MEG AND MULTIMODAL INTEGRATION

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Modern non-invasive brain imaging methods provide powerful ways to study the human brain to better understand how networks of interacting brain areas process information. In magnetoencephalography (MEG), the magnetic field generated by neural currents is measured outside the head. Similarly to EEG, MEG has a millisecond time resolution, complementing hemodynamics-based techniques like functional MRI, which typically have a better spatial resolution but poorer time resolution. The physiological mechanisms underlying MEG and EEG are the same; however, the sensitivity patterns are different. In particular, radially oriented and deep primary currents produce little MEG signals; combined with selective cancellation effects, this has implications to the relative sensitivity of these methods. The fMRI signal, on the other hand, originates from a different physiological mechanism. Therefore, integration of fMRI and MEG/EEG is more challenging, and understanding the mechanisms linking hemodynamics and eletrophysiology is crucial. A simple but often very useful way to combine MEG/EEG and fMRI is to compare the spatial distribution of activity found when each imaging modality is analyzed independently. Convergent results may help to reduce uncertainties inherent in the techniques. Another approach is to use the data from multiple modalities to guide the analysis of each other. The most common approach has been to bias the MEG/EEG source estimates towards the foci found in fMRI. The problem with this approach is that the actual locations of fMRI and MEG/EEG activities may differ. However, in cases where there are multiple possible interpretations of the MEG field pattern, comparison with fMRI (or EEG) could help to resolve which of the possible solutions is most likely. In summary, multimodal brain imaging can provide information about the human brain function not attainable by a single method alone.