

Path analysis of rodent spatial navigation in the Hex Maze task.

We have developed a novel rodent navigation task - the Hex Maze task - that allows the study of gradual build-up of knowledge networks and their updating. The Hex Maze task provides a much more intricate environment than traditional rodent tasks, which allows us to study more complex knowledge networks and their underlying neural processes. Rodents are trained to find food in the maze equipped with numerous extra- and intra-maze cues. For each animal, the goal location remains the same throughout the training, while the start location varies from trial to trial, encouraging allocentric navigation. We obtain various behavioral measures such as distance travelled, correct vs. incorrect choices, and speed and latency to food node arrival.

During the internship, the student will analyse the data of the paths followed by the rodents during the experiment. This analysis will try to shed light on the strategies that rodents use to decide the path they follow. The analysis could involve either only data analysis or also developing a mathematical model with the help of a Postdoc.

Depending on their interests and experience, some examples of tasks the student could address are:

- Compute the actual path length travelled by the rodents and compare this to other metrics such as number of maze nodes crossed or speed in order to determine which metric shows an improved performance and can explain the process of learning.
- Using graph theory and shortest path algorithms to model the data and identify the strategies followed by the rodents.
- Mathematical modelling of spatial patterns shifts to track the acquisition of knowledge. For example, how goal-oriented or random is the rodent's navigation?

Ideally the student is expected to have previous experience writing scripts in Matlab and/or Python. However, students with little experience but high motivation are also encouraged to apply and can be considered for projects where they run scripts written by the supervisor.

Optionally a computer vision component can be added to the rat path analysis if this fits more with the student interests and experience.

If you are interested on applying please send an email with a short description of your background to **I.genzel@donders.ru.nl**

Relevant literature

- Schema-induced shifts in mice navigational strategies are unveiled by a minimal behavioral model of spatial exploration. Christina-Anna Vallianatou, Alejandra Alonso, Adrian Aleman, Lisa Genzel, Federico Stella. bioRxiv 2020.12.21.423808; doi: <https://doi.org/10.1101/2020.12.21.423808>
 - The HexMaze: A previous knowledge and schema task for mice. Alejandra Alonso, Levan Bokeria, Jacqueline van der Meij, Anumita Samanta, Ronny Eichler, Patrick Spooner, Irene Navarro Lobato, Lisa Genzel. bioRxiv 441048; doi: <https://doi.org/10.1101/441048>
-