Thomas Grandy:
Exploratory analysis of changes in EEG parameters when recalling memories of different memory strength

Abstract.

The thesis aimed to scrutinize parameters of the EEG hypothetically related to the hippocampus and medial temporal lobe (MTL) during recall of declarative memories of different memory strengths. For this purpose an experimental design used by Mayes et al. (2003), who found decreasing activity in the hippocampus and parahippocampus region as a function of increasing memory strength was induced and operationalized by different numbers of learning trails. Recall of learned associations was tested by cued recall.

An often proposed hypothesis holds that frequency components of about 4-7 Hz (theta) of the EEG are related to hippocampal activity. Therefore one line of analyses concentrated on aspects of theta reactivity to memory strength.
On a global level it was found that theta parallels the hippocampal activation pattern reported by Mayes et al. Overall theta and even more pronounced induced theta amplitude within the first 3500 ms after cue onset decreased significantly as a function of memory strength. Both effects were significantly larger at the frontal electrode site.

In a second line of analyses event-related potentials (ERPs) were assessed. It was hypothesized that differences can be observed for a parietal positive component (parietal old/new effect), which is also related to the medial temporal lobe and assumed to reflect recollection.
Significantly more positive going ERPs at 500 ms after cue presentation onset were found for increased memory strength. This effect was paralleled by evoked theta at the parietal electrode site.

In sum, it is argued that overall and even more specifically induced theta reflect memory search processes mediated by frontal-hippocampal-parietal interactions, whereas parietal positivity in the ERP and evoked theta mirror more automatized recollection of aspects of the study context necessary for fast and accurate recall. An important implication is that recall of stonger memories does activate the hippocmapus. However, this ecceft is short and transient and may not be observed by fMRI. this the current thesis adds some aspects to the understanding of retrieval processes within the declarative memory system.