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Learning mechanisms for DA-modulated spiking networks in the basal ganglia

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How the basal ganglia act to gate cortically planned actions is a topic of current discussion. Interesting work by Gurney et al [1-3] suggests an interaction between the STN and GPe as a central element of inhibition for action gating, with pathological oscillations occurring if striatal input changes due to dopamine depletion in Parkinson's disease.

But what exactly changes in the signals that the striatum projects to the rest of the basal ganglia? How could the altered dopamine signal and its effect on striatal learning influence the observed functions of the basal ganglia in Parkinsonian and in healthy patients?

While rate-based learning models of the basal ganglia have been suggested [5], a spiking network that reproduces basal ganglia anatomy and autonomously learns a set of possible action sequences that can then be reinforced through dopamine feedback has yet to be demonstrated.

On the way to constructing such a network, we present some effects of spike timing dependent plasticity, synaptic delay, group inhibition, noisy & localised projections and dopamine modulation on feed-forward and associative spiking networks within the basal ganglia and cortex.

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