Neural Feedback Processing During a Guessing and a Learning Paradigm: Comparison of the RewP and the P300 Across Tasks

Franziska Jüres[1], Ruth Wewers[1], Norbert Kathmann[1], & Julia Klawohn[1, 2]

[1] Department of Psychology, Humboldt-Universität zu Berlin, Germany, [2] Department of Medicine, MSB Medical School Berlin, Germany

BACKGROUND

- **Evaluating and learning from feedback** is essential to maximize gains and minimize loss.
- Two event-related potentials (ERPs), namely the **Reward Positivity (RewP)** and the **P300**, have been identified as electrophysiological correlates of feedback processing in reward tasks.[1,2]
- It is still unclear **how learning and expectancy modulate RewP and P300** elicited by monetary feedback **intraindividually**.

RESESARCH AIM

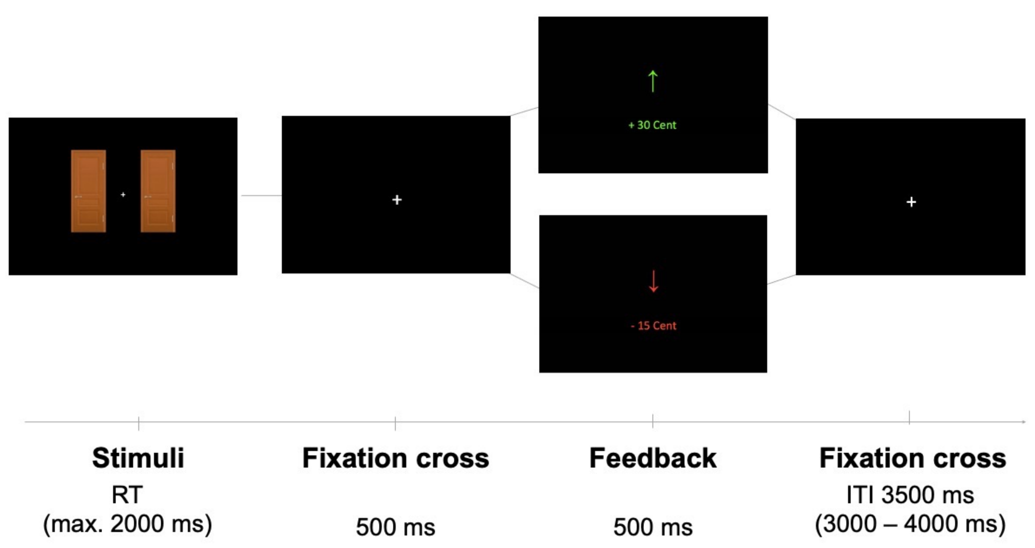
- We expected RewP enhancement following rewards [2] and associations between ERPs across paradigms.
- We further investigated potential modulatory effects of learning processes on P300 and RewP.

METHODS

SAMPLE

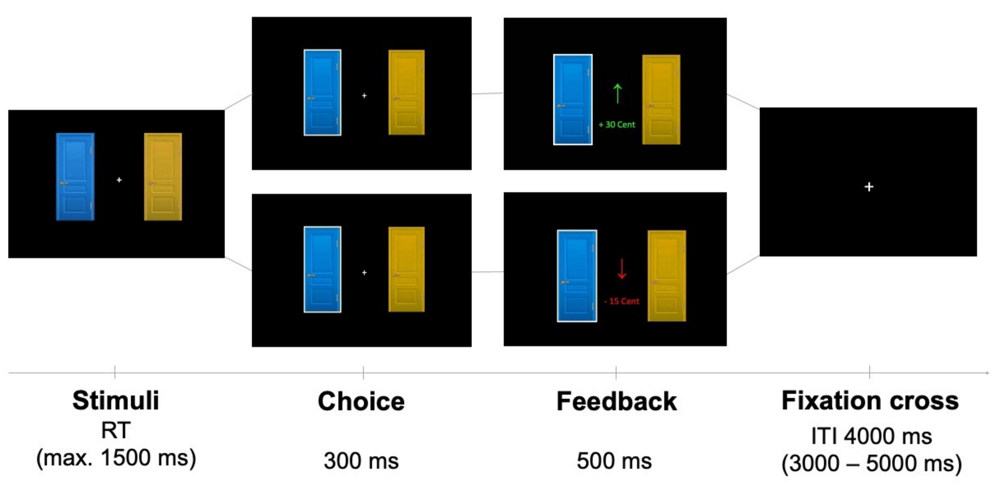
- **32 healthy participants** (females n = 26) aged 18 – 56 years (M = 27.83, SD = 12.26)
- **Executive functions:** **TMT A**: M = 23.01, SD = 6.76, **TMT B**: M = 55.91, SD = 28.40

GUESSING PARADIGM: Doors Task



- 60 trials with random, monetary feedback (30 win / 30 loss)

LEARNING PARADIGM: Reversal Learning Task



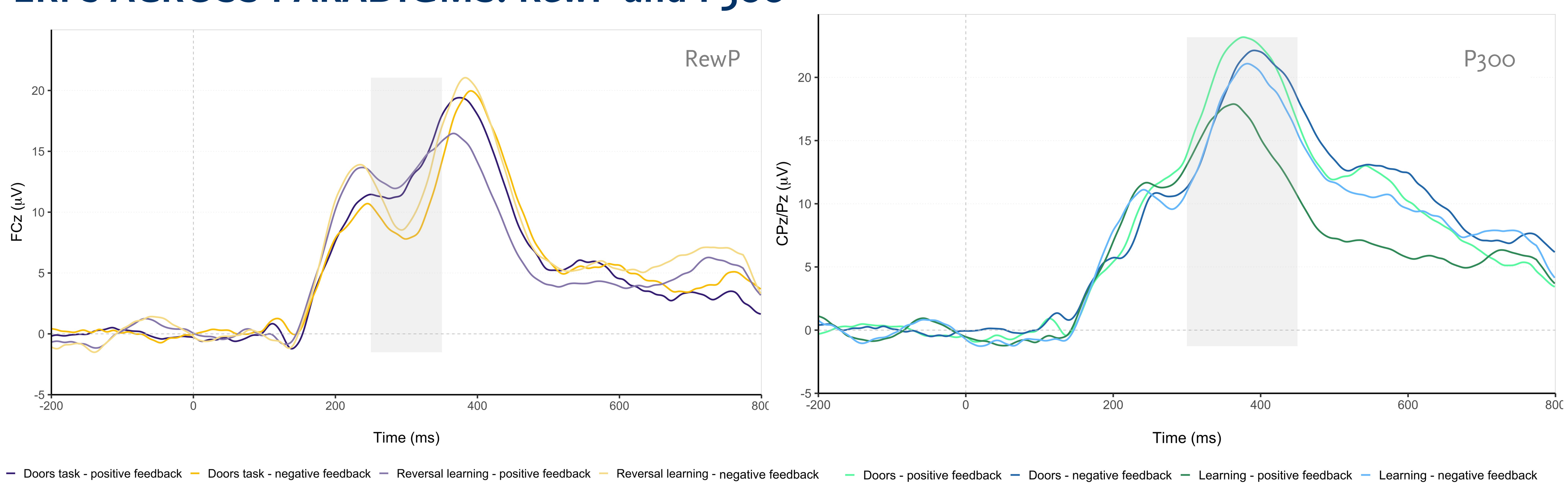
- 140 - 160 trials
- One doors is associated with a monetary reward, the other door with a monetary loss
- Feedback is probabilistic (70:30)
- Contingencies change after reaching a learning criterion (6-10 correct choices)

DATA ANALYSIS

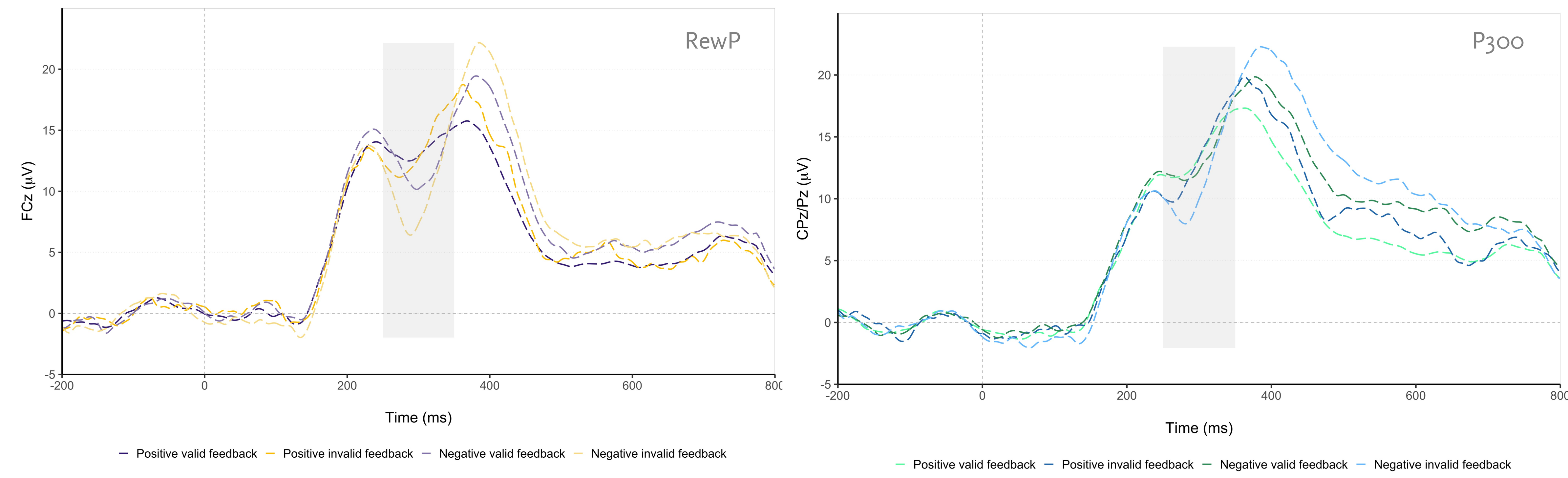
- **2 x 2 repeated measures analysis of variance (ANOVA)** for ERPs with feedback (positive/negative) and task (guessing/learning)
- 2 x 2 univariate ANOVA for ERPs with feedback valence (positive/negative) and validity (valid/invalid)
- **Pearson correlations** between ERPs and feedback type

RESULTS

ERPs ACROSS PARADIGMS: RewP and P300



FEEDBACK VALIDITY IN THE REVERSAL PARADIGM: RewP and P300



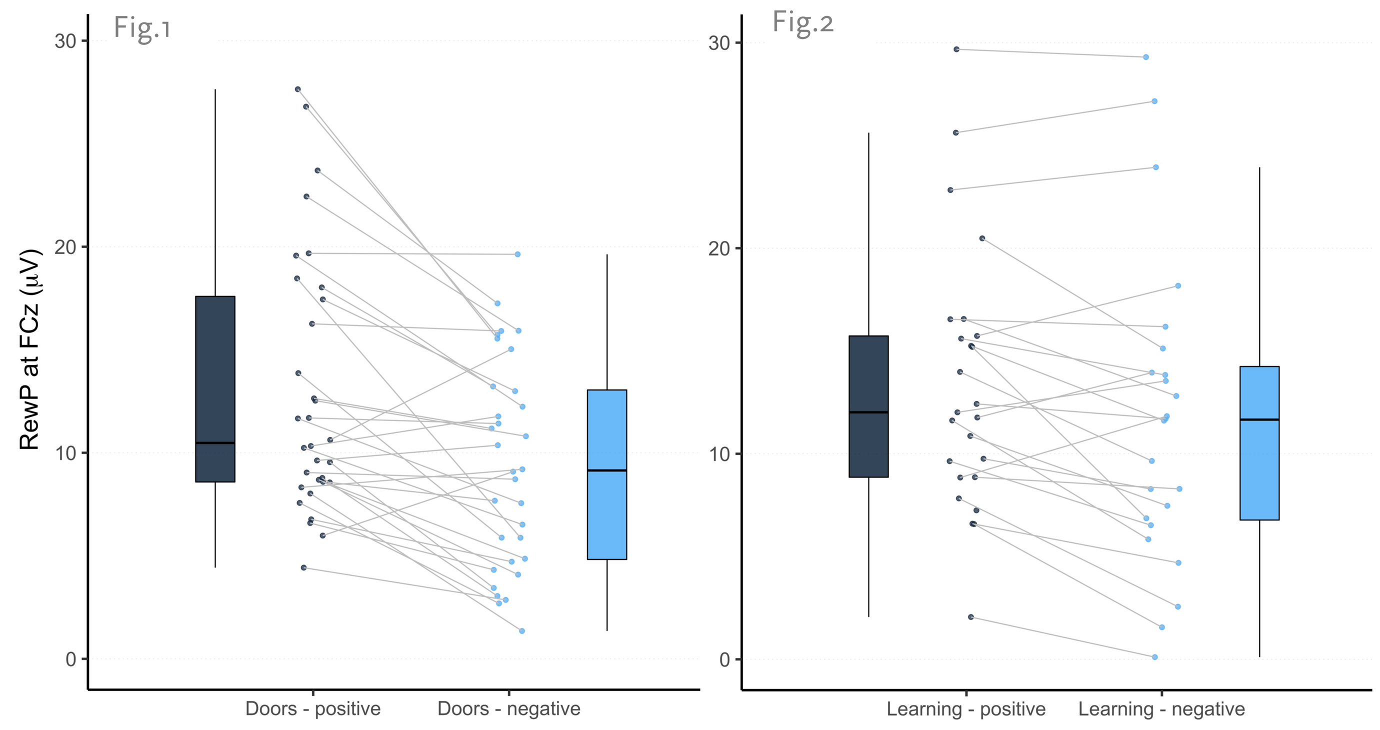
ANOVAs

RewP amplitudes differed within task depending on feedback valence but not across tasks. (Fig. 1 & 2)

- Doors positive feedback > Doors negative feedback $MDiff = 3.436$, $p = 006$
- Learning positive feedback > Learning negative feedback $MDiff = 2.168$, $p = 016$

RewP amplitudes differed within the learning task depending on feedback expectancy.

- Learning positive valid > Learning negative invalid feedback $MDiff = 2.168$, $p = 016$
- Learning positive invalid > Learning negative invalid feedback $MDiff = 2.168$, $p = 016$

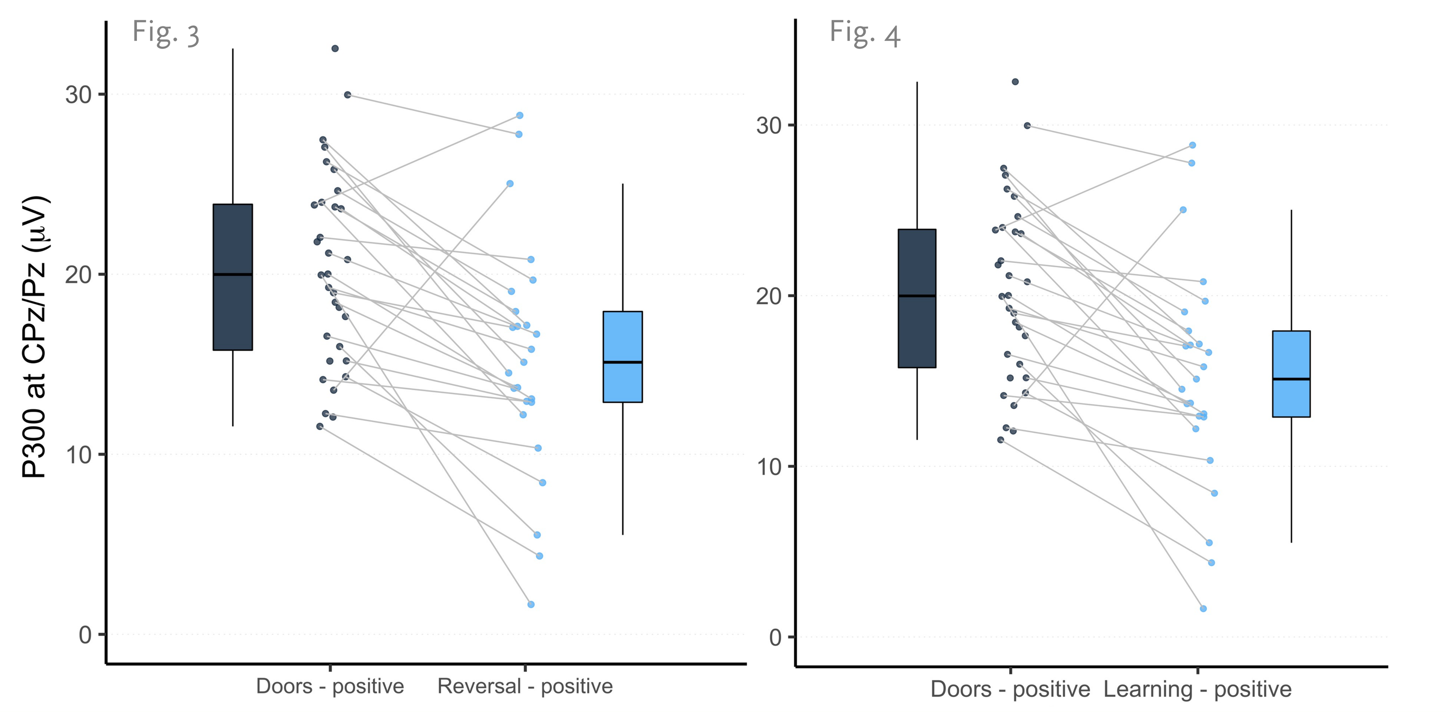


P300 amplitudes differed across tasks depending on feedback valence. (Fig. 1 & 2)

- Doors positive feedback > Learning positive feedback $MDiff = 5.141$, $p = 001$
- Learning positive feedback < Learning negative feedback $MDiff = 2.495$, $p = 001$

P300 amplitudes differed within task depending on feedback expectancy.

- Learning positive valid < Learning negative valid feedback $MDiff = 2.063$, $p = 028$
- Learning positive valid < Learning negative invalid feedback $MDiff = 3.598$, $p = 001$



DISCUSSION & CONCLUSION

SUMMARY

- First results suggest an association between RewP amplitudes across paradigms. For the P300, this relations was only evident for positive feedback
- Expectancy of feedback shows modulatory effects on ERPs in the reversal learning task. Yet, there is no feedback valence-specific effect.

TO COME

- Analysis on behavioral outcomes with computational modeling
- Large-scale data-collection including patients with internalizing disorders, aiming for a sample of 400 patients

[1] Bellebaum, C., & Daum, I. (2008). Learning-related changes in reward expectancy are reflected in the feedback-related negativity. *European Journal of Neuroscience*, 27(7), 1823– 1835. doi: 10.1111/j.1460-9568.2008.06138.x

[2] Proudfit, G.H. (2015). The reward positivity: from basic research on reward to a biomarker for depression. *Psychophysiology*, 52,449–59.

Correspondence: franziska.jueres@hu-berlin.de
Twitter: @FJueres

Supported by the DFG-Forschungsgruppe 5187.