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Life Forms & LightWave
Animating Puppet sections in Life Forms

Background

Credo Interactive Inc., Makers of Life Forms, recently released a software component or plug-in which adds the ability to import and export LightWave scene files (.lws) from Life Forms.

This document shows you how to set up your Puppet sections to take advantage of Life Forms' fast and simple keyframing and mocap editing features.

What you need

You will need:

- **LightWave 3D 5.5 or later**
- **Puppet Master**
- **Life Forms Studio 3** (Demo Life Forms 3 can also be used. The demo version can be downloaded for free from http://www.credo-interactive.com. Note that the demo allows you to export only 5 frames of animation).
- **Latest LightWave plug-ins**. Download these from http://fas.sfu.ca/css/life-forms/ lightwave3d/ index.html

Installing the LightWave 3D plug-in

Please read the Readme file that comes with the plug-ins.

Using Puppet Master with Life Forms

The objective of this tutorial is to help you understand how Life Forms works with Puppet Master. You will learn how to prepare your character and scene file to make the process go smoothly. There is some set-up time involved in the process. However, you only do it once. After the model is set up you'll be able to add motion to the model quickly by:

- Using Life Forms efficient keyframing interface to quickly keyframe animations
- Using Smart Paste functions to loop and recombine your keyframed sequences
- Paste predefined animations that come with Life Forms Studio 3 to your character. The Animation Gallery and PowerMoves Library contains a very large selection of keyframed motion and motion captured animations.**

** Some limitations apply when pasting motion between models. Please see Caveats.

This tutorial assumes you are using Life Forms Studio 3, and Lightwave 5.5, or higher. It is also important that you download the latest files from the Credo-Interactive web site at http://fas.sfu.ca/css/lifeforms/ lightwave3d/ index.html.

Note from the Author (Ed Konyha): A quick render of the character we used for this tutorial is shown below. We built Mr.S.E.C with arms out because we want to create custom keyframed animation for it. However, we were still able to paste basic walk and run sequences to Mr. S.E.C as you will see later on.

For this character, we did not include the head as part of the Puppet Master hierarchy since we want to animate it later with Morph Gizmo. The head was only added after all the animation was done in Life Forms and exported back into Lightwave. After the Puppet Master plug-ins were added, the head was loaded and parented to the character's chest.

Mr.S.E.C walking

Note from the Editor: If you are building character models from scratch it is highly recommended that you build your model arms down to the side. If you carefully define and set pivot points for the Shoulder (collar) section the reduction in the range of movement of the arms is not as great as you'd expect. Moreover, it isn't a bad trade off to be able to apply lots of canned keyframed and mocap sequences to your model. Below is a model built this way.

If you can, build your model with arms down. This will make it easier to apply mocap sequences to the model.

Modelled with arms down

Example:

We will animate Mr. S.E.C's Puppet Master sections by pasting predefined animations. Instead using predefined animations, you may choose to keyframe your own animation. This example consist of the following parts:

Preparing Lightwave Characters & Scene
Loading An Animation and Mapping your Character
Pasting Animation to the Character
Mapping the motion to the Character
Exporting Animation from Life Forms
Importing Animation into LightWave

Preparing LightWave Characters & Scene

1 **Modelling the Mr. S.E.C.**
   Before you start modelling a character for use in Life Forms, it is very important to know that Life Forms prefers the figure to be modelled facing the -Z. Aside from this one important difference when modelling, set up your puppet sections as usual in Lightwave.

Model your Character facing -Z.

2 **Setting up puppet sections in Puppet Master**
   Be careful to parent and set pivot points for each section correctly. Generally, the pelvis or waist should be at the top of the parenting hierarchy. If you are not familiar with Puppet Master, see Related Resources for tutorials on Puppet Master

It's very important to get the pivot points and parenting right.

3   **Be especially careful when defining the Shoulder section**
When building custom model with arms down to the side, you need to define the Shoulder sections correctly.
One would think the upper arm should include the outer shoulder. However, for animating in Life Forms, the optimal set up is to define the Puppet Master shoulder (or collar) section to include the top of the upper arm down to the armpit, or straight up and around if your modelling in T form.

4   **Setting the Pivot point for the Shoulder section**
You can get a good effect by positioning the pivot point for the Shoulder section at the centre of the geometry. It's easier to do this in bounding box mode. You should carefully examine the animation of the Shoulder joint in Life Forms. If you see a problem, you may have to readjust the pivot point accordingly.

If the model's rest position is arms down, the shoulder section needs to be defined properly.

It may take a few tries to set the pivot point correctly for the Shoulder sections.
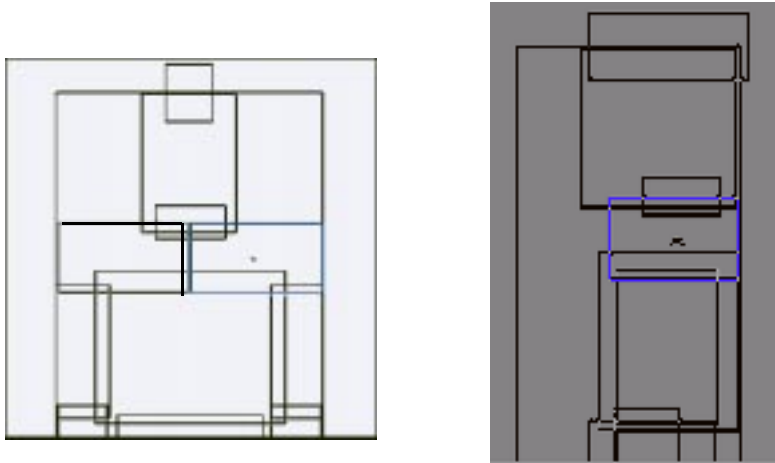
Shown in bounding box mode, these are Shoulder Sections for building meshes with arms down. Note the position of the pivot point.

5   **Clear the metamation target object**
Load your metamation target object and check that the joints bend properly. If all seems fine, clear the metamation target object and Puppet Master anchor from the scene, leaving behind the puppet sections only.

6   **Save at least two copies of the scene**
Finally, make sure this Lightwave scene has no keyframes in it (first frame=0, last frame=0) before you save it.
It is a good idea to make an identical scene with a different name, which you can overwrite as you put your scene together. This way, you will always have the original scene to go back to when you start your next bit of animation with this character.

Pasting Animation to the Character

1 **Open the scene file**
Start up Life Forms. Choose **File menu > Open**. In the File types menu in the Open dialog box, choose the LightWave.lws format. Open the scene that you just saved in Lightwave.
At this point, Life Forms may ask you to direct it to the folder which contains the Puppet limbs for your character. Find the folder and click OK. The character pieces should load very quickly if you turned of the Puppet anchor or Metaform target in the scene.

2 **Open Walk3-1.lfa**
Choose **File menu > Open**. In the Open dialog box and browse to *Life Forms 3 folder/Animations Gallery/Walk folder/Walk3-1.lfa*. Select the file and click Open.
When asked whether to close the previous animation, select **NO**.

3 **Copy animation from Walk3-1**
You should now see two Timeline windows. The first should be **Untitled** and the other is for **Walk3-1**. The Untitled Timeline window is the timeline of your character. Go to the timeline for the Walk3-1.lfa and select the first SHIFT key down and scroll to the last frame that you want to copy. Now choose **Edit menu > Copy**.

4 **Paste the animation to the Mr. S.E.C.**
You can now close all the windows related to the Walk3-1.lfa just to free up some space. Click in the first frame of the **Untitled** timeline (the one with your character) and choose **Edit menu > Paste**. This will immediately open the Joint Map editor.

Mapping the motion to the Character

On the right side of the editor is your figure with all of its body parts, and on the left is the default model used in the walk animation (Walk3-1.lfa). The Joint Map editor allows you to match the parts of your character (the Destination model) to those of the default model (or Source model) provided by Life Forms. If all your character's body parts have hierarchy and joint names similar to the default model's, you may find that the corresponding body parts are already properly assigned. (This was the case with our character.)
If this is not the case, you will have to match up the character parts with the corresponding parts of the default model.

1 Map the body parts: Start at the top of the Joint list. Click the first line. This selects the first body part in the hierarchy (usually the Pelvis) of the des-

tination model. Then, click the corresponding body part on the default model.
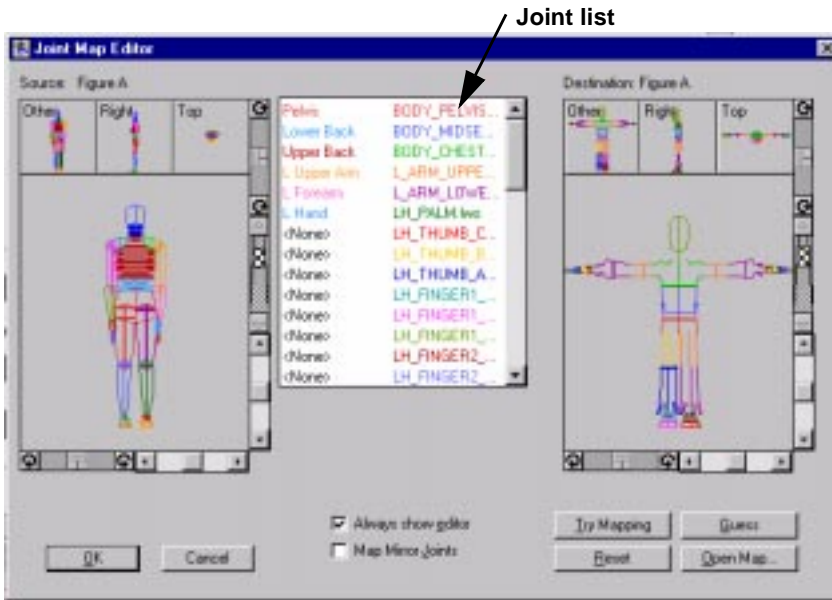
The Joint Map editor

2   Press the down arrow to go through the list repeating Step 1 until you have assigned all the parts. Generally, you will find that after having mapped the left side, the right side should automatically map itself. (This is a great time saving feature, which is built into Life Forms).

3   **Mapping the fingers**: Your character has Puppet sections for fingers, however the default model only has one part representing the fingers. You can map the Finger part of the default model to each finger of you character. What this does is it applies any finger animation from the Source model to each finger in the Destination model. In the case of Walk3-1.lfa, the fingers have no keyframed motion, they inherit motion from the arm swing. You won't lose any information if you do not map the fingers. You can keyframe the animation of the fingers afterwards.

   Mapping complex fingers: When each finger is made of several parts, you should "group" those parts and then map the Default model's finger part to this group of parts. Here's how to do it. First use the window controls to zoom into the Hand. Hold down the SHIFT key and click on those parts that form one finger. Then, click on the Finger part of the source model.

4   **Checking the Joint Axes**: Go back to the top of the list of joints and starting with the first body part, scroll down the list and check the Joint Axes for both figures.The axes should match for each corresponding body part on the list. If you find objects whose axes do not match simply click the Joint axis box under your custom model. In the pop-up menu click the matching

axis. Once you have done this for all the body parts of your character, there is one more step.

5   **Apply a rotation to the arms**: Our character was modelled with his arms perpendicular (outstretched) to his body. The default figure has its arms down at his sides.

Mr. S.E.C.

Default human model

Life Forms needs additional joint map information to correctly apply the motion of the arms from the Life Forms Default model to the our character. This involves selecting the correct Angles to rotate the arms to the same position as the default model's. This is done by mapping the arm and then clicking the Choose button in the Joint Map editor. This opens the Choose Angles window. This window displays the figure with the arm in different positions (all increments of 90 degrees). Select the set that shows the arm in the desired rest position.

You want to avoid this workaround by building your models with arms down to the side. This rest position is used by both the default human and BioVision skeletons.

For Mr. S.E.C we used the following settings for the Upper and Forearm:

Select the upper arm of your character. For the **right shoulder**, or **upper arm**, make sure that Map Mirror Joints is **NOT** checked. Then, Enter the

following rotation angles in the Angles Field: X= 0 Y= 0 Z= 270, and check the Mirror checkbox.

For the **left shoulder** or **upper arm**, make sure that Map Mirror Joints is **NOT** checked. Enter: X= 0 Y= 0 Z = -90 and Do **NOT** check the Mirror checkbox.

For the **left forearm** and **right forearms**, again make sure that Map Mirror Joint is NOT checked. The X, Y, and Z values should be 0 and the Mirror checkbox must be **CHECKED**.

Note: these settings work for the particular model we have used, and for the relatively simply motion of the arms in the Walk3-1.lfa. You may find that they do not work as well for arm movements with lots of twists and rotations in all three planes. Pasting motion will still be useful for getting the motion of all other body parts, and in some instances the motion of the arms is also applied fairly well. You may have to manually correct the motion of the arms. A tutorial containing guidelines for choosing the correct settings for your particular model and techniques for manually correcting the arm positions in the problem keyframes is being written. For more information contact support@credo-interactive.com.

6   **Apply the joint map**: When mapping, joint axes, and the mapping of the shoulder or upper arm rotations has been done correctly, click OK. Life

Forms will now paste the copied animation to the character according to the joint map you defined.

In the Timeline for your character, you should now see the motion capture walk cycle mapped onto your character's body parts. To see your character walking, simply click the first frame on the timeline and click the Play button in the Control panel. You'll see your character walking!

Pasting in a New Animation: From Walking to Running

Now that you have mapped your model successfully, you can apply any animation that was created using the default human to your character. Here we will apply a Run animation to the end of the Walk sequence we pasted before.

1 **Open the File Browser**
Choose **File menu > Browser**. Locate *Life Forms 3 folder/Animation Gallery/ RUN1.lfa*.

2 **Position the insertion point**
In the Timeline of your character's animation, click a frame to position the insertion point there.

3 **Insert the frames of RUN1.lfa**
In the File Browser, click **Paste**. This inserts the animation from RUN1.lfa into your animation. Again, the Joint Map editor will appear. Because we have already defined a joint map for pasting motion between these two models, you don't have to do anything here. Just click OK.You will see that the Timeline now includes the run cycle as well as the previously mapped walk cycle

4 **Play the animation**
To watch the full animation, click the Rewind button to advance to the first frame, the click the Play button. This animation is now ready to export into Lightwave.

Tip: If you don't want Joint Map Editor to open each time you repeat this Paste command, uncheck the Always Show Joint Map checkbox.

This would be a very good time to save your Life Forms animation!)

Exporting Animation from Life Forms

1 **Export a LightWave scene file.**
Make sure that the animation file containing your character is active.
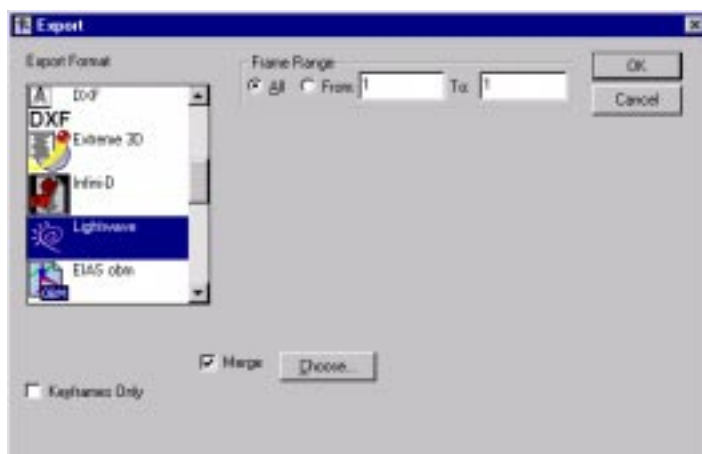Then, choose **File menu > Export**. In the Export Format list, select **Light-Wave.**
- **Uncheck** the Bones Only option.
- **Check** the **Merge** option
- Do **not** check **Keyframes Only**.

When Life Forms exports motion it keyframes every frame of the animation - hence if the frame rate is 10f/s it will create 10 keyframes for each second of animation. This ensures that LightWave has enough data to interpolate the motion correctly.

To make it easier to edit the animation in LightWave, however, you may want to export Keyframes Only. However, for some motions you may find that the motion has *discontinuities* in the motion - a sudden break or jerk in the animation caused by the joint moving from one position to the next using an alternate route that does not make sense for that animation. Another way to reduce the number of keyframes generated (without reducing the frame rate) is to Thin the keyframes. See "Thinning Motion Capture Sequences" on page 12.

Exporting all frames as keyframes ensures that the motion data is correctly interpolated in Light-Wave. To reduce the number of key-frames you can try exporting Key-frames Only, or thinning keyframes before export.

Export dialog box

2 **Merge the animation of your character to the scene file it came from**
In the Export dialog box, click **Choose** to open the Merge dialog box. Select the Lightwave scene that you saved earlier. This will be the file that Life Forms is going to merge animation to. Click **Open** to merge the file and click **OK** to close the export window. Now a Save dialog box will ask you to rename and save the Merged Scene file. Do so and click OK.

3 **Overwrite the scene file**
You will be asked if you want to overwrite the file. Select **YES** and Life Forms will take a few seconds to merge the files.

Importing Animation into LightWave

1 **Import motion**
In Lightwave, load the file you just saved. Go to the Objects panel and load the:
    • anchor object, and
    • metamation target object.

2   Reassign the anchor object

Reassign the Anchor object as PUPPET_ANCHOR and reassign the Met-amation plug-ins. Dissolve your anchor 100% along with your puppet sections and you should see your Puppet Master character moving as he did on the Life Forms Stage!

Note: Parented objects may appear in weird places

If you have any parented objects, (such as a head object in our case) that were brought into the scene after exporting from Life Forms, those objects appear to be offset from their position as you scrub through the frames. Don't panic. If you are a frequent user of Puppet Master, you will realize that Lightwave 3D does not update correctly for Puppet Master in Layout when Puppet Section Object is not selected while scrubbing.

End Comments from the Author

After you have gone through this cycle once, you will find Life Forms a huge time saver for generating complex movements for your characters, whether that motion was keyframed or taken from existing motion files, or created by combining both techniques in the same animation. We hope that this tutorial was enough to get you familiar with the use of Life Forms as it relates Puppet Master, and feel free to email me with any questions, or corrections relating to this tutorial. Have fun!

**Ed Konyha,
Creative Director,**
ed@brainchildstudi-os.com
Brainchild Studios, Inc.

Applying Mocap sequences

How does this tutorial help me if I want to use BioVision motion captured sequences and not animation from the default humans? If you want to apply motion captured sequences, the procedure is the same as described in the tutorial except that you will be copying and pasting the keyframes from the BioVision skeleton instead of the Default human to your custom model. You'll then have to define a joint map for mapping the BioVision skeleton to your custom model.

Short-cut: However, if you have already mapped the Default human to the custom model, there is a short-cut you can use. Simply paste the keyframes from the BioVision skeleton to the default model first. Then, copy the keyframes the default model and paste it to the custom model.

Thinning Motion Capture Sequences

RUN1.lfa is not a motion captured sequence. However, if you are using motion capture, you should consider *thinning the keyframes* in Life Forms before exporting the animation to LightWave. With fewer keyframes the scene file is smaller, and it will be easier to add secondary motion in LightWave by offsetting finger motion for example.

1   Select the range frames you want to thin.

Hold down the SHIFT key while you click on the first frame in the range. Scroll to the last frame in the range and click on it. The range of frames you selected should now be enclosed.

2 **Open the Thin Keyframes dialog box**
Choose **Edit menu > Thin Keyframes**. You can thin some motion sequences more severely than others. For a simple motion sequence you may choose to keep as few as 1 keyframe every **5** frames. You'll have to experiment to determine the ideal ratio.

3 **Experiment to determine the ideal ratio**
Click Play in the Control Panel and examine the quality of the animation. Click **Edit menu > Undo** if you are not satisfied with the result.

Related Resources

A Free tutorial is available at: http://www.tv3d.com/Articles.html

Notes about Puppet Master at: http://www.lightwavelab.com/puppetmaster.htm

Caveats

When your custom model's arms are out-stretched to the side, Life Forms may not be able to paste arm motion to 100% correct. To map the motion as correctly as possible some experimentation is required to find the correct combination of settings in the Joint Map editor.

A tutorial containing guidelines for choosing the correct Settings for your particular model and techniques for manually correcting the arm positions in the problem keyframes is being written. For more information contact support@credo-interactive.com.

Acknowledgements

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- Tony at Nemesis Productions for experimenting with building models arms down.

If you have suggestions or corrections to make, or you want to contribute a tutorial you feel will help Life Forms and LightWave users, email your ideas to info@credo-interactive.com.