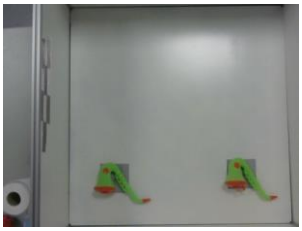
The Object Space Task: How do we form cumulative memories over multiple episodes

Declarative memory includes representations from single episodic events as well as cumulative representations formed over multiple non-identical episodes. These single episodic events are thought to be encoded initially in the hippocampus and over time integrated in the prefrontal cortex for long term storage and sleep has been shown to play a crucial role in this process of memory consolidation (Frankland and Bontempi, 2005). To investigate and delineate the underlying neural processes in further detail, we have developed a novel behavior task in rodents – The Object Space Task which enables to study both episodic memories as well as memory abstraction across multiple episodes (Genzel et al.,2019). The setup exploits the natural tendency of rodents to explore novel objects and environments and unlike other object recognition tasks, it allows us to study cumulative memories.

Both rats and mice are allowed to explore two identical objects placed in different spatial arrangements in a box setup equipped with 2d and 3d cues across multiple trials. By calculating the amount of time spent on certain locations, we get a behavioral output of memory, both short term and long term. Combining this task with electrophysiological, molecular and calcium imaging techniques, we are now trying to investigate the neural processes at different stages of memory formation – encoding, buildup (consolidation) and retrieval and the role of key regions such as hippocampus and prefrontal cortex in each stage. Amongst many, below are a few research questions we are currently trying to address in the lab :

- Role of sleep and novelty in memory consolidation
- Effect of interference in memories
- Role of RGS14, a neural plasticity protein on spatial memory consolidation
- Memory consolidation in rodent models of intellectual disability and depression
- Role of endocannabinoids in memory consolidation



Depending on your background, you can apply for both experimental and computational projects!

Experimental projects

- Rodent behavior
- Molecular techniques such as histology
- Behavioral Data analyses and other techniques like sleepscoring in rodents
- Acute and chronic electrophysiological recordings

Computational projects

- Analyses with big datasets (70k+ videos) – deep learning algorithms, computer-vision
- Electrophysiology data analyses

Internship location: Science Faculty, Donders Institute, Neuroinformatics department Translational Neuroscience Unit

Contact information: Applications should be addressed to l.genzel@donders.ru.nl with a short description of your background.