CoScience Personality EEG

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FRONTAL ALPHA ASYMMETRY AS A MARKER OF APPROACH MOTIVATION?

INSIGHTS FROM A COLLABORATIVE FORKING PATH ANALYSIS.

K. Paul[1], A. Beauducel[2], J. Hennig[3], J. Hewig[4], A. Hildebrandt[5], C. Kührt[6], L. Lange[7], E.M. Mueller[8], R. Osinsky[7], E. Porth[9], A. Riesel[1], J. Rodrigues[4], C.A. Short[1,5], J. Stahl[9], A. Strobel[6], C. Scheffel[6], J. Wacker[1]

(1) Universität Hamburg (2) Rheinische-Friedrich-Wilhelms-Universität Bonn (3) Justus-Liebig-Universität Gießen (4) Julius-Maximilians-Universität Würzburg (5) Carl von Ossietzky Universität Oldenburg (6) Technische Universität Dresden (7) Universität Osnabrück (8) Philipps-Universität Marburg (9) Universität zu Köln

Resting frontal alpha asymmetry (ASY) has been proposed as a marker of approach motivation, but meta-analyses found only weak links with self-reported approach traits. It has been suggested that ASY may show stronger trait associations in situations that elicit motivation. We utilized data from the CoScience project (N > 740) and measured ASY during a resting period, a picture viewing task, and a reward task. Results showed that ASY was not reliably affected by task manipulations and did not relate to traits. Bayesian statistics and a Cooperative-Forking-Path (cFPA) analysis supplement the preregistered analyses. Overall, The validity of ASY as a marker of approach motivation, both state and trait, remains questionable.

BACKGROUND & RESEARCH QUESTIONS

- ASY, measured as the difference in alpha activity, reflects the asymmetric activity of the frontal cortex (Davidson et al. 1997)
- Motivational direction model predicts that left frontal cortical activity is related to positive affect and approach motivation (Harmon-Jones et al. 2013)

(I) ASY & STATES?

✓ ASY increased for rewards, pictures, imagery (Gable & Harmon-Jones, 2008, Wacker et al., 2017)

✗ ASY not sensitive to pictures, autobiographic memories (Adolph et al., 2017 Walden et al., 2014)

(II) ASY & TRAITS?

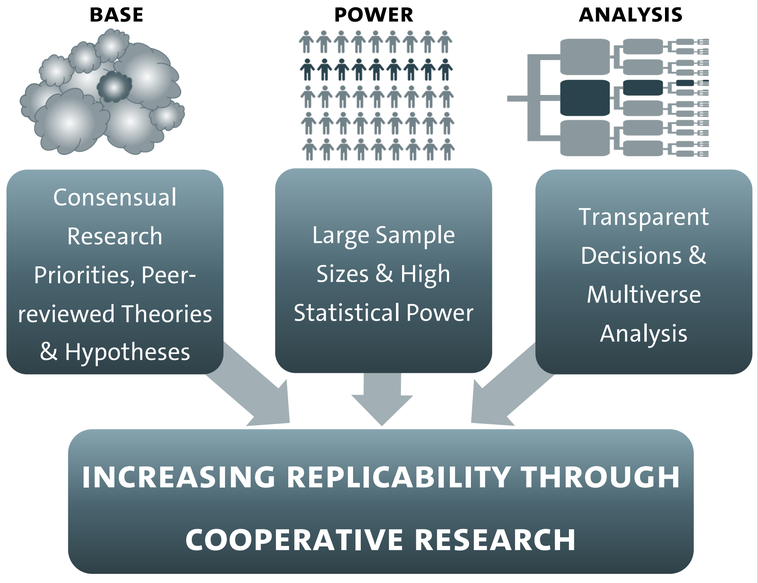
✓ ASY correlates with self-reports trait BAS (Coan & Allen 2003)

✗ ASY does not correlate with self-reports, BAS (De Pascalis et al., 2018, Neal & Gable, 2016)

(II) STATE TRAIT INTERACTION?

- Capability Model: associations with trait BAS in situations where individuals are motivated to approach (Coan et al., 2006)
- Associations of ASY & depression in gambling (Shankman et al., 2011)
- Associations of ASY & BAS in decision making (Rollwage et al., 2017)

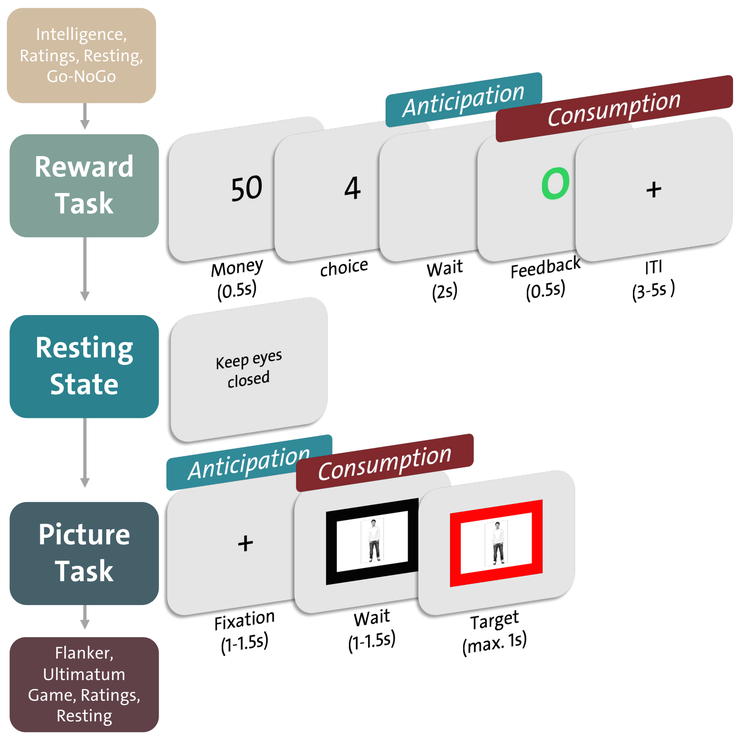
CHALLENGES & SOLUTIONS



PRE-PROCESSING & ANALYSIS

● Data collected in 10 labs across Germany ● N = 740-772 (*M* = 23 years, *SD* = 3, 50 % females) ● 60-64 EEG channels, EOG and Mastoids were recorded at 500/512 Hz using Biosemi/BrainAmp/ActiChamp sytems ● Preprocessing was carried out in EEGlab v2021.0, fully automated ● Reference to Cz for cleaning ● Bad channels identified according to the EPOS pipeline and interpolated ● Participants with more than 20% bad channels were excluded ● High-pass filter of 0.05 Hz ● PREP line noise filter of 50 Hz ● Detrending ● Removing of bad segments using artefact subspace reconstruction ● Bad ICA components identified using IClabel and removed ● Low-pass filter of 30 Hz ● Data Segmented (see Figure Task & Analysis Phases) ● Bad epochs identified with FASTER and removed ● Re-referenced to CSD ● Hanning Window applied ● FFT calculated ● Average spectral power within 8-13 Hz calculated at frontal leads (F3/F4) ● values transformed using natural-logarithm (ln) ● ASY defined as an activity difference (right minus left) ● Minimum clean trials defined ● Outliers defined from ASY/SME distribution ● Attention checks for questionnaire data ● Rankit normalisation ● Predictors centered ● anova(lmer()) & lmBF()

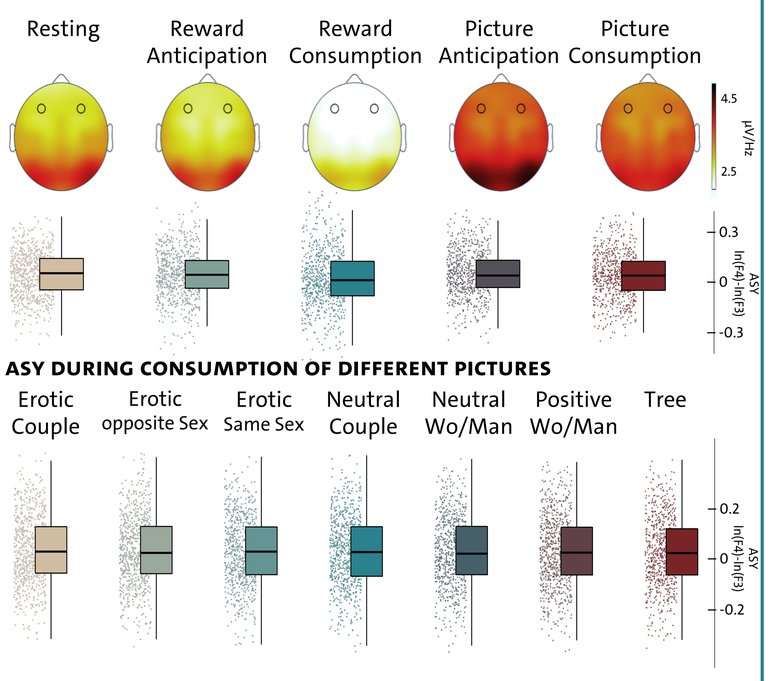
TASKS & ANALYSIS PHASES



Overview of the study design and the individual tasks. The left side shows the order in which the tasks were presented in the context of the full study procedure. The right side shows the trial structure of the reward (top), resting (middle) and picture task (bottom) highlighting the time intervals to define the anticipation and consumption phase.

STATE EFFECTS

ASY DURING DIFFERENT TASKS AND PHASES



ASY DURING CONSUMPTION OF DIFFERENT PICTURES

- ASY during Resting higher than during Picture Anticipation ($F_{1,759}$ = 5.21, p = .023, η_p^2 = .007; weak evidence for H0, BF_{10} = 6e-01, 0.01%; $Mdn_{\eta\ Forks}$ ≤ .001 [-.007, ≤ .001], 15.85% significant)
- ASY during Anticipation of Rewards/Pictures higher than during consumption thereof ($F_{1,732}$ = 21.87, p ≤ .001, η_p^2 = .029; BF_{10}= 6e+02 [0.18 %], very strong evidence for H1; $Mdn_{\eta\ Forks}$ ≤ .001 [-.011, ≤ .001], 14.99% significant)
- ASY during the Consumption of pictures of Erotic Couples higher than for Trees ($F_{6,4724}$ = 3.46, p = .012, η_p^2 = .004; strong evidence for H0, BF_{10} = 4e-02, 0.12%; $Mdn_{\eta\ Forks}$ ≤ .001 [-.001, .001], 3.72% significant)
- No Effect of Reward/Losses/Reward Magnitude (all $Fs_{2,1423}$ ≤ 0.26, ps = 1, $\eta_p^2 s$ ≤ .001; (very) strong evidence for H0, BF_{10} = 5e-06/7e-03[0.09/0.01%]; $Mdn_{\eta\ Forks}$ ≤ .001 [≤ .001, .001], 4.79% significant)

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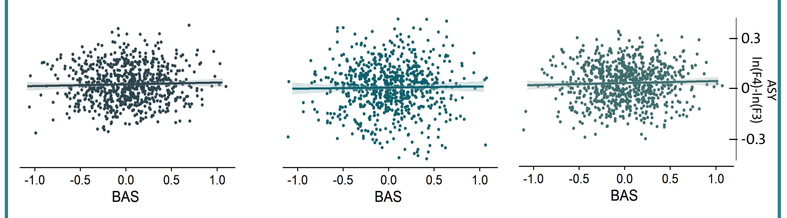
TRAIT EFFECTS

STATE-TRAIT INTERACTION

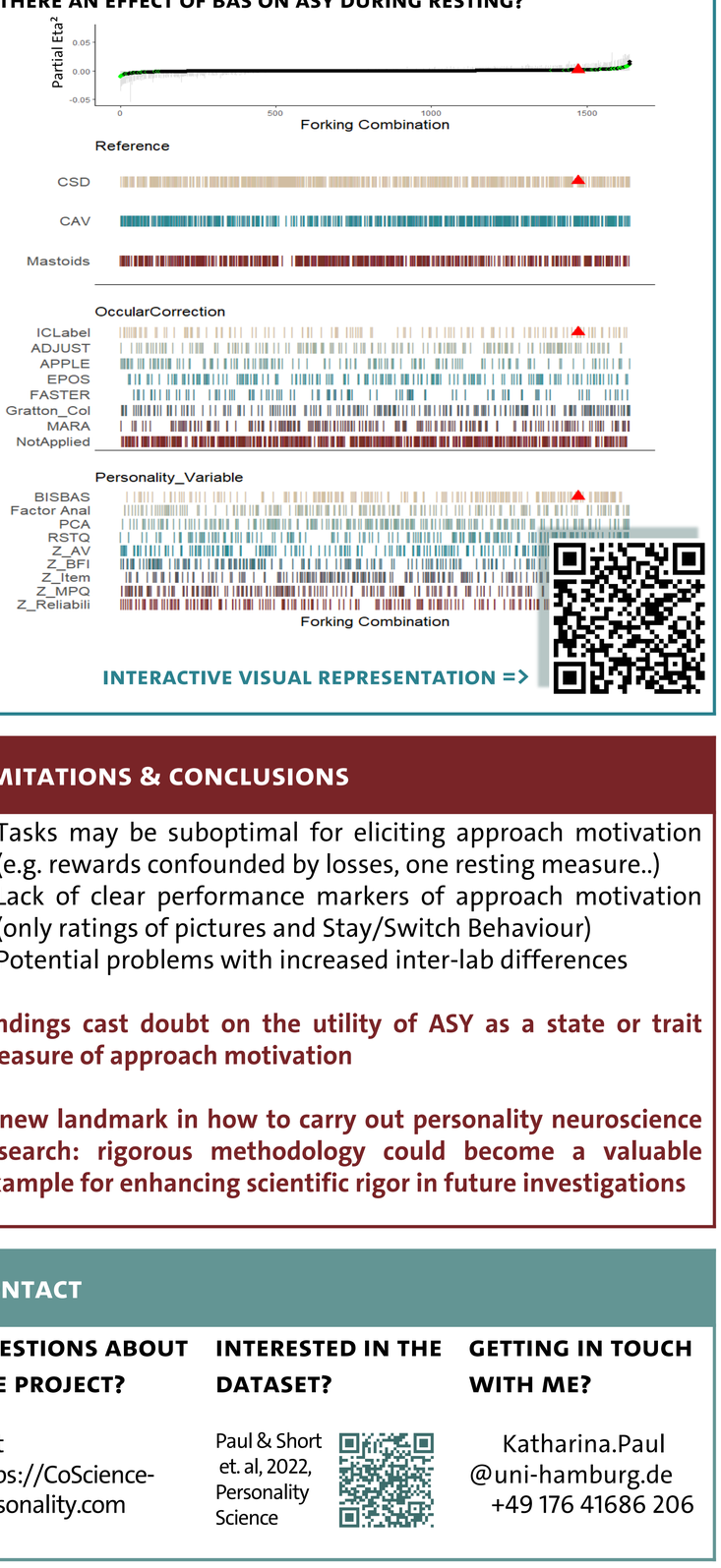


- No association of BAS and ASY during Resting ($F_{1,759}$ = 1.13, p = .289, η_p^2 = .001; positive evidence for H0, BF_{10} = 1e-01, 0.01%; $Mdn_{\eta\ Forks}$ ≤ .001 [-.002, .003], 2.05% significant)
- No association of BAS and ASY during any Phase, neither as a main effect nor as an interaction with any other predictor (all $Fs_{1,780}$ ≤ 2.38, ps ≥.124, $\eta_p^2 s$ ≤ .003; weak to strong evidence for H0, BF_{10} = 9e-13 - 6e-01, 0.58 - 0.11%; $Mdn_{\eta\ Forks}$ ≤ .001 [-.001, .001], 2.71% significant)
- No association of BAS and ASY during consumption of pictures of erotic couples ($F_{6,4653}$ = 0.78, p = .582, η_p^2 = .001; positive evidence for H0, BF_{10} = 1e-01, 0.02%; $Mdn_{\eta\ Forks}$ ≤ .001 [≤ .001, .001], 9.41% significant)

FORKING PATH ANALYSIS

- To assess the robustness against researcher's degrees of freedom during analytical choices, a cFPA (Wacker, 2017b) was carried out
- 30 decisions were forked (referencing, filtering, artefact correction, outlier handling, definition of BAS and ASY....)
- Random subset of 1697 combinations were carried out
- Across the different hypotheses, most forking paths reveal a non-significant effect, without an identifiable pattern on driving choices

IS THERE AN EFFECT OF BAS ON ASY DURING RESTING?



INTERACTIVE VISUAL REPRESENTATION =>

LIMITATIONS & CONCLUSIONS

- Tasks may be suboptimal for eliciting approach motivation (e.g. rewards confounded by losses, one resting measure..)
- Lack of clear performance markers of approach motivation (only ratings of pictures and Stay/Switch Behaviour)
- Potential problems with increased inter-lab differences

Findings cast doubt on the utility of ASY as a state or trait measure of approach motivation

A new landmark in how to carry out personality neuroscience research: rigorous methodology could become a valuable example for enhancing scientific rigor in future investigations

CONTACT

QUESTIONS ABOUT THE PROJECT?

visit https://CoScience-Personality.com

INTERESTED IN THE DATASET?

Paul & Short et. al, 2022, Personality Science

GETTING IN TOUCH WITH ME?

Katharina.Paul @uni-hamburg.de
+49 176 41686 206