Highly expressive moments correspond to less audience synchronisation during a live concert

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INTRODUCTION

- People's strongest musical experiences are most often at live concerts (Lamont, 2011).
- Audience members physiology can synchronise during a concert (Czepiel et al., 2021), and greater brainwave synchrony appears to be related to moments of pleasure (Chabin et al., 2022).

Research Questions
- How does neurophysiological synchronization develop during a performance?
- What is the impact of performance emotional expressivity on synchronization, performance and emotion?

Hypothesis
- Highly expressive moments will correspond with *greater* agreement and synchrony between participants (SD and coherence)
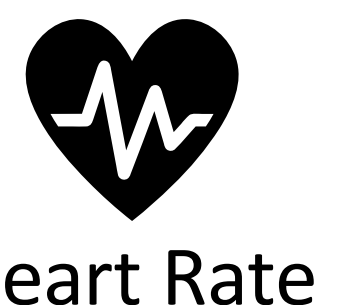
METHODS

- We collected neuro-physiological data and subjective ratings at a concert at the LIVELab (N=20).
- Performers annotated highly expressive moments of their performance.
- In a second online experiment, we collected continuous valence-arousal ratings for two of the pieces from a separate group of participants (N=41).

Concert

Neurophysiology

- EEG
- Heart Rate
- GSR

Music (MIDI and audio recorded)

Set 1
Scarlatti – Sonata in D major, K. 45, Sonata in D minor, K. 213
Schumann – Novelette No. 8 in F sharp minor, Op.21
Prokofiev – Sonata No. 3 in A minor, Op. 28
Chopin – Etude Op. 25, No. 1 "Aeolian Harp" in A Flat Major, Scherzo No. 2 in B flat minor, Op. 31

Set 2
Chopin - Sonata No. 2 Op. 35 in B flat minor
Chopin – Barcarolle Op. 60 in F sharp major
Chopin – Polonaise Fantasy Op. 61 in A flat major

Ratings
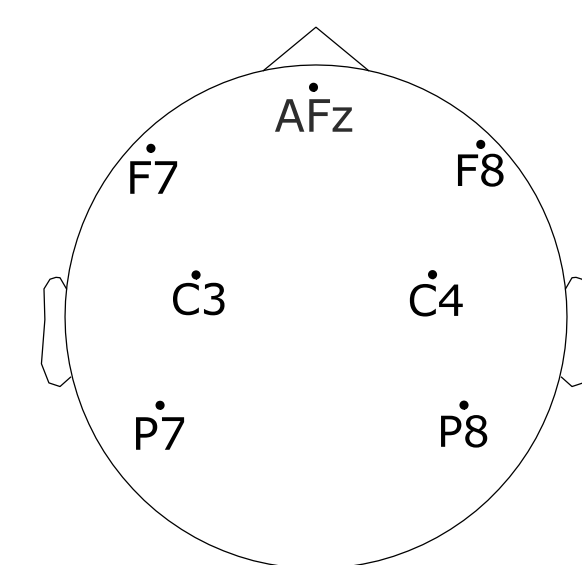9-likert between pieces

Enjoyment

Emotional intensity

Familiarity

Connectedness with performer

Connectedness with audience

Processing
- EEG: Total Interdependence (coherence) in 1-20 Hz (Chabin et al. 2022, Ayrolles et al. 2021 [Hypyp]). Artifact blocking algorithm for movement artifacts (Fujioka et al. 2011).
- GSR: Min/max normalization, phasic GSR extraction via baseline approximation (valley detection and cubic spline interpolation) (Benedek & Kaernbach, 2010).

**Online study**

Music

Set 1
Schumann – Novelette No. 8 in F sharp minor, Op.21

Chopin – Etude Op. 25, No. 1 "Aeolian Harp" in A Flat Major, Scherzo No. 2 in B flat minor, Op. 31

Continuous Ratings
The following are some examples of emotions that might correspond to each section of the rating scales

Please remember to rate what you think the music is trying to convey, which may be different to how you feel in response to the music.
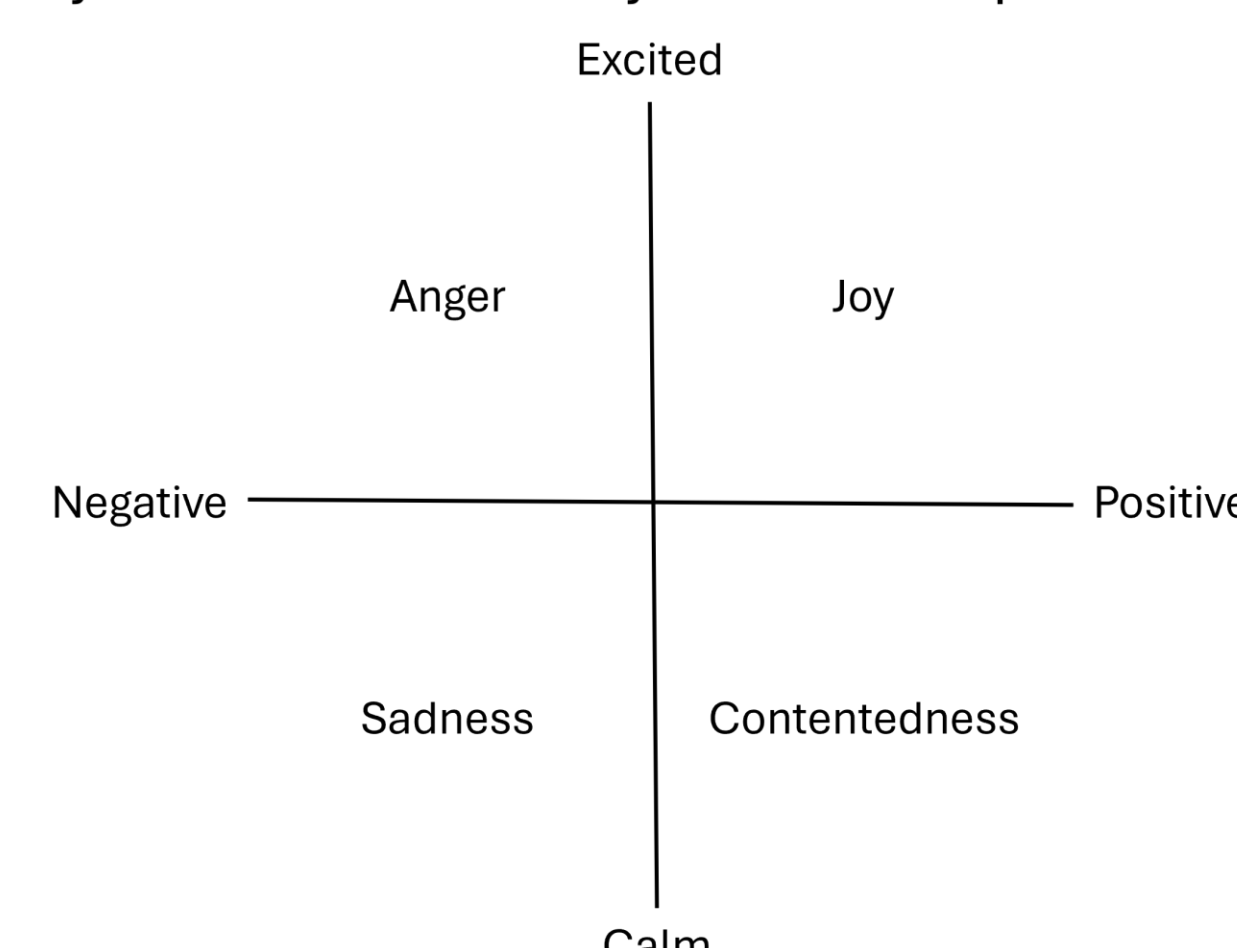
Excited — Anger — Joy — Negative — Positive — Sadness — Contentedness — Calm

Ratings
9-likert between pieces

Enjoyment

Emotional intensity

Familiarity

Connectedness with performer

RESULTS

- No sig. differences in EEG coherence.
- Mixed outcomes in GSR; sig. greater mean GSR for Chopin and higher SD for Schumann.
- Sig. lower mean and greater sd for arousal, lower mean valence for Chopin, and marginally sig. higher mean valence for Schumann.

Chopin / Schumann — EEG (coherence), GSR, Arousal, Valence. Highly expressive: True / False
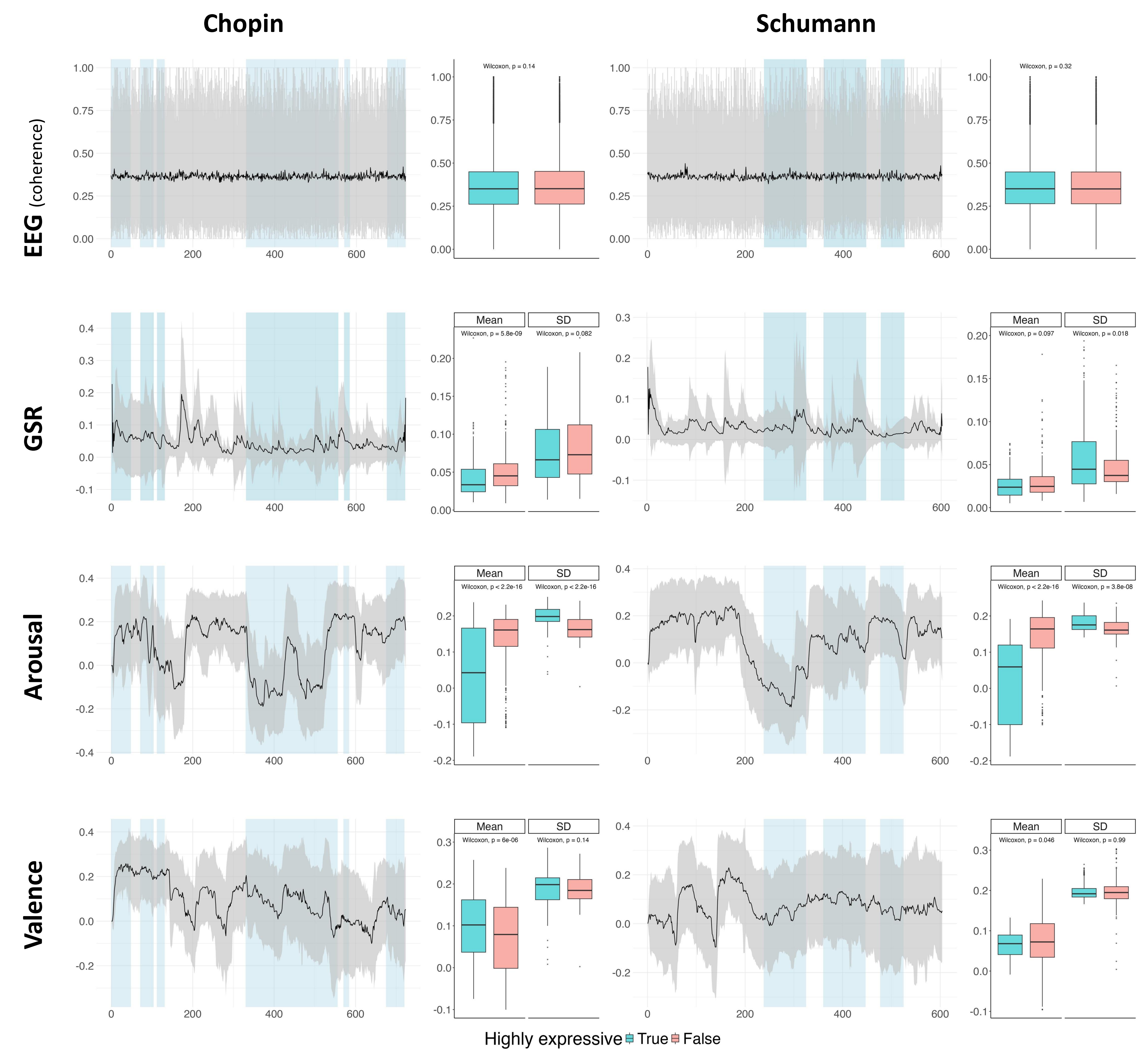
DISCUSSION

- Highly expressive moments correspond to *less* agreement and synchrony between participants.
- Different interpretations of expressive moments? E.g., high vs. low arousal expressive moments.
- Future work:
  - Re(de)fining interpretation of 'expressivity' – segmented vs. continuous.
  - Valence & Arousal -> Tension and/or Expressivity?
  - Looking at audio features e.g., spectral flux.

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