CHAPTER 9: MOTION-CAPTURE ANIMATION

SETTING UP THE CHARACTER SKELETON IN 3DS MAX

Important: You'll need to use BAE to extract the contents of the Skyrim - Meshes.bsa and Skyrim - Animations.bsa archives. Instruction on how to do so can be found in the section Unpacking the BSA Archives.

For these next few sections, we'll need a copy of Havok Content Tools. Sadly it doesn't seem like there's an official download source anymore following Microsoft's acquisition of Havok. But I can't stop you from Googling around…

I would recommend using 3ds Max 2012 or earlier. Some modders have reported that the 3ds Max 2013/2014-compatible versions of Havok Content Tools have issues exporting animations properly for Skyrim. As far as I'm aware, there are no 3ds Max 2015+ compatible versions of Havok Content Tools.

For 3ds Max 2012 I'd also recommend using figment's branch of the Nif Importer/Exporter plugin as the current version on Nexusmods may raise a ParamBlockDesc2 definition error when 3ds Max launches.

There are many body type frameworks for Skyrim with differing bone setups. In the following examples I'm just going to be working with the base-game skeleton.

Now with all of that out of the way, let's get started.

Firstly, we'll need a copy of the Vanilla Skeleton which you can download from Loverslab. You'll need to be logged in to download this file.

Warning: There's some NSFW content on Loverslab. *Some* might be an understatement…

Open 3ds Max 2010_Skyrim_Vanilla Skeleton.max.

If you see a Gamma & LUT Settings Mismatch warning, select 'Adopt the File's Gamma and LUT Settings' then click OK.

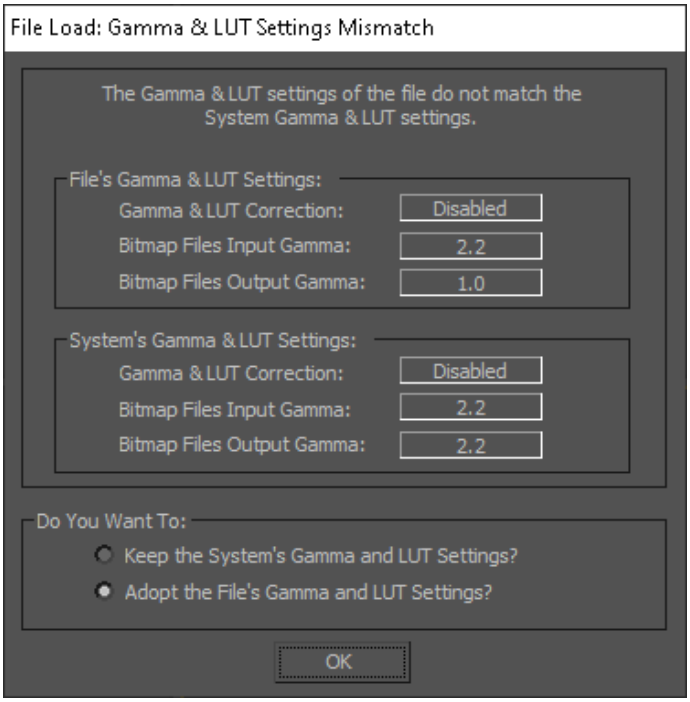

Figure 1207 - Gamma & LUT Settings Mismatch.

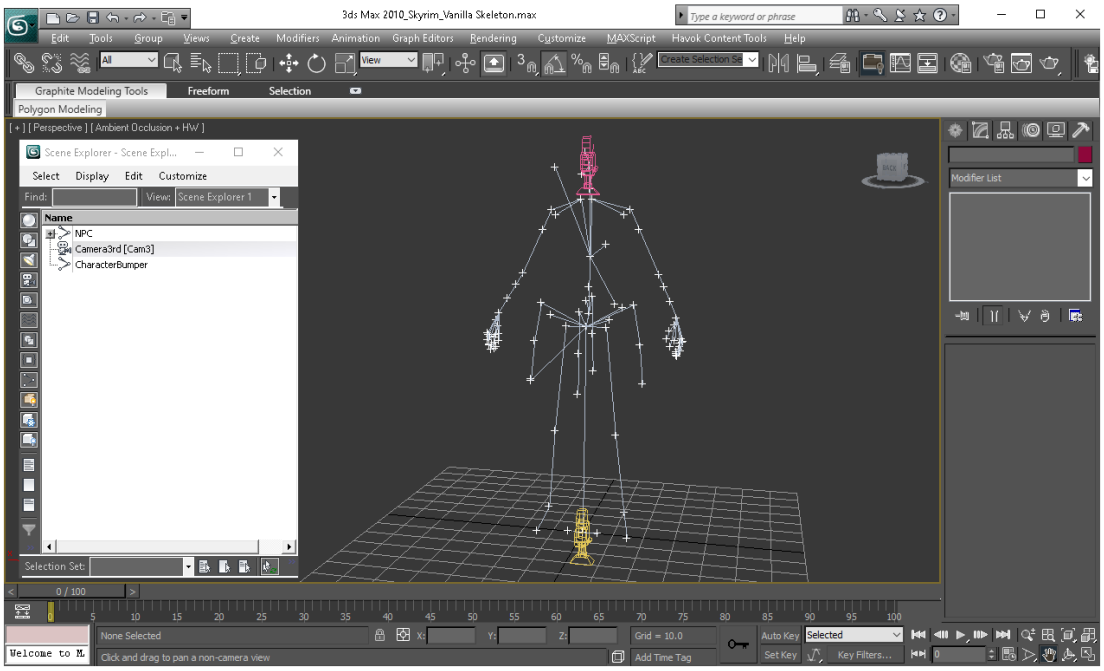

Figure 1208 - Vanilla skeleton loaded into 3ds Max.

Next, let's import a body mesh.

Go back to Import.

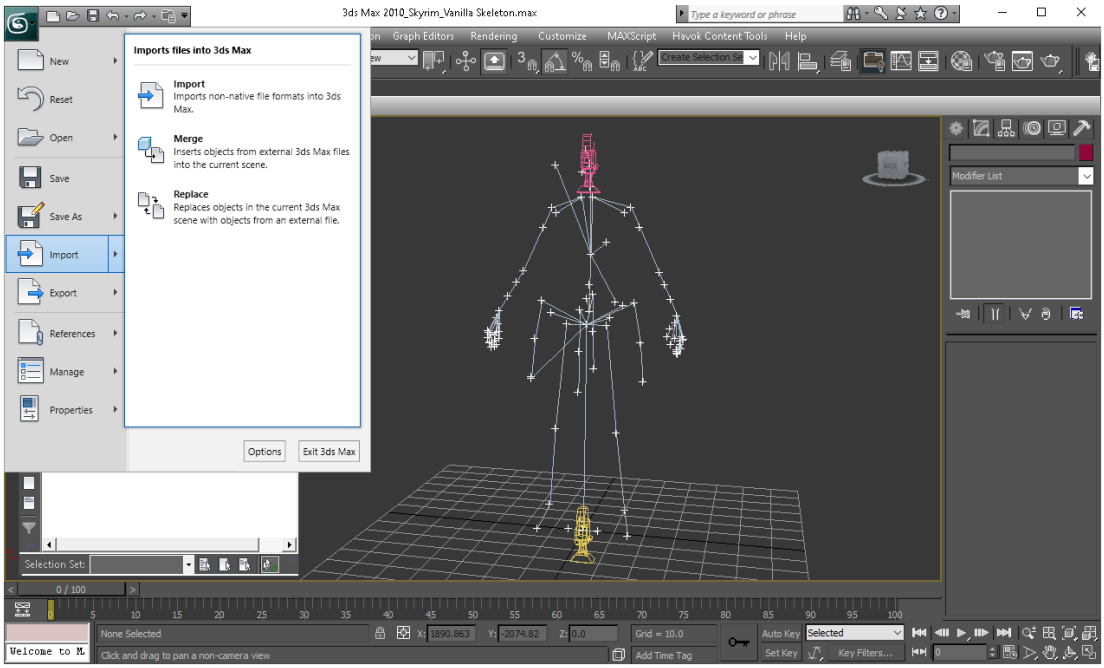

Figure 1209 - Importing a new asset.

This time, select malebody_1.nif then click Open.

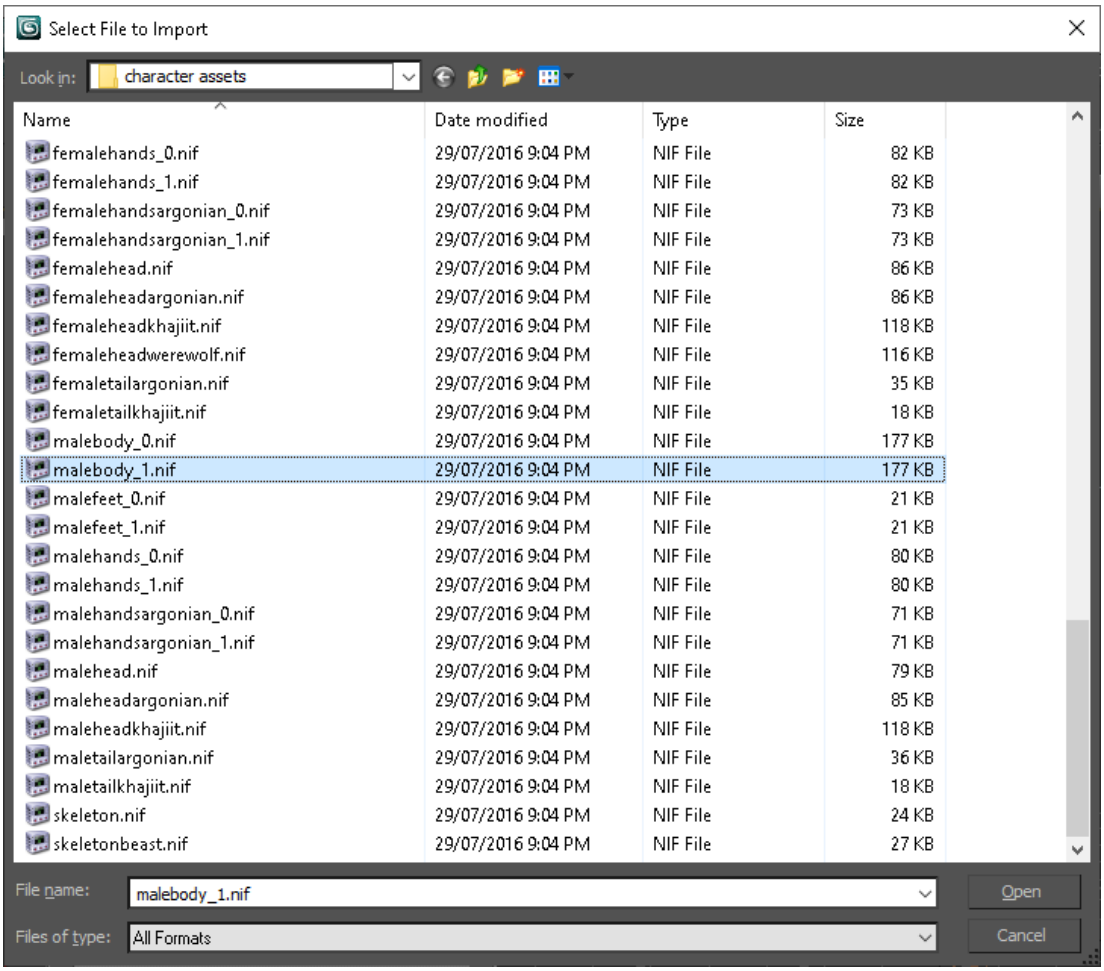

Figure 1210 - Importing malebody_1.nif.

Tick Vertex Colours, Skin Modifier, Auto Smooth Mesh, Flip UV, Render Textures in View, Ignore Root Node and Use Niftools Shader are ticked then click Import.

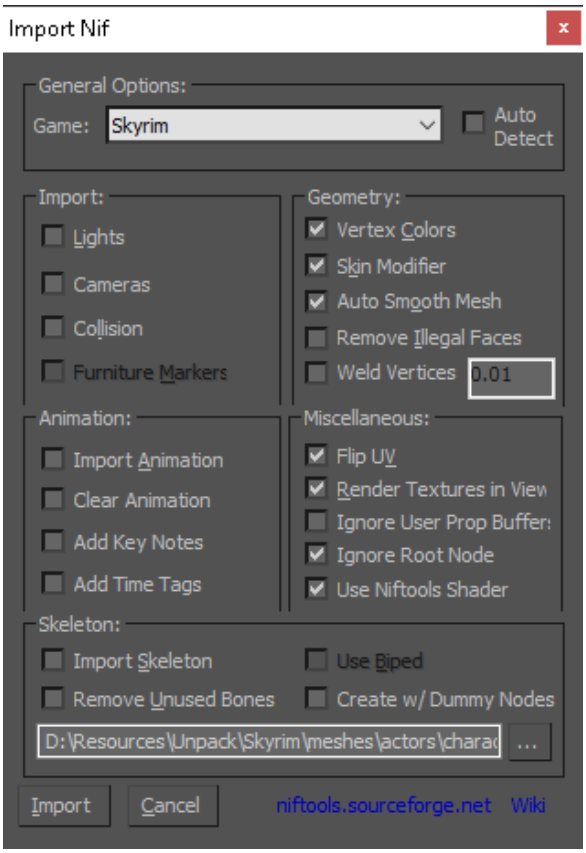

Figure 1211 - Import settings.

You should now see the torso and arms and legs covering the skeleton.

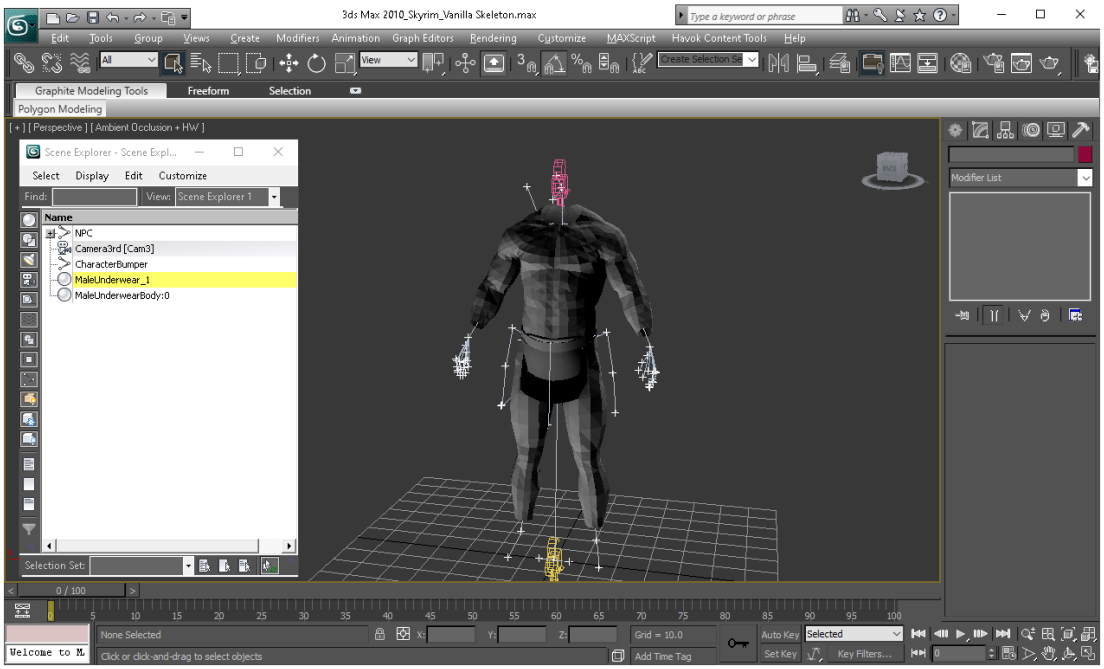

Figure 1212 - Imported malebody_1.nif.

Repeat these steps to import malefeet_1.nif, malehands_1.nif, and malehead.nif.

We should now have a full body as per the screenshot below:

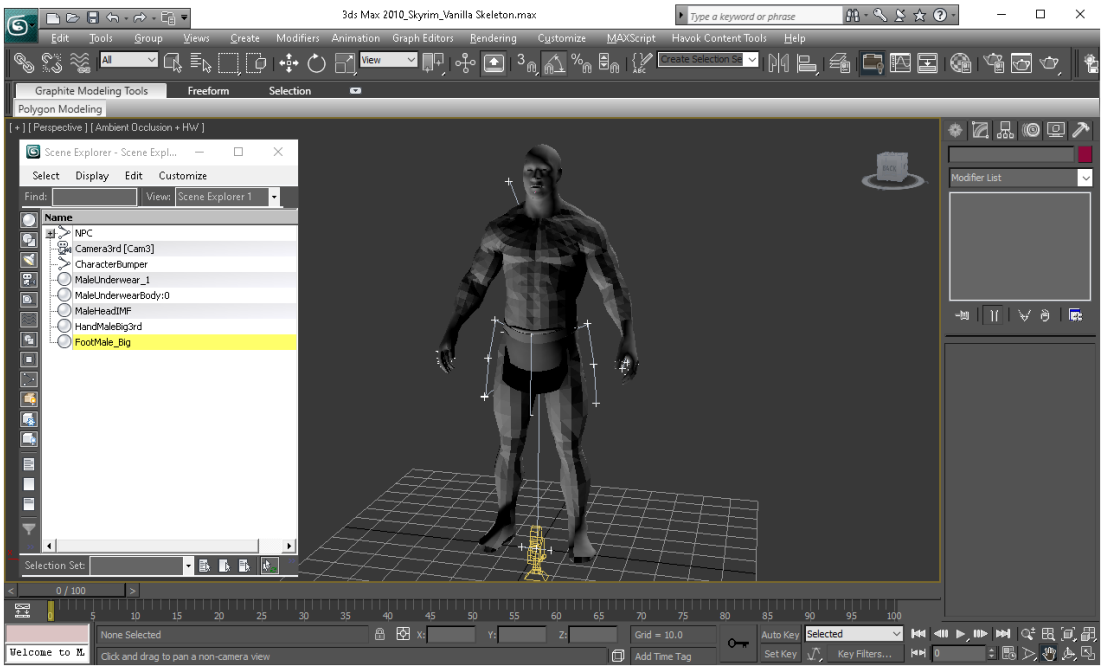

Figure 1213 - The rest of the body parts imported.

Next, let's test importing an animation to ensure everything works as it should.

In order to do this we'll need a copy of hkxcmd which can be downloaded from Nexusmods.

Extract hkxcmd to a new folder.

Browse to that folder and create two new subfolders, one called Input and the other called Output.

Copy the skeleton.hkx file from your skyrim\meshes\actors\character\character assets directory.

Note: You'll need to extract the assets from the Skyrim - Animations.bsa archive first.

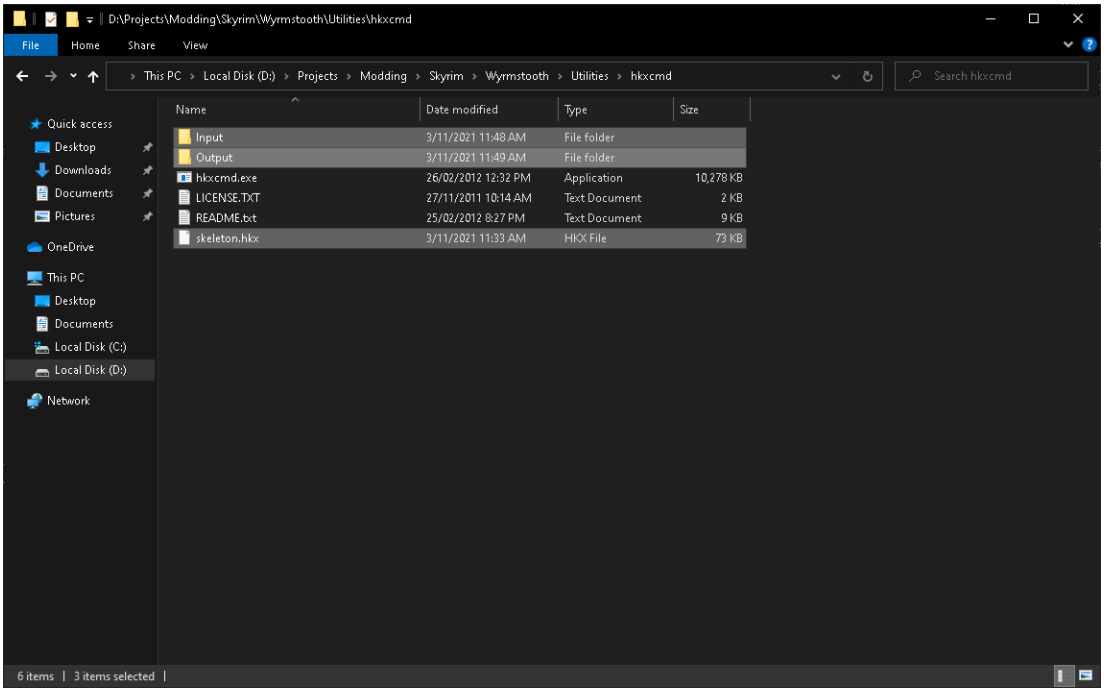

Figure 1214 - Setting up the hkxcmd folder.

Next, browse to skyrim\meshes\actors\character\animations.

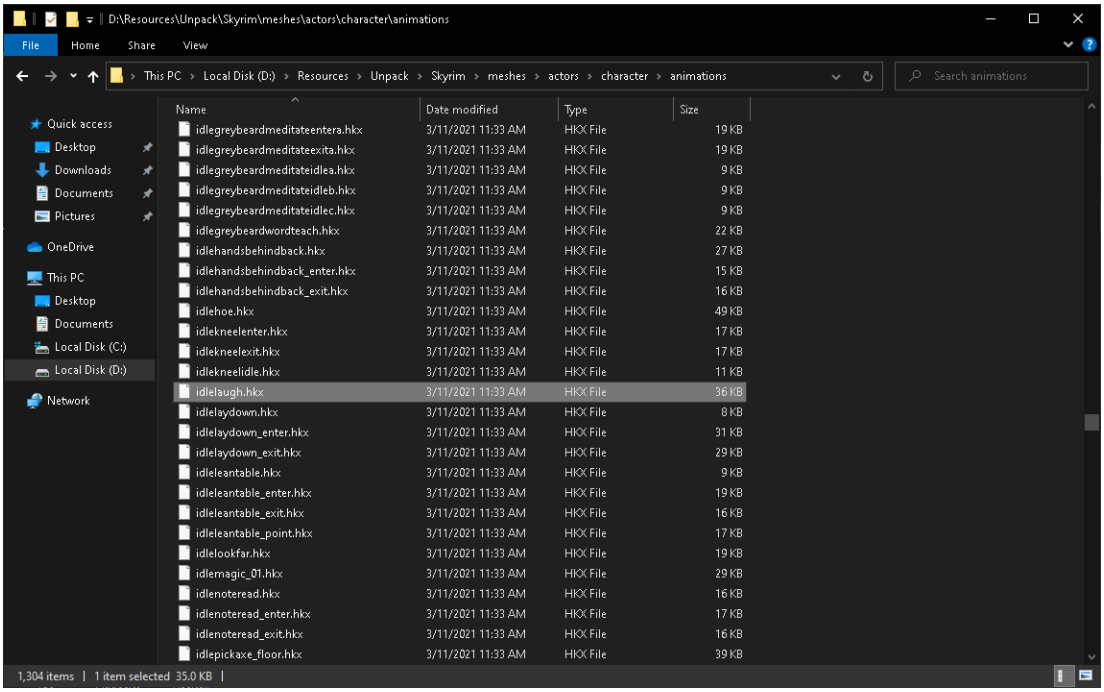

Figure 1215 - List of idle animations.

Copy one of the .hkx files to your hkxcmd\Input folder.

For this example, I just copied idlelaugh.hkx.

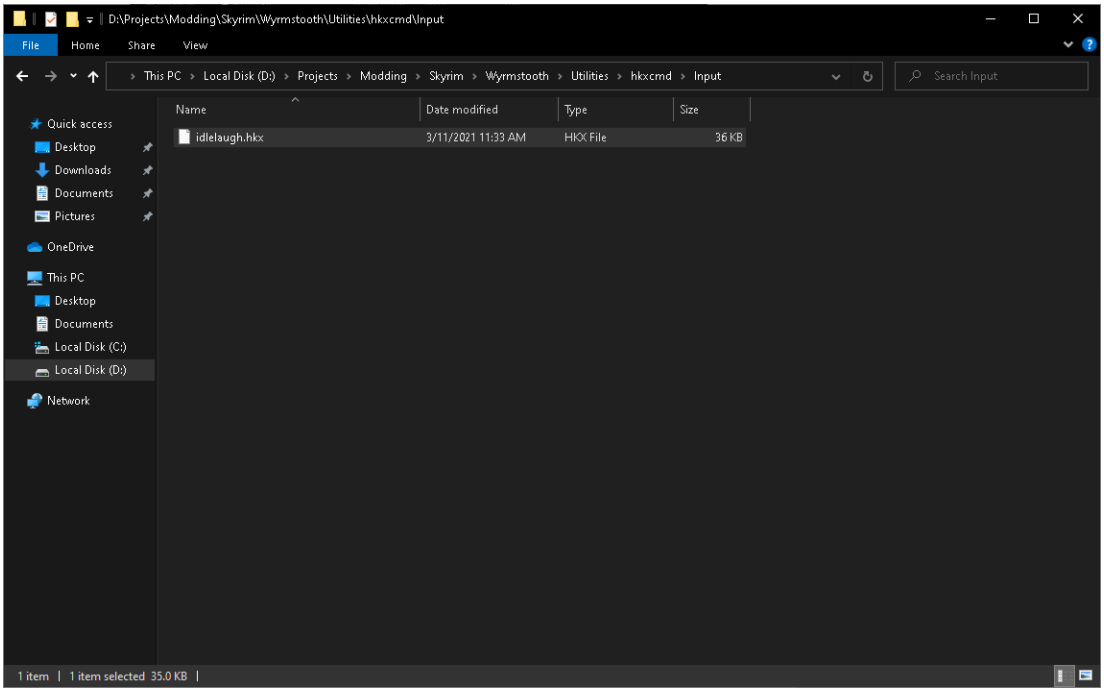

Figure 1216 - idlelaugh.hkx copied to the input folder.

Now open a command prompt and navigate it to your hkxcmd folder.

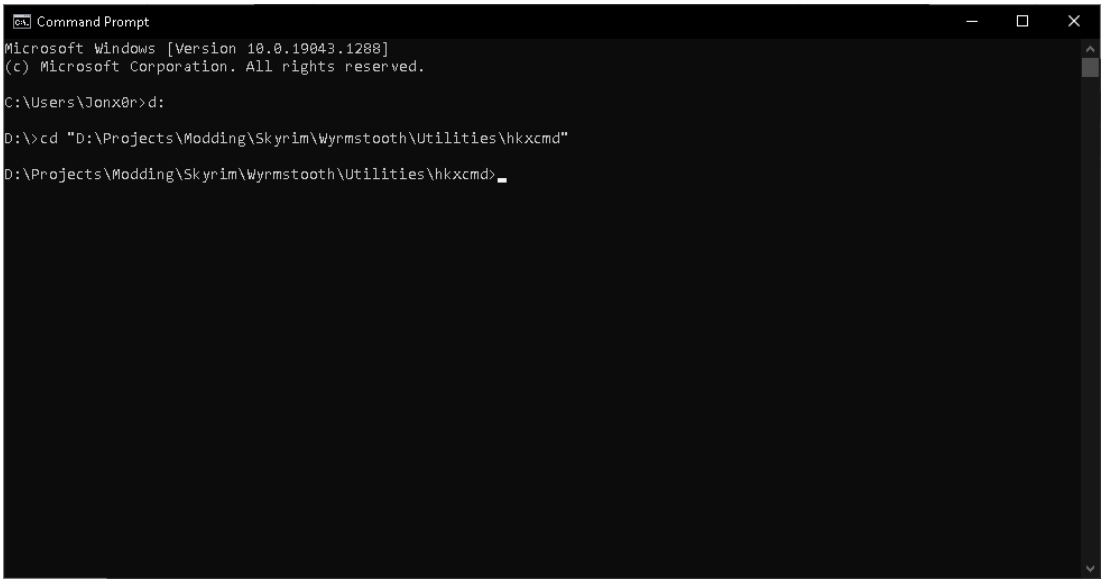

Figure 1217 - Command prompt pointed to the hkxcmd folder.

Run the following command:

```
hkxcmd exportkf "skeleton.hkx" "Input" "Output"
```

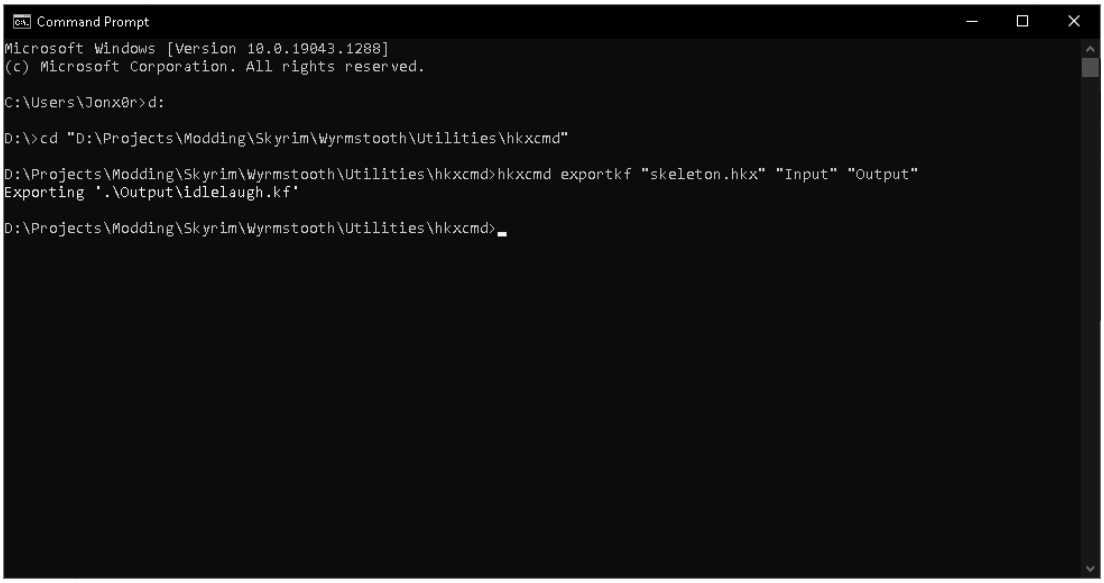

Figure 1218 - Converted the .hkx idle animation file to .kf.

This utility will convert all .hkx files in the Input folder to .kf files which are placed in the Output folder.

Confirm the animation file(s) were successfully converted to .kf.

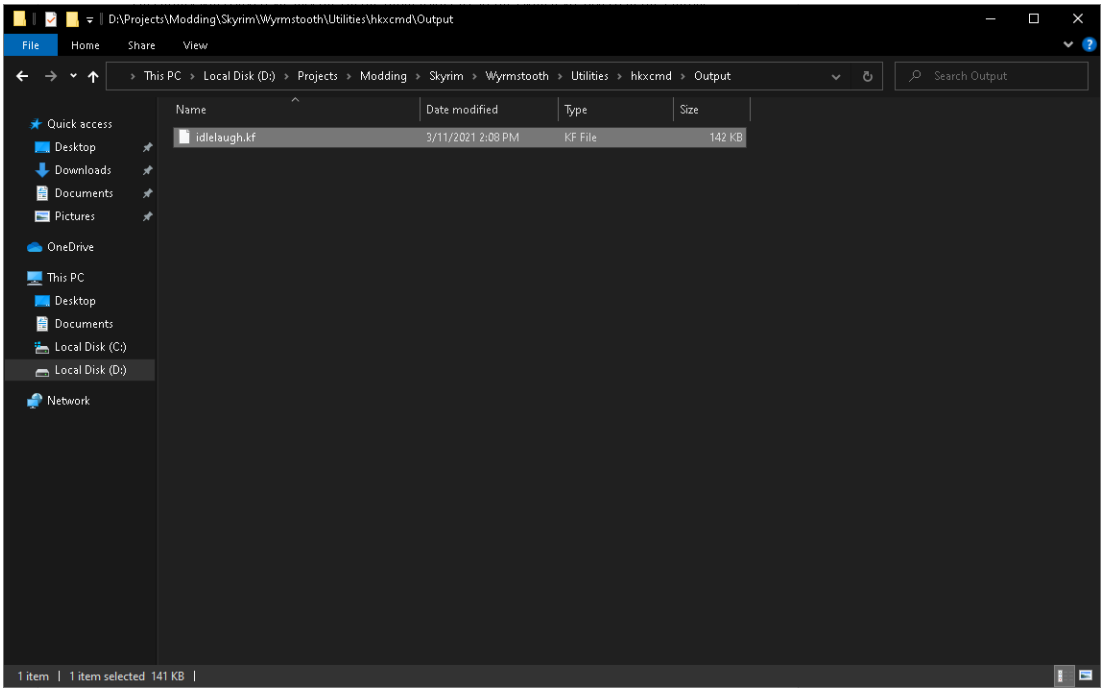

Figure 1219 - idlelaugh converted to .kf format.

Back in 3ds Max, go to Import.

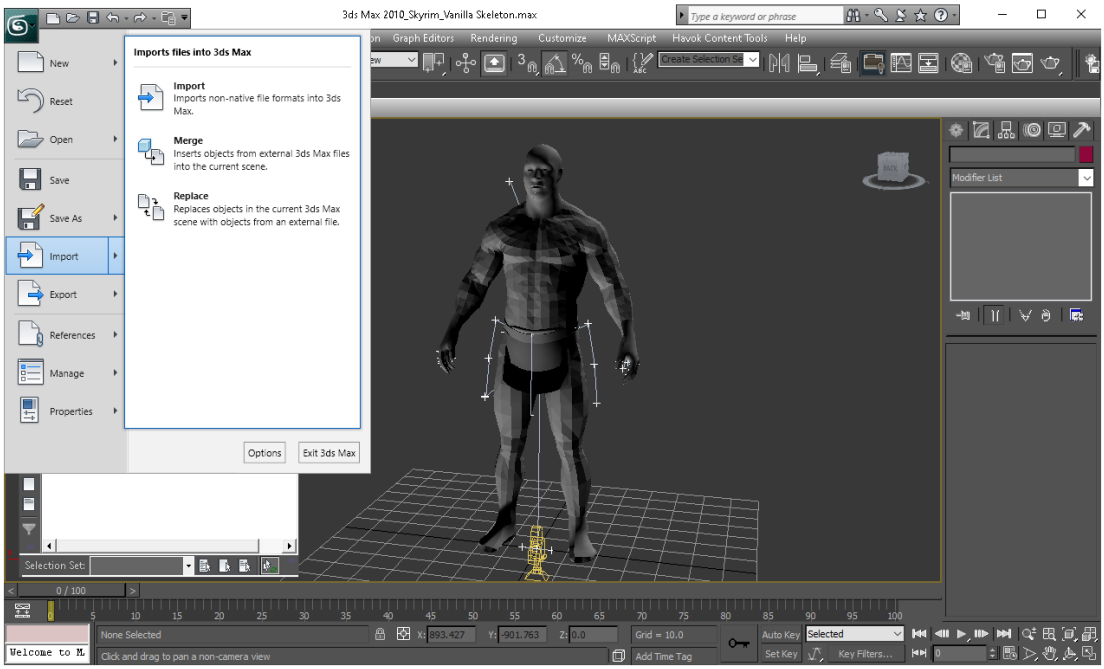

Figure 1220 - Importing a new asset.

Browse to the hkxcmd\Output folder, select the .kf file you converted, then click Open.

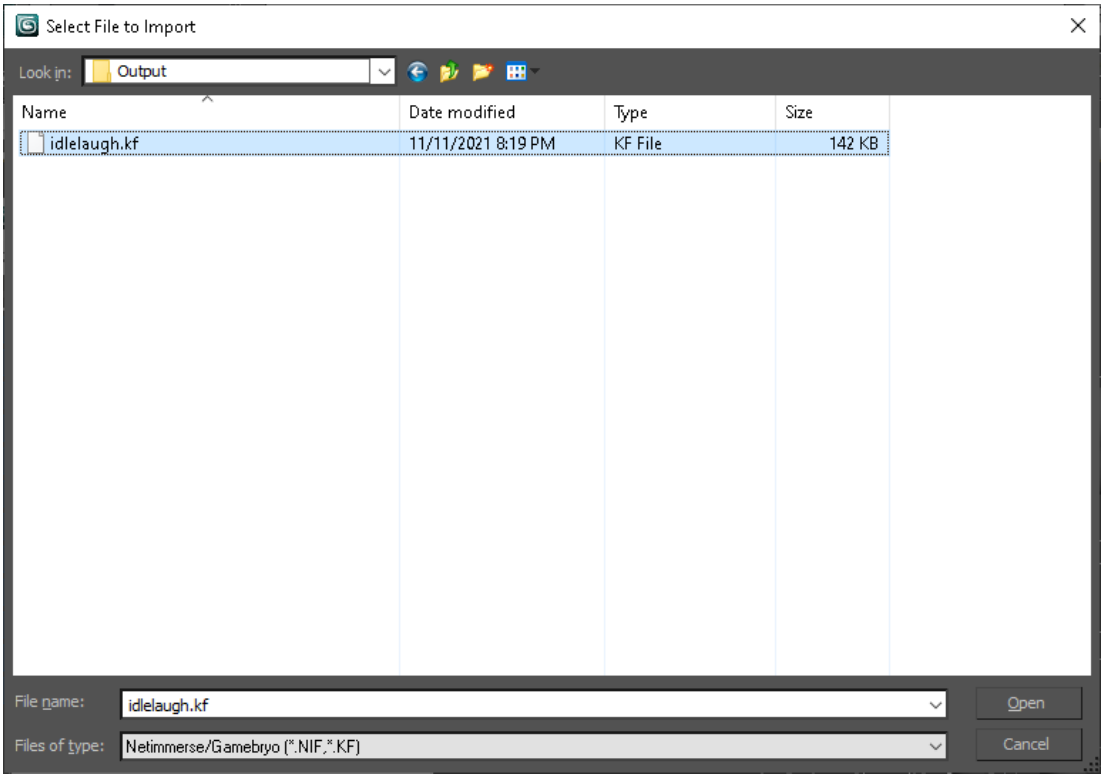

Figure 1221 - Importing idlelaugh.kf.

No need to tick anything, just click Import.

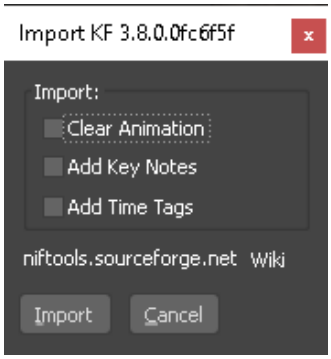

Figure 1222 - .kf import pop-up.

Scrub the timeline and confirm the animation plays as expected.

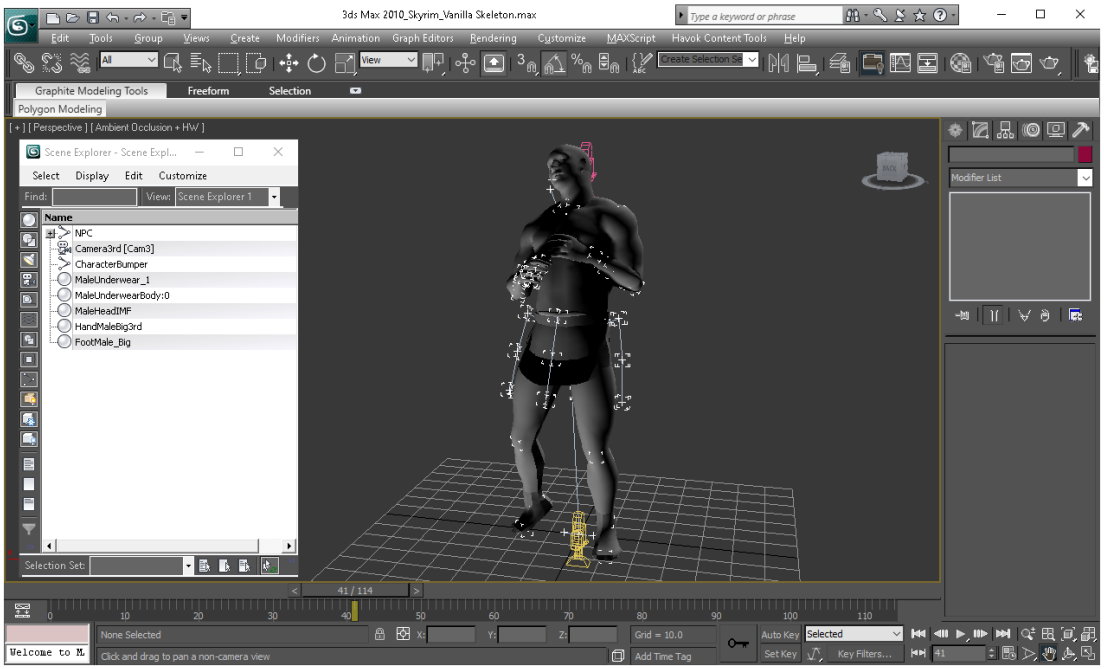

Figure 1223 - Animation plays as expected.

Both the bones and the character mesh should move as you scrub the timeline.

CONSTRAINING THE SKELETON TO A BIPED AND IMPORTING MOCAP DATA

Now that we have a skeleton imported into 3ds Max, let's try and import some mocap data.

These next few sections can be a bit complicated, so I've tried to keep each step as granular as possible.

For this example, I'm going to use the mocap data recorded by Carnegie Mellon University which is available on their website.

In order to use this data in 3ds Max to animate our skeleton, we'll first need to create a biped object and constrain the bones of our skeleton to the biped object. So basically we'll be importing the mocap animation onto the biped object and as it moves, it'll also move our skeleton.

First, let's make the character mesh transparent. Hold down CTRL and left click on the head, torso, hands, loincloth and feet to select them all then press ALT + X to make them transparent.

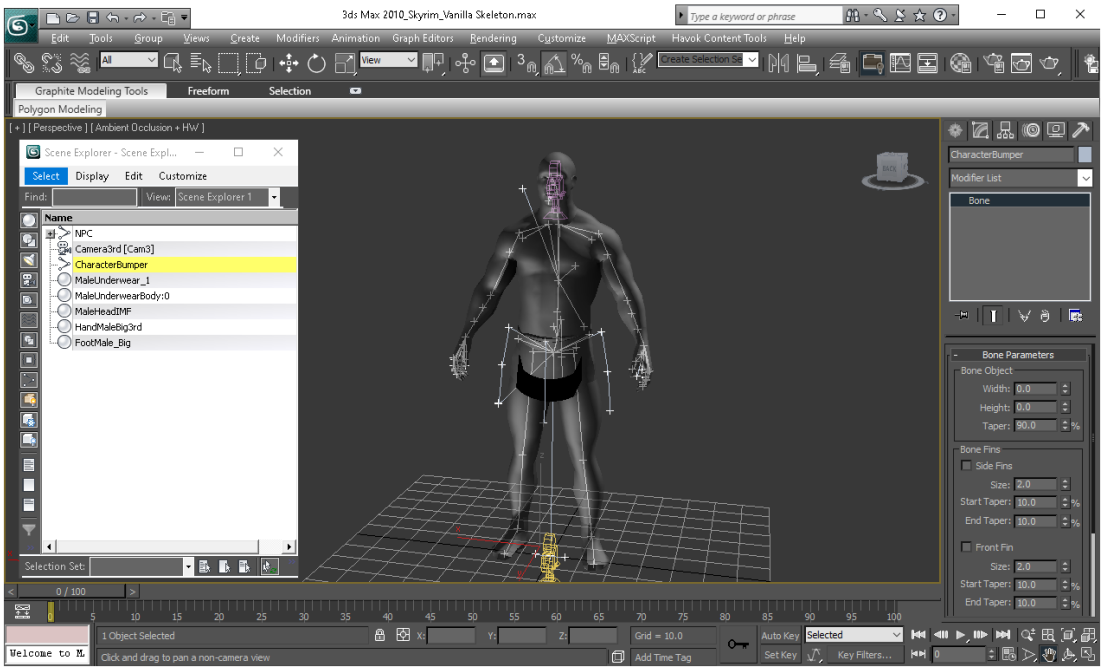

Figure 1224 - Making the character mesh transparent.

With the character mesh still selected, right click and select Freeze Selection.

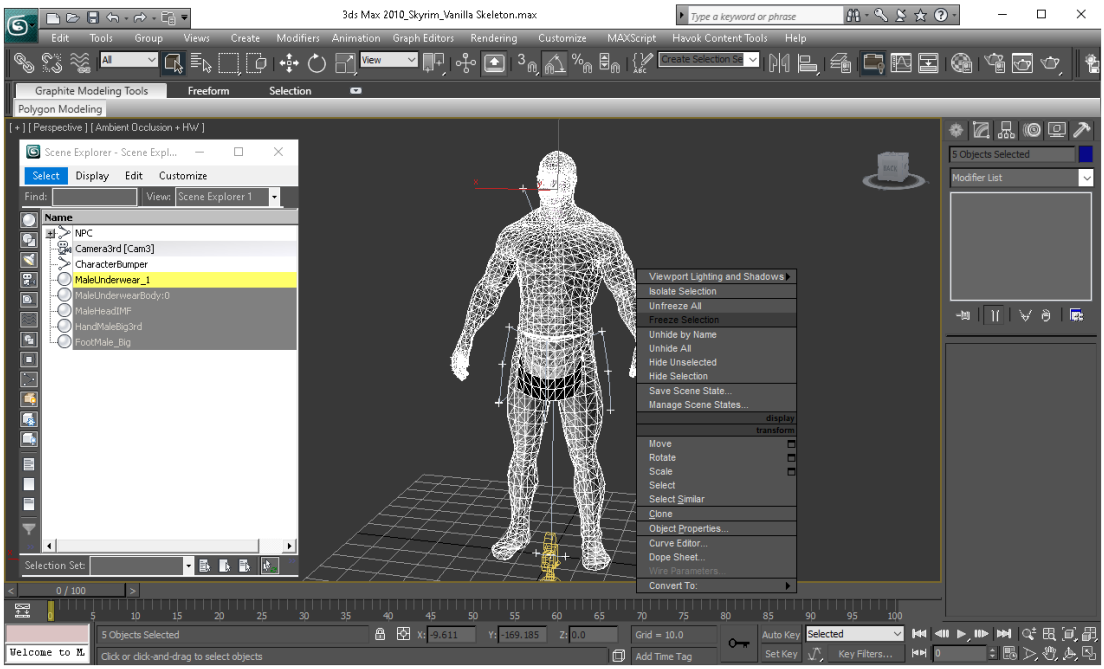

Figure 1225 - Freezing the character mesh.

This will prevent us from accidentally selecting the character mesh when working with the bones in the upcoming steps.

Go to the Create tab and go to Systems.

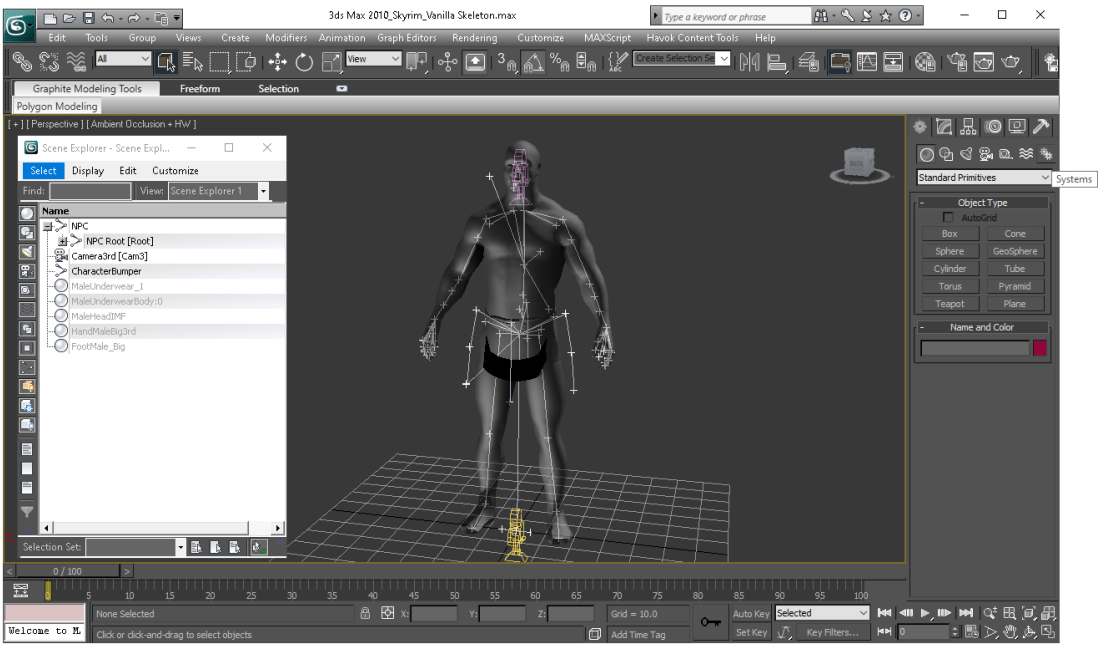

Figure 1226 - The Create tab.

Press F to go to the front view then click on Biped.

Set Fingers to 5 and set Finger Links to 3. Ensure Spine Links is set to 4.

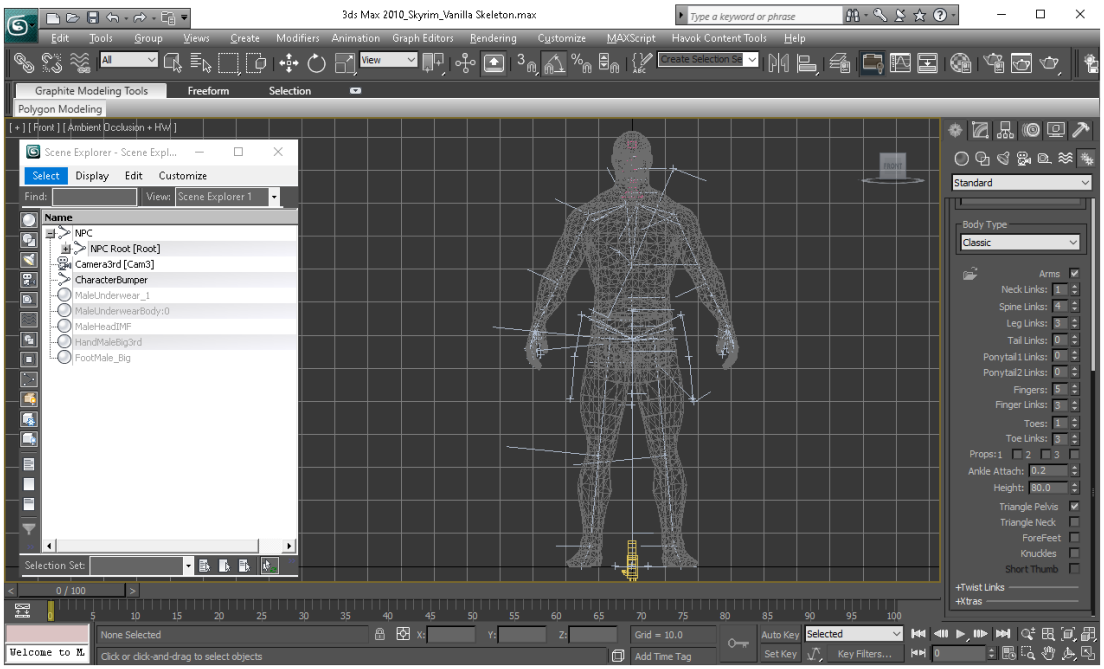

Figure 1227 - Biped settings.

Click and drag in the viewport starting from the bottom. Make it about the same height as the skeleton. This new biped should be named Bip01 by default.

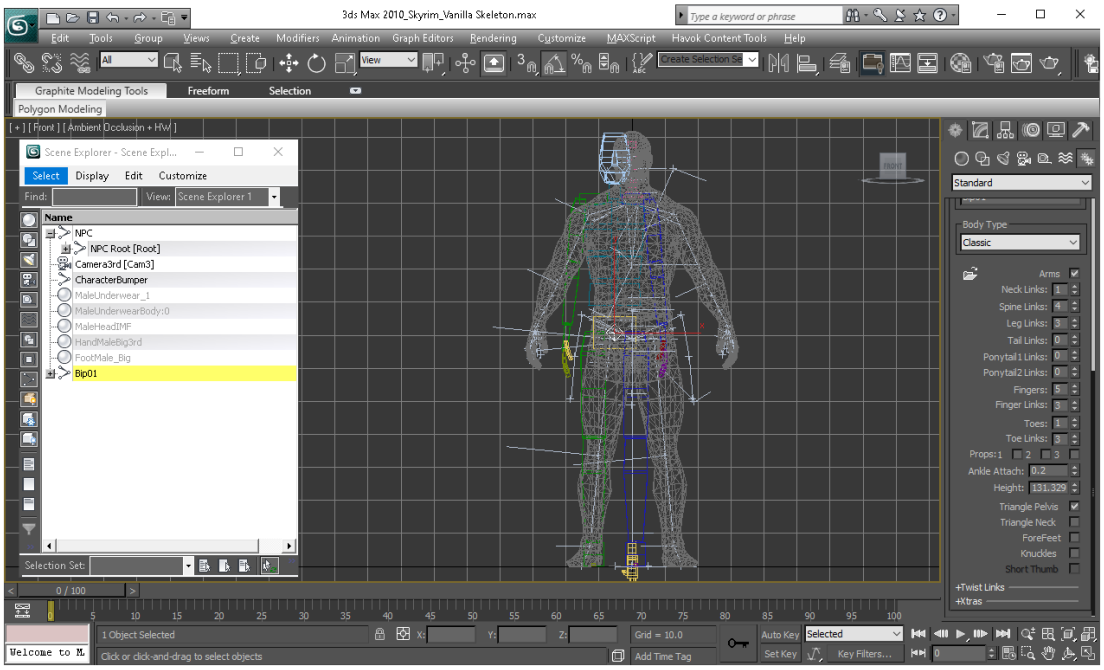

Figure 1228 - Adding a biped.

With Bip01 selected, go to the Motion tab. Scroll down to the Biped section and click on the Figure Mode button.

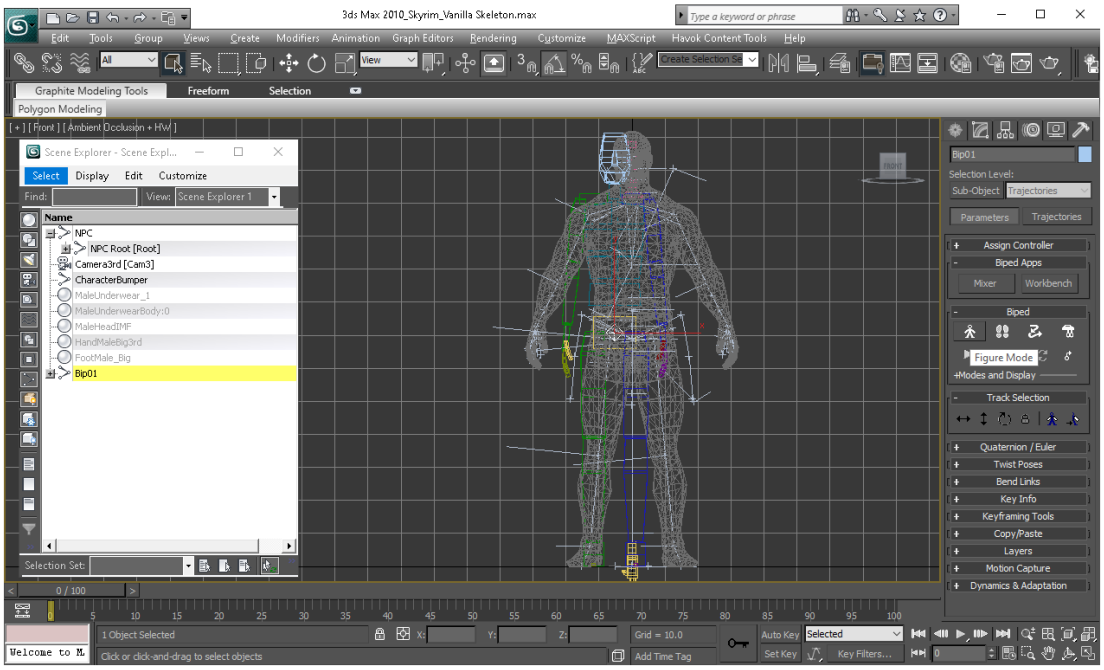

Figure 1229 - Figure mode.

In the object list, click on just Bip01 then right-click on the Move tool in the toolbar.

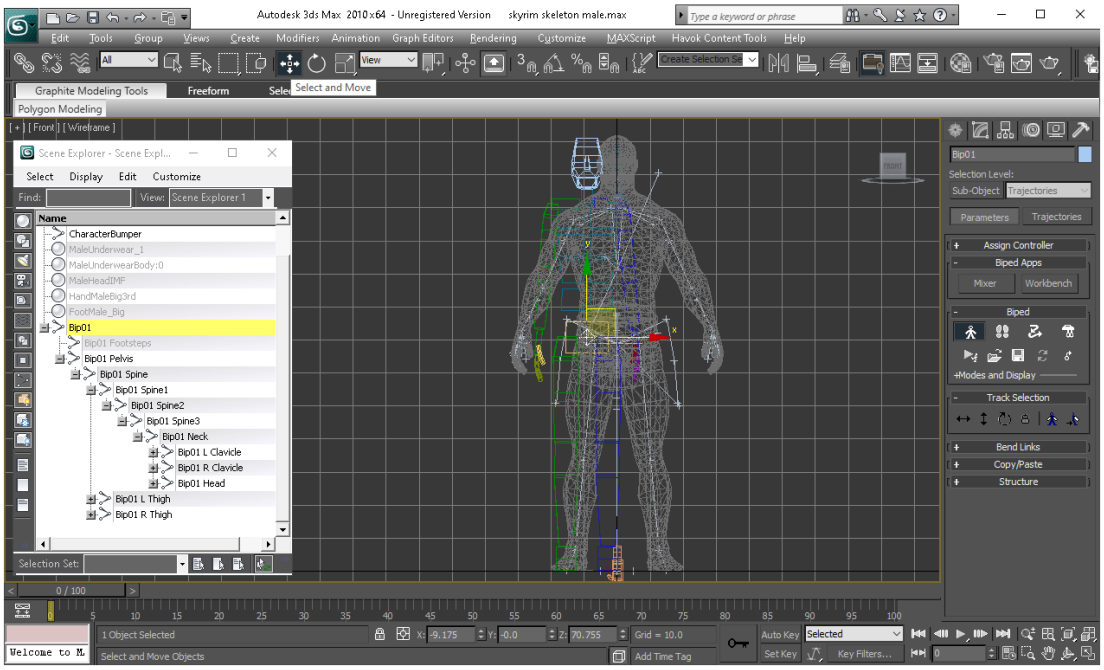

Figure 1230 - Selecting the Bip01 parent object.

Set X and Y to 0.0 then close the move tool properties.

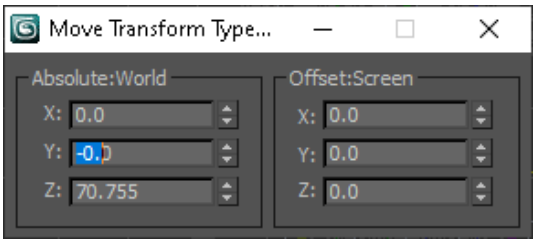

Figure 1231 - Centering Bip01 to the world.

If you press P to switch the viewport back to perspective, you may notice that the biped is facing the wrong way.

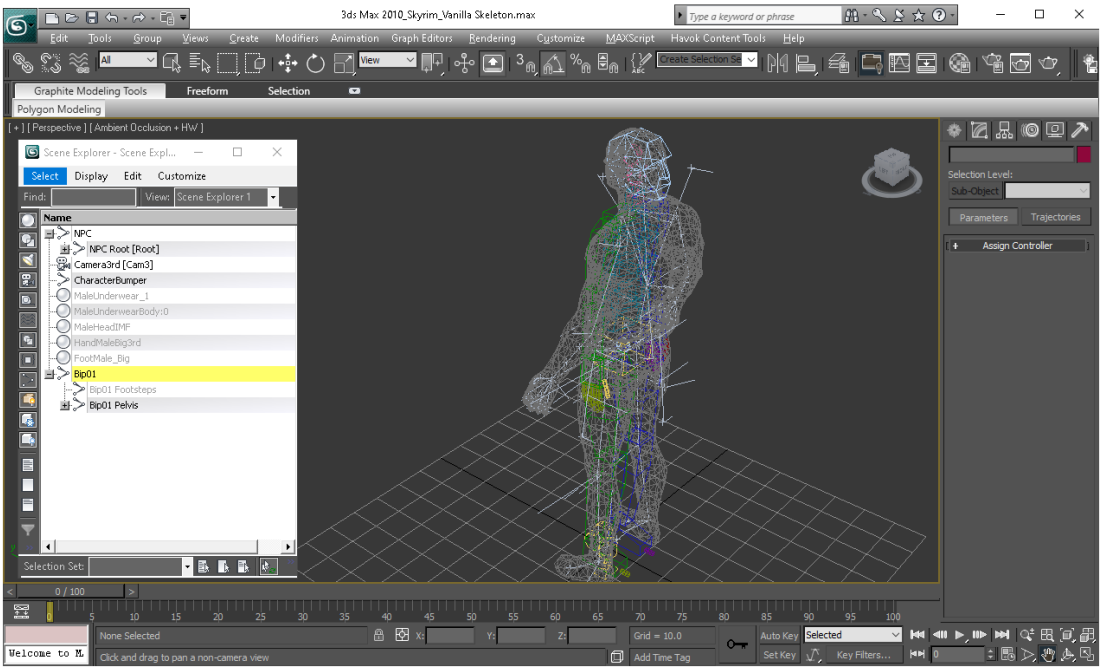

Figure 1232 - Bip01 facing the wrong direction.

To fix this, with the Bip01 parent object still selected, right-click on the Select and Rotate tool.

Set Z to 90 then close the Select and Rotate tool.

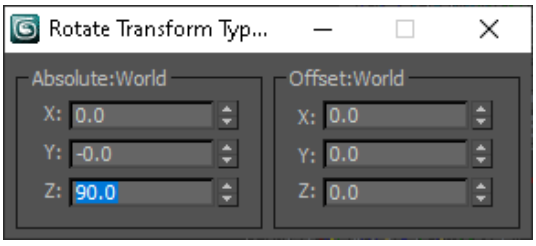

Figure 1233 - Rotating Bip01 to face the right way.

Select the bottom spine segment and move it down until the clavicle is roughly in line with the clavicle of our custom skeleton.

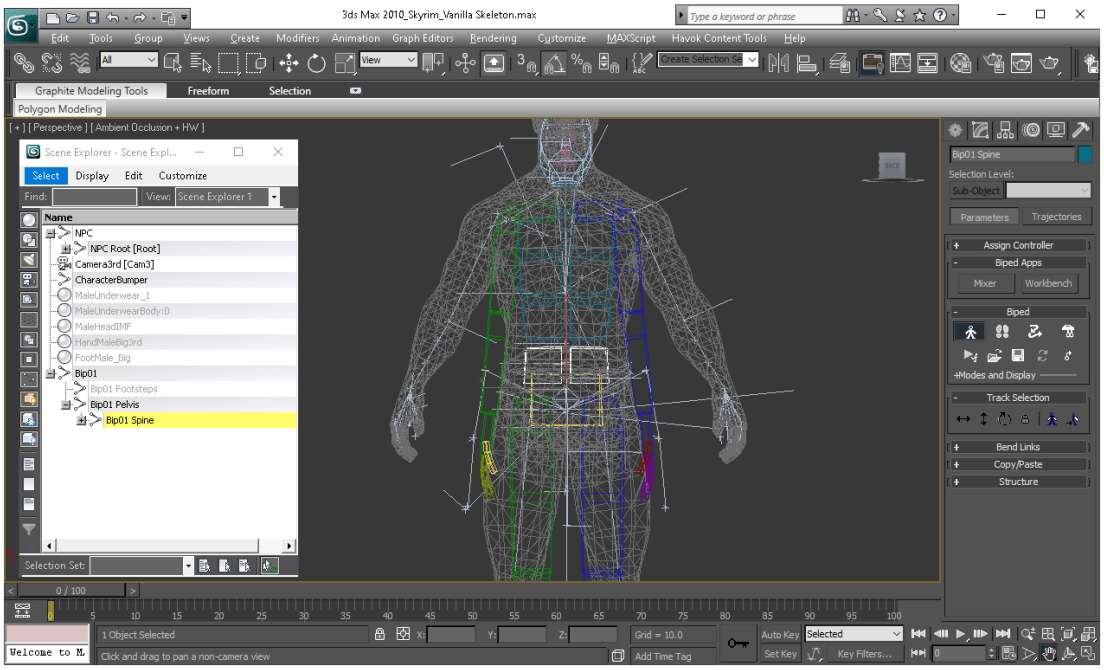

Figure 1234 - Lowering the bottom spine segment.

Click on Angle Snap Toggle to turn it on if it isn't already.

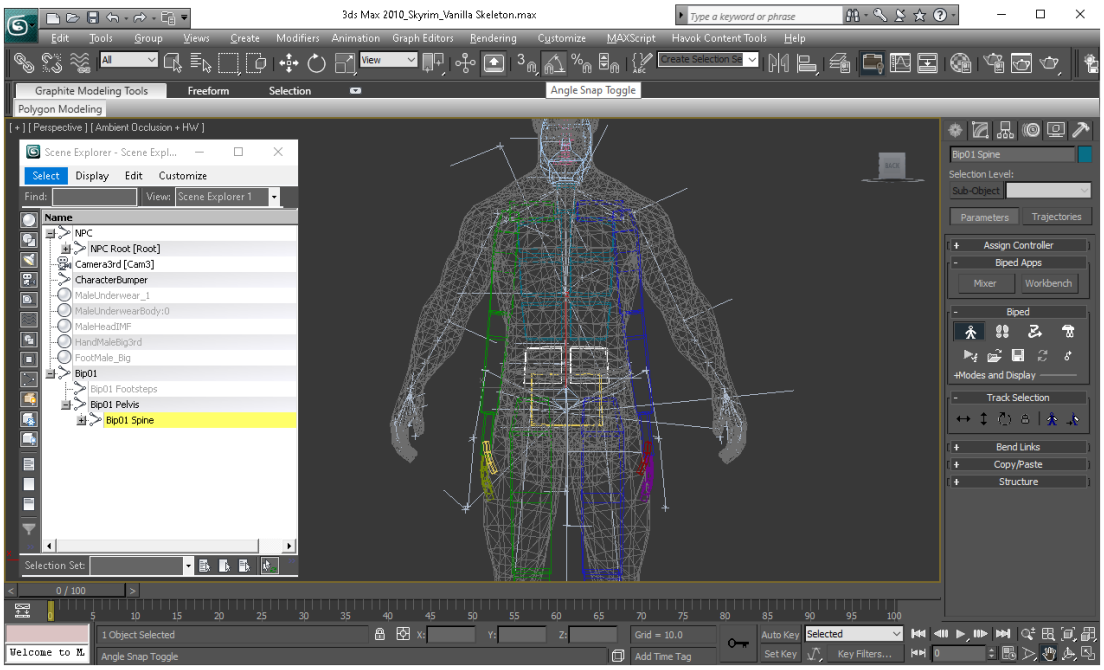

Figure 1235 - Selecting the upper arms on Bip01.

Click on the Select and Rotate tool and rotate Bip01's right upper arm 20 degrees.

It shouldn't matter if it doesn't perfectly match the bones in our skeleton.

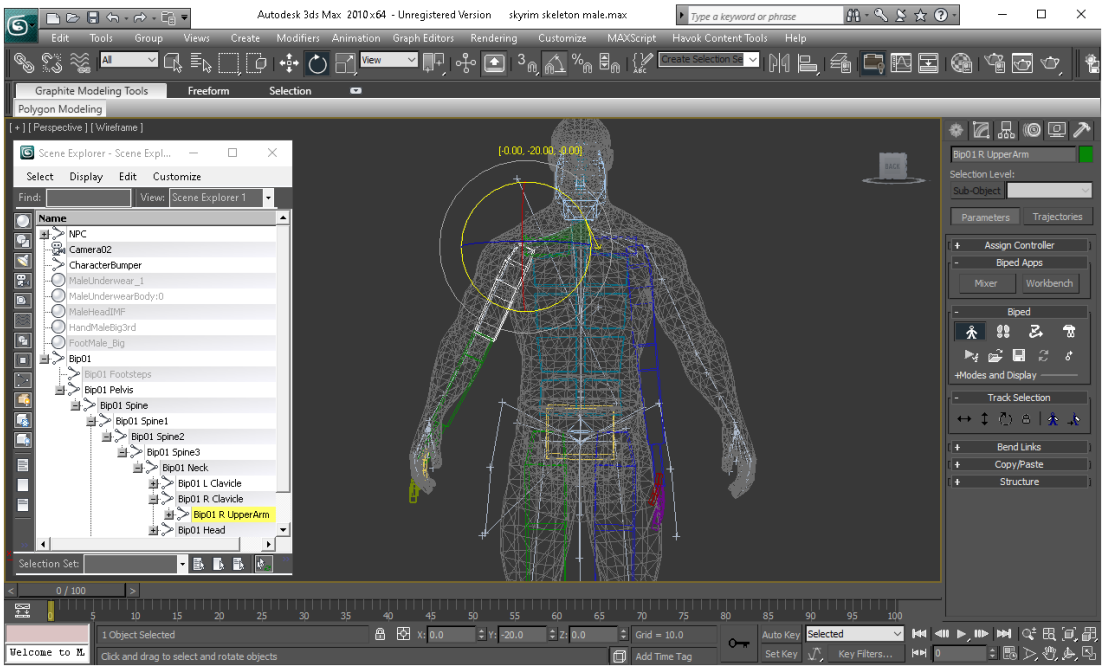

Figure 1236 - Moving the right-arm into place.

Do the same for Bip01's left arm.

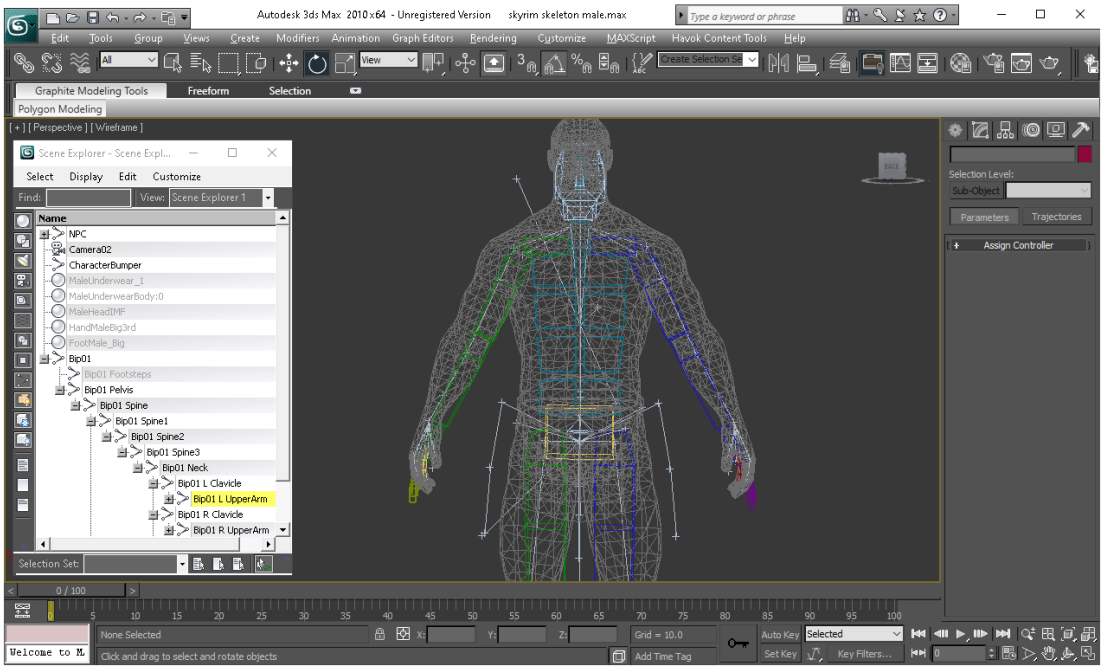

Figure 1237 - Both arms rotated into place.

Select both hands on Bip01 and move them into roughly the same spot as the hands on our skeleton.

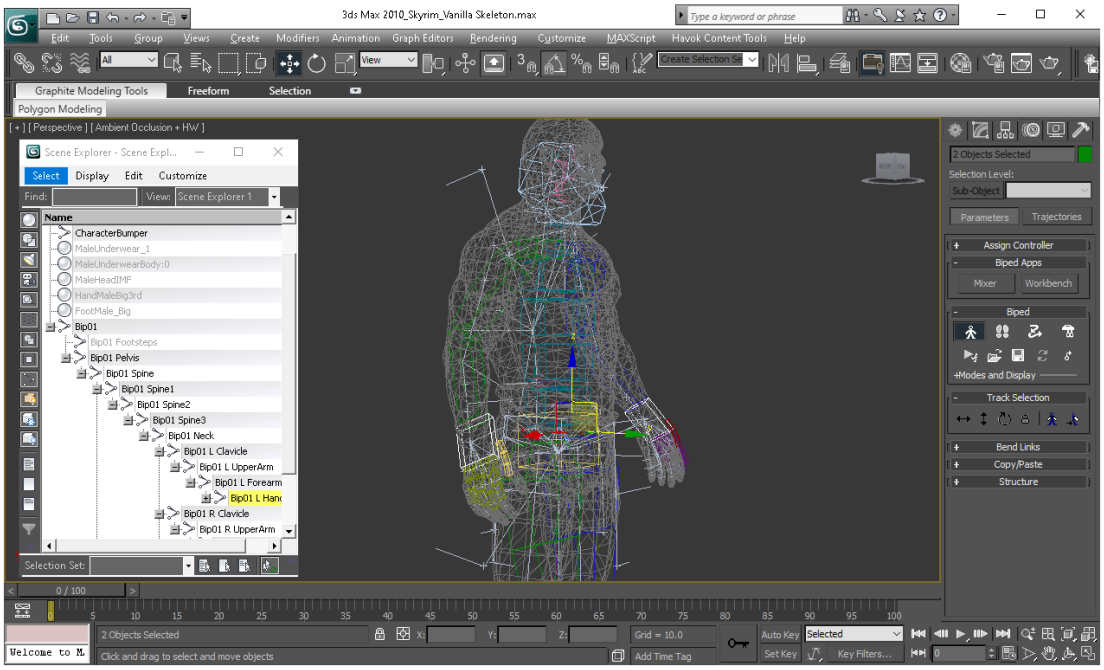

Figure 1238 - Moving both hands into position.

Move Bip01's right leg 5 degrees.

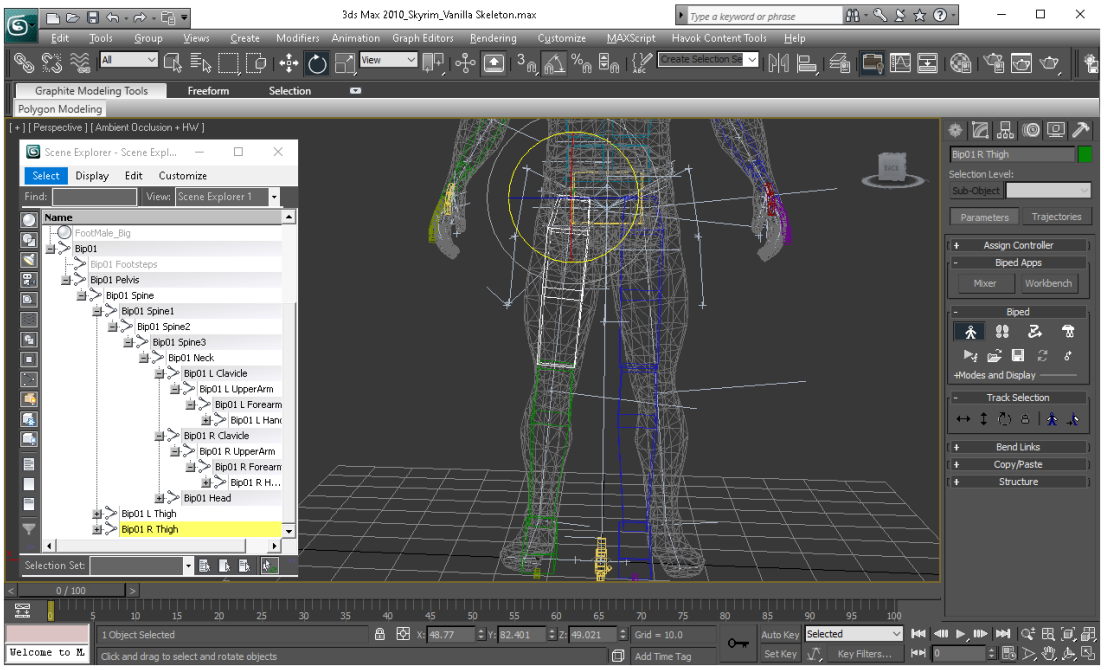

Figure 1239 - Moving the right leg into position.

Do the same for the left leg.

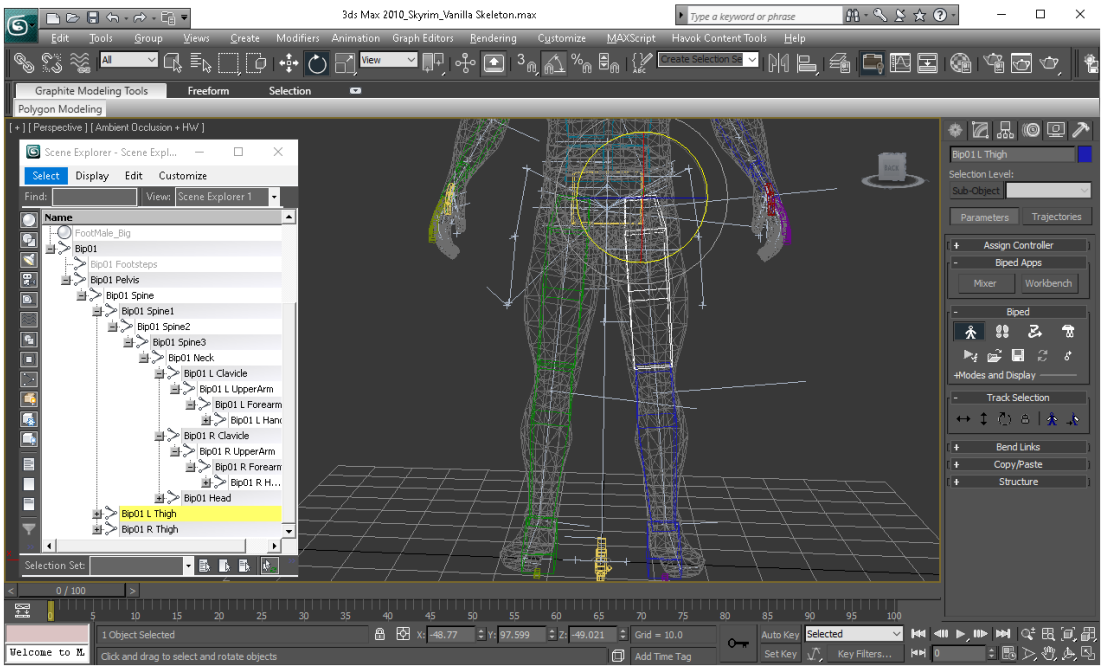

Figure 1240 - Right-leg moved into place.

Move both feet back so that they're roughly in the same place as the feet in our custom skeleton.

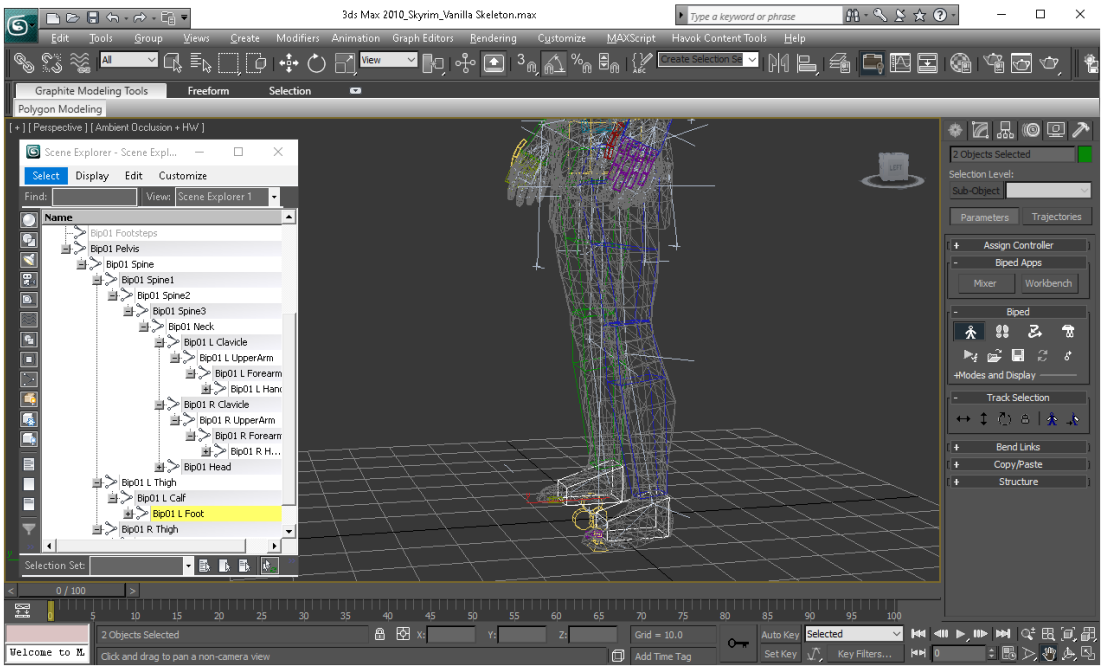

Figure 1241 - Moving the feet into place.

Rotate the feet by about 15 degrees so they match the feet of our custom skeleton.

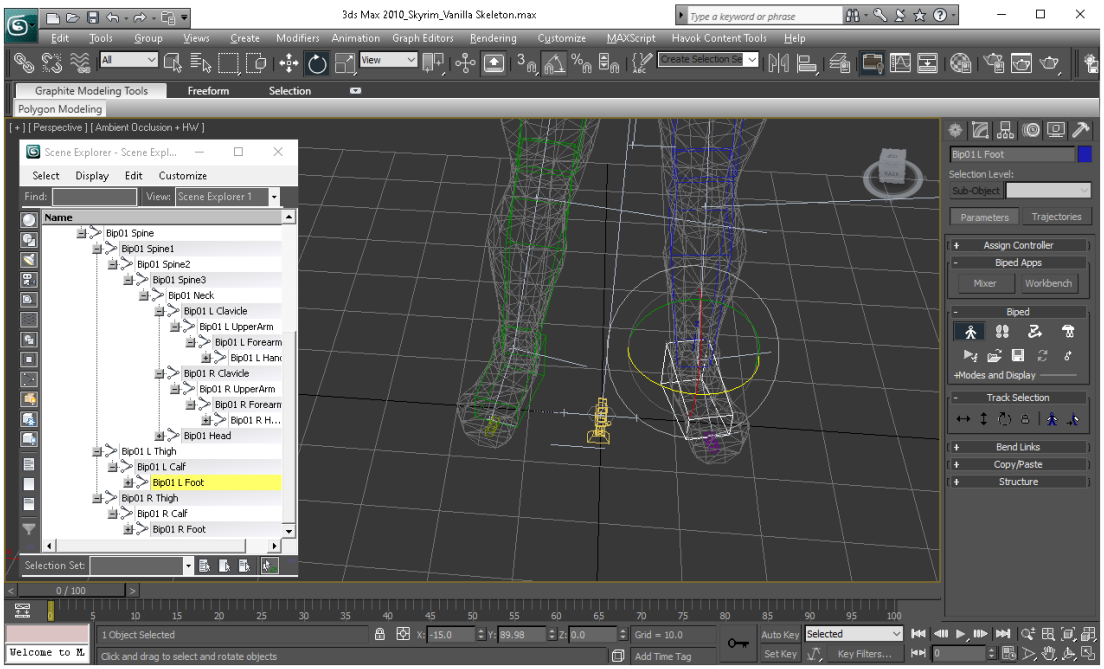

Figure 1242 - Rotating the feet on Bip01to match the feet on the skeleton.

Rotate the hands about 10 degrees to match the skeleton.

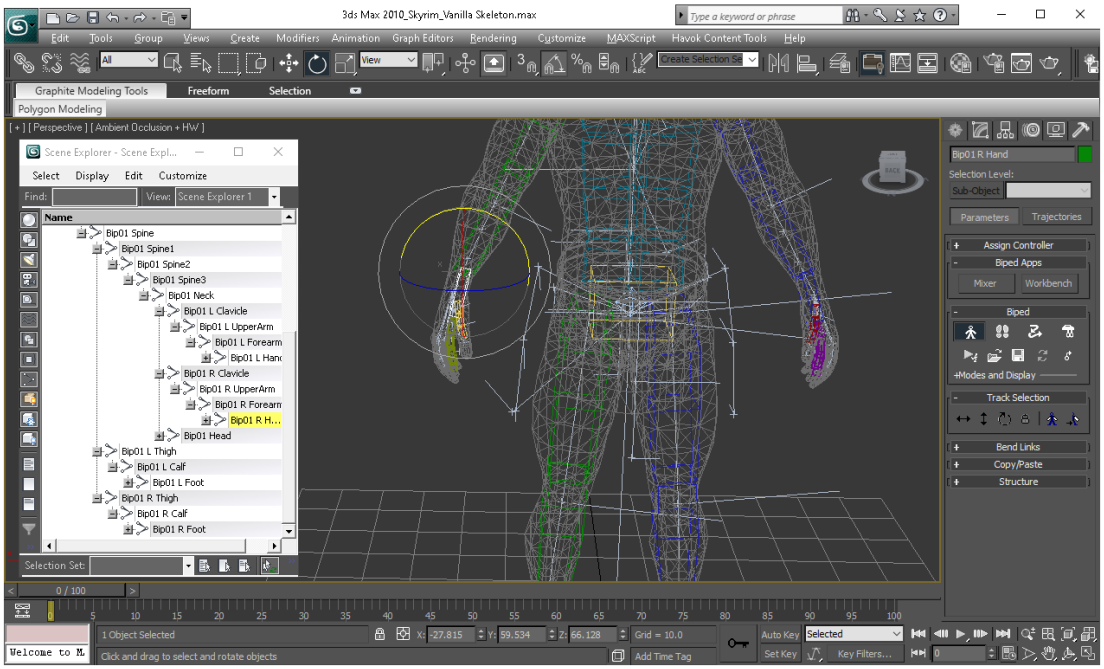

Figure 1243 - Rotating the hands on Bip01 slightly.

Now to set up constraints. For this example, I'm not going to constrain individual toes and fingers to the biped as the motion capture data I'll be working with doesn't capture that sort of information.

Let's start with the NPC L Toe0 [LToe] bone. Expand the NPC object in the hierarchy list and click on this bone to select it.

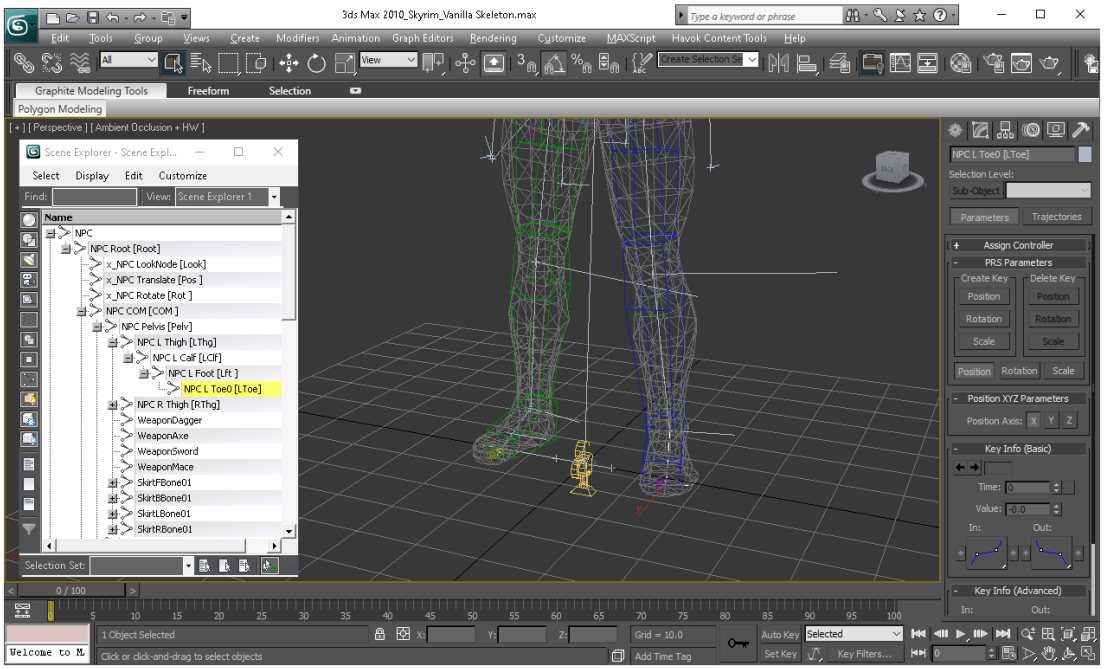

Figure 1244 - Selecting NPC L Toe0 [LToe].

Go to Animation > Constraints > Orientation Constraint.

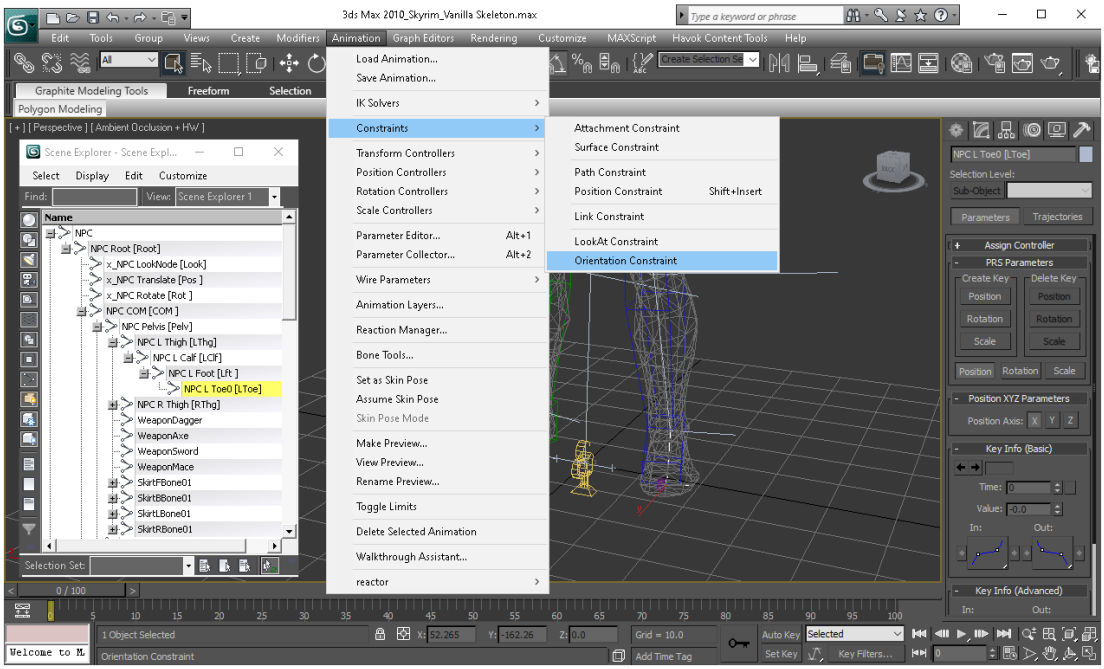

Figure 1245 - Setting up an Orientation Constraint.

Link it to the toe bone closest to Toe0 on Bip01's left foot.

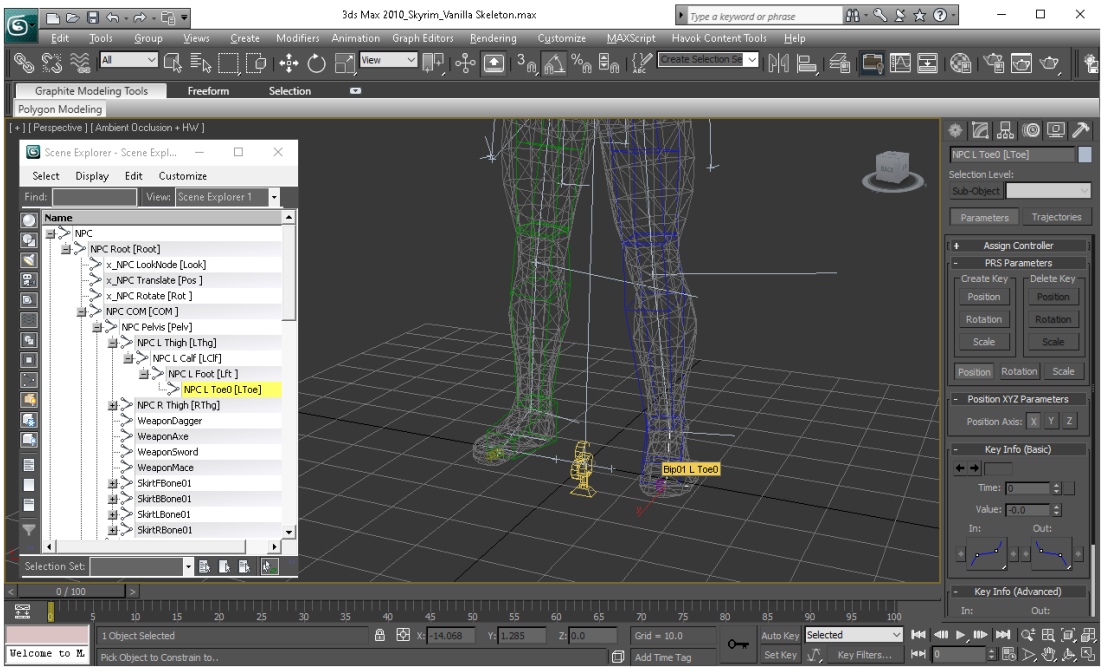

Figure 1246 - Linking the left toe bone.

On the right hand side, under Orientation Constraint, tick 'Keep Initial Offset'.

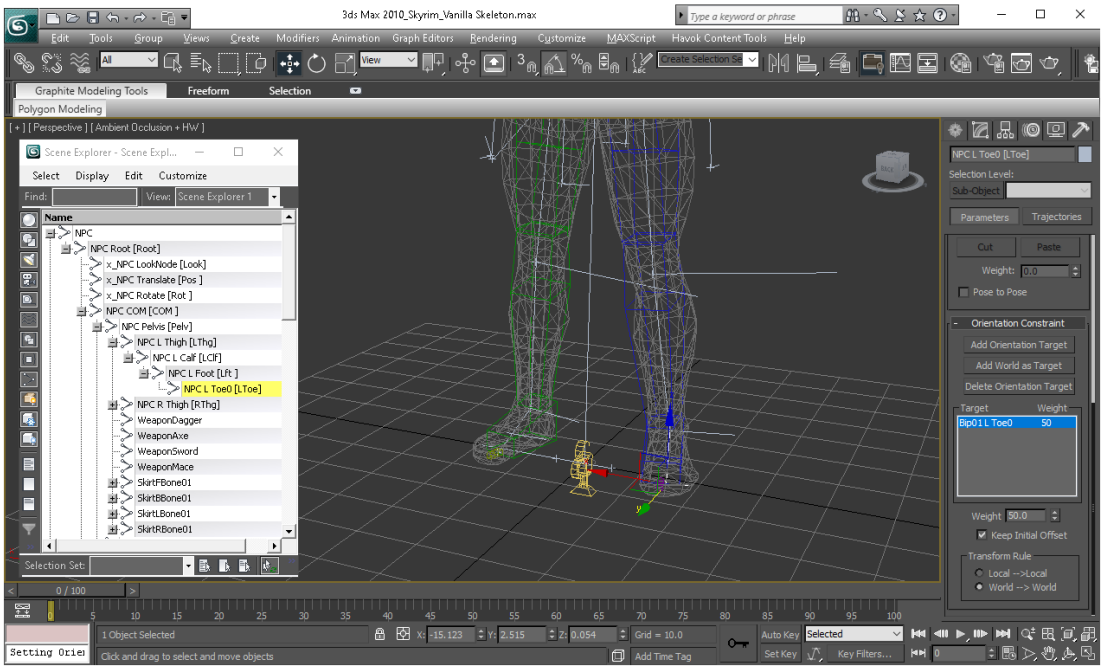

Figure 1247 - Ticking Keep Initial Offset.

Now move up to NPC L Foot [Lft]. Link it to Bip01's left foot. Remember to tick Keep Initial Offset for each bone we link.

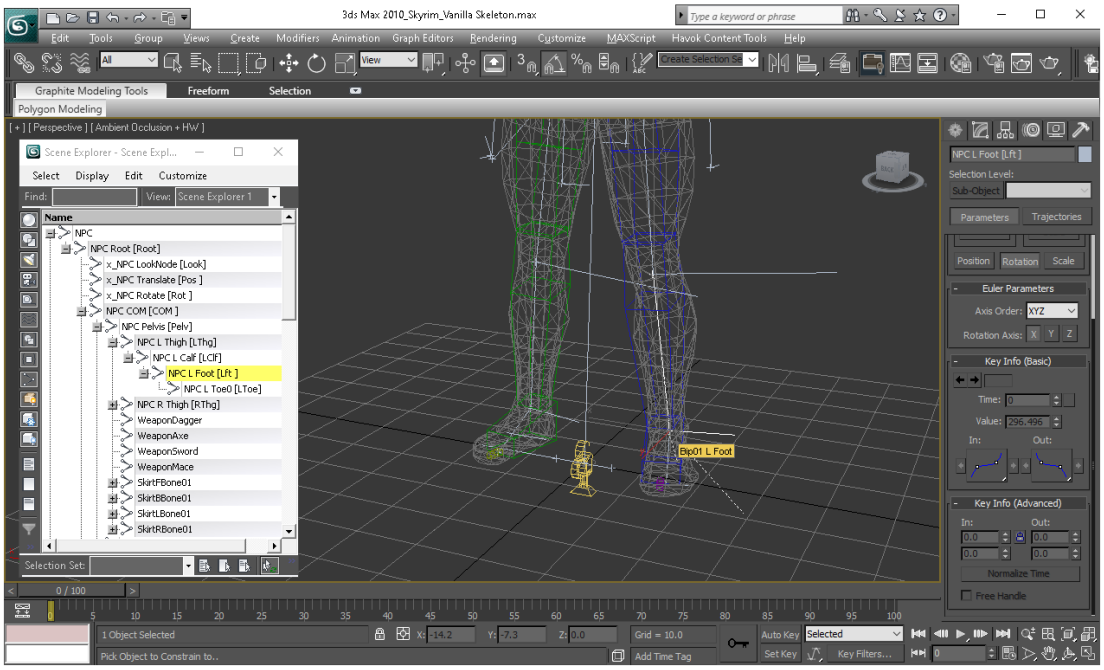

Figure 1248 - Linking the left foot bone.

Next, link NPC L Calf [LClf].

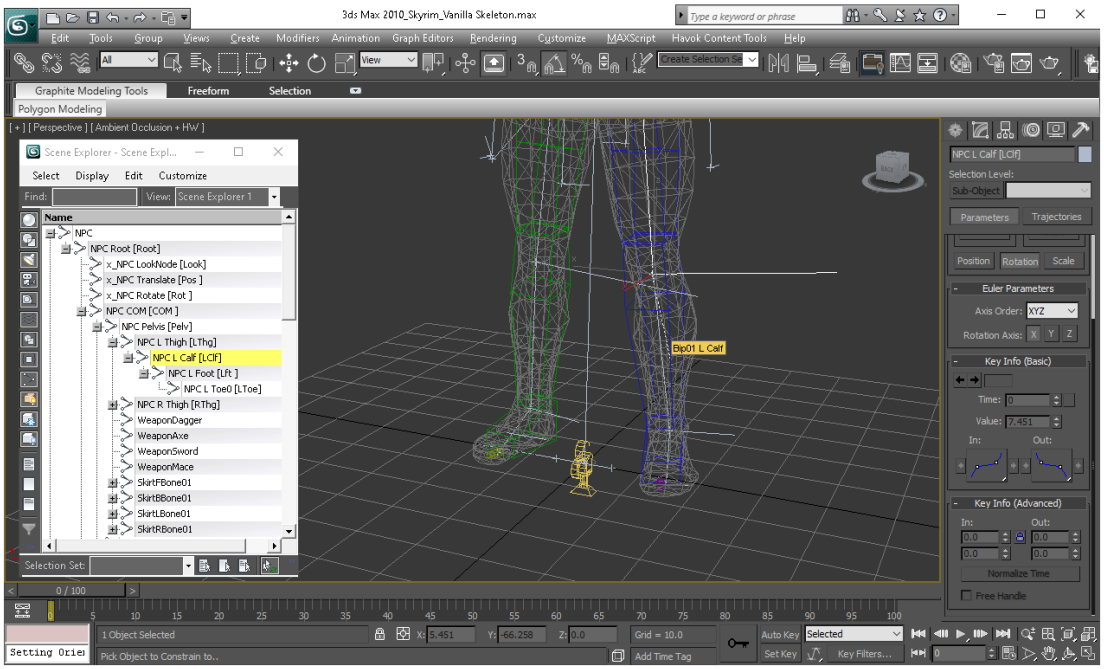

Figure 1249 - Linking the left calf bone.

Then NPC L Thigh [LThg].

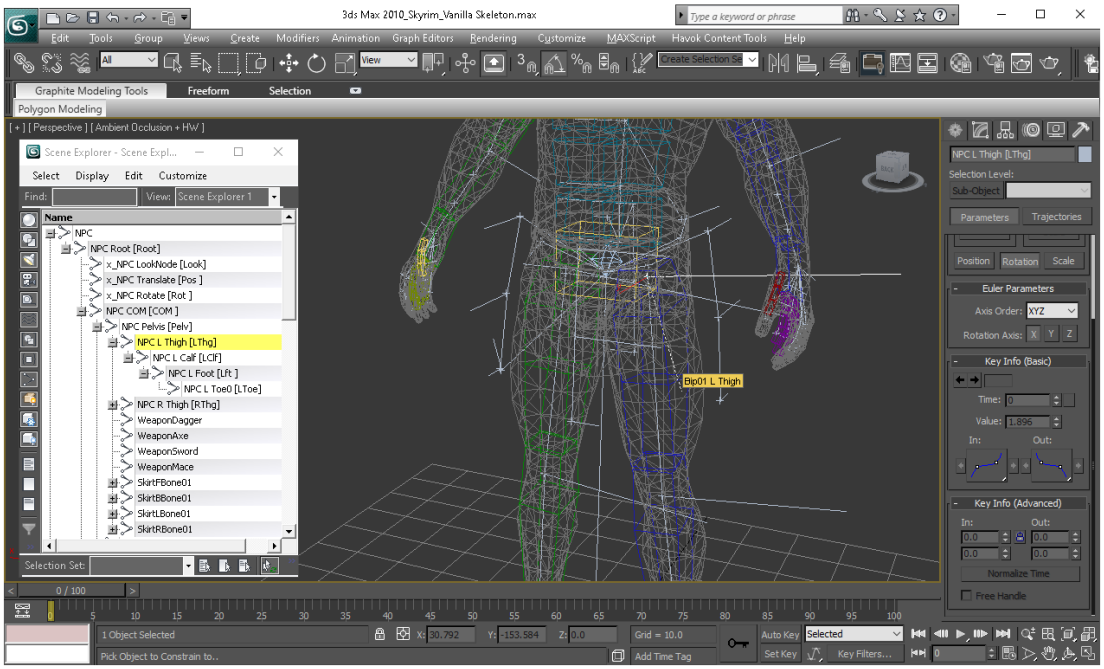

Figure 1250 - Linking the left thigh bone.

Now repeat these steps for the right leg, starting with NPC R Toe0 [RToe].

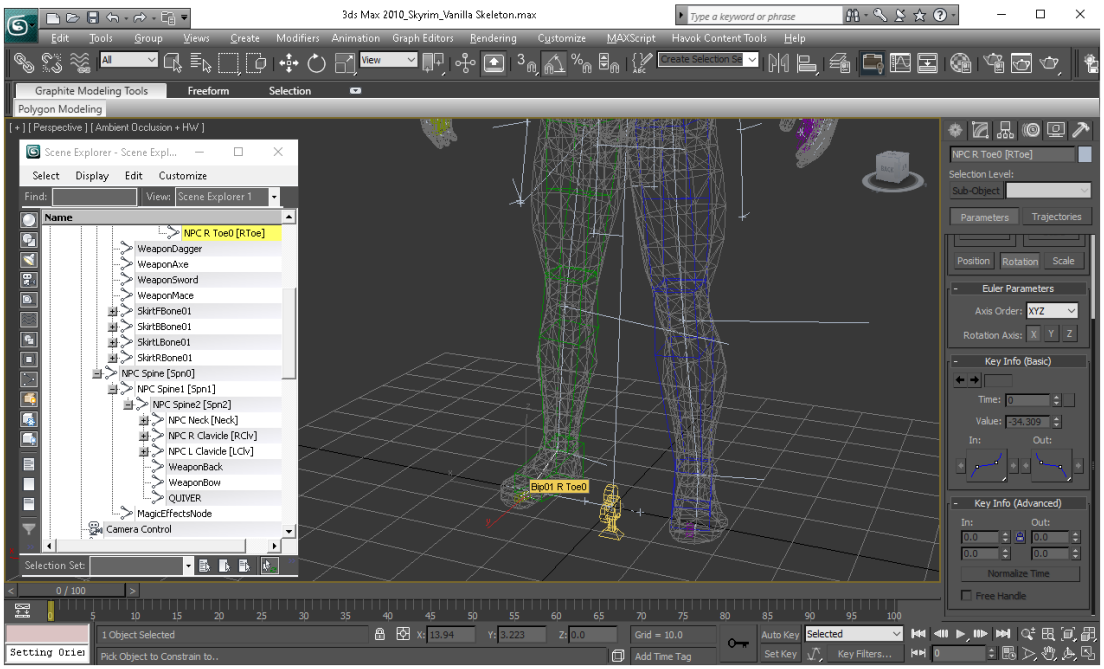

Figure 1251 - Linking bones on the right leg.

Next, the arms.

Start with NPC L Hand [LHnd] and link it to the left hand on Bip01.

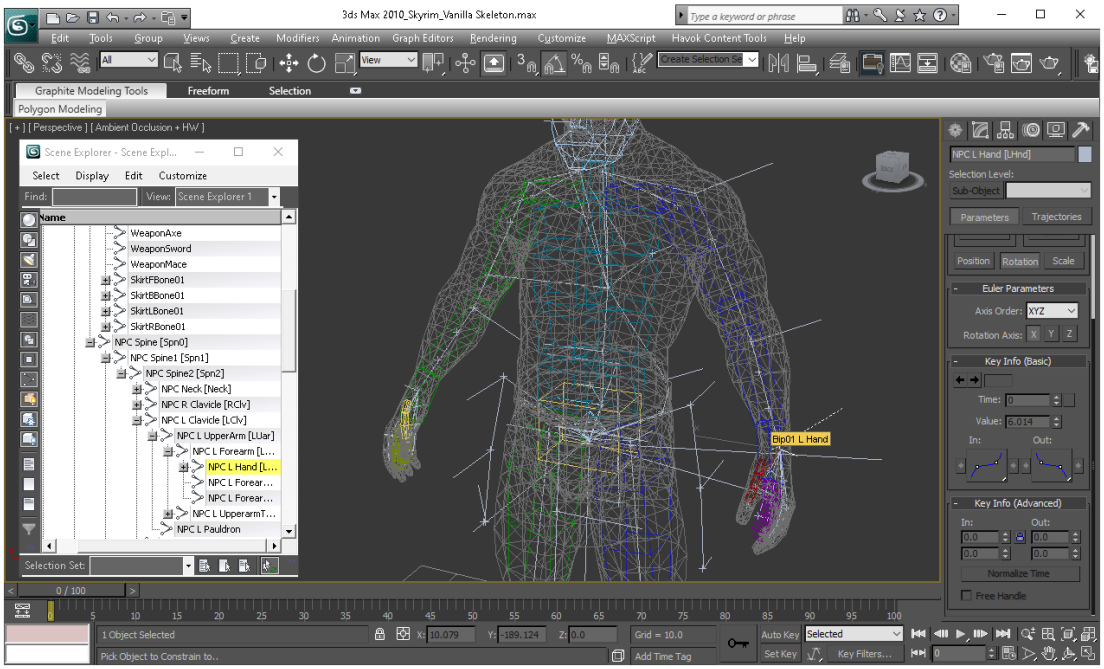

Figure 1252 - Linking the left hand bones.

NPC L Forearm [LLar] is next.

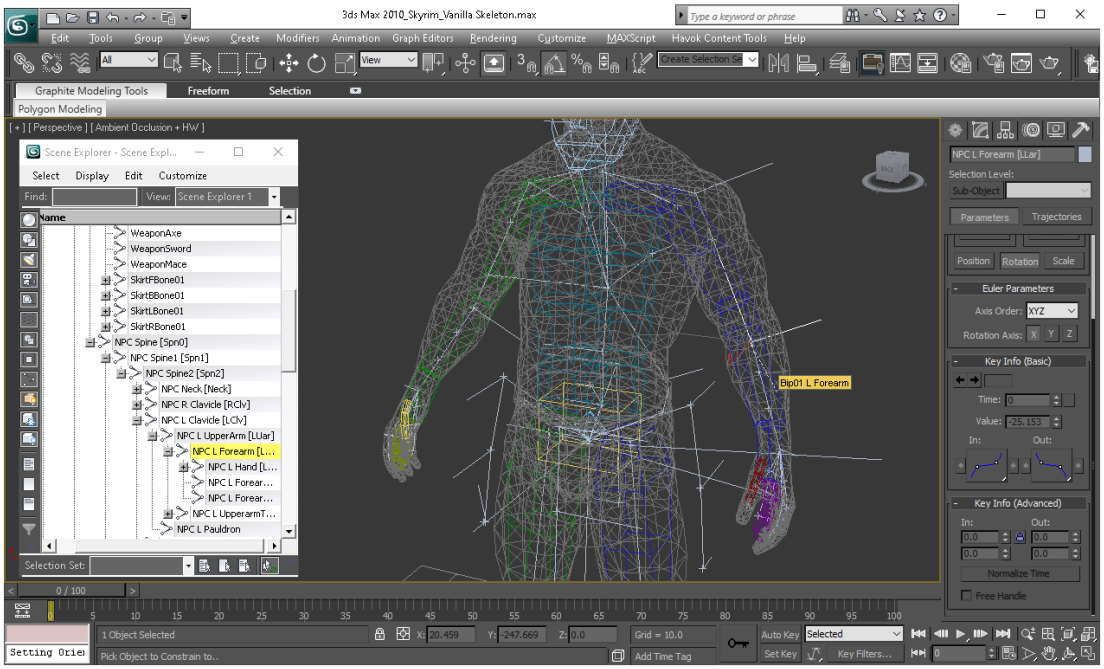

Figure 1253 - Linking the forearm bones.

Then NPC L UpperArm [LUar].

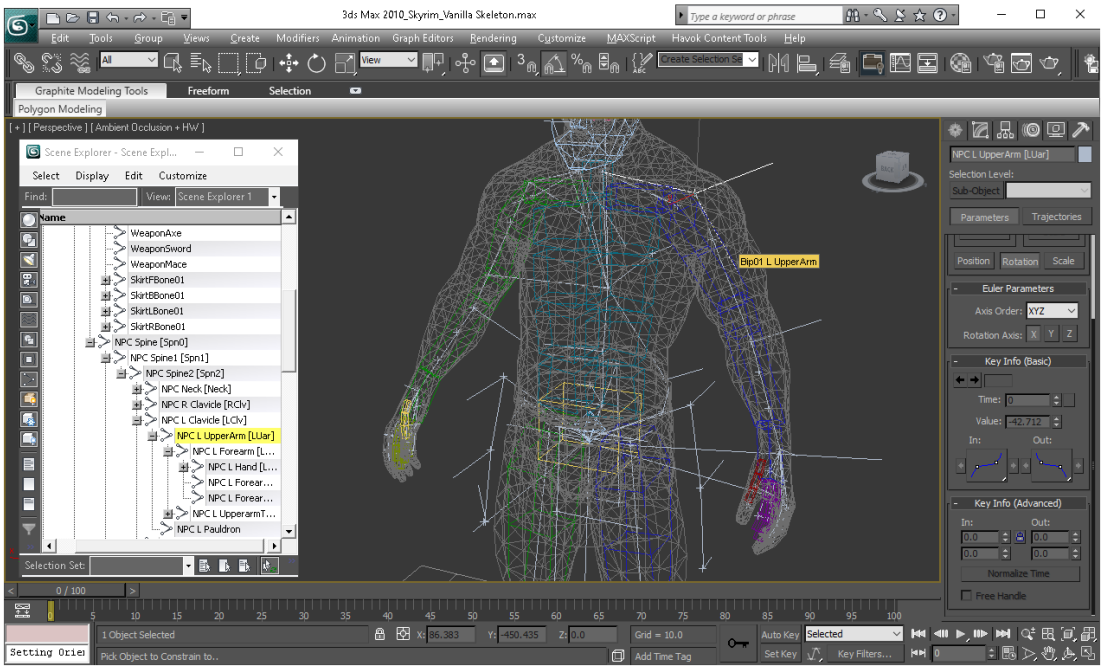

Figure 1254 - Linking the upper arm bones.

Finally NPC L Clavicle [LClv].

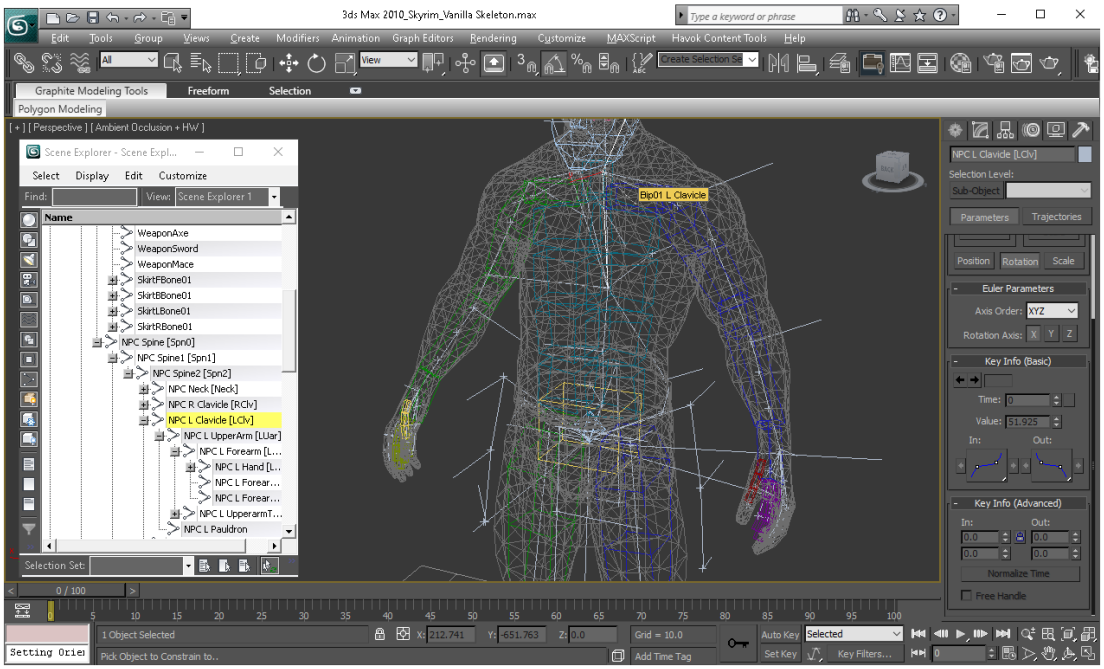

Figure 1255 - Linking the clavicle.

Now repeat these steps for the right arm.

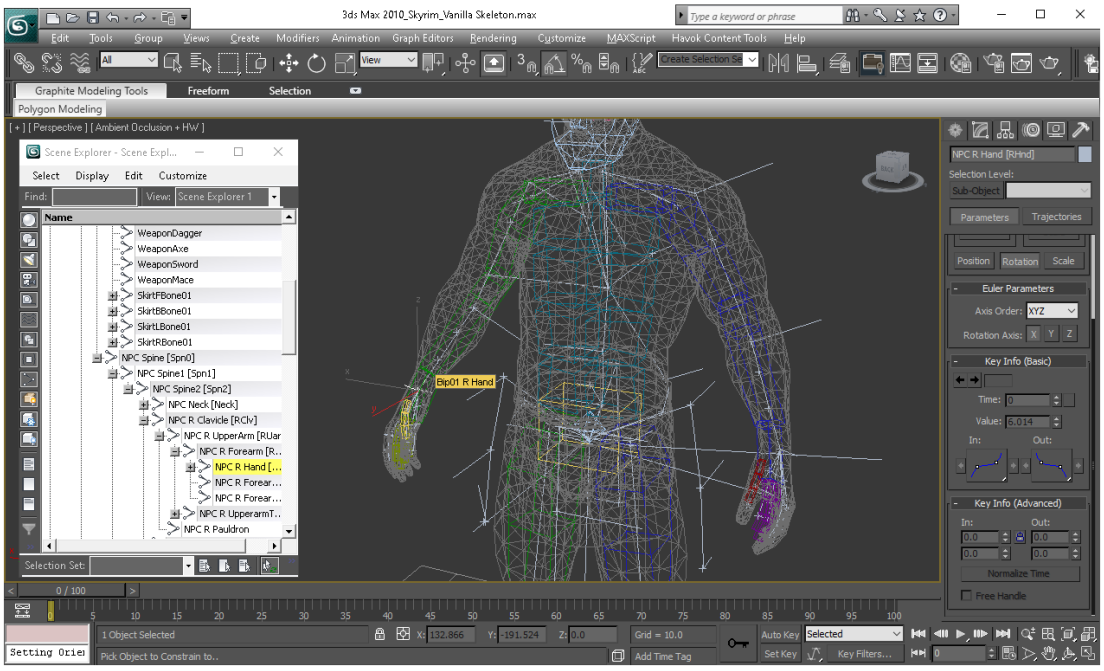

Figure 1256 - Linking the bones in the right arm.

Link NPC Neck [Neck] to Bip01's neck bone.

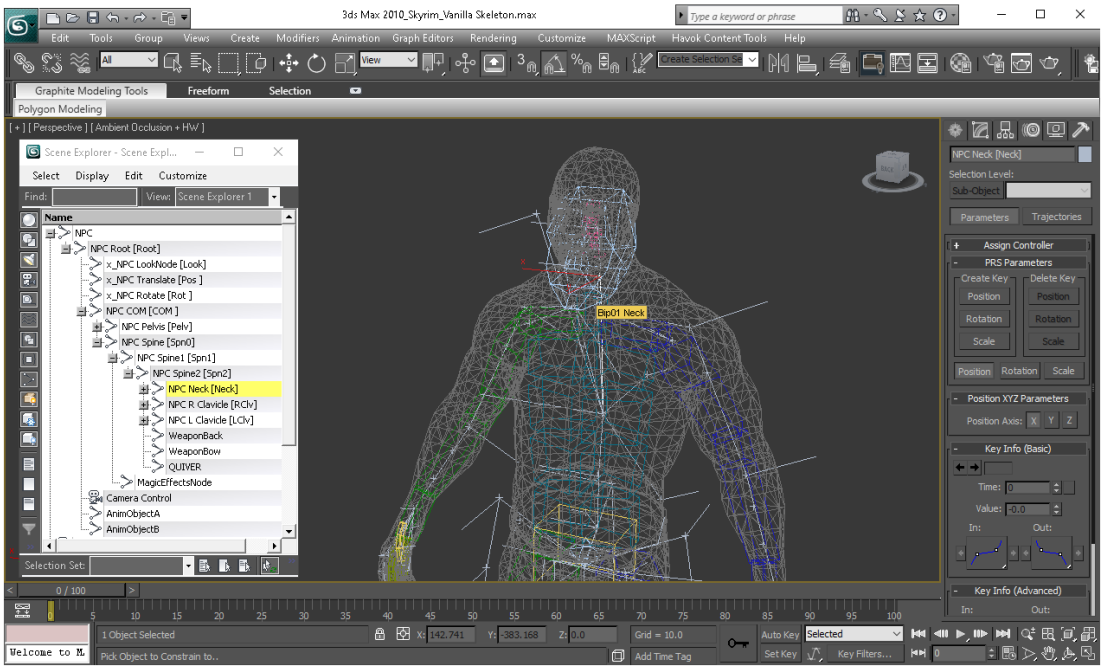

Figure 1257 - Linking the neck bone.

Then link NPC Head [Head] to Bip01's head bone.

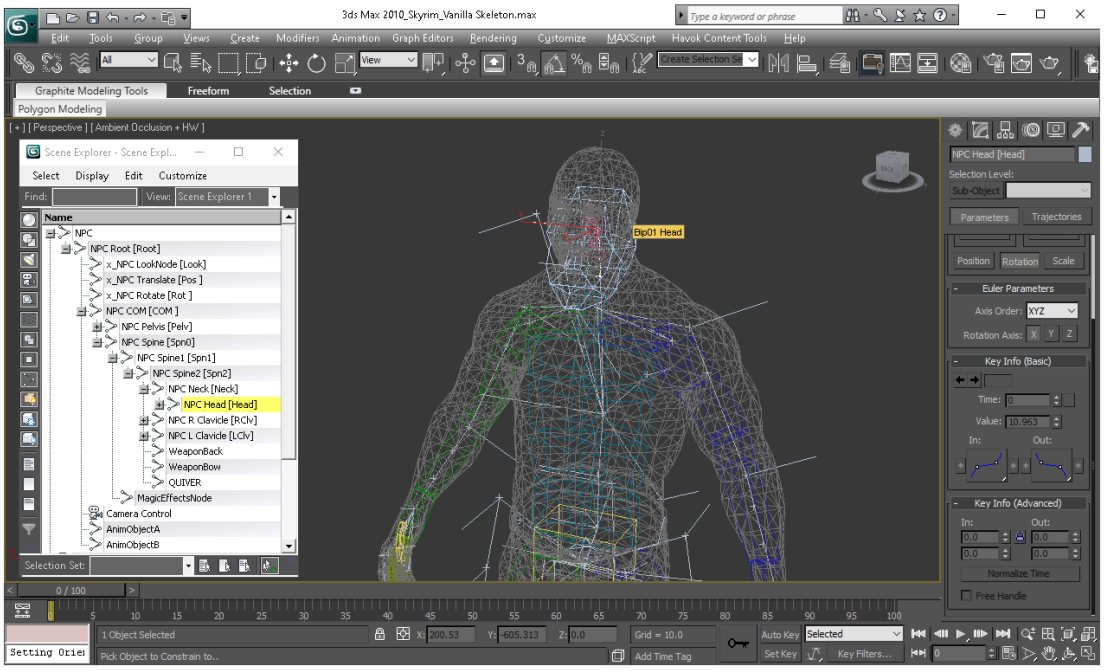

Figure 1258 - Linking the head bone.

Link NPC Pelvis [Pelv] to Bip01's pelvis bone.

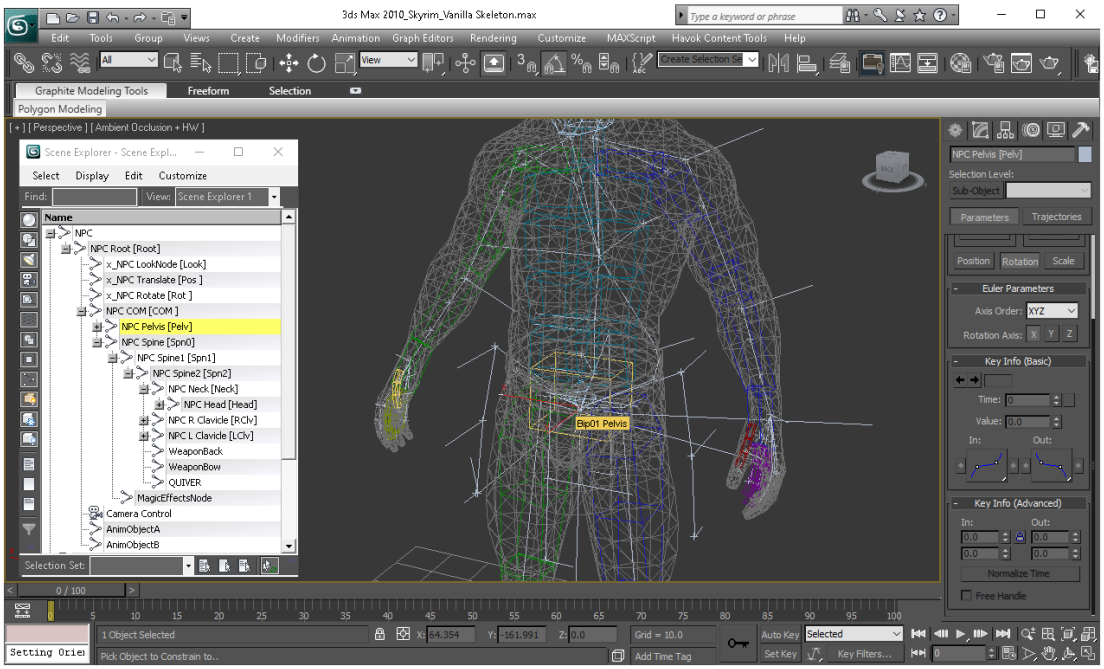

Figure 1259 - Linking the pelvis bone.

Link NPC Spine [Spn0] to the bottom spine bone.

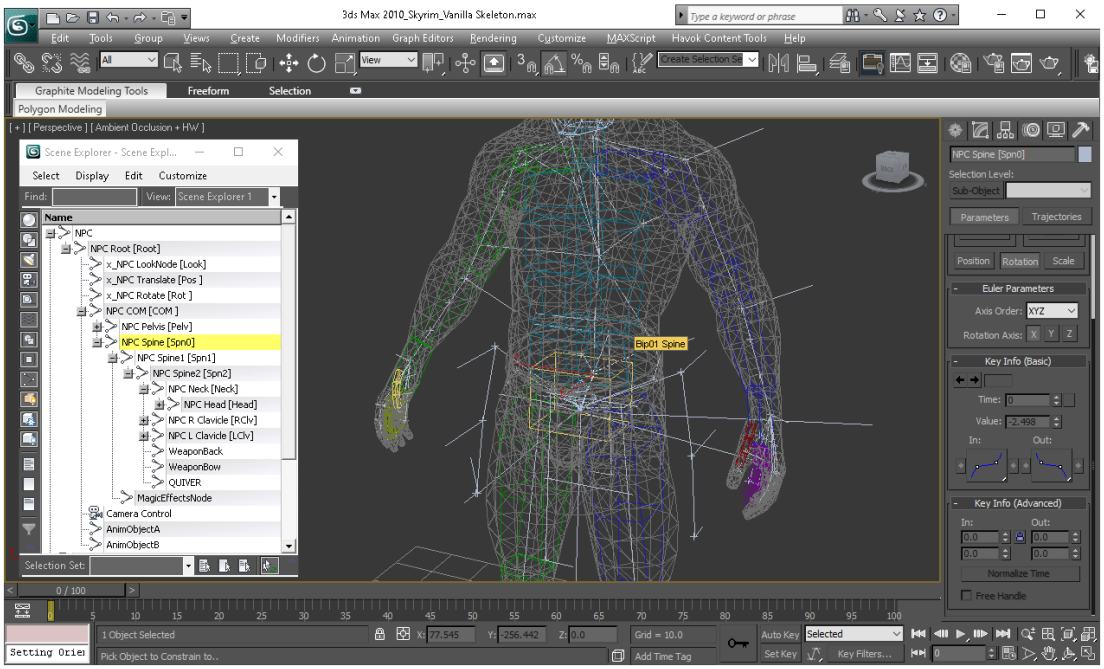

Figure 1260 - Linking the first spine bone.

Link NPC Spine1 [Spn1] to the spine bone above the one we previously linked.

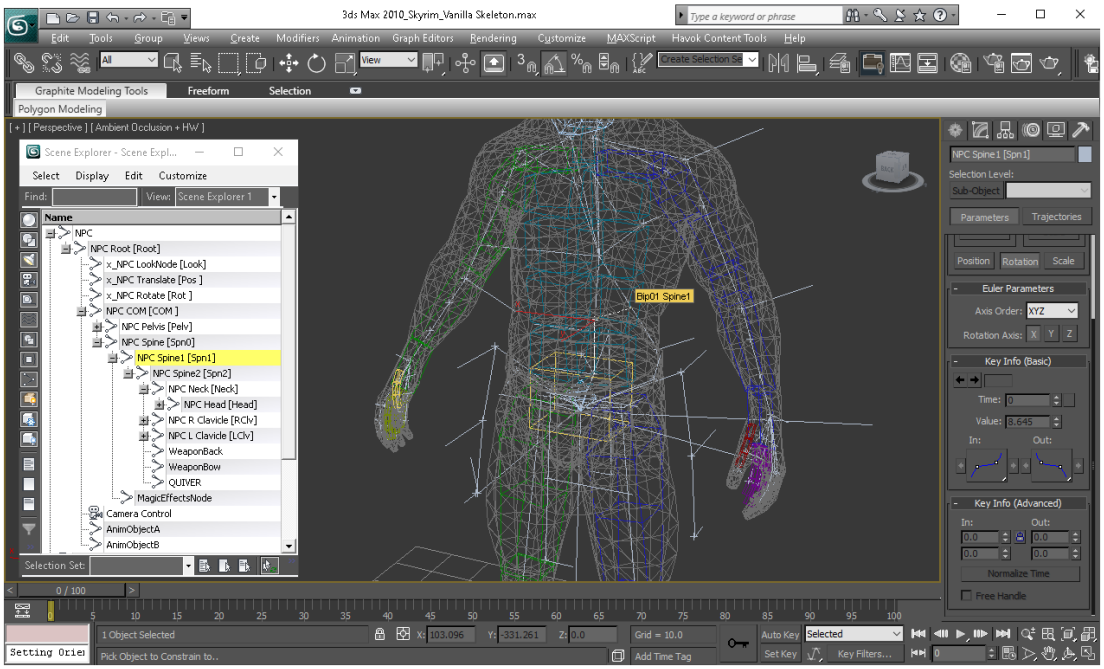

Figure 1261 - Linking the second spine bone.

And link NPC Spine2 [Spn2] to the next spine bone above. The spine bone above that one on Bip01 shouldn't be linked to anything.

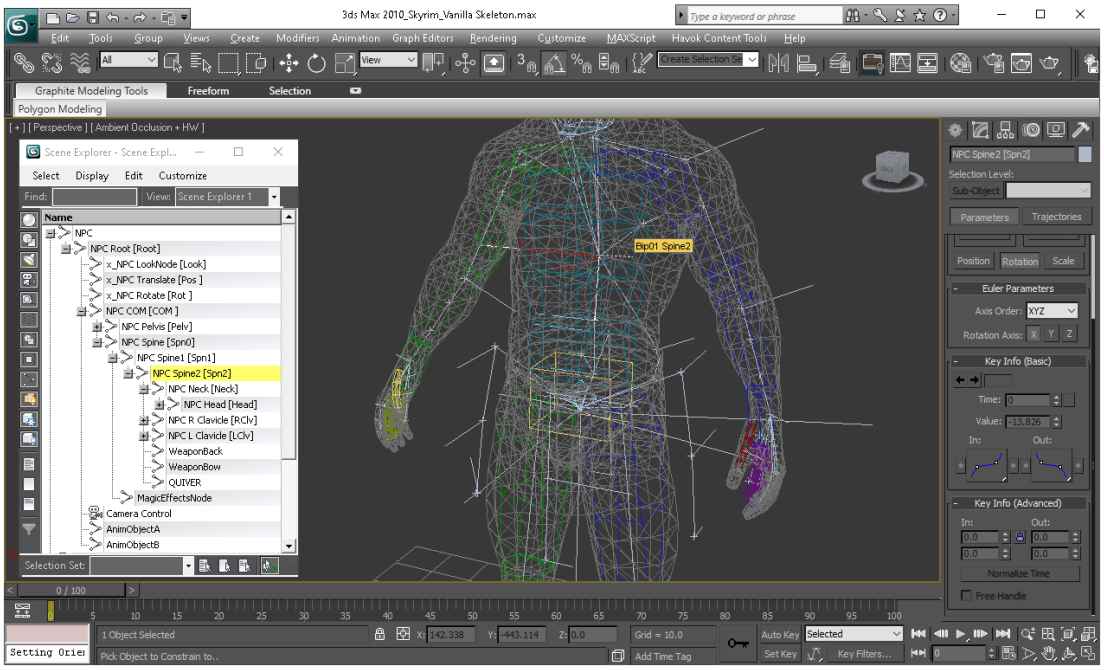

Figure 1262 - Linking the third spine bone.

Next, we need to set up a position constraint.

In order to do that, select NPC COM [COM], then go to Animation > Constraints > Position Constraint.

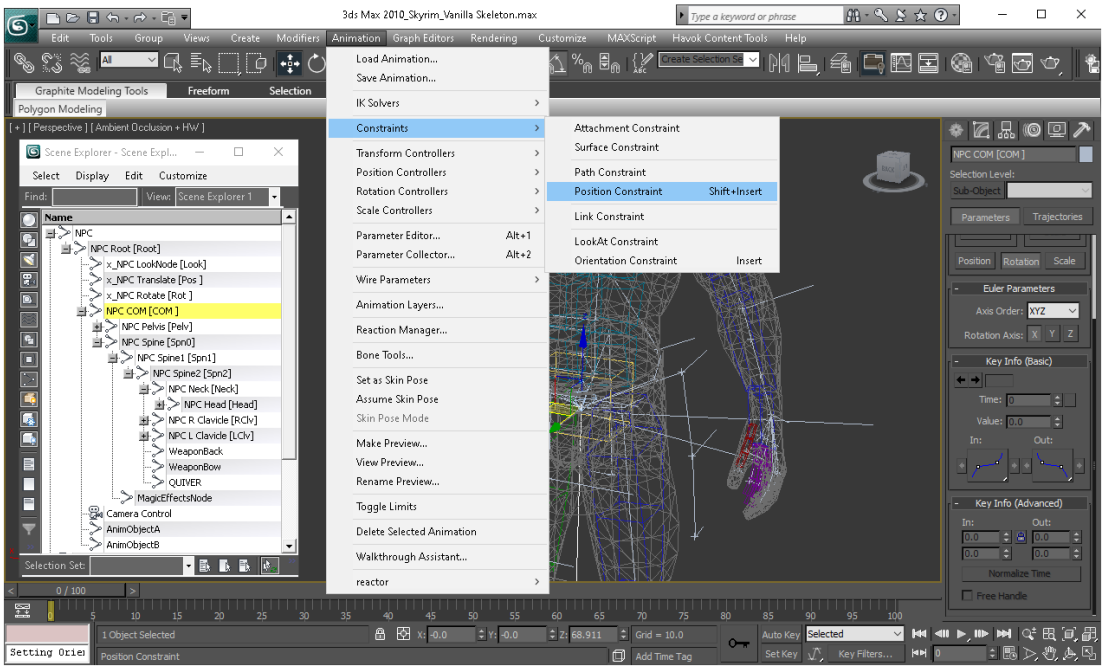

Figure 1263 - Setting up a position constraint.

Link NPC COM [COM] to the pelvis bone on Bip01. Don't forget to tick Keep Initial Offset.

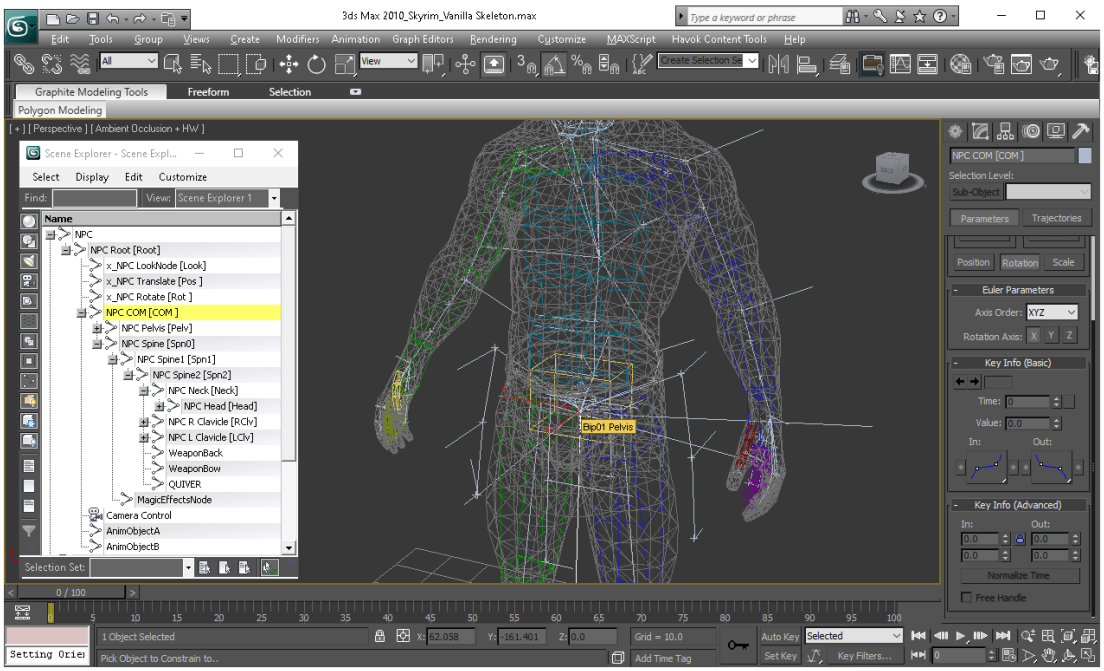

Figure 1264 - Linking NPC COM [COM] to the pelvis bone on Bip01.

We'll also need to add an Orientation Constraint on NPC COM [COM] linking it to the pelvis bone on Bip01 to ensure the spine doesn't get bent out of place when importing mocap data.

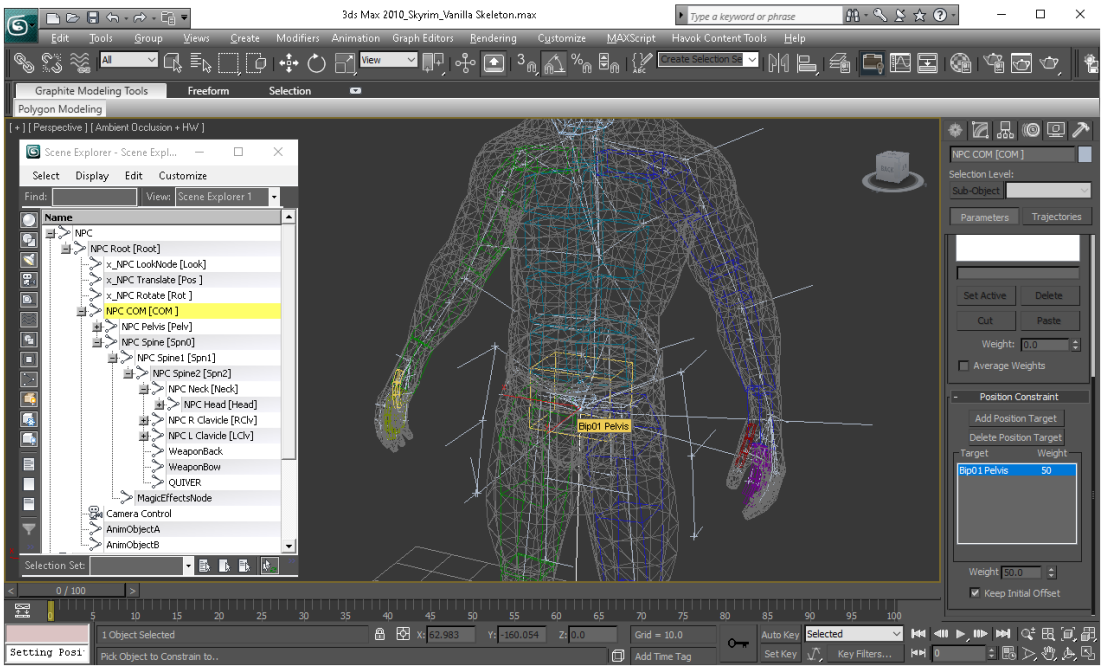

Figure 1265 - Adding an orientation constraint to NPC COM [COM].

Click on Bip01 in the hierarchy list. On the right hand side, go down to the Biped section and click on Figure Mode again to exit out of it.

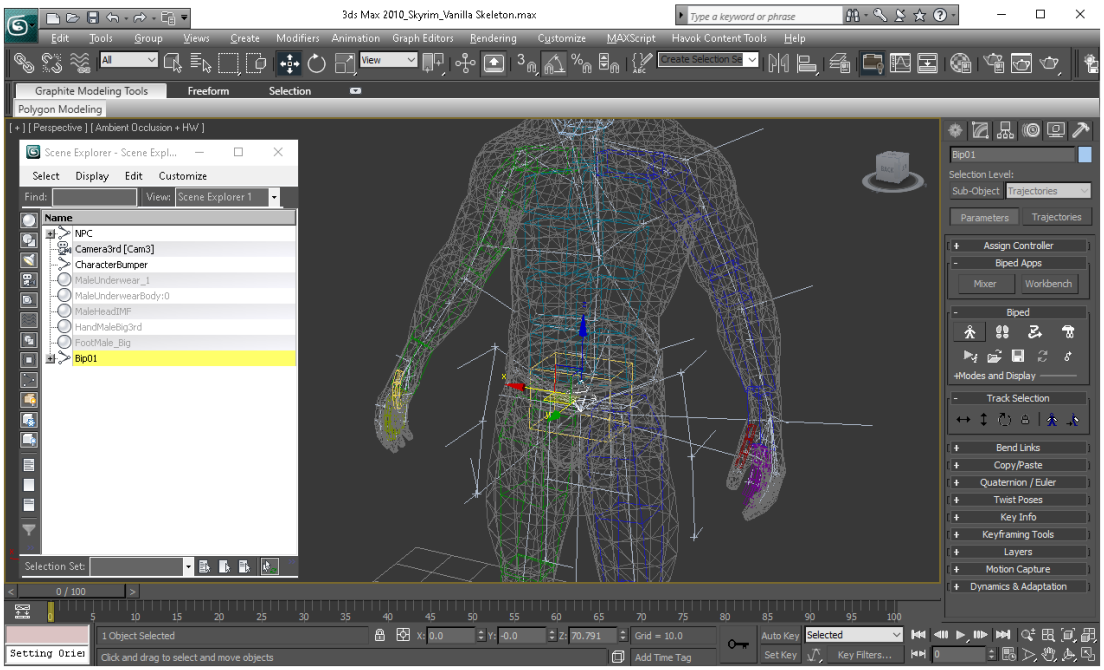

Figure 1266 - Exiting out of figure mode.

Now to test importing some motion capture data.

With Bip01 still selected, go down to the Motion Capture section and click on Load Motion Capture File.

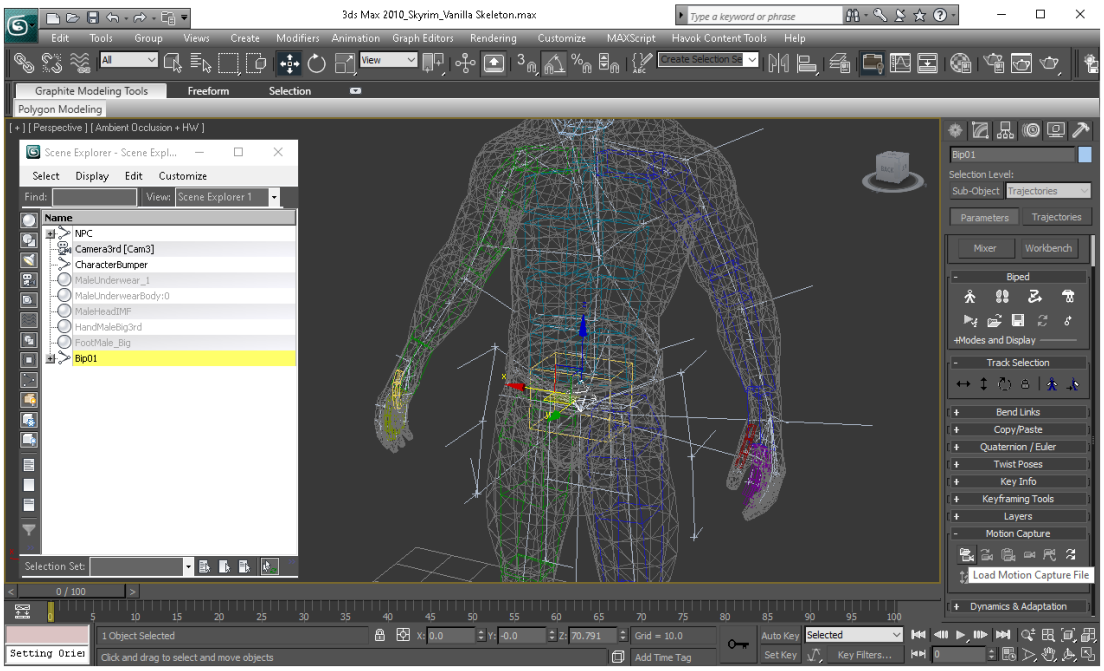

Figure 1267 - Loading a motion capture file.

For this example, I'm going to load a .bvh file provided by Carnegie Mellon University.

Set the 'Files of type' drop down to '(*.BVH)' and select a .bvh file to import.

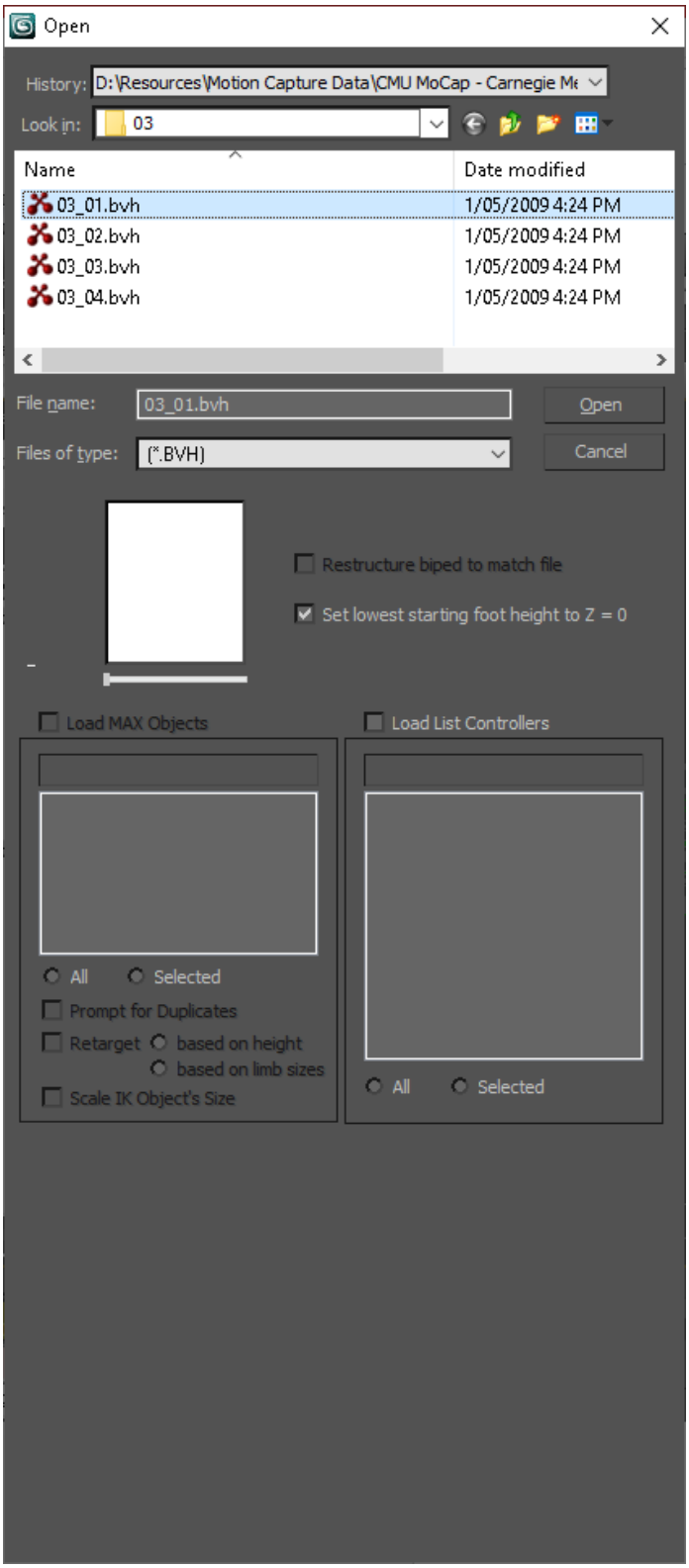

Figure 1268 - Selecting a .bvh file to load.

Click OK to dismiss this warning.

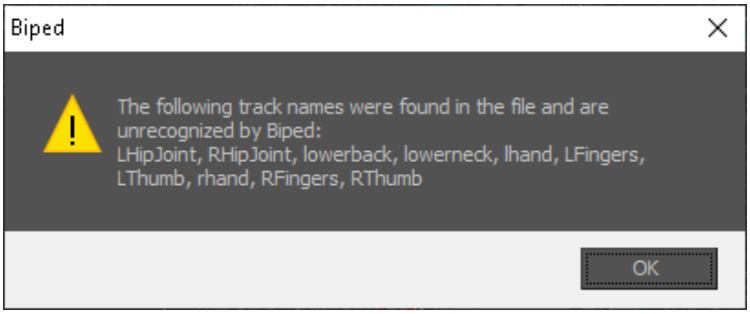

Figure 1269 - Unrecognised bones.

For mocap data from Carnegie Mellon University, a Scale Factor of 4.5 seems to fit best.

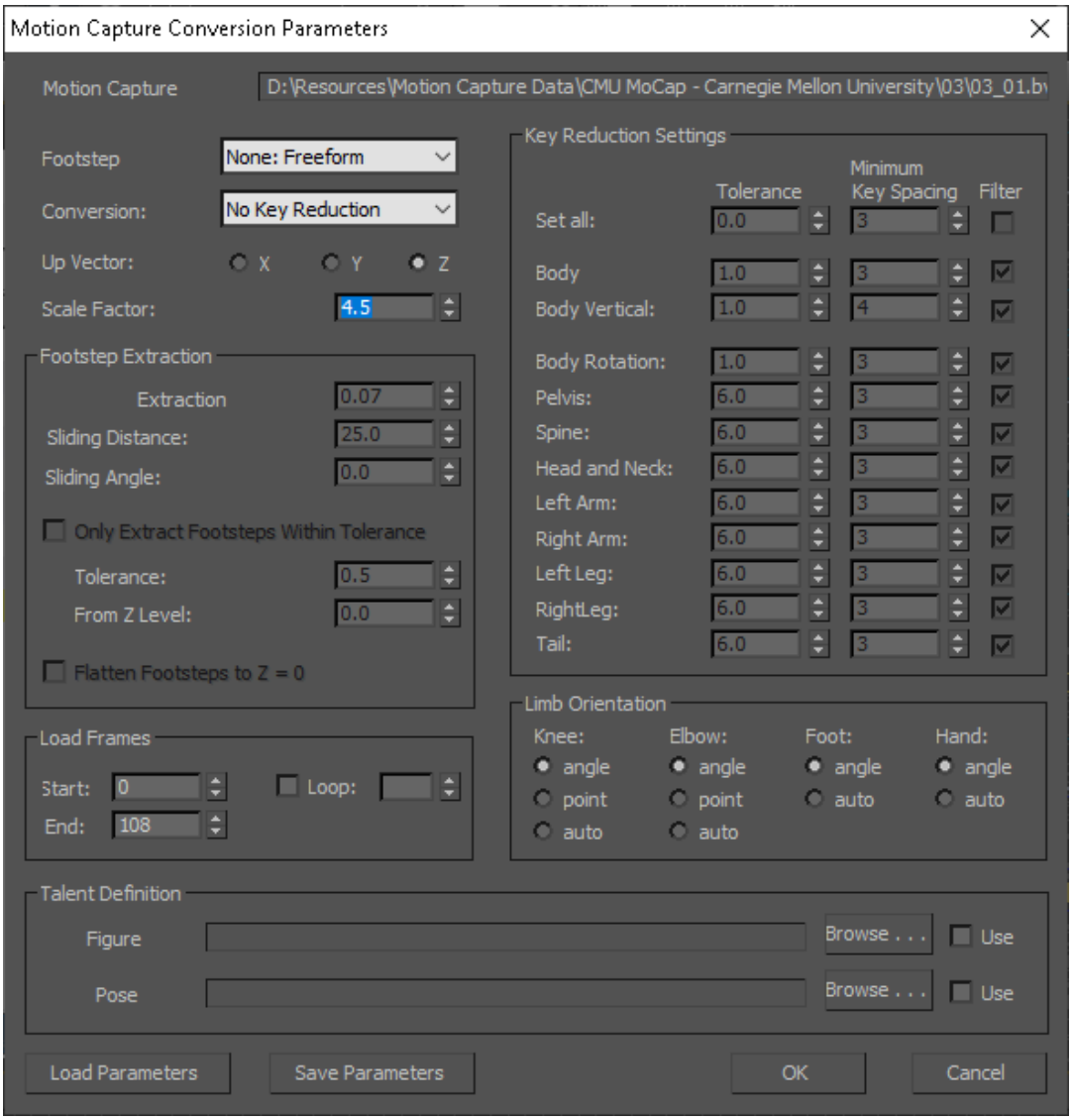

Figure 1270 - Motion Capture Conversion Parameters.

Set Knee and Elbow to 'angle' then click OK.

Scrub the timeline and confirm that the movement of our skeleton matches the movement of the biped.

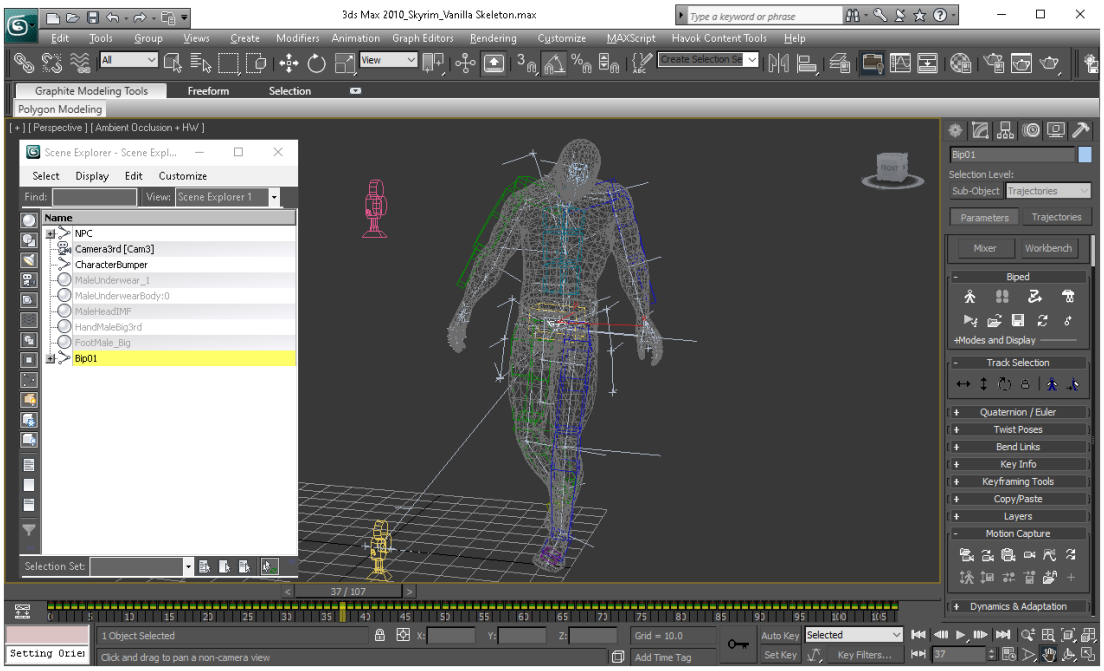

Figure 1271 - The movement of our skeleton constrained to the movement of the biped.

You'll notice that the size of the biped has changed a bit. You will likely need to play around with the Scale Factor when importing motion capture data until you match the size of the skeleton. This is to ensure that the position constraint moves the skeleton around accurately. For example, mocap data from Eyes, JAPAN seems to work better with a scale factor of about 1.8 instead.

EXPORTING ANIMATION FROM 3DS MAX WITH HAVOK CONTENT TOOLS

This section will cover the steps necessary for exporting animation from 3ds Max into Skyrim.

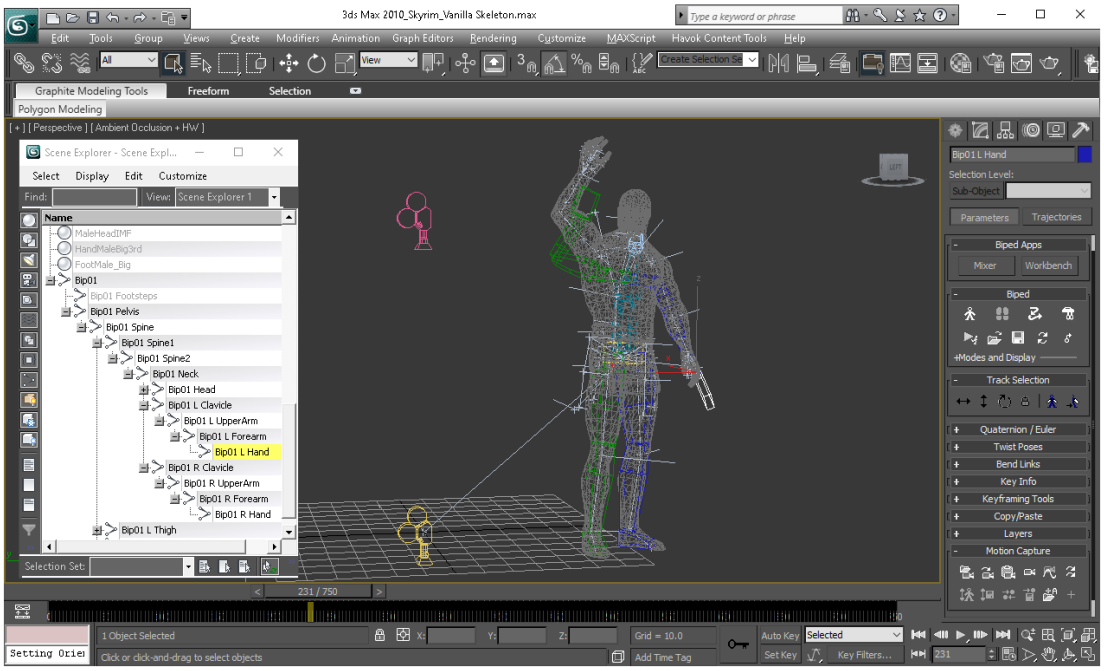

Figure 1272 - Waving motion capture in 3ds Max.

Select the skeleton and all child objects.

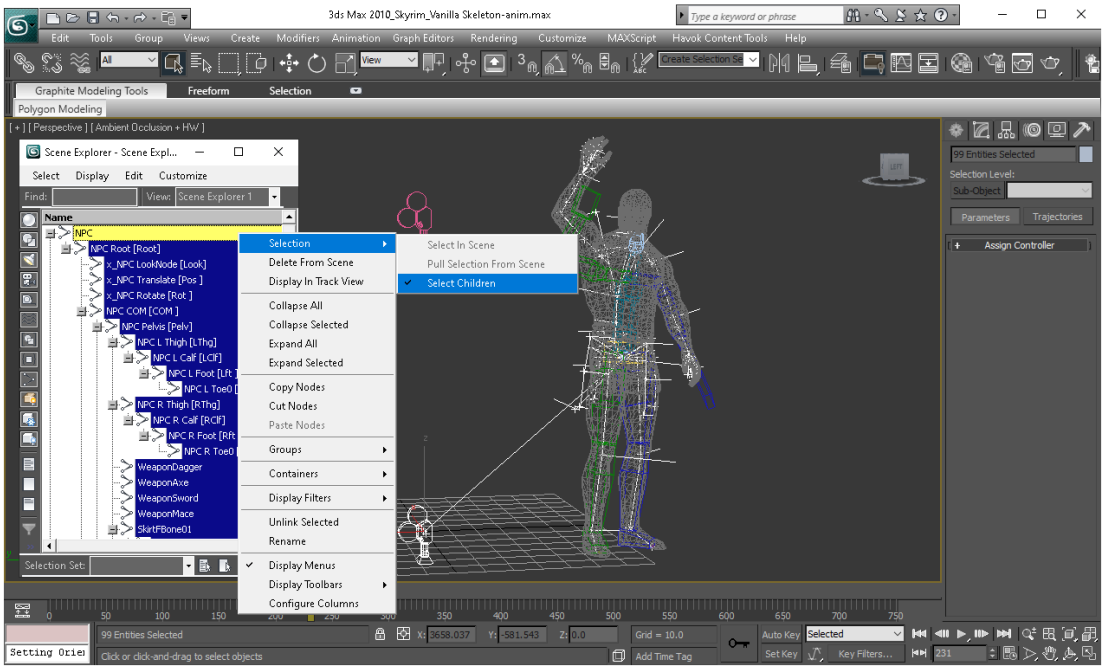

Figure 1273 - Selecting all bones.

Under the Motion tab on the right hand side, click on Trajectories.

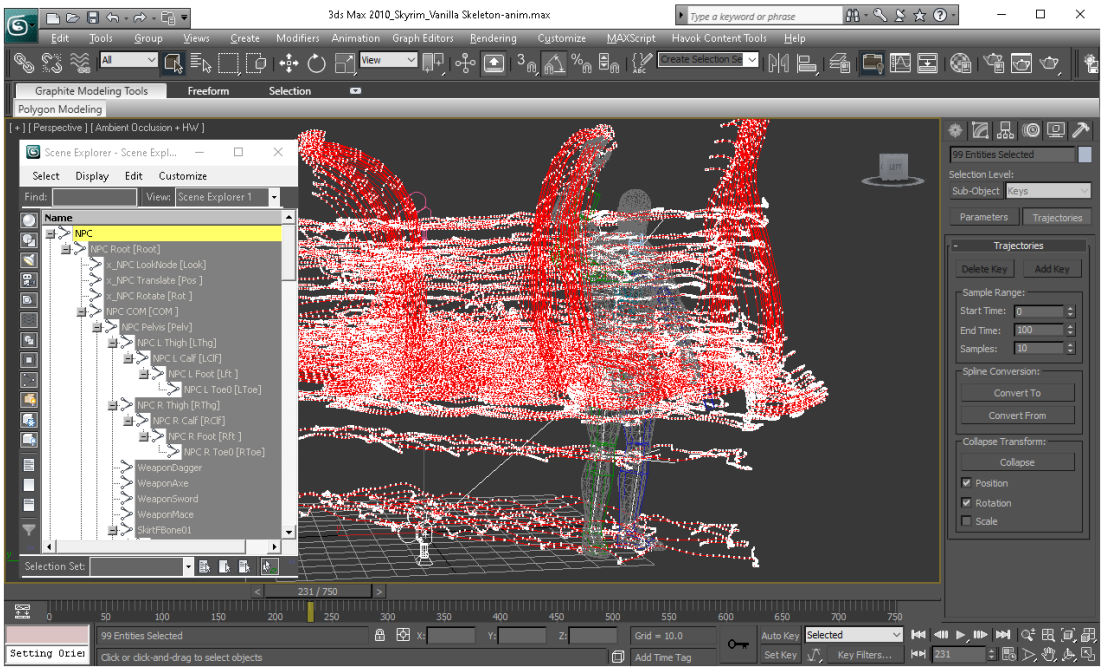

Figure 1274 - Showing trajectories.

Set Start Time to 0, End Time to the last frame (in this example that's 750), increase Samples to 500, and then click Collapse under Collapse Transform.

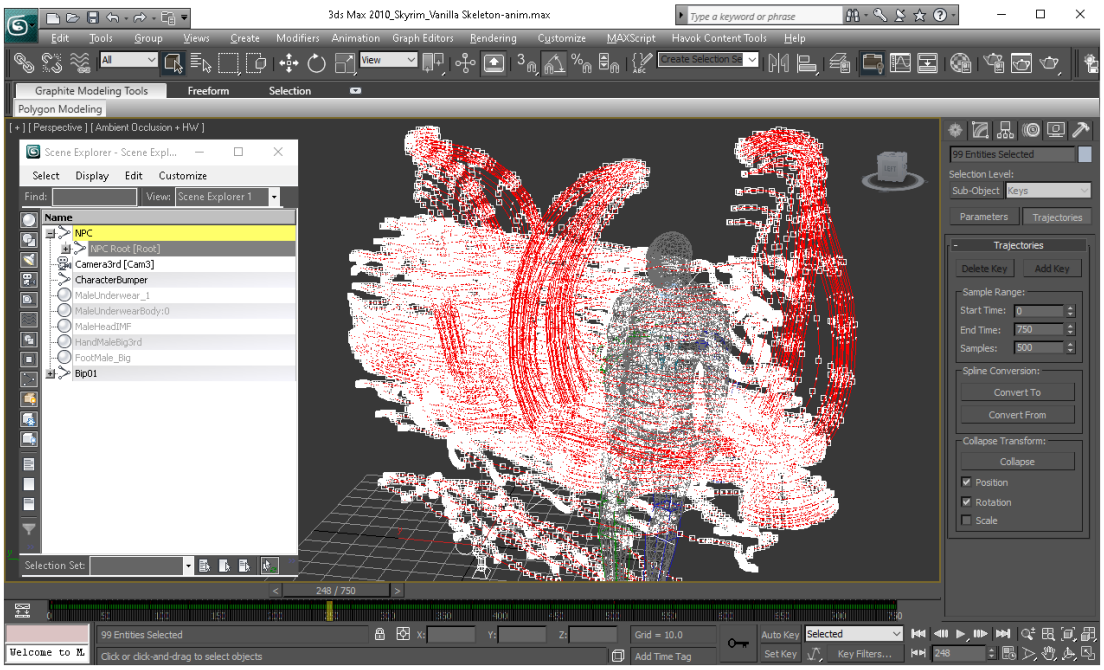

Figure 1275 - Copying transforms from the biped over to the skeleton.

You should see keyframes added to our skeleton's bones in the timeline below the viewport.

At this stage we won't need the biped anymore. Double-click on Bip01 to select all child objects then delete it.

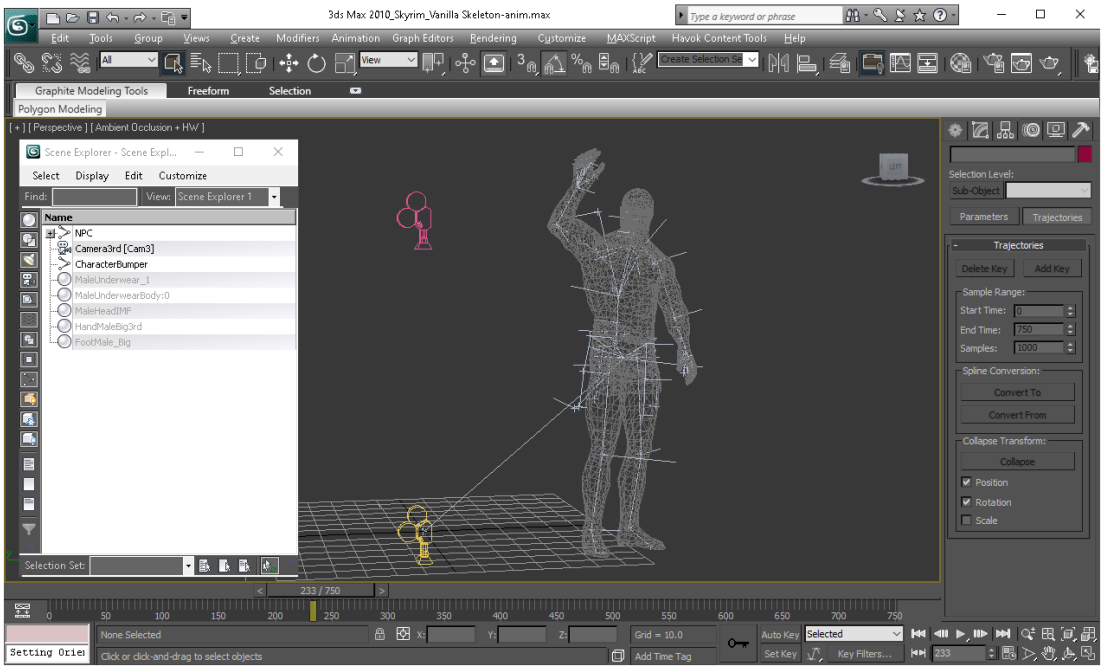

Figure 1276 - Deleting Bip01.

Scrub the timeline and confirm that the skeleton still moves without the biped.

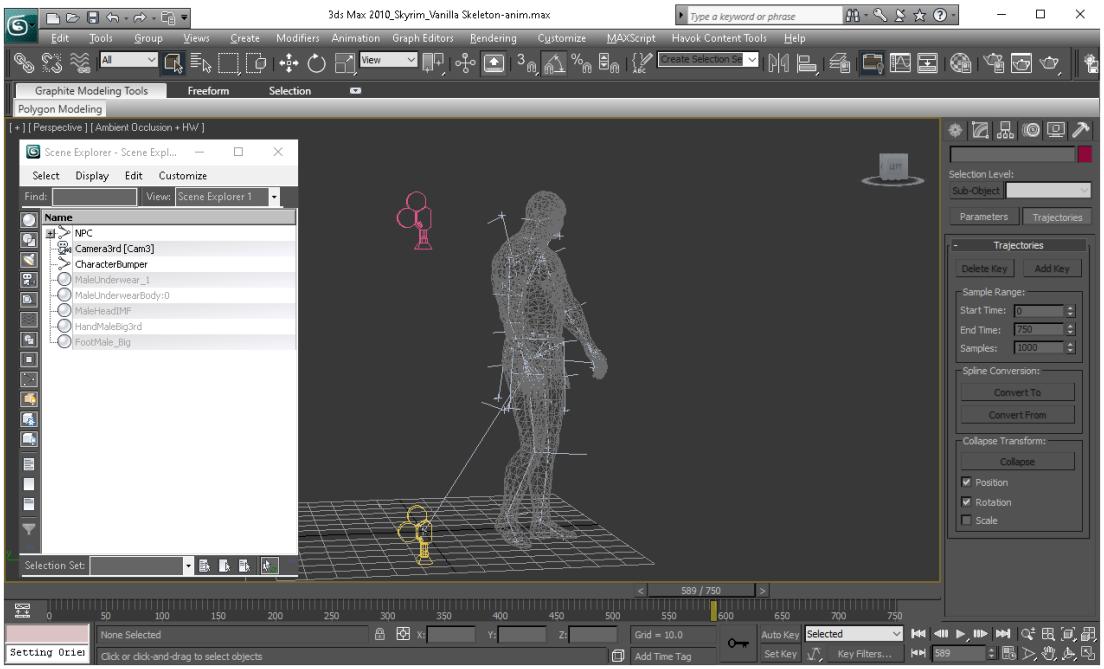

Figure 1277 - Skeleton still moves when scrubbing the timeline.

Select the skeleton and all child objects then right-click in the viewport and select Dope Sheet.

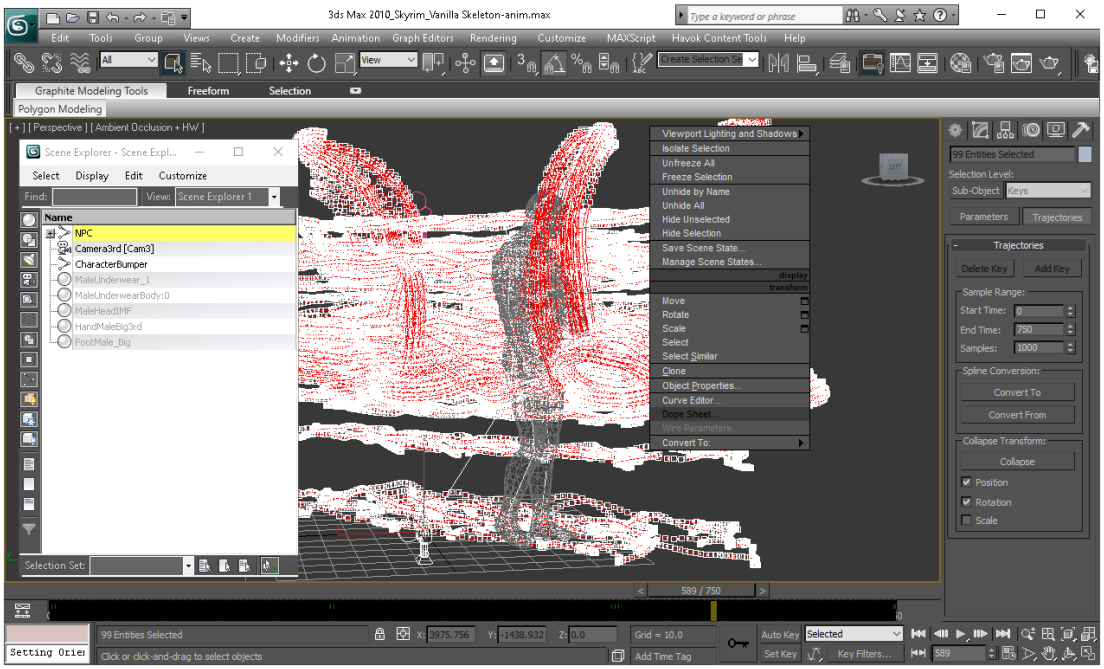

Figure 1278 - Opening the dope sheet.

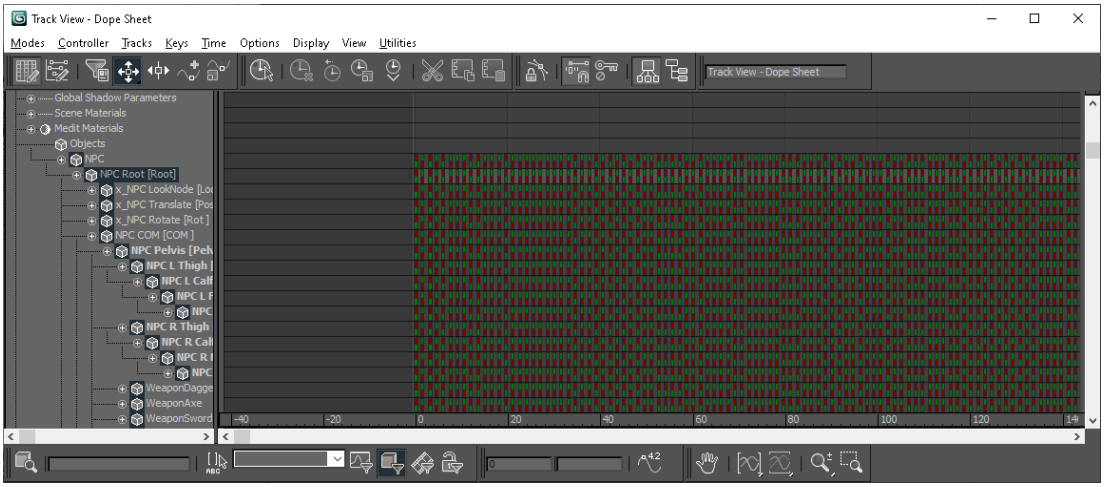

Figure 1279 - Keyframes added to the skeleton.

For exporting the animation, we'll first need to add a note track in the dope sheet on the first and last frames.

Firstly, click on NPC Root [Root] to select it.

Scrub the timeline back to the first frame.

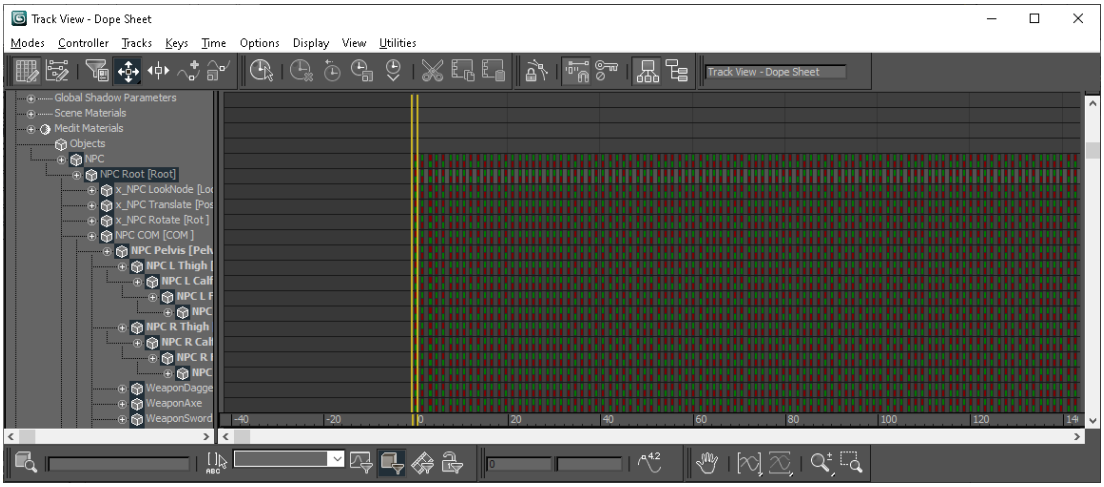

Figure 1280 - Selecting NPC Root [Root] in the dope sheet.

Go to Tracks > Note Track > Add.

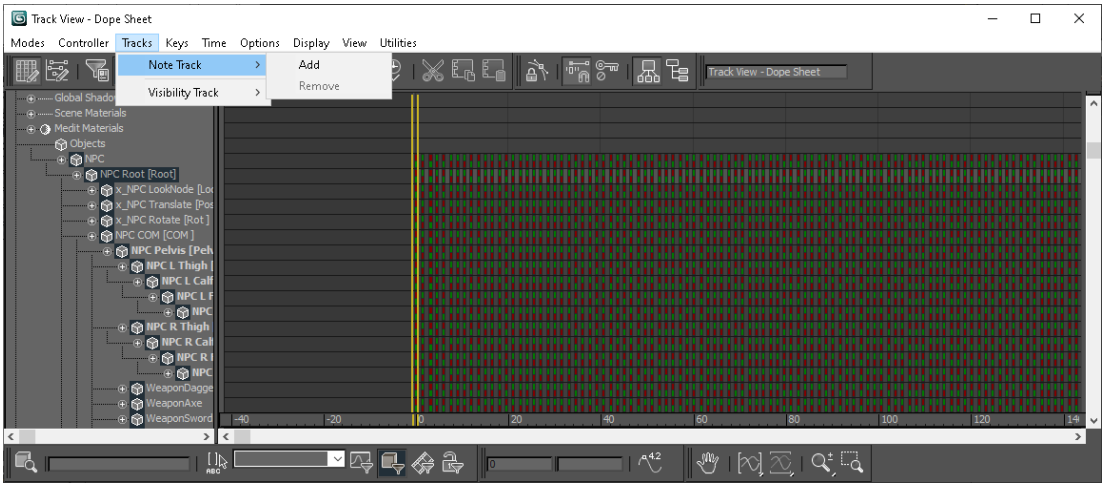

Figure 1281 - Adding a note track.

Go to Keys > AddKeys.

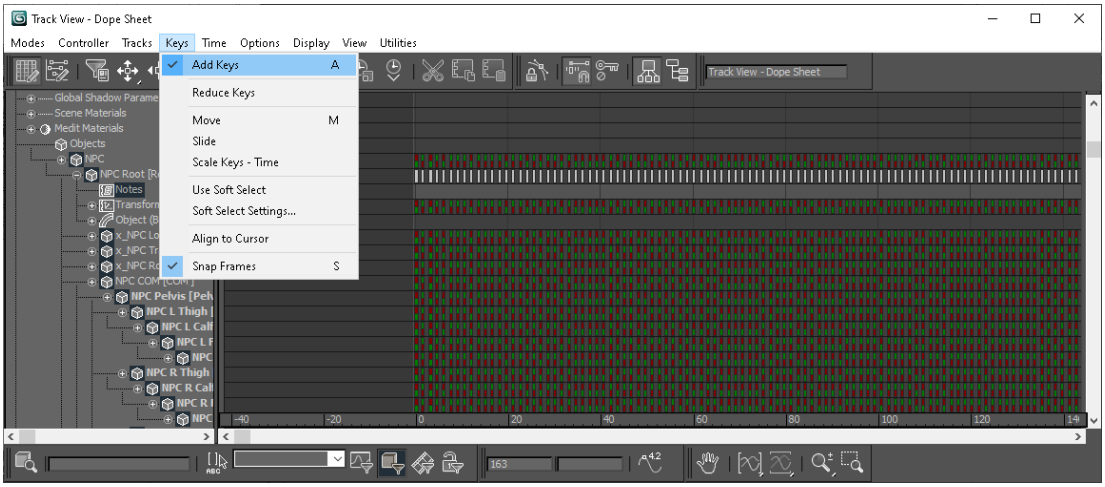

Figure 1282 - Adding a new key to the notes track.

Add a key to the first frame of the notes track and the last frame of the notes track. For this example, that's going to be frame 750.

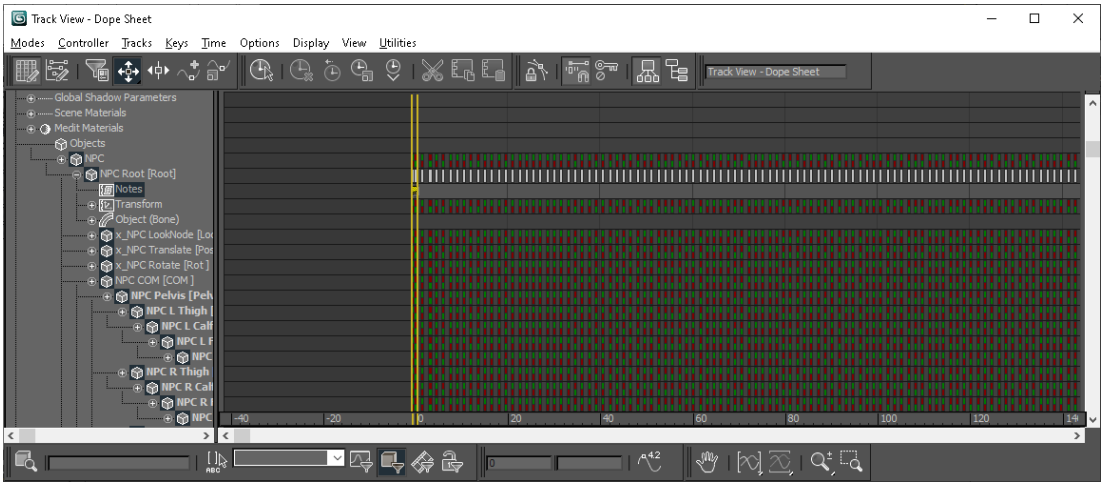

Figure 1283 - New key added to notes track on frame 0.

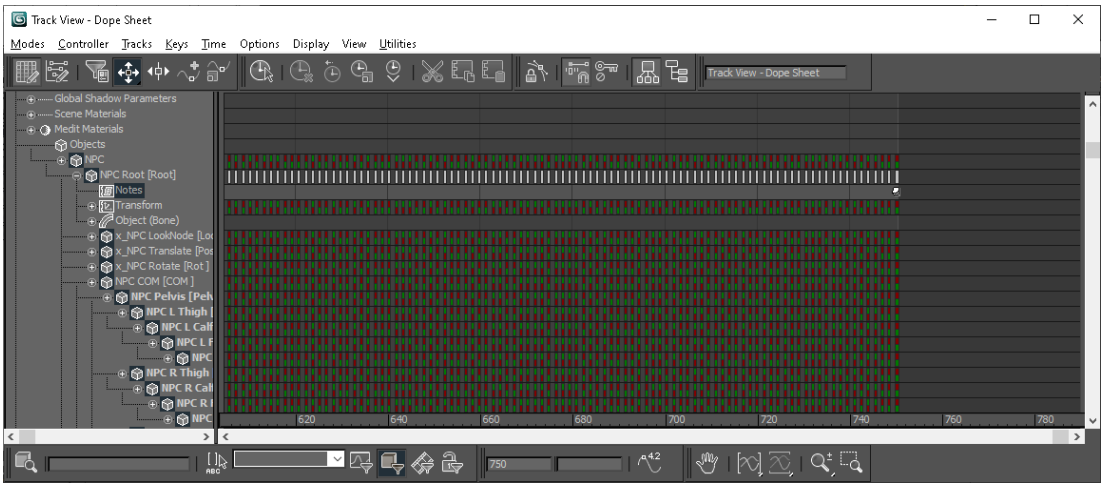

Figure 1284 - New key added to notes track on frame 750.

Right-click on the note on the first frame to open it.

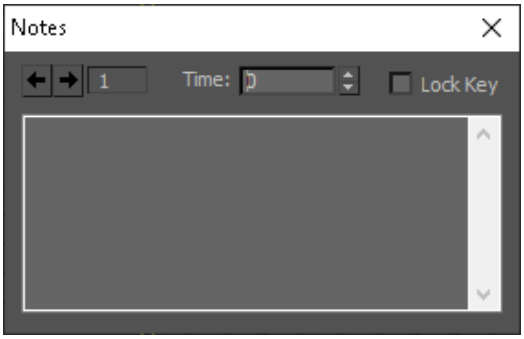

Figure 1285 - Editing the note on the first frame.

We need to add a specific command here:

```
start -name <NameOfYourAnimation> -at y
```

For this example, I'm just going to call the animation 'walkingaroundwaving'.

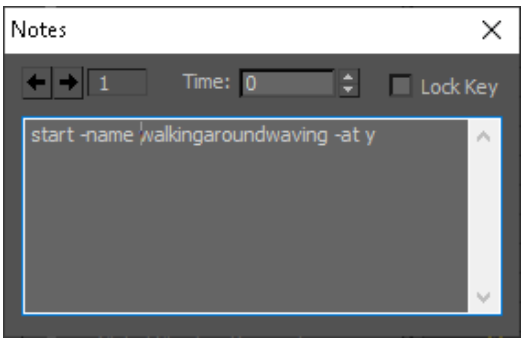

Figure 1286 - Command added to first note.

Add `end` in the last note like so:

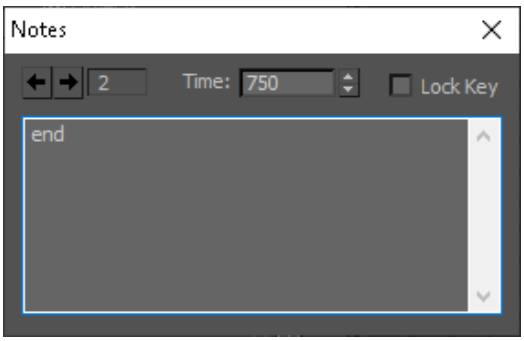

Figure 1287 - Command added to last note.

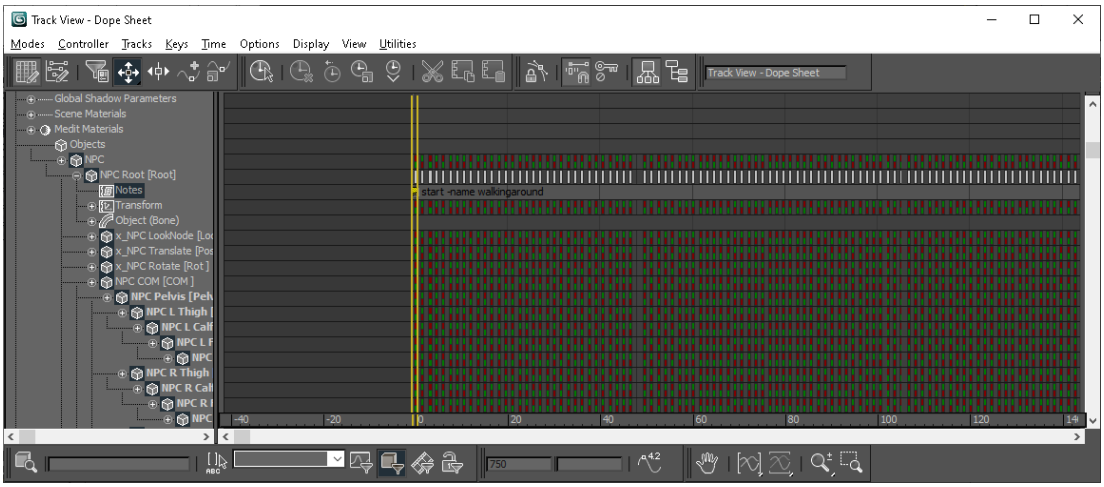

Figure 1288 - Notes added to dope sheet.

Close out of the dope sheet.

Go to Havok Content Tools > Export.

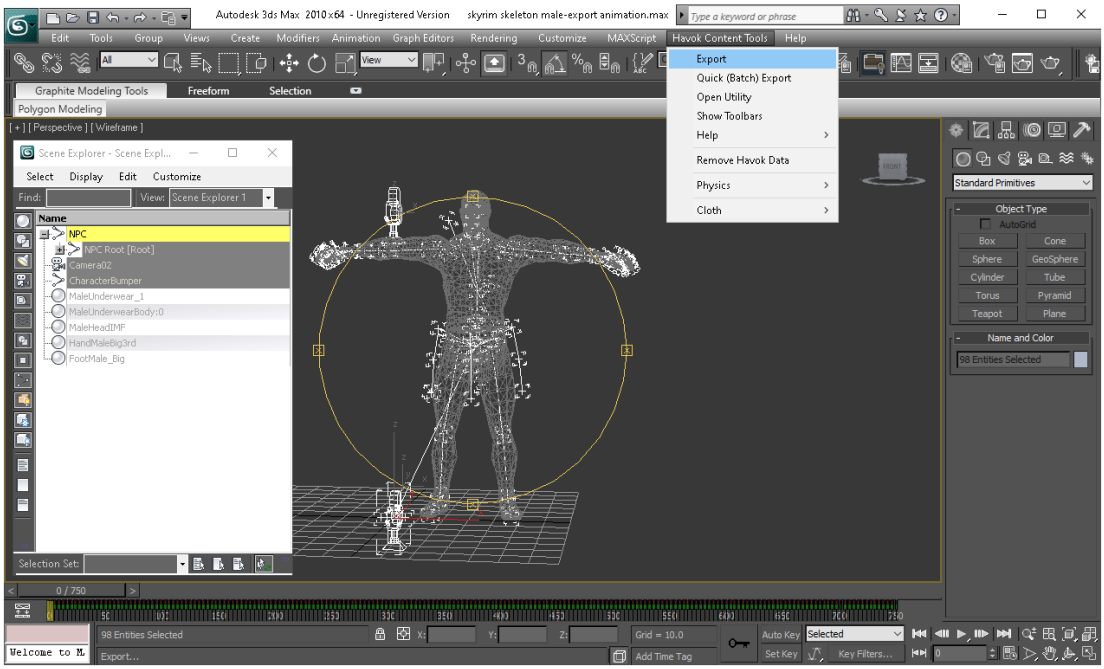

Figure 1289 - Opening the Havok Content Tools exporter.

Go to the Animation tab, click on Create Skeletons then click Add to add it to the current configuration set. Add Create Animations, Extract Motion, Spline Compression, Footstep Analysis and Loop Animations in that order.

Then go to the Core tab and add Prune Types and Write to Platform.

Set the name of the configuration set to Animations.

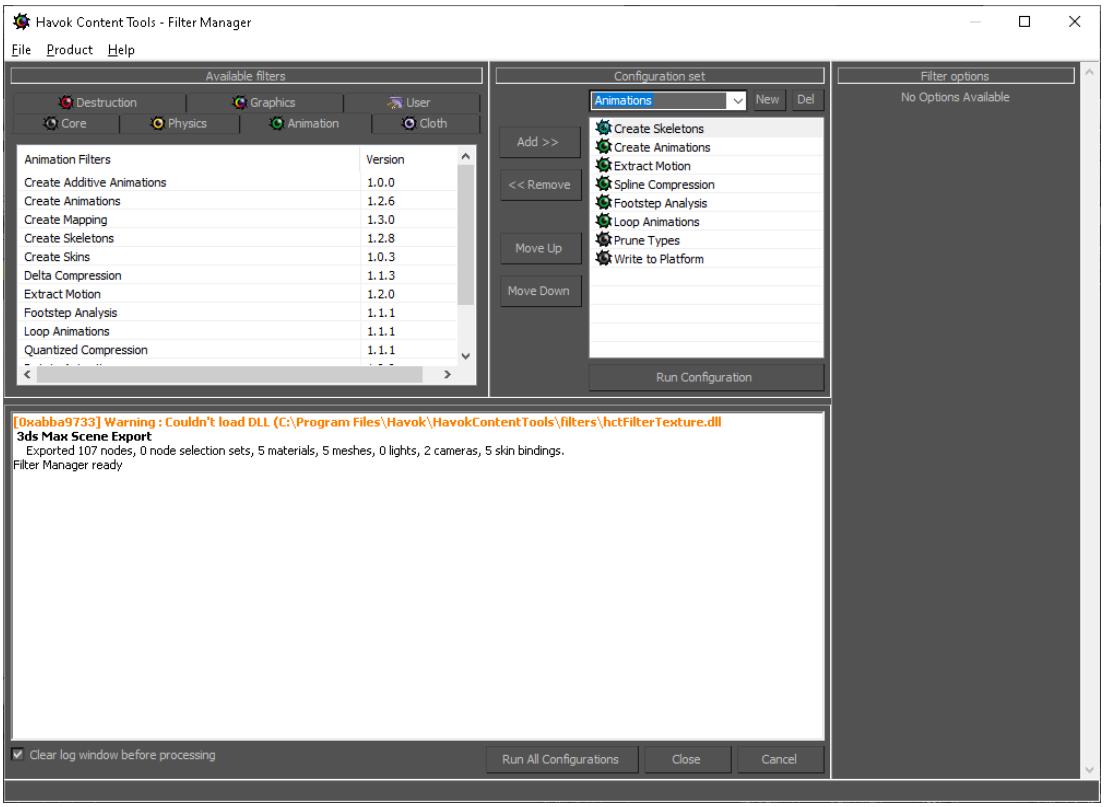

Figure 1290 - Adding tasks to the current configuration set.

First let's start with Create Skeletons.

Under Build Rig, set it to 'From File' and tick 'Use File Order'. Set the file to Skyrim3rdPersonRig.txt. This file came with 3ds Max 2010_Skyrim_Vanilla Skeleton.max.

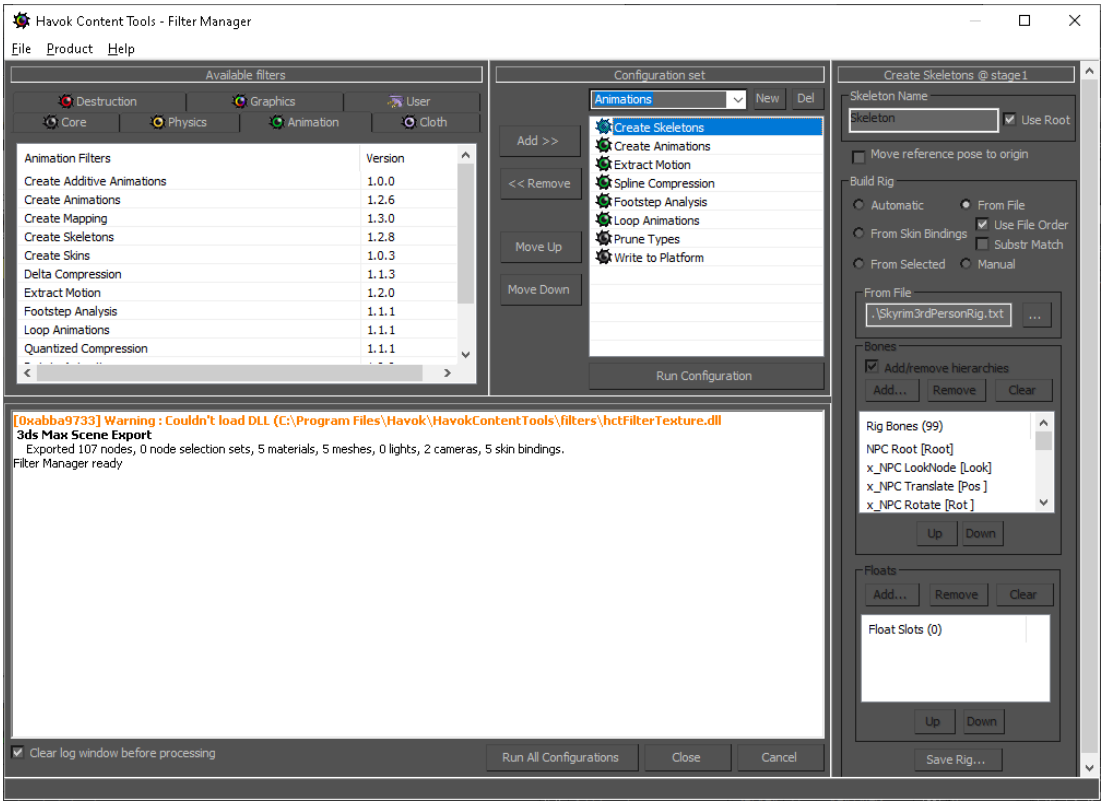

Figure 1291 - Create Skeletons.

Next, under Create Animations, untick X, Y and Z next to Move To Origin. Ensure the first frame is set to 0 and the last frame is set correctly. In my example, the last frame is 750.

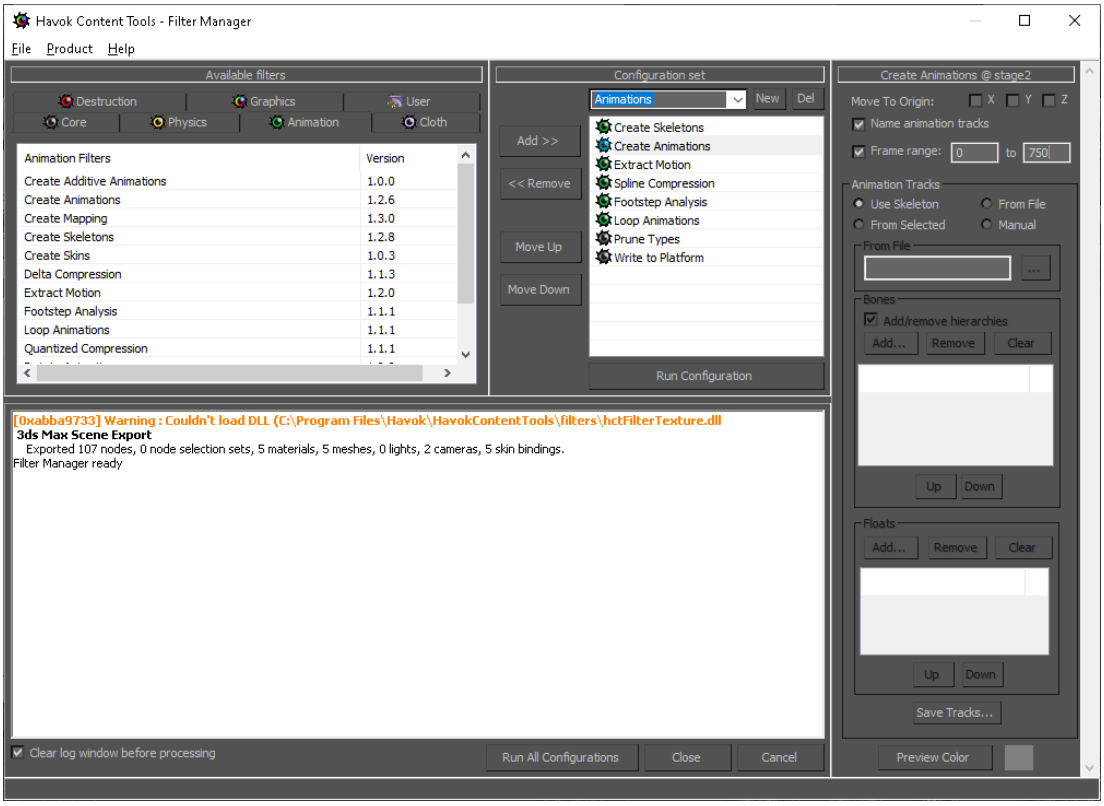

Figure 1292 - Create Animations.

Ensure Extract Motion is set up as per the screenshot below. We shouldn't need to change anything.

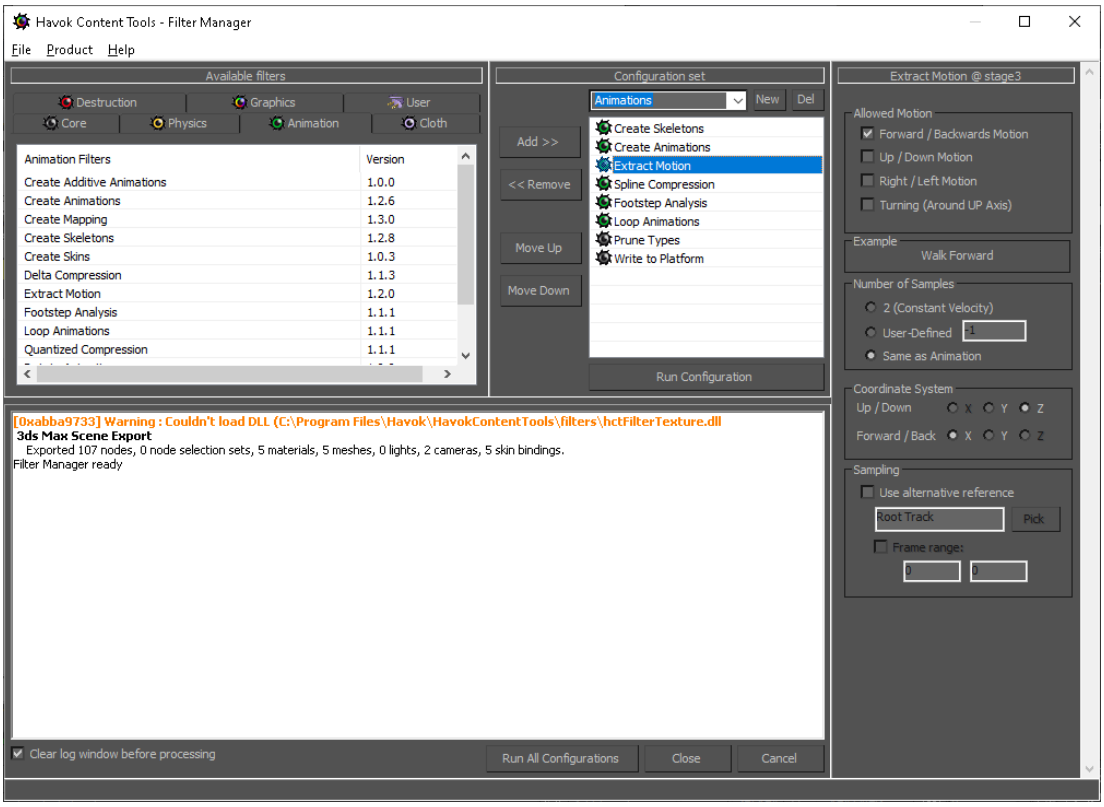

Figure 1293 - Extract Motion.

Spline Compression is next. Make sure the Quality slider is set to High [Lossless].

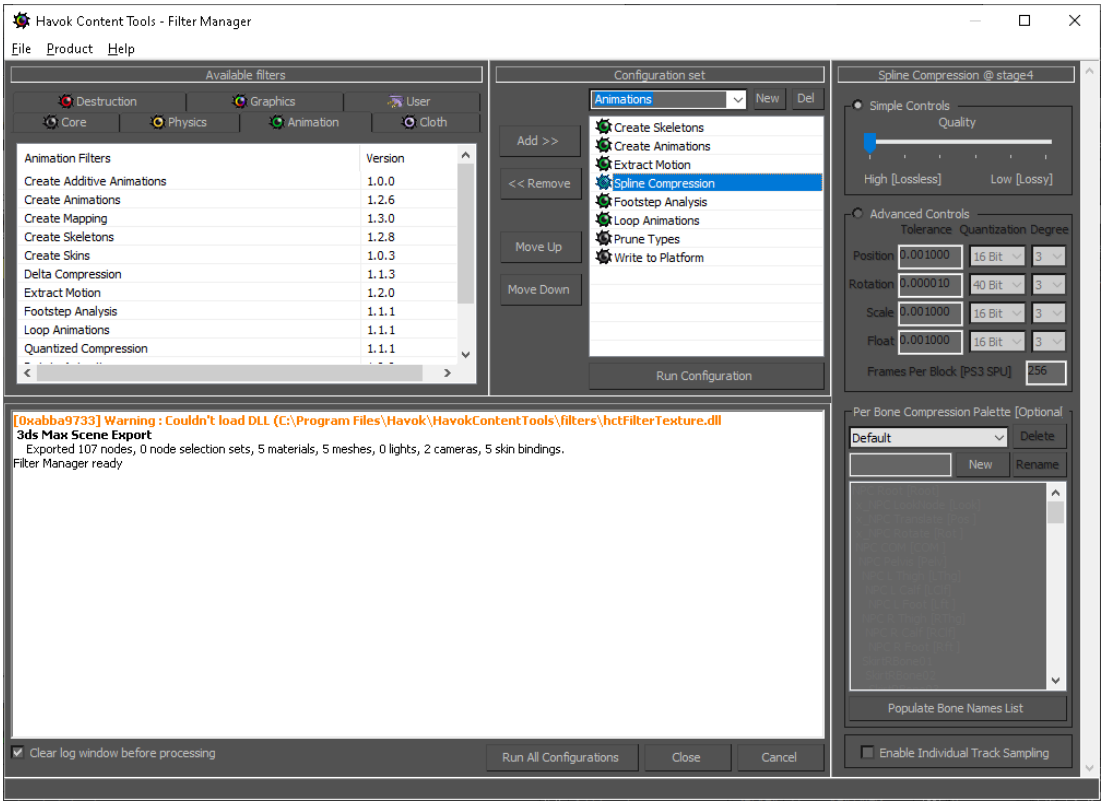

Figure 1294 - Spline Compression.

We shouldn't need to change anything under Footstep Analysis.

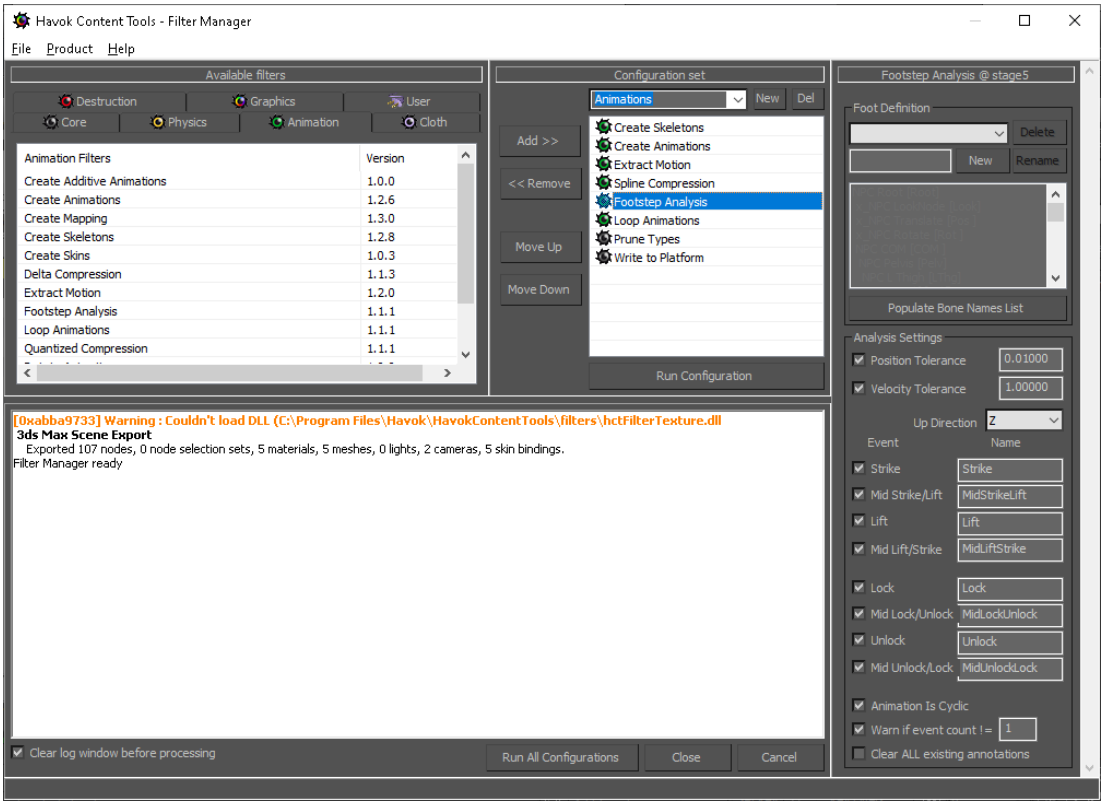

Figure 1295 - Footstep Analysis.

For this example, set the Number of Frames field to one frame after the last frame of your animation. E.g.: 751.

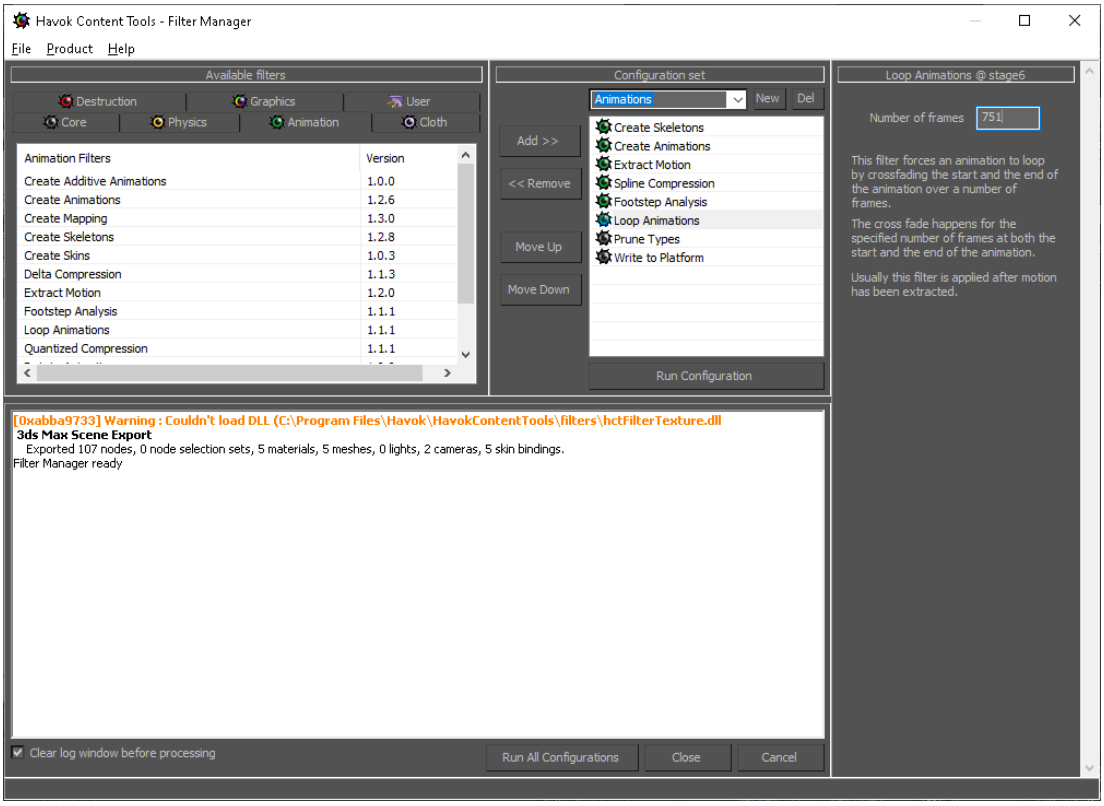

Figure 1296 - Loop Animations.

Go to Prune Types. Under Scene, tick 'All Scene Data'. Under Animation, tick Skeletons, Bone Attachments, Identity Binding Indices, Mesh Bindings and Ragdoll and Mappers. Under Environment, tick Environment Data and under Resource Data tick All Resource Data.

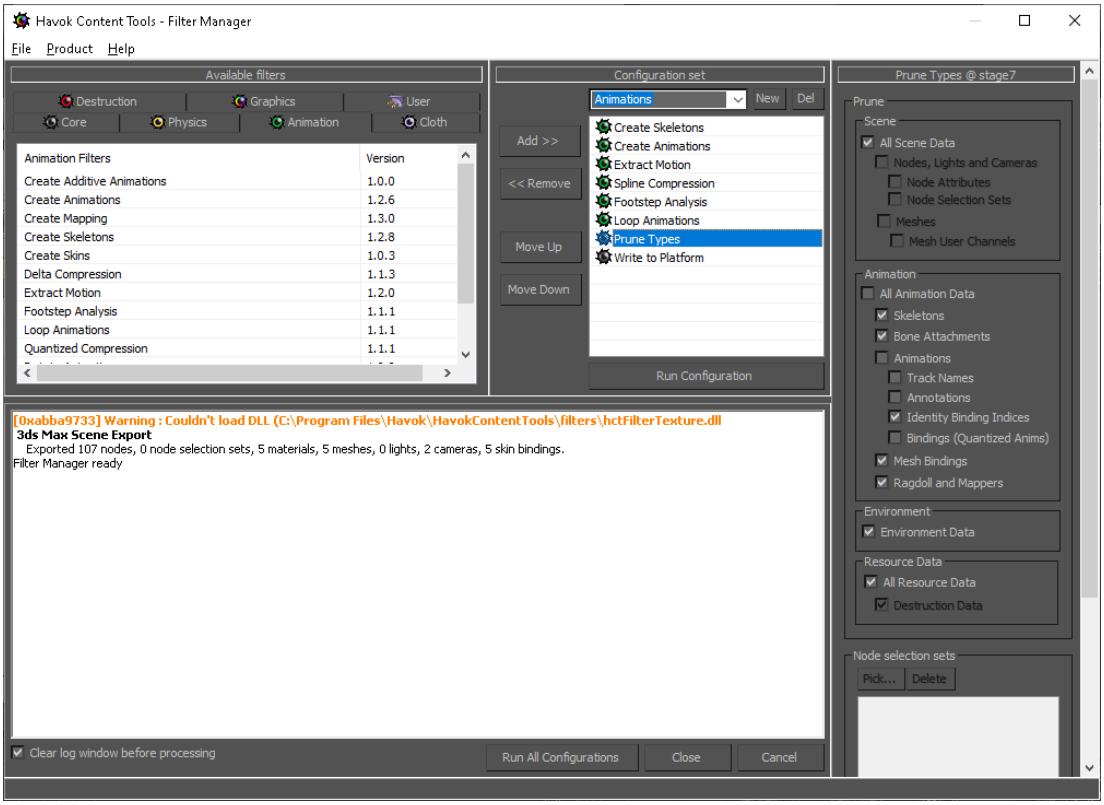

Figure 1297 - Prune Types.

Finally, under Write to Platform, set the Format to Packfile, tick Remove Metadata and click on the '…' button to set the file export location.

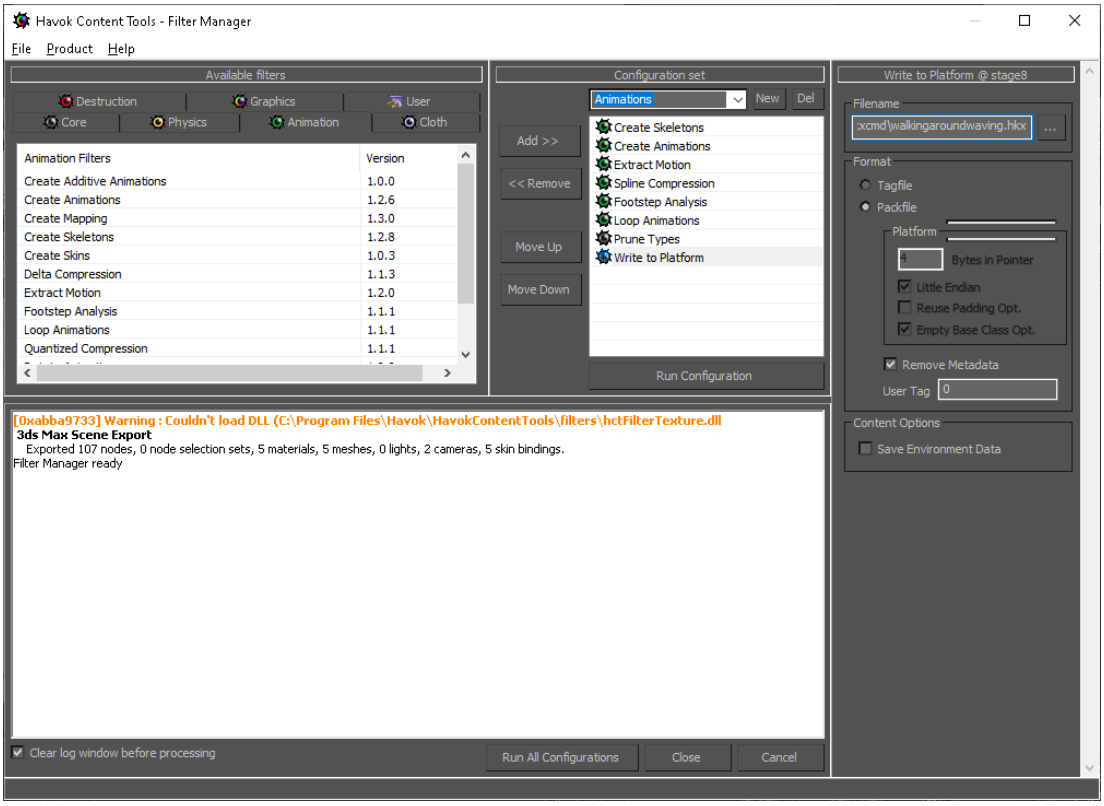

Figure 1298 - Write to Platform.

Ensure you're saving the file as Binary Packfile (*.hkx).

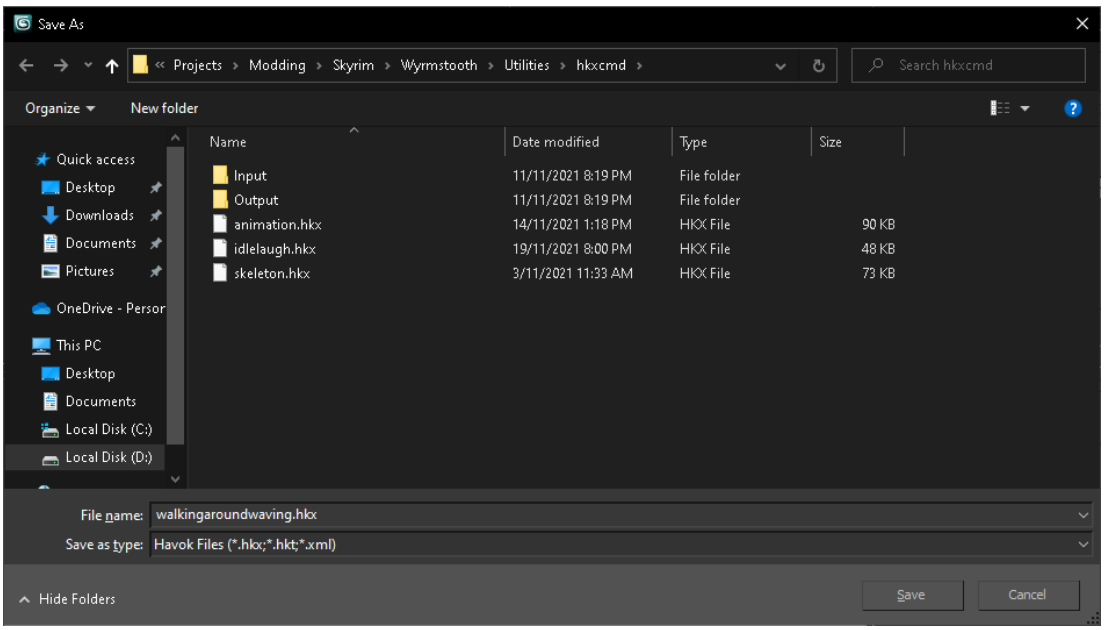

Figure 1299 - File export location.

To begin the export process, click Run Configuration.

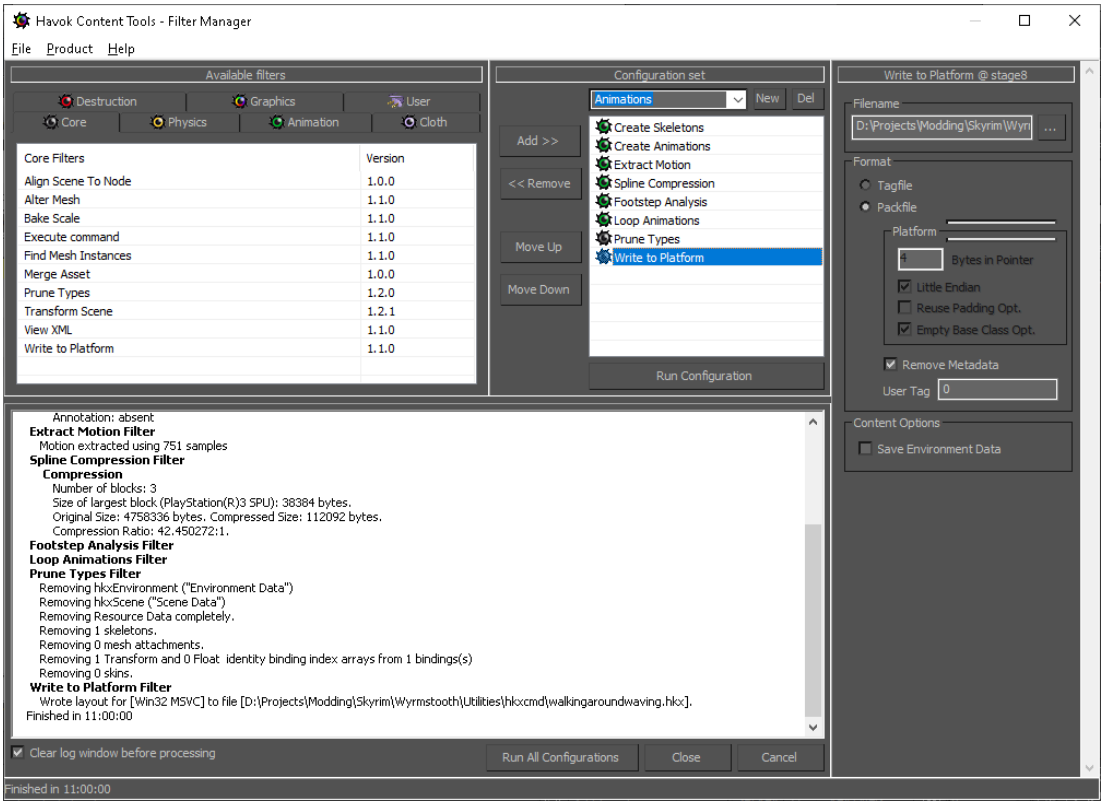

Figure 1300 - Run Configuration.

Browse to the folder you saved the .hkx file to and confirm it has been created successfully.

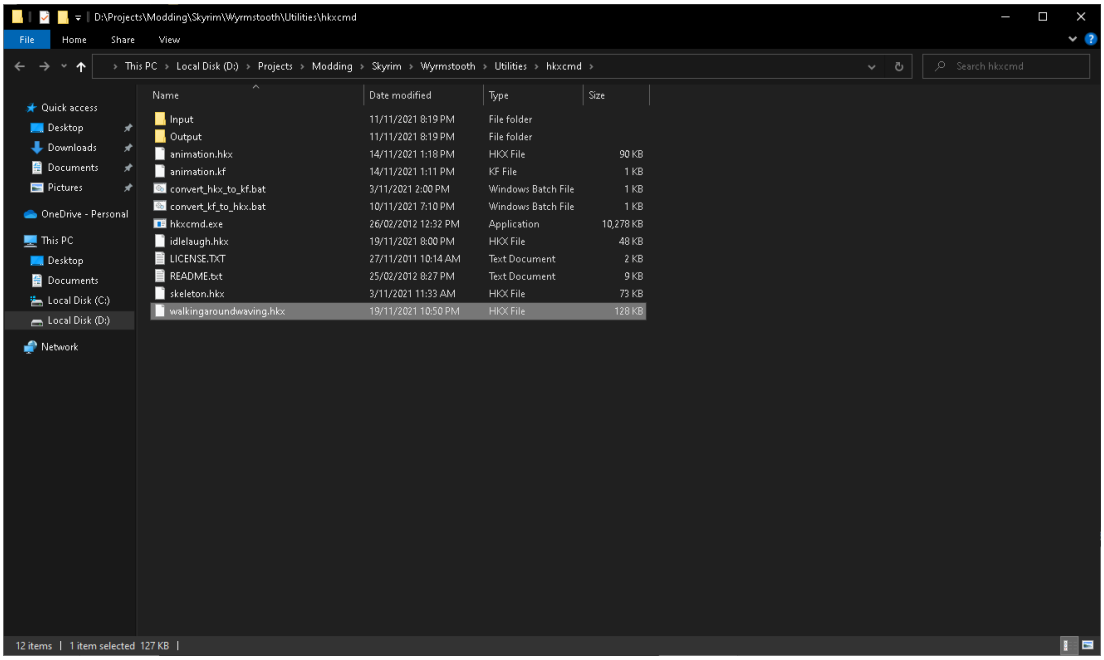

Figure 1301 - Confirming the .hkx file has been exported.

Copy the file to your Skyrim\Data\meshes\actors\character\animations or Skyrim Special Edition\Data\meshes\actors\character\animations folder.

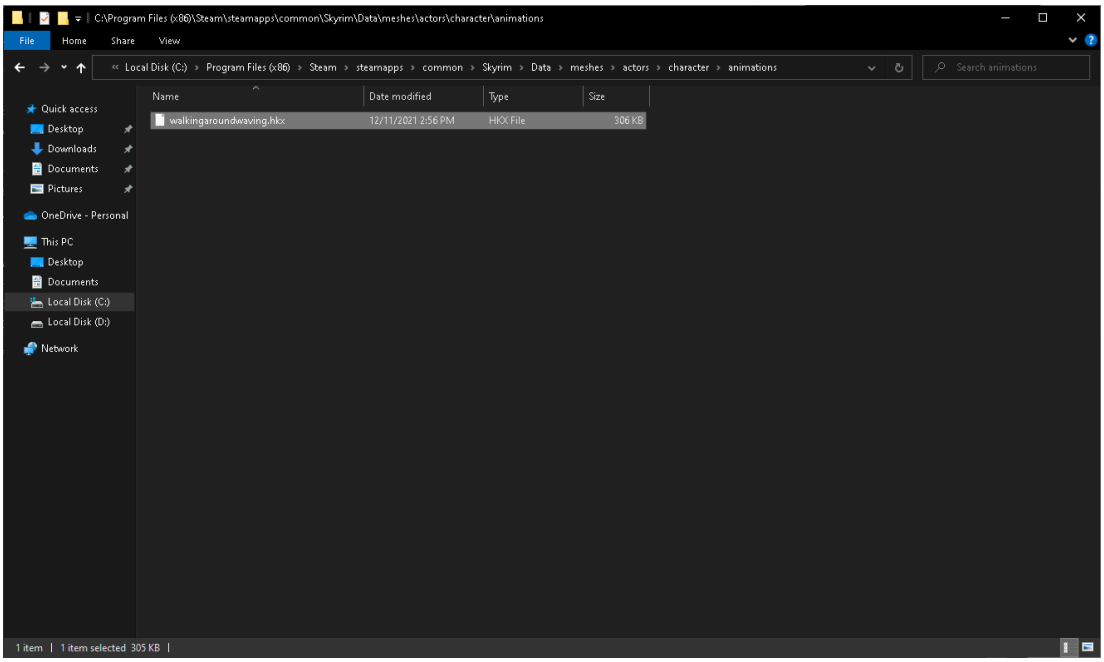

Figure 1302 - .hkx file copied to the Skyrim data folder.

For now, I'm just going to test out this animation in-game by replacing an existing animation temporarily.

To replace an existing animation, simply name it after an existing .hkx file. In this example, I'm going to rename walkingaroundwaving.hkx to idlelaugh.hkx.

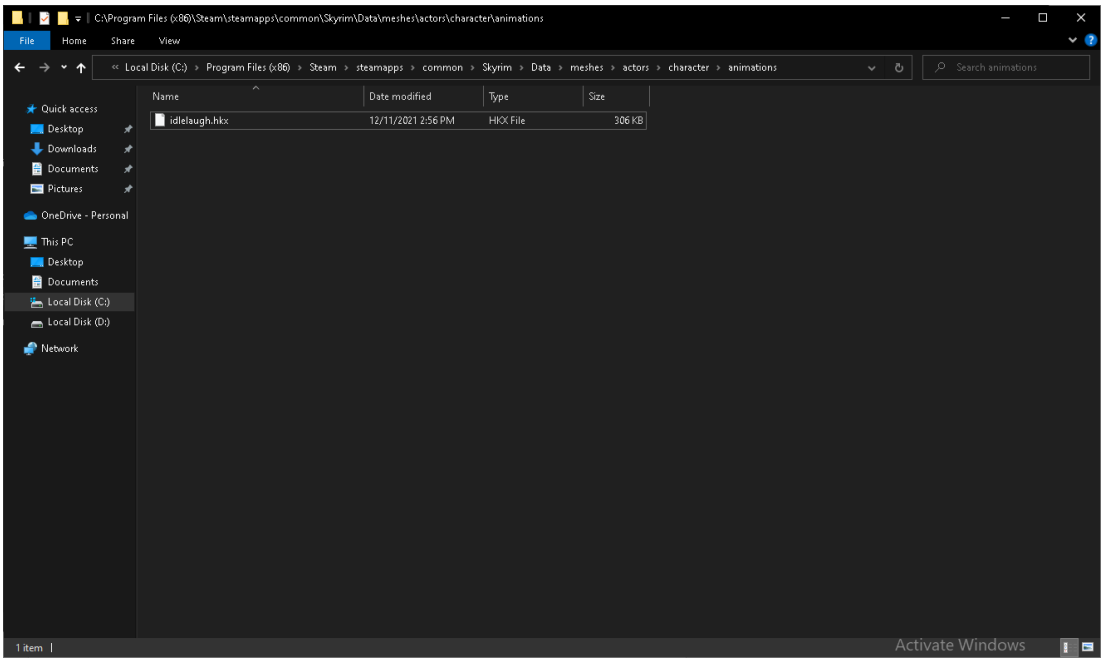

Figure 1303 - .hkx file renamed.

In the Creation Kit, go to Miscellaneous > IdleMarker in the Object Window. Right-click on one of the existing idle animations and select New.

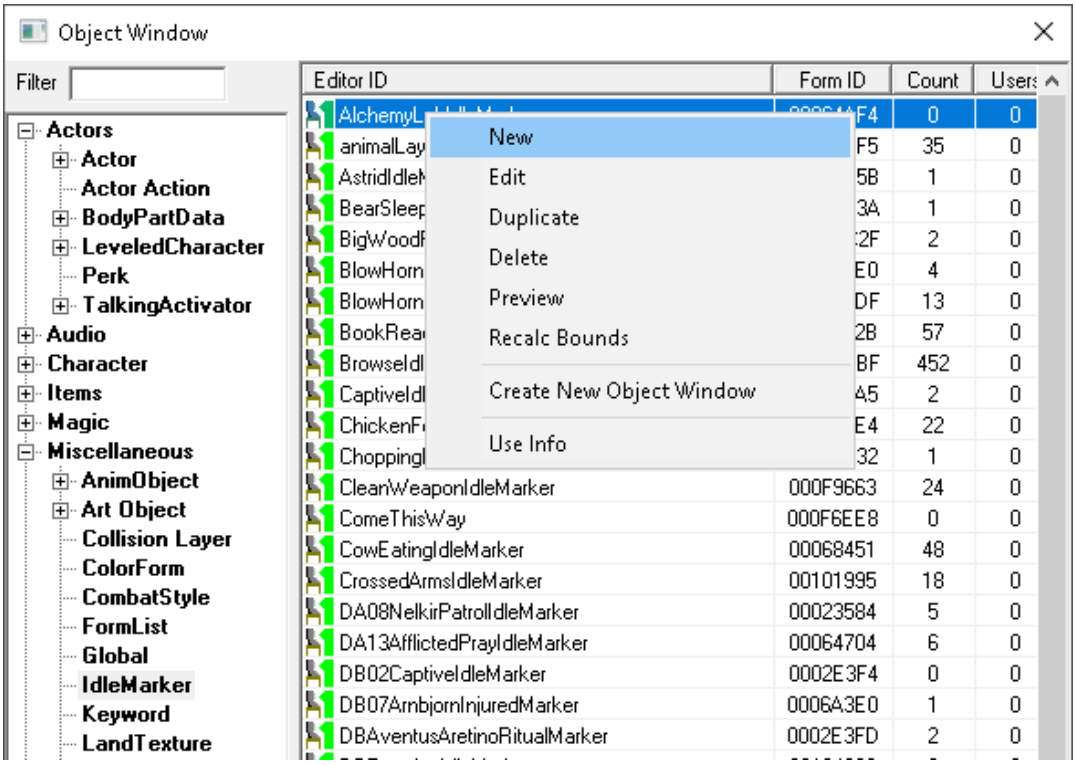

Figure 1304 - Creating a new idle marker.

Set an ID in the ID field. For this quick example I'm just going to set it to WTIdleLaugh.

Since we replaced IdleLaugh I added it to the list of idle animations.

For more guidance on setting up idle markers, see Adding Idle Markers.

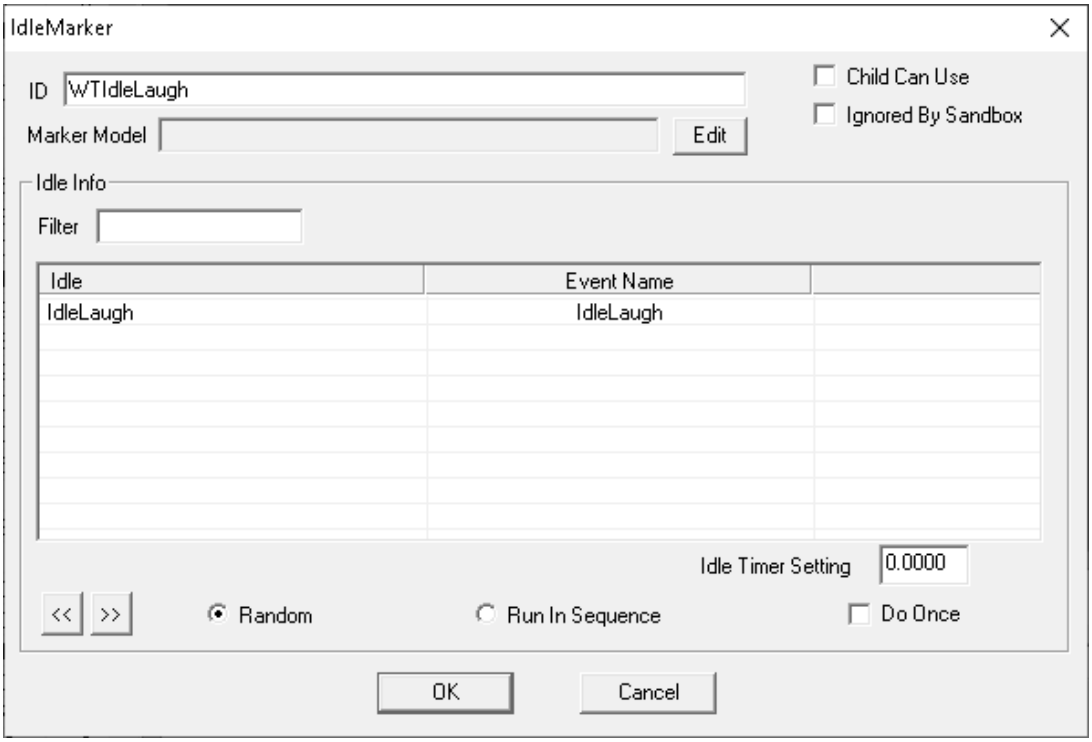

Figure 1305 - IdleMarker setup.

To test things out, I just added an NPC linked to the WTIdleLaugh idle marker and added a COCMarkerHeading marker so when I use console commands to teleport into the cell, I'll be able to see the animation as soon as it starts.

I also added a simple navmesh so the NPC can walk over to the marker.

Figure 1306 - An NPC linked to the WTIdleLaugh marker.

And there we have it, the animation plays successfully in-game.

Figure 1307 - Motion capture animation playing in Skyrim.

CHAPTER 10: SPEECH SYNTHESIS