Exercise 2

In this exercise, you will implement the Rescorla-Wagner model and the Kalman filter. The file TEM-PLATE_EXERCISE2.IPYNB in Ilias provides a template for this exercise. Please submit your completed exercise as an .IPYNB file via Ilias until 02/05/2022.

Exercise 2.1

Implement the PREDICT() and LEARN() functions of the Rescorla-Wagner model. Run the model and plot the resulting squared error over trials (averaged over multiple tasks).
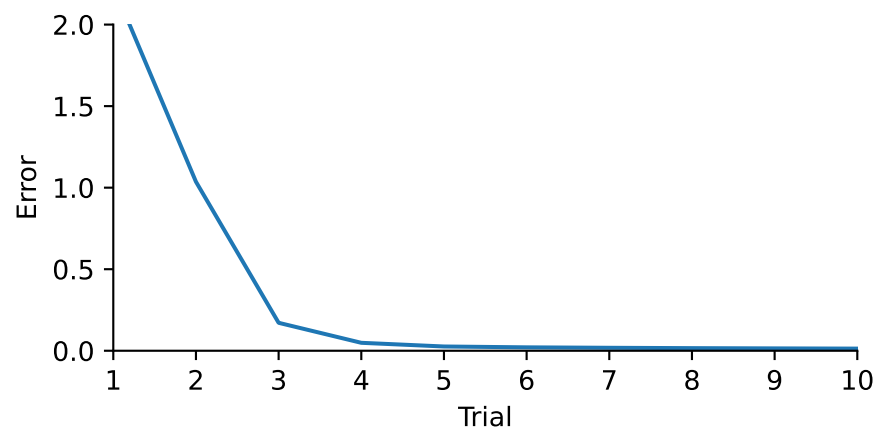
The resulting plot should look something like this:
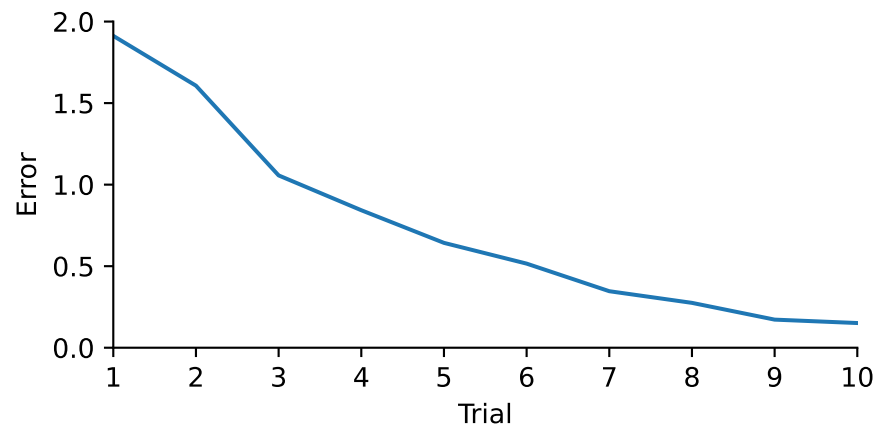
Exercise 2.2

Implement the PREDICT() and LEARN() functions of the Kalman filter. Run the model and plot the resulting squared error over trials (averaged over multiple tasks).

The resulting plot should look something like this:

How can we determine which of these learning algorithms a subject in an experiment is using? One way to accomplish this is to construct a task where the two models make different predictions. The backward blocking paradigm from the associative learning literature is such a task. It involves two phases. In the first phase, two stimuli are repeatedly presented with a reward. In the second phase, only the first stimulus is presented with a reward (i.e., the second stimulus is omitted). Experimentally it has been observed that animals respond weaker to the second stimulus after the end of the second phase (compared to at the end of the first phase), even though this stimulus has never been directly observed in the second phase.

Exercise 2.3

Hypothesize, based on their updating equations, which of the two models aligns with the previously described experimental result. Then, simulate both models on the backward blocking paradigm. Plot how the weight that corresponds to the second stimulus changes over trials. Did your simulations confirm your hypothesis?

The resulting plot should look something like this: