Summary

Working memory dysfunction in schizophrenia: an investigation of multivariate activation pattern and neural synchrony

Schizophrenia (SZ) is a severe mental disorder that is associated with high treatment costs, impaired working capacity, and elevated suicide risk. It is characterized by positive and negative symptoms, but most patients also show neurocognitive deficits, including working memory dysfunction (WM). Previous studies have shown alterations in neural oscillations, especially in the theta (4-7 Hz) and gamma (> 30 Hz) band, during WM processing in SZ. These studies usually focused on one specific WM subdomain deficit and hence, it is difficult to compare findings across experimental paradigms and WM subdomains. Thus far, no comprehensive attempt has been made to directly compare the neural basis of the different WM subdomain deficits in the same group of patients. This is important because it would generate a more unified, empirically-driven theoretical picture of the neural basis of WM deficits in SZ. It could also help in the selection of neuropsychological tests used for the diagnostic assessment of this disorder.

The key objective of this project is to examine the neural basis of WM deficits in SZ across different WM subdomains in the same study groups. To this end, we propose three electroencephalography (EEG) experiments in SZ patients and healthy control participants. In the experiments we will investigate neural oscillations, with a focus on theta and gamma band oscillations and their cross-frequency coupling, and the decoding of WM content, as obtained through multivariate pattern analysis (MVPA). The application of MVPA promises increased sensitivity over univariate methods and can help in distinguishing neural activity related to maintenance and processing of specific WM content from content-unspecific general activity. In the experiments we will examine the following WM subdomains: (1) Maintenance of information in relation to memory load; (2) Selection and prioritizing of WM content; (3) Manipulation of WM content through mental relocation. In all experiments the same stimulus material will be used (pictures with faces and houses) and the data will be analyzed in a WM-delay period, which will allow a cross-experiment comparison of data. Moreover, we will investigate the relationships between EEG and behavioral data with positive and negative symptoms in patients. The project will further our understanding of commonalities and differences in the neural basis of WM subdomains between patients and controls and will contribute to a more coherent theoretical picture of WM deficits and their clinical significance in SZ.