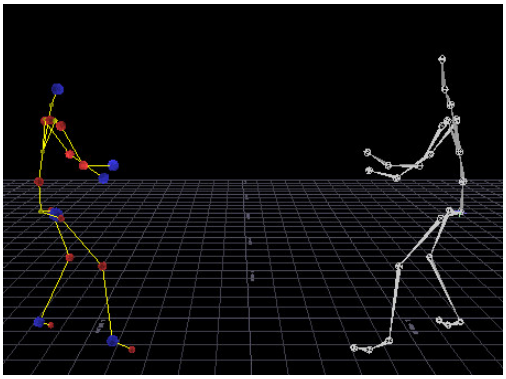
In Maya, you can create complex character rigs for your animations, which can slow down the interaction with your model. In MotionBuilder, a default character rig for bipeds and quadrupeds, which implements IK and FK, can be used to manipulate a skeleton.



*Quadruped control rig*

## Mirroring Animation

The character rig allows you to mirror animation on the Z plane in a single click. This is something that requires scripting in Maya in order to be done.



*Mirror control rig*

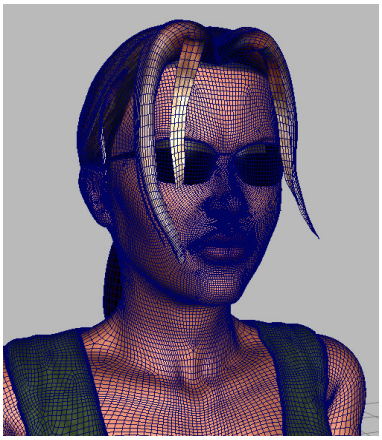
**Retargeting**

If your character uses a MotionBuilder rig, you get character retargeting for free. That means that you can copy any character rig animation to any other similar rig with a few mouse clicks.

*Retargeting between characters*

**Real Time Engine**

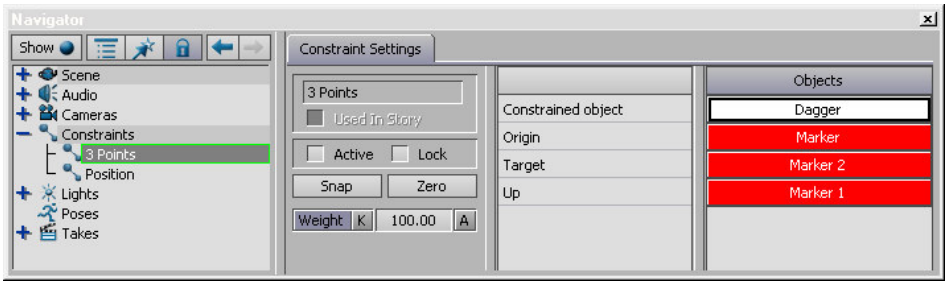
When you play animations on high-resolution models in MotionBuilder, the refresh rate will most likely be higher than Maya.



*MotionBuilder usually gets more FPS than Maya*

## Constraints

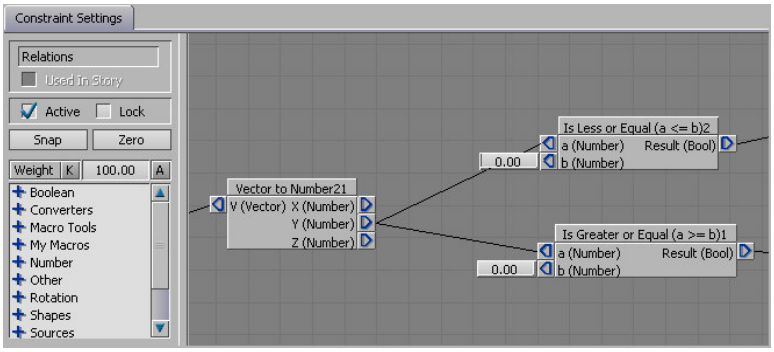
The constraints in MotionBuilder are similar to those of Maya with the Maintain Offset option. The only difference is that the constrained object's properties can still be offset with the manipulators. It is also possible to lock or zero a constraint offset.




*Constraints setup in the Navigator*

## Special Constraints

There are two special types of constraints in MotionBuilder, called Expression and Relation constraints. Compared to Maya, the Expressions constraint works like a simple mathematical MEL expression, and the Relation constraint is just like connections, but they can be turned on and off and blended like any other constraints.




*Relation constraint setup*

We will see later in the course that the Expression and Relation constraints can get input from devices such as mouse, keyboard or joystick. If you setup that kind of relation and press the record button, you can animate objects and characters in real time. A common use for this is to control blendshape while an animation is playing back.

## PART II Using a Maya / MotionBuilder Pipeline

### What goes in and out

Here is a list of the unsupported Maya nodes for MotionBuilder:

- Curves
- Subdivision surfaces
- History nodes (other than skinning and Blendshapes)
- Dynamics
- Some material and shader type
- Set Driven Keys, connections and expressions
- Constraints
- IK handles
- Visibility Layers
- Paint Effects, fur, cloth, hair, etc.
- Custom nodes

Here is a list of the unsupported MotionBuilder nodes for Maya:

- Constraints
- Actors and characters
- Animation layers (must be merged)
- Multiple takes (only one at the time can be imported)
- Devices
- Camera switcher
- Shaders (materials are OK)

If you need a more specific understanding of what gets exported from Maya and imported from MotionBuilder, get the documents related to your FBX plug-in version. This list is subject to change. The best way of knowing if something goes through is to try it out.

### Pros and Cons

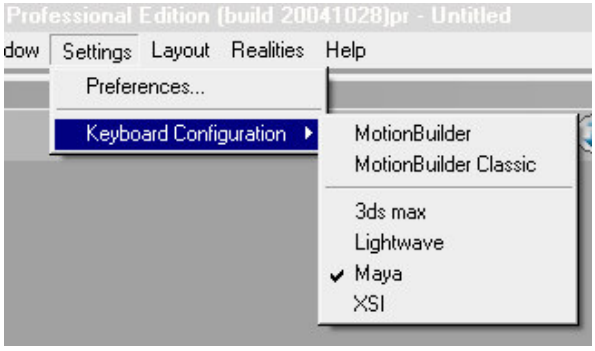
In all scenarios, the biggest disadvantage is ignorance. Most people think MotionBuilder is only motion capture software, but that is really not the case. MotionBuilder is also a very powerful previz and animation software.

A basic knowledge of the software is required in order to evaluate if it is worth it or not to export your characters to MotionBuilder. Once a decision is taken, make sure your rig and naming is final; if not, you might have problems importing the animation back in Maya.

A common mistake using MotionBuilder is to think motion capture is better than keyframe animation or reverse. Some people will say keyframe is better and others will say mocap is better. Motion capture might be faster to get results, but it usually needs cleanup, tweaking and overlaid animation. Animation is a slower process, but the results pinpoint what you wanted to the smallest detail. Experience with both techniques is the only way to really decide which one will be advantageous for your project.

The learning curve of new software can be somewhat rough. Fortunately for beginners, MotionBuilder offers you the option to interact with your scene with a Maya hotkey layout.

Also, using the character rig might not be efficient at first, but keep in mind that, animators who get experienced with it find it very useful.




*Set the Maya keyboard layout*

# II. Maya / MotionBuilder Example

The basics of a Maya / MotionBuilder pipeline are simple but require some extra work to be done prior to converting your model to MotionBuilder. In this example, we will use Clemor and Harley, characters from the Hypnotix game studio. They will be animated in MotionBuilder using motion capture and keyframing, and then brought back into Maya for final tweaking. Doing so allows creating and modifying our animation in real time using the powerful display engine of MotionBuilder.

## PART I What Needs to be Done in Maya?

### Modeling

MotionBuilder supports polygon and NURBS geometry, but no history nodes will be exported. For example, a polySmooth node or a trimmed surface will not be exported. It is also recommended to freeze geometry before exporting.

- Start off by opening a character in Maya. In our case, we will open *Clemor_FK.ma.*

*Clemor facing the Z-axis in T-stance*

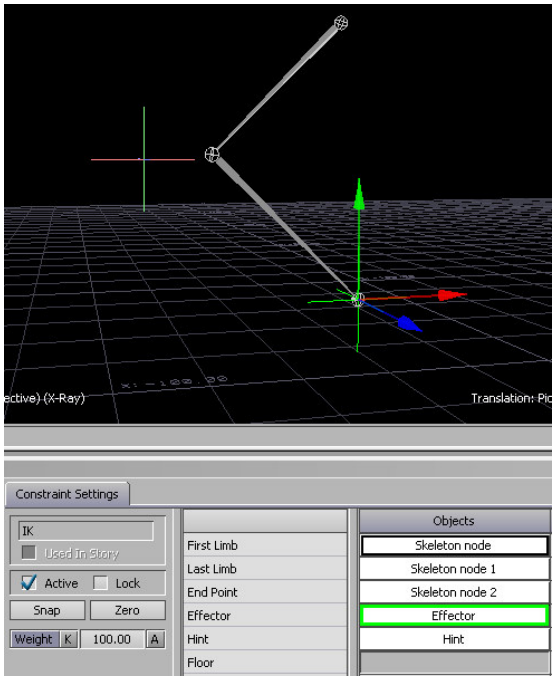
- It is important to have your character in perfect T-stance, facing the Z-axis. The MotionBuilder rig will be more accurate this way. If your character is not in a T-stance, you can always rotate its skeleton once skinned to place it in a good position. Obviously, the T-stance does not apply for quadrupeds.
- MotionBuilder will like your model better if there is no negative scaling or pivot offset. The rule of thumb is to make sure your geometry is frozen, using **Modify** > **Freeze Transformation**.
- Keep in mind is that no history node will be exported beside skinning and Blendshapes. In the case of blendshape nodes, you need to have the actual shapes in your scene prior to export. If you don't have the shapes, use a script to extract the shapes automatically, then recreate the blendshape node.

### Rigging

Any type of Maya skinning is perfectly supported by MotionBuilder.

Rig nodes, other than bones and groups, will be exported as nulls. In fact, the only thing you really need in order to animate a character in MotionBuilder is an FK skeleton. No need for IK handles, since the character rig will take care of that for you.

However, if you need IK handles to be animated once back in Maya, you can use the nulls created by the exporter as parts of constraints. There are two possibilities: constrain the locators to the bones and plot them once animated, or create IK handle constraints to mimic your Maya rig. Either solution will import back the animation correctly in Maya.




*IK constraint setup*

- You can now rig the character with bones, using parenting, smooth or rigid binding. Since all our animations will be done in MotionBuilder, we don't need a fancy setup; simple forward kinematics will do the job.

**Naming**

- If you want to simplify the character rig setup in MotionBuilder, your skeleton needs to be named a certain way. This step is not required, but it will save you time in the process.

```
Hips
Spine (1, 2, 3 …)
Neck (1, 2, 3 …)
Head

Left/Right UpLeg
Left/Right UpLegRoll
Left/Right Leg
Left/Right LegRoll
```

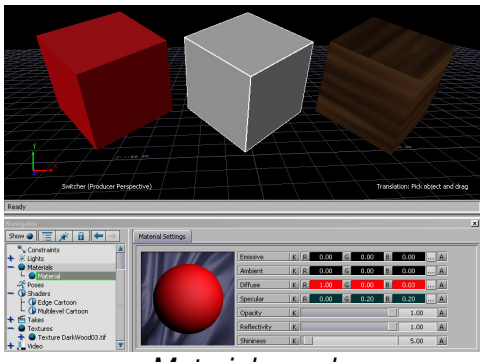
```
Left/Right Foot
Left/Right ToeBase
Left/Right Shoulder
Left/Right Arm
Left/Right ArmRoll
Left/Right ForeArm
Left/Right ForeArmRoll
Left/Right Hand
Left/Right FingerBase

Left/Right Hand/Foot Thumb (1, 2, 3, 4)
Left/Right Hand/Foot Index (1, 2, 3, 4)
Left/Right Hand/Foot Middle (1, 2, 3, 4)
Left/Right Hand/Foot Ring (1, 2, 3, 4)
Left/Right Hand/Foot Pinky (1, 2, 3, 4)
Left/Right Hand/Foot ExtraFinger (1, 2, 3, 4)
```

**Note:** There are no spaces within the names

- MotionBuilder will support identical names from Maya, but it will append its own suffix in order to be able to recognize the nodes individually. This will also import your animation correctly back in Maya.

**Texturing**

UVs and materials are supported by MotionBuilder, but the Maya material attributes might not give the exact same result. You might need to tweak the shaders and materials in MotionBuilder in order to get a similar look.
For this example, materials are not very important since we know we are going back into Maya.



*Material panel*

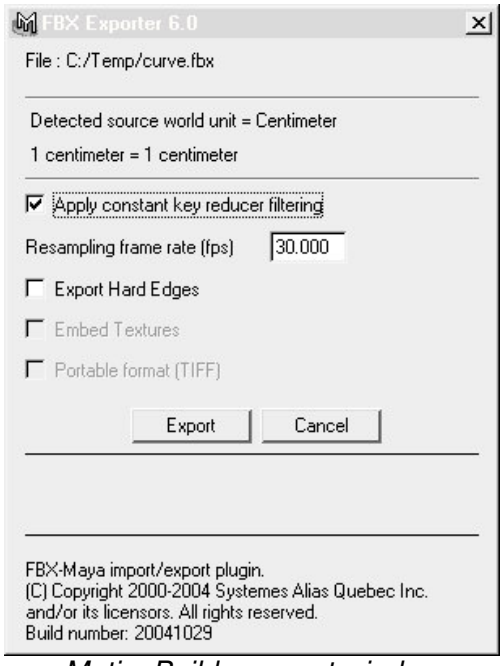
**Exporting**
When a character is ready to be exported to MotionBuilder, all you need to do is to load the FBX plug-in and select **File** > **Export All**. A window will then pop-up, letting you choose from some export options. If any problems occur during this task, the plug-in will warn you. If everything goes well, an FBX file will be written to disk.

Note that prior versions of MotionBuilder 6.0 were backward and forward compatible, but MotionBuilder 6.0 FBX file format was revised and it might not be read correctly by previous versions.

- In order to export, you need to place the *fbxmaya<version>.mll* plug-in in the appropriate Maya Plug-ins directory and then load it through the Plug-in Manager.

*Maya Plug-in manager*

- Once you export to FBX file format, the plug-in options are displayed. Here, you can specify weather you want to reduce constant animation keys and specify a resampling frame rate. You can specify if you want to export polygonal edge information and if you want to embed textures in the FBX file.



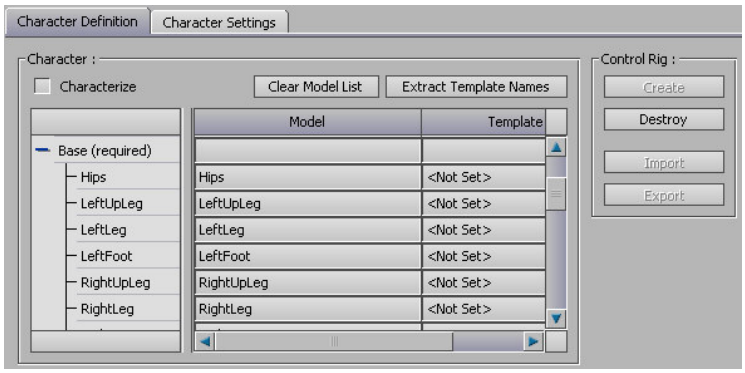
*MotionBuilder export window*

## PART II Using MotionBuilder

### Setting up your Character

You will need to setup your character once in MotionBuilder in order for the software to "understand" the structure of your hierarchy. Here you can give your model a proper scaling, create special constraints and, most important, map your model's skeleton to a Character.

The Character constraint will control your character based on various input, such as motion capture, its character rig (FK, IK or both) or even another Character constraint.




*Character setup*

- Open your exported FBX file with MotionBuilder.
- Some steps are required in order to set up the character rig. If you have named your skeleton with the MotionBuilder convention, you can automatically map the character. If not, you will need to do it manually for each node.

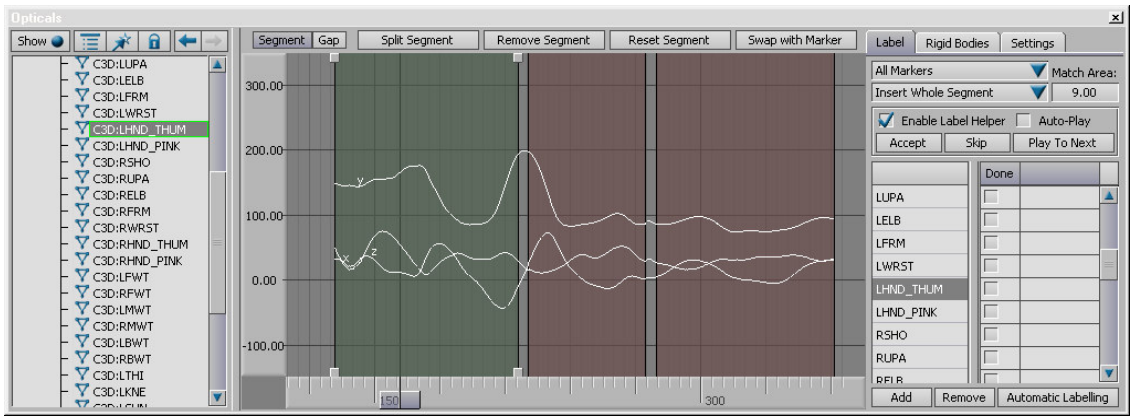

*Automatic mapping in a click*

- If your character is a quadruped, you can also create a quadruped character rig.
- Save your scene as being the rigged character.

**Motion Capture**

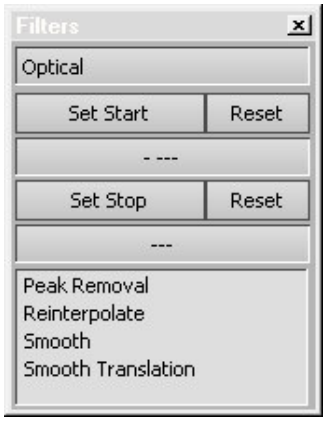
Now that MotionBuilder knows the structure of your character, you can start animating. That can be done using any supported motion capture device, straight keyframing or through another character. For our example, we will use optical motion capture data.

- Create a new scene and import *00_ROM.c3d* and *01_mocap.c3d*.
- You now need to create an actor to follow the optical markers. The actor constraint works with the character constraint, which will in turn, drive your skeleton.
- In order to get better results out of your mocap data, you need to use rigid bodies. A rigid body will constrain a group of markers together, which will mimic a stiff body part, such as the chest or the head. That way, if you lose a marker in a group, the other markers will attempt to place it to its estimated position.
- It is now time to cleanup the mocap segments using the optical panel.




*Optical panel*

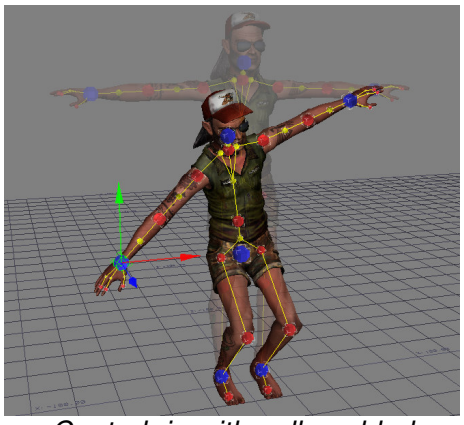
- Now that the data is cleaner, it is recommended to use optical filter, which shall smooth out the animation curves.




*Optical filter panel*

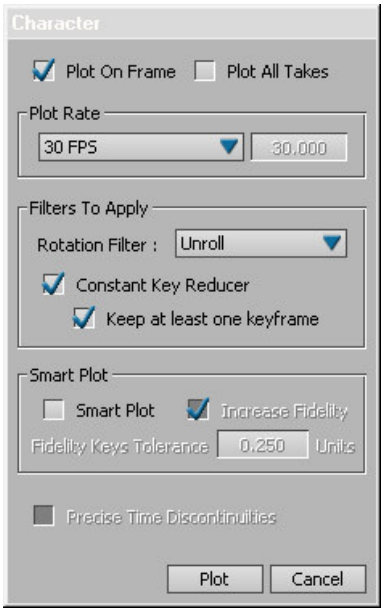
**Character Rig**

All you have to do at this stage is to specify an input type for your control rig and adjust its properties to best fit your animation.



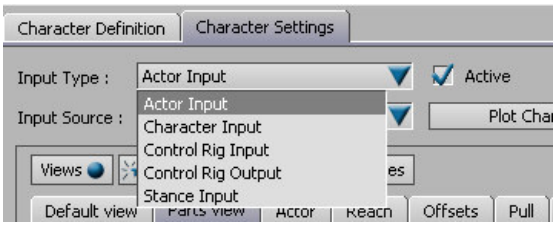
*Control rig with pull enabled*

- Append the rigged character to your scene and constrain it to follow the actor.
- You can play with several options susceptible of improving the assignation of the character to the actor.
- Once you are happy with the rig reaction, you need to plot the animation from the actor to the rig itself.




*Plot options*

The character constraint has several possible input and output. It can retrieve animation from an actor, another character or its skeleton, and it can give its animation to its skeleton.

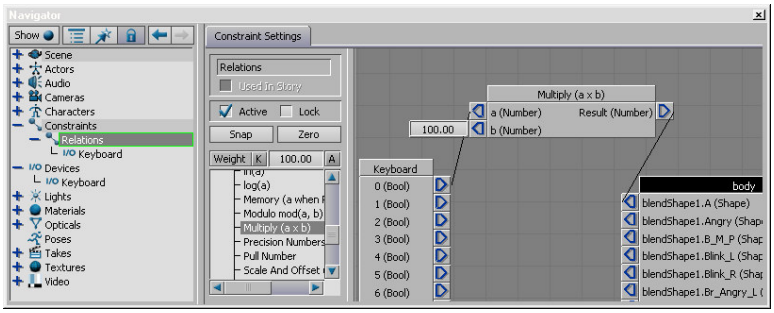



*Character input types*

**Keyframes and layers**

Now is the time to take advantage of powerful tools such as layers, takes and motion blend.

- Most of the time, you will have to tweak your animation to best fit your model. To do so, you need to keyframe over the mocap using layers.
- The Character Controls window allows you to quickly interact with the rig. Several options can be used such as pinning in translation and rotation, pulling and auxiliaries.
- When keyframing the rig, it is possible to do it on layers, which are added to the base animation. What you see in the perspective is the result of the base layer plus all the added layers.
- When you are done, you need to plot the animation to the skeleton. Doing so will disable the rig and show you the bones animation which can be imported back in Maya.
- Perhaps one of the most powerful tools of MotionBuilder is the Motion Blend tool. Here you can loop a take, blend multiple takes and redirect motions. You can then process the result to a new take.
- Before going back to Maya, you might want to do some more animation. Blendshapes for example can be hooked up to the keyboard and recorded as the animation and sound plays. This allows you to quickly establish facial animation.




*Keyboard hooked to Blendshapes*

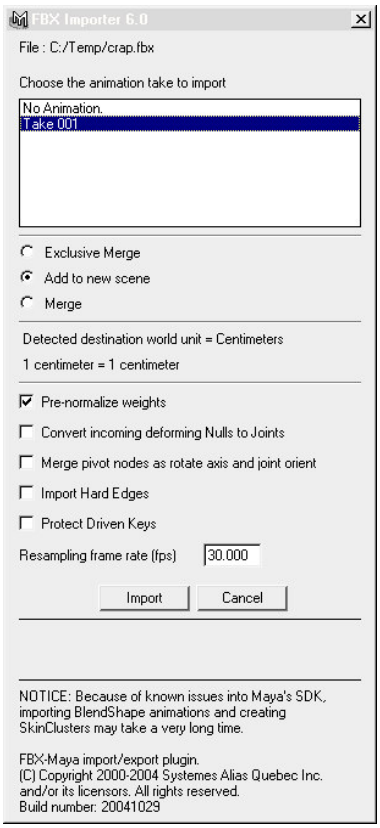
- For lip-synching, you can use the Voice Reality tool, which will attempt to recognize the phonemes spoken in a dialog.

## PART III Back to Maya

**Importing the Data**
Once you are happy with your animation, you need to plot your animation on the character bones. Plotting an animation works exactly like “bake” in Maya. Once that is done, you can do some cleanup in your scene then save it so the importer can get it into Maya. Cleanup means that you can get rid of unused nodes such as old motion capture makers, old constraints or reference geometry.

Note that not all MotionBuilder nodes go through the importer.
When in Maya, if you select **File** > **Import** and choose an FBX file, you will be prompted with an option window. Here you can choose if you want to import the animation of the FBX file in a new scene or to merge with the current scene. The merging option is very powerful, as it will assign the animation to the nodes with the same names.
If you had constrained locators, for example an IK handle, which was plotted in MotionBuilder, merging it in Maya will cause the IK handle to be animated.

- Your animation file can now be either imported in Maya or merged to the current scene. If you merge the FBX file the current Maya scene, every matching name will get its respective animation. Since Maya does not support multiple takes, you have to specify which take you want to import. The other import options will change what and how the file is imported.



*Character input types*

**Workaround**
It is a little more complicated if you want to import the animation on a reference, since Maya will add a prefix to each node. In that case, retrieve your animation by importing the FBX file in a new scene and then export an anim file. Import it back on the referenced character.

**Rest of Maya Pipeline**
From here, you can go on with your Maya pipeline. If you want to use dynamics or any other post animation process which could not be done in MotionBuilder, now is the time to do it. At any time, you can go back in MotionBuilder, tweak the animation, and then merge it again over your models.

**Reusing and Blending Animations from Maya**
If you already have an animated character in Maya for which you would like to use the MotionBuilder Motion Blend tool, it is possible to do so. The solution might not be pretty, but it is possible. Doing so could potentially save you time, generating new animation from existing ones.
Simply export your character as is, correcting any issues revealed from the exporter. Note that custom attributes will be correctly exported with animation (but not connected).

In Motion Builder, select all the animated nodes and drop them in the Motion Blend window. Now generate your new animations from various takes.
Save and import the file back in Maya. It might be better to then export your animation with animExport and import it back onto your original character.

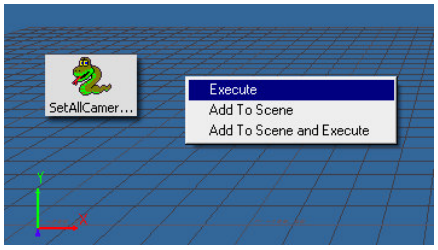
# III. Tools and Scripts

Advanced users with coding knowledge can push the limits even more by using embedded scripting languages and software development kits. Even though Maya and MotionBuilder are quite differ programmatically, they both offer the possibilities of creating scripts, macros or custom tools for your pipeline.

## PART I Custom Tools

### Scripting languages

While you can use MEL in Maya to automate tasks, you can use Python scripting in MotionBuilder. Note that the scripting language in MotionBuilder is fairly young and not as powerful and intuitive as MEL, but you can still automate tasks with it. Scripting is available only for MotionBuilder Pro and higher.

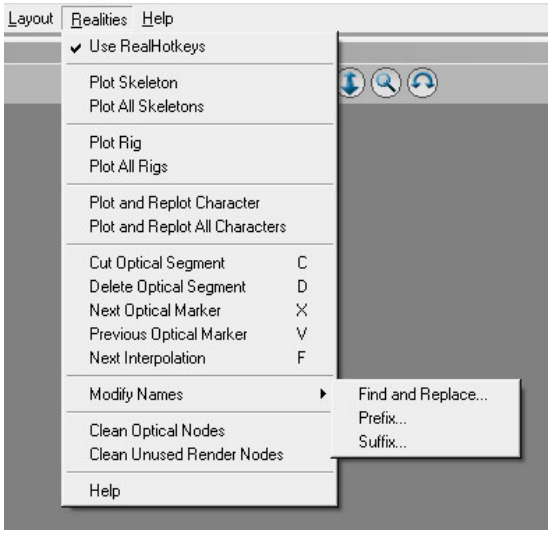



*Dragging a Python script*

### Software Development Kit (SDK)

Just like Maya, MotionBuilder has a powerful SDK letting you create utilities for your convenience. The only drawback is that MotionBuilder Standard does not support plug-ins.

At Realities, we are using plug-ins to get customizable solutions, such as hotkeys and menu items. Doing so considerably speeds up repetitive tasks.




*RealPlugin menu*

# IV. Conclusion

Based on what you've just experienced, you probably now have a bettering understanding of the advantages of combining tools from both Maya and MotionBuilder. Although it depends on your needs, using such a pipeline can drastically speed up any animation tasks. It is now up to you to exploit those tools to your advantage.

For more information about Realities Studio, visit http://www.RealitiesStudio.com.

If you have any questions, comments or concerns about this course or our plug-ins for MotionBuilder, you can post these on the Realities forum at http://forum.RealitiesStudio.com.

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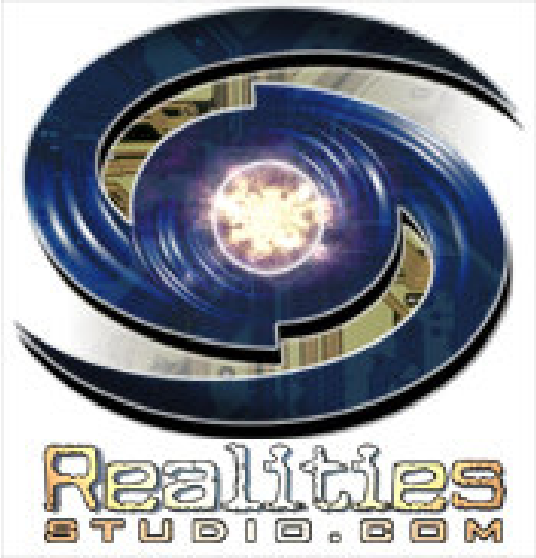


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