**Report on Loom Movement Data:**

12-18-23:

Meeting with Leanne notes:

* Discussed the long term goal of submission to a journal.
* Discussed need for additional matched control participants.

I started off the discussion showing Leanne the plot below and link this article:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1693116/pdf/12639336.pdf>

and Showing this Figure:

Which shows the general movement of the right hand going from grab to drop movements

The general discussion with Leanne around this data is that we need to find a way to characterize all the various measures in this study around central points in time. This type of data could be a way to identify the START and END position times for Movement analysis including:

* Velocity
* Acceleration
* Jerk

But also to time stamp the moments that we want to evaluate gaze and arousal as well.

**Next steps included: using not only the x-pos of the had but also the y and z to potentially isolate a more accurate start and end time for the movements.**

This is a portion of the plot from above. The circled segment is indicative that this data may require some filtering. After some research and a conversation with Juila, I am going to try a butterworth low pass filter. Julia also sent me this paper which I am using to create the filter parameters for order and cutoff frequency:

FILTERING SIGNALS FOR MOVEMENT ANALYSIS IN BIOMECHANICS - Francesco Crenna, 2015



I currently need to decide what filter order I am going to use, but to test out the various types I need to set up a trial filter. I can not seem to find a single study that analyses VR Controller movement data AND uses a filter (smooths) the data. I am not sure if this is because it is unnecessary or some other reason… I have identified what I think is most likely noise in the plot above but, it really doesn’t seem like a big deal.

I think the best option at this point is to plug and play to see if anything changes.

So I have tired multiple different kinds of butterworth filters and none of them seem to work as intended, which I probably my fault, however I also looked high and low for any kind of VR movement analysis that is doing filtering and I can not find a single instance.

I did find this paper:

<https://link.springer.com/article/10.1007/s10055-022-00722-7>

Which talk about the use of controller movement vs hand movements in VR.

I really cant seem to find anu kind of study that uses VR Controllers to track motor movements. Therefore, I also cannot find any example of filtering done on this kind of meaaruement procedure. I did find this paper:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4690598/>

This paper uses a Vicon motion capture system. Each marker position was filtered using a fourth-order low-pass Butterworth filter with a 6-Hz cutoff frequency.

Suggestions on procedure for dealing with this movement data:

1. Interpolate data between point or fit a line
2. Separate the individual pints and interpolate each
3. Smooth
4. Derivatives

Before continuing to do this it might be worth my time to figure out what is the best questions for running this kind of analysis. What is the legitimate question that I am answering with this data.

VR Movement References of Note:

1. <https://academic.oup.com/ptj/article/95/3/415/2686558>
   1. Discussing the validity of VR movements
2. <https://link.springer.com/article/10.1186/1743-0003-8-36>
   1. Measurement of movement in VR