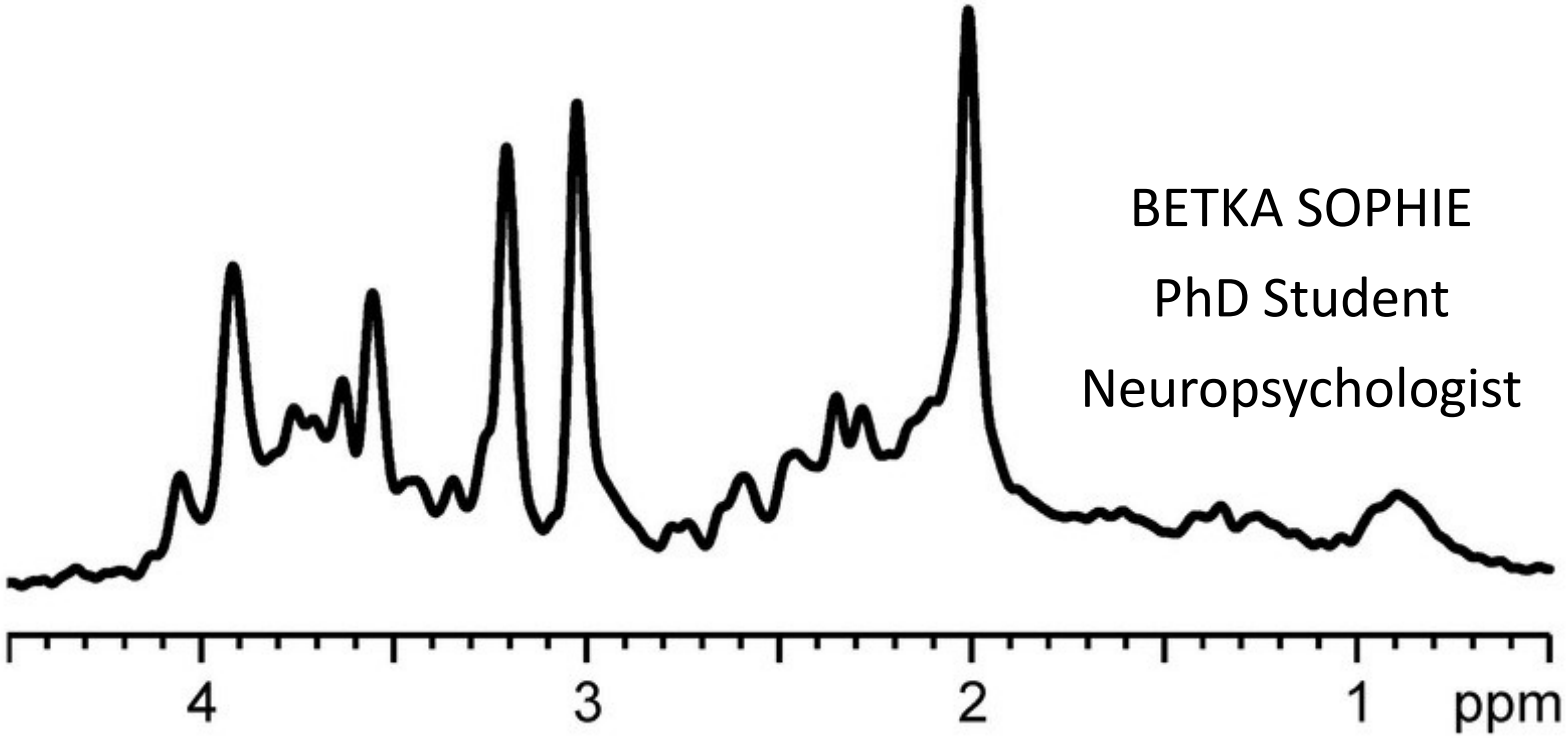
Bodily sensation processing in social drinking: *a combined MRS, VBM & SBM study*

Society for the Study of Addiction

10th November 2017



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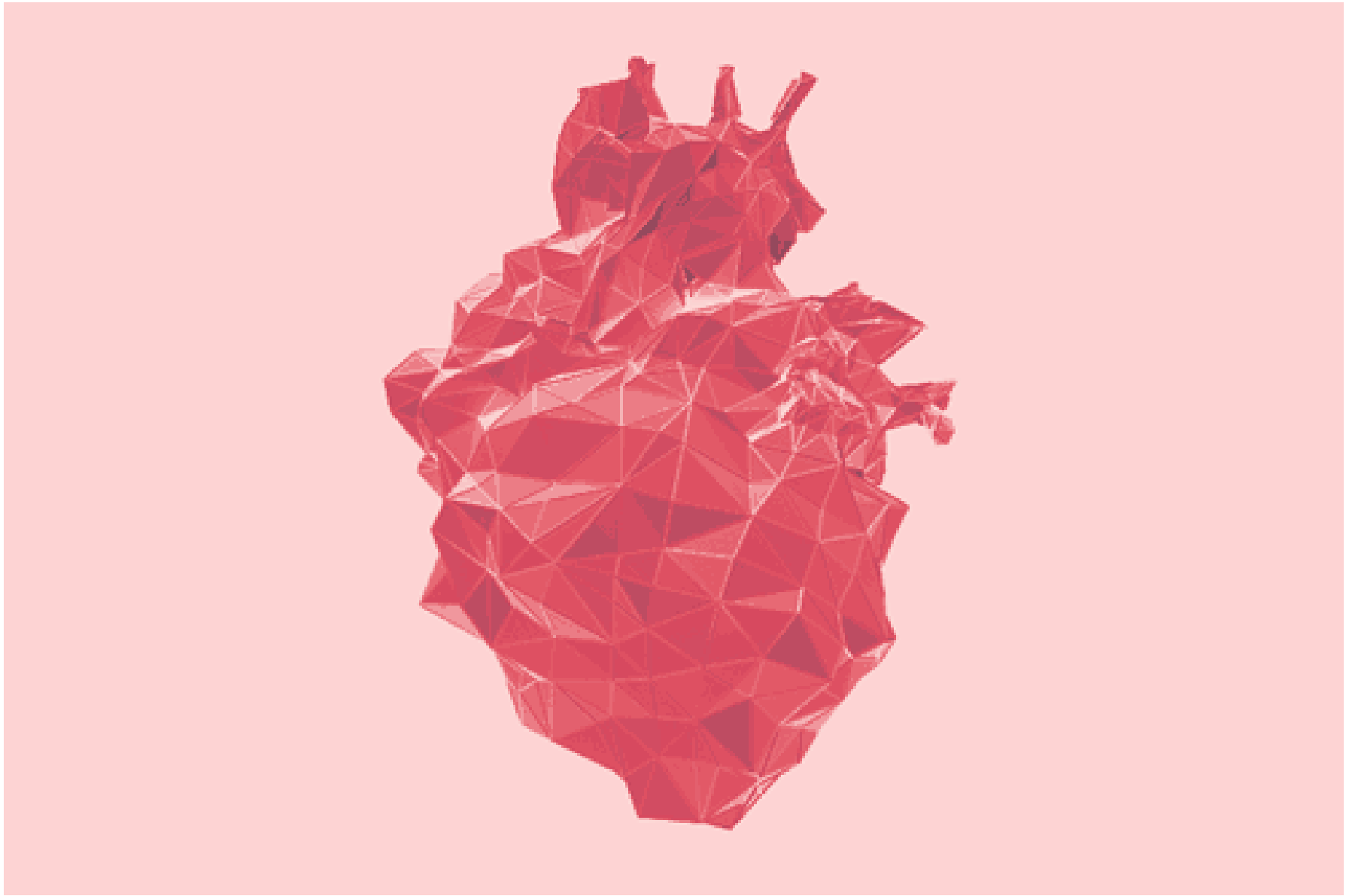
PhD Student

Neuropsychologist



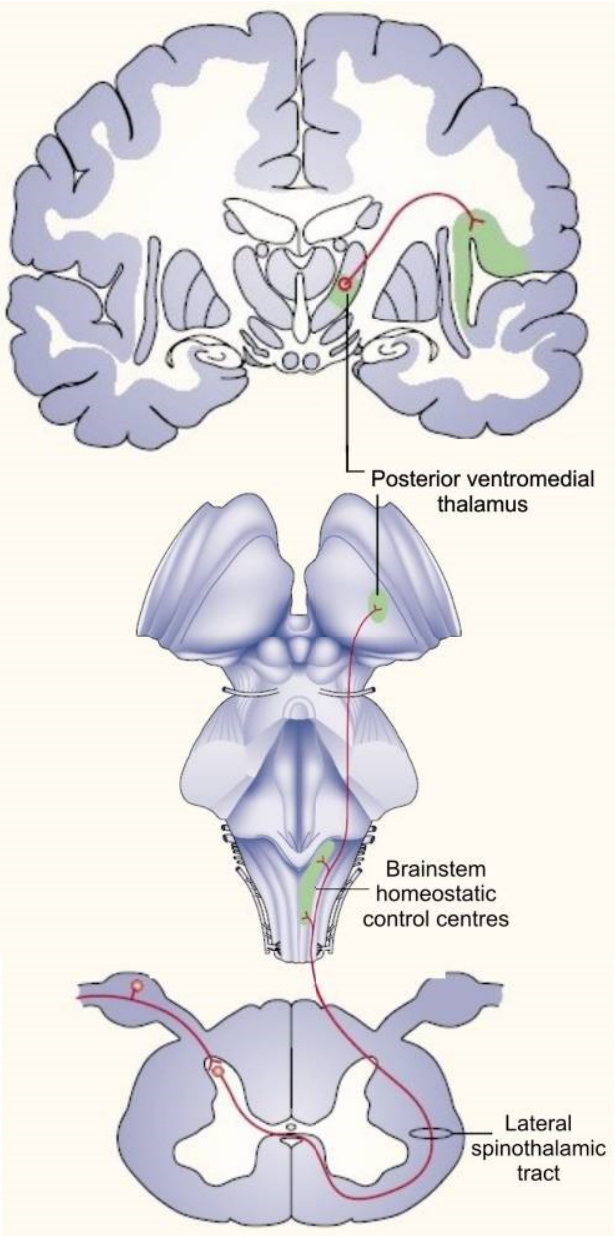
Interoception

General sensitivity to bodily sensations

e.g. heart beat, visceral pain, thirst

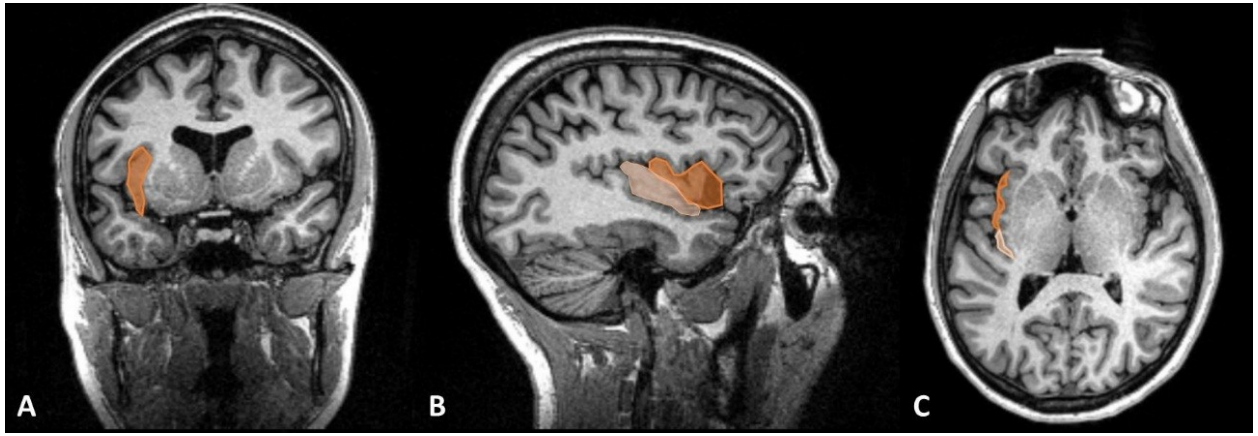
Crucial facet of emotional regulation

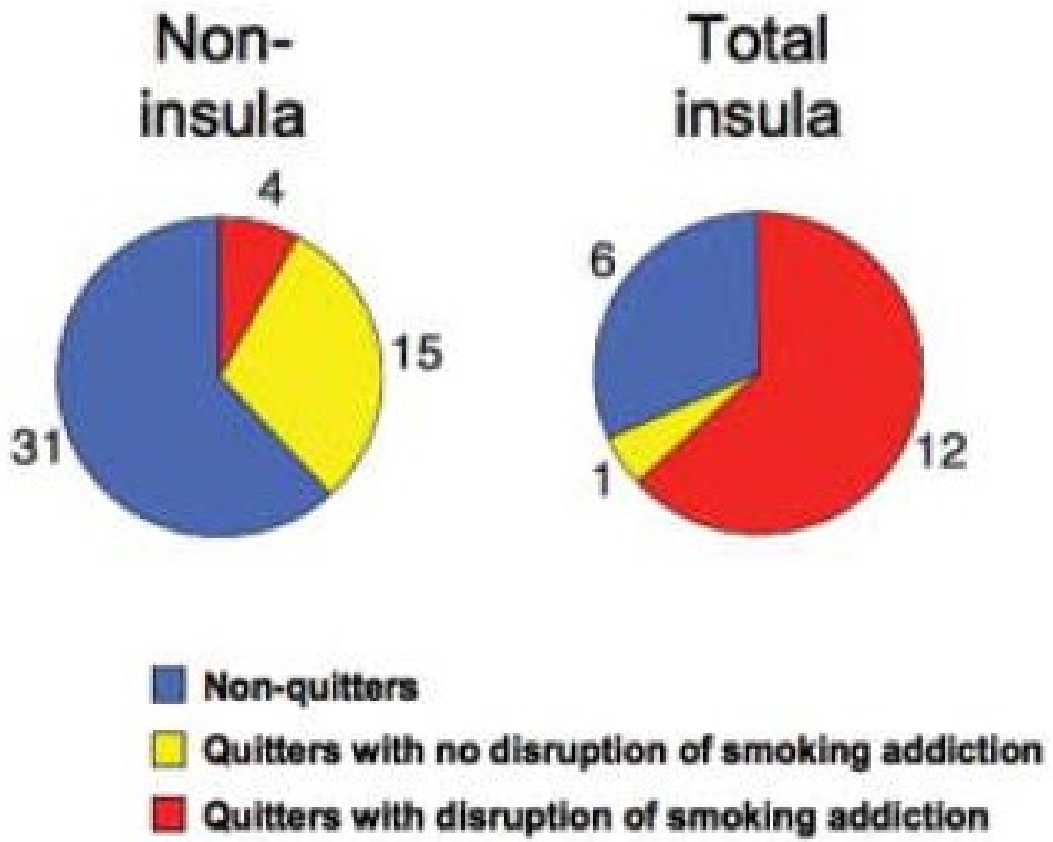
Insula, the “interoceptive hub”



Craig, 2002; Gray & Critchley, 2007; Critchley et al., *2004;* Garfinkel et al., 2014*; Somnez et al., 2016; Ates Col et al.,2016*

Addiction and Insula

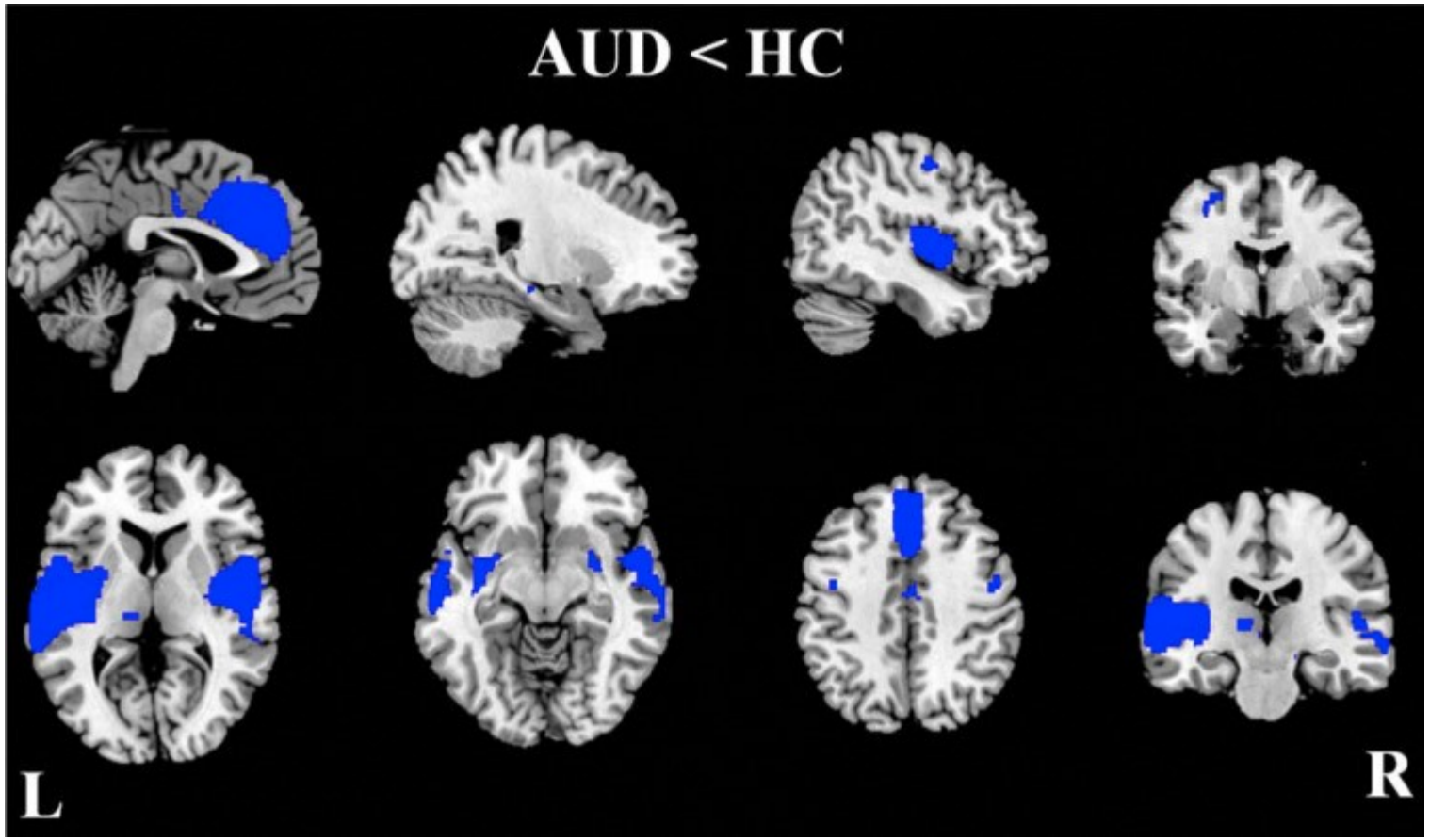




Insula lesion ➡ Increased likelihood of smoking addiction disruption

Naqvi et al., 2007

Insular Volume and Alcohol

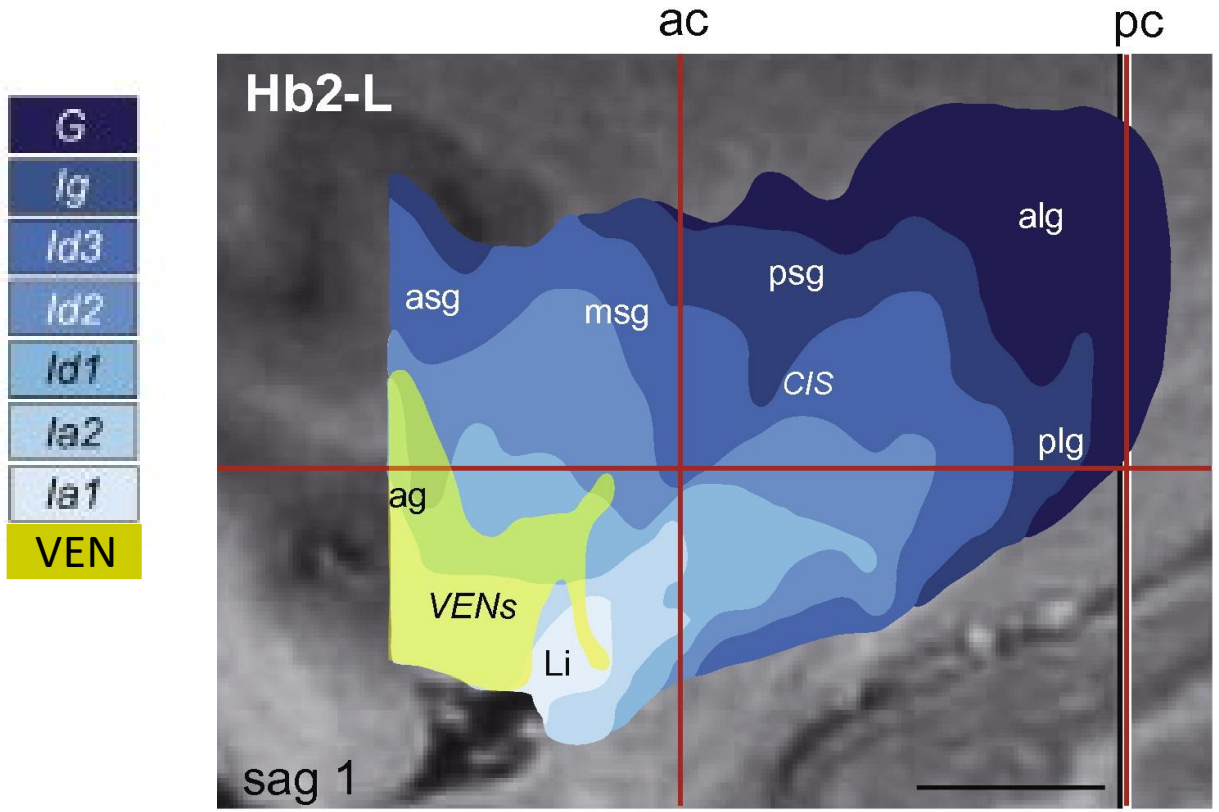


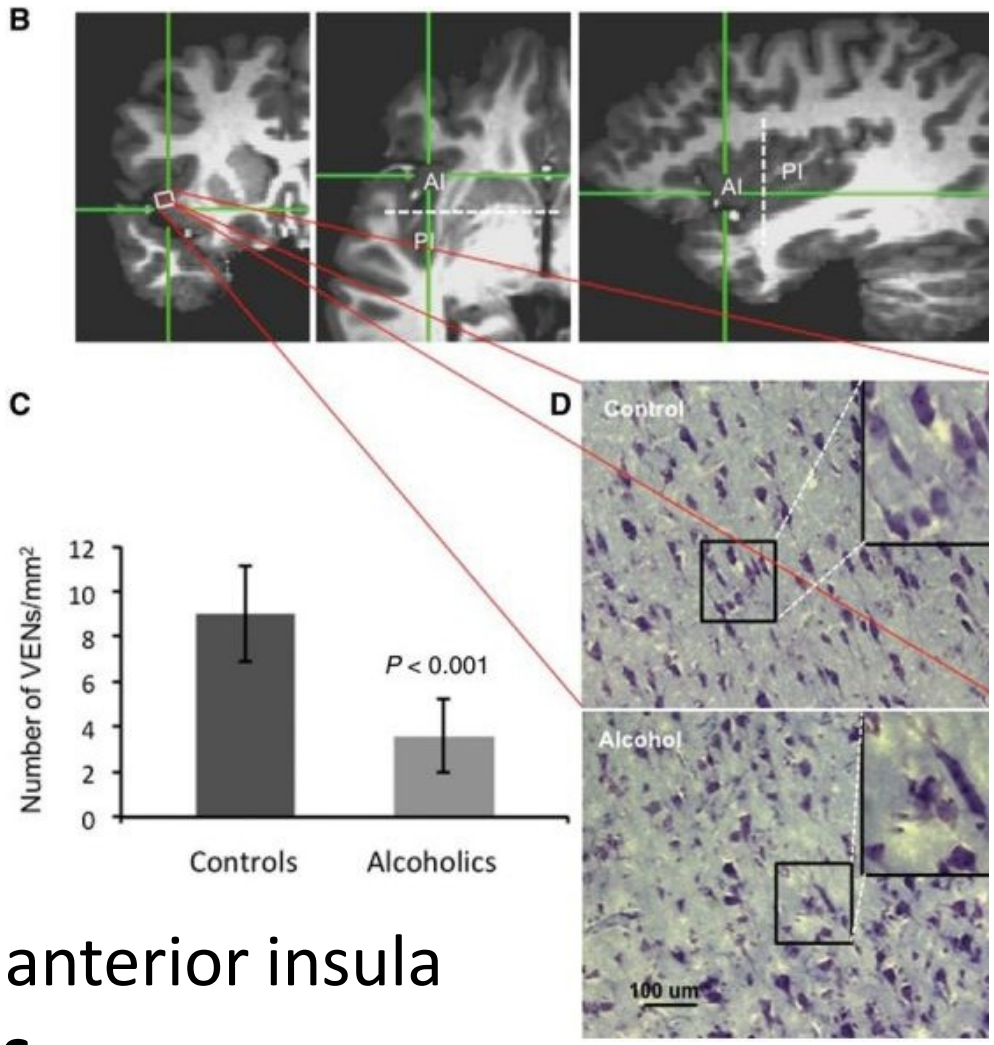
a voxel-based meta-analysis

Cortical and subcortical grey matter shrinkage of the brain

Markis et al., 2008; Yang et al., 2016

Insular Von Economo Neurons and Alcohol



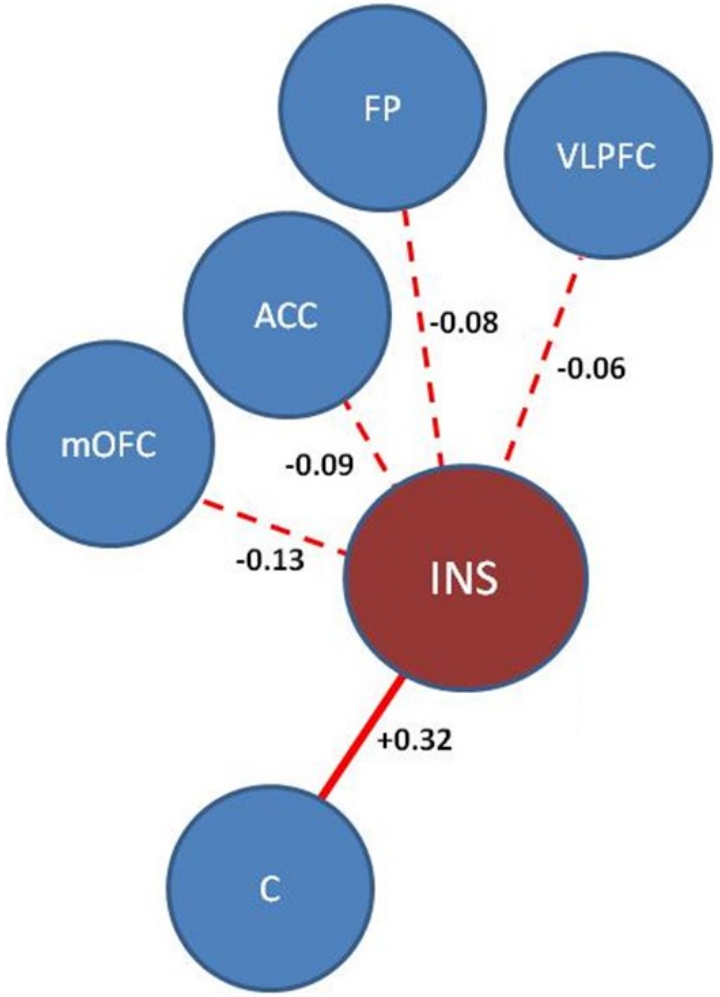


Reduction of Von Economo Neurons in anterior insula

- 60% in alcohol dependent individuals

Senatorov et al., 2015

Insular Connectivity and Alcohol



Decreased connectivity between insula and frontal regions in alcoholism

Reduced white matter integrity in heavy drinkers correlated with increased insular activation
=> loss of control over alcohol

O'Dally et al., 2012; Camchong et al., 2013; Monnig et al., 2014

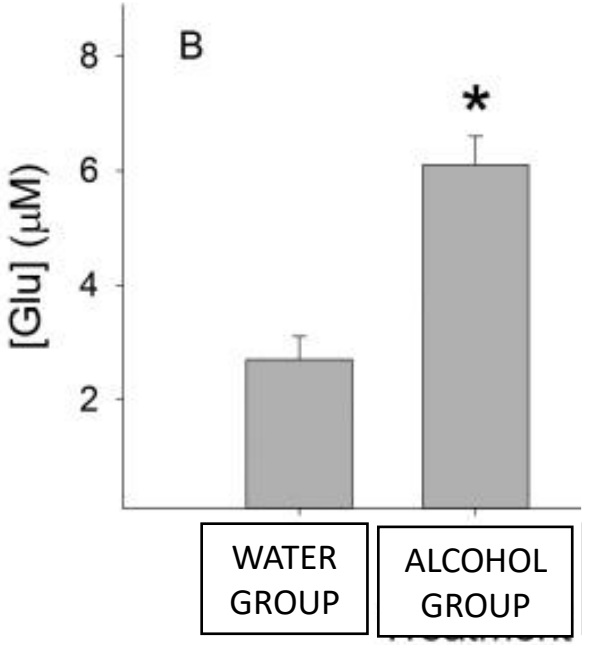
Insula, Glutamate and Alcohol

Projections on (insular) pyramidal neurons are **glutamatergic** (main excitatory neurotransmitter)

Alcohol **interacts** with glutamatergic neurotransmission

Leading to **excitotoxicity** and neuronal death

Most of studies focused on **frontal or reward-related areas =>** what about the **insula**?



Lovinger et l., 1989; Trujillo and Akil, 1995; Tsai et al., 1995; Roberto et al., 2004; Ding et al., 2012

Objective & Hypotheses

Measuring insular glutamate concentration, volume and surface parameters in social drinkers

Insular glutamate concentration will be negatively correlated with social drinking

Insular grey matter volume and cortical folding will be negatively correlated with social drinking

Methods

Participants

32 Healthy male social drinkers (age M=25.09 years)
Weekly units drunk were measured (M=24.82, SD=18.09)

Questionnaires

-Alcohol Use Disorders Identification Test (AUDIT)
-Obsessive Compulsive Drinking Scale (OCDS)
(e.g. drinking-related thoughts, urges to drink, and the ability to resist those thoughts and urges).

Asked to abstain from drinking alcohol 24h before the experiment.
Breathalysed prior the scan

Mehrabian et al., 1978

Methods

MRI Data acquisition

1.5 Tesla MRI scanner (Siemens Magnetom Avanto)

T1-weighted images - 3D MP-RAGE sequence

Repetition Time (TR) =2730ms

Echo Time (TE)= 3.57ms

7˚ Flip angle

Matrix = 256x256

Field of view (FOV) = 256x256mm

1.0 mm isotropic voxel size

192 slices

Methods

MRS Data acquisition

Single-voxel spectroscopy -Point RESolved Spectroscopy (PRESS) Sequence

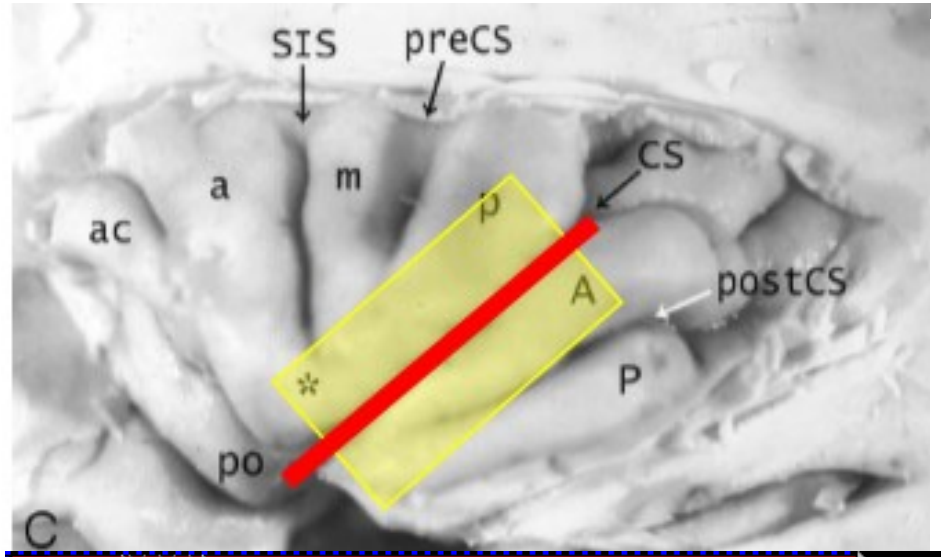
TR=2000ms; TE=40ms; 90° flip angle; 128 excitations; FOV =16 cm

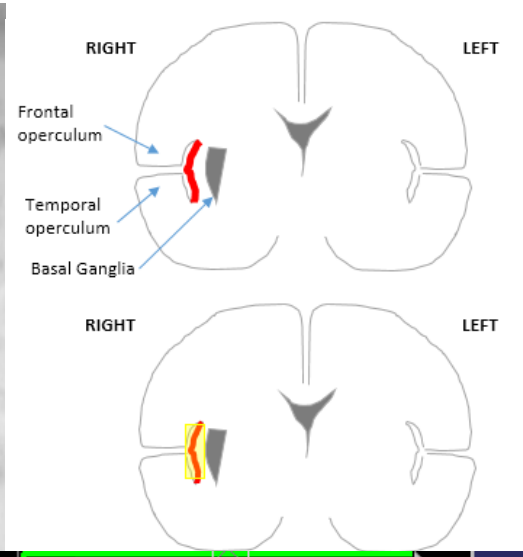
Voxel size 10x15x25 mm

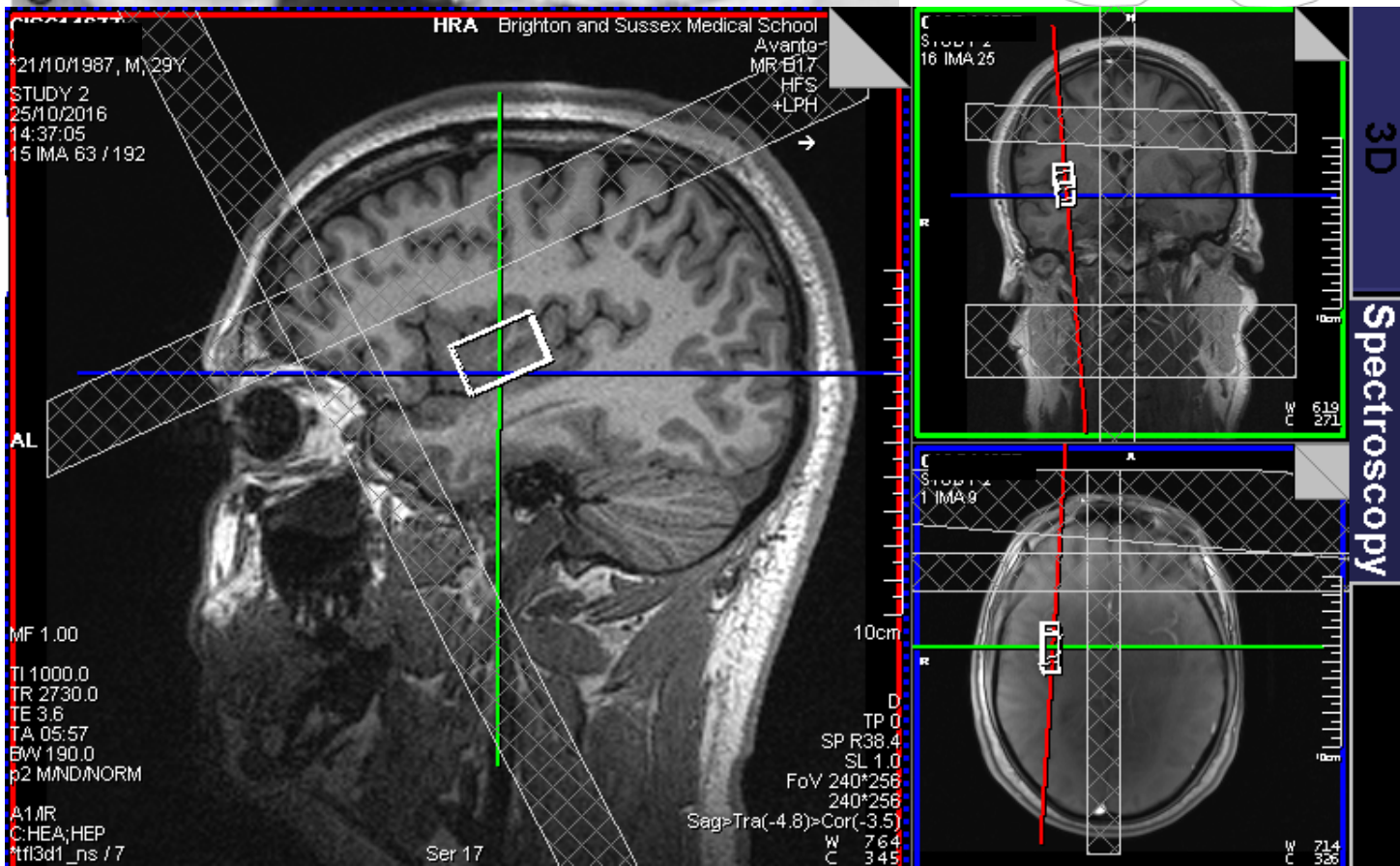
Right mid-insula

Glutamate + Glutamine (Glx) ;
Glutamate (Glu) and Glutamine (Gln)

Bottomley et al, 1987; Jang et al., 2005







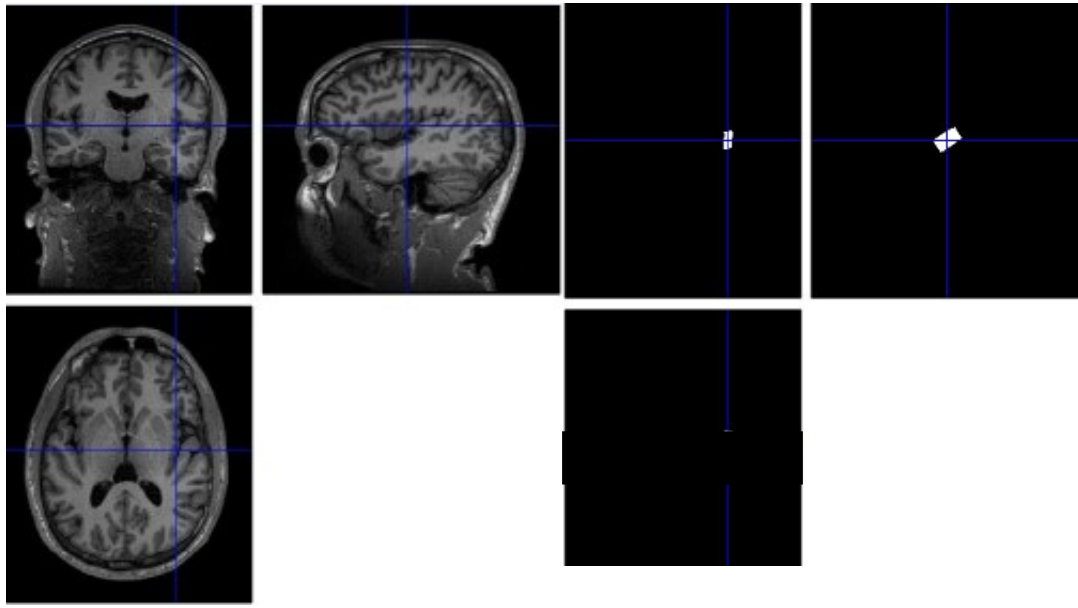
Methods

MRS Data analysis

Creation of a binary mask of the VOI

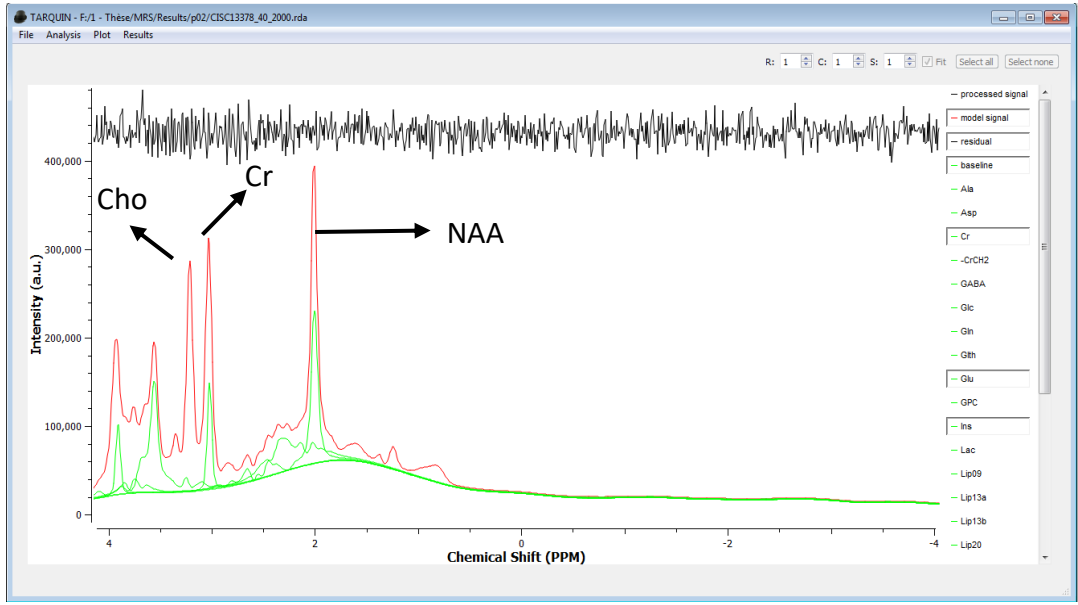
Resliced to the T1 (SPM12)

T1 was segmented



Internal water as reference

Corrections: partial volumes, water attenuation, water concentration, water and metabolites relaxation effects



Tarquin 4.3.7

(water attenuation=1;

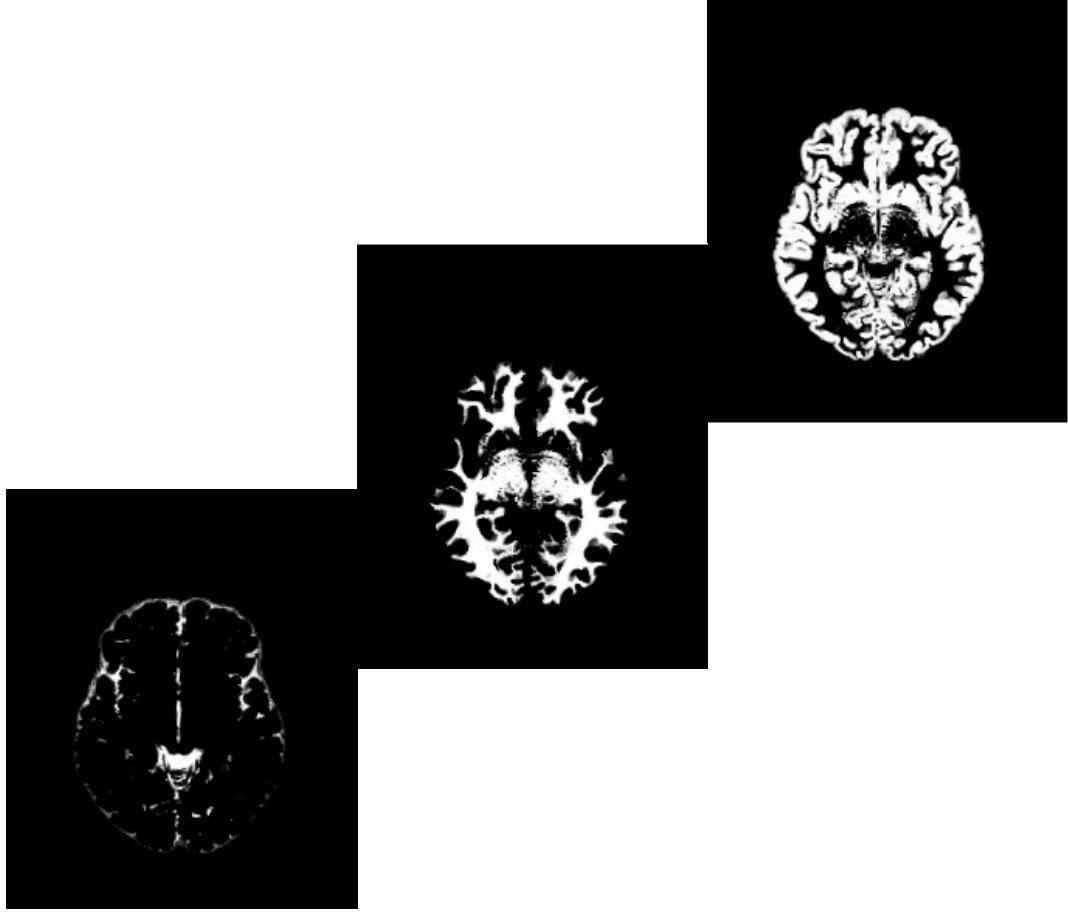
water concentration 55510 mM)

Gasparovic et al., 2006; Yymazal et al., 1999; Kingsley et al., 1998; Ernst et al., 1993

Methods

MRI Data analysis

Voxel and Surface based Morphometry (CAT12)



Region of Interest/ ROI: Extraction

Grey matter volume and **cortical gyrification**

before normalization from right insula

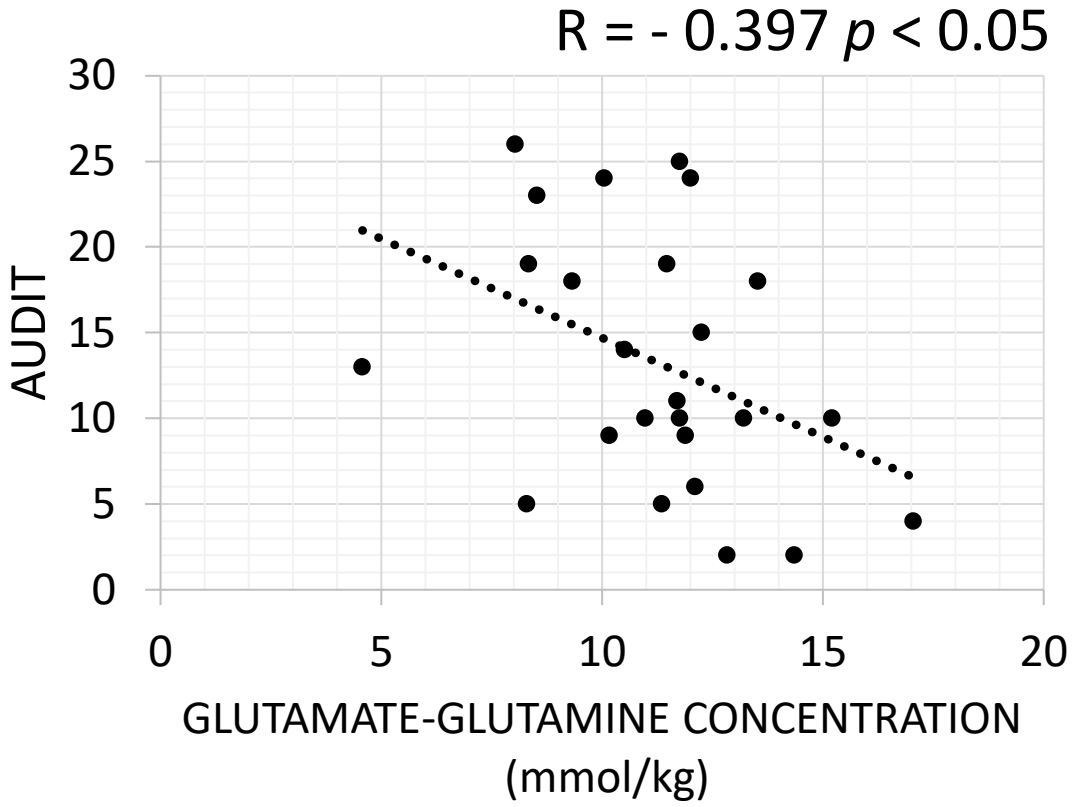
Statistical Analysis

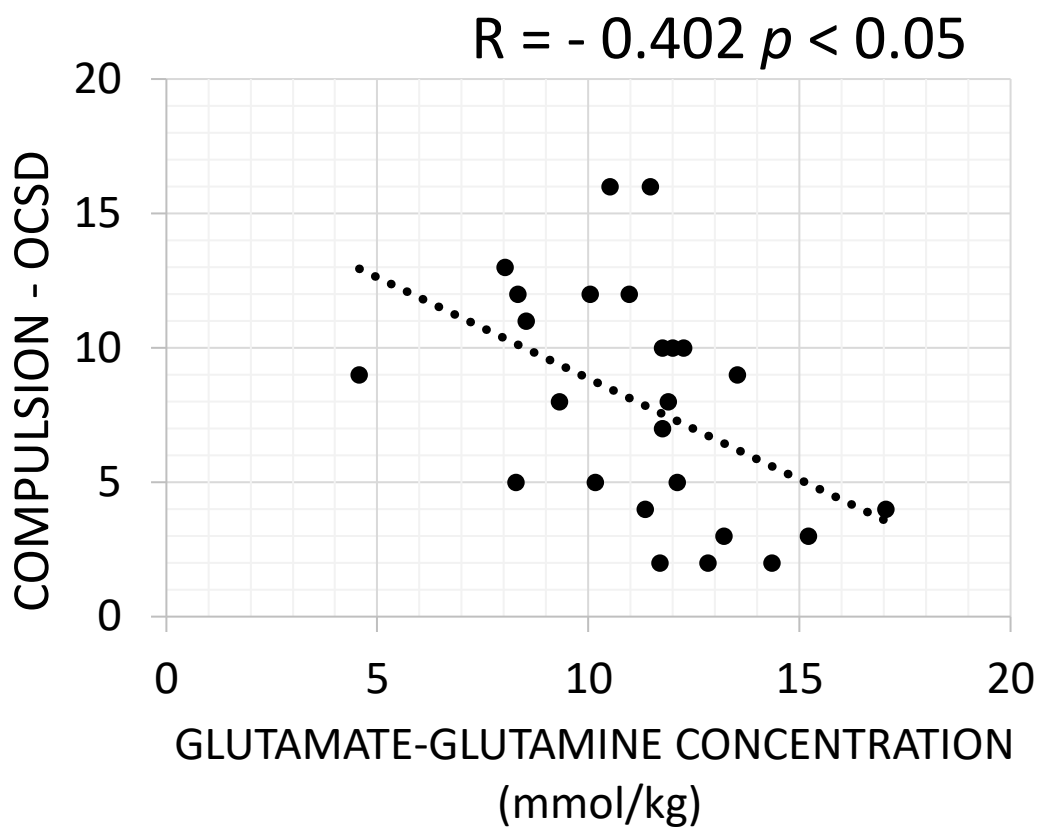
Correlations and regressions (controlling for age and Intracranial volume) using SPSS 24

Ashburner 2005; Luders et al., 2006

Results

MRS





Alcohol use disorder severity and **alcohol compulsions** are related to **reduction of insular glutamate and glutamine concentrations**

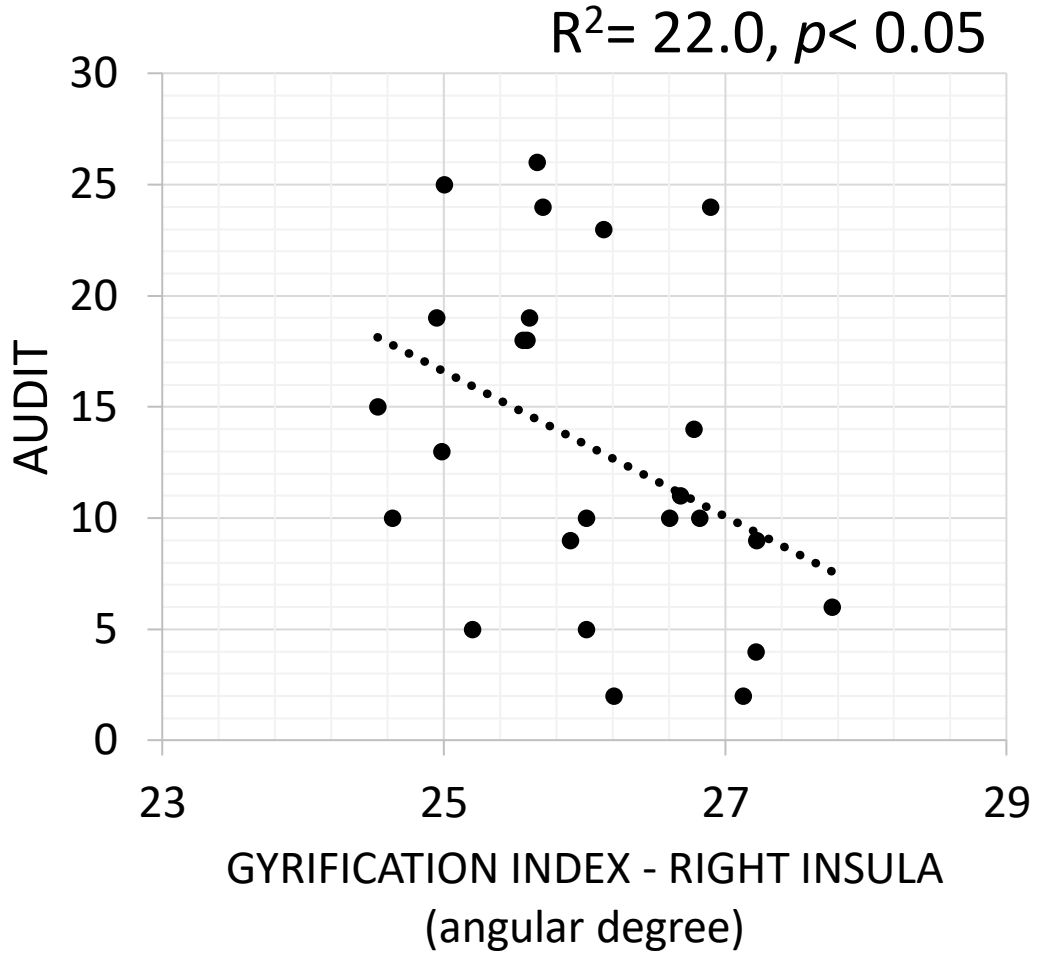
Betka et al., in prep

Results

SBM
ROI – right insula

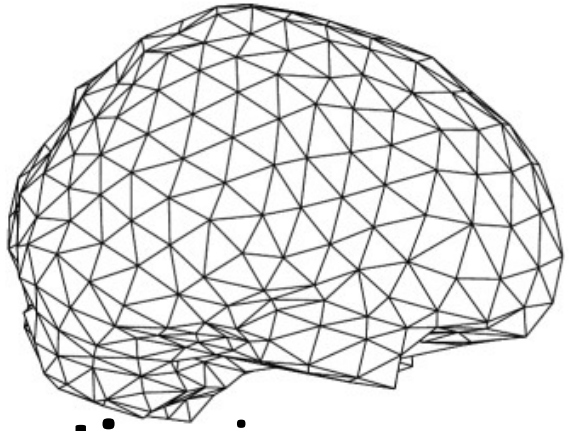
Alcohol use disorder severity was predicting reduced gyrification index in the right insula.

Severity of alcohol use disorder is associated with a **decreased cortical folding** in the right insula.
No VBM results



Betka et al., in prep

Conclusion



Reduced insular glutamate and glutamine concentration in heavy drinkers (mainly driven by glutamate).

Insular gyrification reduction but no insular volume reduction

Atrophy => metabolite reduction => interoception impairment

Subtle changes?

Is cortical gyrification a more sensitive measure of early alcohol-associated decline in grey matter?

Impact

First study looking at the interoceptive component of alcohol seeking

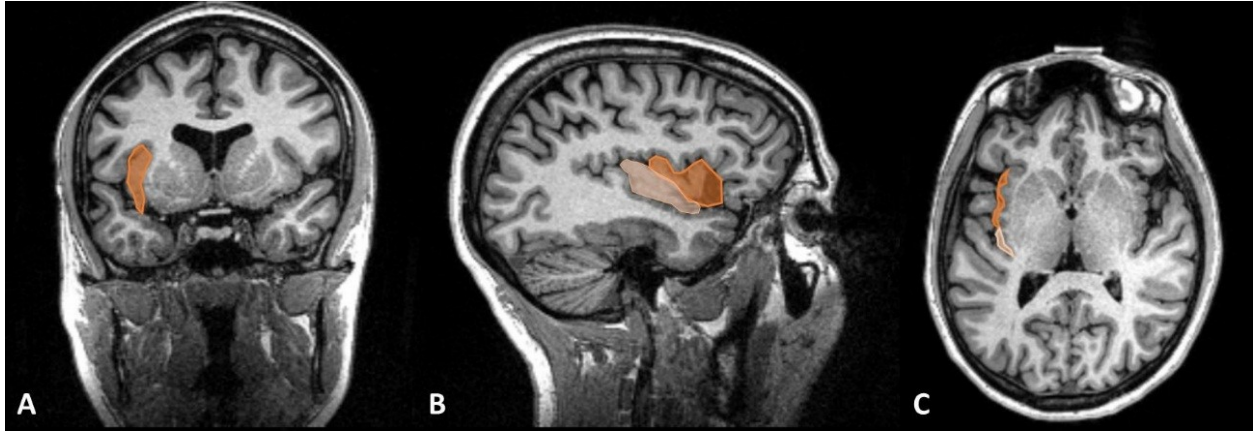
Integrity of insular cortex

In social drinkers

Using multimodal neuroimaging

Implication

The insula :



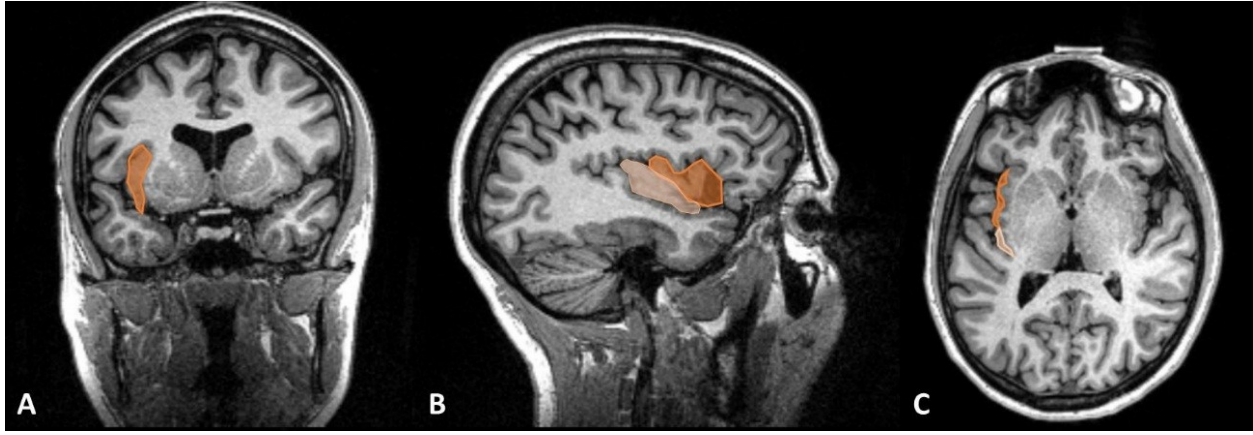
- Central role in the interoceptive component of drug seeking
- Impaired in alcohol and drug use disorders

IF

insular disruption ⇔ compulsion ⇔ relapse

Implication

The insula :



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- Impaired in alcohol and drug use disorders

IF

insular disruption ⇔ compulsion ⇔ relapse

Thank you for your attention!

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