

# Motion Capture Programming Assignment

CS 448D: Character Animation

Due: Wednesday, May 27<sup>th</sup> 11:59PM

## 1 Logistics

In this assignment, you will learn how to process motion capture data from a modern active-marker motion capture system. The assignment will require you to install Autodesk MotionBuilder. A trial version of Autodesk MotionBuilder is available from the Autodesk website, at <http://usa.autodesk.com/adsk/servlet/mform?siteID=123112&id=9415220>. If for whatever reason you are unable to install or run the MotionBuilder trial, please contact the course assistant.

Once you have installed MotionBuilder, you should obtain the marker data from the course website. We ask that you not distribute the data. You will modify the .fbx file containing the marker data to attach an actor to the markers and then bind a character to the actor. The completed .fbx file with a character animated from the motion capture data should be submitted by e-mail to the course assistant.

The remainder of this document provides a high-level tutorial for processing motion capture data in MotionBuilder. If you have trouble performing some task, please consult the MotionBuilder manual first, as well as the internet. If you are still stuck, you are welcome to contact the course assistant.

This assignment is meant to be completed individually.

## 2 Procedure

### 2.1 Load the Data

Your first step should be to load the mocap.fbx file in MotionBuilder. At the Open Options dialog, click “Open.” You should now see a set of markers in the Viewer window. Feel free to rotate or pan the view using the buttons at the top of the Viewer, and scrub through the frames using the bar at the bottom of the Transport Controls. Note the pulldown menu in the Transport Controls



Figure 1: Toggle between tracks using the pulldown menu.

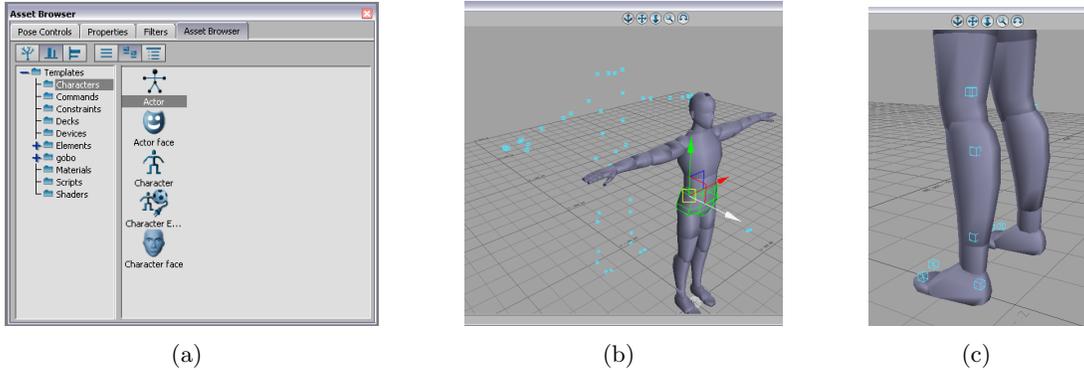


Figure 2: Drag the actor into the Viewer pane to create one, and then fit it to the markers.

section (fig. 1), which should read “Take 001.” There are two takes in the mocap.fbx file. “Take 001” is the T-pose, and “Take 006” is the actual animation. You may flip to “Take 006” to see the animation, but for now we will work with “Take 001.” The T-pose is meant to make it easier to attach an actor to the markers, and is usually recorded at the beginning of every motion capture session.

Note that “Take 006” has accompanying audio – you can see it in the Navigation pane under “Audio.” To hear the audio (if you wish), you may need to select your audio device under “Destination.” If you want, you can use the clapboard to synchronize the audio to the motion, but this is not required.

## 2.2 Position the Actor

In the Asset Browser, select Characters. Click and drag the Actor asset into the Viewer pane (fig. 2). You should now see a human figure in the Viewer pane. This is a model of the actor that we would like to fit to the markers. Now scrub through the frames until you find one where the T-pose is best aligned with the axes - the arms should be parallel to the ground, the head should be pointing straight ahead (this may be tough to tell), and the trunk should be as close to vertical as possible. Now we must fit the actor model to the markers.

You can manipulate the actor model by clicking on individual body parts in the Viewer and selecting a tool from the right edge of the Viewer pane. If you have used a 3D modeling tool in the past, these tools should be immediately usable. If not, you may want to take a moment to familiarize yourself with the Translate, Rotate, and Scale tools. By clicking on individual parts of the actor and manipulating them, you can position the actor to best fit the markers. Moving or rotating body parts will also affect the parts farther down the skeleton. So translating the pelvis, for example, will move the entire actor.

Now you should manipulate the actor to best fit the T-pose. Aim for the markers to be located on the surface of the actor model, just as they would be on the skin of a real person. Remember that you may need to rescale some body parts to fit.

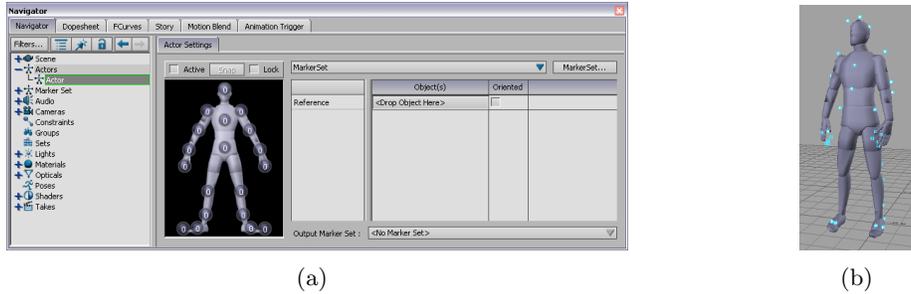


Figure 3: Create a new marker set and map the markers to the actor. Once the marker set is activated, the actor will follow the markers.

### 2.3 Attach Markers

Once the actor is fitted to the markers, select the actor in the Navigator pane (on the left side). This will bring up the Actor Settings. Click “MarkerSet” and create a new marker set. There should be a circle with a “0” over each body part of the actor. Now we must assign markers to each body part (fig. 3). Note that since the motion capture system used active markers, they are already labeled - that is, the system already knows which marker is which across frames. Therefore, all markers are uniquely identified. You can scroll through the full list of markers in the scene by expanding “Scene” and “OWL:Optical” in the Navigator pane. Now, click on each marker in turn, either in the Viewer or the Navigator pane, and drag it onto the circle on the actor schematic that corresponds to the body part that marker is on. The number in the circle should increment. You can undo your decision by clicking on the circle and deleting the marker from its list. For the hands, try to identify the markers that are not attached to the fingers – there should be only two markers on the wrists. You are not required to attach the finger markers to any body part.

Once you are done, all markers but two should be assigned to some body part. Two of the markers correspond to the clap board that was used to synchronize the motion to the sound, and will not be mapped to the actor. At this point, you may want to save your work. Now, check “Active” in the Navigator pane. The actor is now bound to the marker set, and you should be able to scrub through the sequence and see the actor move with the markers. If the actor appears awkward or wrong, you may want to restore your saved work and either reposition the offending body parts or reassign some markers until activating the marker set achieves the desired results.

### 2.4 Clean the Data

Now the actor is mapped to the markers, and we can switch to “Take 006.” If you play “Take 006,” you may notice occasional anomalies, such as twitching limbs. Although this motion capture sequence is relatively clean, occasionally markers become occluded or their position is computed incorrectly. You should now try to find each such anomaly and correct it. The simplest way to do this is to watch the sequence and pause at each one. Then, try to identify the marker that is responsible for the problem (often a marker positioned on the offending body part). Double-clicking on the marker will bring up a graph of its position in the Navigator pane. Here, you can correct mistakes by selecting and deleting incorrect positions, which often occur around occlusions (indicated by grey intervals with black borders in the graph, fig. 4). MotionBuilder will automatically

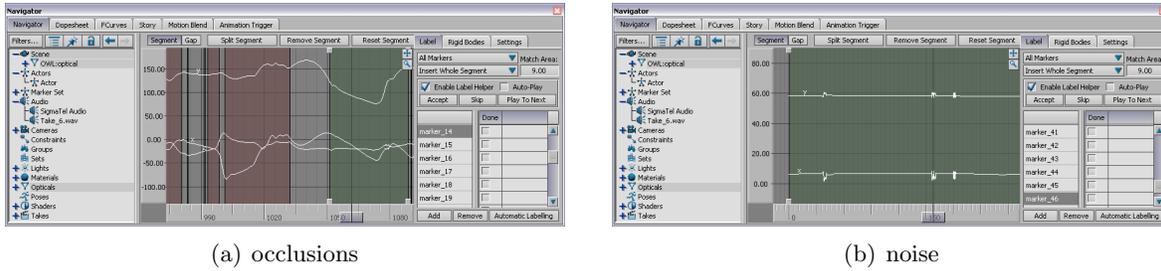


Figure 4: Occlusions and mistakes in marker tracking will cause anomalies.

interpolate over deleted frames. For further details on cleaning up the motion of a single marker, see “Segment and Gap Options” in the MotionBuilder manual. It can sometimes be difficult to figure out the cause of an anomaly, so try to be patient.

## 2.5 Animate the Character

Once the actor animation is smooth and continuous, we can map a character to the actor. To make motion capture data useful, we usually want to animate some skeleton with it. The configuration of this skeleton will often depend on our specific application. This is why there is a distinction between the actor and the character. For this assignment, we will use a simple skeleton contained in the char.bvh file that was included with mocap.fbx. First, import the bvh into the scene (File, Import...). This may put you into a dummy “char” sequence, so select “Take 006” again from the dropdown list. The parts of the skeleton use the MotionBuilder naming convention, so MotionBuilder should be able to automatically recognize it as a biped skeleton. You should see an entry “Hips” in the Navigator under “Scene.” Select the entire “Hips” tree, and drag a Character from the Asset Browser. Select “Characterize” (fig. 5) and “Biped.” Now select the new character in the Navigator. In Character Settings, “Actor Input” from the “Input Type” menu and check “Active.” The character skeleton should now be animated. Feel free to play around with the character settings to produce a more accurate remapping of the animation, though this is not required.

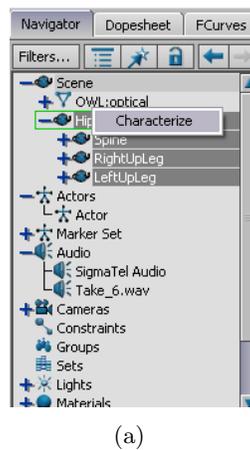


Figure 5: Drag the character onto the entire selected skeleton subtree and select “Characterize.”