Master Thesis Opportunity: Investigating Reactivation-Induced Rapid Memory Consolidation in Wakefulness and Sleep

The **Brain States for Plasticity group** (PI Dr. Svenja Brodt) invites applications from highly motivated Master students (m/f/d) to join our team at the [Max Planck Institute for Biological Cybernetics](#) in Tübingen, Germany. In the **REHA** project, we aim to examine and compare the **nature of memory consolidation during rehearsal and sleep**.

Both sleep and rehearsal have been shown to accelerate systems memory consolidation by reactivating mnemonic information. However, little is known about the underlying neural mechanisms involved in rehearsal-induced memory consolidation, and how the stabilizing effects of rehearsal may be modulated by sleep. The REHA project will investigate in which respects rehearsal-consolidated memory representations may resemble or differ from memories that have undergone classical, sleep-dependent memory consolidation. To this end, we will collect functional and diffusion-weighted MRI data while participants perform an image-location learning task. After learning, participants will either experience a night of total sleep deprivation in the lab or will be sent home to sleep wearing a mobile EEG that records polysomnography data. Following a three-day delay, participants will re-enter the MRI scanner to assess potential changes in memory representations of rehearsed and non-rehearsed associations.

We are currently offering Master theses on this project in two main areas:

Topic 1: Rehearsal-dependent changes in neural activity (fMRI)

- **Potential research questions include**: Which brain regions are involved in rehearsal-dependent consolidation? How do their contributions change over learning repetitions? How do interactions between brain regions differ for rehearsed vs. non-rehearsed associations?
- Students will collect and analyze **functional MRI data** to characterize neural changes during rehearsal. Analyses may include **univariate** or **multivariate** approaches as well as **functional connectivity** analyses.

Topic 2: Sleep characteristics and memory retention (EEG/polysomnography)

- **Potential research questions include**: Which sleep characteristics affect memory retention? Are sleep characteristics related to neural changes during learning? How well are rehearsed vs. non-rehearsed memories retained after sleep compared to sleep deprivation?
- Students will collect, score, and analyze **polysomnography data** to investigate sleep-dependent memory consolidation following learning. Analyses may include **sleep architecture analyses**, **time-frequency analyses**, or **connectivity analyses**.

Who we are looking for:

- Preferably students studying neuroscience, psychology, cognitive science, or a related field.
- Proficient in German and English.
- Experience with Python and/or MATLAB recommended.
- Interested in state-of-the-art cognitive neuroscience research and motivated to work in a fun and engaging team!

Theses are available **starting from summer/fall 2024**.

If you are interest in writing your thesis in the REHA project, get in touch with project leader **Lena Schroeder via lena.schroeder@tuebingen.mpg.de**