

Different Oscillatory Networks underlie reward processing of novel and familiar music

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Background

Listening to pleasant music is related to brain activity in reward processing areas, such as the *striatum*, along with cortical areas that engage in music processing, such as the *superior temporal gyrus* and *right inferior frontal gyrus*. All these areas form a functional network during pleasant music listening [1].

However, little is known about the temporal dynamics of these brain interactions. In the present study we explored phase synchronization between EEG channels in an oscillatory band of interest (theta) in order to study the oscillatory signature of the networks underlying music-evoked pleasantness.

Study 1

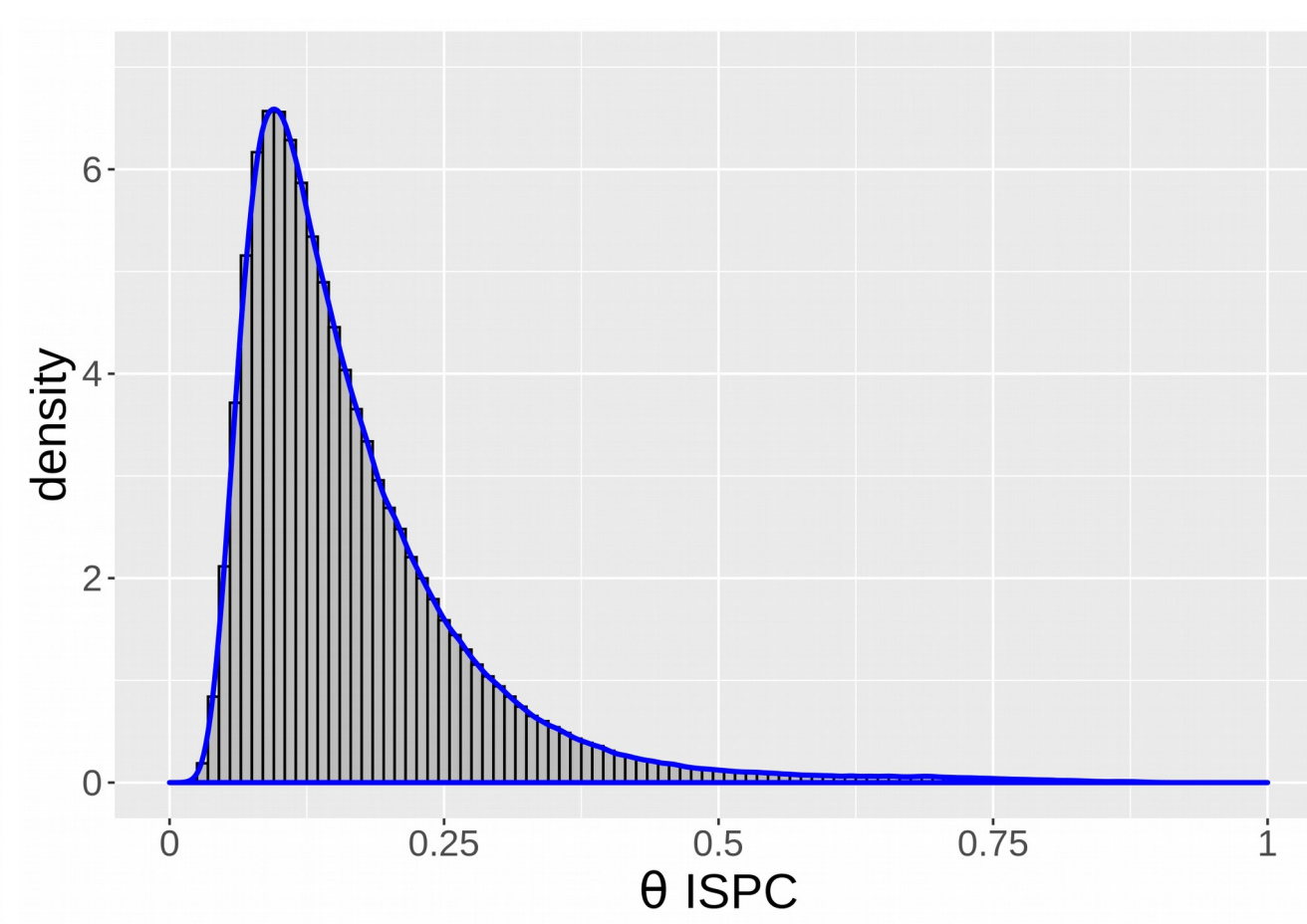
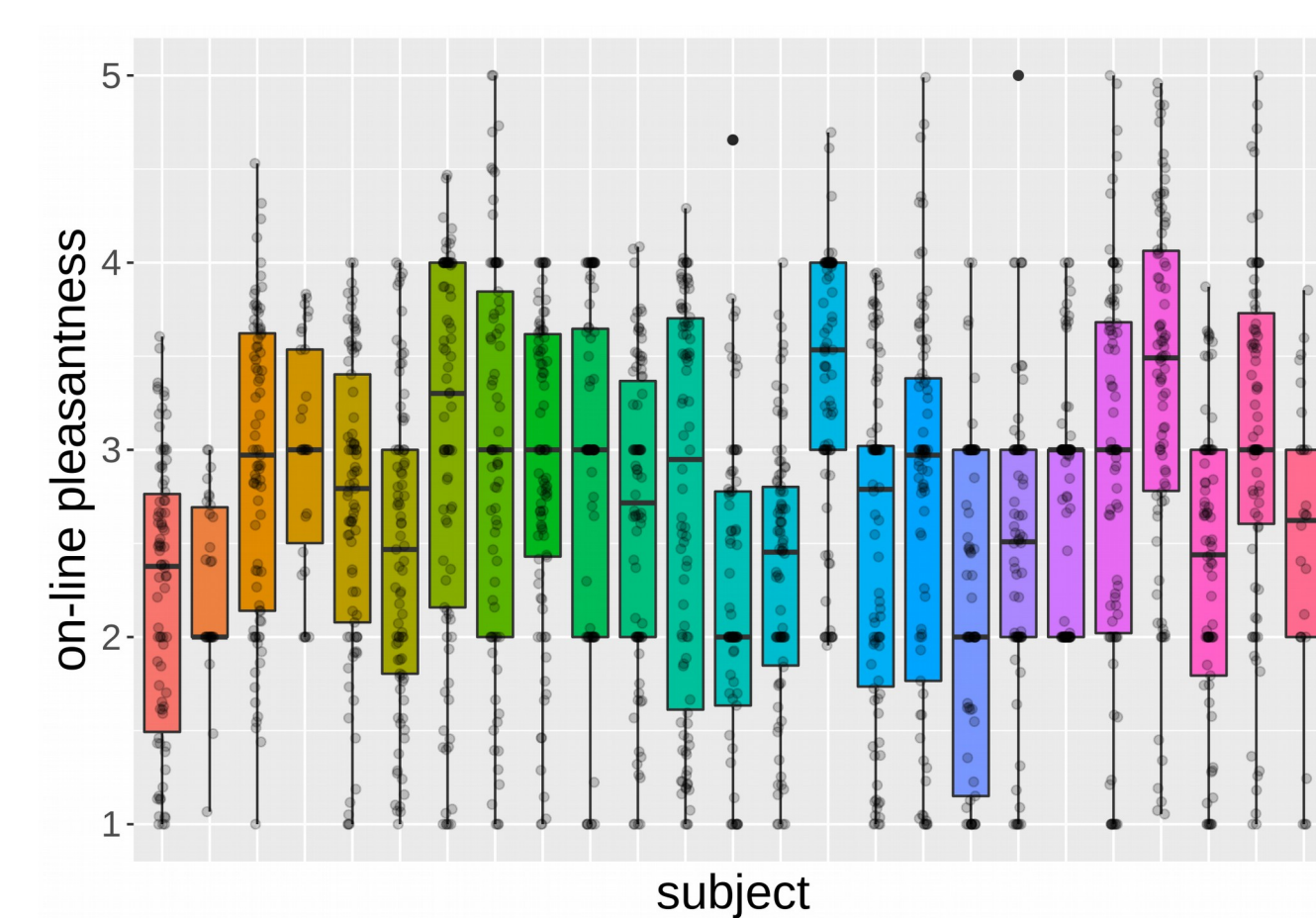
Methods

1. Twenty-two participants listened to 30 music excerpts (from a pool of 60) whilst continuously rating the degree of evoked pleasantness. Each excerpt's online pleasantness was computed as the average of the given responses weighted by the time each one was held.

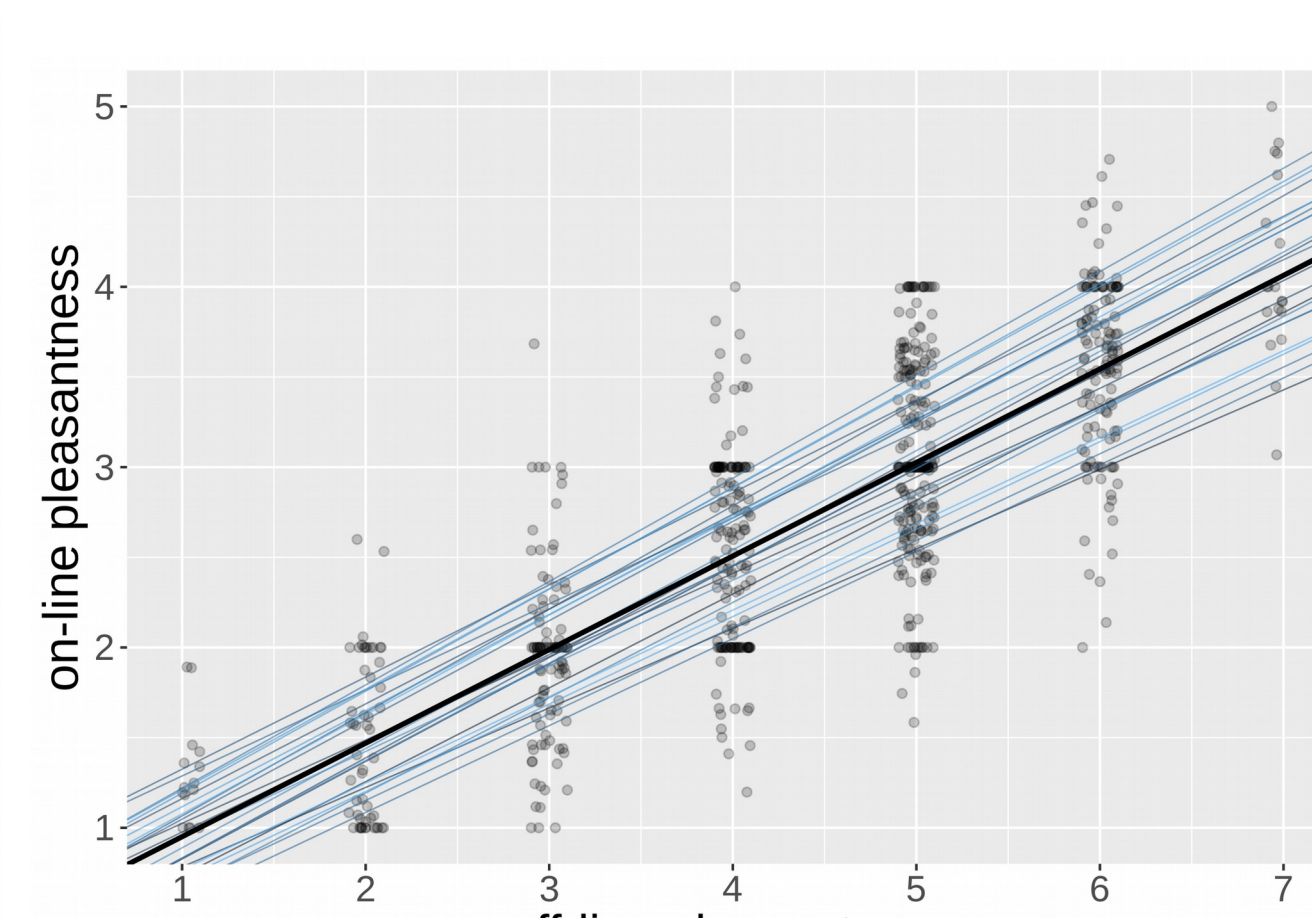
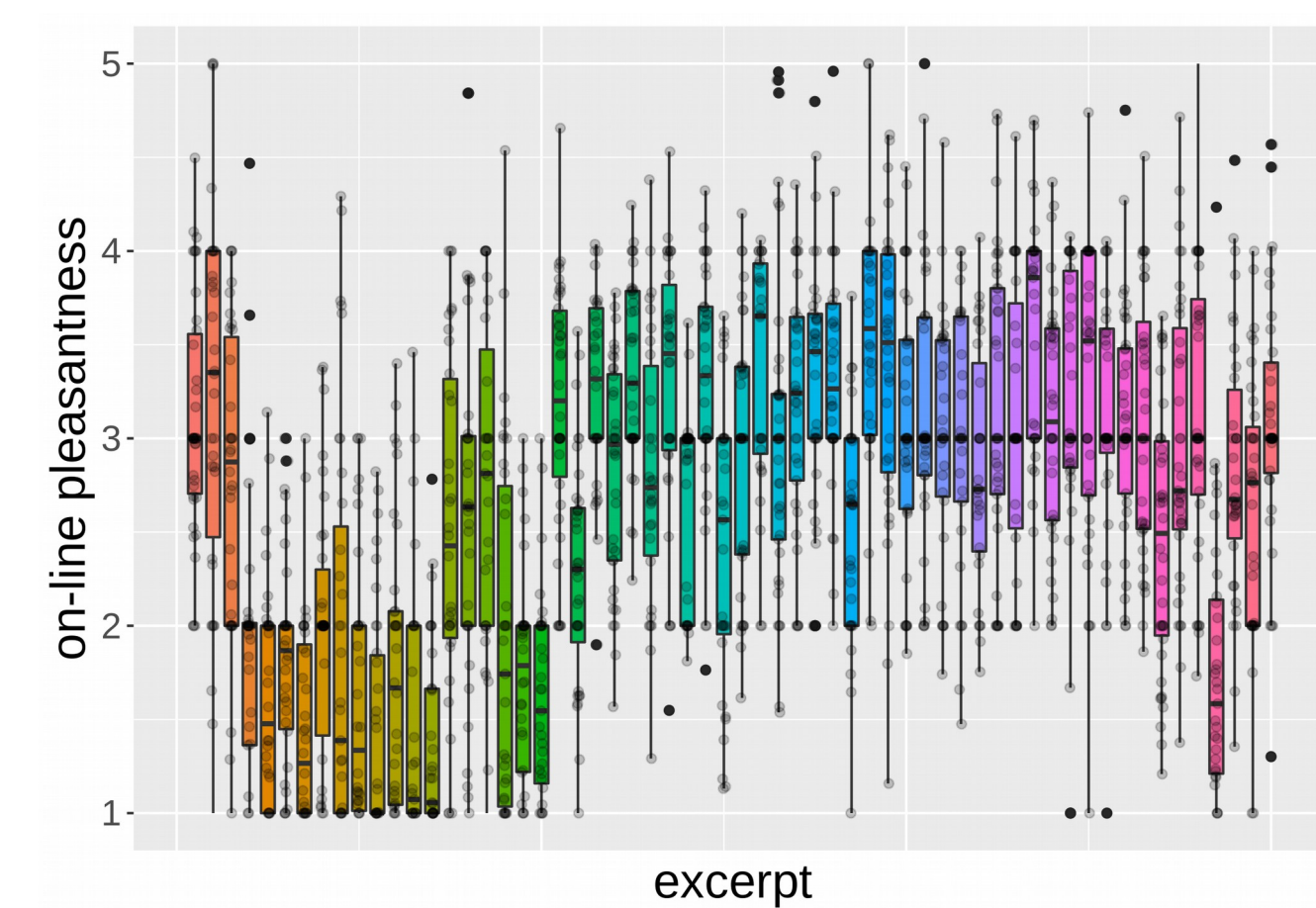
2. Epochs consisted in the whole music fragments excluding the first and last 2 seconds. Time-frequency analysis was carried on the spatially filtered data in order to obtain the *inter-site phase clustering* (ISPC) over time for every pair of EEG channels in **theta** (4-8 Hz).

3. ISPCs were regressed on reported pleasantness using multilevel Bayesian estimation in a mass-univariate analysis. A Beta likelihood was assumed to explain the data since ISPC values are non-normally distributed in the unit interval.

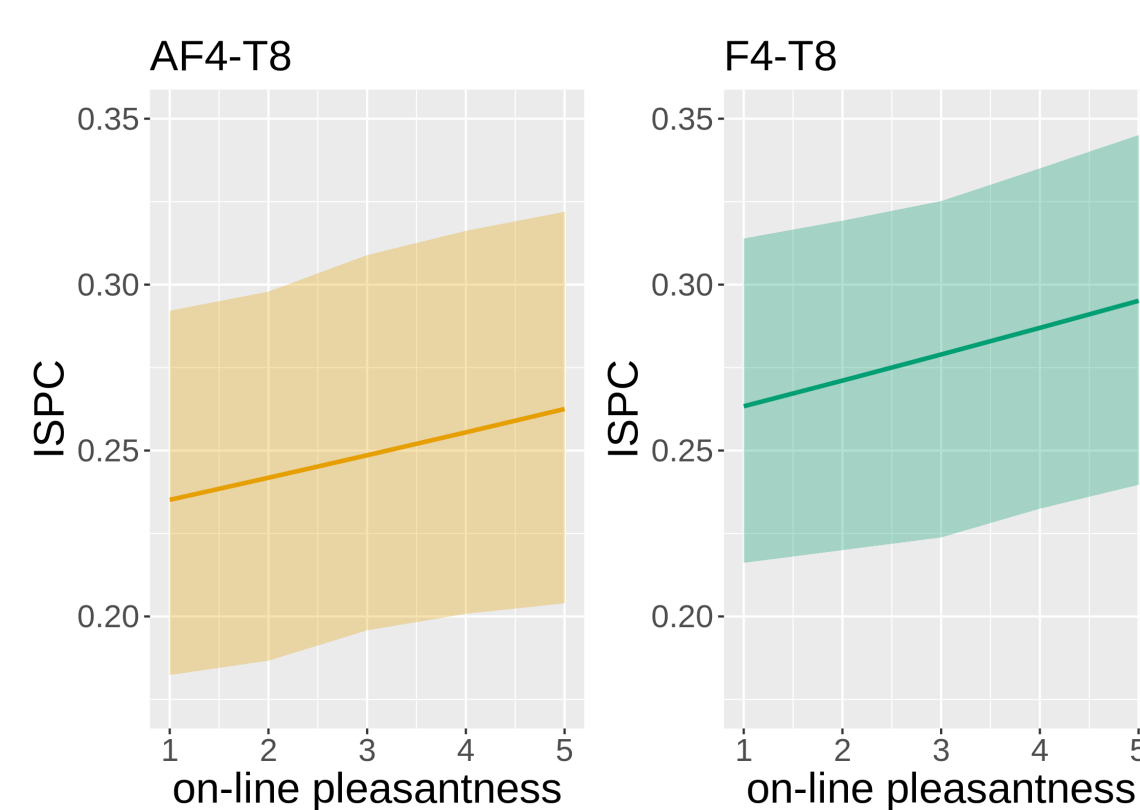
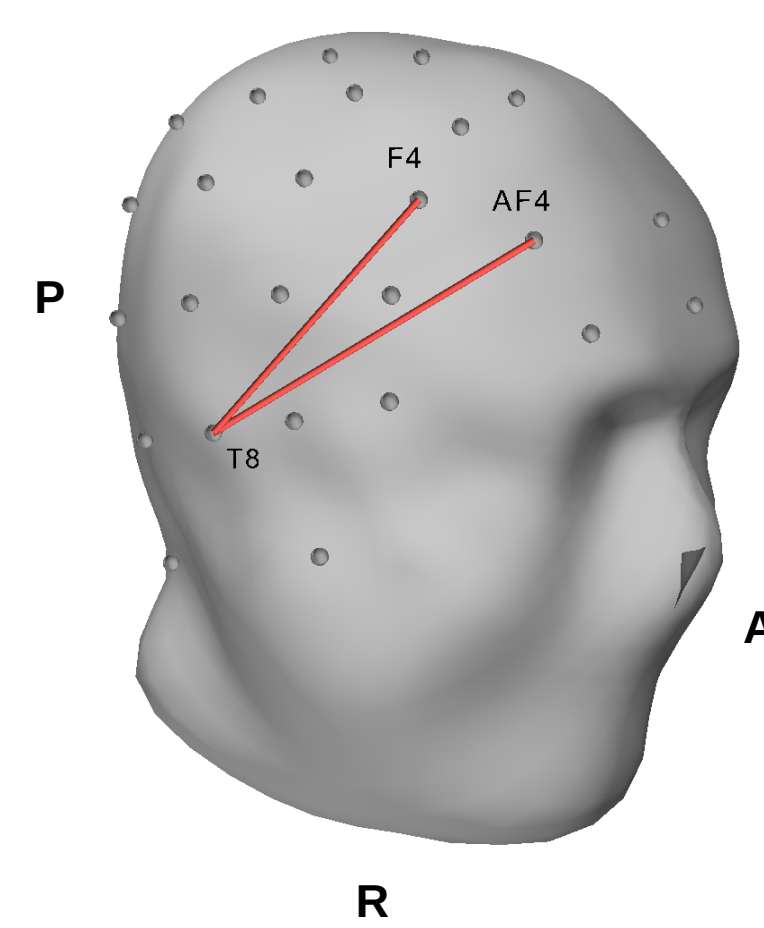
Results



B. Distribution of ISPC values.



C. Reported pleasantness was highly predicted by an overall liking likert scale.



D. Right fronto-temporal connections showed an increase in synchronization with greater reported pleasantness.

A. Distribution of reported pleasantness per subject (top) and excerpt (bottom).

Study 2

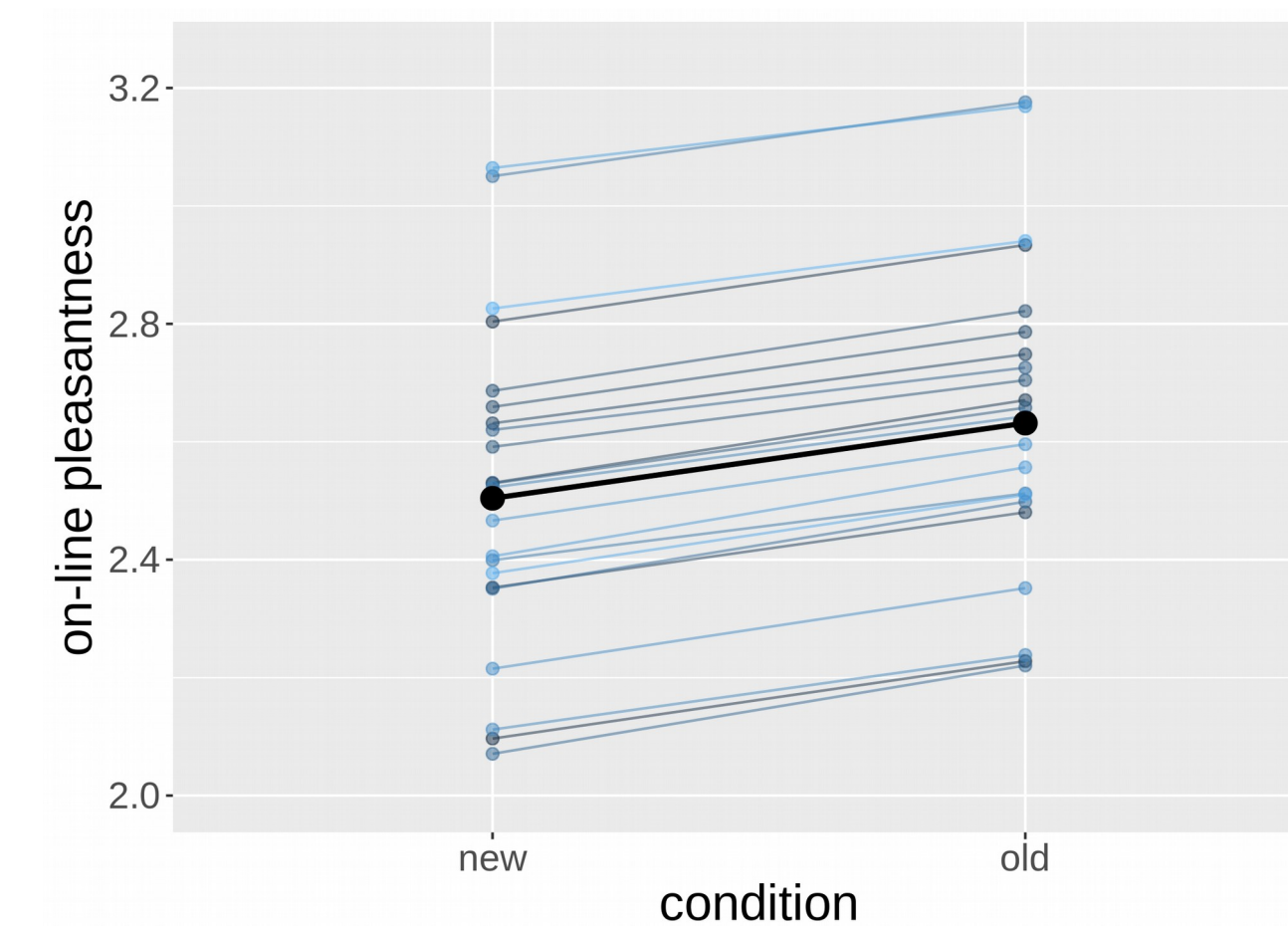
Methods

1. The same participants underwent the same paradigm 24 h later, listening to the same old 30 excerpts plus 30 new excerpts.

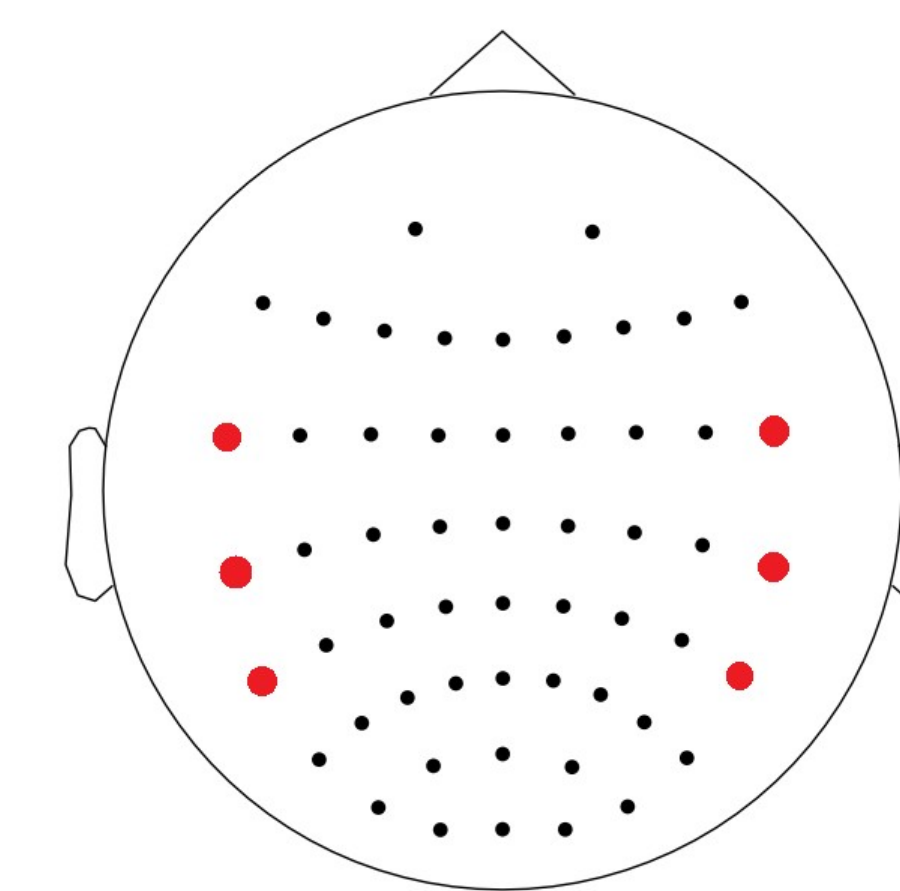
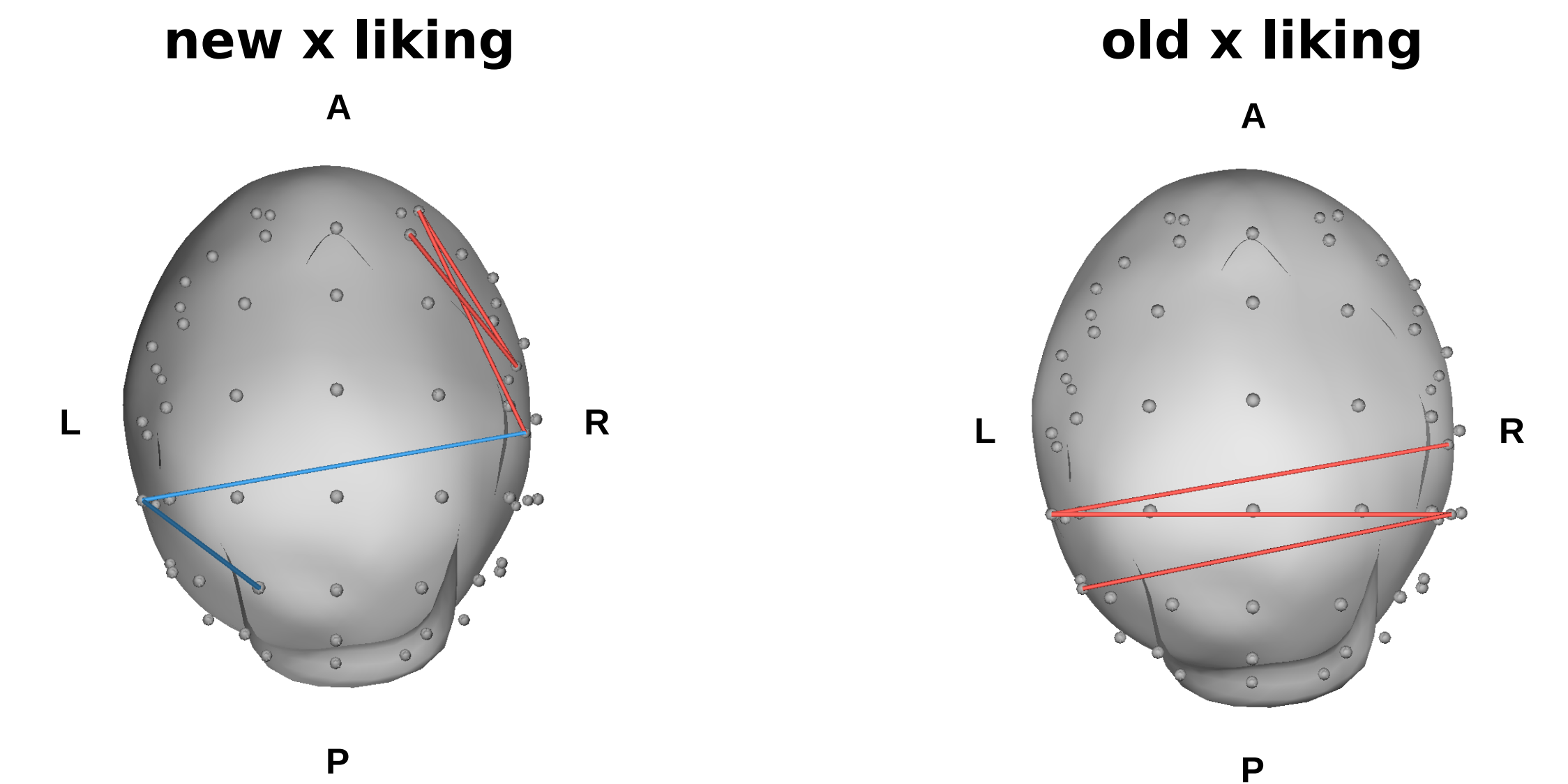
2. Trials from this session were divided into least liked vs. most liked with a median split on reported pleasantness for each subject.

3. A mass-univariate moderation analysis (liking x familiarity) was carried on all connections involving temporal channels in **theta**.

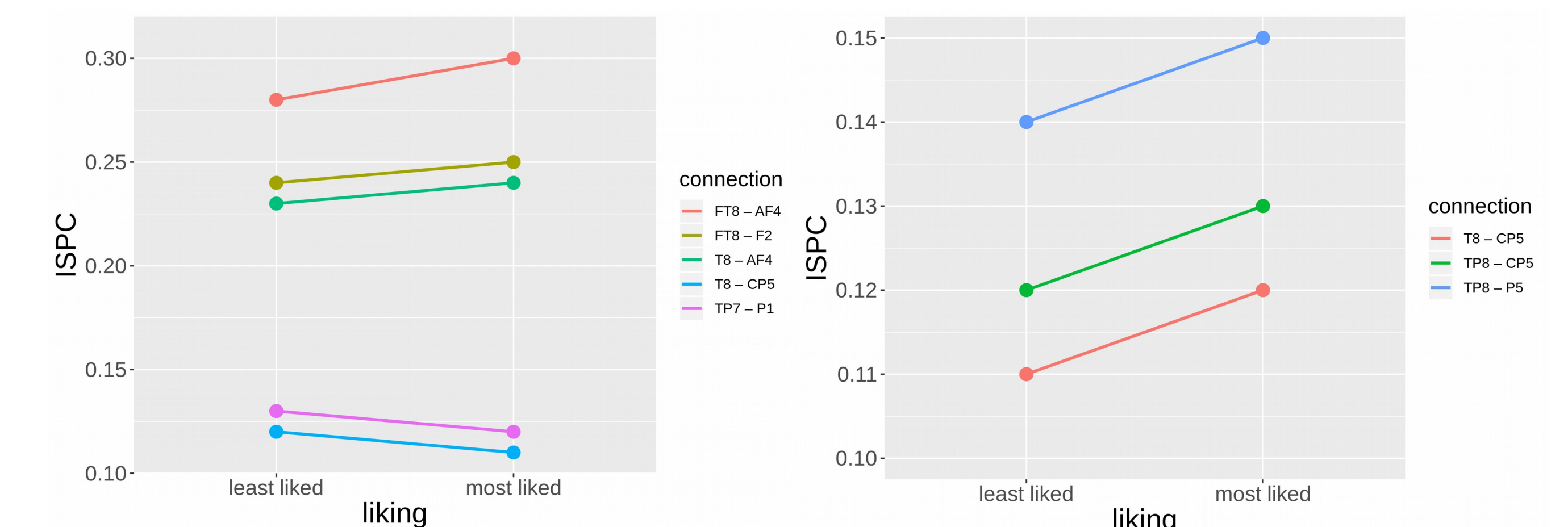
Results



A. Reported pleasantness was higher for old songs.



B. Seed electrodes for connectivity computation.



C. For new excerpts (left), right fronto-temporal connections increased in synchronization with greater liking. Bilateral temporo-parietal connections showed a decrease. For old excerpts (right), right temporal to left parietal connections showed an increase.

Conclusions

• Results in **Study 1** are in agreement with previous literature showing a right lateralization during music processing [1], greater frontal theta activity during pleasant music listening [2] and greater theta phase synchronization among areas supporting **auditory working memory** [3] and **auditory prediction error** [4]. These mechanisms have been hypothesized to be of utmost relevance for music-reward processing [5].

• Results in **Study 2** suggest that the aforementioned mechanisms underlie music-reward processing when music is unfamiliar. In turn, liking familiar songs appears to be supported by temporal-parietal interactions, also in theta, a mechanism that might be related to **memory retrieval** [6] during **auditory processing**. Importantly, these interactions appear to be disengaged when liking unfamiliar music.

References

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Acknowledgements

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