

Exploring the link between neural entrainment and altered states of consciousness through electronic music

SCAN TO GET THE POSTER!

Aparicio-Terrés, R.^{1,2}, López-Mochales, S.^{1,2}, Díaz-Andreu, M.^{3,4,5}, Escera, C.^{1,2,4,6}

¹ Brainlab - Cognitive Neuroscience Research Group, Department of Clinical Psychology and Psychobiology, University of Barcelona

² Institute of Neurosciences, University of Barcelona

³ Department of History and Geography, University of Barcelona

⁴ Catalan Institution for Research and Advanced Studies (ICREA)

⁵ Institute of Archaeology of the University of Barcelona

⁶ Institut de Recerca Sant Joan de Déu (IRSJD)



INTRODUCTION

Music plays a pivotal role in all ritualistic contexts. Its sonic characteristics change depending on its function. In electronic music festivals, the **highly rhythmic and repetitive beats of electronic music** seem to trigger an altered states of consciousness (ASCs) similar to a **dissociative state**¹.

From a neuroscientific standpoint, several neural mechanisms have been suggested to explain how exposure to repetitive stimulation might induce ASCs. The one that has received the most attention is **entrainment**, the natural synchronization of brainwaves to the phase of periodic external stimuli².

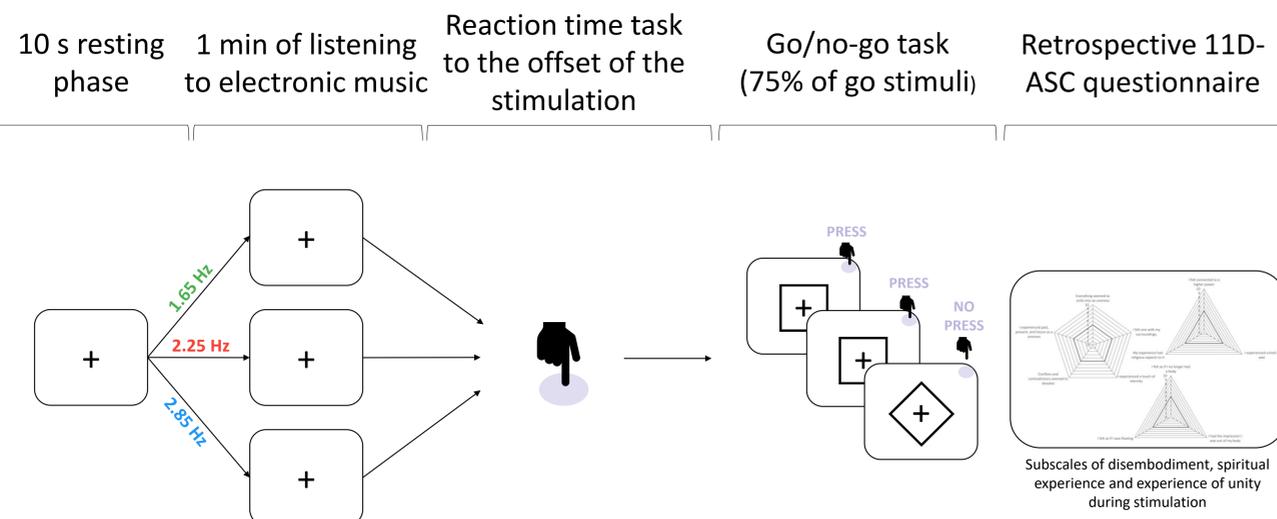
The relationship between entrainment and ASCs has not been systematically explored before. To shed light on this relationship, we drew upon the finding that the rate at which repetitive auditory stimuli are presented modulate the magnitude of entrainment, **reaching a peak at around 2 Hz**³. By manipulating the beat frequency of electronic music, it is possible to investigate whether there is a correlation between an increase in entrainment and a greater manifestation of dissociative characteristics.

AIM To explore the relationship between entrainment and ASCs by manipulating the beat frequency of electronic music

METHODS

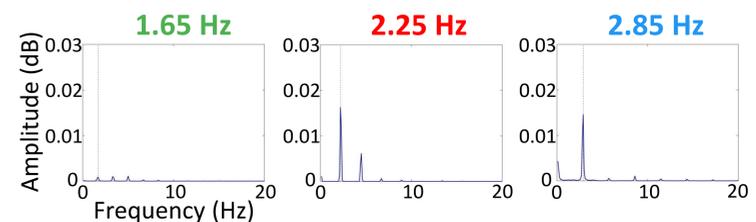
PROCEDURE

19 participants listened to 1-minute long electronic music extracts with different beat frequencies (1.65 Hz, 2.25 Hz and 2.85 Hz) in a repeated-measures design.

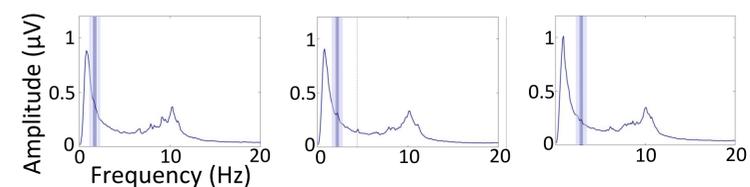


ANALYSIS OF ENTRAINMENT

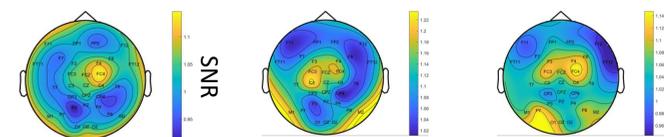
1. Determine the beat frequency



2. Fast-Fourier Transform of the neural responses



3. Signal-to-Noise Ratio at the significant harmonics

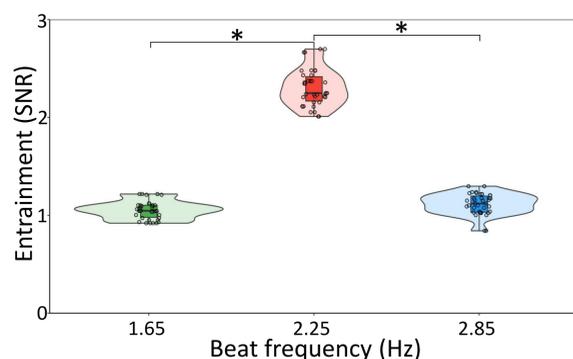


EEG recordings: **ENTRAINMENT**

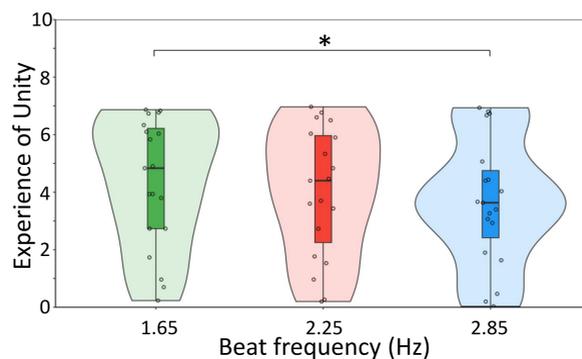
Behavioral tasks: **ALTERED STATE OF CONSCIOUSNESS**

RESULTS

1. Entrainment was higher for the musical extracts at 2.25 Hz compared to the musical extracts with faster and slower beat frequencies

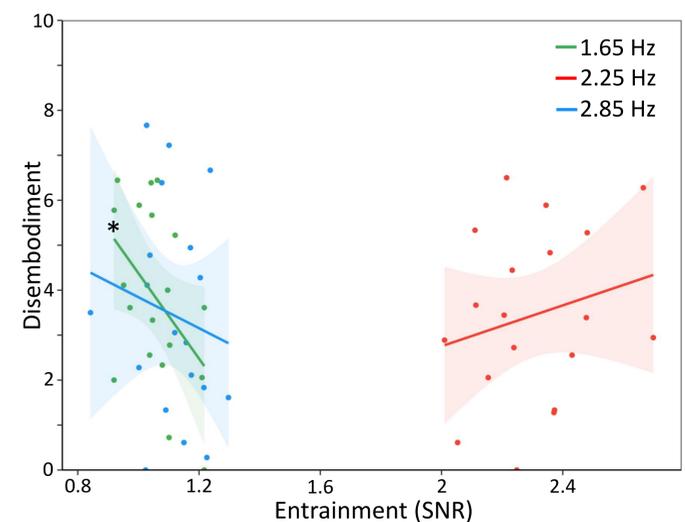


2. Participants felt more unity when listening to the fastest musical extract at 2.85 Hz compared to the slowest one at 1.65 Hz



3. There were no differences in cognitive function between musical extracts with different beat frequencies

4. For the musical extracts at 1.65 Hz, the less entrainment, the more feelings of disembodiment participants experienced



CONCLUSIONS

Consistent with previous findings, we found that entrainment is modulated by the beat frequency, reaching a peak at 2.25 Hz. This is the first report showing that entrainment is related to ASCs. Specifically, the less entrainment to the beat frequency, the more feelings of disembodiment, only when listening to music at 1.65 Hz. This finding provides a potential physiological mechanism to explain the usage of repetitive sounds to trigger ASCs.

REFERENCES

1 Tramacchi D. T. Field tripping: Psychedelic communitas and ritual in the Australian bush. *J Contemp Relig.* 2000 May;15(2):201-213
 2 Large E. W., Snyder J. S. Pulse and meter as neural resonance. *Ann N Y Acad Sci.* 2009;1169:46-57
 3 Will U, Berg E. Brain wave synchronization and entrainment to periodic acoustic stimuli. *Neurosci Lett.* 2007 Aug 31;424(1):55-60



The Artsoundscapes Project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 programme (GA No. 787842).