Investigating Resting-State EEG Correlates of Sustained Attention in Healthy Ageing: A Cross-Sectional Baseline Study

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Background

- Ageing is linked to **cognitive decline**, heightened **dementia risk**, **changes** in 1/f-like **aperiodic neural activity** and **individual alpha peak frequency (IAF).**[1,2]
- Studies link **higher IAF** with **better cognitive performance**[3], however, many have **overlooked the influence of aperiodic activity** despite its established correlation with ageing, **potentially skewing interpretations.**
- IAF may be a biomarker for attention impairments in ageing, however, **the association between IAF, once accounting for aperiodic activity, and sustained attention in older adults is unknown.**

Methods

- **Baseline Cross-sectional** sample of healthy Older Adults enrolled in LEISURE[4] study, **50-84 years** (N=96; M=65.39±8.44 years, 80.2% female).
- Spectral parameterization (specparam[5]) of 4-minute **eyes closed resting-state EEG** to reveal exponent and offset from aperiodic activity and IAF from aperiodic-adjusted alpha oscillations in averaged **global** region (32 channels).

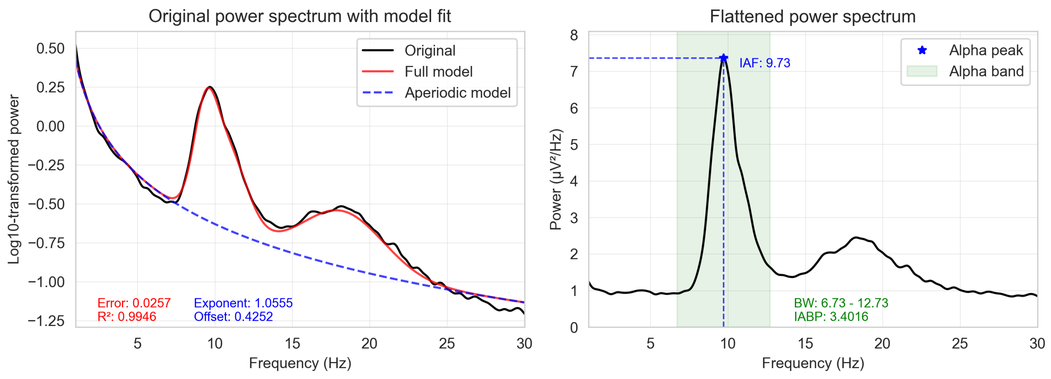


Figure 1. Process of spectral parametrisation i.e., (1) estimation of aperiodic activity parameters (exponent and offset) with 'specparam' and (2) subtracting the aperiodic model from the spectrum (i.e., flattening) and estimating IAF .

- **Sustained attention** measured using the **CANTAB** Rapid Visual Information Processing (RVP) task.

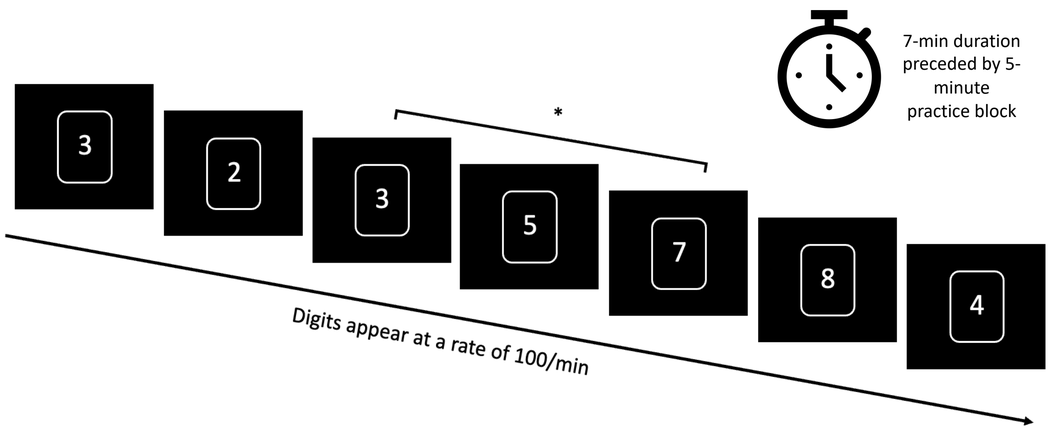


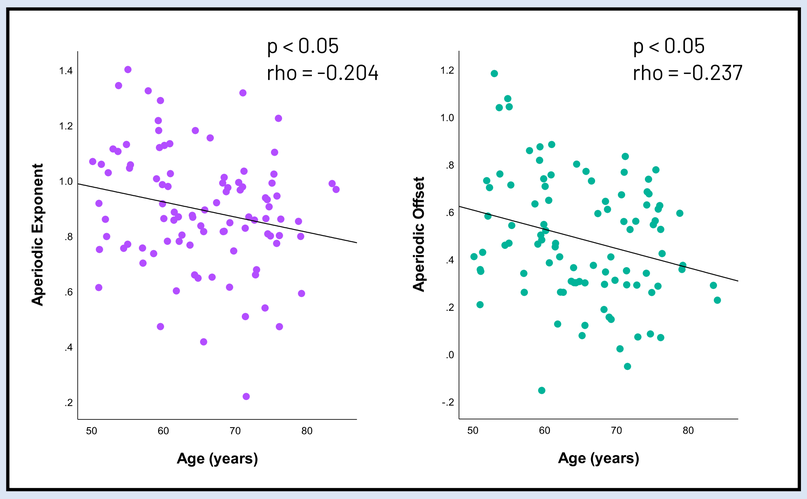
Figure 2. CANTAB RVP task: Subjects detected a series of target sequences (e.g., 3-5-7, 2-4-8, 4-6-8; denoted by *) and touched a button when they saw the last digit of a target sequence ('7' in this example). Nine target sequences appeared every 100 numbers.

Results

1 Age-related alterations in EEG parameters

Spearman correlations showed a **significant negative association** between **age and aperiodic activity** (exponent and offset).

We found no relationship between age and IAF in our sample.



Indicates a **flatter exponent** and **lower offset** with **increasing** age.

Figure 3. Linear regressions between global EEG aperiodic activity parameters (i.e., exponent and offset) during resting-state and age.

2 EEG parameters and sustained attention

Hierarchical linear regression showed a **significant negative association between** global **IAF** and **sustained attention performance** after controlling for age, gender and education.

The same association was not seen for aperiodic activity (i.e., exponent and offset) in our sample.

Indicates the **higher** the resting state **IAF**, the **greater** the **number of false alarms** (the number of times the subject responds outside the response window of a target sequence).

Hierarchical Linear Regression Analysis of Predictors of Total False Alarms in a Sustained Attention Task

	β	R^2	*F*	*p*
Model 1				
Age	0.13			
Gender	-0.01			
Education	0.07			
Summary		0.02	0.58	0.63
Model 2				
Age	0.15			
Gender	-0.02			
Education	0.15			
Alpha peak frequency	0.28*			
Summary		0.09	2.22	0.07
Change		0.07	7.01	0.01

β = standardized beta coefficients
* *p* < 0.05

Conclusion

- Underscores the **need to consider aperiodic activity when assessing the ties between age, neural activity, and cognitive function.**
- These findings indicate that **IAF could serve as a biomarker for sustained attention in older adults.**
- This has implications for **illuminating the underlying neural basis of cognitive declines observed in dementia.**

References

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