COMPUTATIONAL NEUROSCIENCE SEMINAR

LABORATORY OF COMPUTATIONAL NEUROSCIENCE (LCN)

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

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Striatal dynamics explain duration judgements

Time, like space, is a fundamental dimension of the environment, yet how time is processed in the brain is poorly understood. Prior studies have shown that population dynamics in a number of brain areas encode information about the passage of time. However, it is not known whether such temporal representations inform subjects' judgments of duration or merely covary with elapsing time. The striatum is an input structure of the basal ganglia implicated in several time-dependent functions such as reinforcement learning, decision making, and interval timing. To determine whether striatal ensembles drive subjects' judgments of duration, we manipulated and recorded from striatal neurons in rats performing a duration categorization psychophysical task. We found that striatal neurons displayed diverse firing patterns and that the dynamics of these patterns predicted duration judgments. In fact, using the state of a simultaneously recorded ensemble to judge duration produced performance that matched that of the animal. Importantly, these findings were not explained by the immediate sensorimotor state of the animals as assessed by analysis of high speed video of behavior. Furthermore, striatal neurons were necessary for duration judgments, as infusions of the GABAa agonist muscimol into the striatum produced a specific impairment in the duration sensitivity of animals' judgments. Lastly, we show that elapsing time, the relevant decision variable for the task, was encoded by striatal populations and ran faster or slower when rats judged a given duration as longer or shorter, respectively. These results demonstrate that striatal dynamics form an internal "neural population clock" that supports the fundamental ability of animals to judge the passage of time.

Host : Prof. Wulfram Gerstner