

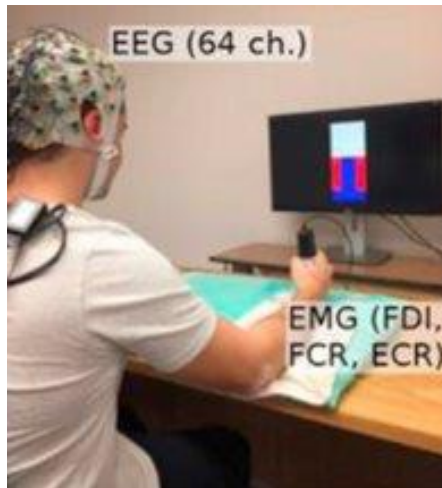
Beta burst analysis

Data analysis

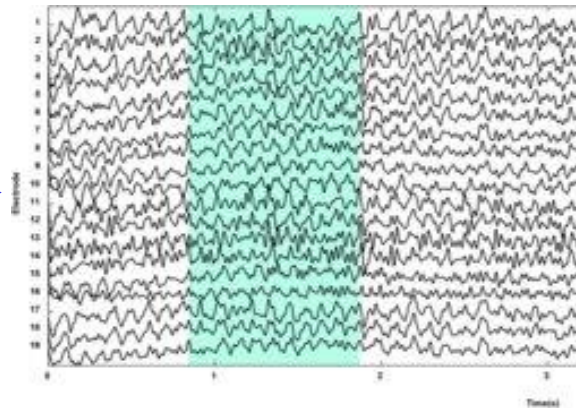
Data Preprocessing:

- Bandpass filter (1-90 Hz)
- Notch filter (60 Hz)
- ICA for eye blinks and muscle artifacts
- Visual inspection

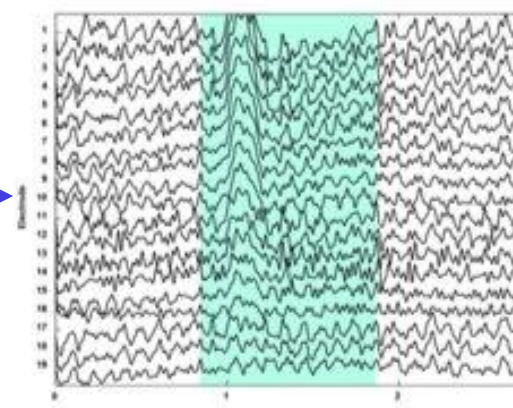
EEG & motor task



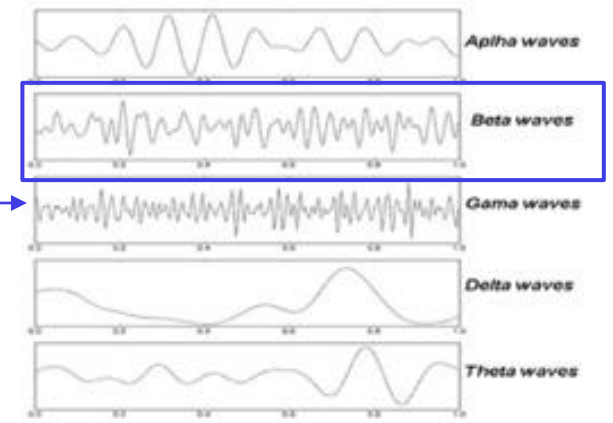
Raw signal



Pre-processed signal



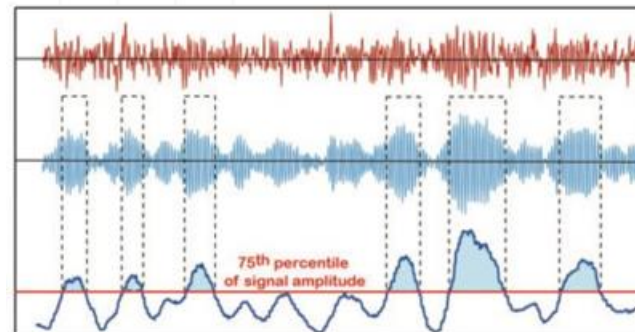
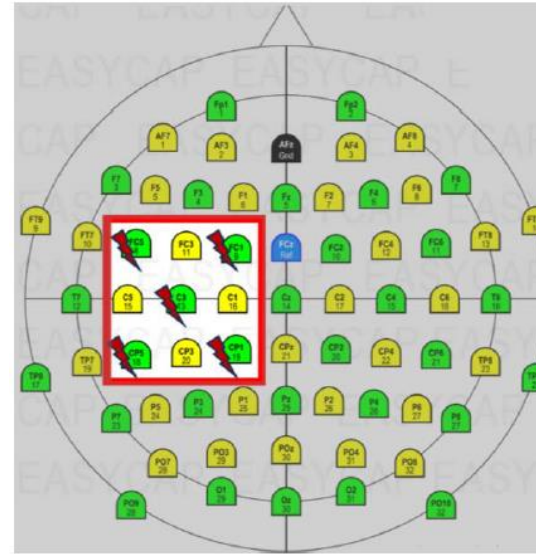
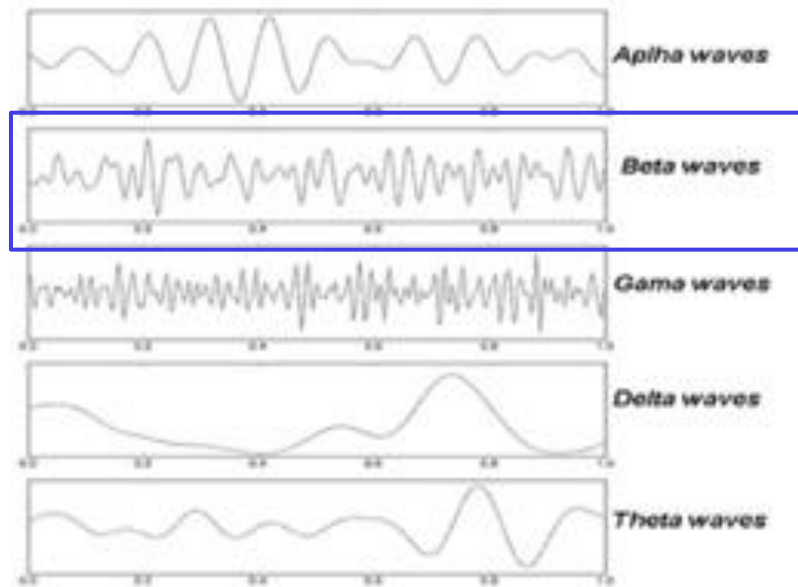
Frequency analysis



Dal Maso *et al.*, 2018

Data analysis

Frequency analysis

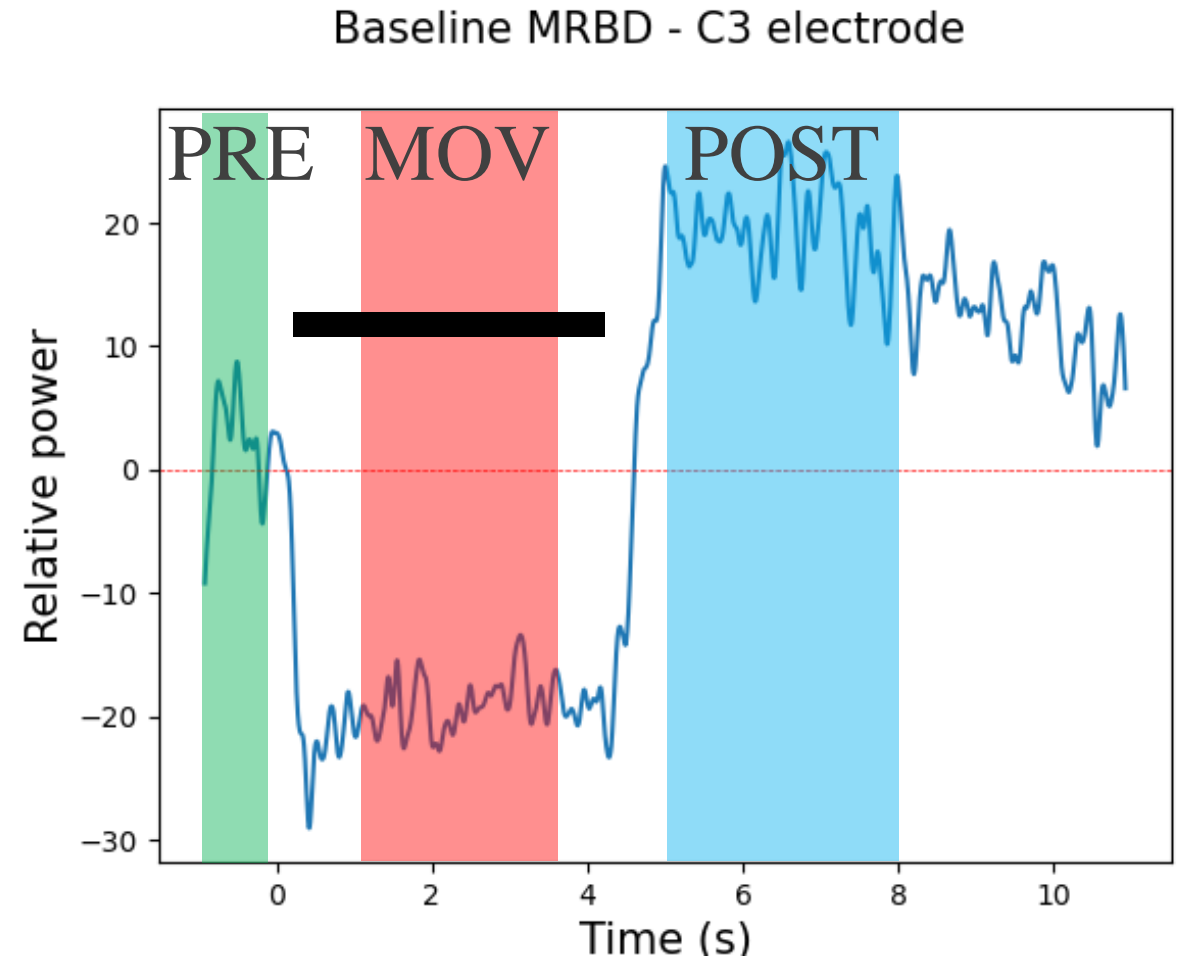


Tinkhauser *et al.*, 2017

Statistical Analysis

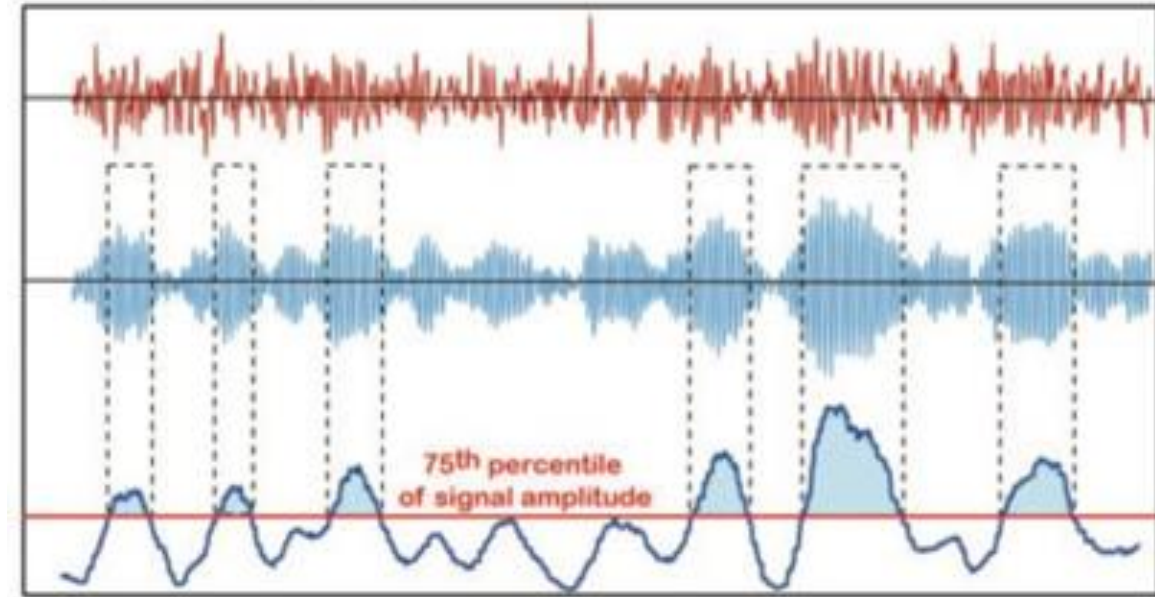
Beta burst extraction

- Each motor epoch was divided into the following intervals:
 - [-1.1s, -0.1s] Pre-movement
 - [0.5s, 3.5s] Movement
 - [5s, 8s] Post-movement
- For consistency, the resting state blocks were also separated into 3-second intervals.



Threshold method

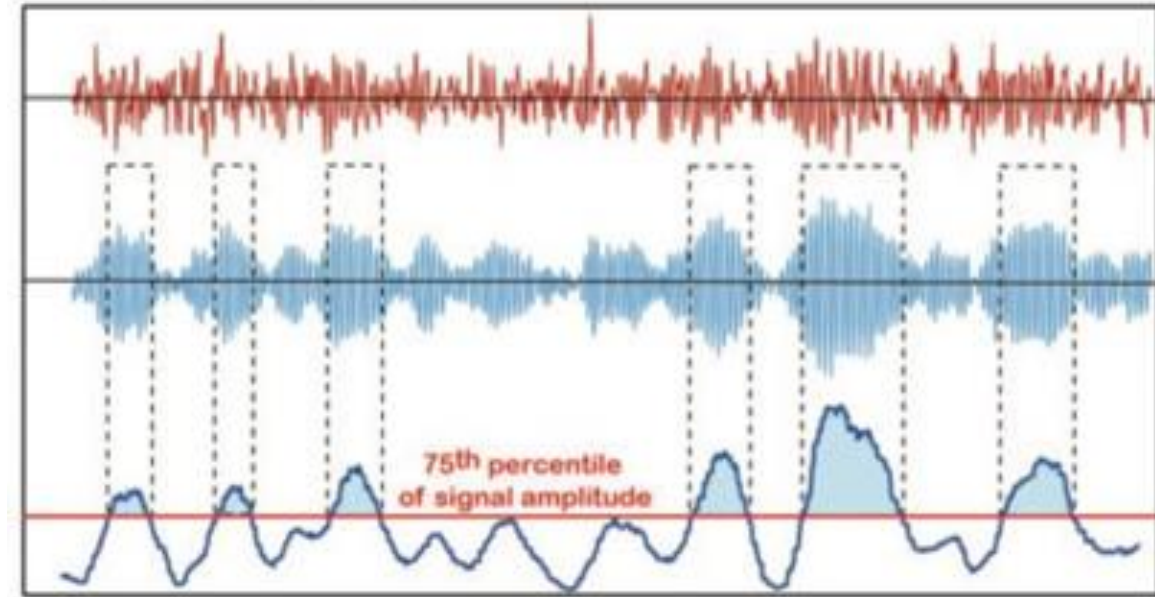
- For each motor epoch and resting state block:
 - Bandpass filter the signal over the beta frequency range [15Hz, 29Hz]
 - Apply the Hilbert transform on the signal
 - Extract the envelope of the signal amplitude
 - Remove the linear trend in the signal



Tinkhauser *et al.*, 2017

Threshold method

- For each interval of interest:
 - Compute the 75th percentile of signal amplitude as the burst detection threshold
 - Extract bursts that are at least 100ms-long above the threshold

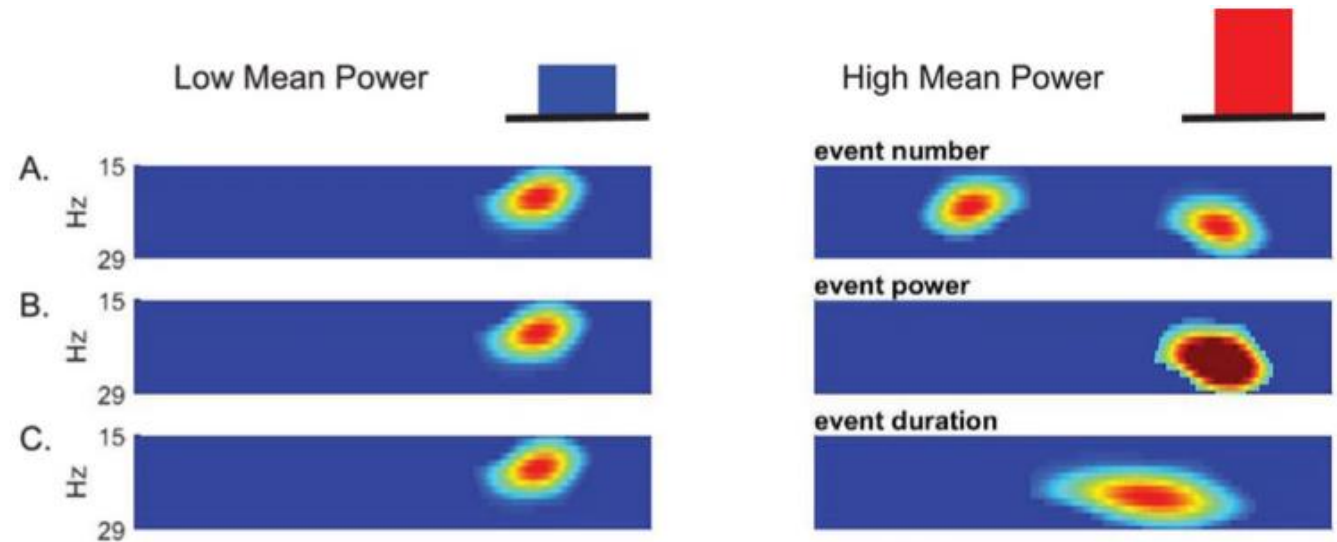


Tinkhauser *et al.*, 2017

Beta Burst features

For each interval of interest, extract the following burst features:

- **Burst rate**
- **Burst amplitude**
- **Burst duration**



Shin *et al.*, 2017

Underestimated bursts

- Hypothesis: Bursts are underestimated when extracted from small intervals.

- Extract all resting state data from all participants.

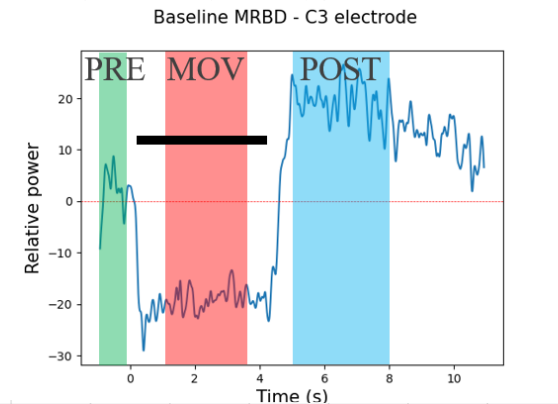
- Divide all the data into intervals of sizes: [1, 2, 3, 4]s



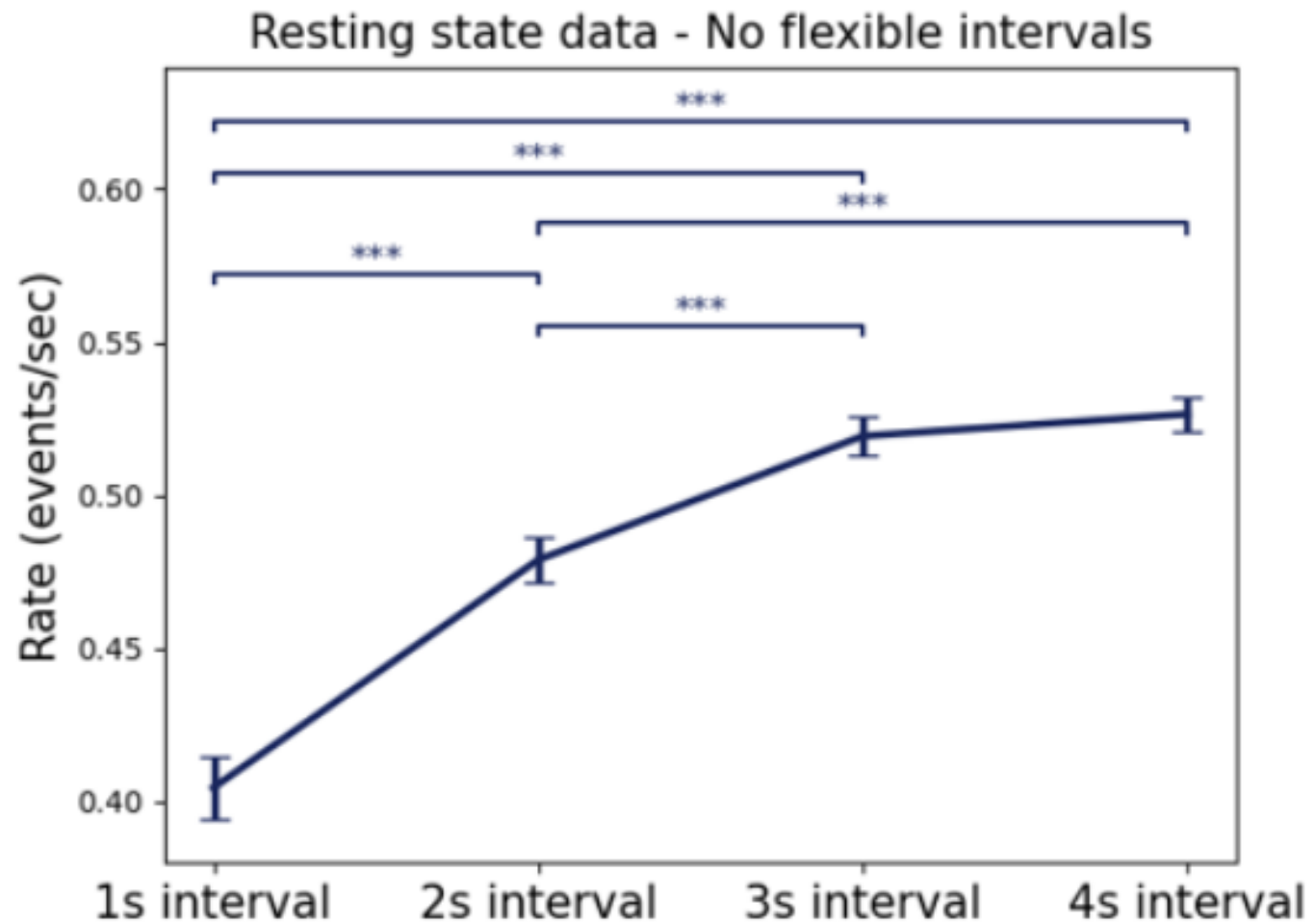
- Extract the burst rate from each interval of interest (1s, 2s, 3s, 4s)

- Apply Bonferroni-corrected t-tests between each interval.

- If bursts are correctly identified, there shouldn't be any statistical difference between the 4 interval groups.

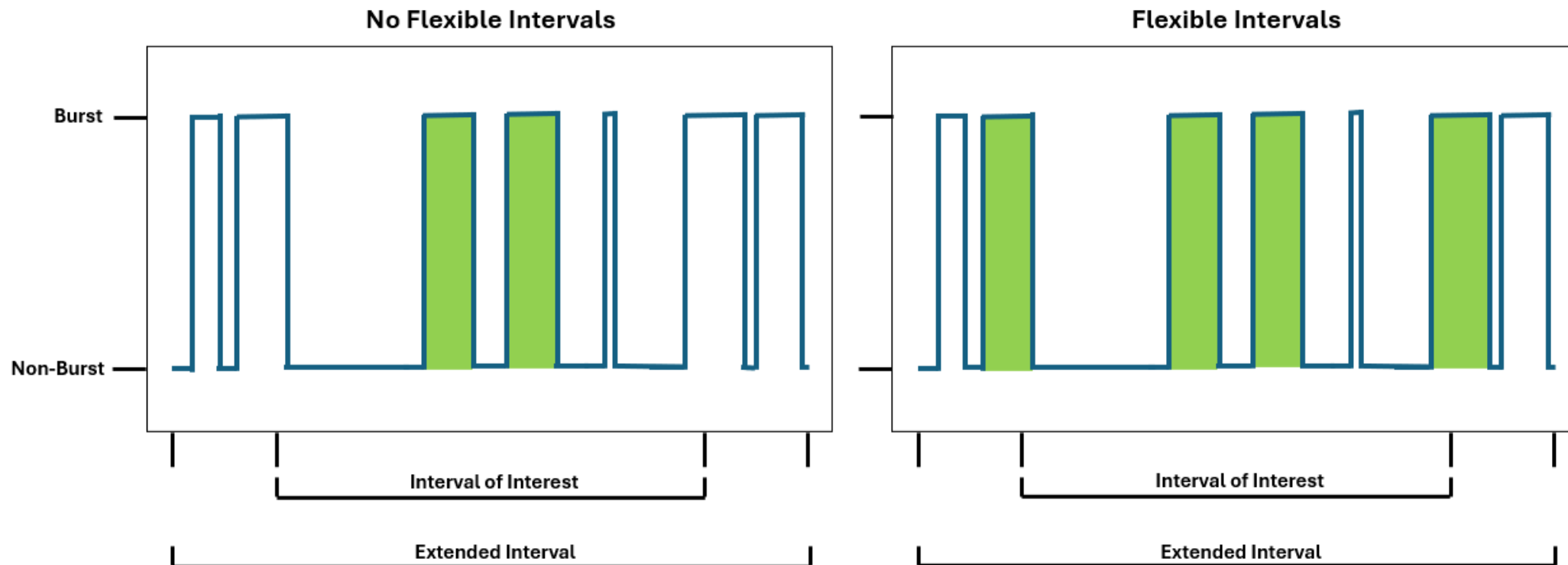


Underestimated bursts




Flexible intervals

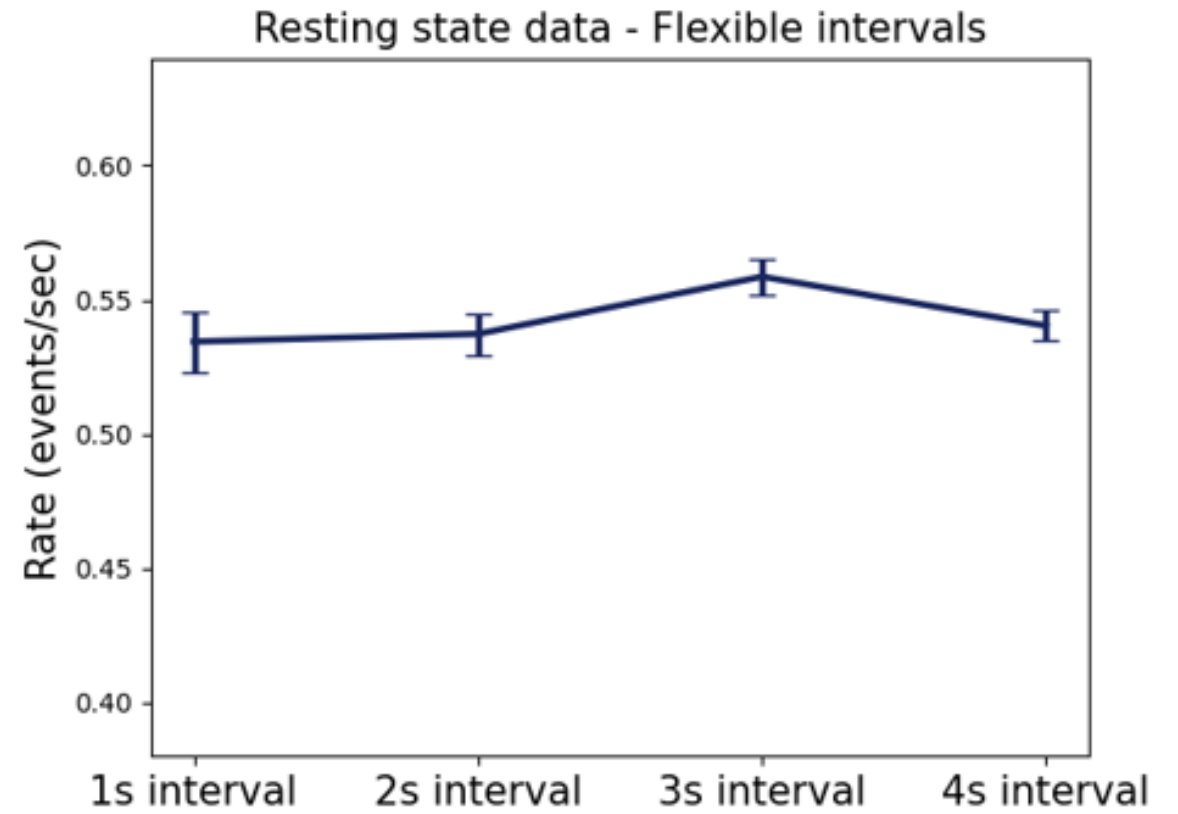
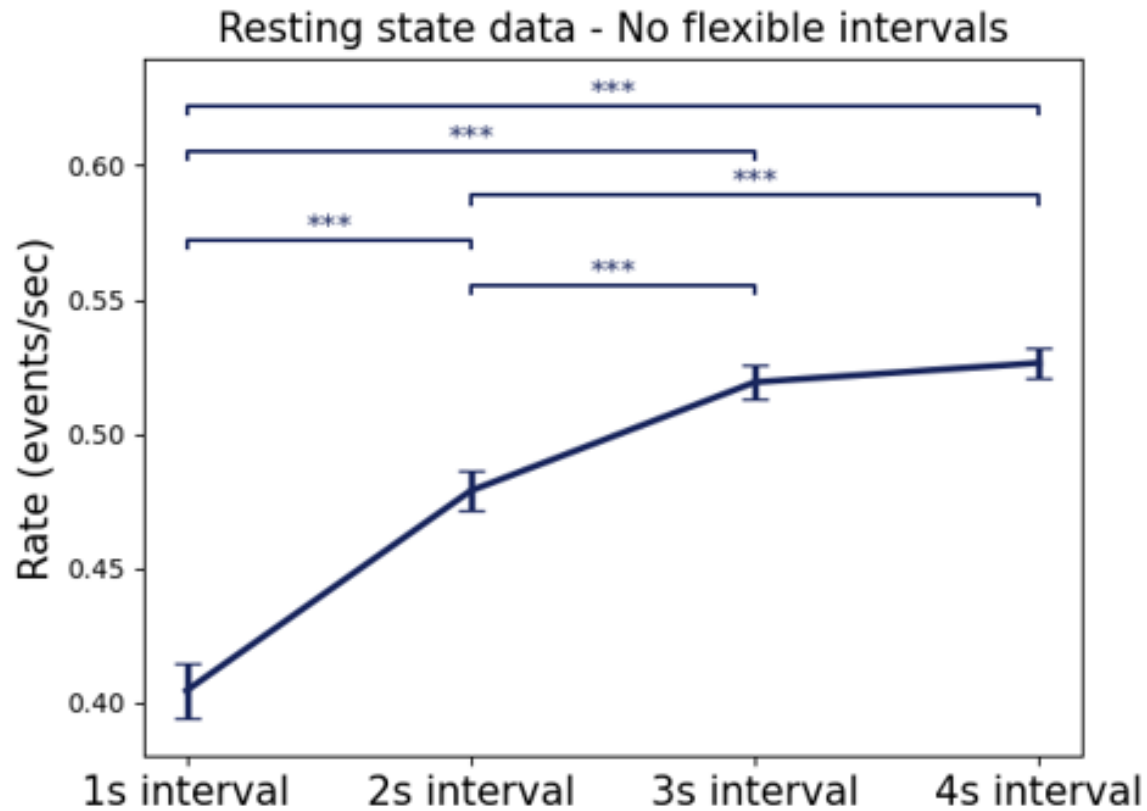
- Hypothesis: Bursts are underestimated when extracted from small intervals.



Flexible intervals (testing)

- Extract all resting state data from all participants.
- Divide all the data into intervals of sizes:
[0.3, 1, 0.6, 2, 0.6, 3, 0.6, 4, 0.3]s

- The short intervals (0.3s and 0.6s) are used to have no crossover between the intervals of interest when using flexible intervals.
- Extract the burst rate from each interval of interest (1s, 2s, 3s, 4s) using no flexible intervals and using flexible intervals with 0.3s of data added on each extremity.
- Apply paired Bonferroni-corrected t-tests between each interval.
- If bursts are correctly identified, there shouldn't be any statistical difference between the 4 interval groups.

Flexible intervals (testing)



Flexible intervals

- No adjustments needed for the movement intervals since they are already separated
- The 3-second resting-state intervals were readjusted to not overlap: $[0.3, 3, 0.3]$ s

