

## Summary

Examining the neural network dynamics underlying the temporal integration window of crossmodal perception

Cognitive neuroscience has long sought to explain the observation that conscious perception is apparently shaped by neural processes occurring both before and after stimulus onset. Studies have revealed that neural activity preceding a stimulus influence our perception. Additionally, information that is presented within a few hundreds of milliseconds after a stimulus can still affect perception of the stimulus. We use the term postdiction to describe such backwards-oriented perceptual phenomena. Together, these findings suggest that perception is shaped by the integrative processing of information presented in a temporal window surrounding a stimulus. At the neural level, many theoretical accounts of postdiction phenomena postulate an interplay between feedback and feedforward processing. Furthermore, there is evidence that synchronized brain activity, as expressed in neural oscillations, serves as a neural mechanism that affects perception. To date, it is not well understood how neural oscillations in the temporal integration window contribute to postdiction phenomena. In this project, we will test how feedback and feedforward processes, as reflected in beta-band (13-30 Hz) and gamma-band (> 30 Hz) oscillations, respectively, as well as evoked brain responses, contribute to postdictive crossmodal perception. We will combine Bayesian causal interference (BCI) and electroencephalography (EEG) data analysis to study the neural mechanisms underlying two crossmodal paradigms: the illusory audiovisual (AV) rabbit and the invisible AV rabbit. In these paradigms, either an illusory visual flash is induced by a subsequent audiovisual stimulus (illusory AV rabbit), or the perception of a real flash is suppressed (invisible AV rabbit). The paradigms were selected for two reasons: (i) Crossmodal processes have been previously linked to neural oscillations and they require integrative network processing. (ii) The paradigms evoke opposite percepts, i.e., inducing or suppressing a flash, and the neural mechanisms underlying these paradigms can be directly compared. We will investigate the role of neural network dynamics in oscillations and decode signatures of crossmodal postdiction from patterns of evoked brain responses. Using BCI, we will test the assumption that postdiction can arise if observers infer a common cause of the flashes and sounds. We will examine how prior causal expectations and the likelihood, i.e., the sensory evidence that a stimulus induces a particular percept in an observer, influence perception and neural processing in the two paradigms. This combined EEG-modelling project will improve our understanding about how neural network dynamics underlying the temporal integration window shape crossmodal perception.