

Dimensions of Interoception in Epilepsy and Functional non-epileptic seizures

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Introduction

Interoception describes the predictive representation and control of the internal physiological state of the body.

Disturbances in interoception have been demonstrated in people with functional non-epileptic seizures and other functional neurological disorders.

Interoceptive deficits have been found to be associated with increased levels of dissociation and functional seizure frequency.

Little is known about interoception in epilepsy.

Aim

To compare dimensions of interoception across three groups – people with functional non-epileptic seizures (FS), people with epileptic seizures (ES) and healthy controls (HC).

Hypothesis

We hypothesised that people with ES would display deficits in interoception compared to HC, given the neuroanatomical correlates of interoception (cingulate, insula, prefrontal cortex) are frequently implicated in epilepsy.

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Methods

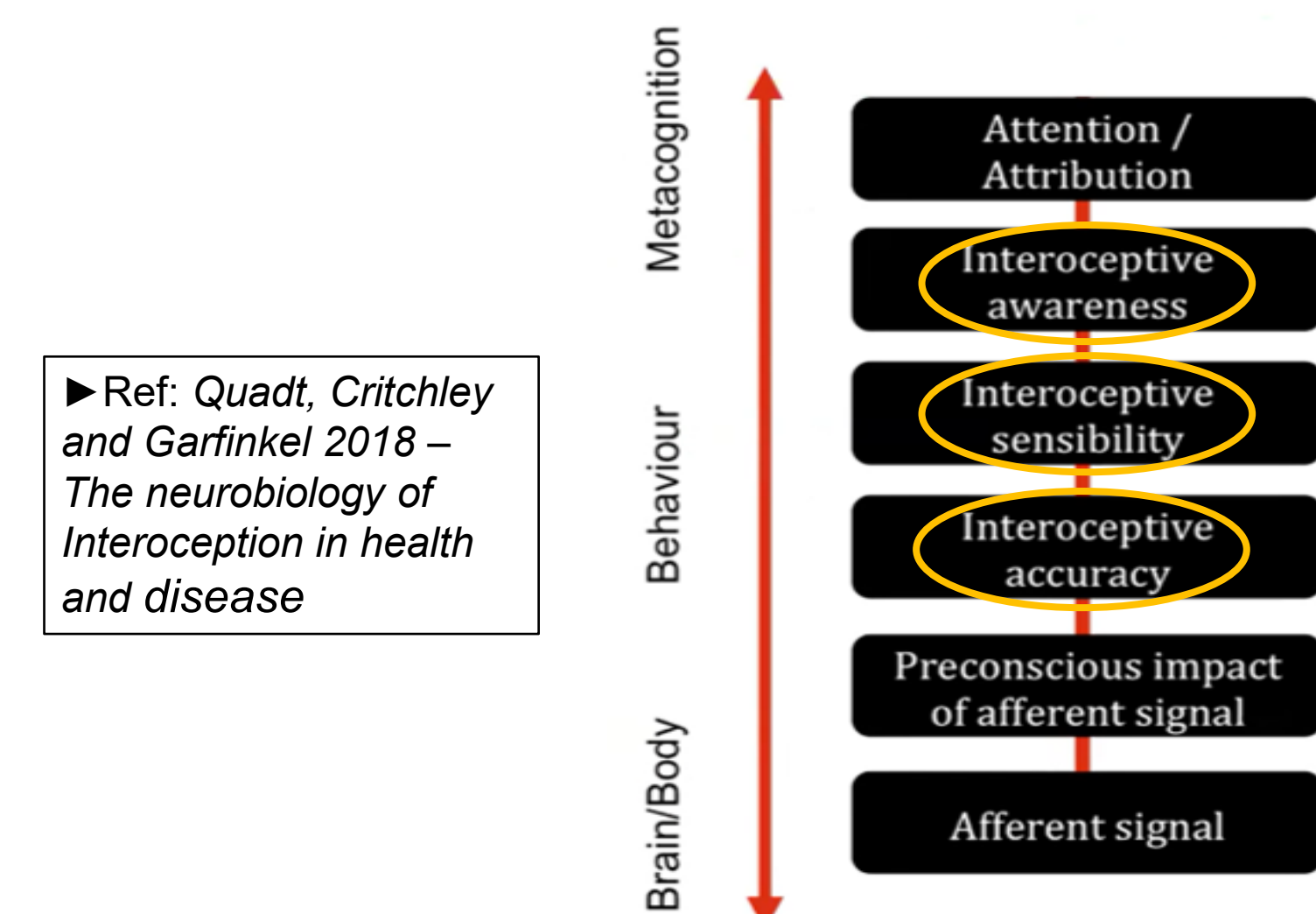
37 participants with FS, 48 with ES and 34 HC completed measures of:

(1) **Interoceptive accuracy** – objective performance on a heartbeat tracking (HTT) and heartbeat discrimination task (HDT)

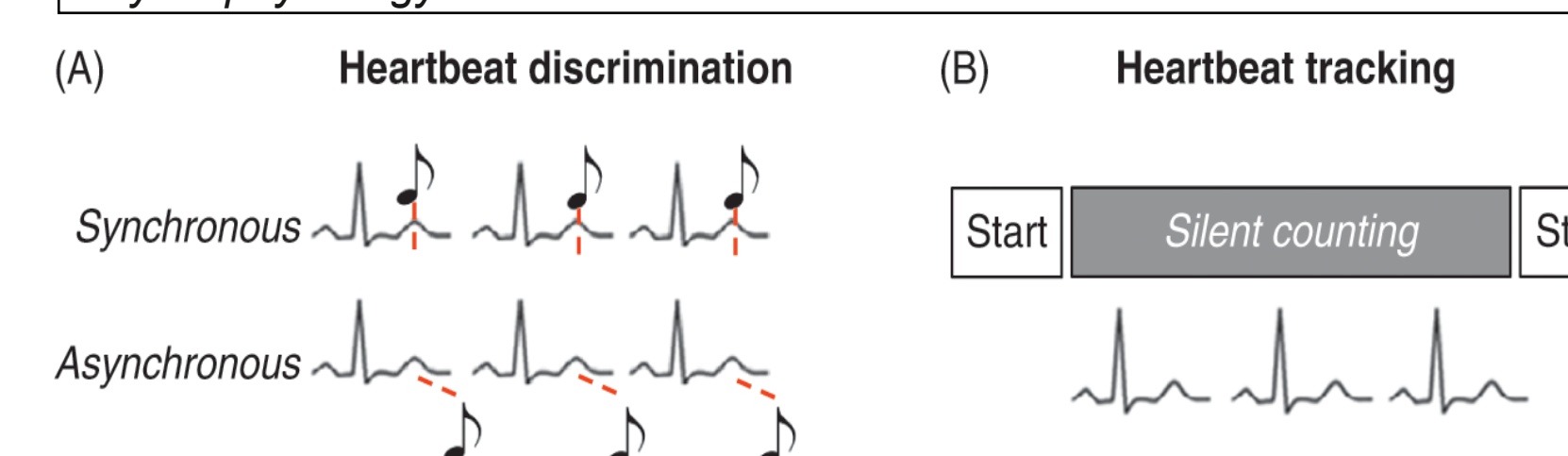
(2) **Trait interoceptive sensibility** – subjective sensitivity to internal sensations (measured using the Porges Body Perception Questionnaire) and

(3) **State interoceptive sensibility** – subjective trial-by-trial measures of confidence in heartbeat detection.

These measures were used to compute **interoceptive awareness** (metacognitive measure) and interoceptive prediction errors. All completed self-report ratings of dissociation (MDI, SDQ), depression (BDI) and anxiety (BAI).

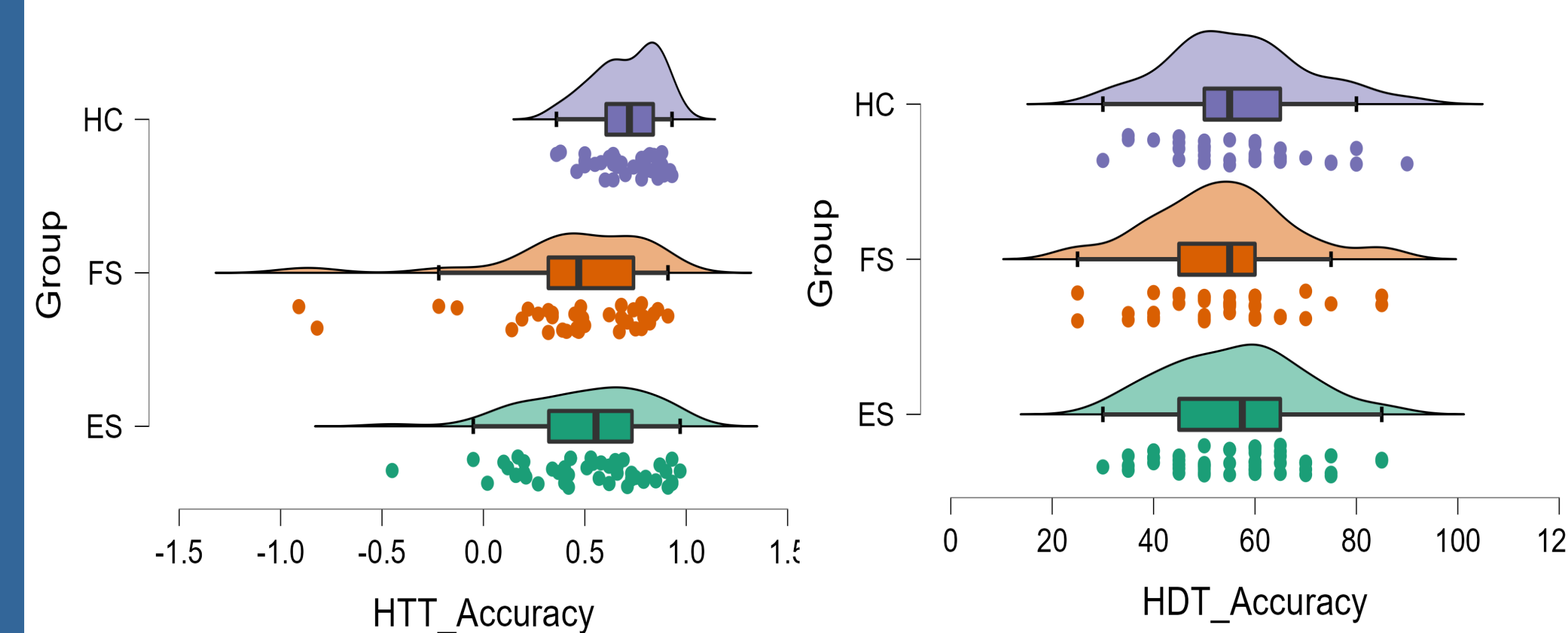


Overview of Heartbeat discrimination task (HDT) and Heartbeat tracking task (HTT) Ref: Garfinkel, Critchley and Pollatos 2016. *The Interoceptive System: Implications for Cognition, Emotion, and Health. Handbook of Psychophysiology*



Results

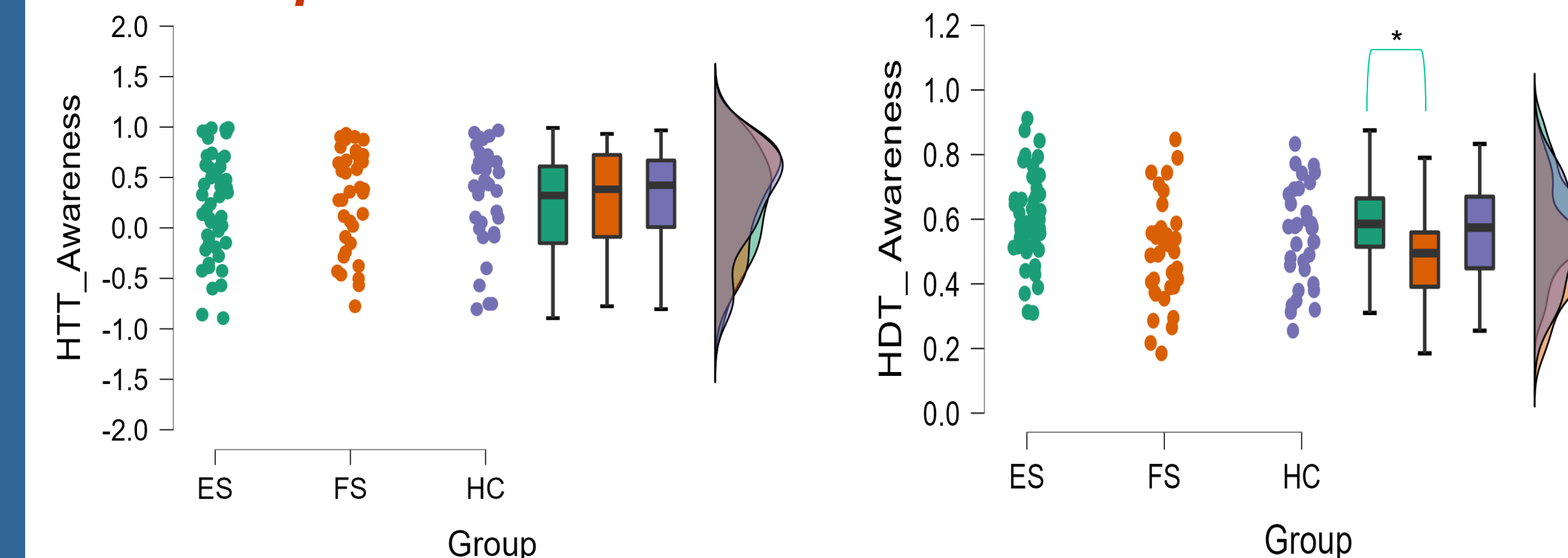
Interoceptive accuracy



▲ Figure 1. Statistically significant differences in Interoceptive Accuracy measured through the HTT were found between the groups ($\chi^2(2) = 12.474, p = 0.002$) with the highest mean score demonstrated in HC, followed by ES and then FS groups. Pairwise comparisons revealed significant differences in accuracy when comparing HC to both ES ($p = 0.010$) and FS ($p = 0.003$), but not between ES and FS groups ($p = 0.582$). No differences in interoceptive accuracy measured through the HDT were found between the groups.

Trait interoceptive sensibility differed significantly across the groups ($F(2, 116) = 11.769, p < 0.001$) and was highest in FS, followed by ES, then HC but did not differ significantly between ES and FS groups ($p = 0.969$)

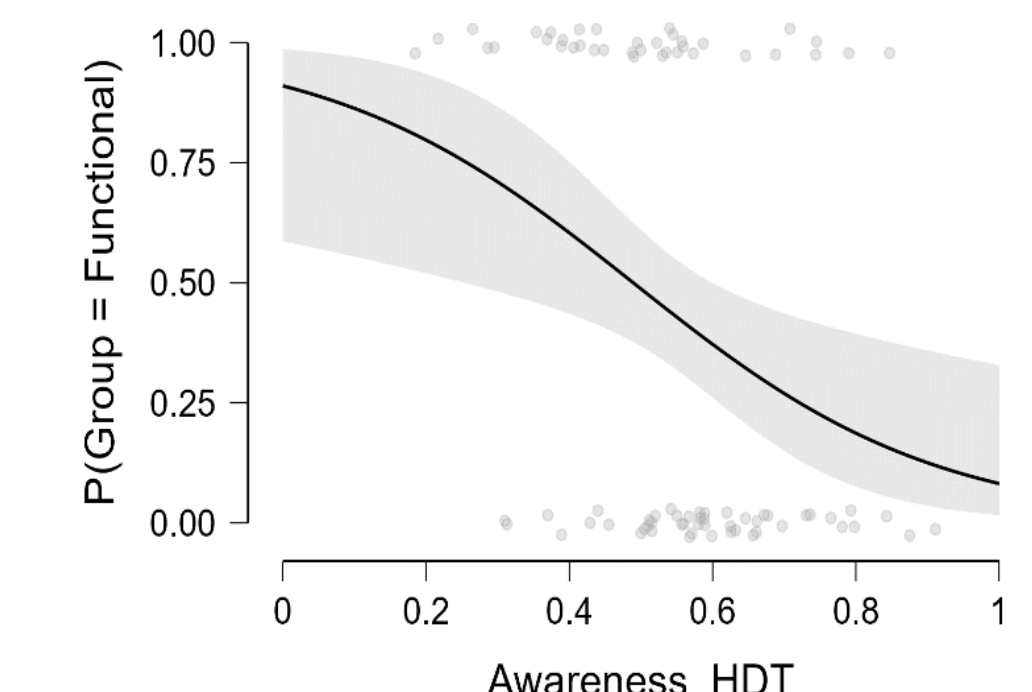
Interoceptive awareness



▲ Figure 2A. No differences in HTT awareness were found between the groups ($F = 0.293, p = 0.747$)

▲ Figure 2B. Significant differences in HDT awareness were found between the groups ($F = 5.182, p = 0.007$). Post hoc → significant differences between ES and FS ($t = 3.214, p = 0.005$). Mean HDT awareness for FS group (0.495) was lower than mean HDT awareness for ES (0.598) and HC (0.548)

► Figure 3. HDT awareness significantly predicted FS diagnosis (OR = 0.009, $p = 0.009$), even when accounting for anxiety and depression



Results summary

- Both ES and FS groups demonstrated significantly reduced interoceptive accuracy and increased interoceptive sensibility compared to HC, though these measures were not found to differ significantly between ES and FS groups.
- Interoceptive awareness on the HDT differed significantly between ES and FS groups ($t = 3.214, p = 0.005$). HDT awareness significantly predicted FS diagnosis (OR = 0.009, $p = 0.009$), even when accounting for anxiety and depression
- Both ES and FS groups had a higher interoceptive trait prediction error (difference between trait interoceptive sensibility and accuracy) compared to HC (data not shown).

Conclusions

We provide evidence for interoceptive deficits in both ES and FS groups, compared to HC.

Interoceptive deficits in ES could be related to the structural effects of epilepsy on interoceptive networks and bottom-up processing of interoceptive information.

Our study has implications for understanding the role of interoception in epilepsy, and how dimensions such as interoceptive awareness, may differ between ES and FS groups.

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