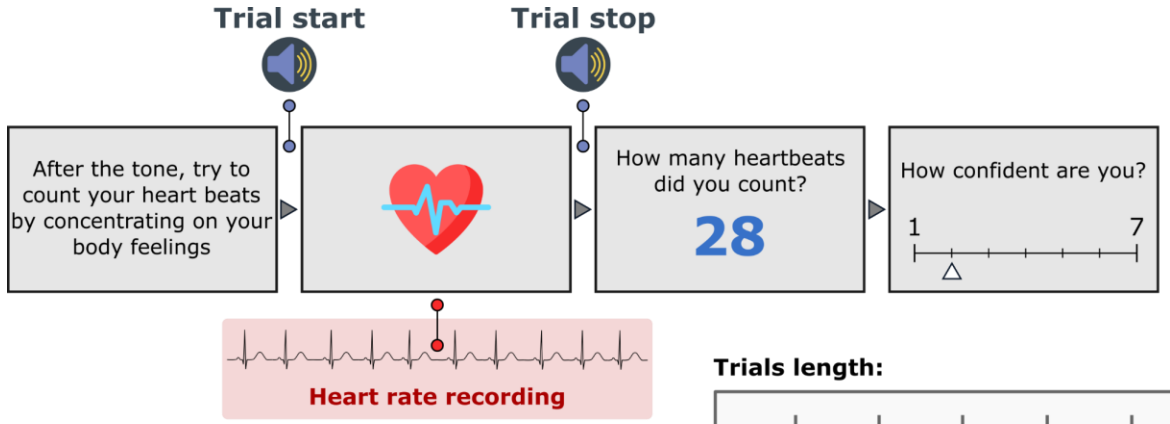
Introduction

Nicolas Legrand[1], Niia Nikolova[1], Camile Correa[1], Malthe Brændholt[1], Anna Stuckert[1], Nanna Kildahl[1], Melina Vejlø[1], Francesca Fardo[1,2], Micah Allen[1,3,4]

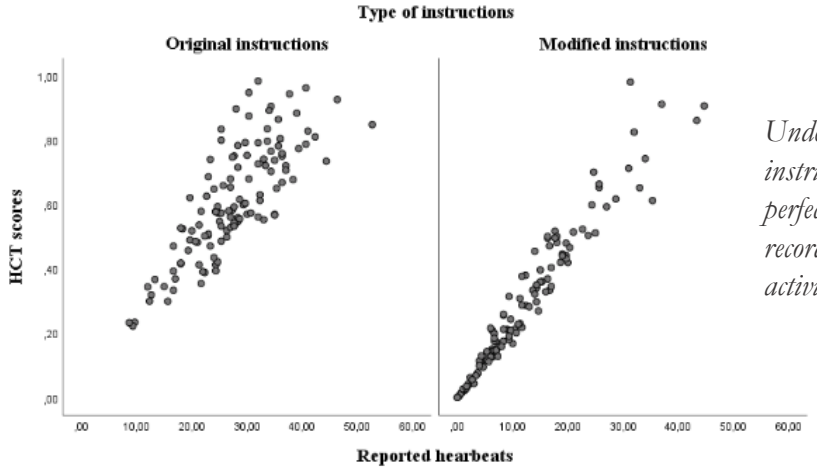
1-Center of Functionally Integrative Neuroscience, Aarhus University Hospital, Denmark
2-Danish Pain Research Center
3-Aarhus Institute of Advanced Studies, Aarhus University, Denmark
4-Cambridge Psychiatry, University of Cambridge, United Kingdom

Most studies measuring cardiac "*interoceptive accuracy*" (iACC) use the Heartbeat Counting (HBC) task (Dale & Anderson, 1978; Schandry, 1981).

The heartbeat counting task

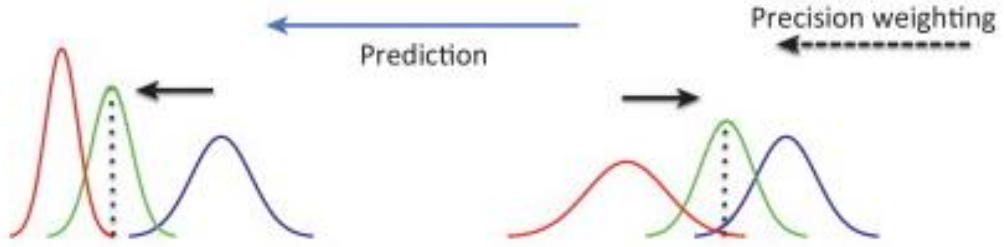


A central issue associated with the use of the HBC or similar tasks concerns the role of subjective beliefs about one's heart rate.



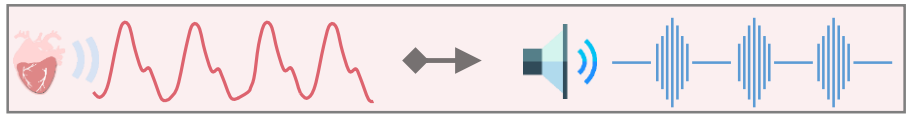
Under modified (i.e., more valid) instructions, HCT scores can be almost perfectly predicted without actually recording participants' objective cardiac activity (Desmedt et al., 2020).

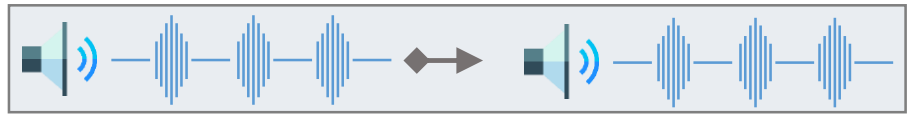
Numerous studies have shown that subjective beliefs dominate HBC behavior – even leading some authors to conclude that physiological measurement during the task is unnecessary.



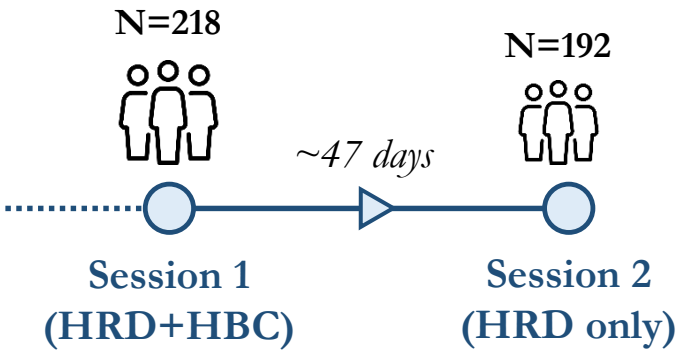
However, recent computational approaches to interoception suggest that cardiac experience (e.g of the heartbeat) arises from combining prior beliefs about the heart rate with ascending cardiac sensory information, according to the precision or confidence of these signals. To measure these beliefs more accurately, we developed a novel Bayesian approach…

Methods

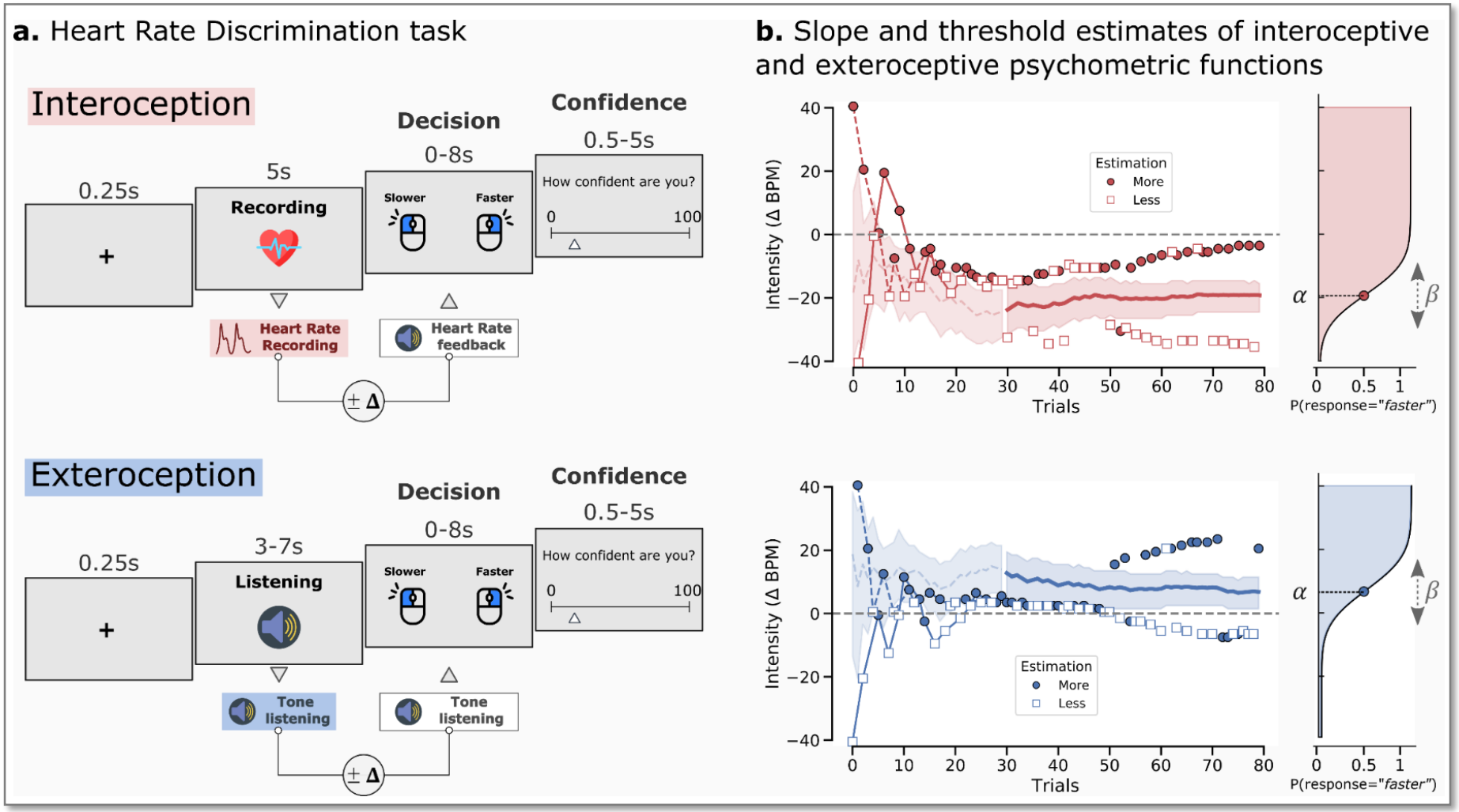




Experimental design



- Healthy participants
- Pulse oximeters
- Ages between 18 and 56 (25 ± 5)
- 126 females, 91 males, 1 other
- HRD duration
  - Session 1: 30 min
  - Session 2: 22 min



Poster B11: *Measuring the Accuracy and Precision of Interoceptive Beliefs: A Novel Psychometric Bayesian Approach*

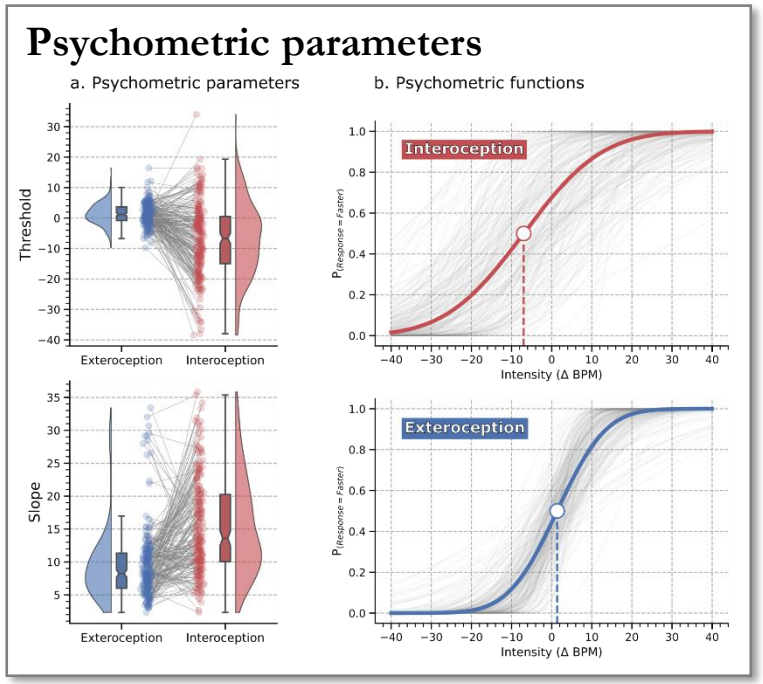
Nicolas Legrand, Micah Allen

Embodied Computation Group

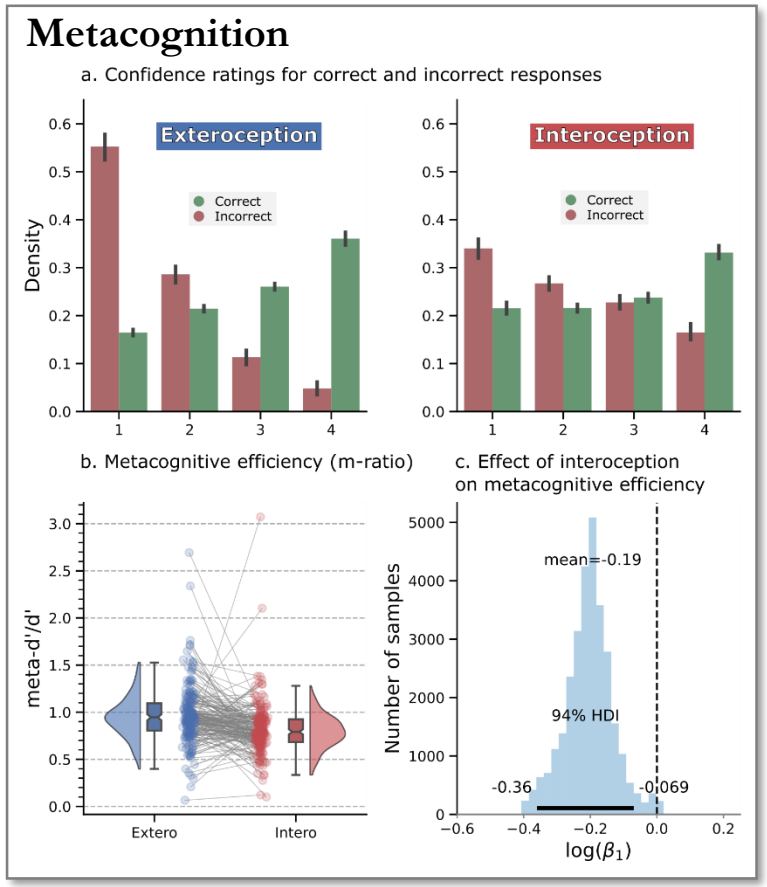
ECG embodied computation group

AARHUS UNIVERSITY

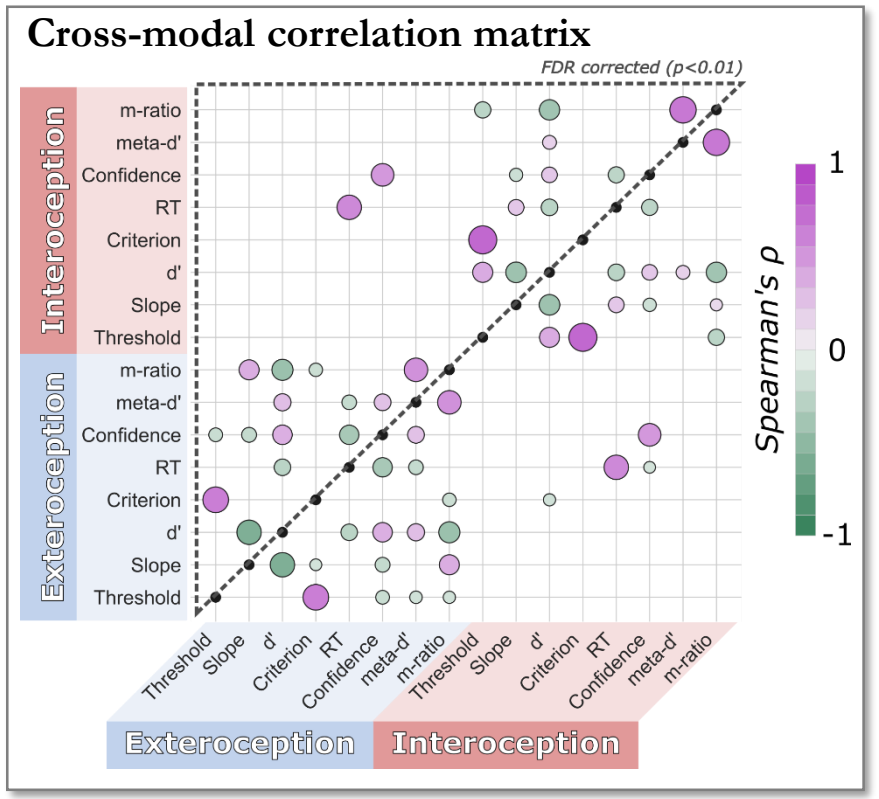
Results



Psychometric parameters: Cardiac beliefs were substantially more biased and less precise than exteroceptive beliefs. This can be seen in the psychometric function: participants underestimate their HR by about 7 BPM at rest and show greater uncertainty around the threshold.



Metacognition: Further, interoceptive beliefs showed poorer metacognitive efficiency, a measure of interoceptive insight controlling for individual differences in discrimination sensitivity.



Cross-modal correlation: Interoceptive parameters measured by the task were largely independent of exteroceptive processes (e.g. temporal estimation, or other cognitive bias).

Nicolas Legrand, Micah Allen

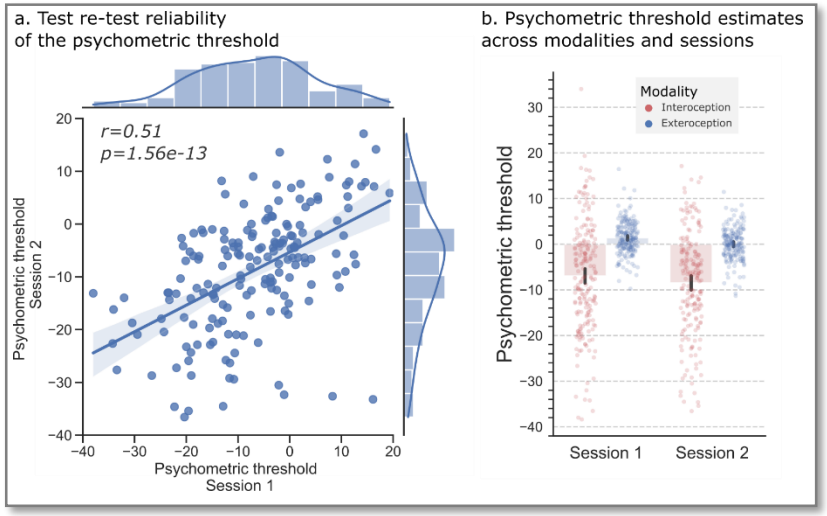
Embodied Computation Group

ECG embodied computation group

AARHUS UNIVERSITY

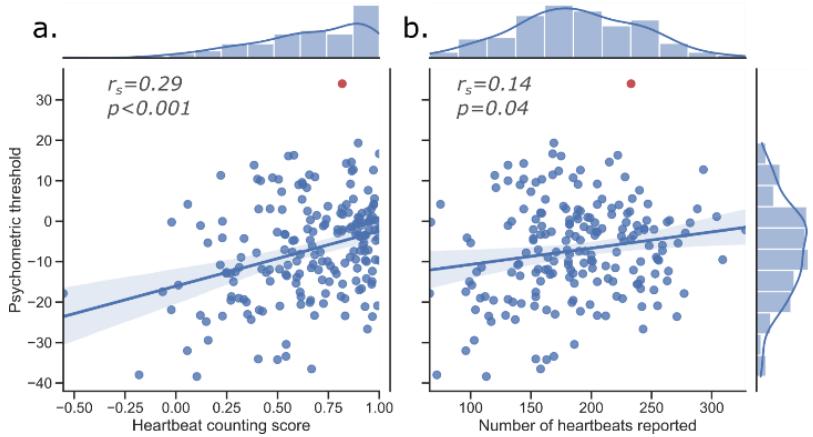
Discussion

Reliability



Face validity

Correlation with the heartbeat counting task parameters



Further directions

Computational modeling

The task design makes the transition to computational modeling easy (HGF, reinforcement learning, diffusion models, metacognition…).

Clinical studies

The simplicity of the task and the required material make it easy to use with clinical populations. The task duration can be controlled and adapted.

Modular

The package is modular and can easily be extended, improved, and adapted to other hardware.

Conclusion

All the main results reported here were reproduced in the second session (see paper.)

The good reliability and face validity of the task suggests that this is a robust way to measure the precision and accuracy of cardiac interoceptive beliefs.

Future works will pair pharmacological and experimental manipulation with computational modeling.

Paper

SCAN ME

Data and code

SCAN ME

Cardioception package

Forthcoming…

Poster B11: *Measuring the Accuracy and Precision of Interoceptive Beliefs: A Novel Psychometric Bayesian Approach*

Nicolas Legrand, Micah Allen

Embodied Computation Group

ECG embodied computation group

AARHUS UNIVERSITY