Discovery of key whole-brain transitions and dynamics during human wakefulness and non-REM sleep

The modern understanding of sleep is based on the classification of sleep into stages defined by their electroencephalography (EEG) signatures, but the underlying brain dynamics remain unclear. Here we aimed to move significantly beyond the current state-of-the-art description of sleep, and in particular to characterise the spatiotemporal complexity of whole-brain networks and state transitions during sleep. In order to obtain the most unbiased estimate of how whole-brain network states evolve through the human sleep cycle, we used a Markovian data-driven analysis of continuous neuroimaging data from 57 healthy participants falling asleep during simultaneous functional magnetic resonance imaging (fMRI) and EEG. This Hidden Markov Model (HMM) facilitated discovery of the dynamic choreography between different whole-brain networks across the wake-non-REM sleep cycle. Notably, our results reveal key trajectories to switch within and between EEG-based sleep stages, while highlighting the heterogeneities of stage N1 sleep and wakefulness before and after sleep.

General information
Publication status: Published
Organisations: Cognitive Systems, Department of Applied Mathematics and Computer Science, Dartmouth College, Max-Planck-Institut für Kognition- und Neurowissenschaften, Vrije Universiteit Amsterdam, University of Oxford, Netherlands Institute for Neuroscience NIN - KNAW, Kiel University, Aarhus University
Corresponding author: Stevner, A. B.
Number of pages: 14
Publication date: 1 Dec 2019
Peer-reviewed: Yes

Publication information
Journal: Nature Communications
Volume: 10
Issue number: 1
Article number: 1035
ISSN (Print): 2041-1723
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
Original language: English
Electronic versions:
s41467_019_08934_3.pdf
DOIs:
10.1038/s41467-019-08934-3
Source: Scopus
Source-ID: 85062403138
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review