

## INTRODUCTION

- Pain is a complex phenomenon which comprises perceptual, behavioral, and autonomic components<sup>1</sup>.
- Together, these components prevent injury and promote recovery. Moreover, changes of these components have been observed in chronic pain<sup>2,3</sup>.
- However, it is still unclear how the brain translates noxious stimuli into the perceptual, behavioral, and autonomic components of pain.
- Here, we applied EEG and multilevel mediation analysis to investigate whether and how EEG responses differentially contribute to the translation of noxious stimuli into the different components of pain.

## CONCLUSIONS

- The translation of noxious stimulation into the perceptual, behavioral, and autonomic components of pain is subserved by different and complementary temporal-spectral patterns of neuronal responses.
- This finding suggests a concept of pain in which sensory, motor, and autonomic components are partially independent processes.
- The comprehensive analysis approach promises to further our understanding of these processes in health, and their possible alterations in chronic pain.

## LITERATURE

- <sup>1</sup>Melzack & Casey, In: The Skin Senses, 1968
- <sup>2</sup>Hodges & Smeets, Clin J of Pain, 2015
- <sup>3</sup>Woda et al., Psychoneuroendocrinology, 2016
- <sup>4</sup>Oostenveld et al., Comp Intell Neurosci, 2011
- <sup>5</sup>Wager et al., Neuroimage, 2009
- <sup>6</sup>MacKinnon, Introduction to Statistical Mediation Analysis, 2013

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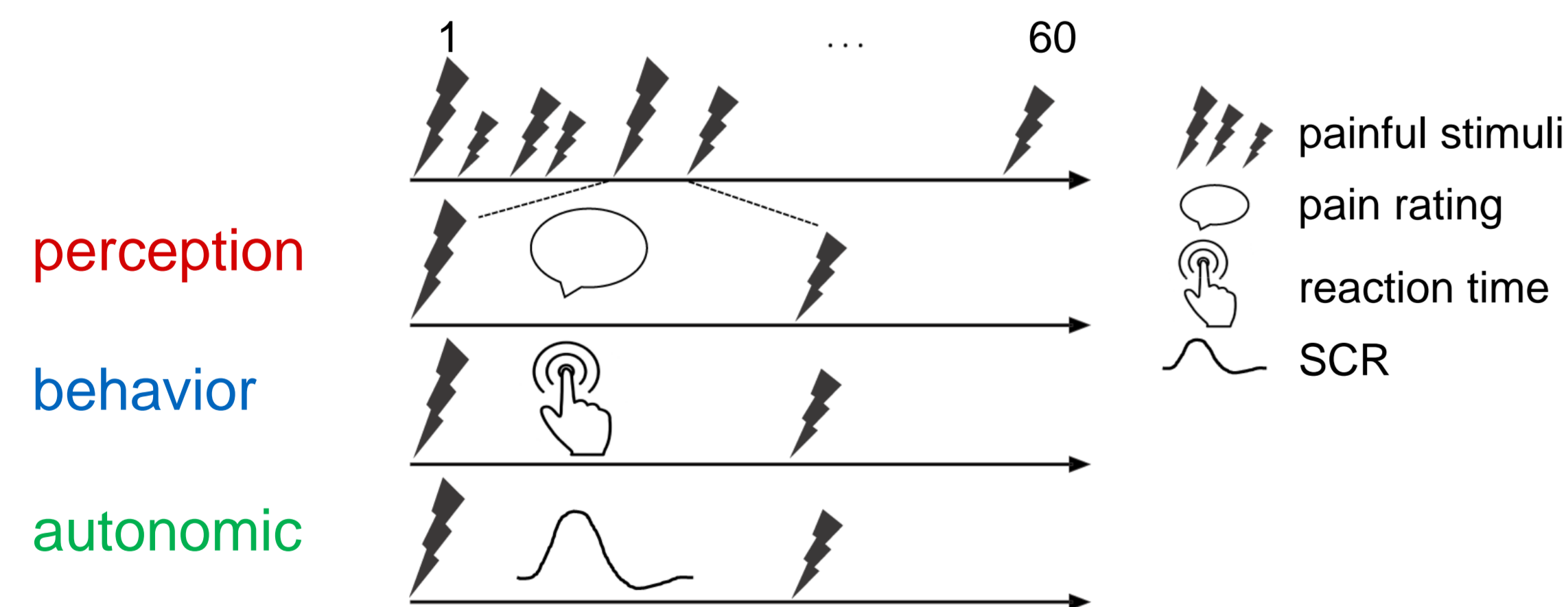


## METHODS

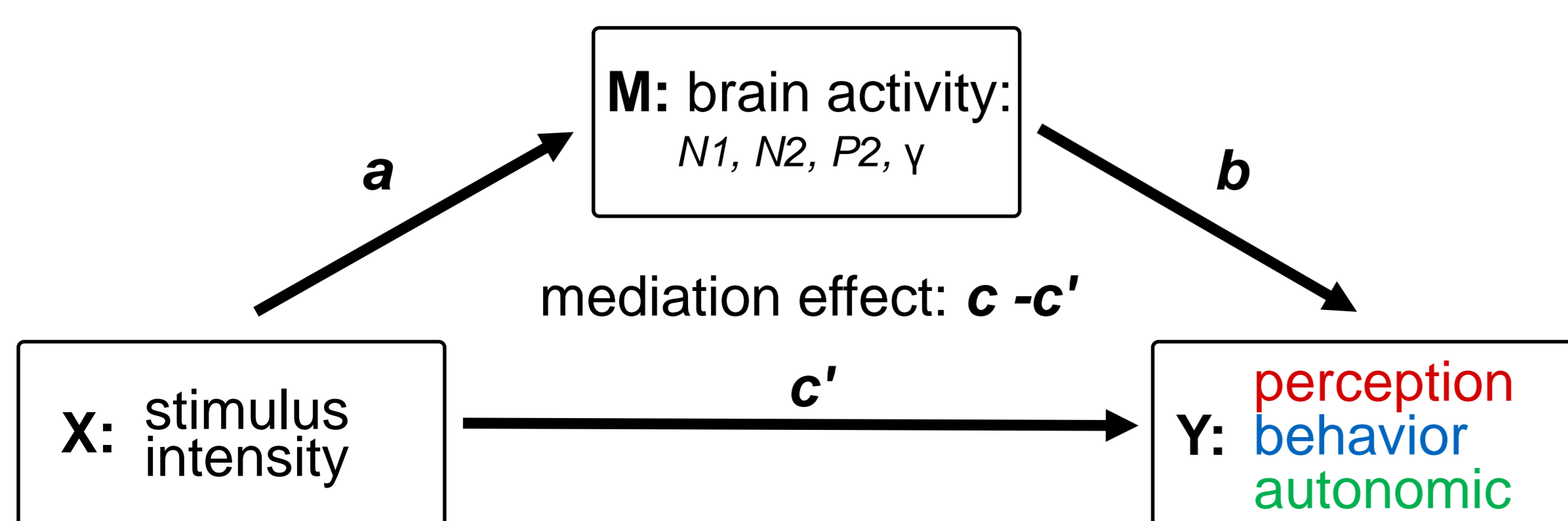
- Subjects** - 51 healthy subjects (27 ± years, 25 females)
- Stimulation** - Painful laser stimulation (Nd:YAP laser)
- 64-ch EEG** - Time-domain & time-frequency analysis (FieldTrip<sup>4</sup>)  
 - Source analysis (beamforming)
- Analysis** - Multilevel mediation analysis (Mediation Toolbox<sup>5</sup>)  
 - Cluster-based permutation statistics

## Paradigms

The experiment comprised three paradigms, which investigated the perceptual, behavioral, and autonomic components of pain. Pain ratings, reaction times, and skin conductance responses (SCRs) to painful stimuli served as measures of the three components.

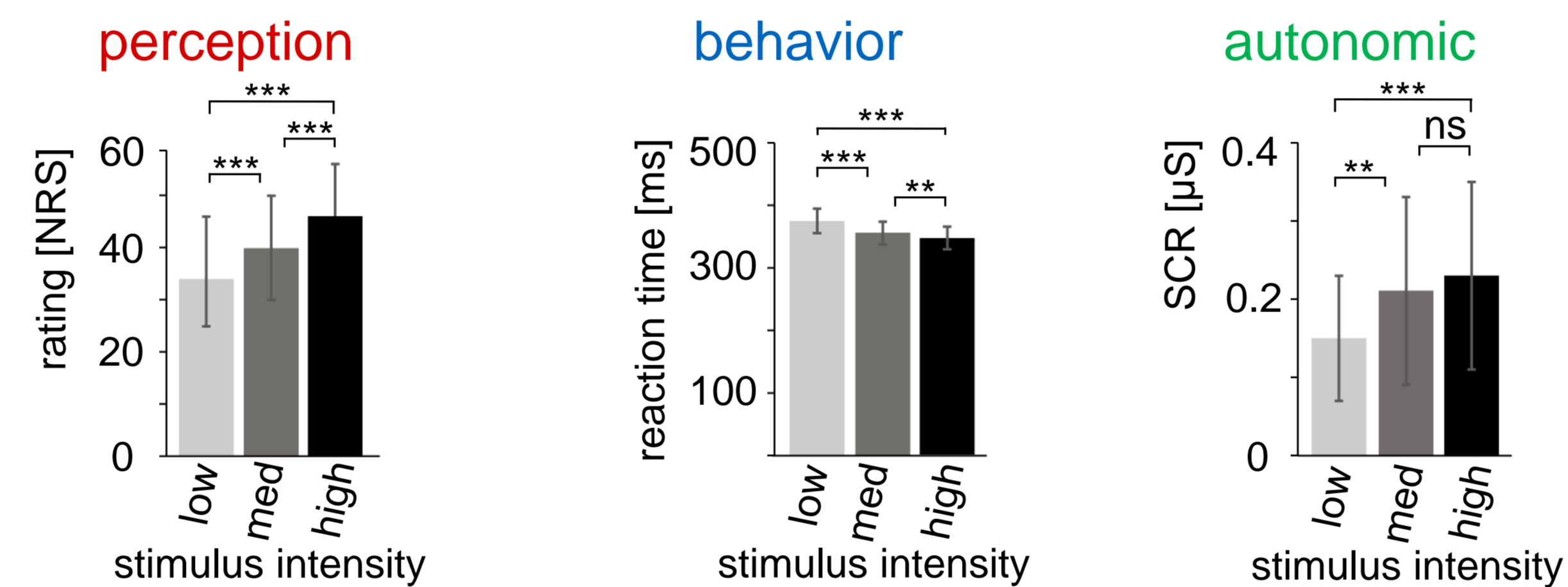


## Multilevel mediation analysis<sup>6</sup>

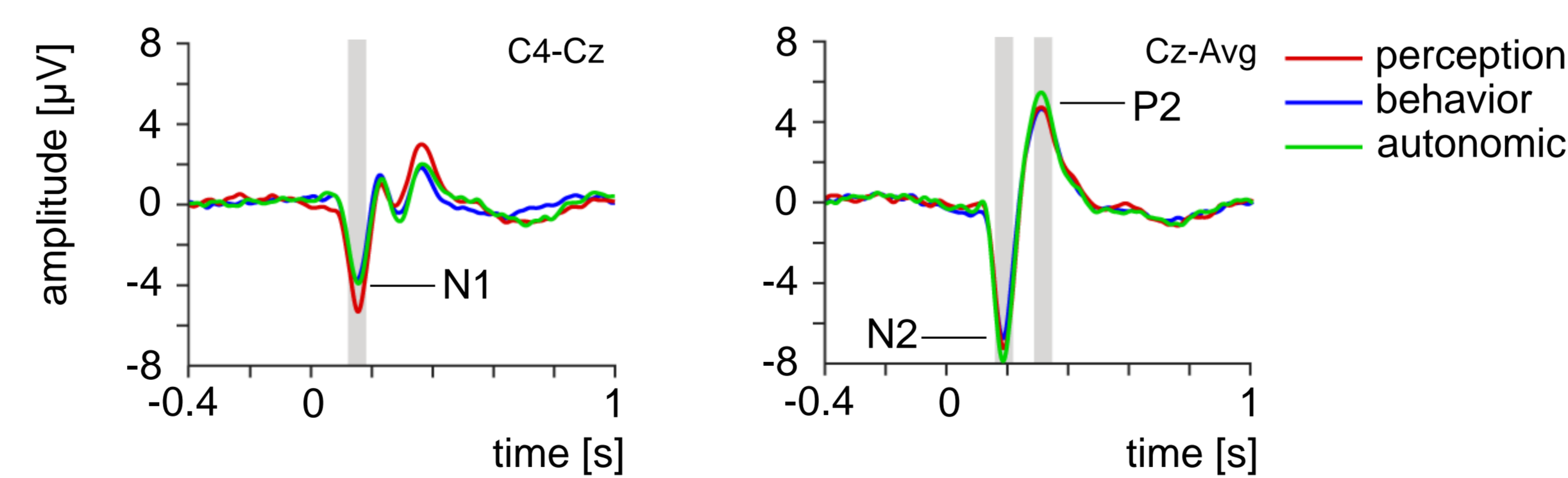


## RESULTS

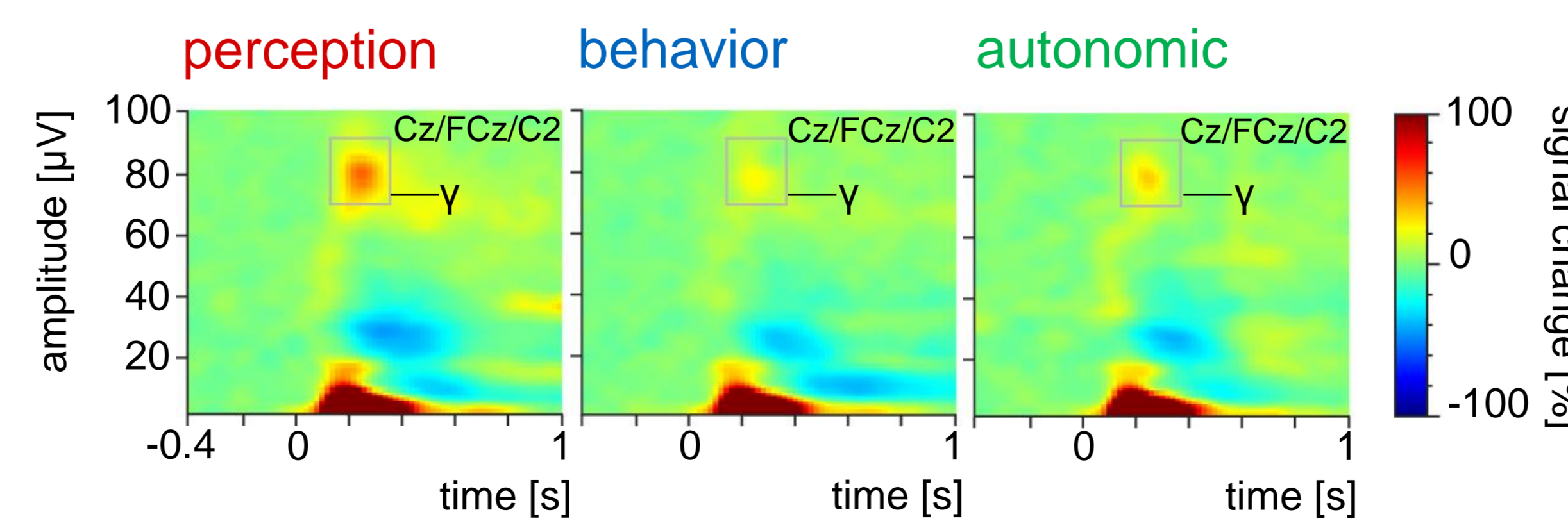
### Behavioral data



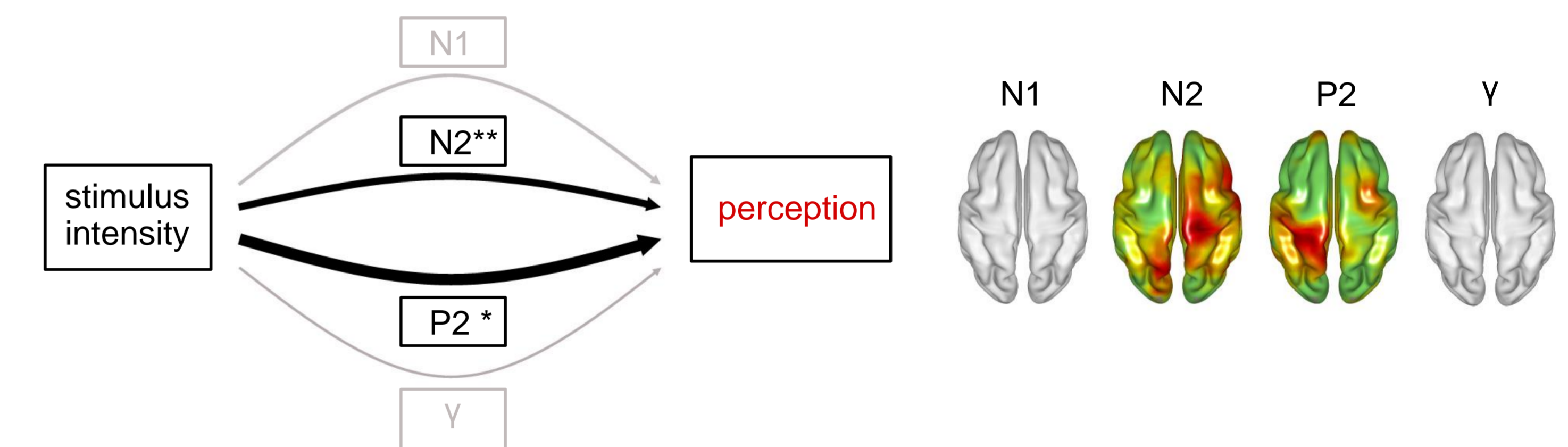
### Evoked potentials



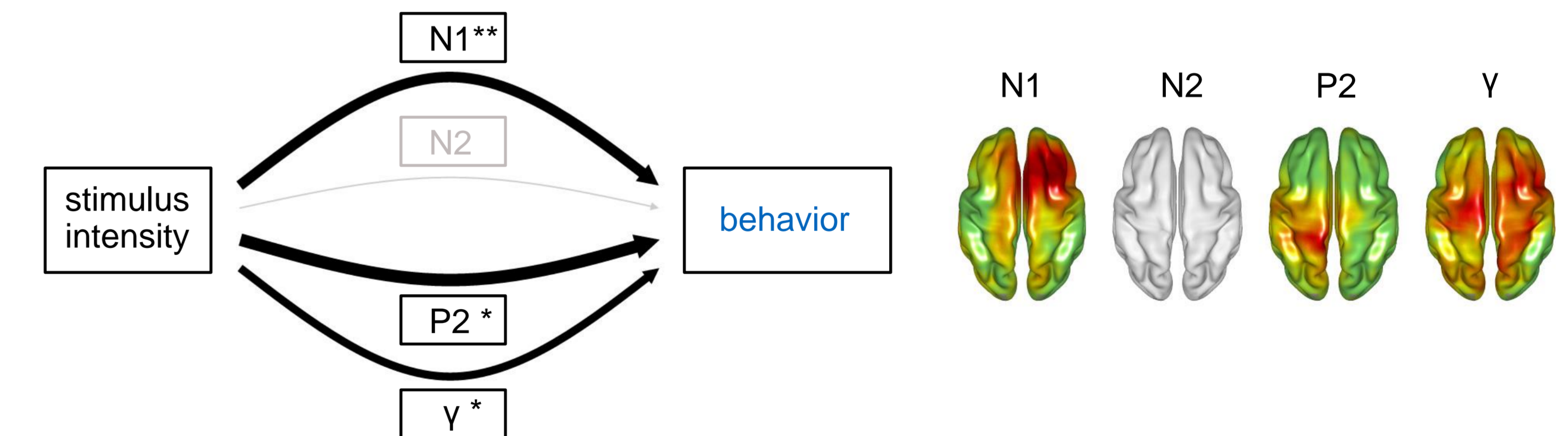
### Time-frequency representations



### Brain mediators of perception



### Brain mediators of behavior



### Brain mediators of autonomic responses

