

restingIAF: A RELIABLE, AUTOMATED METHOD FOR QUANTIFYING INDIVIDUAL ALPHA FREQUENCY





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INTRODUCTION

IAF is a fundamental property of brain processing relating to individual differences across various domains:

- perception^[1,2]
- memory^[3] & attention^[4]
- language^[5]
- general intelligence^[6]

IAF might also help improve the precision of frequency band analysis.^[7]

THE PROBLEM

IAF is typically indexed by a dominant (peak) frequency elicited during eyesclosed resting-state M/EEG. However, a subset of individuals do not demonstrate a clear alpha peak.

Further, visual identification of peak frequency from channel spectra is time-consuming and prone to bias.

Automated strategies may solve these problems, but also introduce new sources of error.

KEY FINDINGS

CONCLUSIONS

- S-G filtering aids accurate, automated extraction of target alpha components.
- Empirical data show similar characteristics to previous large *n* studies.
- restingIAF may help improve reliability and rigour of future IAF research.

FUTURE WORK

- \square Soon:
- GitHub release
- Assess performance in children
- \Box LATER:
- Develop GUI for EEGLAB
- Automate parameter settings

THE IDEA

We devised an automated routine that estimates **peak alpha frequency (PAF)** from the 1st derivative of Savitzky-Golay filtered spectra.

S-G filtering smoothes noisy fluctuations while preserving peak characteristics. [8] We also extended this approach to derive **centre of gravity (CoG)** estimates of IAF.

AFFILIATIONS & REFERENCES

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[1] Cecere et al. Curr. Biol. 2015, 25, 231. [2] Samaha & Postle. Curr. Biol. 2015, 25, 2985. [3] Klimesch. Brain Res. Rev. 1999, 29, 169. [4] MacLean et al. Brain Cogn. 2012, 78, 218. [5] Bornkessel et al. Exp. Psychol. 2004, 51, 279. [6] Grandy et al. NeuroImage. 2013, 79, 10. [7] Klimesch. TICS. 2012, 16, 606. [8] Zeigler. Appl. Spectrosc. 1981, 35, 88.

METHOD

ALGORITHM

The routine is summarised in the flow diagram (right). To register as a PAF, peaks must exceed a background spectral noise threshold and a secondary peak threshold. Number of estimates for averaging can also be thresholded. *restingIAF* has EEGLAB and Python implementations.

EMPIRICAL DATA

63 healthy adults (42 females; age range: 18-74 yrs).

2 min eyes-closed resting-state EEG recorded pre/post 90 min experimental session.

SIMULATION DATA

Single and complex (Gaussian-distributed) alpha component signals were randomly synthesised and embedded within pink noise. Signal-to-noise ratio (SNR) and component dispersal (α) were parametrically varied.

