Using EEG-based functional network at rest and its relationship with personality traits

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Introduction

Resting brain state networks

- In the examination of the resting-state activity in the brain, it has been revealed the presence of functional connectivity between the different tissues of the brain, where some corresponding to brain areas specific for distinct tasks. These can be defined as resting state networks (RSNs) (Cabral, et al., 2014).

Resting brain state networks and personality

- A negative correlation between psychological resilience and brain network flexibility has been revealed in brain regions which are within the alpha, beta and delta bands (Paban, et al., 2019). The brain networks in each EEG frequency band were created using EEG source-space connectivity method.
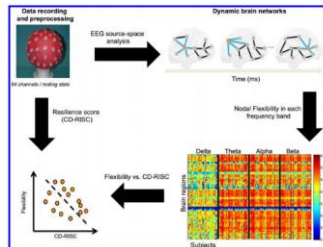
- Graph theoretical analysis of the resting-state fMRI data showed that Openness predicted the default network global efficiency (Beaty, et al., 2018). Thus, as Openness increased, the Default Network displayed dynamic information processing.
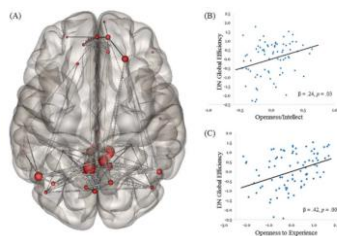

Materials and Methods

- A total of 196 healthy individuals who were aged between 17 to 29 years took part in the experiment. Participants took part in the resting state EEG recordings, 64 total electrodes were used.

- Sampling frequency used for the EEG recording was of 512 Hz. High-pass filter of 0.1 Hz was used to remove slow drifts. Notch filter of 50 Hz was used to remove line noise.

- Data was re-referenced to the average of the earlobes and segmented in epochs of 6 seconds. Lastly, ICA was conducted to remove any eye artefacts from the data.

- 10-item measure of the Big Five personality were recorded (TIPI-10).

Brain Network Construction

- Brain networks will be reconstructed using the EEG source-space connectivity method.(rebuilding the structure of the cortical sources by solving the inverse problem) and measuring the functional connectivity between the time series that has been rebuilt. These will be done in EEGNet for the inverse problem and OPENMEEG to produce the head model (Hassan, et al., 2018)

- The estimation of the statistical coupling between the EEG signals would be conducted by phase synchronization analysis and graph theory-based analysis for the integration and isolation for the network.

- Network flexibility will be constructed after and this shows how the given node changes over time, this will be computed at the level of each brain region.
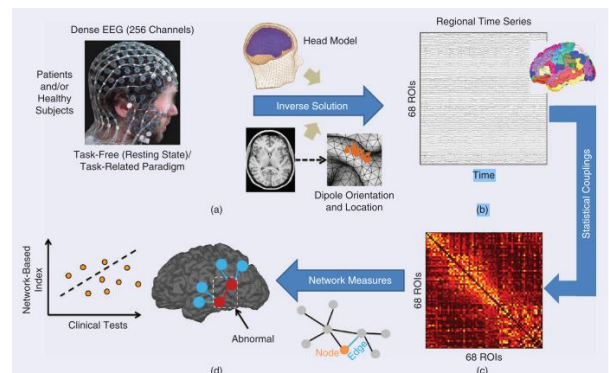
Expected Results

- Network flexibility should show a positive relationship with other personality traits

- Theta band should not show a statistical significant result between personality and network flexibility.

- Although the results should show a significant result. However, due to only using 64 electrodes could have an impact as it previous literature it has been stated that depending on the number of electrons the network may vary and this could produce different results.

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Hassan, M., & Wendling, F. (2018). Electroencephalography source connectivity: aiming for high resolution of brain networks in time and space. *IEEE Signal Processing Magazine*, *35*(3), 81-96..

Paban, V., Modolo, J., Mheich, A., & Hassan, M. (2019). Psychological resilience correlates with EEG source-space brain network flexibility. *Network Neuroscience*, *3*(2), 539-550.