

FROM REST TO TASK: EEG CORRELATIONS WITH WORKING MEMORY PERFORMANCE IN AGEING

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INTRODUCTION

Resting-state EEG reflects spontaneous neural activity and is linked to cognitive functions. One of its variables, the aperiodic slope, is associated with better cognitive functioning, with a steeper slope indicating better performance. Some studies have linked it to specific cognitive functions, such as visuomotor performance, learning, and working memory (Dziego et al., 2023; Immink et al., 2021; Voytek et al., 2015). However, other studies suggest that its steepness may reflect broad cognitive ability rather than momentary cognitive processes (Euler et al., 2024). This discrepancy may be influenced by mediating factors such as education level, which could obscure its relationship with specific tasks (Montemurro et al., 2024).

Ageing is linked to both working memory decline and a flatter aperiodic slope, yet no studies have directly explored their connection. While some research suggests a link between resting-state activity and executive functions, findings remain contradictory (Finley et al., 2024).

As working memory is an executive function, this pilot study aimed to investigate the association between aperiodic slope steepness and visuospatial working memory in older adults.

METHODS

The sample consisted of 14 older adults (mean age = 69.8 years, SD = 6.81), 86% of whom were female. Resting-state EEG was recorded with a 32-channel g.tec g.Nautilus wearable headset and gel electrodes, positioned according to the 10–20 system. Electrode impedance was kept below 50 kΩ. Data were recorded for 6 minutes, preprocessed using EEGLAB v2024.1 in MATLAB R2024a, and downsampled to 256 Hz. The median aperiodic slope steepness was calculated with the FOOOF algorithm in Python. Visuospatial working memory was assessed using the Corsi Block-Tapping Test and its reversed version.

PROCEDURE

The procedure involved the following steps:

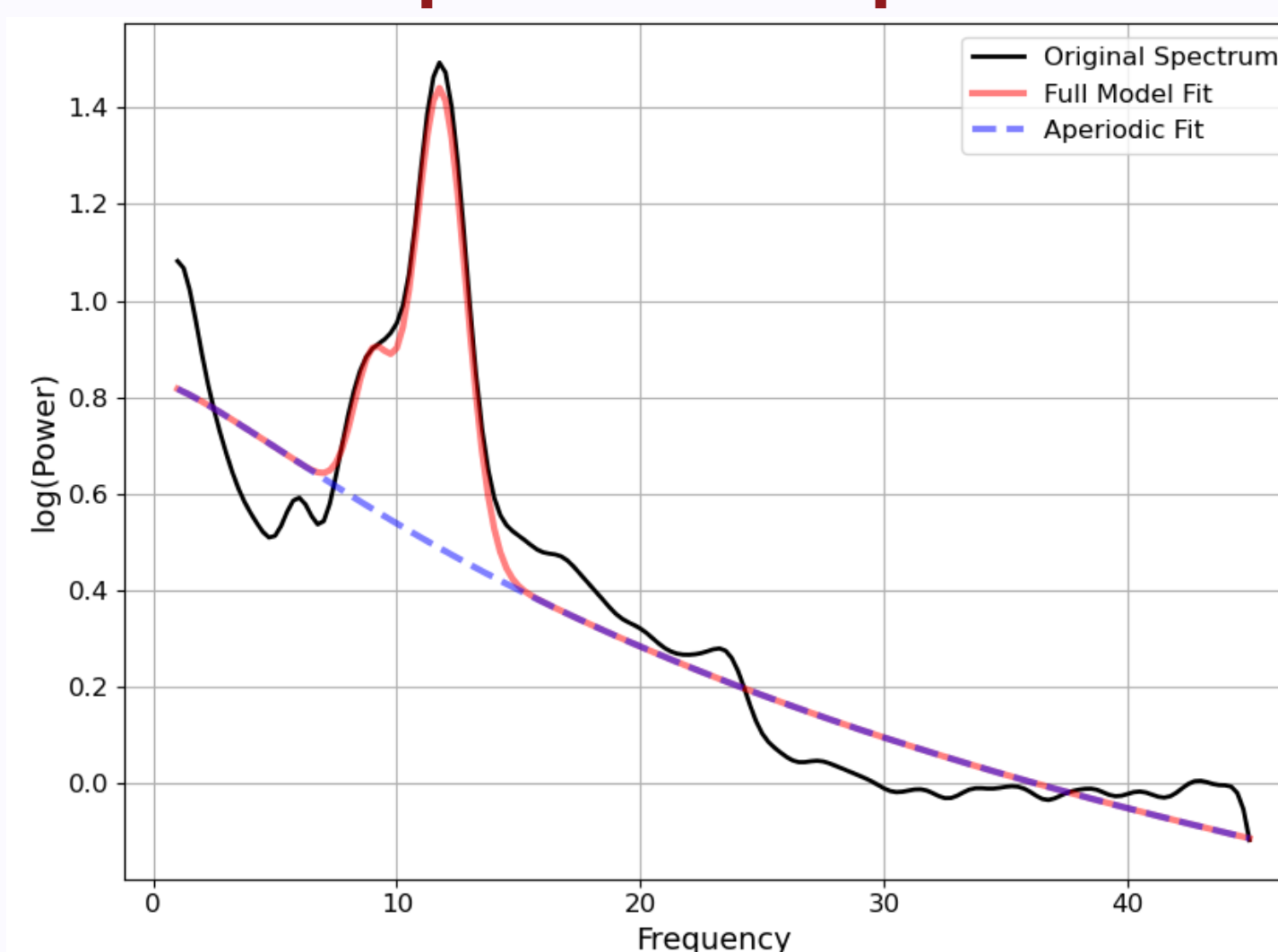
1. Cognitive testing: participants completed the Corsi Block-Tapping Test and the Backward Corsi Block-Tapping Test.
2. EEG equipment setup.
3. Instruction session.
4. EEG recording: participants sat for 3 minutes with their eyes open, gazing at a fixation cross in the center of the screen. Then they sat for another 3 minutes with their eyes closed.

DATA ANALYSIS

Data analysis was performed in two steps:

1. The Shapiro–Wilk test was performed to assess the normality assumption, and the assumption was not met for the Corsi test results.
2. Spearman's correlation was used for the analysis.

Example of rs-EEG aperiodic slope

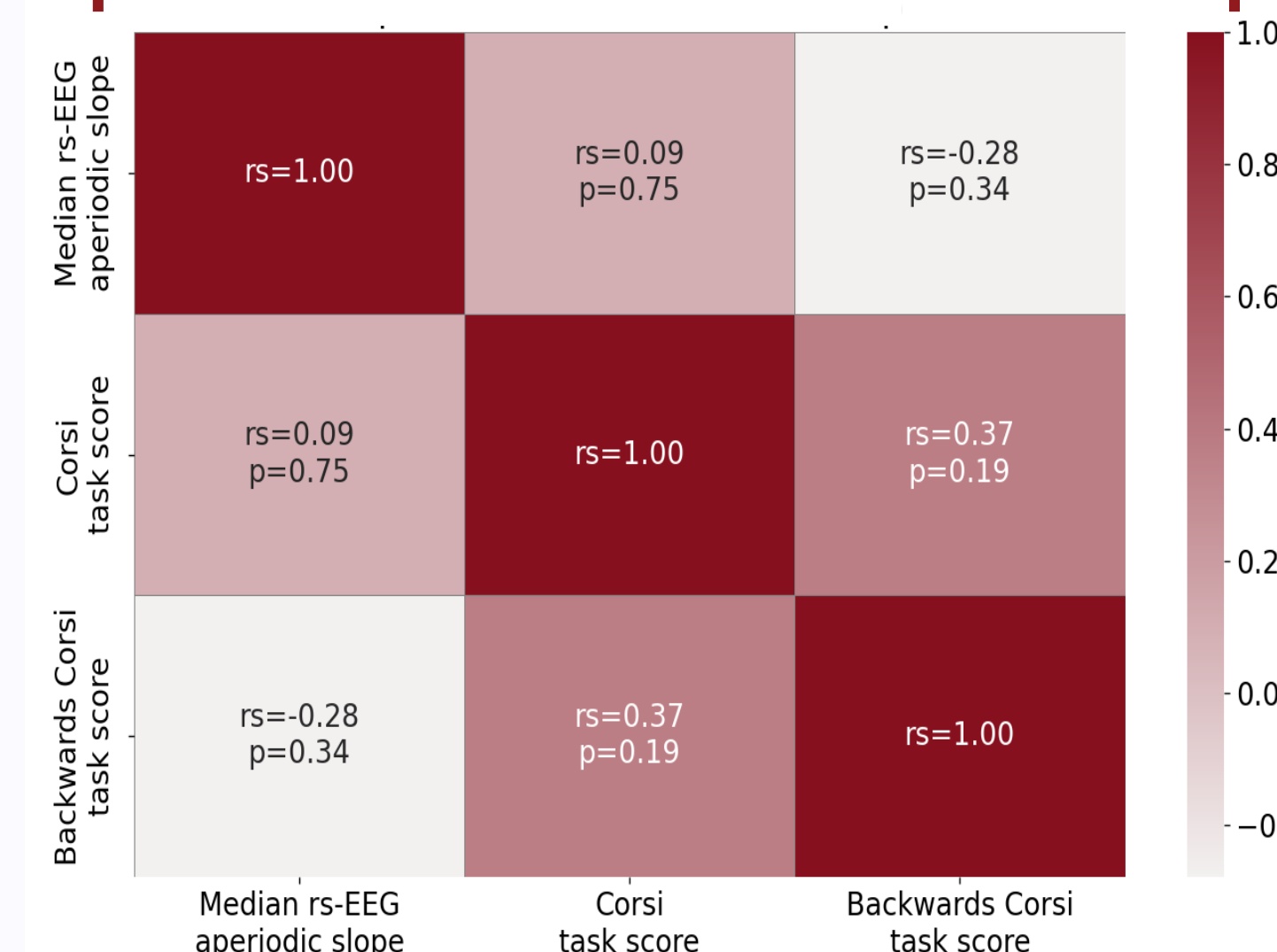


Averaged aperiodic slope across all channels, subject III

RESULTS

The analysis found no significant associations between the aperiodic slope steepness and the Corsi test ($r_s=.092$, $p=.754$), or the Backward Corsi test ($r_s=-.278$, $p=.336$).

Spearman correlation heatmap



CONCLUSION

Our results indicate that the aperiodic slope does not show a significant relationship with working memory performance in older adults. This finding aligns with those studies that interpret resting-state brain activity as an indicator of broad cognitive functioning rather than specific cognitive domains. Meanwhile, there could be some confounding factors that may have influenced this relationship and were not considered in our study. Further studies could explore the relationship between the aperiodic slope and other working memory components, such as visuospatial working memory, in a larger sample of older participants.

PROJECT

Rīga Stradiņš University/Administration and Development Department/Development and Projects Department/Project "Internal consolidation of RSU and external consolidation of RSU with LSPA", No. 5.2.1.1.i.0/2/24/1/CFLA/005/Grant "Modifiable bio and life-style markers in predicting cognitive decline(MOBILE-COG)", No. RSU-PAG-2024/1-0014.

REFERENCES

