Parameter	Value	Units	Description
N	100	-	Number of neurons per population
dt	1	ms	Integration time step
T	50	ms	Stimulus pulse duration
τ_{stim}	50	ms	Decay constant of stimulus
τ_w	40	ms	Time window for firing rate integration
p_r	30	Hz	Rate of Poisson stimulus pulse
σ_N	Ɲ (0,100)		Gaussian white noise at membrane
ρ	1/7	-	Fractional change of synaptic activation
τ_s^E, τ_s^I, τ_s^{inp}	80,10, 10	ms	Time constant for synaptic activation for excitatory (EE and IE), inhibitory (EI), and input connections
g_L	10	nS	Leak conductance
C_m	200	pF	Membrane capacitance
E_L	-60	mV	Leak reversal potential
E_E, E_I	-5,-70	mV	Excitatory and inhibitory reversal potentials
v_{th}, v_{th}^I	-55, -50	mV	Spiking threshold potential (excitatory, inhibitory)
v_{rest}	-60	mV	Resting potential
v_{hold}	-61	mV	Reset potential
t_{ref}	3	ms	Absolute refractory period
τ_p, τ_d	2000, 1000	ms	LTP/LTD eligibility trace time constant, recurrent connections
T_p^{max}, T_d^{max}	0.0033, 0.00345	-	Saturation level, LTP/LTD eligibility trace, recurrent connections
η_p, η_d	45 x 3500, 25 x 3500	ms^{-1}	Activation rate, LTP/LTD eligibility trace, recurrent connections
τ_p^{FF}, τ_d^{FF}	200, 800	ms	LTP/LTD eligibility trace time constant, feed forward connections
$T_p^{max,FF}$, $T_d^{max,FF}$	0.0034, 0.0045	-	Saturation level, LTP/LTD eligibility trace, feed forward connections
η_p^{FF}, η_d^{FF}	8.8 x 3500, 10 x 3500	ms^{-1}	Activation rate, LTP/LTD eligibility trace, feed forward connections
r_{th}, r_{th}^{FF}	10, 30	Hz	Hebbian activation threshold (recurrent and feed forward connections)
T_{reward}	25	ms	Duration of neuromodulator presentation upon change in stimulus
T_{tr}	25	ms	Duration of refractory period for traces following neuromodulator presentation
d_{reward}	25	ms	Novelty delay upon change in stimulus
η	0.16(recurrent) , 32 (feed-forward)	ms^{-1}	Learning rates, recurrent and feed forward connections (note that these are scaled by the delay period, so are implemented in MATLAB as $\eta = 2*\eta_{fixed} / T_{reward}$). Slower learning rates will be more stable, but take more trials to converge to fixed-points.
φ	0.26 (0.3)	-	Sparsity of fixed connections, implemented in MATLAB as 0.3, which results in an effective sparsity of 0.26 because of random number generator oddities
W_{EE}^{MT}, W_{EI}^{MT}	0.2, 70	nS	Synaptic connection strength, Timer to Messenger excitatory to excitatory (EE) and inhibitory to excitatory (EI) connections
W_{EI}^{TT}, W_{EI}^{MM}	100, 100	nS	Synaptic connection strength, intercolumnar Timer-Timer and Messenger-Messenger inhibitory to excitatory (EI) connections
W_{IE}^{TT}, W_{IE}^{MM}	0.2, 1	nS	Synaptic connection strength, intracolumnar Timer-Timer and Messenger-Messenger excitatory to inhibitory (IE) connections

Supplementary File 1. Table of Main Model Parameters. For full code, see http://modeldb.yale.edu/266774