



## Computational models of decision making to identify trait components of vulnerability to anxiety in musicians

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### 1. Background

Continuous exposure to acute stressors in musicians' career can generate music performance anxiety (MPA). Anxiety influences in how the brain altered belief formation and uncertainty estimation in people's learning. The ability to understand the mechanisms that drive pathological feelings of anxiety and the associated alterations in decision-making and uncertainty, may help to improve treatment from MPA musicians [1]. EEG recordings showed that patients with trait anxiety presents alterations in beta oscillations (13-30 Hz), located in contralateral sensorimotor and prefrontal cortex [2]. And this can explain anxiety-related learning alterations.

### 2. Aims

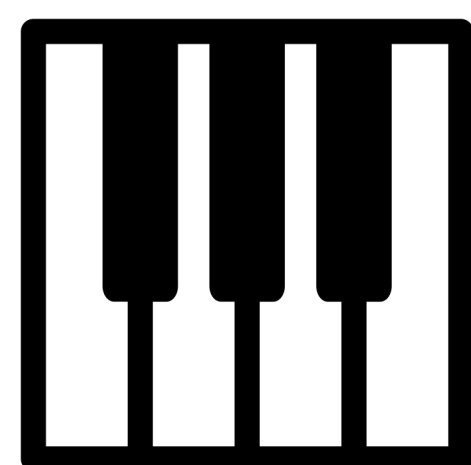
- Development of a hierarchical Bayesian model to assess learning biases and decision making under uncertainty in musicians with different levels of anxiety.
- Investigate modulation in the amplitude of beta oscillations in association with updating beliefs about the hidden dynamics of the melody.

### 3. Research question

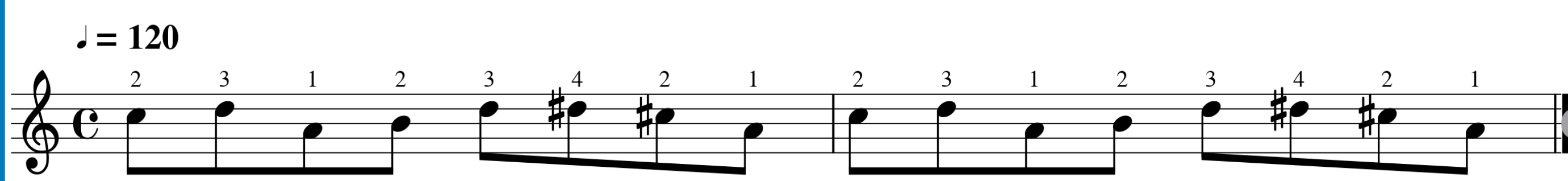
- Piano players learn more faster with punishment - based learning?
- Beta oscillations increase with reward - based learning while beta oscillations decrease with punishment - based learning?

### 4. Study design

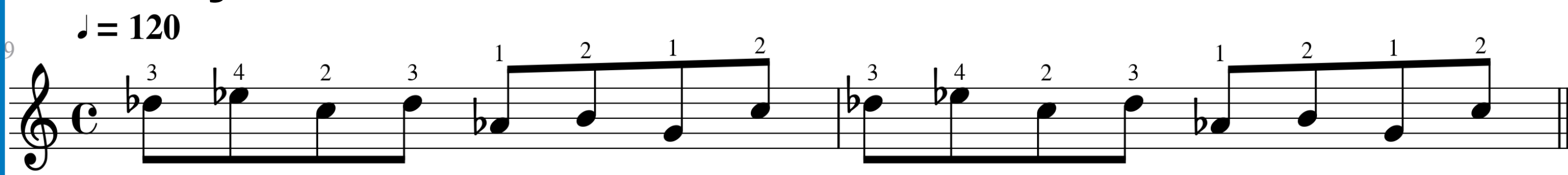
- EEG (64 electrodes, extended international 10–20).
- Within-subject design with 40 participants (right-hand).
- 2 feedback: positive or negative
- 2 different melodies (100 trials each)



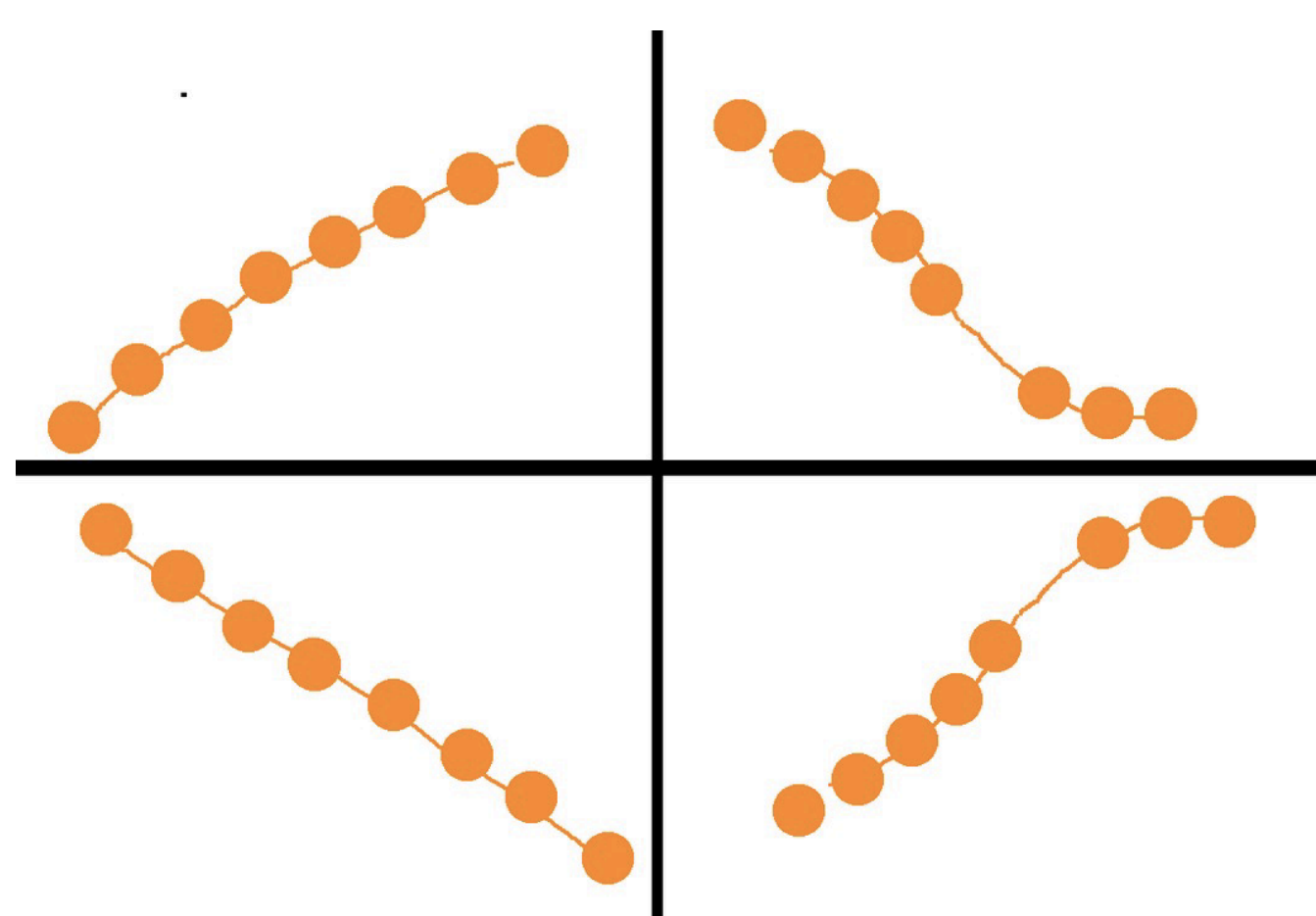
#### Melody 1



#### Melody 2

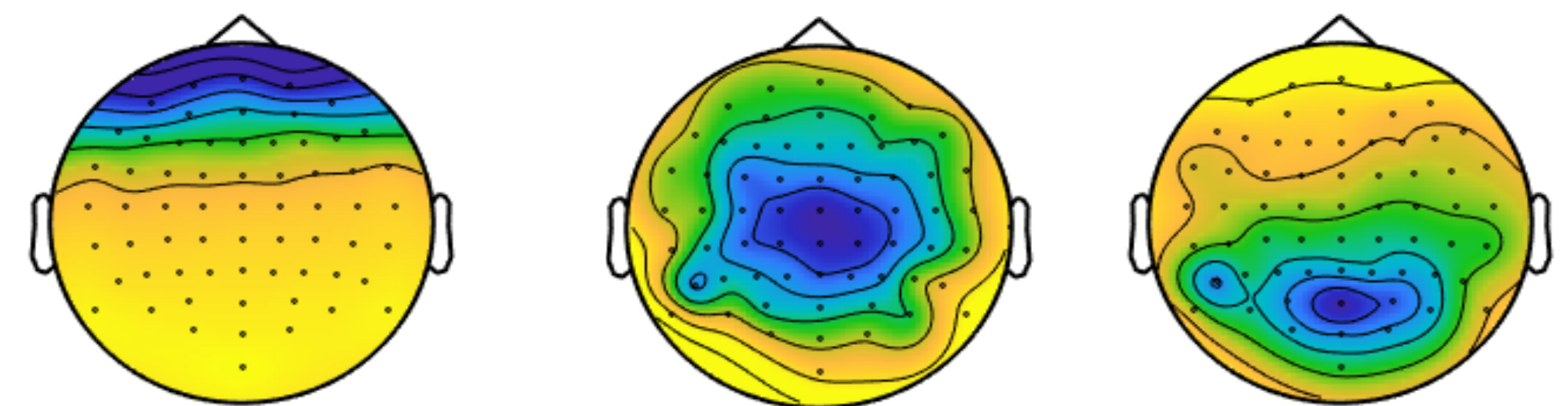


- Participants' aim: find the hidden dynamics of the melodies.

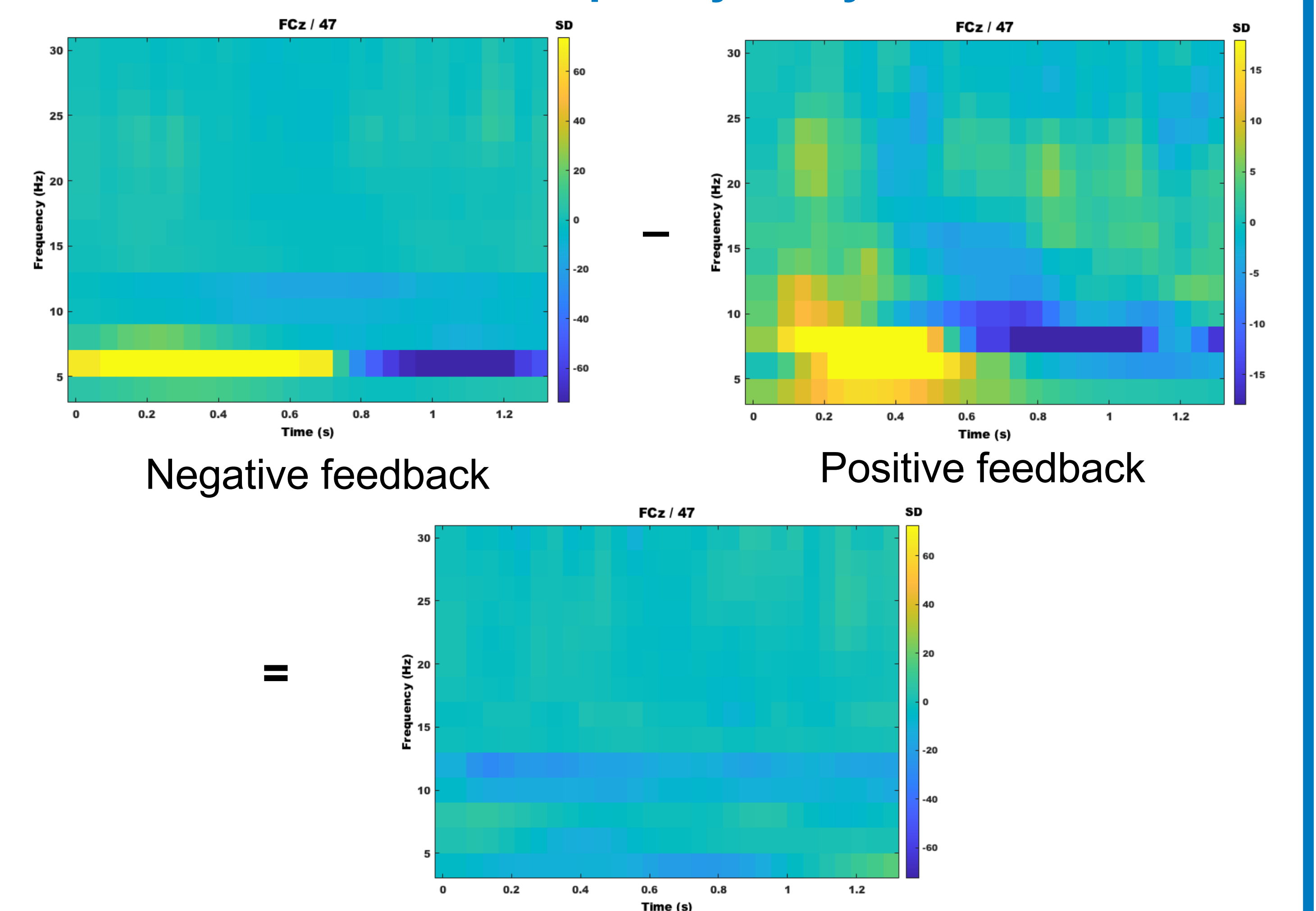


### 4. EEG pre-processing

- Apply a high-pass and notch filter (EEGLAB toolbox).
- ICA-based artifact correction and visualisation with manual component rejection (FieldTrip toolbox).



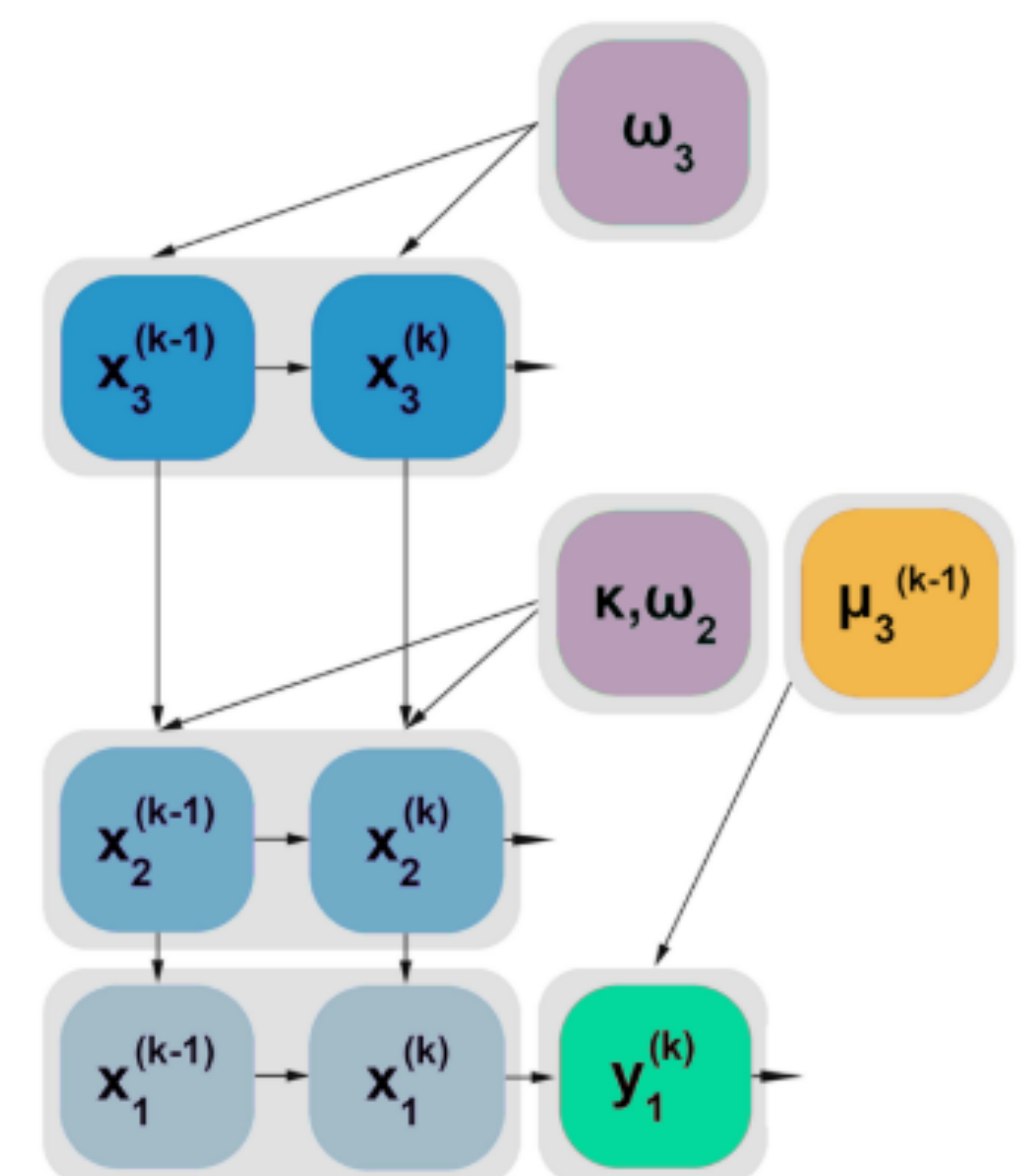
### 5. Time - frequency analysis



### 6. Next steps

- To assess belief updating: a Hierarchical Gaussian Filter (TAPAS).
- Computational trajectories using: convolution modelling for oscillatory response (SPM).
- Beta activity changes during learning: non-parametric permutation test (FieldTrip toolbox).

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[1] Aylward, J., Valton, V., Ahn, W. Y., Bond, R. L., Dayan, P., Roiser, J. P., & Robinson, O. J. (2019). Altered learning under uncertainty in unmedicated mood and anxiety disorders. *Nature Human Behaviour*, 3(10), 1116–1123.

[2] Sporn, S., Hein, T. P., & Ruiz, M. H. (2018). Alterations in the amplitude and burst distribution of sensorimotor beta oscillations impair reward-dependent motor learning in anxiety. *BioRxiv*, 1–40

[3] Hein, T. P., Cagg, Z., Ivanova, M., Ruiz, M. H., Fedele, T., & Nikulin, V. (n.d.). anxiety in humans, 2023.