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Looking at the role of direct and indirect pathways in basal ganglia networks at different levels

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The role of basal ganglia in motor action initiation and selection has been well studied and now it is evident that impairment in this structure causes not only causes movement disorders as Parkinson's disease, Huntington's disease but also behavioral dysfunctions as addiction, obsessive-compulsive disorder [1-4]. In order to understand the mechanisms giving rise to motor actions, cognitive processes related to these actions as decision making and the diseases occurring due to malfunctioning of these structures, various computational models of direct and indirect pathways have been proposed [5-9]. Here, in order to set a simple relation between models of basal ganglia at different levels, a simple mass model indicating the controversial role of direct and indirect pathways will be introduced first. While dopamine (DA) in direct pathway enhances the activity in Thalamus giving rise to inhibition of action, arise of DA in indirect pathway disinhibits Thalamus activity promoting the action to take place. This activity can be followed from Figure 1 for different DA levels. Based on the results of this simple mass model, spiking neural network (SNN) is built by point neurons and the relation between the local field potential of this SNN and simple mass model will be discussed. The aim is to build a simple relation between different levels of computational models which would help investigating the mechanisms behind the cognitive processes without engaging in detailed models initially. Thus, the simple mass model proposed would be primary model giving a chance to test the initial interpretation of the concepts formed and lead to setting up more detailed, realistic models.

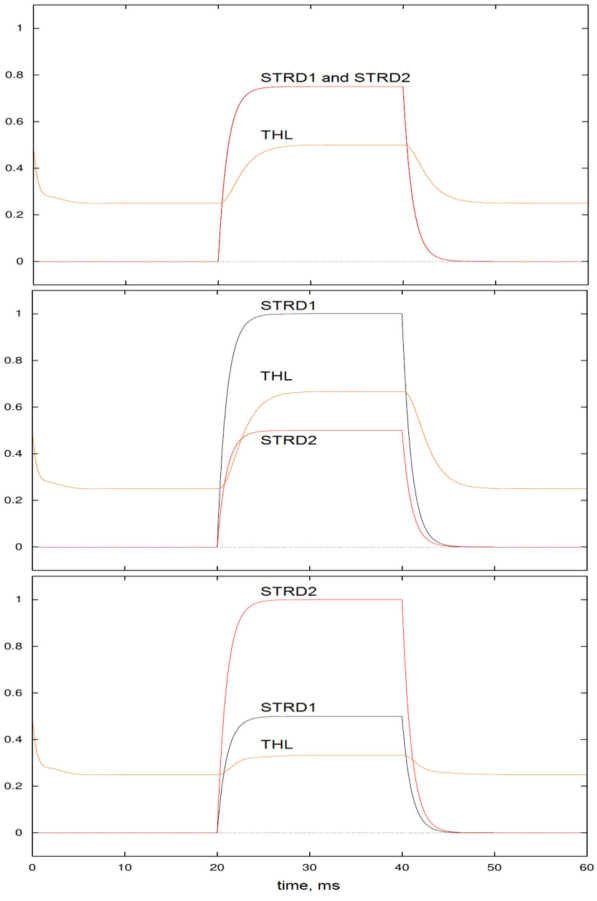

Figure 1 DA level is normal, high and low at top, middle and bottom, respectively. THL activity is normal, high and low similar to STRD1 activity and contrary to STRD2 activity.

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