



Local sleep episodes during wakefulness and space travel

“SleepSpace”

Executive Summary

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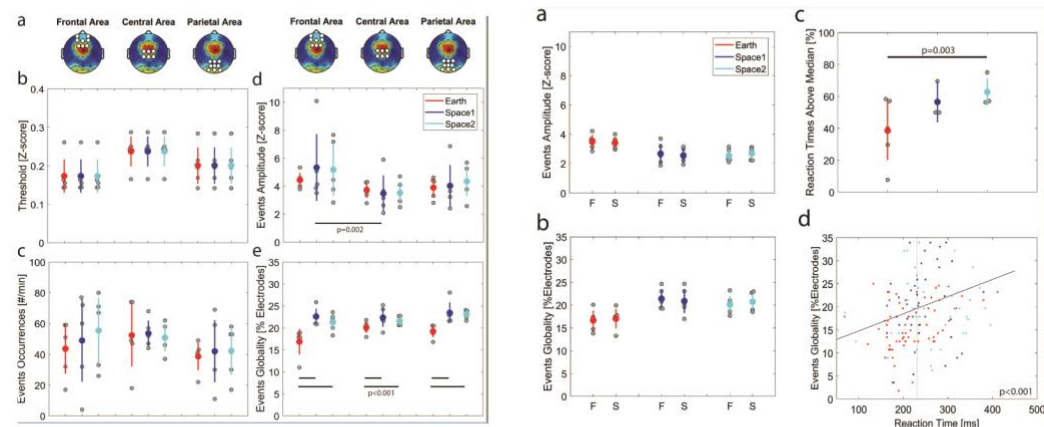


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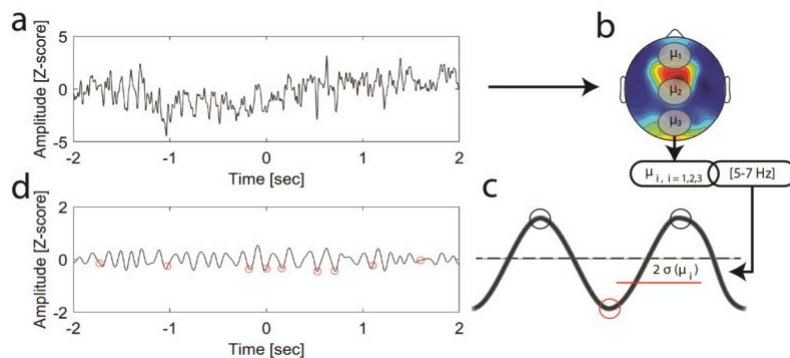
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Picture:

Local sleep-like events characterisation and their impact on cognitive tasks during microgravity stay



Local sleep-like events detection method



Motivation:

The aim of this study is to assess how space travel modifies local sleep episodes in wakefulness during a visuo-motor task and whether this is related to performance. To this end, specific EEG (electroencephalogram) data previously recorded on board of the ISS during Neurospat experiment (AO-2004, 118) are used.

Methodology:

EEG markers of high sleep pressure can be observed during wakefulness, by increased theta activity (5-7 Hz), while asleep by an increase of slow wave activity (SWA) (0.5-4 Hz) (Cajochen et al, 1999; Finelli et al, 2000; Borbély et al, 2016), in awake humans alongside the sleep pressure (Fattinger et al, 2017b) and following sleep deprivation (Hung et al, 2013; Bernardi et al, 2015).

Local sleep-like events were here detected and characterized (size over the scalp and density per minute) following preexisting methods (Massimini et al, 2004; Fattinger et al, 2017b) in preflight (on Earth) and in-flight (Space 1 and 2) conditions in five astronauts during a period from 250 ms before (i.e. motor action planning) and 500 ms after (i.e. maximal reaction time) a visual stimulus which indicated a manual tracking onset. Reaction times of the motor execution were also calculated.

Results:

When compared to the Earth condition, we observed in space:

- A global increase of theta power
- Higher amplitudes for local sleep-like events in the frontal area
- Local sleep-like events extended more largely over the scalp (i.e. increased globality)
- Slower reaction times and overall slower reaction times when local sleep-like events were more global

Publications:

- “Local sleep-like events during wakefulness and their relationship to decrease in alertness in 5 astronauts on the international space station”. G. Petit, AM. Cebolla, S. Fattinger, M. Petieau, L. Summerer, G. Cheron and R. Hubert (*Submitted to npj Microgravity*)

Highlights:

Continuing these promising results, it would be interesting to characterize sleep-like events around the motor response precisely related to the docking motor response and to study the potential link between sleep-like events and succeeded/failed docking. We are currently analyzing the EEG power spectral perturbations during this period.