A Review on Interactive Adaptive Processes Which Underline Short-Term Motor Learning

MohammadAmin Alamalhoda[a], **Arsalan Firoozi**[a], **and Mehran khorshidi**[a]

[a]Student, EE Department, Sharif University of Technology

This manuscript was compiled on June 23, 2022

Abstract

Motor learning

Null

Results

Robustness of spontaneous rebound in the multi-rate model

A key feature of the multi-rate model is its ability to predict the spontaneous recovery. Figure **??** only shows spontaneous recovery for specific sets of model parameters, however spontaneous recovery is a general feature of this model over a very wide space of model parameters. Because an analytical approach to demonstrating this property is difficult, we performed a large set of simulations in which the model parameters where systematically varied (by as much as a factor of 10). In these simulations the fractional spontaneous recovery (max rebound/max initial learning) was assessed following asymptotic learning and unlearning to baseline. The results of these simulations are shown in Figure 2. There are four parameters in the multi-rate model and each panel below displays the amount of spontaneous recovery when two of these parameters are systemically varied. There are six panels because there are six different two-parameter combinations. Note that in all cases more than 80% of the parameter space shown displays a spontaneous recovery of greater than 20%, where the amount of spontaneous recovery refers to the ratio of the maximum recovery in the error clamp phase to the asymptotic amount of learning during the initial learning phase. These simulations show that spontaneous recovery is a robust feature of the multi-rate model in this experimental paradigm, and that the finding of spontaneous recovery does not depend upon a narrow choice of parameter values.

ACKNOWLEDGMENTS. We highly appreciate ...

References

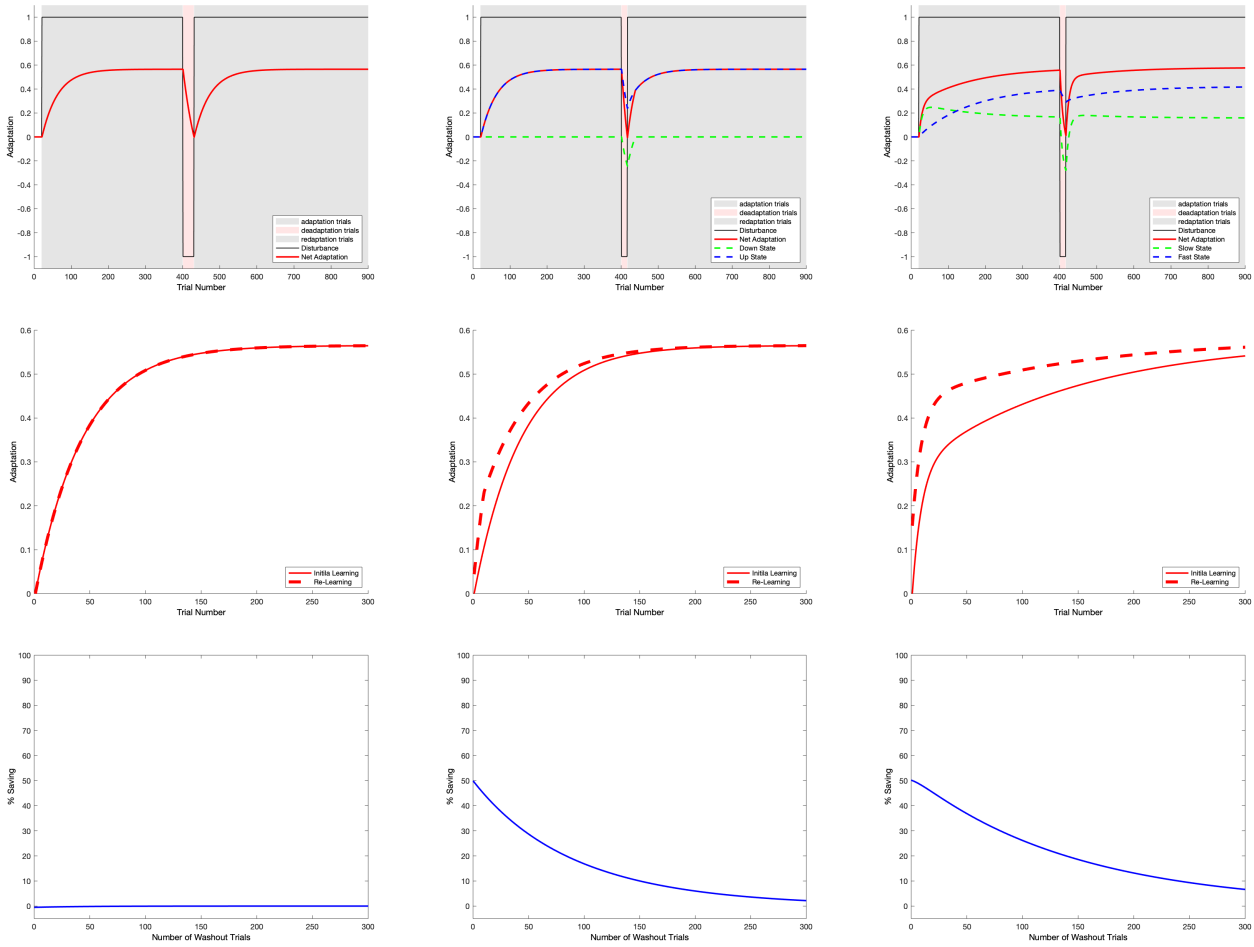
All codes will be provided to you upon request
Contact ma.alamalhoda@gmail.com

Significance Statement

Hmmmmm

Author contributions

[1]All contributed equally to this work



(a) Single State **(b)** Gain Specific **(c)** Multi Rate

Fig. 1. Simulations of Motor Adaptation Experiments That Show Savings
First row shows the model simulations of the experiment paradigm (Disturbance plot) which is plotted in black. Second row shows a direct comparison of simulated performance in the initial learning and relearning blocks. Third row shows the amount of savings found in simulation, as a function of the number of washout trials. The amount of savings is measured as the percent improvement in performance on the 30th trial in the relearning block compared to the 30th trial in the initial learning block.

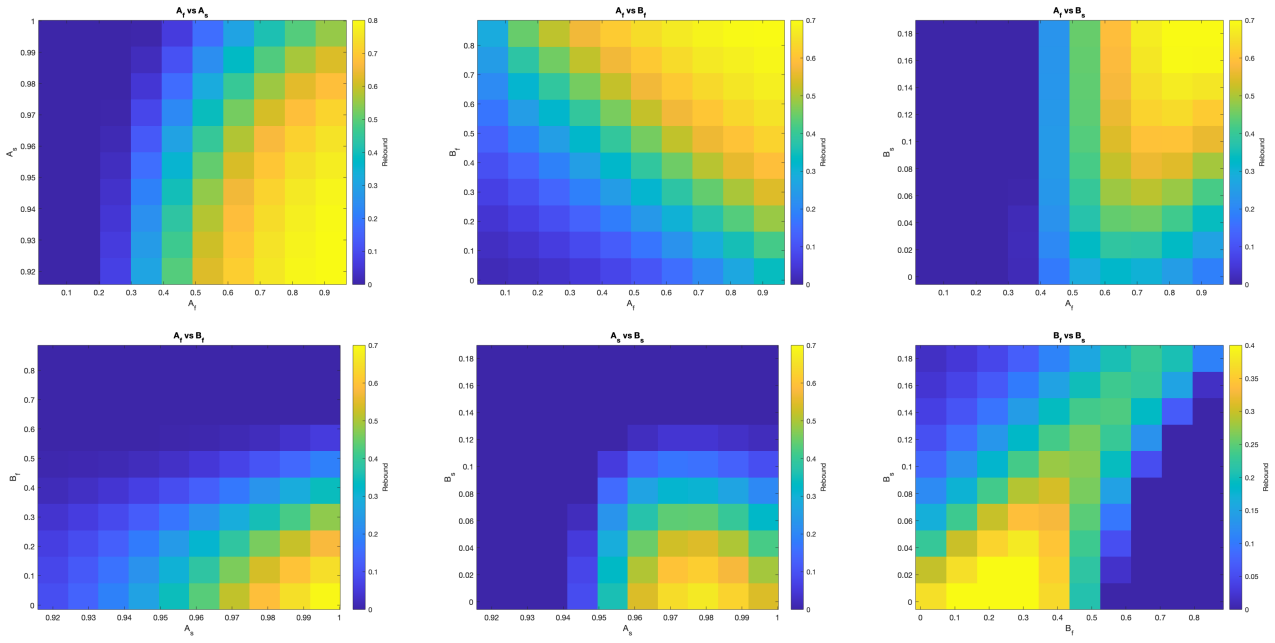


Fig. 2. Simulation of the effects of different learning rates and forgetting factors on the amount of the spontaneous rebound predicted by the multi-rate model
All of the plots show value of the spontaneous rebound vs different parameters of the multi-rate model. default value of the parameters is: $A_f = 0.92$, $A_s = 0.996$, $B_f = 0.03$, and $B_s = 0.004$. The amount of the spontaneous rebound is measured as ratio of maximum recovery in the error-clamp phase to the asymptotic amount of learning during the initial learning phase.

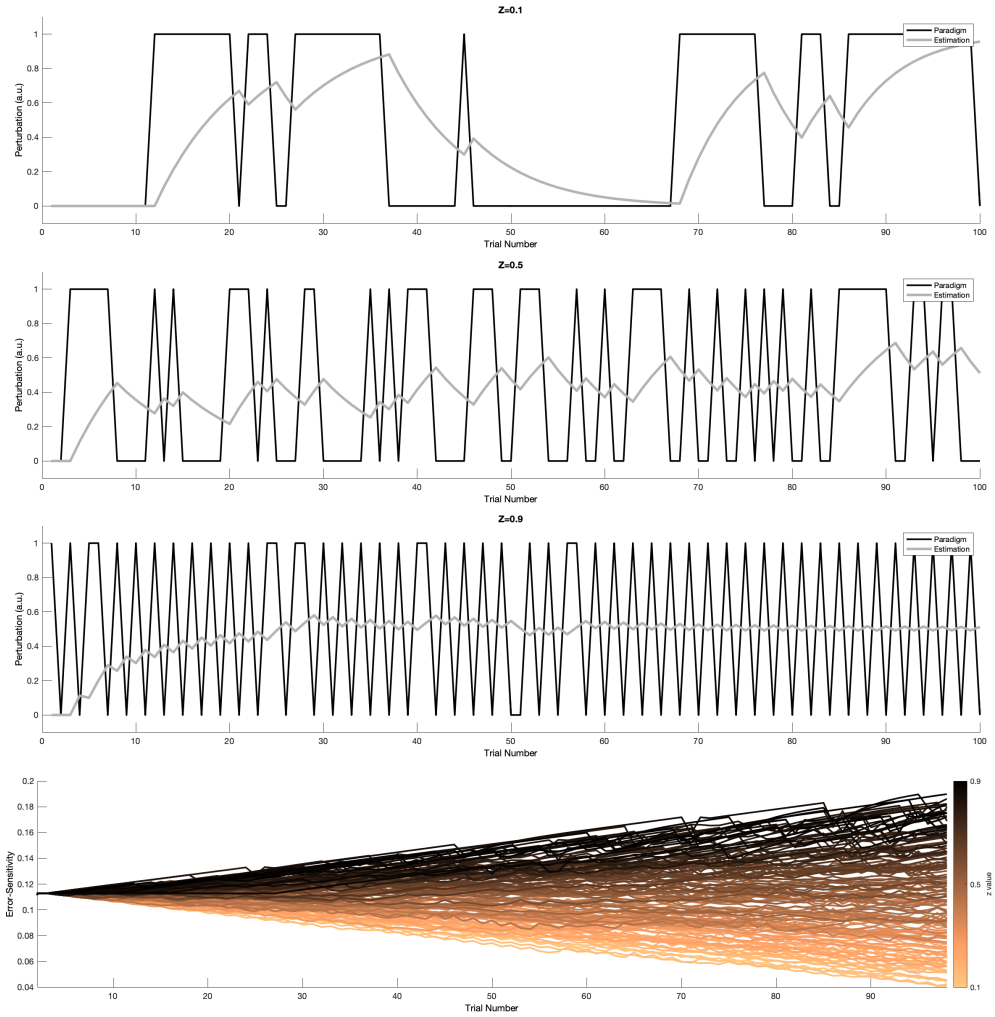


Fig. 3. Herzfeld Theoretical model
First three rows presents model performance for slow, medium, and rapidly switching environments (gray line represents $\hat{x}^{(n)}$. Forth row shows the error-sensivity value over the trials for different values of Z. Bigger error-sensivity values lead to less learning from the error, so model learns more from slow switching environments in comparison with rapidly switching environments.