with "a change in the level of consciousness" during human sleep. The fourth type he called "spindles" which are attributed to thalamo-cortical activity. Thought to interact with sleep spindles are K-complexes (KC), proposed to result from a synchronized cortical network imposing excitatory and inhibitory actions on cortical neurons.

*Aim:* To map haemodynamic correlates of sleep spindles and KC.

*Methods:* A healthy volunteer reached sleep stage (SS) IV (Rechtschaffen 1968) when studied with functional magnetic resonance imaging at 3 T (Trio, Siemens, Erlangen, Germany) and simultaneous polysomnography recordings (EEG, electrooculogram, electromyography (BrainAmp MRplus/ExG, Brain Products, Munich, Germany), respiration belt, pulse-oximetry (Siemens)). After artifact subtraction, the SSII EEG segment was used to analyse blood oxygenation level-dependent (BOLD) signal changes in response to spindles and KC in a general linear model (GLM, SPM2) including respiration and cardiac cycle as effects of no interest.

*Results:* During 14 min of SSII, 115 spindles and 50 KC co-occurring with spindles were identified. BOLD signal changes were positive for spindles and negative for KC, bilateral and – in summary – co-localised in the thalamus, frontal and central (sensory-motor), temporal (auditory) and occipital (visual) cortices.

*Discussions:* Sleep spindles and KC may reflect synchronized activity of primary cortices, coordinated via the thalamus. Deactivations with KC may reflect inhibition of sensorimotor and auditory cortices activated in the MRI scanner during sleep spindles with the thalamus as a gating relay station. The direction of the signal changes attributed to spindles and KC by the GLM may not be accurate but rather reflect the occurrence of a biphasic signal change in response to these EEG sleep phenomena.

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**P31.3 On the estimation of causality between cortical spatial patterns during voluntary movements in normal subjects by using independent component analysis**

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*Background:* It is well known that static images of brain regions activated during particular tasks do not convey the information of how these regions communicate one to each other. To now, functional connectivity has been computed between brain signals. However, the brain does not produce any "single waveform" but rather engages several distributed cortical areas in order to process information. Hence, the question is whether instead to estimate the causality between single waveforms derived from the different cortical or scalp areas it is possible estimate the causality between "spatial patterns of brain cortical activations".

*Objectives:* In this report we attempted to estimate the causality between distributed cortical systems during the execution of simple movements in a group of normal healthy subjects.

*Methods:* From the high resolution EEG recordings it was estimated the cortical waveforms in the Region of Interest (ROIs) selected for all the group population. Such waveforms were then subjected to the Independent Component Analysis (ICA). The independent components obtained by the application of the ICA algorithm were then processed by the Partial Directed Coherence algorithm, in order to extract the causality between the spatial cortical patterns of the estimated data.

*Results:* Cortical patterns estimated suggest the involvement of a large network of parietal and premotor areas in the beta band during the preparation of the voluntary movement.

*Discussion:* These results are the first that demonstrates the involvement of a group of cortical areas that "causes" the activation of a second group of cortical areas for a simple motor task. Differences between already presented methods using ICA lying in the use of cortical signals instead scalp topography, being the first more accurate than the second in the representation of the brain activity from high resolution EEG recordings.

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**P31.4 Detection of the time-varying cortical connectivity patterns by the adaptive multivariate estimators in high resolution EEG studies**

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