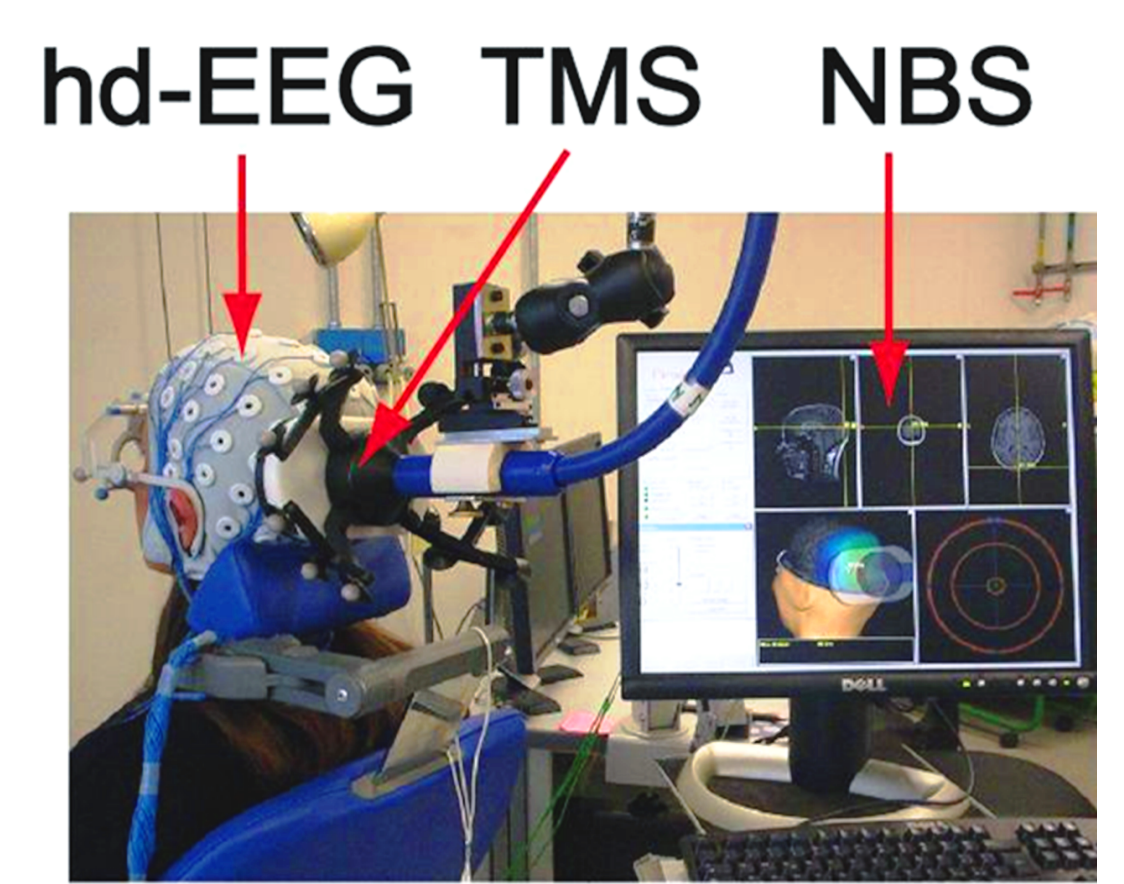


## Background

Waking-life events are often incorporated into sleep consciousness. External stimuli applied during sleep also sometimes affect dream content. During wakefulness, transcranial magnetic stimulation (TMS) administered to the parietal cortex can induce visual percepts. The aim of this study is to investigate the influence of TMS on the content of the conscious experience reported upon awakening from rapid eye movement (REM) and non-REM sleep.

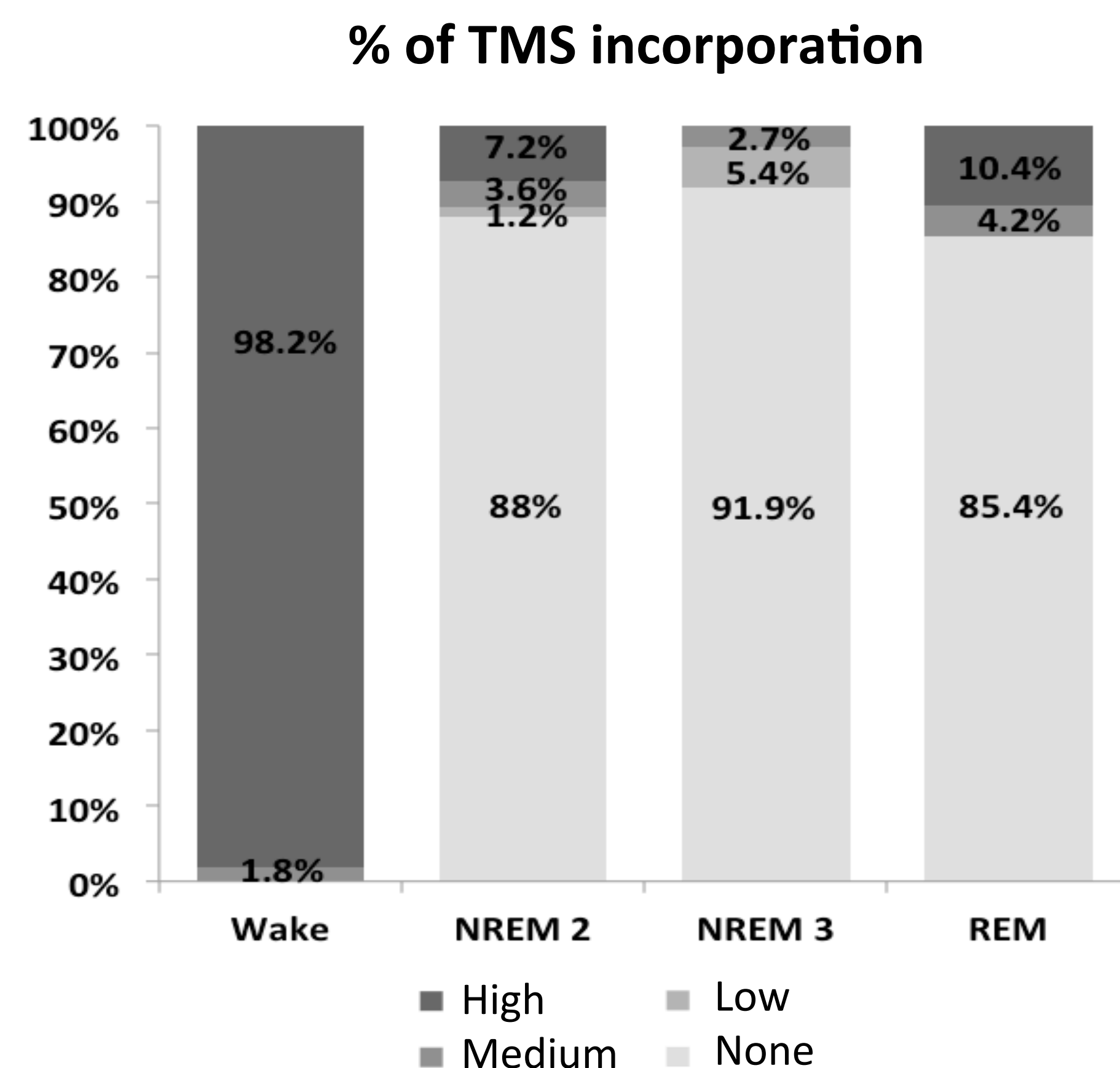
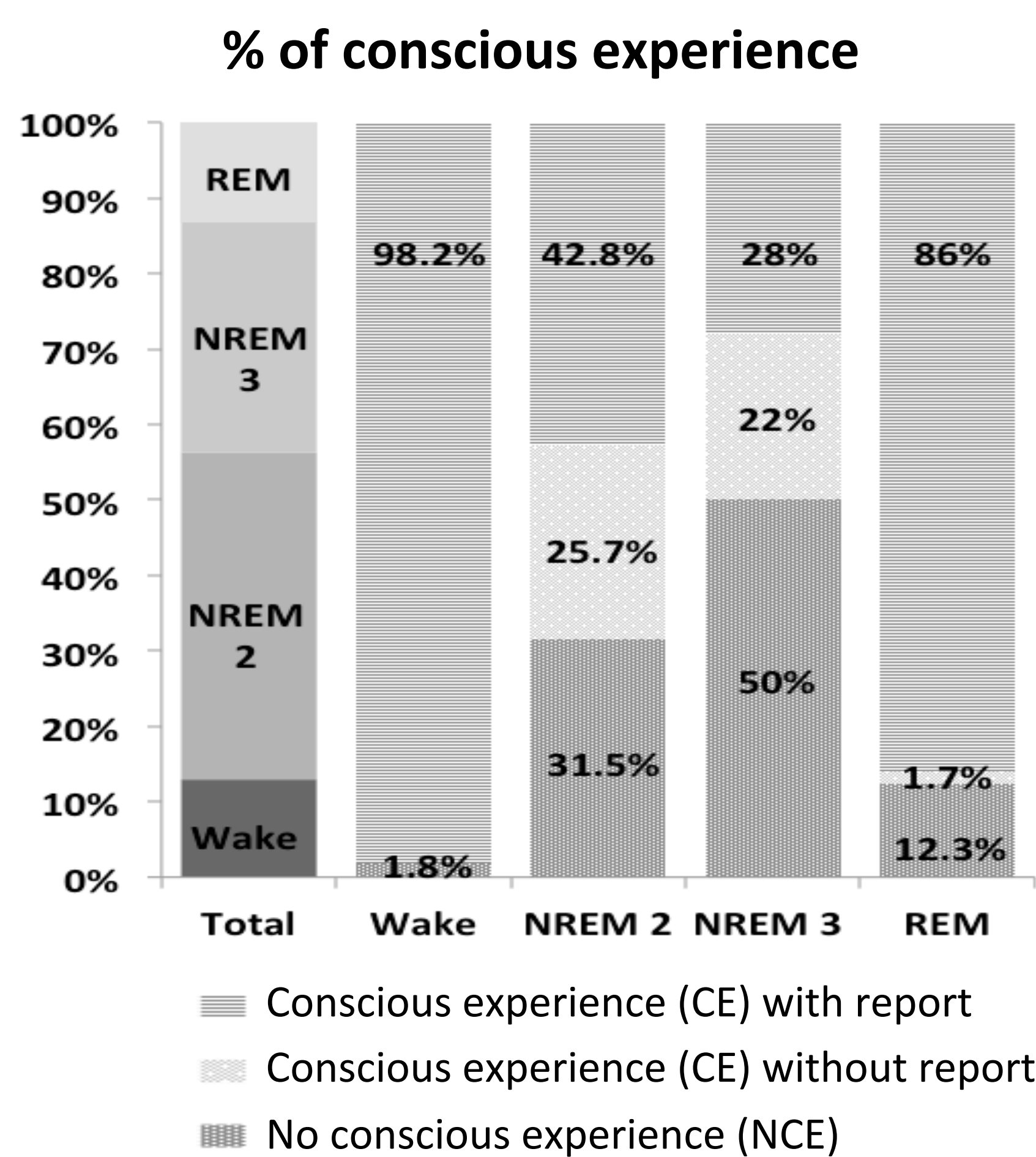
## Methods

- 8 healthy participants (1 female, 19–30 years old). One subject reported TMS-induced percepts.
- 43 overnight TMS–EEG recordings (Nexstim eXimia, 60-channel EEG, navigated TMS using individual MRIs of the subjects) targeting the medial superior parietal lobule, with up to 16 awakenings per night.
- 432 questionnaires collected that assessed consciousness and its content from wake, REM, and non-REM sleep sessions.
- EEG: artifact-free data of the last 2.5 min before the awakenings were analyzed using fast Fourier transform over one-second time window before the TMS pulse (~70 trials). We also looked at the spatial distribution of the responses. Statistics were performed with bootstrap analyses ( $p < 0.001$ ).

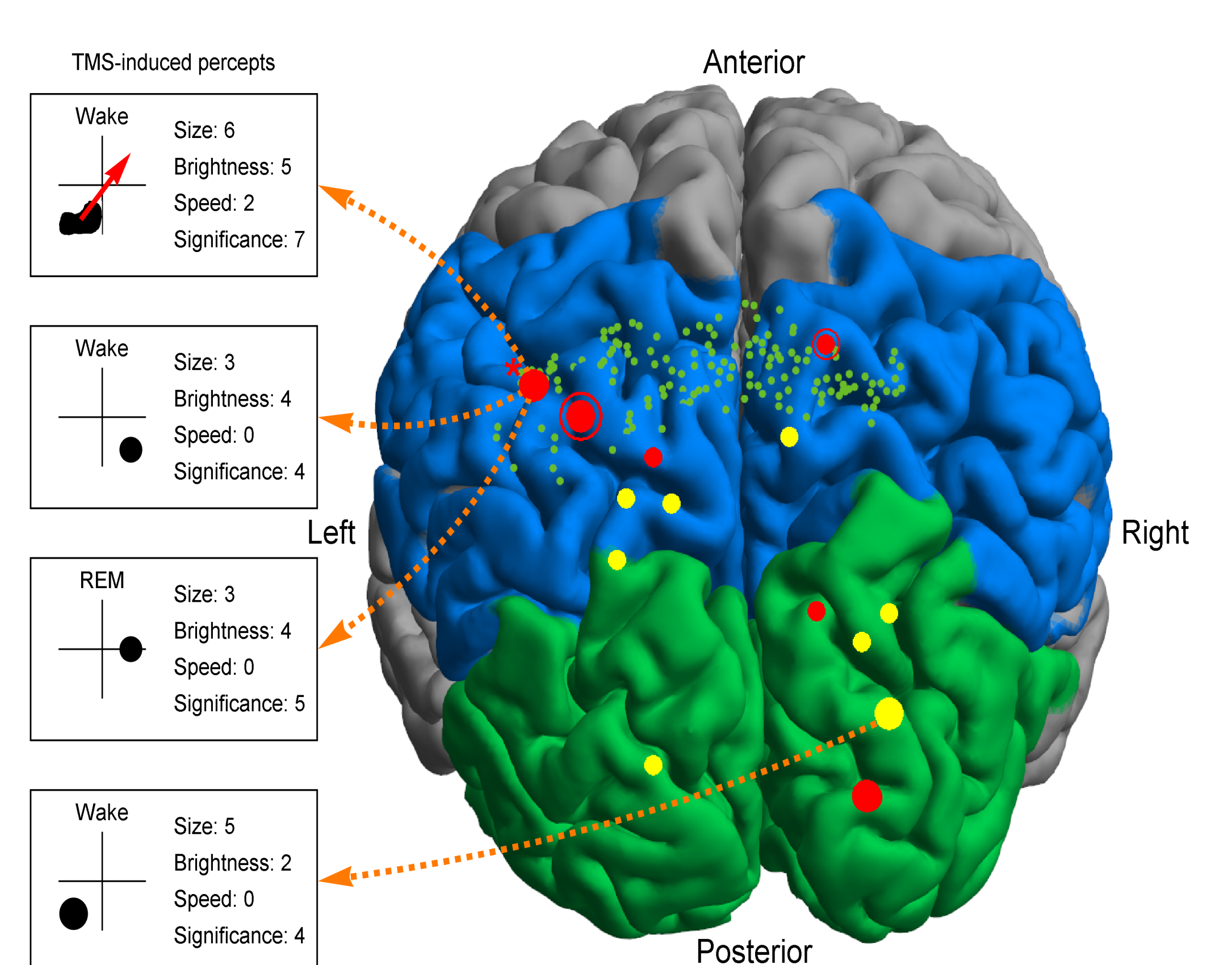


## Results

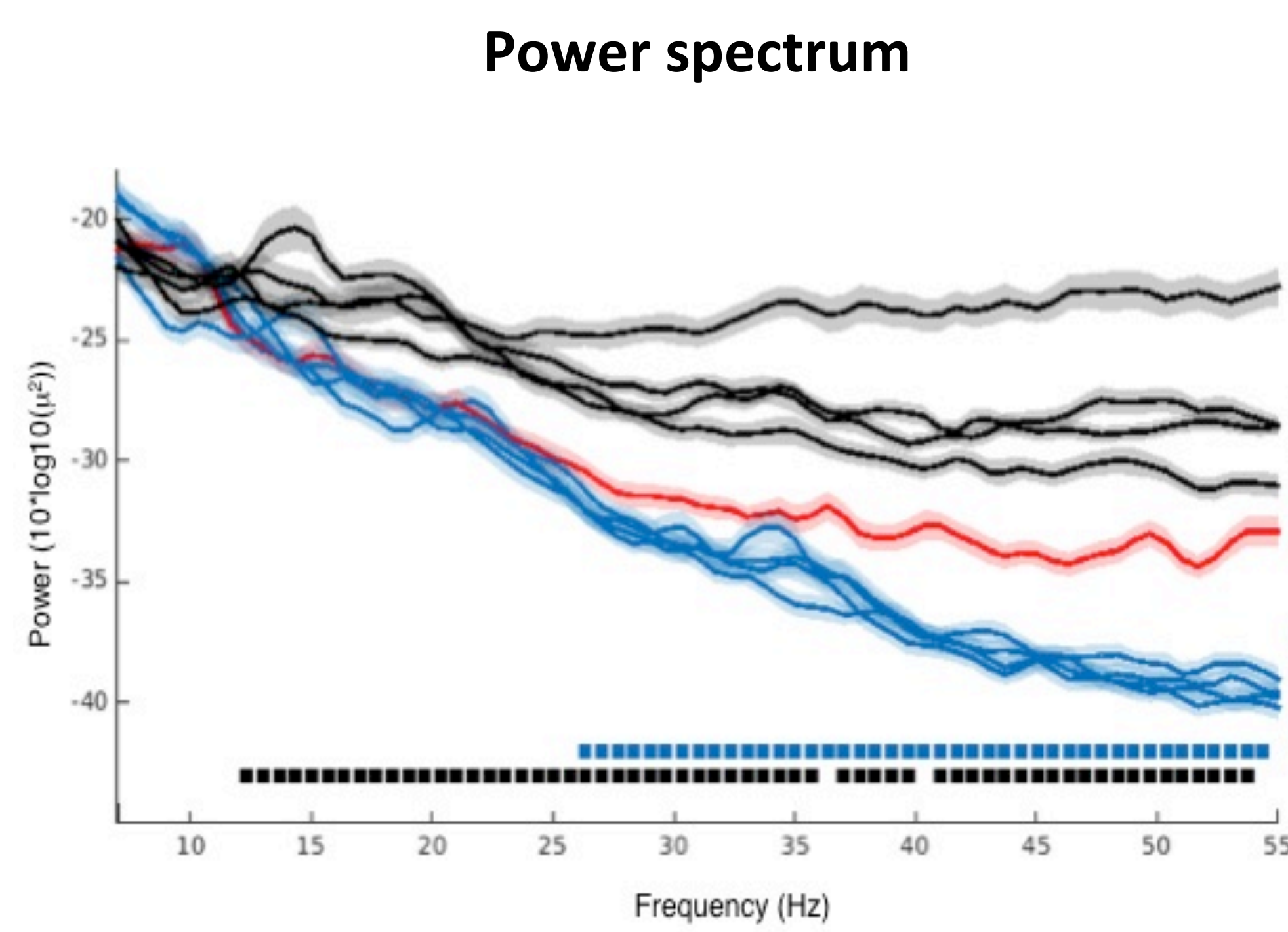
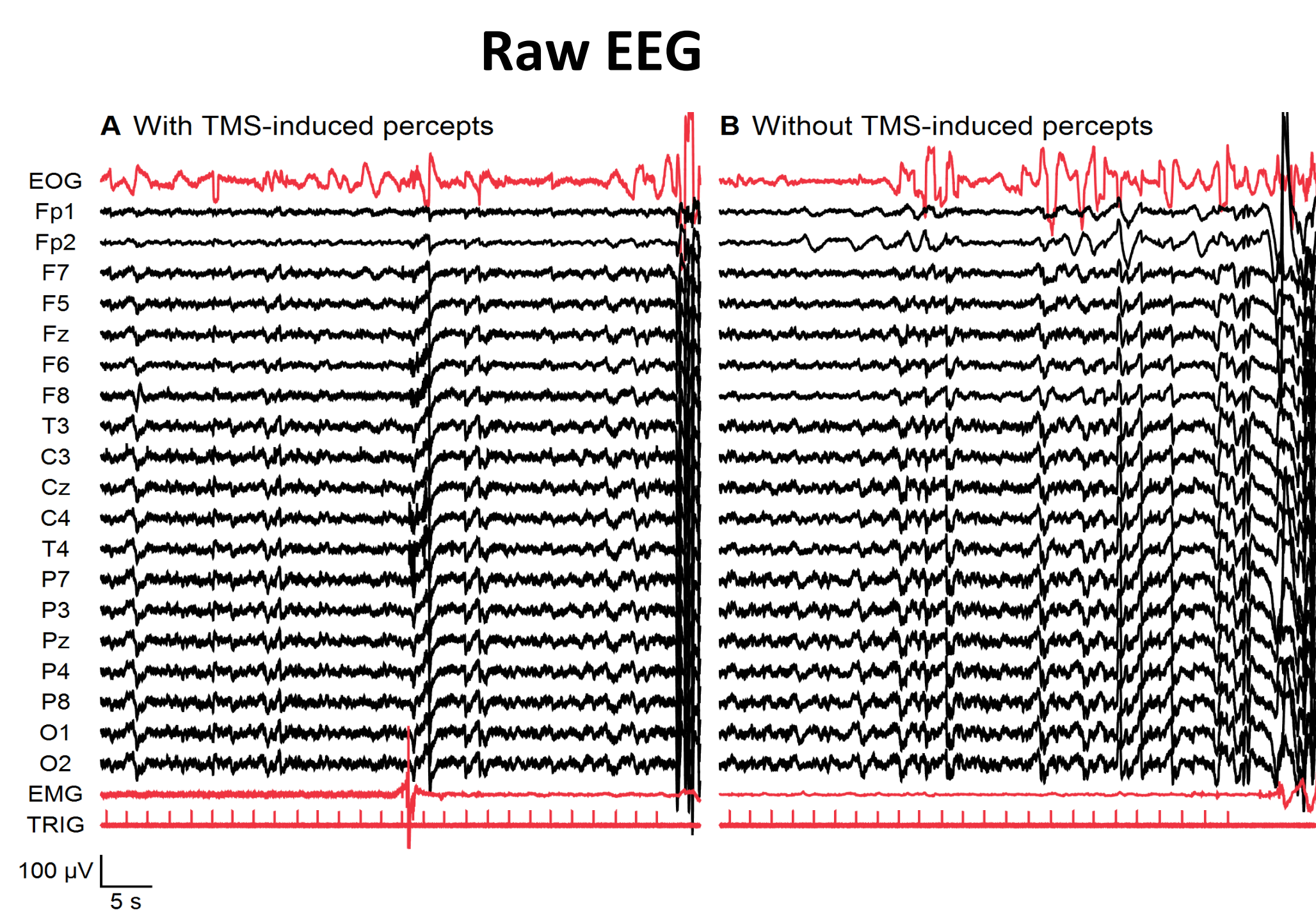
### 1. Behavioral responses



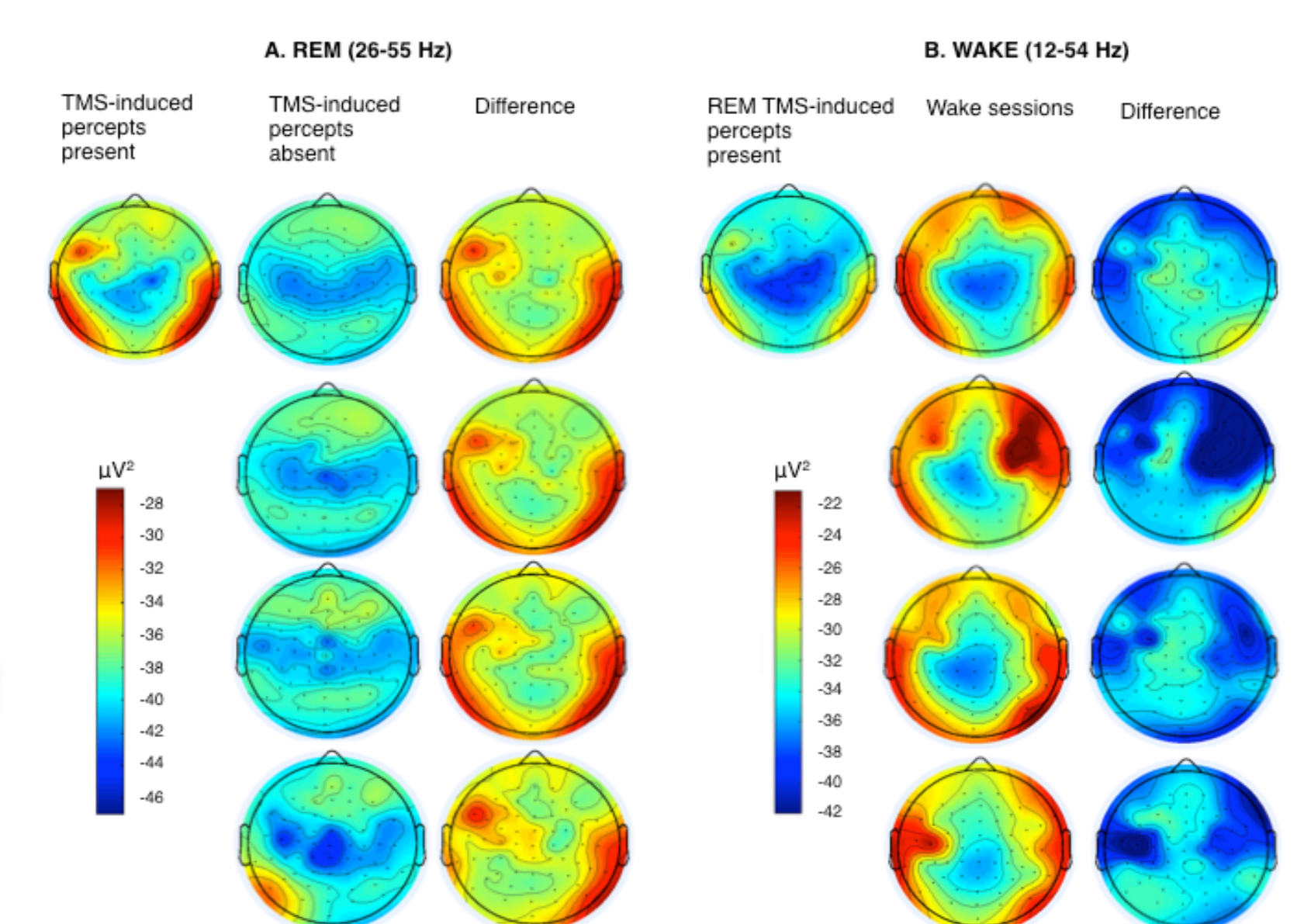
### TMS-induced percepts



### 2. EEG responses



### Scalp topographies



15% of the dreams occurring in REM sleep were related to TMS (TMS *per se* or TMS environment). In non-REM sleep, the respective number was 11% (12% in stage 2 and 8% in stage 3). One subject reported experiencing TMS-induced percepts in one REM session, and the percepts were similar to those perceived in wakefulness. In that REM session, the EEG showed increased gamma-band activity in the temporo-occipital regions compared to REM sessions in which TMS induced no percepts.

## Acknowledgement

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## Conclusion

Our results show that, in a laboratory environment, dreams can incorporate TMS-related content. Moreover, we show that it is possible to evoke TMS-induced percepts in REM sleep by stimulating the parietal cortex, which thus seems to be a generator of TMS-induced percepts in sleep.