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# Interoception and activation in the anterior insula cortex in binge drinkers.

Sophie Betka<sup>1,2,4</sup>, Gaby Pfeifer<sup>1</sup>, Sarah Garfinkel<sup>1,3</sup>, Jessica Eccles<sup>1</sup>, Cassandra Gould Van Praag<sup>1</sup>, Henrique Sequeira<sup>4</sup>, Theodora Duka<sup>2</sup>, and Hugo Critchley<sup>1,3</sup>

<sup>1</sup> Brighton and Sussex Medical School, Clinical Imaging Science Centre, Brighton, BN1 9RR, England; <sup>2</sup> University of Sussex, Psychology Department, Brighton, BN1 9RR, England; <sup>3</sup> Sackler Centre for Consciousness Science, University of Sussex, UK; <sup>4</sup> University of Lille, SCALab, CNRS UMR 9193, Lille, 59045, France.

## Introduction

**Interoception** refers to the **sensory processing of internal bodily signals**, guiding cognitive and motivational behaviours.



In **addiction**, disturbances of interoception are expressed as altered **insular cortex activation** and have been described, for example through the phenomenon of **craving**<sup>[1]</sup>.



Studies focusing on **substance use disorders** report **aberrant activation** of the **anterior insula cortex (AIC)**, during emotional processing<sup>[2]</sup>. Among **alcohol dependent** subjects, **reduced interoceptive ability** has also been observed<sup>[3]</sup>.

**Objective:** Investigating the neural correlates of interoception in social drinkers during an emotional processing task.

## Methods

### Participants & Procedure

11 male participants (Age: M=24.82; SD=4.45) filled in the Body Perception Questionnaire (BPQ), measuring the **Interoceptive Sensibility**. Participants indicated their awareness of 45 bodily sensations (e.g. stomach and gut pains) using a five point scale ranging from 'never' coded as 1 to 'always' coded as 5. The **BPQ score** was the mean of all the answers. The completion of the Alcohol Use Questionnaire allowed the computation of the **Binge Drinking Score (BDS)**. Then, subjects performed an emotional empathy task during fMRI scanning (Figure 1).

### fMRI Task



Figure 1. Empathy for pain paradigm

### Protocol and Preprocessing

We used an event-related design, including 64 pictures of a hand in painful contexts and 64 pictures of a hand in non painful contexts<sup>[4]</sup>. ~900 volumes were obtained using a T2\*-weighted **multiband echo planar imaging (EPI)** sequence; Acceleration Factor=2; TR=1379ms, TE=42ms, flip angle 90°. All functional images were slice-time and motion corrected, unwrapped, coregistered to participants' individual structural volume, and spatially normalised. All data were acquired using a 1,5 T scanner.

### Statistical Analyses

Using SPM12, we correlated the BDS with contrast images for Pain and No Pain. Non-parametric two-tailed correlations between questionnaire scores, behavioural ratings and extracted insular activations were computed, using SPSS 22.

## Results

### Behavioral data

No correlation was observed between ratings of pictures and questionnaire measures.

### fMRI data

The activation of a cluster in the right AIC was **positively correlated** with BDS (Figure 2).

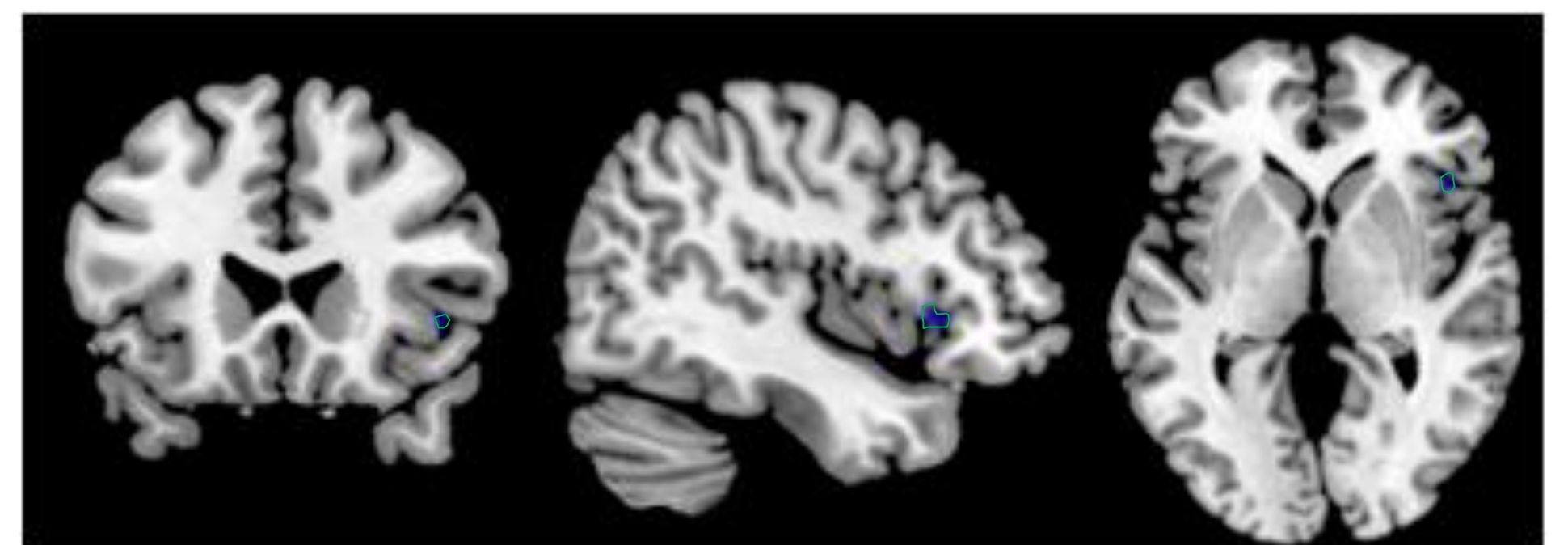


Figure 2. A positive correlation was observed between the activation of cluster in the right AIC and BD scores. [MNI 45 20 -1] Height threshold T=4.91, p<0.05 (FWE)

The activation of the AIC cluster was **negatively correlated** with interoceptive sensibility ( $\tau = -.59$ ,  $p < 0.05$ ; Figure 3).

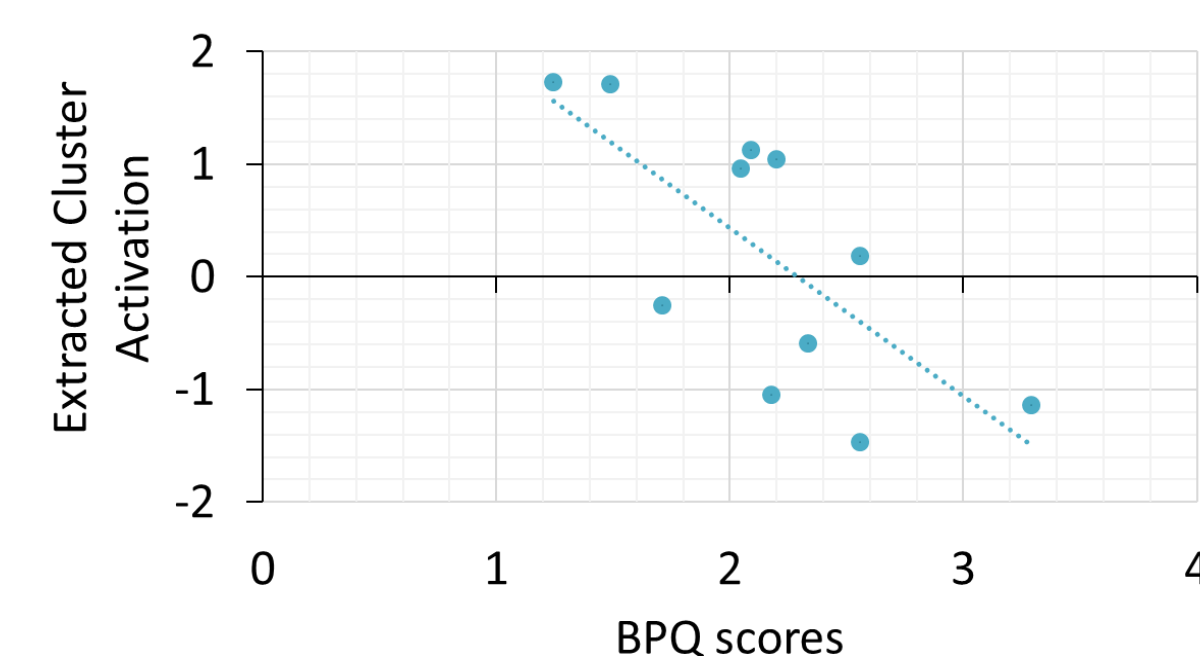


Figure 3. A negative correlation was observed between the extracted cluster activation and the BPQ scores.

## Conclusion

- Interoceptive processes are not only disrupted in drug or alcohol use disorders, but are **further impaired in binge drinkers**.
- At the objective level, this disruption is underpinned by a **hyper activation of the anterior insular cortex**, which could be characterized as a **compensation mechanism**.
- At the subjective level, binge drinking is associated with a reduced interoceptive sensibility.



- Further studies should investigate the **causal relationship** between Interoception and Addiction should be.

- However, our findings are in line with the emergent literature supporting the important **role of interoception in addiction**, which may inform the **development of new therapies** targeting interoceptive processes.

**References:** <sup>[1]</sup> Naqvi et al., (2007). *Science*.26; 315(5811):531–534. <sup>[2]</sup> Berk et al., (2017). *Addiction*.110, 2025–2036. <sup>[3]</sup> Ates Col et al., (2016). *Arch Neuropsychiatr*; 53: 17–22.<sup>[4]</sup> Jackson et al., (2005). *Neuroimage*.24, 771–779.

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Contact: [H.Critchley@bsms.ac.uk](mailto:H.Critchley@bsms.ac.uk)  
[S.Betka@bsms.ac.uk](mailto:S.Betka@bsms.ac.uk)

