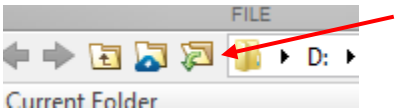
MOVEMENT NEUROSCIENCE LAB

Cinematik Instructions

This program is used to analyze kinematic and gaze data that are collected in MNL lab (Physical and VR) for the reach-to-grasp experiments. Each trial will have its respective graph of the reach (transport) and grasp (aperture) components based on the Wrist, Thumb, and Index trajectories. The program will allow to identify "bad" trials, preprocess data (interpolating, filtering), and export data base for further analysis.

Open MATLAB

Browse for the following folder: **Z:\Matlab\Cinematik1.5** by clicking on this icon:



And going to the tuniklab Z-drive>>Matlab>>Cinematik1.5>>**Select Folder**

On MATLAB run the command *Cinematik* and click Enter, a new window should pop up.

Load the data

On the new window click on Data>>Import and select *Use a study config file*

Click Next

Navigate to the project you are working on and click on *SubjectsFolder*, choose the subject and select *Kinematics*

Click on Open and choose the XML document *"objectData"*

Click Open>>Ok>>Ok>>Ok and then click on Import

Wait until all trials have loaded successfully

Click Close>>Close

On the new window that popped up, select the time channel: **ms Since Start**

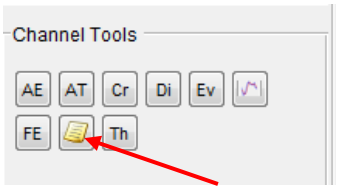
Click on Okay

Saving the project

At this point save the work as a new project and name it **Cinematik_[SubjectID]_Loaded**

Interpolate the Data

Click on the yellow notepad icon under Channel Tools:



Click on Select M-File and click on *InterpScript*>>Open

Click on Choose Channels and select the following channels (beware of Input Guidelines window):

- ms Since Start
- Tracker 3X
- Tracker 3Y
- Tracker 3Z
- Tracker 4X
- Tracker 4Y
- Tracker 4Z
- Tracker 5X
- Tracker 5Y
- Tracker 5Z
- Switch Release Triggered (1 if true)
- Object Grabbed
- Eye Tracker Pos X
- Eye Tracker Pos Y
- Eye Tracker Pos Z

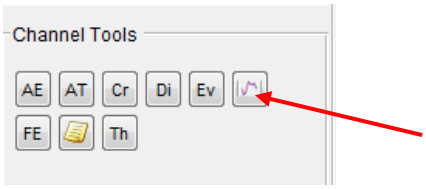
Click on Okay>>Ok

You will see that output channels are automatically named with ending *_Interp*

Click on Okay

Filtering

Click on the following icon (filter function):



Add input channels using the green + sign (you can only filter 5 channels at a time)

In the input window, click on *Channel Name* and choose the following:

Tracker 3 X_Interp
Tracker 3 Y_Interp
Tracker 3 Z_Interp

Tracker 4 X_Interp
Tracker 4 Y_Interp
Tracker 4 Z_Interp

Tracker 5 X_Interp
Tracker 5 Y_Interp
Tracker 5 Z_Interp

Be careful to choose the channels that end with **_Interp**

In the output window, name the channels respectively using the list below:

Wrist X_Interp_Filt
Wrist Y_Interp_Filt
Wrist Z_Interp_Filt

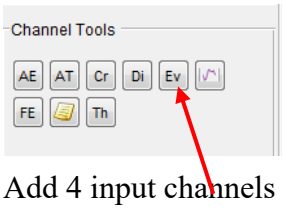
Thumb X_Interp_Filt
Thumb Y_Interp_Filt
Thumb Z_Interp_Filt

Index X_Interp_Filt
Index Y_Interp_Filt
Index Z_Interp_Filt

Click on Continue, the filter options should show *Lowpass, order 4, cutoff 6Hz*, Click Okay
Repeat for the channels left, until all 9 have been inputted.

Calculate Aperture2D (based on X and Y trajectories)

Click on the following icon (EV function):



Add 4 input channels using the green + sign and select the following for each input:
Input A Thumb X_Interp_Filt
Input B Index X_Interp_Filt
Input C Thumb Y_Interp_Filt
Input D Index Y_Interp_Filt

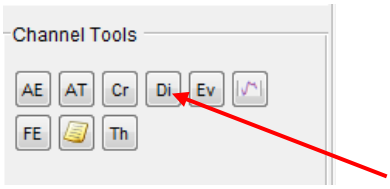
Name Output 1 as *Aperture2D*
Click on Continue
Name the variables as follows:
A- Thumb X_Interp_Filt
B- Index X_Interp_Filt
C- Thumb Y_Interp_Filt
D -Index Y_Interp_Filt
X -Aperture2D

Enter the following MATLAB expression:
X = sqrt((B-A).^2 + (D-C).^2);

Plot Aperture2D:
Click on the top left window and select *Aperture2D* as the Y-Data and *ms Since Start_Interp* as the X-Data
Click Okay
A graph should be plotted for each trial

Calculate velocity

Click on the following icon (Di function):



For the input, select the following channels accordingly:

Time channel → ms Since Start_Interp

Channel to Differentiate → Aperture2D

For the output, name the following channel as:

Output (d/dt(Input)) → Vel_Apr2D

Click on Continue>>Okay

Plot Vel_Apr2D:

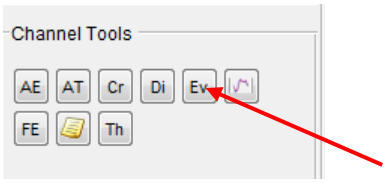
Click on the middle left window and select *Vel_Apr2D* as the Y-Data and *ms Since Start_Interp* as the X-Data

Click on Okay

A graph should be plotted for each trial

Transport2D

Click again on the EV function:



Remove Input B, as to make sure there is only one input channel, Input A

Select Wrist X_Interp_Filt as the input channel

Name the output channel as *Wrist X_Interp_Filt_zero*

Click on Continue

Name the variables as follows:

A - Wrist X_Interp_Filt

X - Wrist X_Interp_Filt_zero

Enter the following MATLAB expression:

X = A-A(1, 1);

Follow the same instructions for the EV function again
Select Wrist Y_Interp_Filt as the input channel
Name the output channel as *Wrist Y_Interp_Filt_zero*
Click on Continue

Name the variables as follows:
A - Wrist Y_Interp_Filt
X - Wrist Y_Interp_Filt_zero

Enter the following MATLAB expression:
X = A-A(1, 1);

And again, click on EV function icon
Keep input channels A and B and select the following, respectively:
Input A → Wrist X_Interp_Filt_zero
Input B → Wrist Y_Interp_Filt_zero
Name the output channel as *Transport2D*
Click on Continue

Name the variables as follows:
A - Wrist X_Interp_Filt_zero
B - Wrist Y_Interp_Filt_zero
X - Transport2D

Enter the following MATLAB expression:
X = sqrt(A.^2 + B.^2);

Plot Transport2D:
Click on the top right window and select *Transport2D* as the Y-Data and *ms Since Start_Interp* as the X-Data
Click on Okay

Calculate velocity

Click again on the Di function icon:

For the input, select the following channels accordingly:

Time channel → ms Since Start_Interp

Channel to Differentiate → Transport2D

For the output, name the following channel as:

Output (d/dt(Input)) → Vel_Trans2D

Click on Continue>>Okay

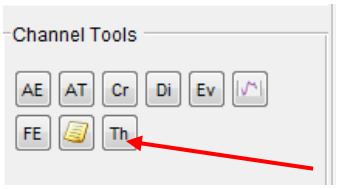
Plot Vel_Trans2D:

Click on the middle right window and select *Vel_Trans2D* as the Y-Data and *ms Since Start_Interp* as the X-Data

Click on Okay

Add Onset and Offset

Click on the Th icon under Channel Tools:



For input channel 1, choose *Switch Release Triggered (1 if true)_interp*

Name Event 1 as Onset

Click on Continue

Set Onset threshold to **99%**

Click Okay

Click on the Th icon again, and choose *Object Grabbed_interp* as the input channel

Name Event 1 as Offset

Click Continue

Set Offset threshold to **49%**

Click Okay

Click on each graph, and add **onset** and **offset** as events (at the bottom of the window)
Make Onset green and make Offset red

Optional: Plot X, Y, and Z values

Click on the **bottom left graph**
Add three plots, by clicking on the +Add icon and select following data:

1. Y-Data: *WristY_interp_filt*; X-Data: *WristX_interp_filt*; Z-Data: *WristZ_interp_filt*
2. Y-Data: *ThumbY_interp_filt*; X-Data: *ThumbX_interp_filt*; Z-Data: *ThumbZ_interp_filt*
3. Y-Data: *IndexY_interp_filt*; X-Data: *IndexX_interp_filt*; Z-Data: *IndexZ_interp_filt*

Add Onset and Offset events

Click on the **bottom right graph**
Plot the data for the wrist only by selecting *WristY_interp_filt* for the Y-Data, *WristX_interp_filt* for the X-Data and *WristZ_interp_filt* for the Z-Data.
Add Onset and Offset events
Change the color of the plot to black, for example.
Click Okay

Saving the project
At this point save as new project and name it **Cinematik_[SubjectID]_Loaded_Plotted**
Once analysis is complete save it as **Project_[SubjectID]_Complete**