Training stay at the Bergen fMRI-group

Linda Geerligs

When used separately, fMRI and EEG have important limitations; they only allow for either temporally or spatially restricted inferences regarding brain function. In order to gain more understanding of the dynamics in brain functioning, we need a better image of where and when information processing occurs. Integration of recording and analysis approaches which draw upon the strengths of both methods will allow this more complete characterization of regional brain responses.

Both in terms of recording techniques and data analysis, the integration of EEG and fMRI data represents a challenge. EEG data obtained in the MR-scanner is contaminated by different kinds of artefacts. These are caused by the changing gradient of the magnetic field and by the interaction between the pulsating blood flow and the magnetic field. Dr. M. Moosmann, my supervisor in the Bergen fMRI-group, has worked on methods for removing these artefacts from the EEG data. In the first part of my training stay, I learned about different methods that are available for performing these corrections, about their pro's and con's and about their implementation in existing software. Additionally we discussed recording procedures which allow for optimal artefact removal. These artefact removal steps are crucial to achieve good data quality.

The most common method for combining EEG and fMRI data is the following. First the EEG amplitude in a specific time window after stimulus onset is averaged (e.g., the average amplitude between 300-400 ms). This is done for every stimulus onset. The second step is to correlate this value with the fMRI BOLD signal in a trial-by-trial fashion. Brain areas which show such a correlation are (part of the) the neural generators of the EEG signal in this time window. During my stay I learned to create these models for the fMRI data. Additionally I learned about different methods to aggregate these data of single subjects to make comparisons between groups and task conditions. Because this is a relatively new field, I did not only learn existing methods; there was also the opportunity to have some interesting discussions about the methodology and about optimizing models for the comparisons of subject groups and task conditions.

Besides learning this methodology, I had the possibility to learn about the interesting work on attention in dichotic listening tasks that is performed at the Bergen fMRI group. This work is closely related to my thesis work, which is focussed on attention in the healthy ageing brain. Researchers working on this topic have helped me by discussing the results of my studies so far and the ideas for future experiments.

In November I am planning to start an EEG-fMRI experiment at my home lab. In both the recording and the analysis phase I will be able to apply all the knowledge I have gained in the Bergen fMRI group. During my stay in Bergen I wrote a document in which all steps of the procedure for EEG-fMRI analysis are explained. Additionally, Dr. Moosmann and I wrote several scripts for the implementation of the analysis which can be adapted flexibly for the use in other experiments by different researchers. With these tools I will be able to aid other researchers in my home lab, who would like to do combined EEG-fMRI analyses.

I am very grateful to the NENS for their support of my visit to the Bergen fMRI group. I want to thank Prof. K. Hughdahl for the integration in his group and most of all I want to thank Dr. M. Moosmann for teaching me the methods for EEG fMRI analysis and for providing me with the tools to perform these analyses efficiently. The knowledge acquired during this month will greatly improve my research quality and my personal career.