

Level (Bachelors, Masters or PhD)	Project Name	Project Description	Relevant Readings	Requirements	Estimated Duration of Project	Start date
Master's	Credit Assignment	In this project we aim to study credit assignment (MF and/or MB) in aging adults and examine the mechanisms that may explain their deficits. As a first step, we will be testing younger and older adults on a computer task which tests credit assignment. In a second step, we will be administering this task in the scanner to examine potential mechanisms such as replay.	Moran, R., Keramati, M., Dayan, P., & Dolan, R. J. (2019). Retrospective model-based inference guides model-free credit assignment. <i>Nature communications</i> , 10(1), 750. https://www.nature.com/articles/s41467-019-08662-8.pdf	Experience coding in R and/or Python. Curiosity about fMRI and/or MEG.	6 months - 1 year	3/1/2025
Master's or Bachelors	Surprise/Updating	Using an existing task, the goal of this project would be to examine surprise signals and updating in younger as well as older adults. Additional mechanisms such as attention and representation could be examined as well.	Nassar, M. R., Bruckner, R., & Frank, M. J. (2019). Statistical context dictates the relationship between feedback-related EEG signals and learning. <i>elife</i> , 8, e46975. https://elifesciences.org/articles/46975.pdf	Experience with EEG data collection, basic knowledge of EEG analysis, experience coding in R and/or MATLAB. Knowledge of Python is a plus.	6 months - 1 year	
Master's	SR Maze	Using a novel 3D Maze (designed in Unity), the goal of	Momennejad, I., Russek, E. M., Cheong, J. H., Botvinick, M. M., Daw, N. D., & Gershman, S. J. (2017). The successor	Experience coding in R and/or Python. Interest/experience	6 months - 1.5 years	earliest start December 2024

		this project is to examine which decision strategies younger and older adults engage in and how the relative contribution of these strategies shifts due to different types of changes in the decision-making environment. We will examine this (1) behaviorally, as well as (2) using fMRI.	representation in human reinforcement learning. <i>Nature human behaviour</i>, 1(9), 680-692. https://www.nature.com/articles/s41562-017-0180-8.pdf	in computational modeling.	(project dependent)	
Master's	Effects of short Pauses on learning	We increasingly find evidence that neural reactivation occurs during brief pauses from the task. Are these brief pauses indeed beneficial for learning? This project will be focussed on re-analysing existing data from the lab from a skill learning task (Wittkuhn et al., 2024). Can we find evidence, that these brief pauses improve performance on following trials? Possible extensions include setting up own experiment in which the effect of	Wittkuhn, L., Krippner, L. M., Koch, C., & Schuck, N. W. (2022). Replay in Human Visual Cortex is Linked to the Formation of Successor Representations and Independent of Consciousness. <i>bioRxiv</i>, 2022-02.	Experience coding in R and/or Python. Curiosity about fMRI and/or MEG.	6 months - 1.5 years (project dependent)	

		pauses is systematicall evaluated in a continual learning setup.				
Masters	Resting State fMRI Analyses on NSD data	The Natural Scenes Dataset (NSD) is a freely available large-scale fMRI dataset conducted at ultra-high-field (7T). The dataset includes resting state phases that might show evidence of reactivation. This project would focus on establishing a computational analysis pipeline for a large data set to test hypothesis about reactivation during rest in the human brain.	Allen, E.J., St-Yves, G., Wu, Y. et al. A massive 7T fMRI dataset to bridge cognitive neuroscience and artificial intelligence. Nat Neurosci 25, 116–126 (2022). https://doi.org/10.1038/s41593-021-00962-x	Experience coding in R and/or Python. Curiosity about fMRI and/or MEG.	6 months - 1.5 years (project dependent)	
Master's	tracking eye movements using electrophysiological recordings	In this project a method is developed to electrophysiologically measure eye movements with a high spatial precision (~ 0.5 degrees of visual angle). For this, a combination between electrophysiological recordings and eye		required: - experience with coding (Python/Matlab) - experience with electrophysiological recordings (EEG, EOG or EMG) OR eye tracking nice to have: - some understanding of neural networks	1-1.5 years	earliest start is October/2025

		tracking will be applied. The thesis comprises data collection and data analyses with a focus on machine learning/neural networks.				
Master's	eye movements in EEG and fMRI data	In this project previously collected EEG and fMRI data will be analysed. Using DeepMReye (convolutional neural network), it will be investigated how eye movements behave during a memory task and offline periods and in relation to oscillations obtained from the EEG signal.		required: - experience with coding (Python/Matlab) nice to have: - experience with fMRI data - some understanding of neural networks	1-1.5 years	earliest start is October/2025
Bachelor's/Master's	Effects of curriculum on human learning/memory	In this project, we study the influence of interleaved/blocked curricula on younger and older adults' learning/memory. For Bachelor thesis: conducting the in-house data collection and learning basic behavioral data analysis (e.g., quantifying human	Logan, G. D. (2021). Serial order in perception, memory, and action. Psychological Review, 128(1), 1–44. https://doi.org/10.1037/rev0000253 Zhu, S., Lakshminarasimhan, K. J., Arfaei N., Angelaki, D. E. (2020). Eye movements reveal spatiotemporal dynamics of visually-informed planning in navigation. eLife, https://doi.org/10.7554/eLife.73097	- Experience with coding (Python/Matlab/R); - Basic knowledge of statistics; - For the bachelor's thesis, german speaking.	Bachelor's: 6 months; Master's: 1 year.	

		performance on different dimensions of the sequences, using (G)LMM to perform statistical tests etc.). For Master thesis: 1) Implementation of computational modelling to dissociate the underlying cognitive processes; 2) Exploratory direction: gaze replay.				
Bachelor's	Influence of fieldmaps on MRI image quality	We want to systematically compare the effects of different types of fieldmaps on the quality of MRI image. The student will learn how to perform the fMRI preprocessing, in particular how to use fieldmaps to perform distortion correction caused by magnetic field inhomogeneities.	No reference.	- Experience with Python.	3-6 months	
Master's	fMRI decoding and online replay analysis	In functional MRI (fMRI) studies, a separate localizer task is typically employed to train a classifier, which is subsequently applied to the main task to	Wittkuhn, L., & Schuck, N. W. (2021). Dynamics of fMRI patterns reflect sub-second activation sequences and reveal replay in human visual cortex. Nature Communications, 12(1), 1795. https://doi.org/10.1038/s41467-021-21970-2	- Experience with Python. - Basic knowledge of machine learning preferred.	1 year.	

		avoid bias. This project seeks to determine whether effective decoding can be achieved directly from the stimuli in the main task and if the classifier can be used for online replay analysis. The outcomes will be compared to those obtained using a separate localizer task.				
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