

Cardiac responses to auditory expectations during sleep reveal variations of hierarchical processing across arousal states

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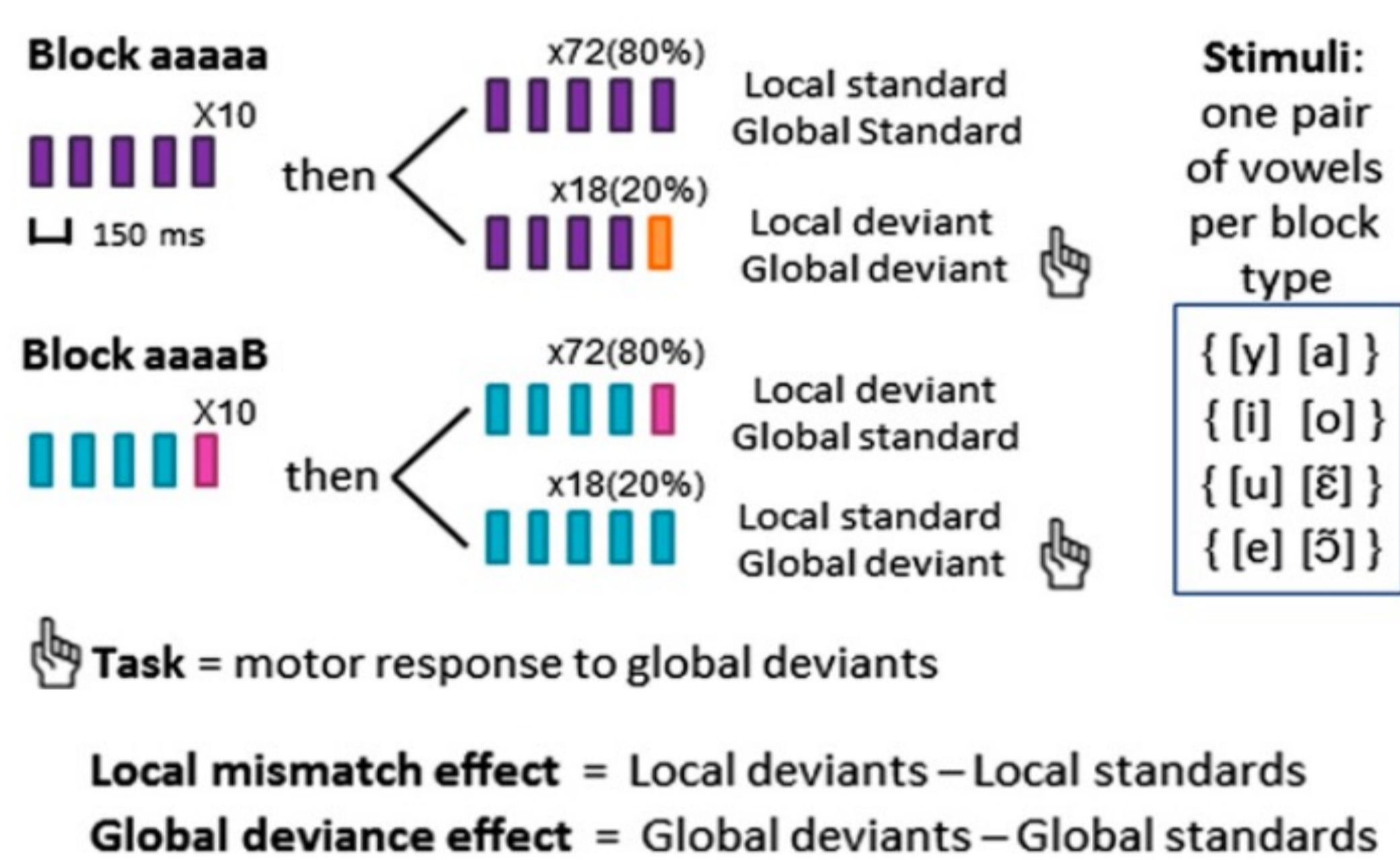


Introduction

- What can **bodily signals** reveal about cognitive processing in **low-arousal non-communicative states**?
- Brain and cardiac signals reveal the disruption of hierarchical predictive processing in **disorders of consciousness** (Bekinschtein et al., 2009; Raimondo et al., 2017)
- Brain signals reveal the disruption of hierarchical predictive processing during **sleep** (Strauss et al., 2015)
- We hypothesize that **cardiac activity** reveal disruption of hierarchical predictive processing during **sleep**

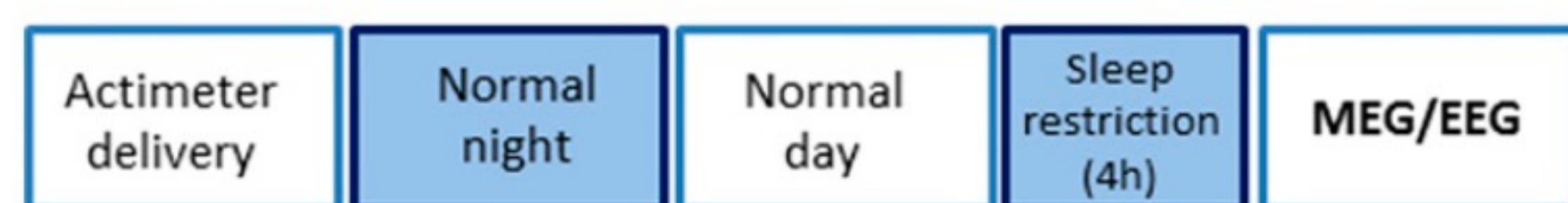
Methods

- **Local-global paradigm** (Bekinschtein et al., 2009)
- 4 similar sounds + a deviant
- Local and global deviations



- **Morning nap study** (Strauss et al., 2015)
- N=19, 18-35 yo
- MEG/EEG and ECG recordings

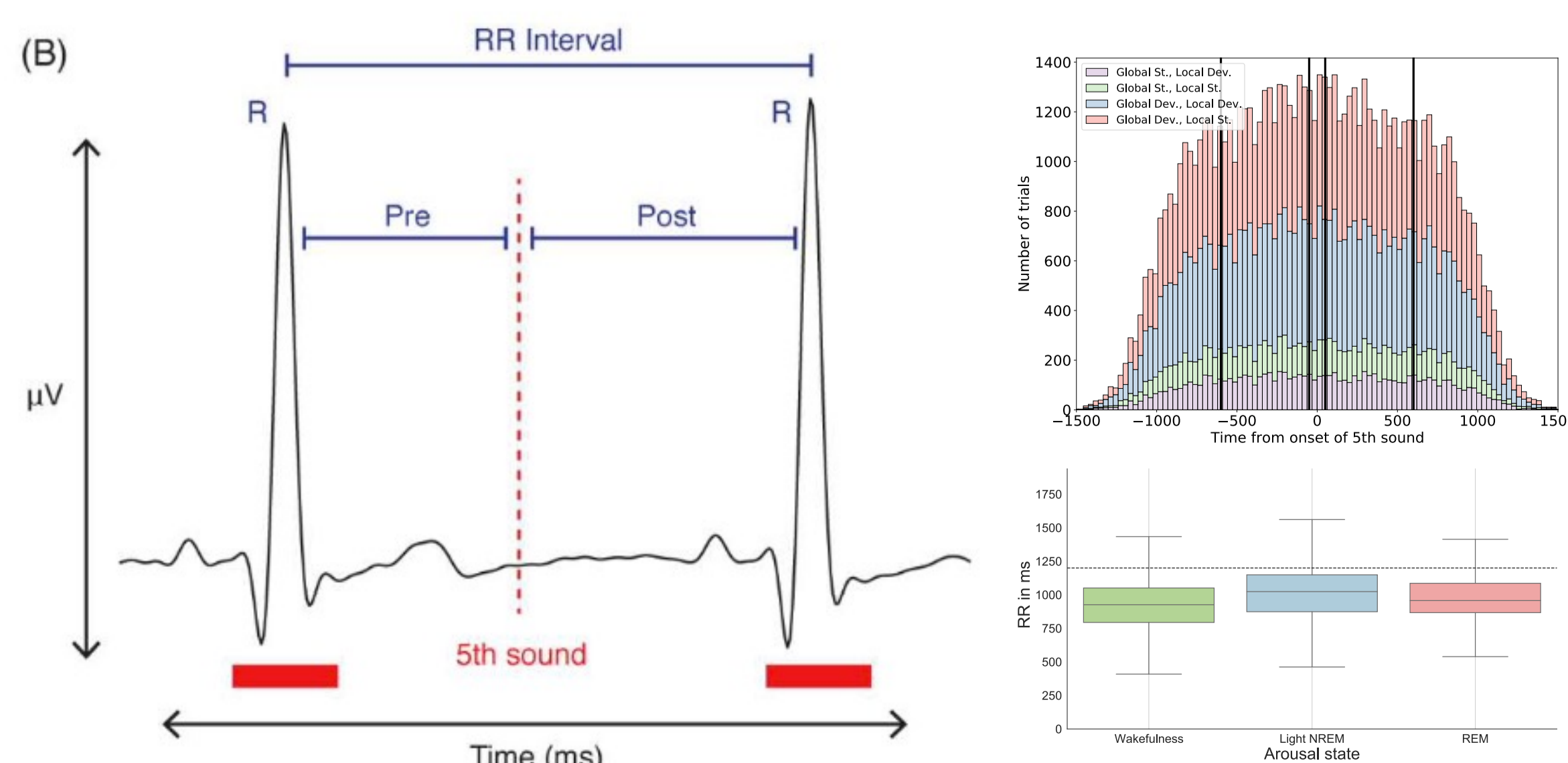
A Protocol



B Procedure during MEG/EEG recording

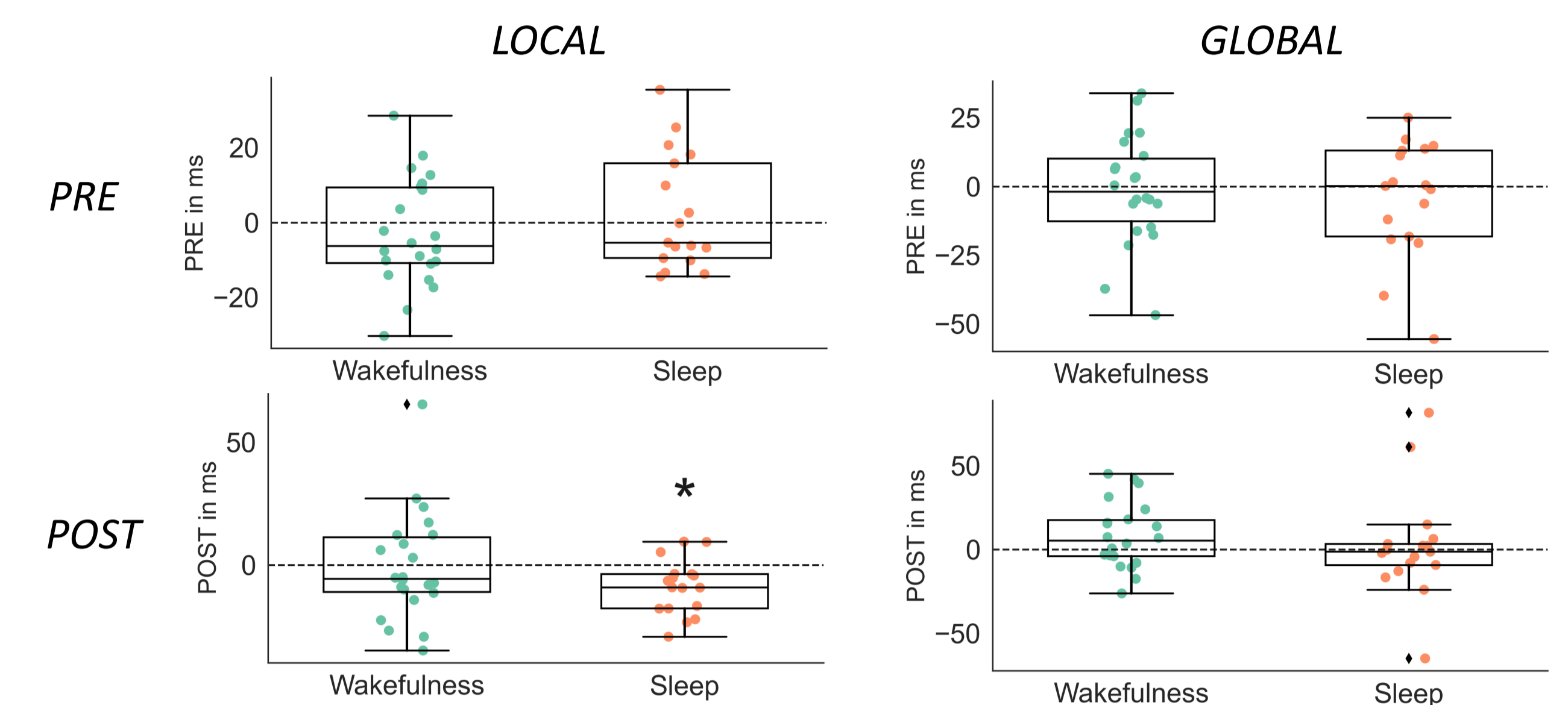


- **Cardiac analysis** (Raimondo et al., 2017)
- R peak extraction (Systole package in Python) around 5th sound
- Pre and Post >50ms and <600ms + RR interval <1200 ms

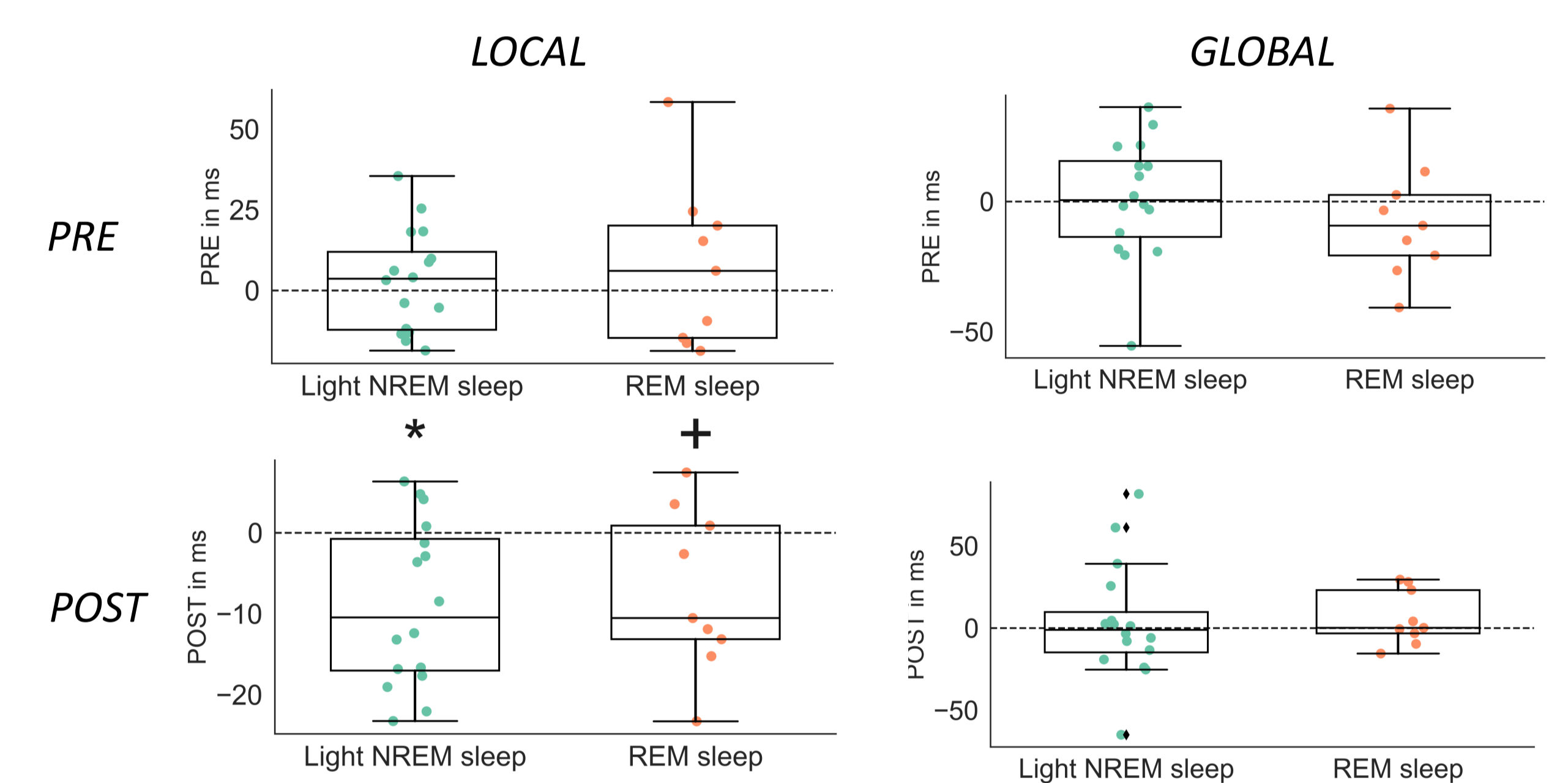


Results

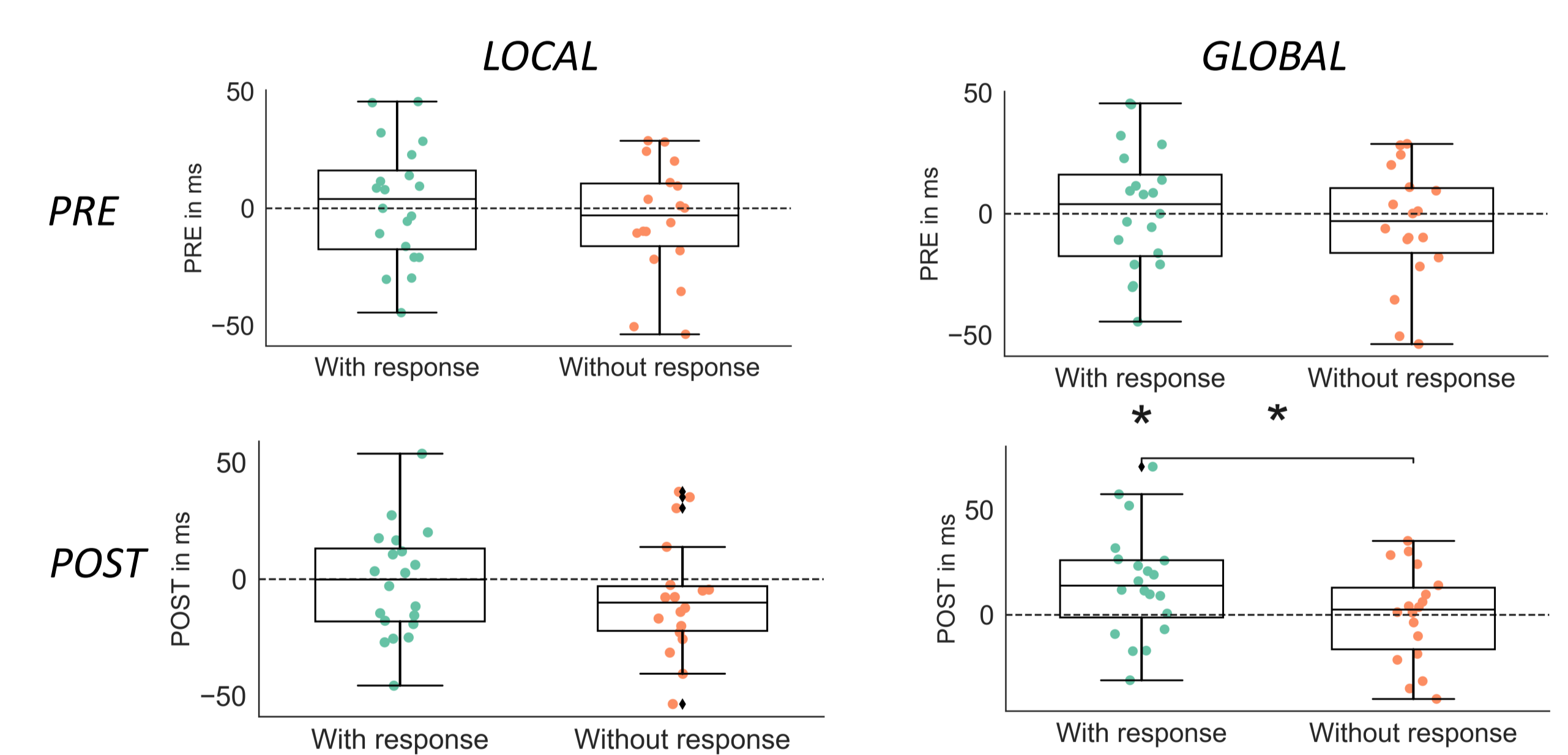
- **Cardiac acceleration after local deviants during sleep**



- **Cardiac acceleration after local deviants during light NREM sleep**



- **Cardiac deceleration after global deviants before motor response**



Discussion

- **Task instructions are revealed during wakefulness**
 - Cardiac deceleration indexes motor preparation during wakefulness
 - No cardiac responses to deviants in wakefulness (Raimondo et al., 2017)
 - This pattern diverges from cerebral responses (Strauss et al., 2015)
- **Disruption of hierarchical processing is revealed during sleep**
 - Cardiac acceleration reveal preserved local processing during sleep
 - No cardiac responses for global deviants during sleep
 - This pattern converges with cerebral responses (Strauss et al., 2015)

References

Bekinschtein et al. (2009). Neural signature of the conscious processing of auditory regularities. *PNAS*, 106(5), 1672-1677 [link](#)
 Strauss et al. (2015). Disruption of hierarchical predictive coding during sleep. *PNAS*, 112(11), E1353-E1362 [link](#)
 Raimondo et al. (2017). Brain-heart interactions reveal consciousness in noncommunicating patients. *Ann. Neurol.*, 82(4), 578-591 [link](#)

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- **Github:** <https://tinyurl.com/4yrxe364>

➤ **Qr code**

