Neurophysiological Responses in Prefrontal Regions Differ Between Musicians and Non-Musicians

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Background

Studies converge to strongly support an association between musical training and enhanced neural circuitries[1,2]. Musicians have notably been reported to perform better than non-musicians on tasks that require inhibitory control (IC), a critical component of executive functioning[3,4]. However, the exact neural mechanisms underlying this improvement in IC remain poorly understood.

Inhibitory control: the ability to control one's attention, emotion, and thoughts in order to suppress irrelevant internal or external interference and to attend to what is needed or appropriate[5].

Goals:

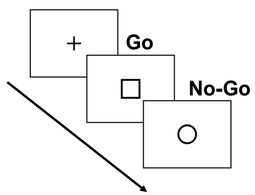
- to replicate previous studies that reported the neural correlates of IC to be altered in musicians.
- to investigate differences in cortical excitation and inhibitory mechanisms between musicians and non-musicians in several brain regions.
- to assess whether these measures of cortical neurophysiology underly IC differences.

Methods

45 healthy participants were recruited:

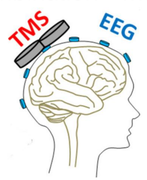
- 21 musicians (mean age 21.4 – range 17-24 years)
- 24 non-musicians (mean age 20.6 – range 18-25 years)
- No history of a neuropsychiatric illness

Differences in inhibitory control were assessed by measuring the event-related potentials (ERP) in a visual Go/No-Go task[6].

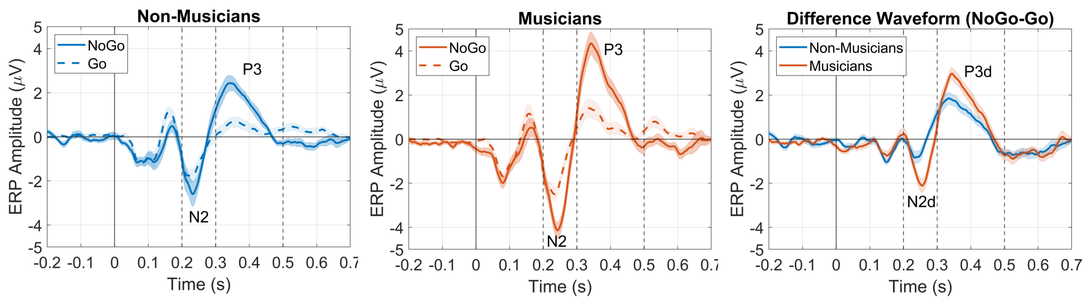


Transcranial magnetic stimulation in combination with electroencephalography (TMS-EEG) was used to measure cortical reactivity and connectivity in six regions of interest:

- Bilateral DLPFC
- Bilateral motor cortex
- Bilateral intraparietal lobule



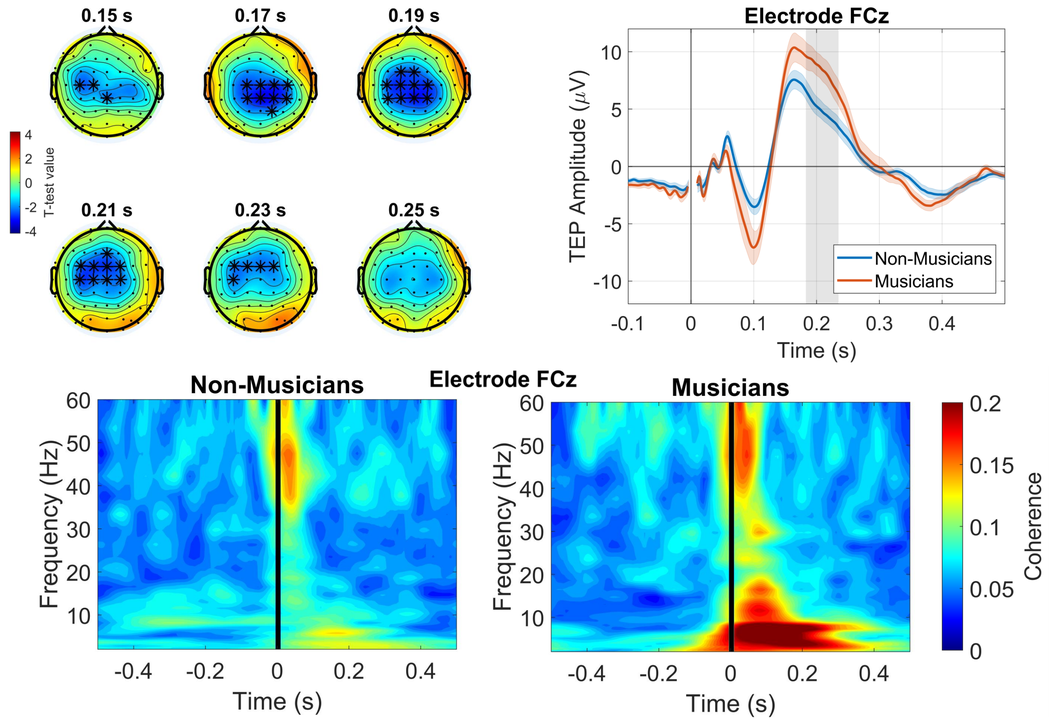
ERP Results in Frontocentral Region



Musicians exhibited greater positive amplitude in P3 in Go and No-Go waveforms.

Musicians exhibited greater negative amplitude in N2d in difference waveform.

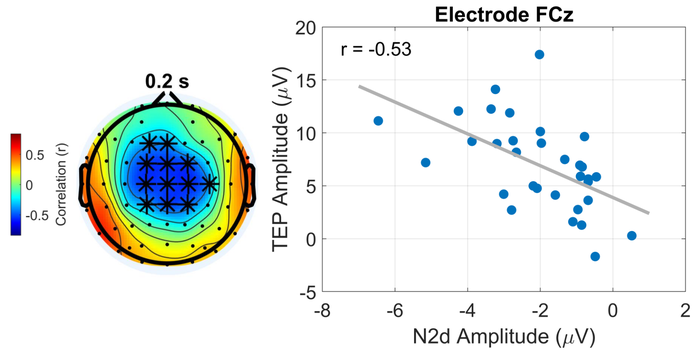
TMS-EEG Results in Right DLPFC



Musicians exhibited greater cortical reactivity and connectivity in the right DLPFC.

No significant differences in the five other regions.

Correlation between ERP and TEP



Correlation between N2d ERP and TEP components in the right DLPFC.

No correlation between ERP and TEP components in the five other regions.

Conclusion

- Neural correlates of inhibitory control are altered in musicians.
- Neurophysiological responses seems to differ between musicians and non-musicians in the right DLPFC specifically.
- Cortical reactivity in the right DLPFC might underly the inhibitory control differences observed between musicians and non-musicians.

References

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