

Reinforcement learning of 2-joint virtual arm reaching in detailed cortex simulation

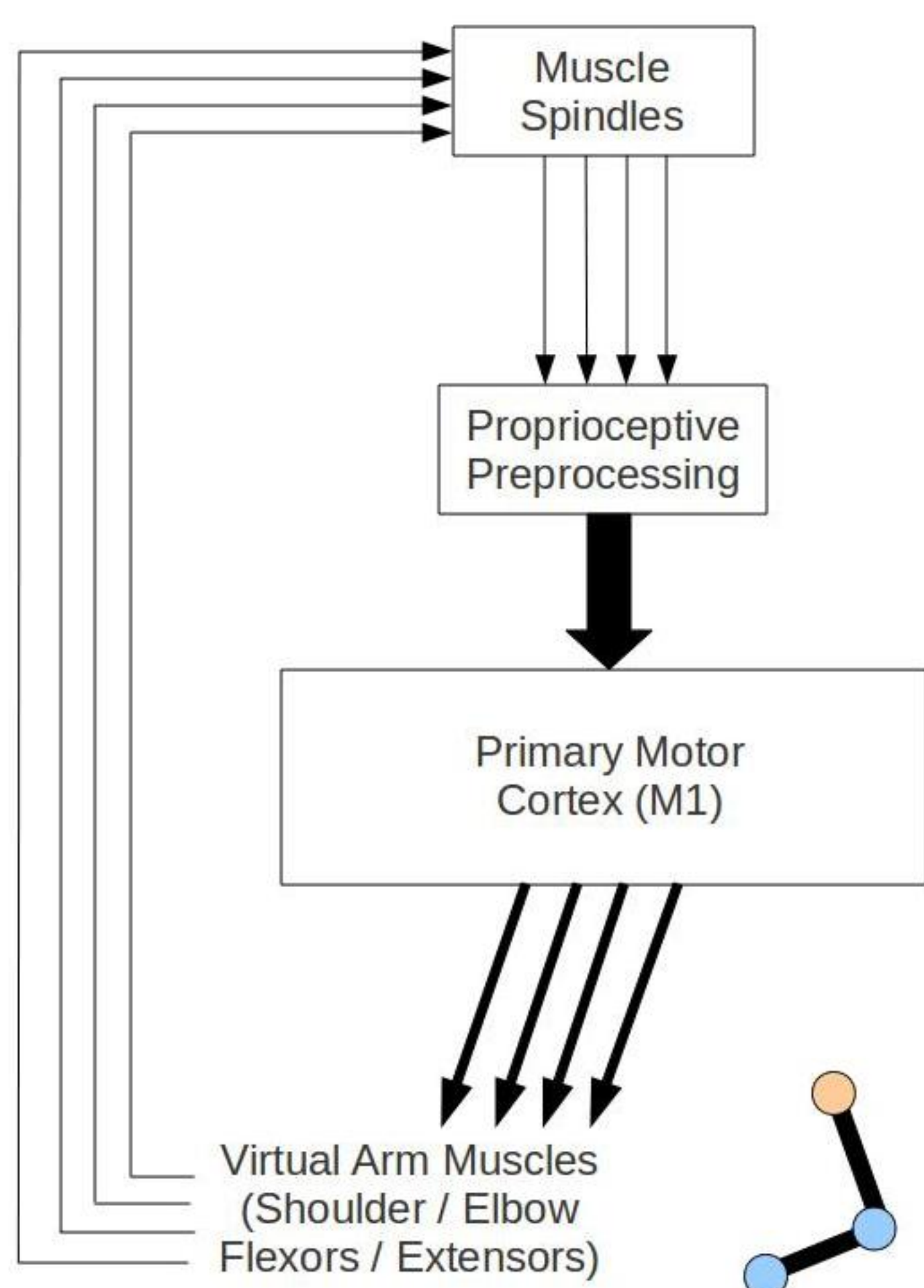
SA Neymotin¹, GL Chadderton¹, CC Kerr^{1,2}, JT Francis¹, WW Lytton^{1,3}

¹SUNY Downstate Medical Center; ²University of Sydney; ³Kings County Hospital, Brooklyn, NY



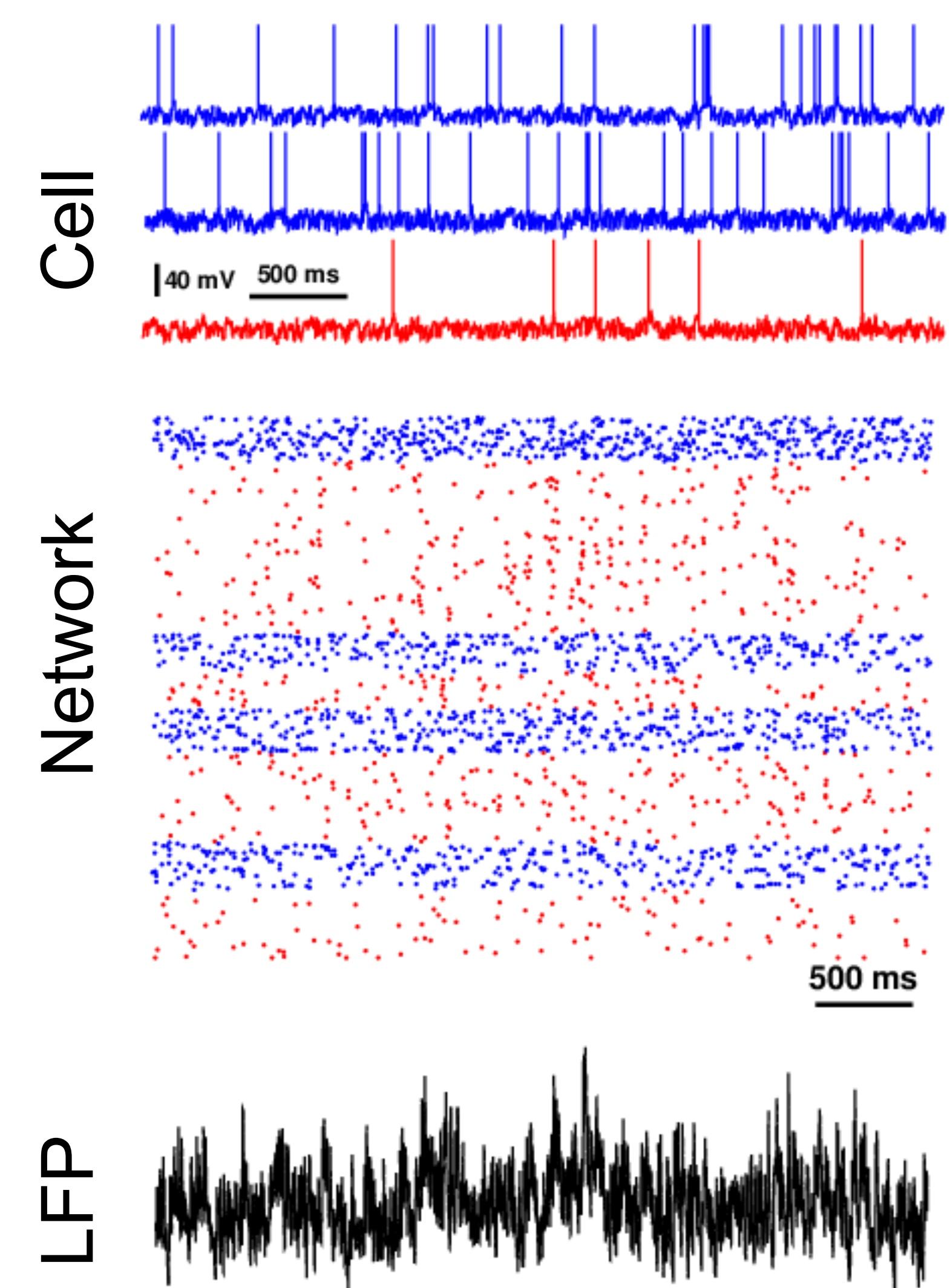
Inside the Black Box

Each component of the sensorimotor loop is itself a complex brain area

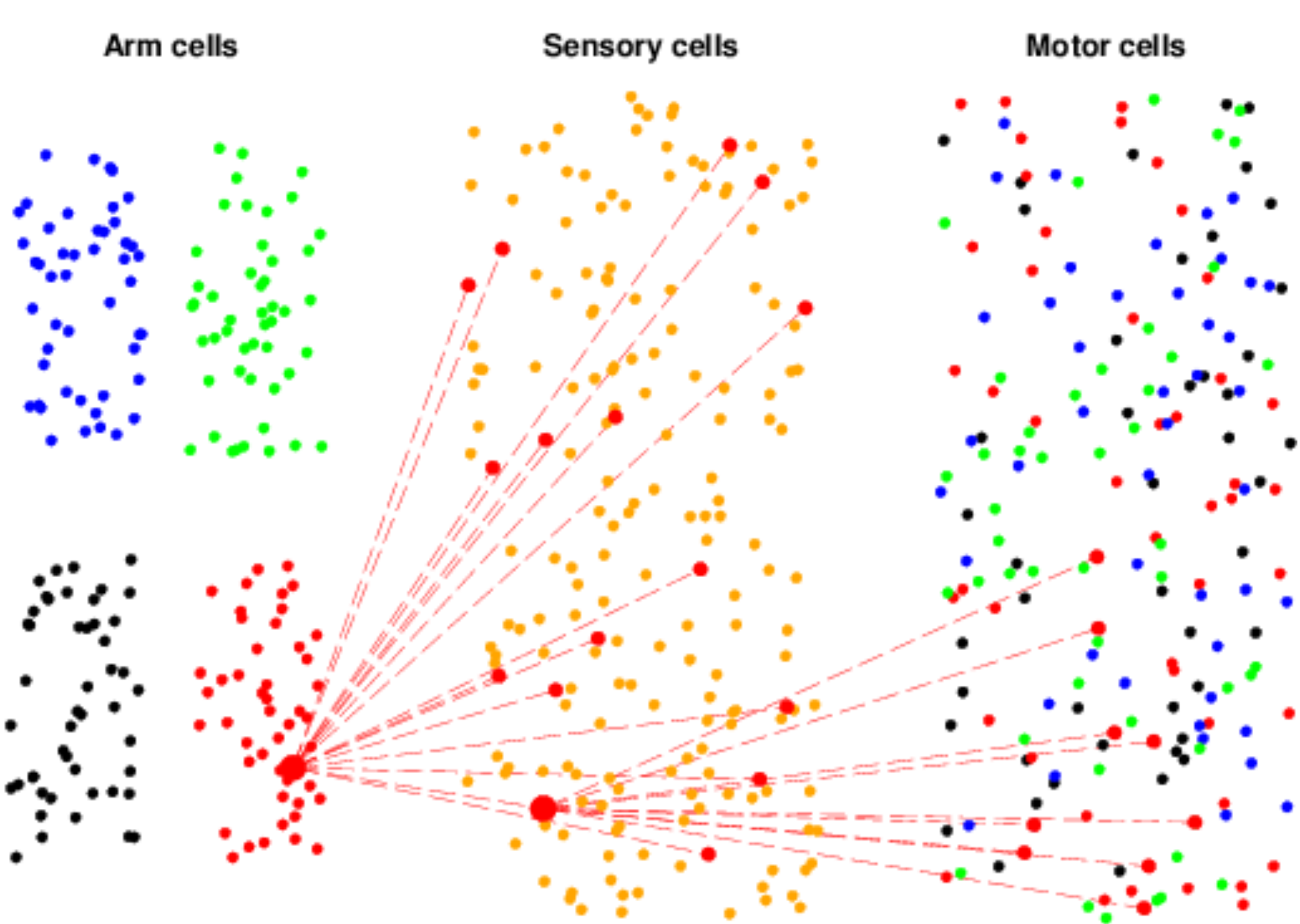


Methods

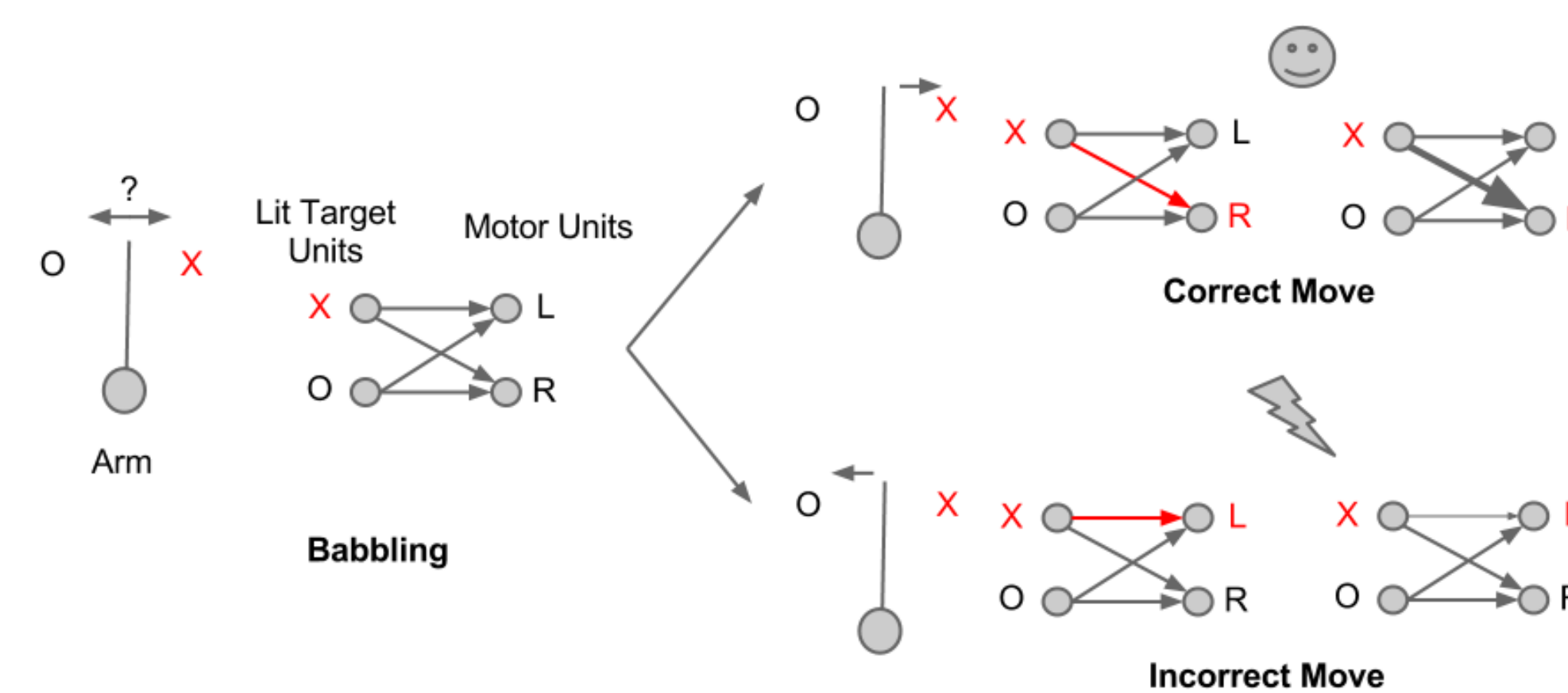
Multiscale models of the brain



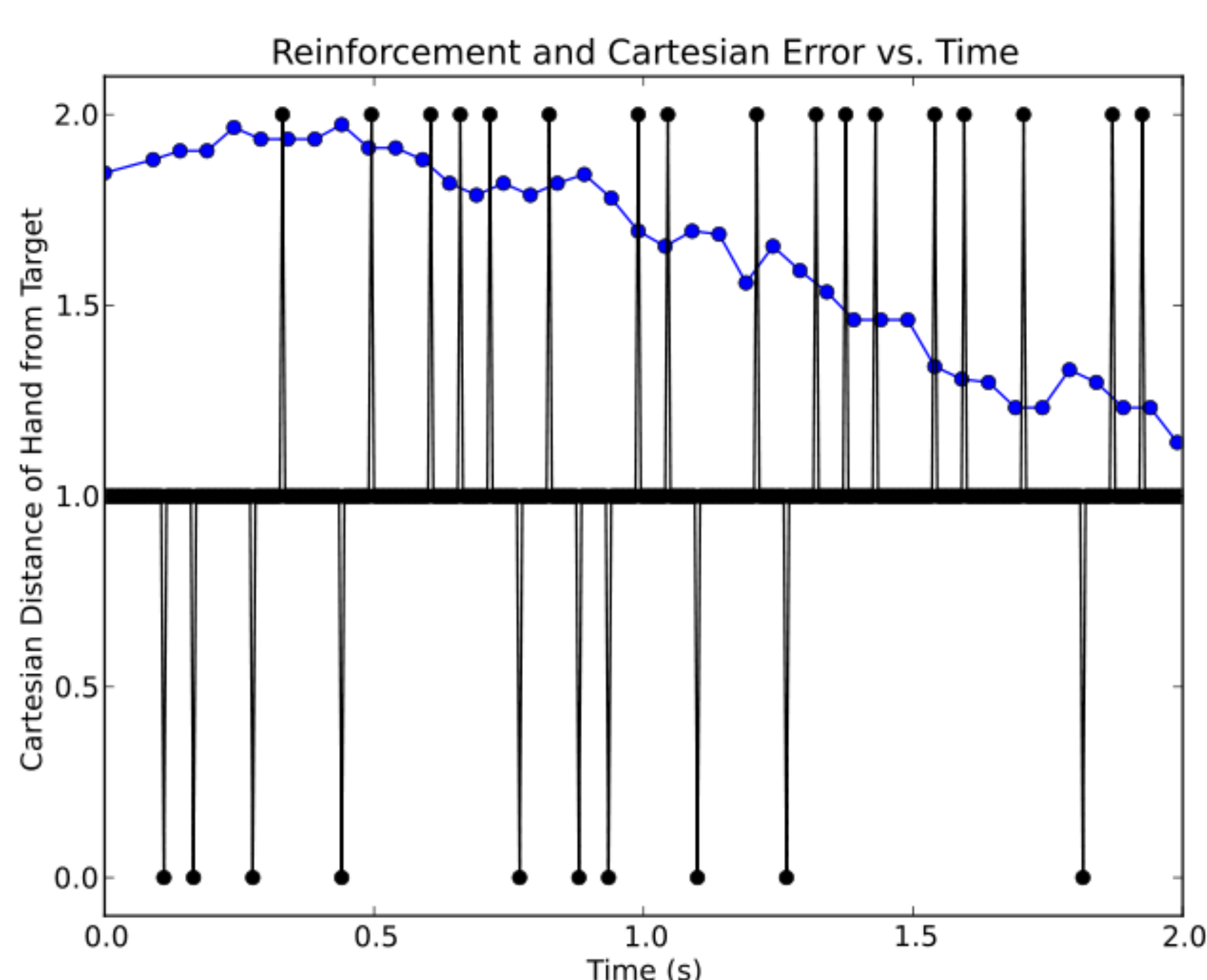
Modular Connectivity



STDP-based Reinforcement Learning

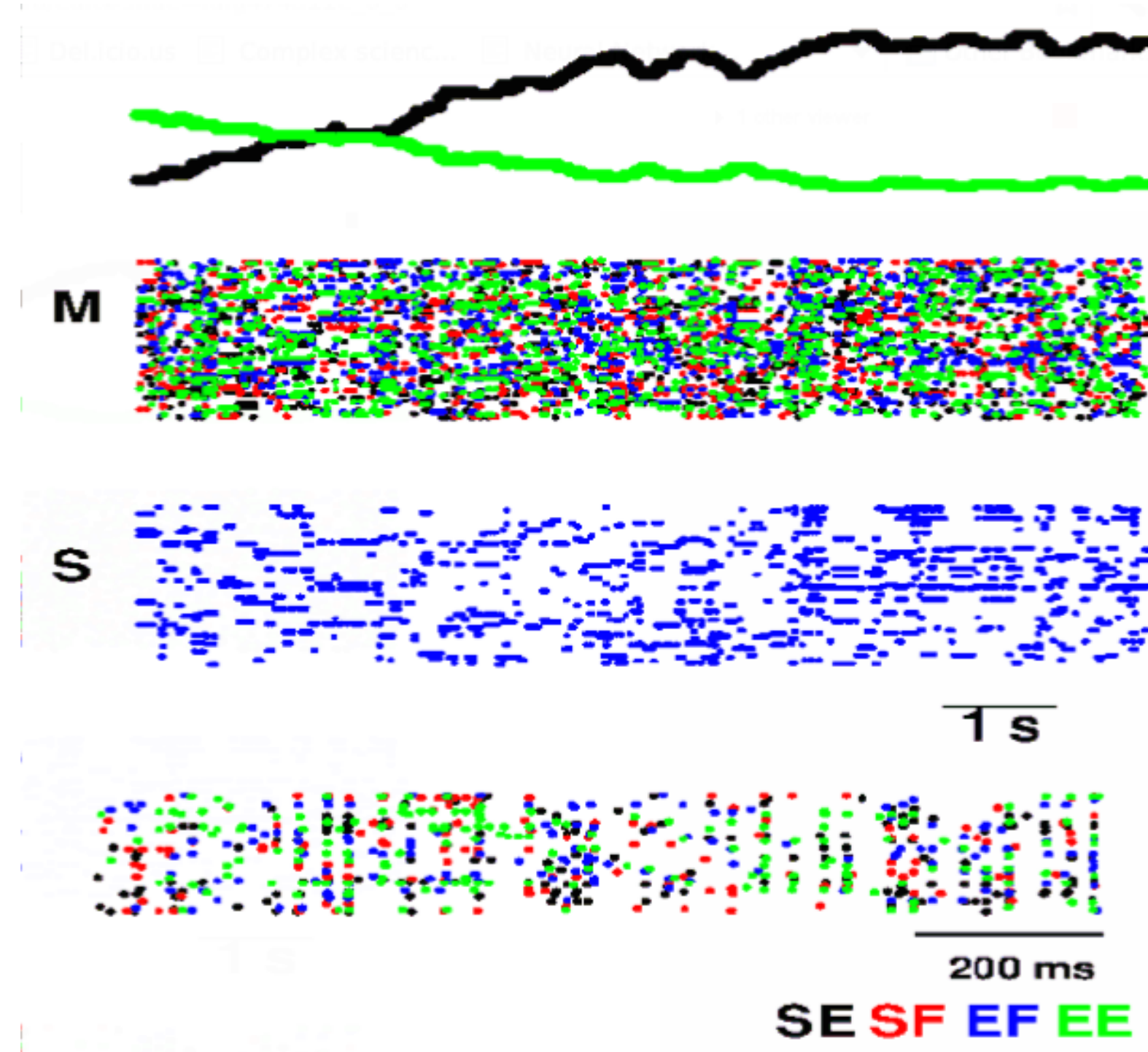


Reinforcement learning with LTP/LTD

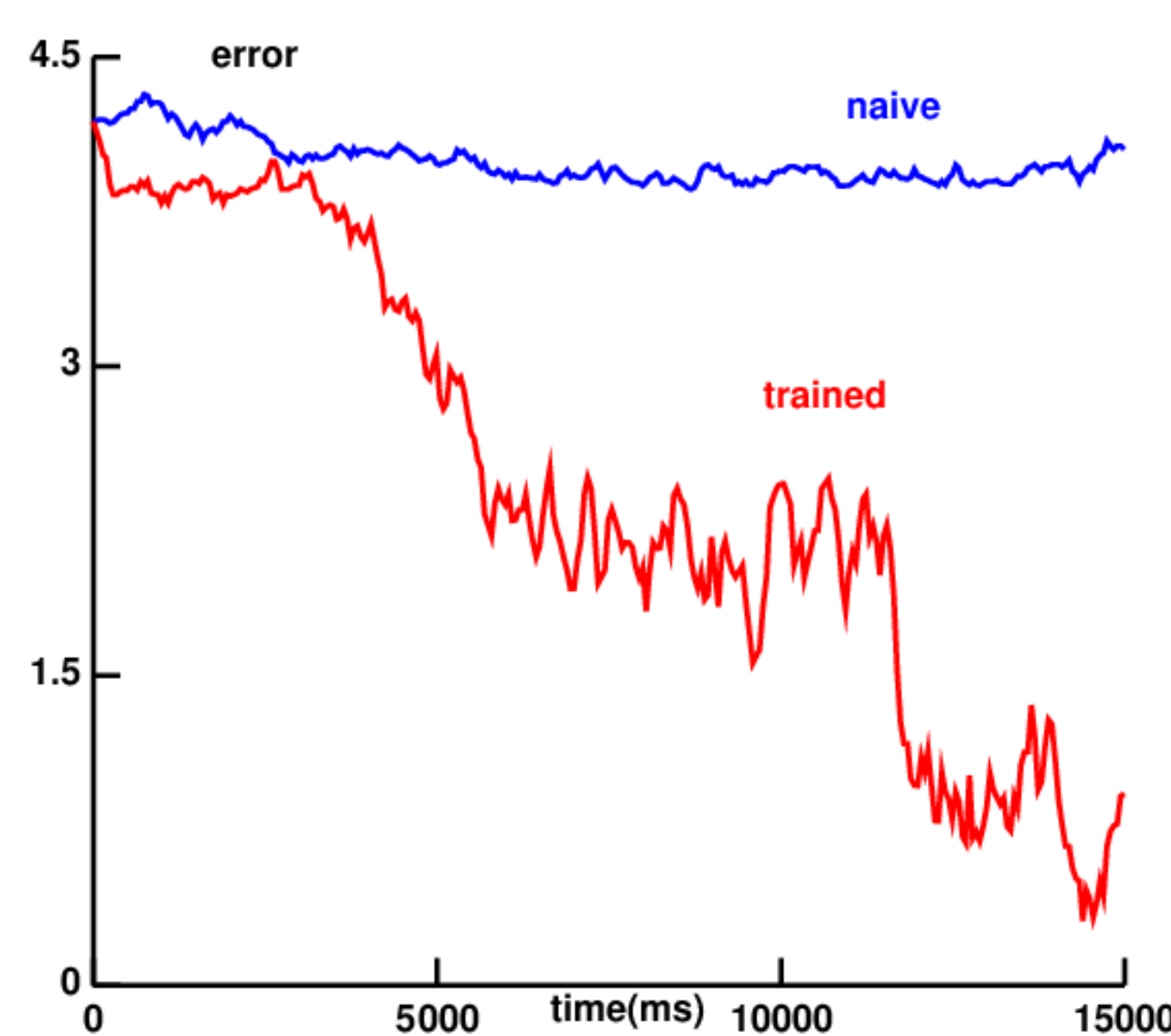


Results

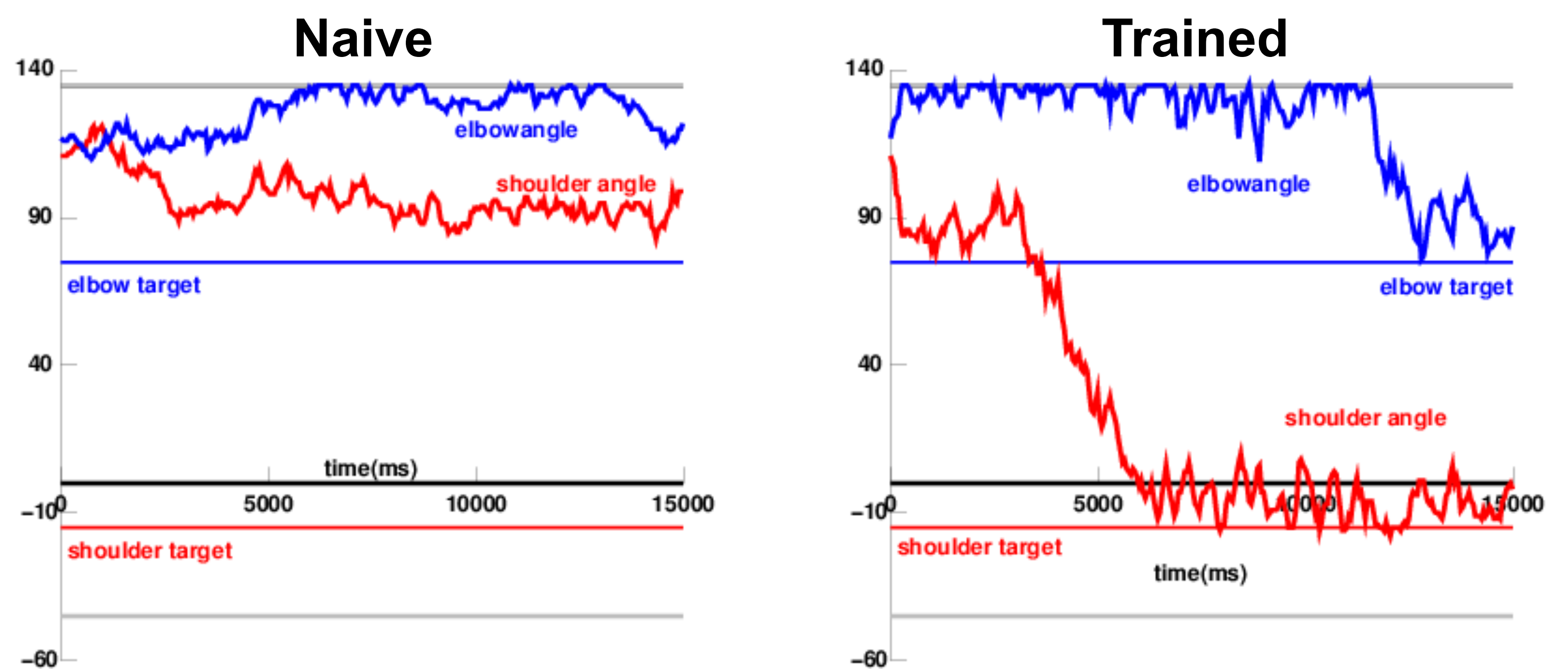
Trained 2 DOF network: raster plot



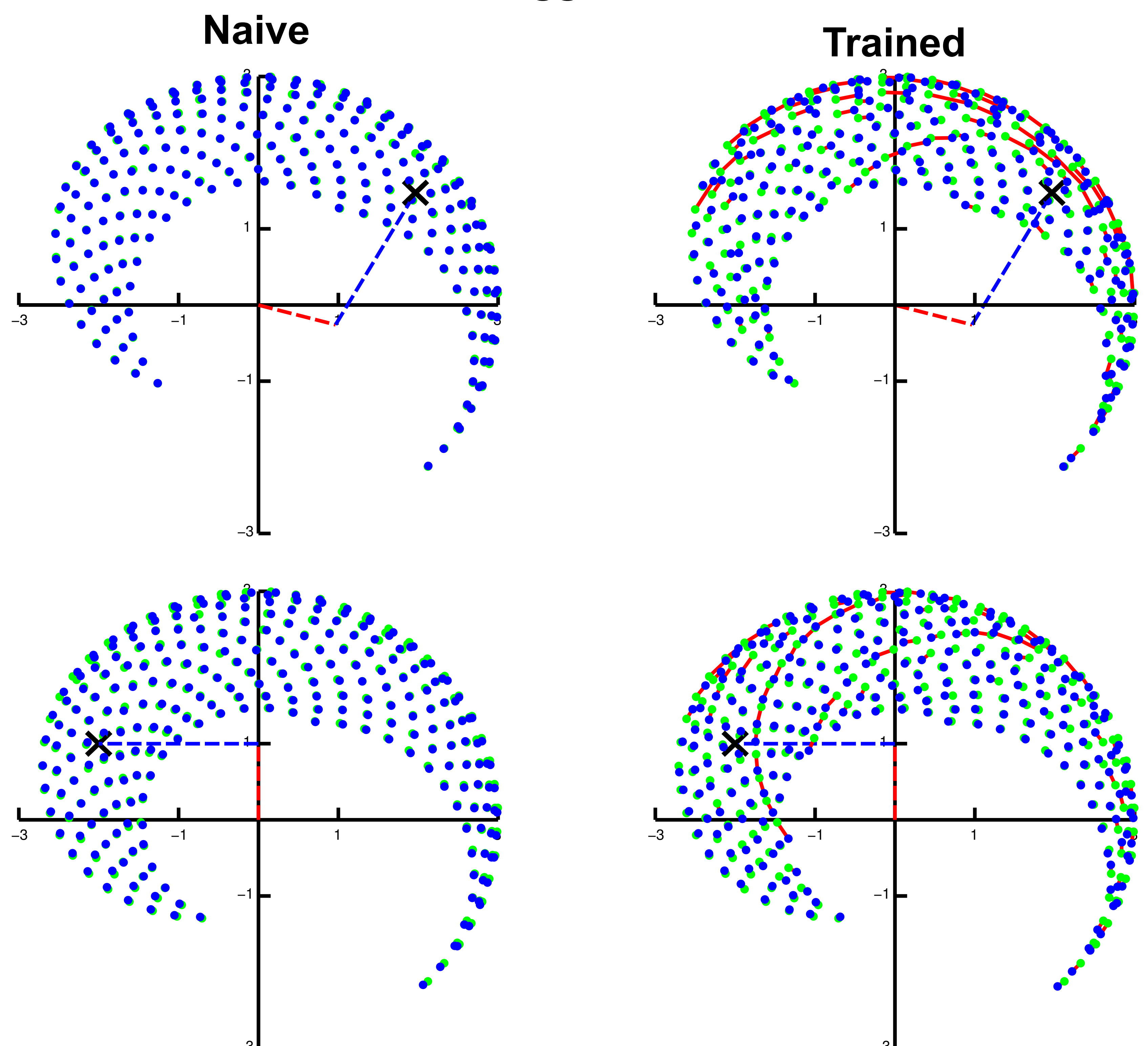
2 DOF network reaches target in plane



Trained network reaches target: joints



Vector field suggests an attractor



Conclusions

1. A detailed spiking model of sensory and motor cortex utilizing STDP-based reinforcement learning can learn to control a (virtual) arm.
2. The trained network shows evidence of attractor dynamics.

Thinking inside the box:

3. Multiscale modeling can begin to resolve the gap between large-scale control theory and small-scale measurements of LFPs and spike times.

Abbrevs: DOF: degrees of freedom; LTP long-term potentiation; LTD: long-term depression; LFP: local field potential; STDP: spike-timing dependent plasticity
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