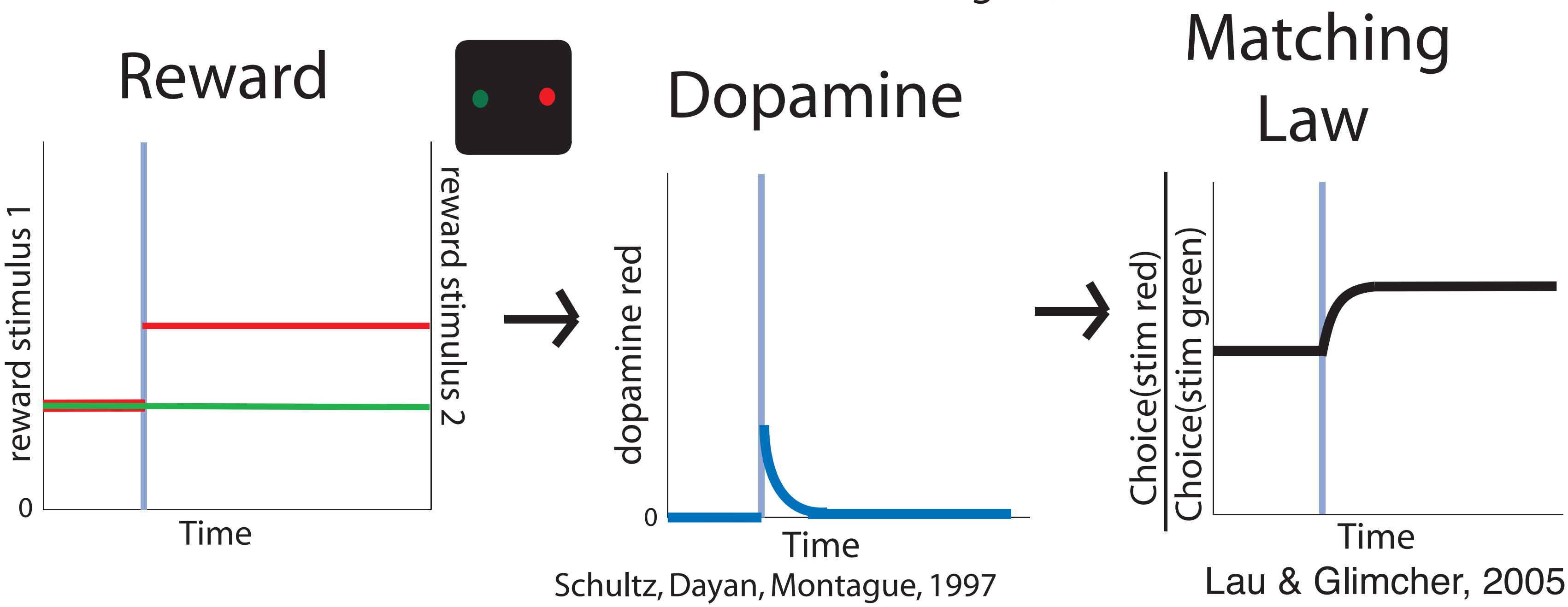


Introduction

Natural Rewards

$$Q_{a,t} = Q_{a,t-1} + \alpha(r_t - Q_{a,t-1})$$

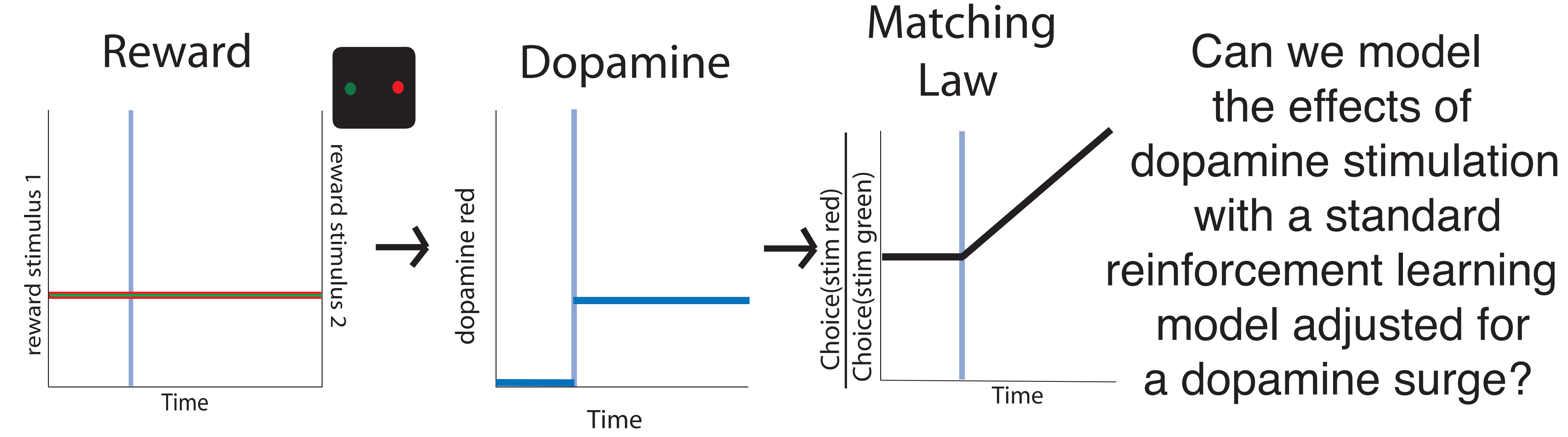
Rescorla & Wagner, 1972



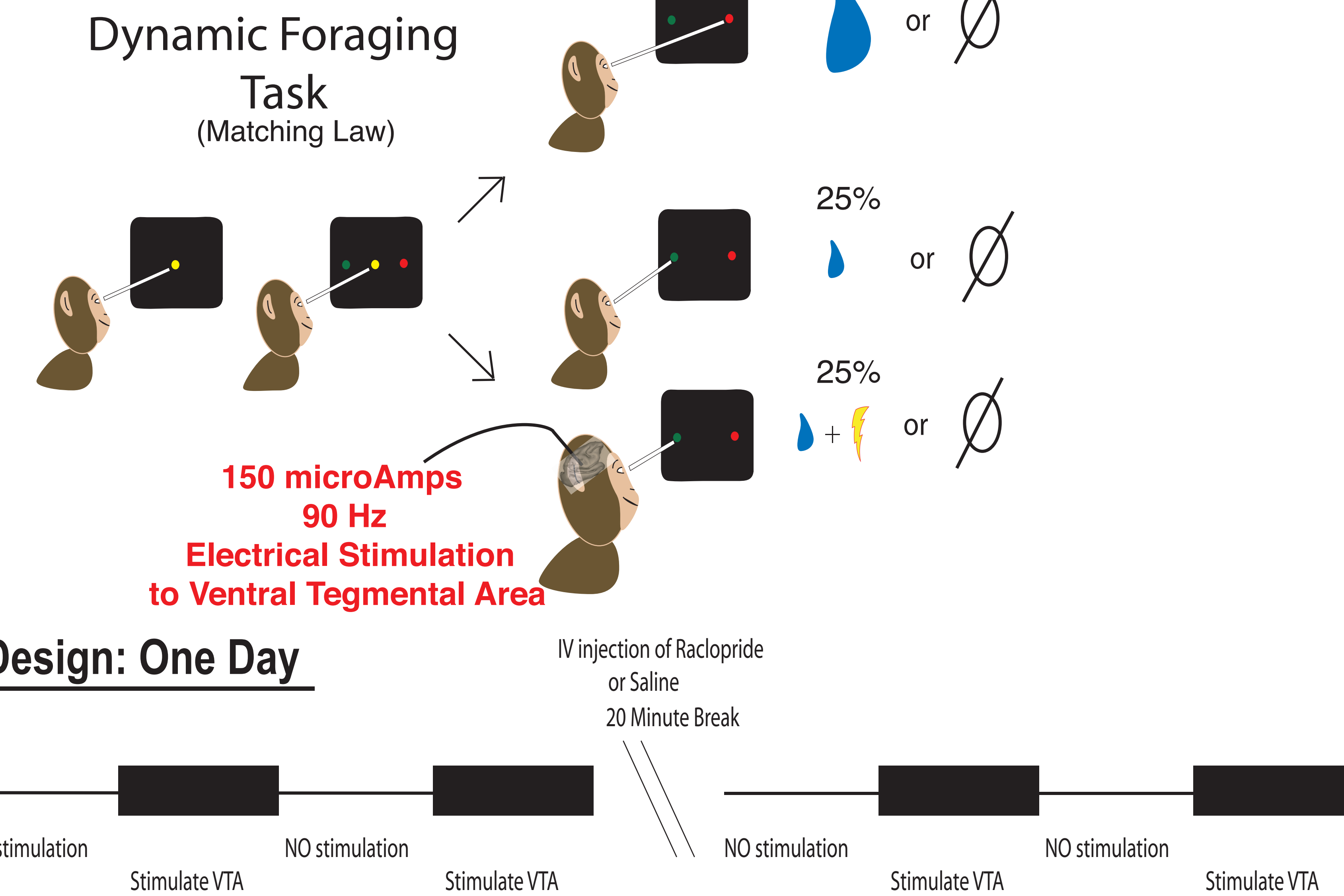
Drugs of Abuse?

$$Q_{a,t} = Q_{a,t-1} + \alpha(r_t - Q_{a,t-1}) + D_t \quad \text{or} \quad Q_{a,t} = Q_{a,t-1} + \max\{\alpha(r_t - Q_{a,t-1}) + D_t, D_t\}$$

Redish, 2004

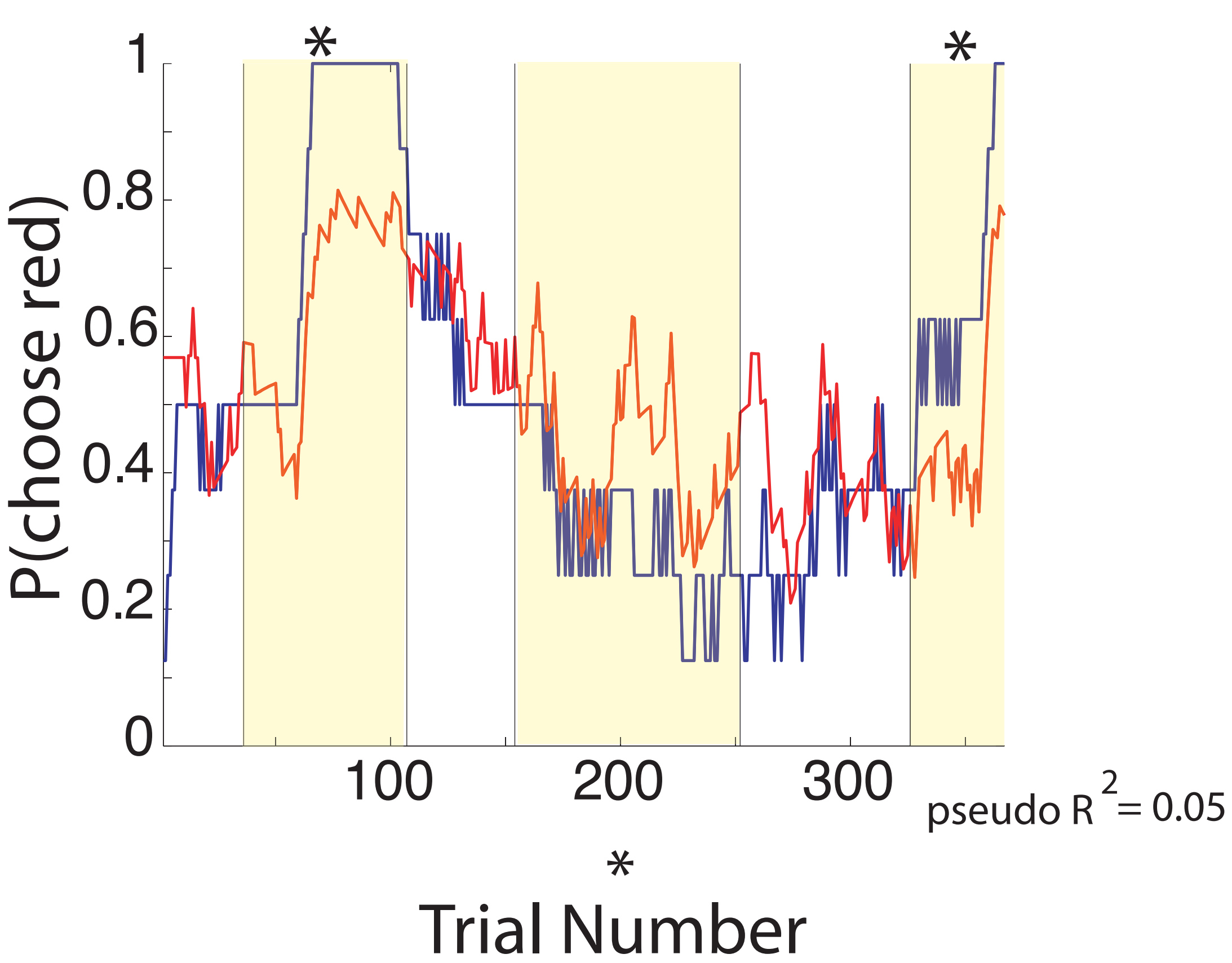


Task

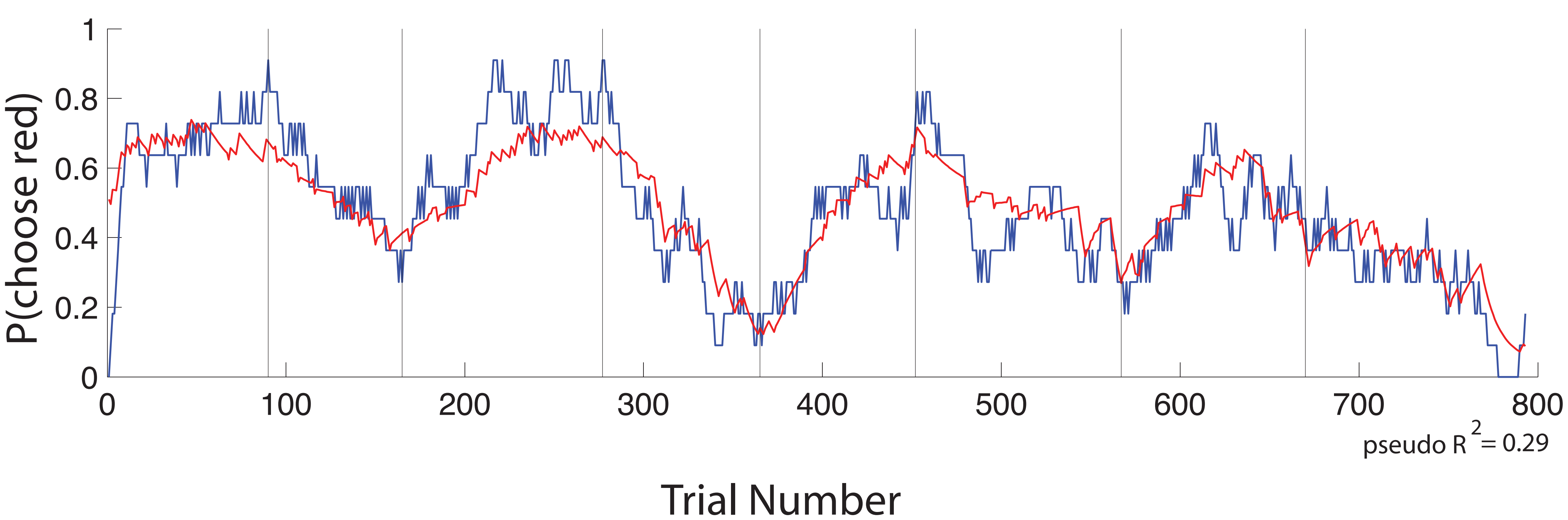


Results

~~$$Q_{a,t} = Q_{a,t-1} + \alpha(r_t - Q_{a,t-1})$$~~



Standard RL Model fit to behavior without VTA stimulation



Modelling Stimulation

Model

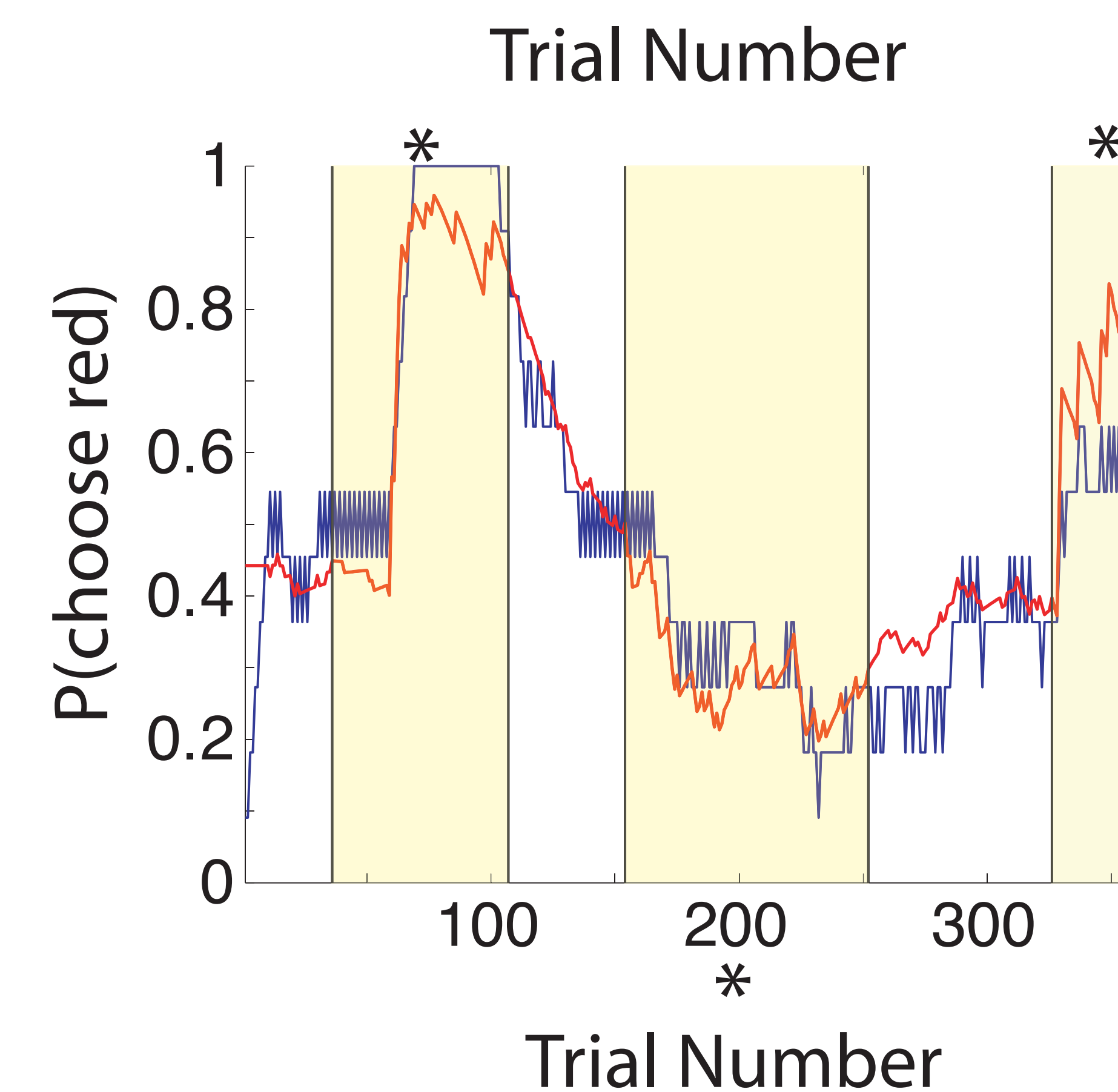
$$Q_{red,t} = Q_{red,t-1} + \alpha(r_{red,t} - Q_{red,t}) + D_{red,t}$$

$$Q_{green,t} = Q_{green,t-1} + \alpha(r_{green,t} - Q_{green,t})$$

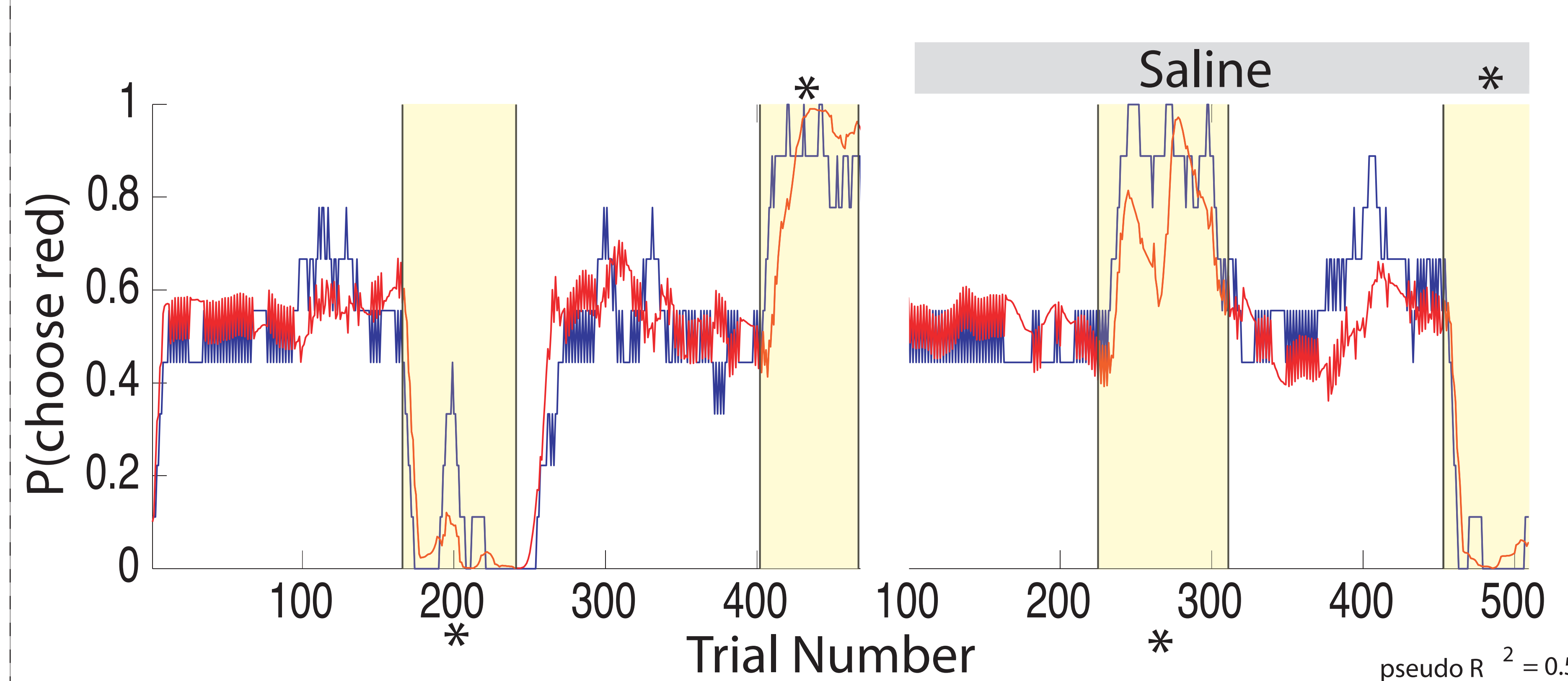
$$DV = Q_r - Q_g + bias_{spatial}$$

$$choice\ probability = \frac{1}{1 + e^{beta * DV}}$$

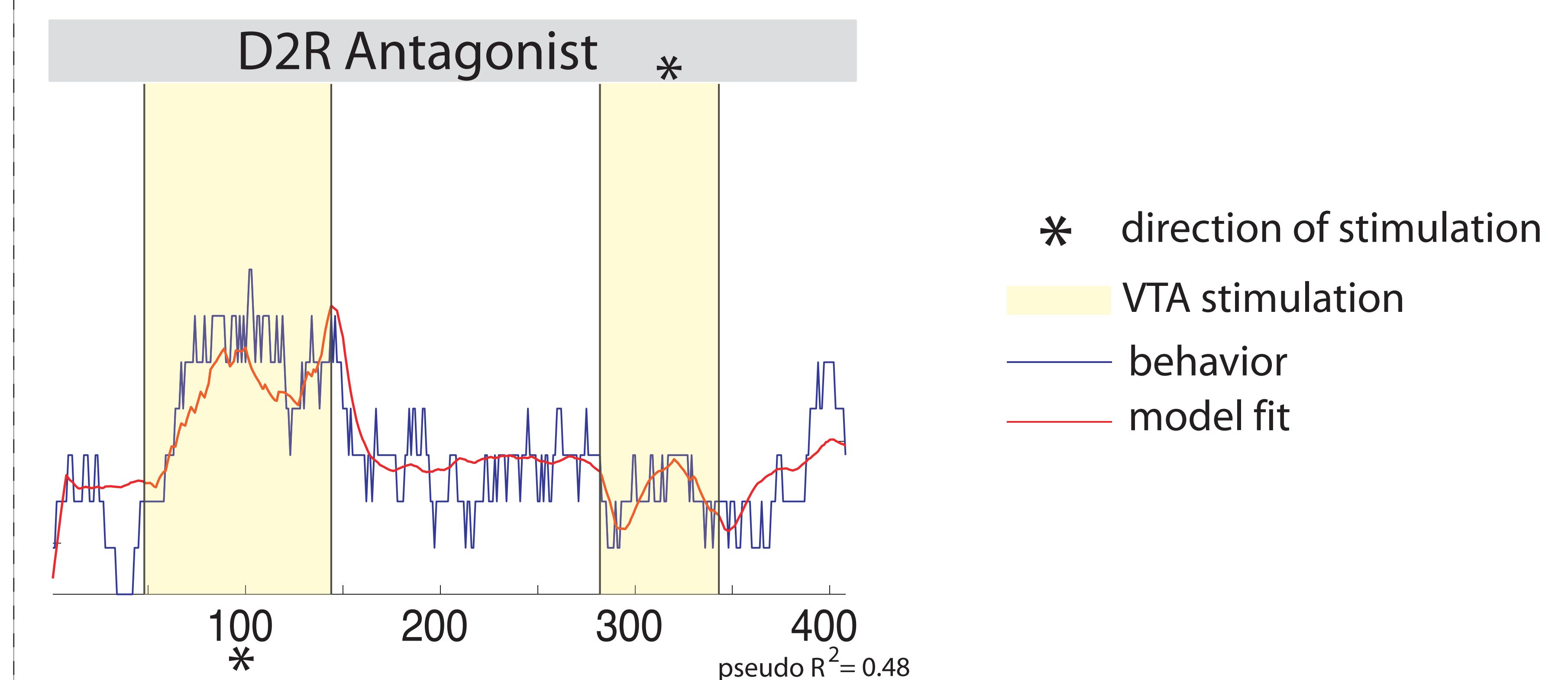
Minimizing predicted probability of choosing the red target against the actual choice (1 or 0)



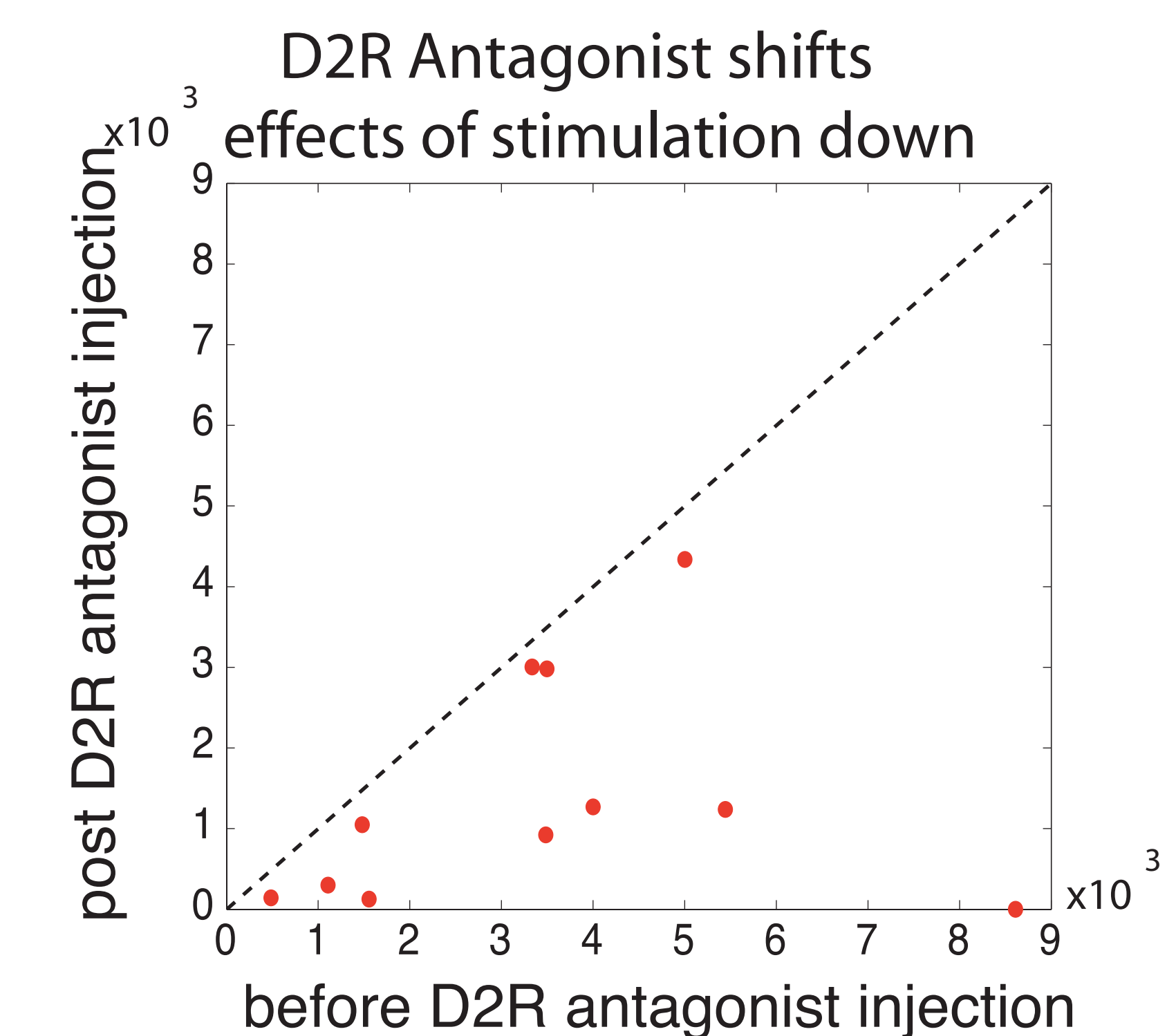
Model Fit before and after saline



Effects of Dopaminergic Blockade



D2 Receptor partial blockade reduces D(t)



Conclusion

- A term for dopamine stimulation is a necessary adjustment to the reinforcement learning model.
- blocking D2 dopamine receptors attenuates effects of stimulation