Department of Psychology
The University of Hong Kong
香港大學心理學系

Departmental Seminar

Cognitive Maps and Stressed Engrams:
The Functional Role of Representational Distances in Human Memory Traces

4:00 p.m. – 5:00p.m. │ September 13, 2024 (Friday)

Rm 813, 8/F, The Jockey Club Tower │ Centennial Campus │ The University of Hong Kong

Professor Nikolai Axmacher, M.D., Ph.D.
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Abstract
The advent of novel cognitive neurosciences methods – specifically, multivariate analyses and models from artificial intelligence – now allows tracking the memory traces of individual experiences in the human brain. These memory traces are organized in cognitive maps, which consist of multiple layers with distinct representational formats that reflect the sensory hierarchy from perceptual to conceptual processes and that correspond to the different layers of deep neural networks (DNNs). I will first describe how higher representational distances – i.e., increased distinctiveness – of task-relevant formats benefit the later accessibility of memories. In the second part, I will show how negative experiences – from psychosocial stress to trauma-analogue experiences and fear conditioning – impair these distinct representations and induce overgeneralized memory traces at different levels. Finally, I will discuss the opposing roles of context in trauma memories and extinction learning, reflected by decontextualized representations of traumatic memories and overly distinct representations of extinction contexts.

About the Speaker
Nikolai Axmacher is Professor of Neuropsychology at Ruhr University Bochum (Germany). Our research aims to identify the formation and transformation of memory traces in the human brain from the level of single cells via small oscillatory assemblies to large-scale networks. This goal can only be achieved by combining several advanced recording methods including 3T and laminar 7T fMRI recordings, intracranial EEG, and human single unit recordings with methods from artificial intelligence, in particular deep neural networks, that serve as models for multi-layered memory traces. In addition, we explore the neural mechanisms and the functional role of different navigational strategies and their impairment in early stages Alzheimer's disease. Our studies have been published in more than 150 articles including papers in Science, Nature Neuroscience, Nature Reviews Neuroscience, Trends in Cognitive Sciences, Neuron, Nature Communications, Science Advances etc. These articles were cited more than 15,000 times, resulting in an h-index of 56. Nikolai Axmacher was awarded several prestigious awards including an ERC Consolidator Grant (2M€), is an elected member of the Memory Disorders Research Society, and serves as a Scientific Advisor for research institutions around the world.

Zoom Meeting (For participants who couldn't attend the Seminar in person)
https://hku.zoom.us/j/6985555998?pwd=V05yTGJWNTlzazd2OFZ0Q3FReHVkdz09
Meeting ID: 698 555 5998 │ Password: Psyc

~All are Welcome~

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