Title: M/EEG Evidence for Probing Environmental Information During Sleep

Presenting Author: Malgorzata Wislowska

Author(s): Malgorzata Wislowska, Centre for Cognitive Neuroscience [CCNS], University of Salzburg, Salzburg, Austria; (2) Laboratory for Sleep and Consciousness Research, University of Salzburg, Salzburg, Austria, Christine Blume, Centre for Cognitive Neuroscience [CCNS], University of Salzburg, Salzburg, Austria; (2) Laboratory for Sleep and Consciousness Research, University of Salzburg, Salzburg, Austria, Manuel Schabus, Centre for Cognitive Neuroscience [CCNS], University of Salzburg, Salzburg, Austria; (2) Laboratory for Sleep and Consciousness Research, University of Salzburg, Salzburg, Austria

Abstract:

Recent research brought forward the idea that during sleep our brain, even though unconscious, remains responsive. All the more, the sleeping brain can to some extent utilize environmental cues. This brain-environment interaction is however bound by very particular sleep-specific neural dynamics in a way that is little understood. We explicitly explored the extent of information processing during various sleep stages with a paradigm, where subject’s name (interleaved between other first names) is presented aurally. We presented this stimulus set to 28 participants (11 male), who after a short wake interval had an opportunity to sleep in an MEG scanner, while electric (EEG) and magnetic (MEG) brain signal was recorded. Additionally we collected individual MRI scans from a sub-sample of subjects for later source reconstruction.

The brain responses to stimuli depended on specific sleep stages. The EEG signal revealed a classical N1-P2 complex during wakefulness, which diminished during light sleep, but which showed augmented during consolidated sleep stages, possibly reflecting an evoked K-complex. Oscillatory M/EEG brain responses to stimuli were characterized on the one hand by wake-specific gamma (~60-90Hz) synchronization, and on the other hand by theta (~4-6Hz) synchronization across all sleep stages. Interestingly, during (especially N1-N2) sleep, a pronounced synchronization in sigma range (~10-20Hz) locked to the stimulus presentation was evident; a response that doesn’t seem to emerge during sleep in response to simple tones. Further analyses revealed that this sigma response specifically differentiated between own and other names, with the earlier inducing stronger synchronization (cluster p-values ≤ 0.03). Since this response is completely absent during wakefulness, this could hint towards a substantial change of top-down regulation from wake to sleep.