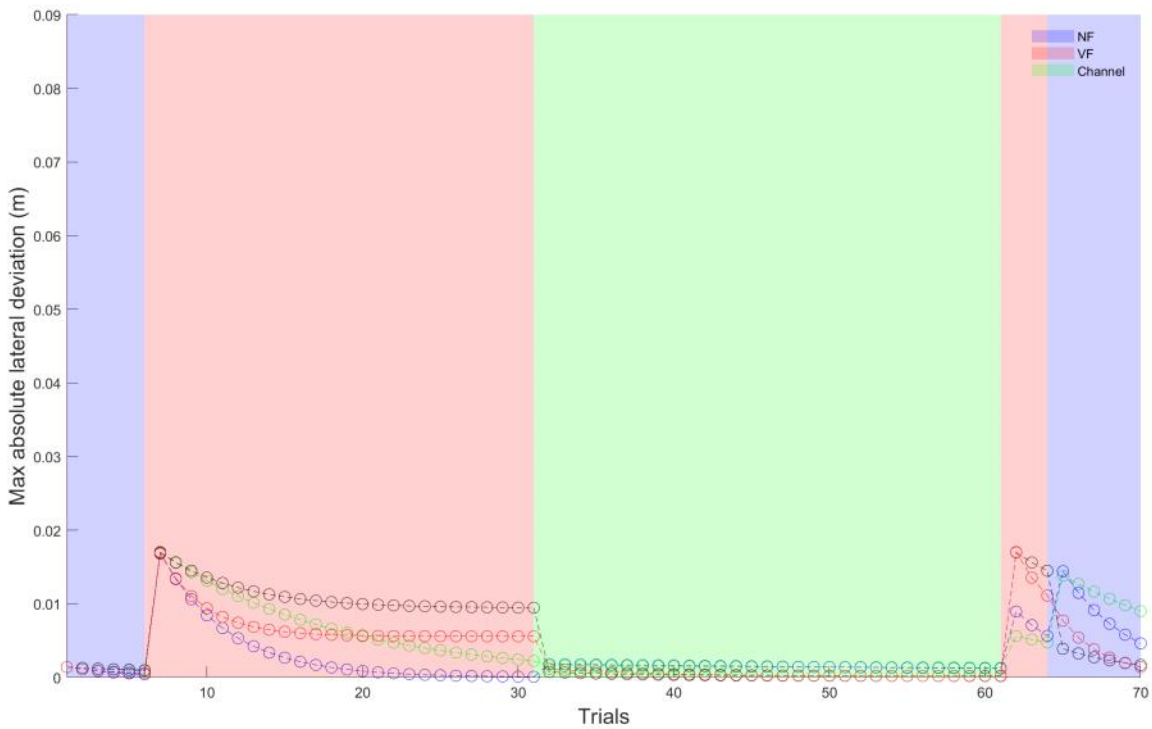
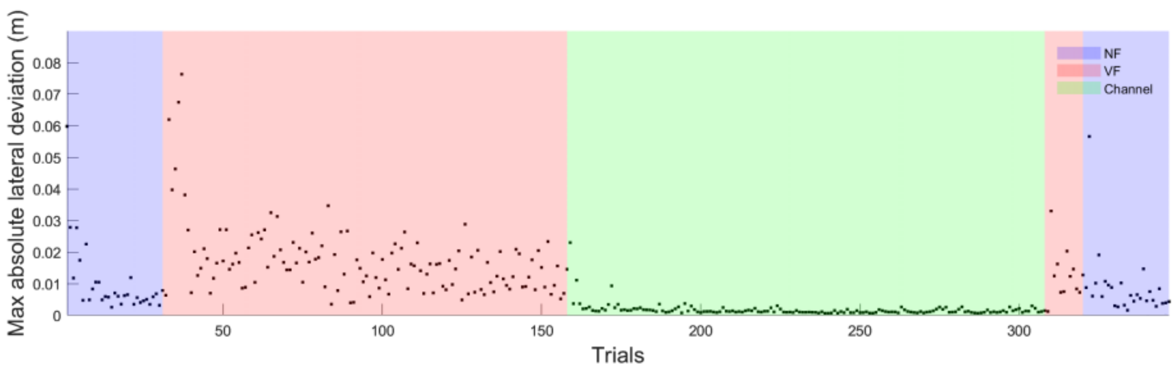
Q2b&c

27 February 2023 12:49

Q2b





In conclusion: The RED plot is the best for matching the real data.

- **In green: Alpha = 0.08; Gamma = 0.001;**
    - This shows the original results without tweaking alpha and gamma.
- **In blue: Alpha = 0.2; Gamma = 0.001;**
    - Shows that a high alpha reduces the number of trials it takes the participant to learn the how to interact in the new force field.
    - Shows a steeper negative gradient.
- **In black: Alpha = 0.08; Gamma = 0.1;**
    - In the first VF phase, the participant plateaus when there is a steady deviation of around 0.01m. The curve plateaus quicker than the green curve, but at a higher deviation.
    - In the final VF phase, deviation is at its highest.
    - In the final NF phase, a high Gamma reduces the maximum absolute lateral deviation.
- **In red: Alpha = 0.2; Gamma = 0.1;**
    - In the first VF phase, the curve is in-between the black and blue curves. We see how it quickly reaches a steady deviation yet the deviation is still high (it does not reach 0).
    - In the final NF phase, we see it drop to the smallest deviation to match the black curve.

Explanation

A high value for Alpha represents a high influence from the feedback controller. A high value for Gamma represents a low influence from the feedforward controller.

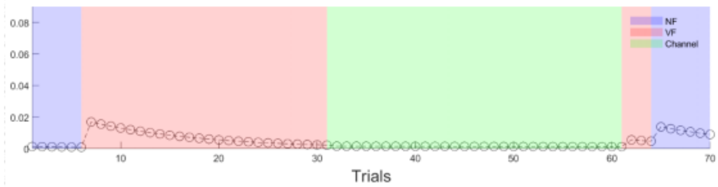
Feedback:

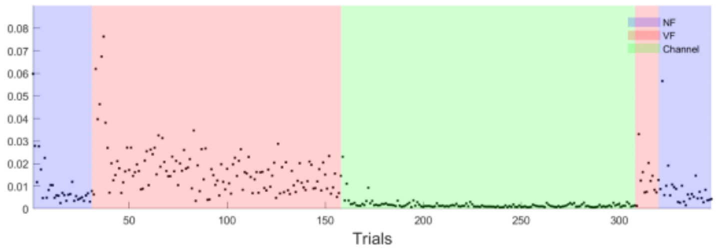
- We use feedback control so that the system reacts to real-world data and is taking reducing the error as a result. Hence, this is why the blue and red curves (with high values for Alpha) reduce the max deviation.
- Control systems with feedback usually are better at resisting external disturbances, hence these systems adapt quickly whenever there is a new force field.

Feedforward:

- We use feedforward control to measure disturbances and take corrective action before they upset the process. By increasing the value of Gamma, we are reducing the feedforward control which means we are not predicting as much.
- In the first VF phase, the systems with high feedforward control (blue and green) perform well since they have a long time to adapt and know what the disturbances can be.
- However, in the final NF phase, i.e. when the disturbances change, the feedforward controller does not perform as well as its model for predicting how to correct the trajectory is wrong.

Q2c





Outlier

- The real data has an outlier close to the beginning of the washout trial which the results from 2a do not.
- This would be hard to simulate with a controller and would mean we are overfitting to the data to this one experiment, when we want to fit to future experiments, too.
- Using a combination of feedforward and feedback control smooths out the simulation meaning we lose the possibility of outliers in our simulation.

Slope

- Excluding this outlier, the general curve of the simulation fits the shape of the real data from the washout trial. They ***both decrease linearly***.
- However, the simulation starts at a slightly higher deviation of 0.02m whereas the real data starts at 0.01m
- Furthermore, the real data finishes close to 0.002m whereas the simulation finishes close to 0.01m.
- The red plot in my response to 2a) is a better reflection of the real data as it, similarly, starts close to 0.01m and finishes close to 0.002m. This curve represents an alpha of 0.2 and a gamma of 0.1 (i.e., high alpha and gamma).
  - The high value for gamma means it favours feedforward control less. The washout trial is short so it does not give enough time for the feedforward controller to predict well, hence, a high value for gamma is desired.
  - A low value for alpha generally means a steep change in deviation meaning the subject learns less quickly. In the washout trial, the subject will learn quickly since they are already well-adapted to this field hence we want a high value for alpha.
- Another thought - the controller is predicting a higher error since the type of field is changing again. However, this phase is the NF which the subject is already well-adapted to.