# *The MotionMonitor xGen Software Guide:*
Hand Detail Digitization

The MotionMonitor xGen provides the user with the ability to track relative carpal, metacarpal, and phalanx bone movements or movements relative to a proximal segment such as the forearm or shank. The following is a step-by-step procedure that will guide the user through the process of setting up a subject for collection with the hand detail feature:

Please see *Getting Started Biomechanical Session* for configuring hardware, world axes, calibrating stylus, and other basic setup functions of the software.

For this guide, it's assumed that the same sensor has been assigned to the Right Hand and Right Hand Carpus and that sensors are also assigned to the Right Hand 1st Distal Phalanx and Right Hand 2nd Distal Phalanx segments.

1. Once a subject has been added under the Subjects header in the Components Setup tab, enable the bone segments on the hand that are to be tracked by the sensors, as seen below. From the dropdown down menus, select the corresponding sensor assigned to each segment, also shown below. Note: The Hand Carpus must be enabled and tracked if any interpolation of finger segments are to be performed. The Hand segment and Hand Carpus can share the same sensor assignment.
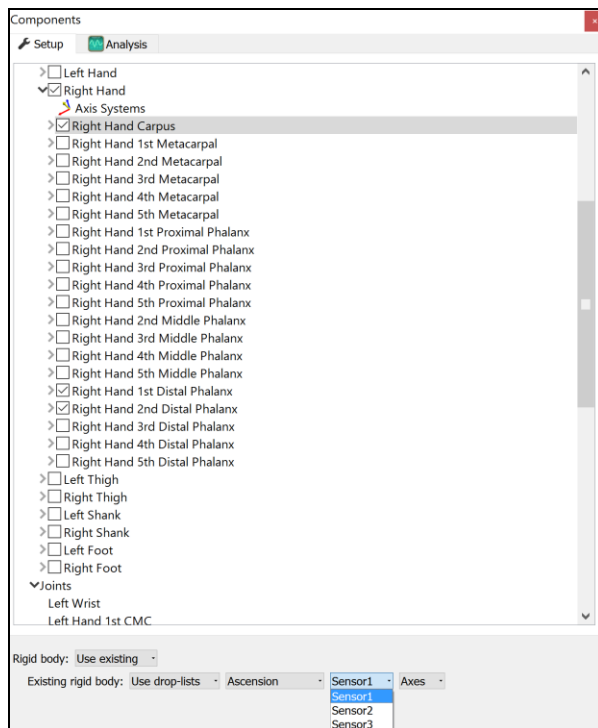
2. The segment endpoints to be defined will auto populate under the Joints sub-header for your Subject based on the segments that were enabled in the previous step. Digitize with stylus should be chosen as the location method. An optical based system could also use an expression to define joint locations, if markers can define these positions. When digitizing with a stylus, the number of points to digitize can be selected with a centroid calculation used when more than one point is digitized. Alternatively, joint center offsets can be applied in the Forward, Leftward, and Upward direction. The settings must be individually set for each segment endpoint.
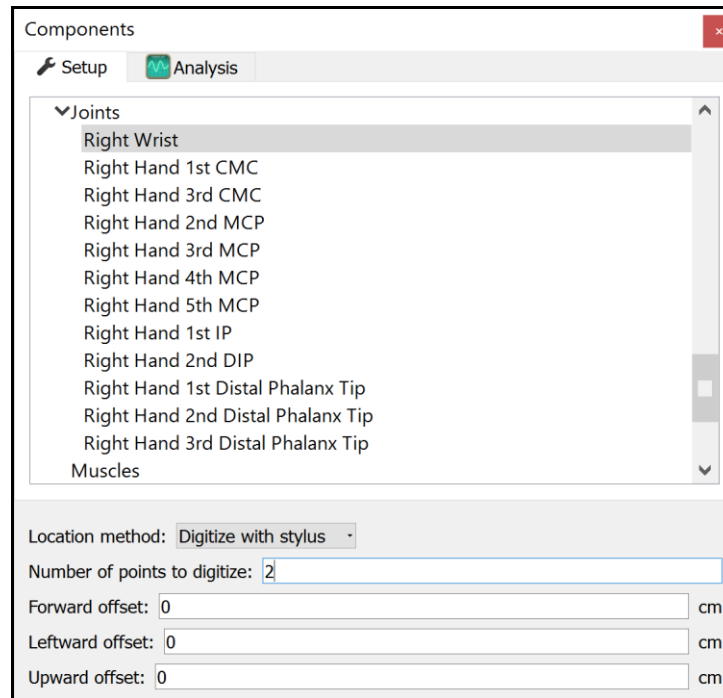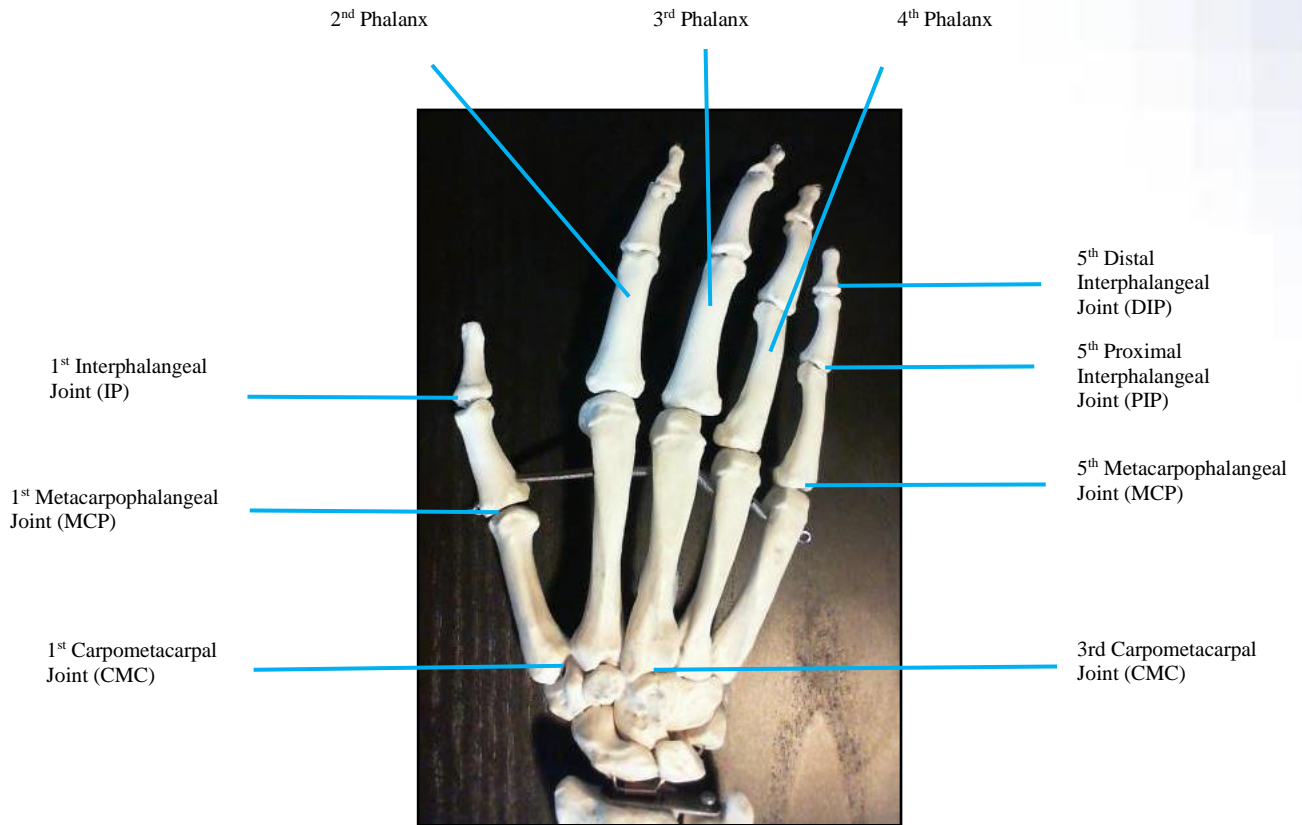

Note: A centroid method or joint center offsets should be applied for accurate measurements of intersegment calculations.
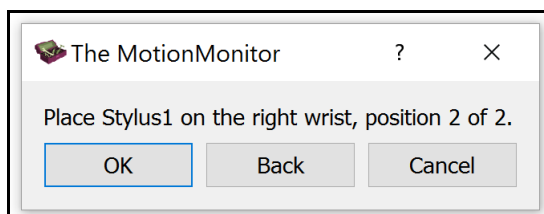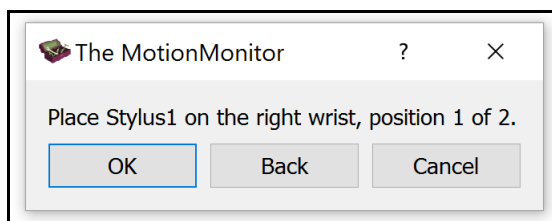
3. After clicking "Calibrate" in the subject properties pane, the user will be guided through a series of digitizing segment endpoints. If segments other than the hand are tracked, a neutral stance configuration must be selected. Furthermore, the mass of the subject can be input for anthropometric assumptions. The stylus used for digitizing is also selected here.
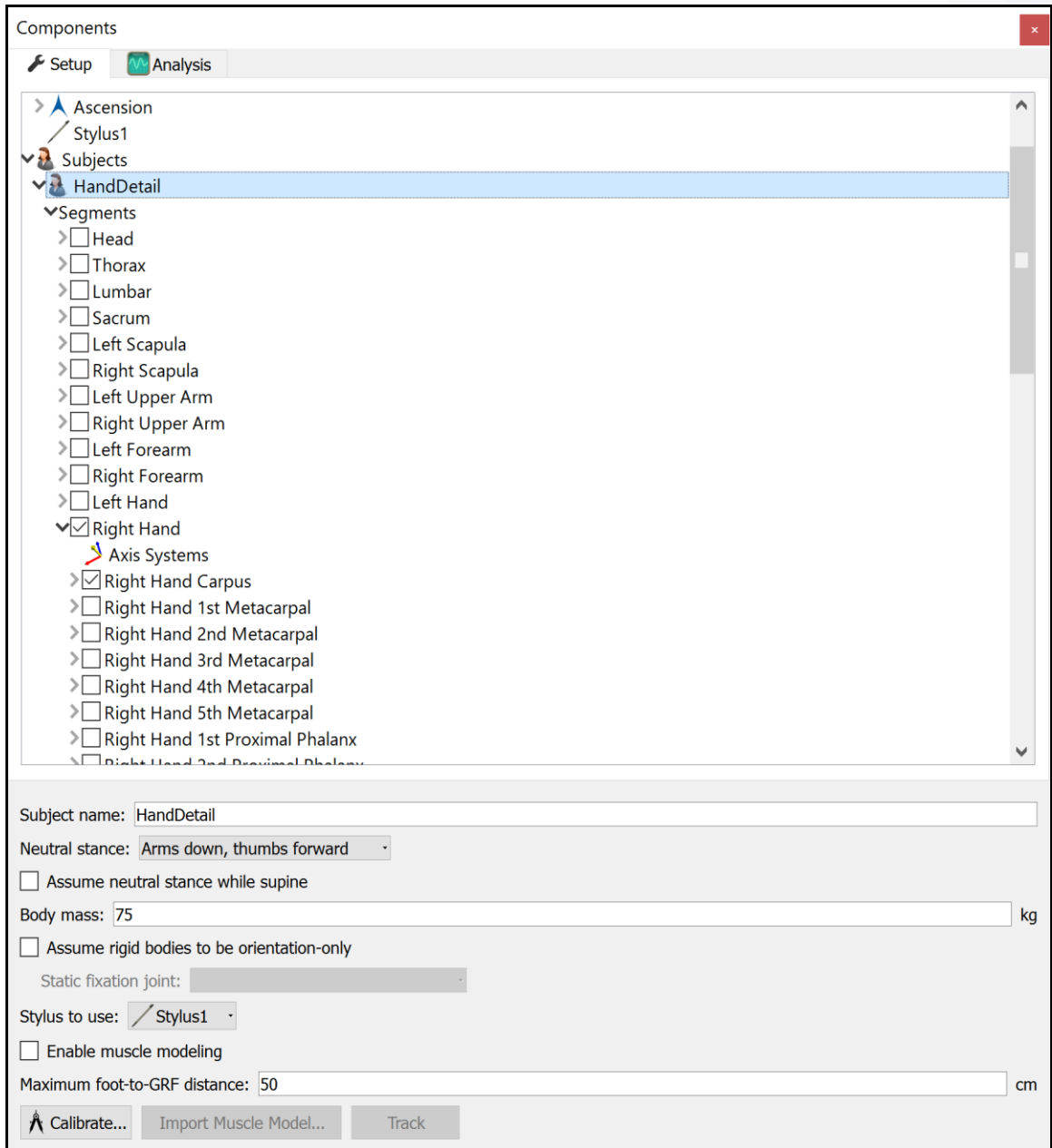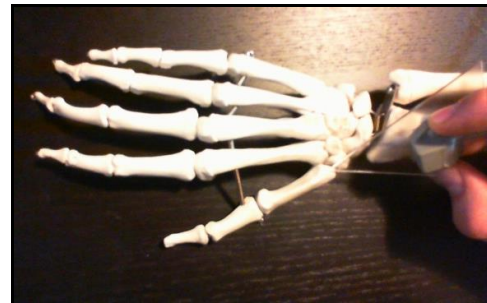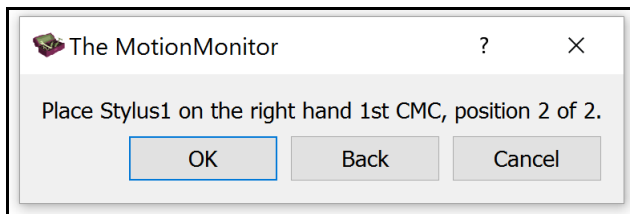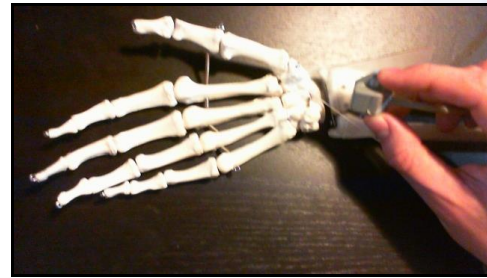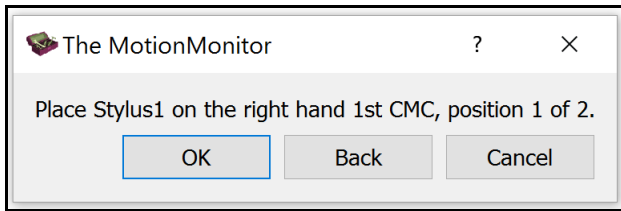
Please use the diagram below as a guide for locating points:

2nd Phalanx   3rd Phalanx   4th Phalanx

1st Interphalangeal Joint (IP)

1st Metacarpophalangeal Joint (MCP)

1st Carpometacarpal Joint (CMC)

5th Distal Interphalangeal Joint (DIP)

5th Proximal Interphalangeal Joint (PIP)

5th Metacarpophalangeal Joint (MCP)
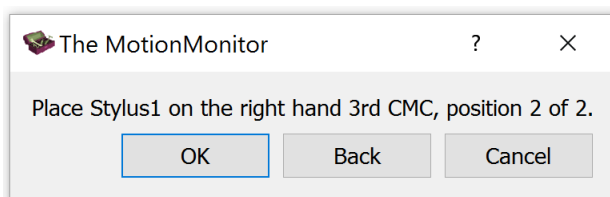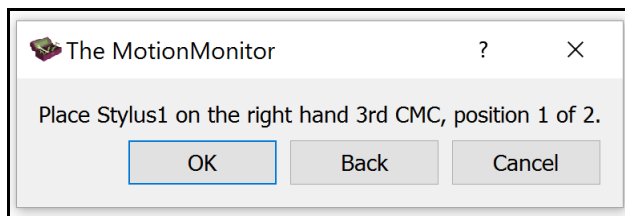
3rd Carpometacarpal Joint (CMC)

4. The first step of locating segment endpoints begins with the proximal segment endpoint of the hand at the wrist. The pictures below demonstrates a centroid method of locating the joint center.
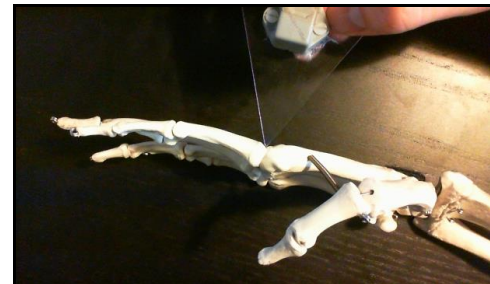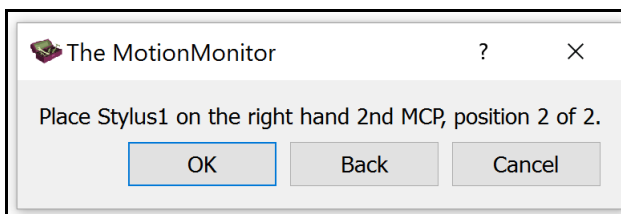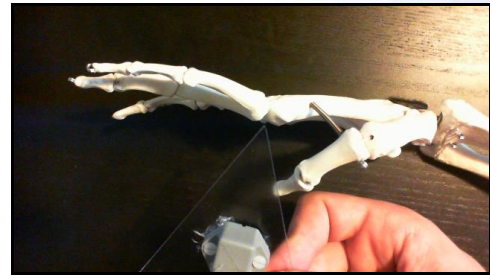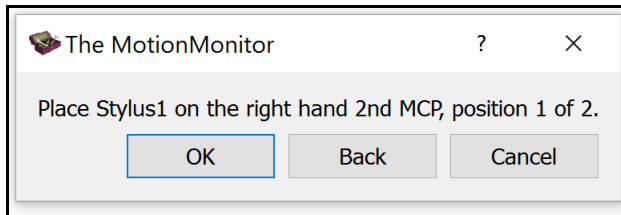

The MotionMonitor   ?   ✕

Place Stylus1 on the right wrist, position 1 of 2.

OK   Back   Cancel

The MotionMonitor   ?   ✕

Place Stylus1 on the right wrist, position 2 of 2.

OK   Back   Cancel

5. Next, the Right Hand 1st Carpometacarpal joint is digitized using the centroid method.

The MotionMonitor   ?   ✕

Place Stylus1 on the right hand 1st CMC, position 1 of 2.

[OK]   [Back]   [Cancel]

The MotionMonitor   ?   ✕

Place Stylus1 on the right hand 1st CMC, position 2 of 2.
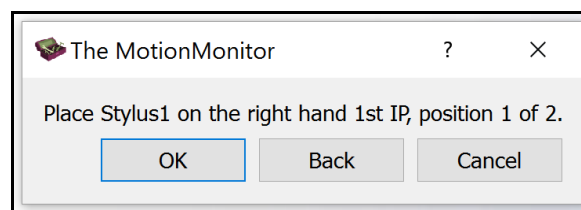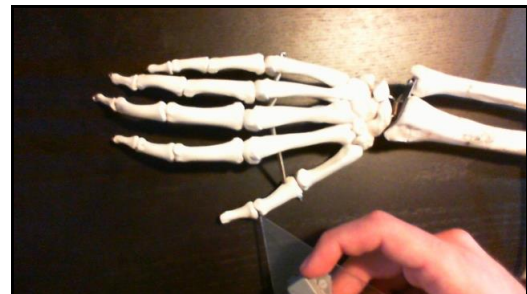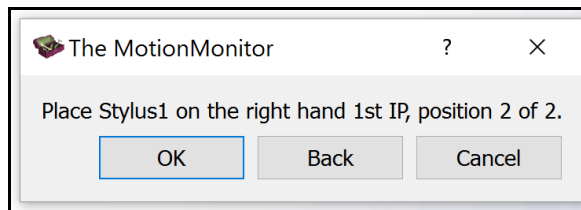
[OK]   [Back]   [Cancel]

6. Then, the Right Hand 3rd Carpometacarpal joint is digitized using the centroid method.

The MotionMonitor   ?   ✕

Place Stylus1 on the right hand 3rd CMC, position 1 of 2.

[OK]   [Back]   [Cancel]

The MotionMonitor   ?   ✕

Place Stylus1 on the right hand 3rd CMC, position 2 of 2.
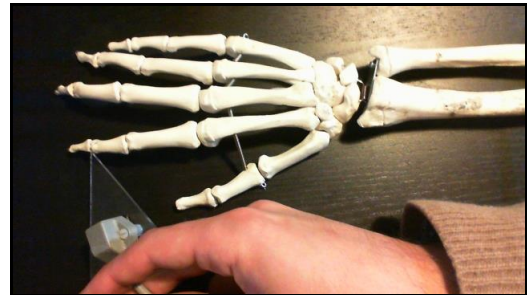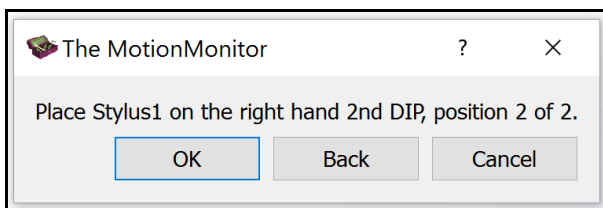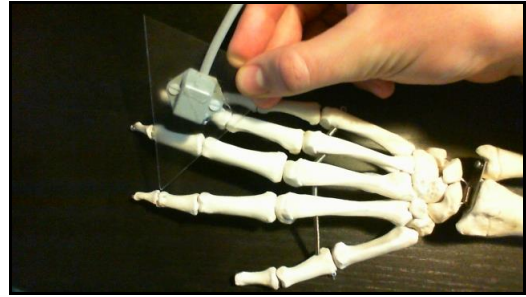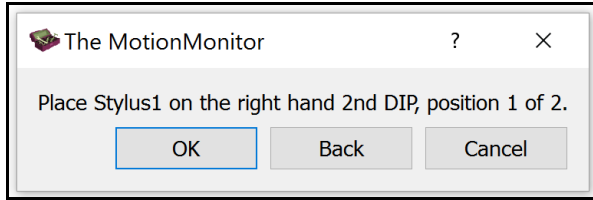
[OK]   [Back]   [Cancel]

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7. Next, the Metacarpophalangeal joints are digitized using the centroid method. The images below show the Right Hand 2nd Metacarpophalangeal joint being digitized.

The MotionMonitor

Place Stylus1 on the right hand 2nd MCP, position 1 of 2.

OK   Back   Cancel

The MotionMonitor

Place Stylus1 on the right hand 2nd MCP, position 2 of 2.

OK   Back   Cancel

8. Then, the Right Hand 1st Interphalangeal joint is digitized using the centroid method.

The MotionMonitor

Place Stylus1 on the right hand 1st IP, position 2 of 2.

OK   Back   Cancel

The MotionMonitor

Place Stylus1 on the right hand 1st IP, position 1 of 2.

OK   Back   Cancel

9. Next, the Right Hand 2nd Distal Interphalangeal joint is digitized using the centroid method.

> The MotionMonitor   ?   ✕
>
> Place Stylus1 on the right hand 2nd DIP, position 1 of 2.
>
> [OK]   [Back]   [Cancel]

> The MotionMonitor   ?   ✕
>
> Place Stylus1 on the right hand 2nd DIP, position 2 of 2.
>
> [OK]   [Back]   [Cancel]

10. Then, the Right Hand 1st Distal Phalanx tip is digitized.

> The MotionMonitor   ?   ✕
>
> Place Stylus1 on the right hand 1st distal phalanx tip, position 1 of 1.
>
> [OK]   [Back]   [Cancel]
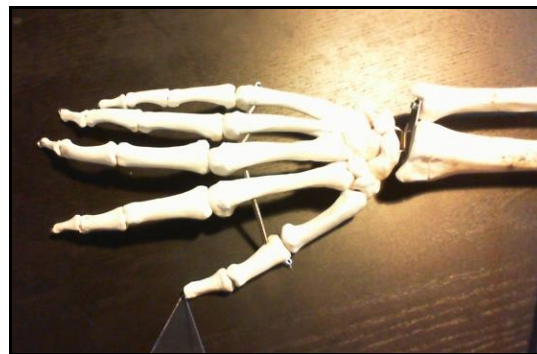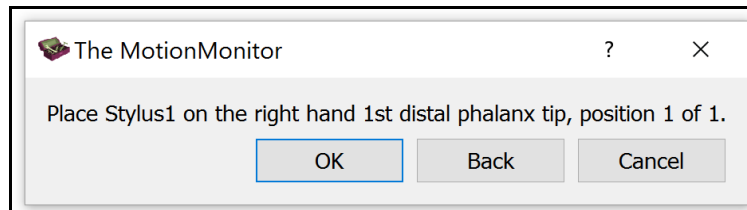
11. Next, the Right Hand 2nd Distal Phalanx Tip is digitized.
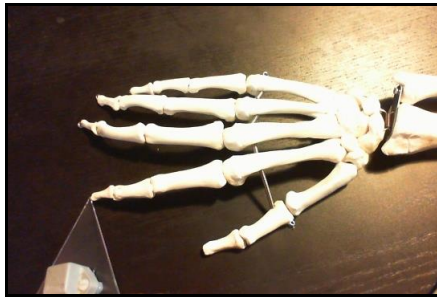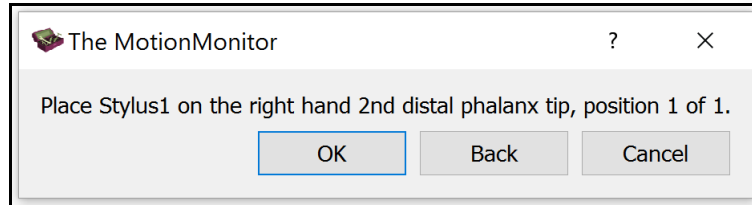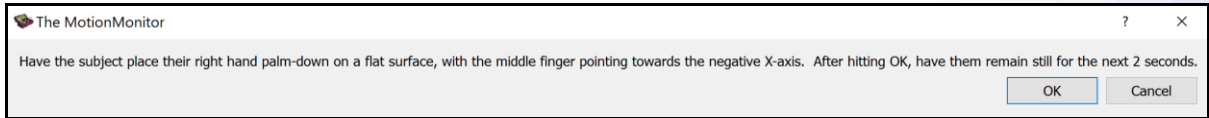

12. Then, the Right Hand 3rd Phalanx Distal Tip is digitized to scale the length of the hand.
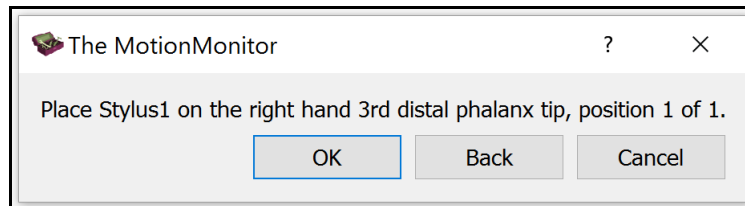
13. Finally, the subject is prompted to place their hand, palm-down, on a flat surface with the middle finger directed towards the world axis direction specified through World Axes properties pane.

14. The hand detail setup is now complete. The visualization for the hand detail animation is controlled through the Animation header in the Analysis Components tab. Analysis variables can be defined and graphed through the Analysis and Graphs headers in the Analysis Components tab, respectively. The workspace containing your Subject setup definitions can be saved as well as any Analyses containing variable definitions, graphs, export reports and animation window settings.