
The Role of the Subthalamic Nucleus in Multiple Alternative Perceptual Decision Making revealed by 7T Structural and Functional MRI

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Abstract

Recently, quantitative mathematical and neurocomputational models have been developed that make predictions about the latent psychological processes and brain structures involved in multiple alternative decision-making. In particular, the subthalamic nucleus (STN), a small structure in the basal ganglia (BG), is hypothesized to become more active with an increasing amount of choice alternatives. This increase of activity is thought to reflect a decrease in baseline activity causing a delayed response of the output nuclei of the BG so that more evidence can be accumulated in favor of the correct response. In the present study, first the behavioral data were fit with the linear ballistic accumulator (LBA) model to capture the latent psychological processes involved in multiple alternative perceptual decision-making. Secondly, ultra-high resolution 7T functional and structural MRI data were collected to test our STN hypotheses. 7T functional data showed higher stimulus-related activation with an increase of choice alternatives only in the right STN. These results are also captured by the LBA model fits as the drift rate decreases and the threshold increases due to a prolonged decision process. In sum, the present study highlights the functional role of the STN in multiple alternative perceptual decision-making.

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