

Transcranial random noise stimulation enhances retention performance after training of a complex cognitive task.

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Introduction

Transcranial Random Noise Stimulation (tRNS) :

- Learning reinforcement of complex task management
- Inducing noise in the neural system
- Effects and mechanisms still in debate¹

The Space Fortress videogame :

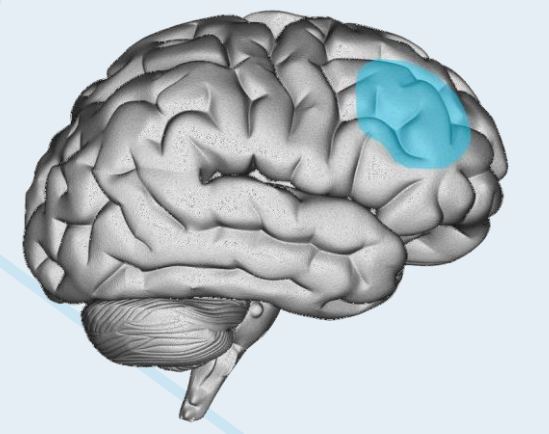
- Pseudo ecological task
- Designed to study complex task learning²
- One week training

rDLPFC
right Dorsolateral Prefrontal Cortex

complex task management³

Objectives

- To assess the effect of tRNS over behavioral performance in complex task training
- Target : right Dorsolateral Prefrontal Cortex (rDLPFC)
- Based on Snowball et al. (2013)⁴



Hypothesis

Better long-term and retention performances for the stimulated group compared to sham.

Methods

The Space Fortress Game



Total Score

Sum of 4 Sub-Scores

Fortress Score

Flight Score

Mine Score

Bonus Score

40 Healthy Participants

randomly assigned

STIM

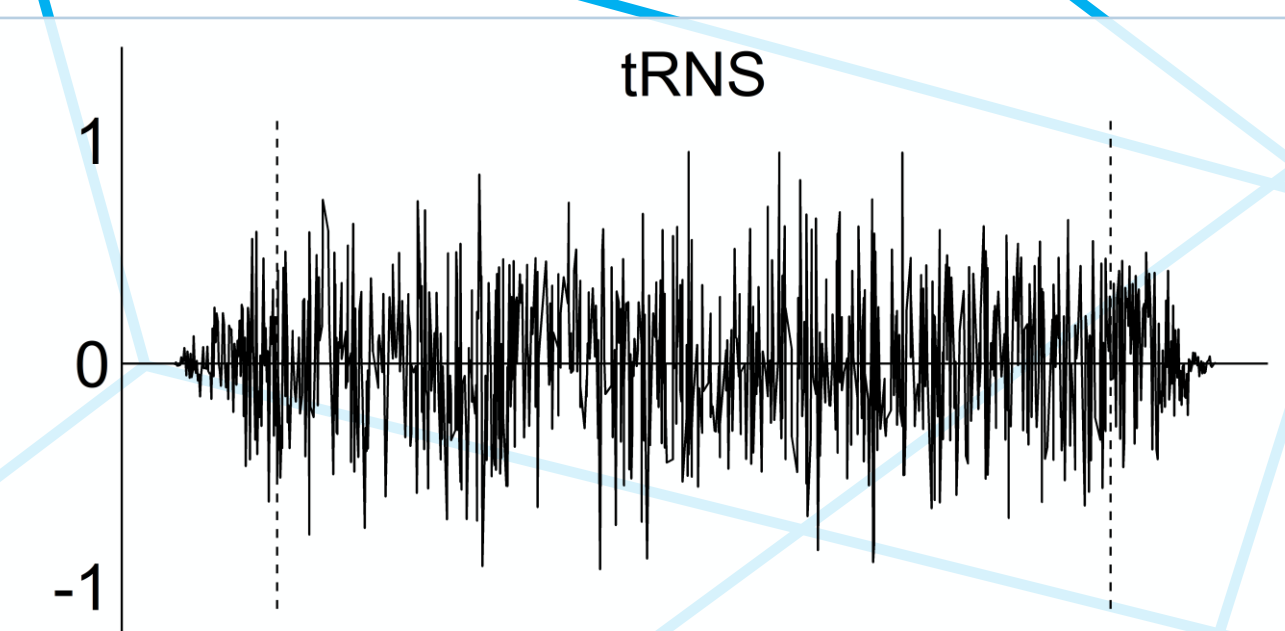
SHAM

Each participant performed 11 game sessions (GS) over 7 consecutive days and 2 GS 10 days later.

1 Game Session :

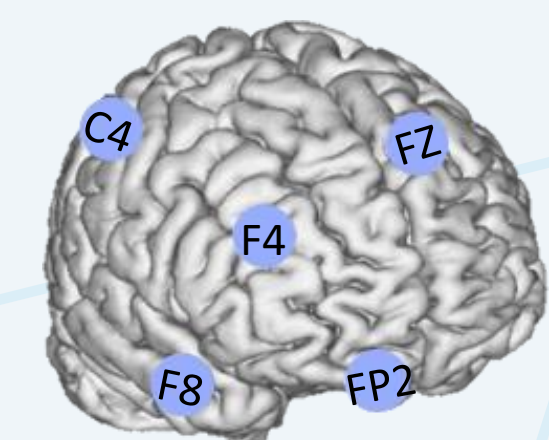
2 * 10" Space Fortress

20" Stimulation (STIM or SHAM)



Random noise Stimulation pattern

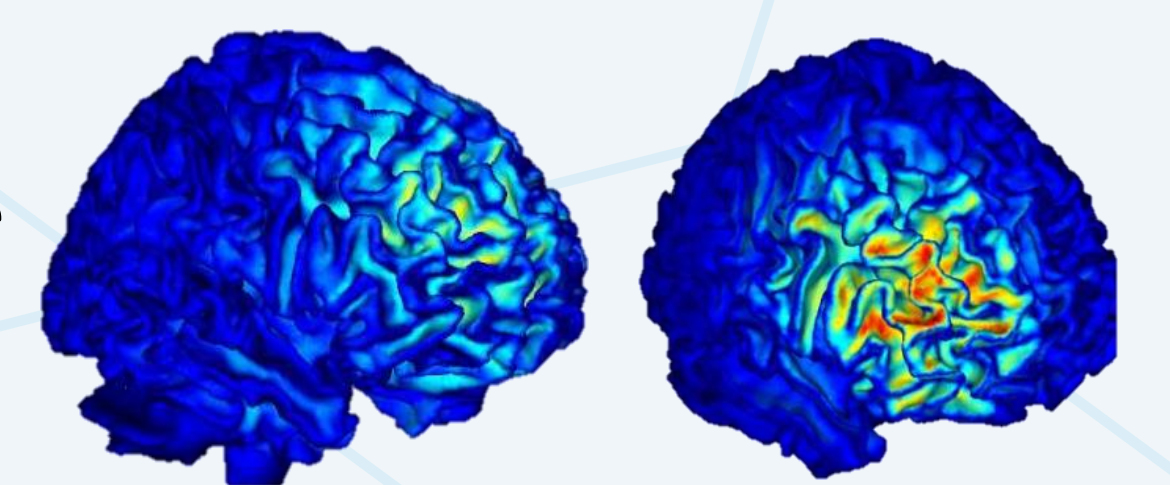
Montage



SHAM

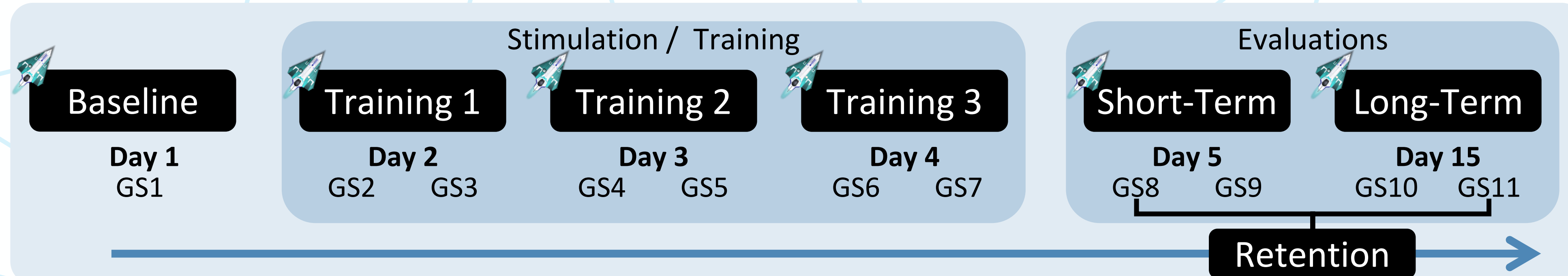
tRNS

Influence Map



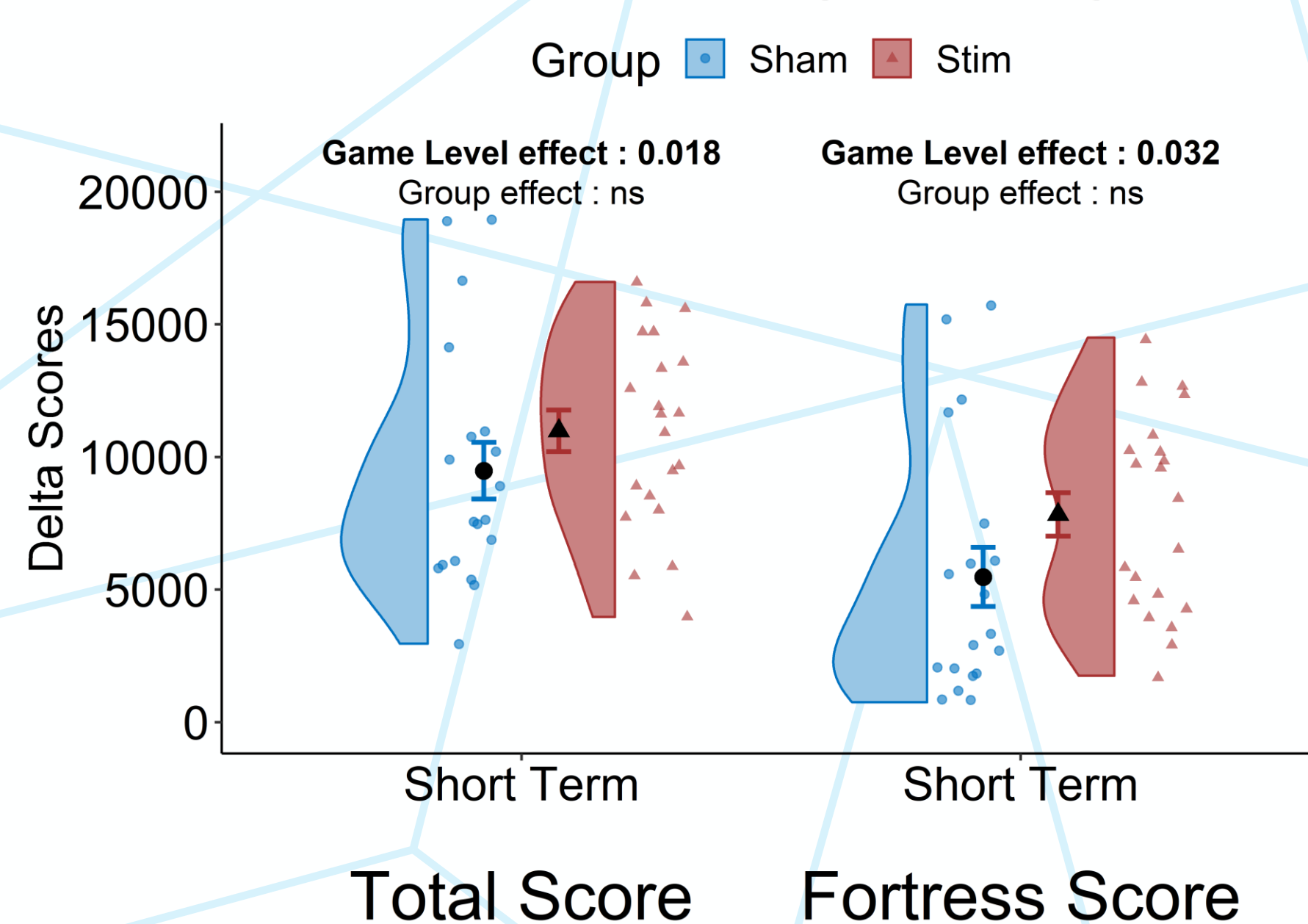
0 0.02 0.04 0.06 0.08 0.10 ||En|| (mV)

SHAM & tRNS High Definition Montages

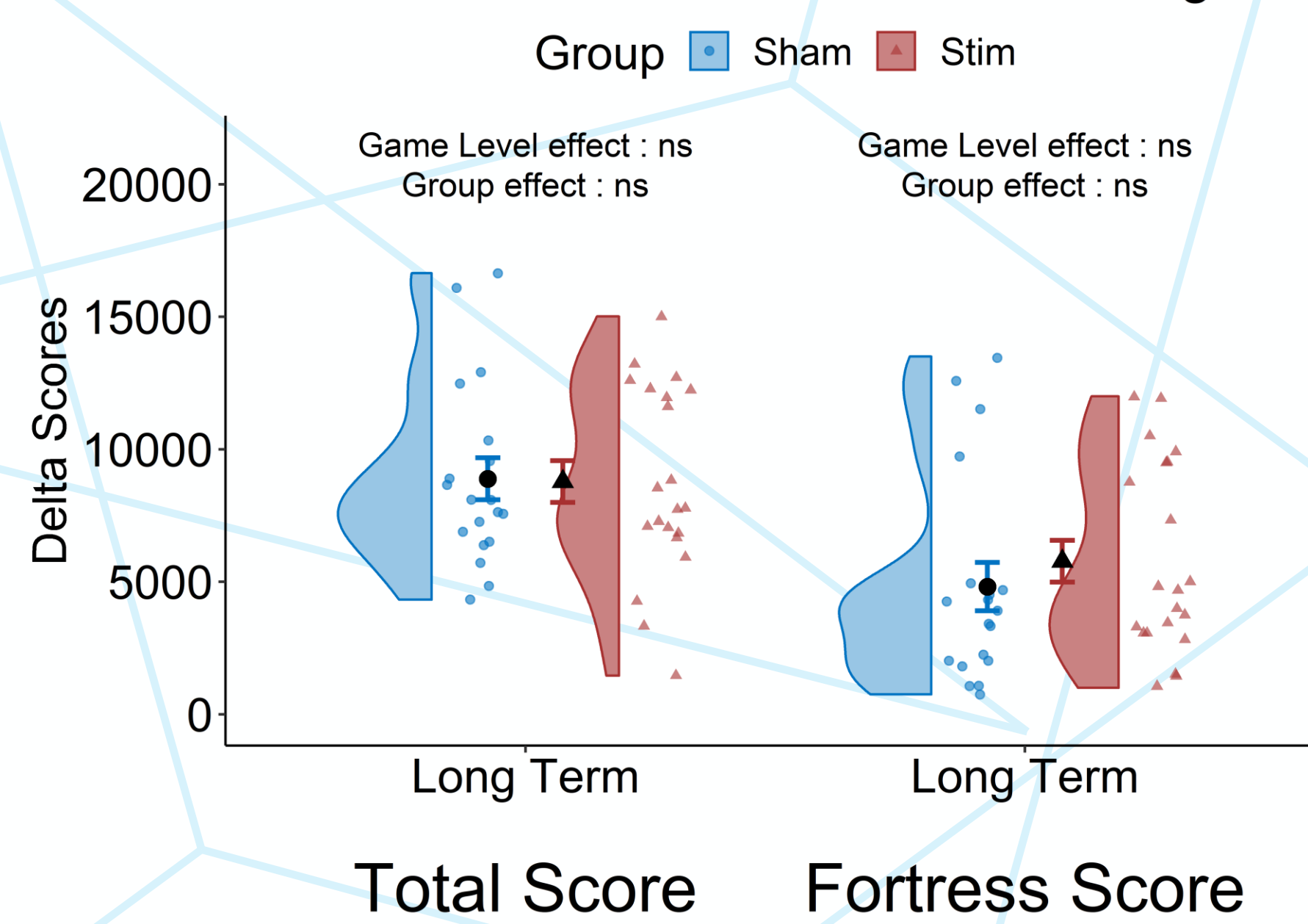


Results

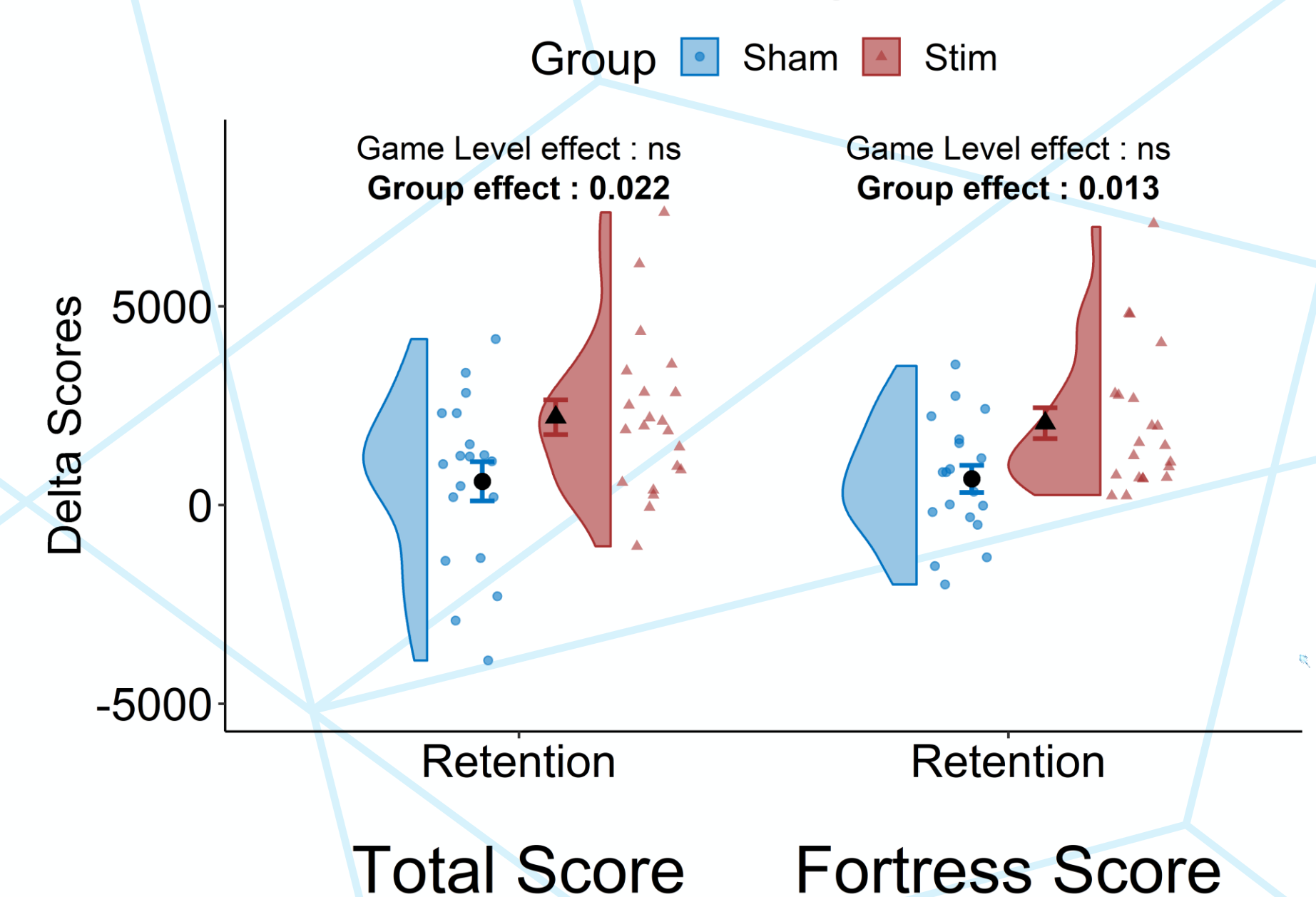
Total and Fortress Delta Scores on Short Term



Total and Fortress Delta Scores on Long Term



Total and Fortress Delta Scores on Retention



No Group effect on Short Term nor Long Term Δ Scores

Group effect on Retention Δ Score

STIM

>

SHAM

Conclusion

Stimulation of the rDLPFC

MAY NOT INDUCE

Faster Learning
Global progress of performance

MAY LEAD TO

Better consolidation effects of what
has been learned

Stimulation of a specific network may not have a macroscopic effect⁵

Perspectives

- Further study on light aircraft pilots
- tRNS during ecological behavioral task : flight and multitasking
- Further evidence of a possible consolidation effect of focal tRNS over complex task management

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4. Snowball, A. et al. Long-term enhancement of brain function and cognition using cognitive training and brain stimulation. *Curr. Biol.* 23, 987–992 (2013).
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