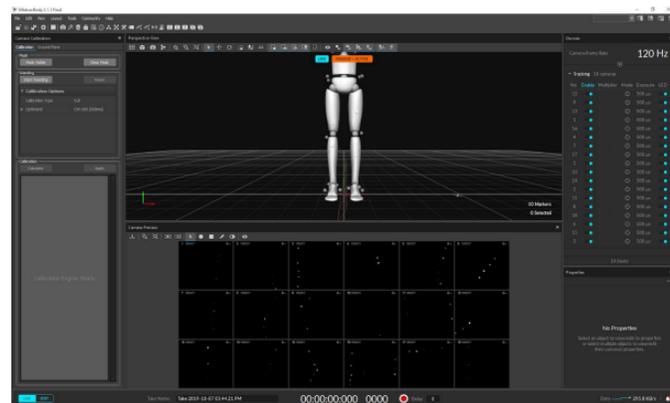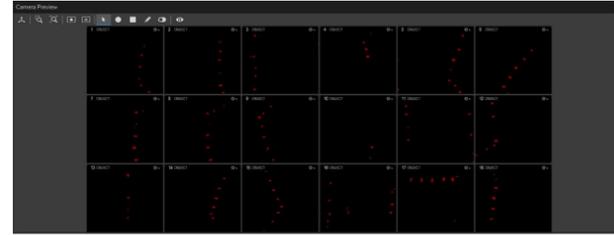How Do I….
# Setup for Motion Capture

- Room Setup
  - The room is on a per reservation request system. Please check in before your time slot, or email if there has been a cancellation. Make sure that the area does not have any objects (tables, chairs, previous project equipment) in it. If there is anything, please move it along the walls so that it is not caught by the cameras.
- Computer Login + Starting the Software
  - The computer for this system lives full time in the room, located in one corner by the door. Turn on the computer and the monitor. There should be a keyboard and mouse with this setup. For this class, the login information for the computer will be your net ID and password. Once you are logged in, you can start Motive from its icon on the desktop.
- Equipment Check
  - All the equipment needed is already in the room, located in one corner of the room. There are the motion capture suits, markers, wand, ground plane, hats, and gloves. There should also be the ground plane markers and wand, along with the computer and its accessories (keyboard, mouse, monitor). If anything is damaged or missing please note it before use - and contact Mike Toomey.
- Wanding
  - Before launching Motive, please make sure that the area is clear of any reflective objects (like reflective stripes on backpacks or reflective shoe logos, etc). The cameras may mistake them for markers and alter the data. Keep all markers out of view of the cameras at this moment as well. After launching Motive, it should be set to its default calibration workspace. If not, it may be accessed through the layout menu, and you need to switch to it.
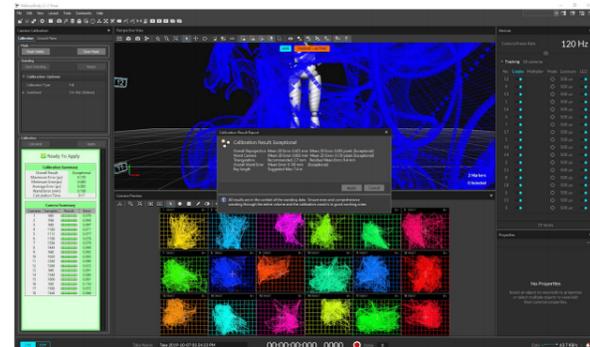


The Calibration Workspace on Motive

- ○ The Calibration Workspace on Motive
- ○ In Motive, there is now a panel on the lower half of the screen showing the views of the camera. A bar at the top of this panel has an icon that looks like a shield with a minus symbol on it. If you hover over it, it should say "Clear Masking" and click this now.
- ○ Then click on the Mask Visible button to mask any interference that might still be present. This tool lets the cameras know to ignore anything that might be reflective that are not the markers.


Mask Visible in effect, the markers detected are now shown in red.

- ○ Mask Visible in effect, the markers detected are now shown in red.
- ○ The wand is the calibration tool that lets the cameras calculate their position relative to the other cameras.
- ○ The wand should be in one piece but make sure it is not loose with the markers or the top bar, as you will be moving it around the space. In the right hand panel, click the button to begin wanding. Now you can use the wand and walk through the space.
- ○ Feel free to move the wand up and down, twirl and wave it as well through the space. For a sample to be calculated, the wand must be visible to at least 3 cameras at once. Ensure that you wand the entire studio. Ideally you want 5,000-10,000 samples to get an excellent calibration.
- ○ Once you have all the samples you need, click the button to finish wanding. The computer will run through the data and will pop up with a dialog once it is finished. After accepting the calibration, it may prompt you to save your project. Create a new folder in an appropriate location and give it a clear memorable name to save your project there.
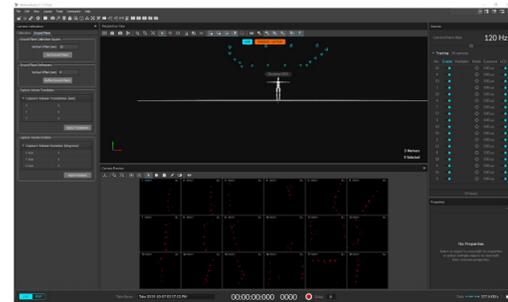

A successful calibration. The colorful data at the bottom panel is from wanding. It is mapped to the 3D space.

- ● Setting Up the Ground Plane
  - ○ The ground plane can then be laid in the center of the room with the +z-axis in the direction of the screen. Make sure that the bubbles register as level as well. If they need to be adjusted, the feet screw in and out.
  - ○ Then simply hit "Set Ground Plane" in the top left corner to set the ground in Motive.

- ○ After completing the ground plane set up, the cameras should be positioned above the skeleton. The calibration is now complete and you are ready to get started with your actor. Make sure you put away the ground plane and wand markers so they will not confuse the system.



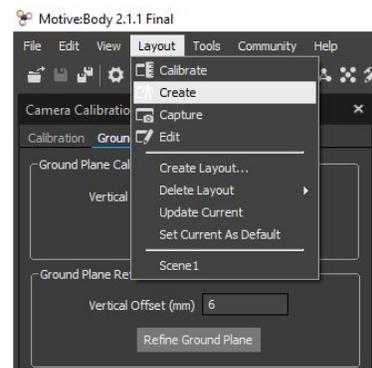After completing the ground plane set up, the cameras should be positioned above the skeleton.

- ○ PLEASE NOTE - Motive needs to be re-calibrated after each restart or for sessions longer than two hours. If you have a session that is planning on lasting longer than 2 hours, please reset in the middle, as the repetition of movements may cause the markers to shift over time and cause problems with results.

- ● Capturing Data
  - ○ Motion Capture Suit
  - ○ The motion capture suit comes in a few parts: the top, the bottom, gloves, boots, velcro straps and a hat. All must be worn for accuracy. These black suits come in four sizes: S, M, L, XL. It is best to choose a suit which is tight to the actors skin. Please have the actor wear tight/ well fitting clothing to make the suit as tight as possible. If the suit is loose, the markers will slide on the suit, messing up the data capture.
  - ○ There are velcro straps that are used to securely attach the top of the suit to the bottom. They go on the waistband of the pants and holds the shirt down. This prevents the fabric from twisting with body movements. Always communicate with the actor before touching their body or making adjustments to the suit.
  - ○ The hat has a hole in the back for a ponytail to be placed through it. Hair longer than shoulder length should be tied up and secured as it could obscure the back and shoulder markers. The pants have a velcro strap meant to be secured around the ankle before the boots are put on. The boots must be worn without shoes. For the hands of the suit, the fingers loop around the pinky, index and thumb. Then the gloves slide right over those. Please try to keep all of the Motion Capture suit as tight and straight as possible. Now that the suit is on, it's time to place the markers.
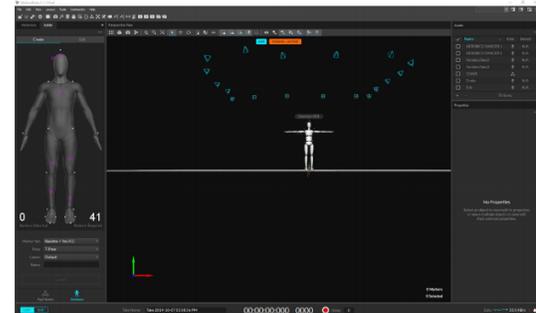
- ● Markers
  - ○ In Motive, switch the layout to the Create layout. In the panel to the right, select the Baseline + Hinged Toe markerset. The computer should show a diagram for the placement of all the markers on the suit. Please note that the legs will have slightly different positions for the markers These are important and help

the system differentiate between the left and right side of the body. The display will show all the markers that are needed (should be 41 total).

○ Selecting the layout tab allows the user to switch between workspaces.

○ Make sure you always verbally communicate with the actor before placing all the markers on the actor.



The model with the correct placement of markers is displayed on the left. As the cameras detect markers, the number on the left will increase. Once it is the correct amount, a skeleton can be created. Additionally, in edit, you can recalibrate the skeleton if needed.

○ Place the markers on the actor as shown in the preview. You can orbit around the preview by alt-clicking and pan using alt and the middle mouse button to get a better look at the marker placement.

○ Have the actor hold their arms in T-pose while placing the markers on the upper body to make sure that they are placed correctly.

○ The elbow and knee markers should be placed right on the pivot point of the bones so that it does not move when the going is flexed. It can be helpful to have the actor bend their knee or elbow to see where the joint actually bends when placing the marker.

○ Once all of the markers have been placed, have the actor T-pose and click the "Create" button.

● Motive Tips

○ When you are ready to capture a movement, enter the name of the take in the field (i.e. "walkcycle01") and click record. If you are doing multiple takes of the same action, use the "Again +" button to increment the version number. Have someone else taking notes on the session and noting down the names of the takes that were good and any other notes you might want to mention.

○ Have the actor T-pose at the beginning of the take and after you click record and before you say "action" so that you have a good skeleton reference to work off of. If you are performing a particularly difficult action to track, have the actor end on the T-pose as well.

○ Come into the studio with a shot list or plan for the actions you want to capture. Especially if you are capturing more than one action in a session, to ensure that you do not miss anything and to keep notes about the details of the action.

● Recording Data

○ Back at the top, switch the layout to Capture. At the bottom of the screen, you will see the name of the take and the red record button. Please enter a name that is

meaningful to you since the default is the date and time (it makes it easier to find later).

- ○ Once you are ready, click the red button to record. You will see a red outline appear on the workspace area, indicating that it is actively recording.
- ○ Once you are ready to stop, simply click the red button again to stop the recording. You will notice the red outline disappear from the workspace and the take will now appear on the list of takes on the left.

- ● Exporting Data
  - ○ When you record an action in Motive, it is recorded as a raw take (.tak) file. To be able to take that data and put it into another program, you must export it.
  - ○ Select the take that you would like to export. Then go to file ⇨ export tracking data. This will bring up a dialog box, asking you where you would like to save your data and the file format. Please select FBX Binary Format and then click save.

- ● Rigidbodies (Additional Motion Tracking for Props)
  - ○ If you need to track additional objects or props, then rigid bodies can be used. We have two prop foam swords that are already pre setup for use.
  - ○ You must attach at least three markers to the object. More markers should be used if the markers can't be seen from all sides and orientations of the object.
  - ○ Also try to place the markers asymmetrically so that it is orientable to the software. In Motive, select the relevant markers, right click, and create the rigidbody.

- ● Editing
  - ○ Switch your layout to the "Edit" layout in the Layout menu. Open your project file (ending in the extension .ttp) from the file menu. On the left you should see your takes. Double click on one to begin editing it. In the "Assets (Current Take)" section, select your skeletons. In the bottom left Display tab, set "Show Tracking Errors" and "Show Target Marker Lines" to "Visible". This can help you identify tracking errors more easily.
  - ○ "Show Tracking Errors" highlights missing markers and limbs with errors by highlighting them as red. "Show Target Marker Lines" draws lines from where a labeled marker is to where it's expected to be. This can help identify swapped markers, among other things.
  - ○ Switch to tracks view by clicking on the icon above the timeline that looks like a set of green lines. This view lets you quickly see gaps in each marker's data. The

goal of motion capture cleanup is to remove all the gaps to get smooth, continuous data.

- Cleanup
  - First, fill small gaps in every channel. Set the Max Gap Size to 10, and the Interpolation to cubic. Click "Fill Everything" to fill all gaps in all channels that are 10 frames or less.
  - Switch the timeline filtering from "All Markers" to "Gapped Markers". Next, fill gaps one at a time using the Find Previous/Next buttons in the Fill Gaps panel. Generally, Cubic and Model Based are the best options to use.
  - Model Based will base the filled data off of other markers on the model and try to match their trajectory, and will also ignore the Max Gap Size setting.
- Live Streaming into MotionBuilder
  - If you want to check out a movement on a specific character rig, you can do that with MotionBuilder, a 3D animation software (available from Autodesk).
  - In Motive, open the data streaming pane and ensure that local loopback is set, and the bone naming convention is set to FBX. In MotionBuilder, under devices, find "Optitrack Skeleton" and drag that into the scene.
  - Check the "Live" and "Recording" boxes and then use the dropdown menu to create the model binding. There should now be a skeleton in the viewport.
  - Have the actor stand in T-pose. Drag a character object onto the hips joints of the Optitrack skeleton in the outliner. Click "Characterize", and "Biped".
  - In the character window on the right, select the destination character in the top of the dropdown and the optitrack skeleton as the source. The character should now be moving in the viewport.