Open PhD position in Cognitive Neuroengineering investigating the attentional and social mechanisms of robotically-induced hallucinations using EEG decoding and brain stimulation.

The Laboratory of Cognitive Neuroscience (Olaf Blanke: https://www.epfl.ch/labs/lnco/) opens a new PhD position on the attentional and social brain mechanisms of experimentally-induced hallucinations in healthy participants and in Parkinson's disease. The project will combine the use of robotics and virtual reality (VR) with non-invasive brain stimulation, and high-density EEG/MEG recordings to unravel the contribution of attentional and social brain mechanisms to hallucinations. The project is part of a major research project in Western Switzerland on the brain mechanisms of altered states of consciousness (hallucinations) and related cognitive functions in healthy individuals and patients with Parkinson's disease.

Project description:

Hallucinations are important phenomena for the neuroscience of consciousness and frequent symptoms in major psychiatric and neurological diseases, including Parkinson's disease (Ffytche et al., Nature Reviews Neurology, 2017). Despite the high prevalence and clinical relevance, little is known about their neural mechanisms and research on hallucinations is hampered by their unpredictable and private nature, making their investigation, quantification and assessment highly challenging (i.e., Bernasconi et al., Nature Protocols, 2022). This PhD project is based on our recently developed methods merging robotic and virtual reality (VR) technologies to induce experimentally controlled specific hallucinatory states (Blanke et al., Current Biology, 2014; Bernasconi et al., Science Translational Medicine, 2021) and to quantify hallucinations using new implicit VR-based behavioral markers (Albert et al., Nature Communications 2024). Clinical evidence suggest that hallucinations in PD might be related to fluctuations in attention (e.g. Shine et al., Parkinsons Disease, 2015) that are potentially related to sleep like intrusions (slow waves) during wakefulness (Arnulf et al., Neurology, 2000), further associated with a more rapid cognitive decline (Bernasconi et al., Nature Mental Health, 2023).

The current project plans to build on these recent methods and discoveries and has three main aims. First, to integrate robotics and VR with high-density EEG/MEG to investigate whether attentional fluctuations caused by sleep like intrusions during wakefulness modulate robot-induced specific hallucinations (presence hallucinations), and related subjective mental states (in healthy participants and patients with Parkinson's disease). Second, to combine this EEG/MEG-VR-robotics system with MRI-based non-invasive brain stimulation (temporal interference electrical stimulation; e.g. Wessel et al., Nature Neuroscience, 2023), applied at specific oscillatory frequencies, to further modulate robot-induced presence hallucinations. Third, to predict hallucinatory states using machine learning applied to behavioral and neural data.

Requirements:

The ideal candidate should have a Master degree (or equivalent) in engineering, computer science, neuroscience or neurotechnology, medicine or biology, be strongly motivated with a keen interest in cognitive-systems neuroscience and neuroimaging/signal analysis. Previous work in applied machine learning and in non-invasive brain stimulation are a plus.

Working environment:

The successful applicant will join the EPFL Chair in Cognitive Neuroprosthetics which is led by Prof. Olaf Blanke. The Lab is part of Geneva's thriving Neuroscience community, based at the beautiful Campus Biotech, bordering Lake Geneva in the middle of the city. The Ph.D. candidate will be enrolled in the EPFL Ph.D. program Neuroscience (EDNE).

Start of position:
Spring 2025

Application procedure:
Interested candidates must submit their application to the EDNE doctoral school (https://www.epfl.ch/education/phd/edne-neuroscience/edne-how-to-apply/)