

# Can I Feel my Heartbeat and Hunger? An Exploration of Interoceptive Belief Updating in Anorexia Nervosa

Alkistis Saramandi<sup>1</sup>, Laura Crucianelli<sup>1,2</sup>, Athanasios Koukoutsakis<sup>1</sup>, Veronica Nisticò<sup>1,3,4,5</sup>, Liza Mavromara<sup>1,6</sup>, Diana Goeta<sup>7</sup>, Fragkiskos Gonidakis<sup>6</sup>, Benedetta Demartini<sup>1,3,4,7</sup>, Sara Bertelli<sup>7</sup>, Orsola Gambini<sup>3,4,7</sup>, Paul M Jenkinson<sup>1,8</sup>, Aikaterini Fotopoulou<sup>1</sup>

<sup>1</sup>Department of Clinical, Educational and Health Psychology, University College London, UK, <sup>2</sup>Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden, <sup>3</sup>Department of Health Sciences, University of Milan, Milan, Italy, <sup>4</sup>Aldo Ravelli Research Centre for Neurotechnology and Experimental Brain Therapeutics, University of Milan, Italy, <sup>5</sup> Department of Psychology, University of Milan-Bicocca, Milan, Italy, <sup>6</sup> Eating Disorders' Unit, 1st Department of Psychiatry, National and Kapodistrian University, <sup>7</sup> Psychiatry Unit, ASST Santi Paolo e Carlo, S. Carlo General Hospital, Milan, Italy, <sup>8</sup> ISN Psychology, Institute for Social Neuroscience, Melbourne, Australia



- Anorexia Nervosa (AN) affects 1.9% of the population and has the **highest mortality** and **morbidity** rates among psychiatric disorders
- High **relapse** and treatment **drop-out** rates – ?due to the **ego-syntonic nature** of AN and poor insight --> **poor belief updating** and **metacognition**

**Q:** Which are the **determinants** of **interoceptive** processing **deficits**, and how are prospective **self-efficacy beliefs** about interoceptive abilities **formulated** and **updated**?

In AN, interoceptive impairments have been associated with difficulty in perceiving cardiac signals, and a distorted sense of satiety. **It is unclear whether effects observed in the cardiac modality translate across other interoceptive modalities.** Given that the *gastric system is directly linked to AN symptoms* we explore whether patterns of *pessimistic beliefs and poor belief updating* are similar between cardiac and gastric interoception.

## Hypotheses:

H<sub>1</sub>: The clinical groups would expect to perform more poorly in the HCT vs HCs and give lower ratings.

H<sub>2</sub>: The clinical groups would misestimate their performance in the HCT more than HCs as indexed by the greater discrepancy between their retrospective estimates relative to their performance.

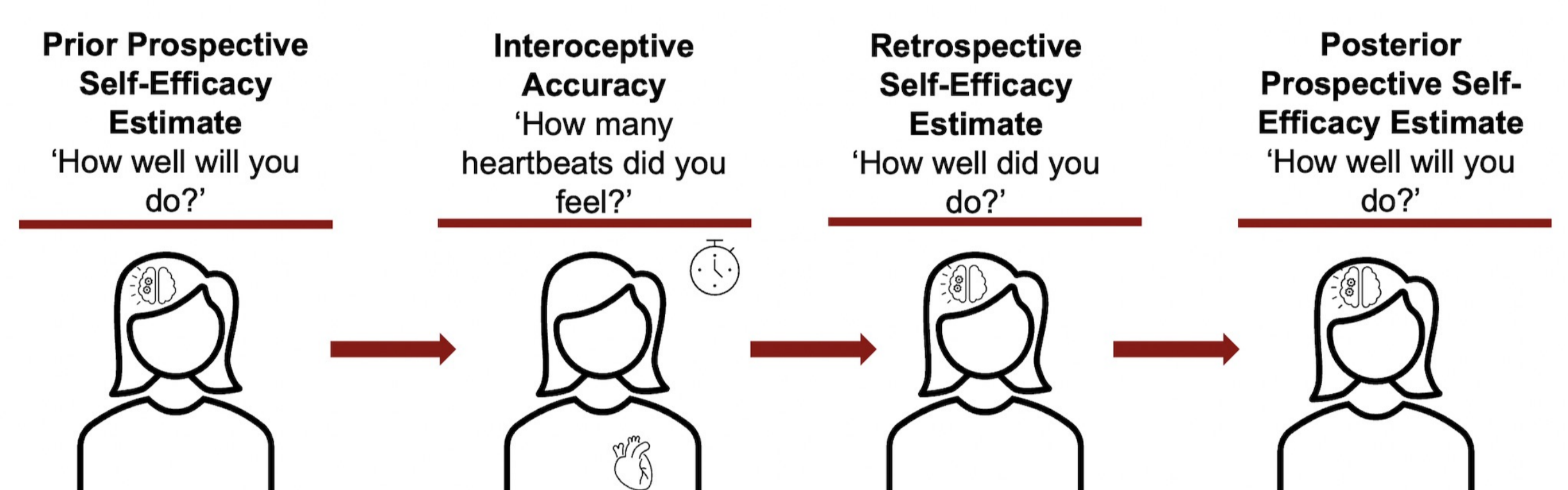
H<sub>3</sub>: The clinical groups would have a lower Bayesian optimal learning rate than the HC group. Differences in belief updating would be explained by low interoceptive self-efficacy.

H<sub>4</sub>: How do AN patients use states of fullness to predict future states?

Qualitative comparisons: Do we observe the same patterns between the cardiac and gastric modalities?

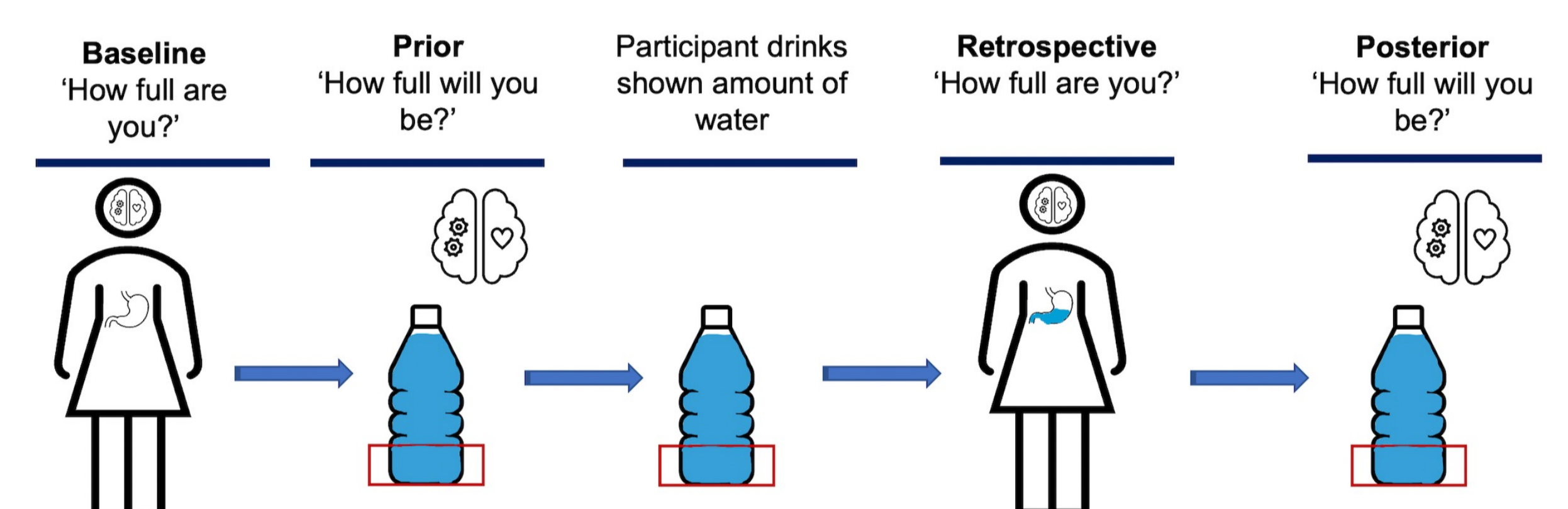
## Experiment 1: Cardiac Interoceptive Belief Updating

AN=35, AN-WR=40, HC=117

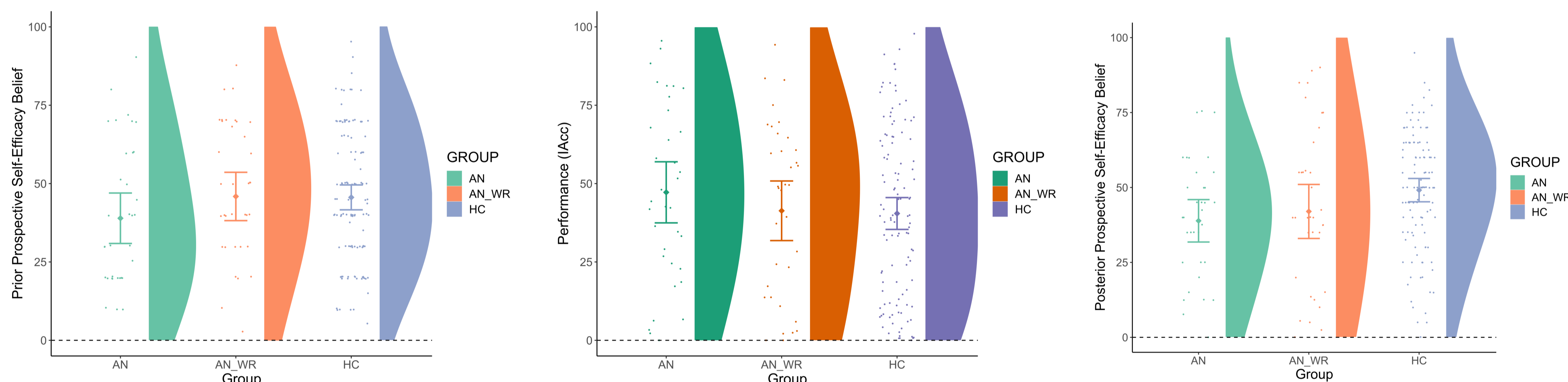


## Experiment 2: Gastric Interoceptive Belief Updating

AN=20, HC=46



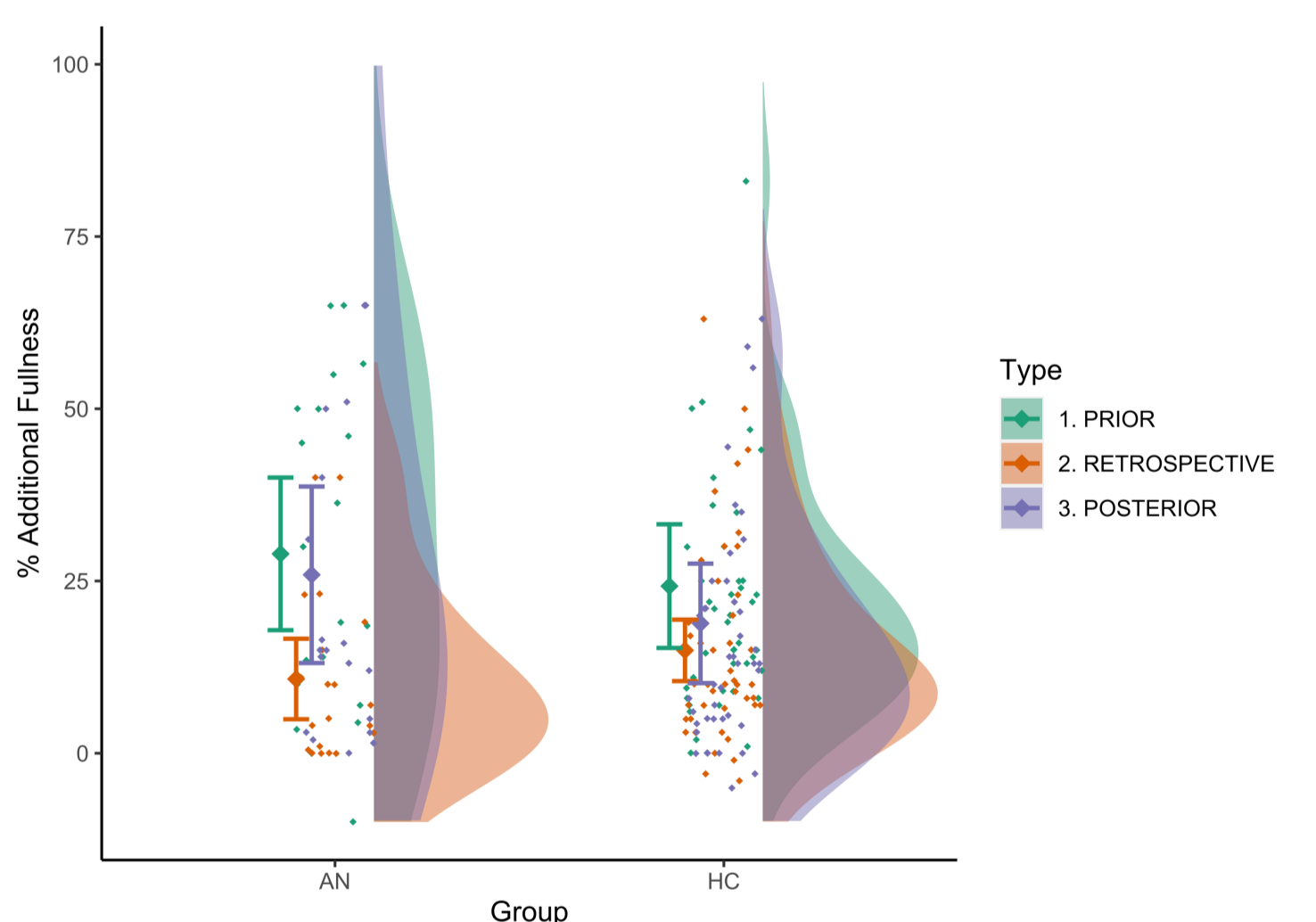
## Cardiac Interoception



### Experiment 1: Results

1/ Interoceptive Accuracy (IAcc) n.s. difference 2/ AN n.s. priors vs HCs; AN, AN\_WR ↓ retro vs HCs 3/ ↓ posteriors explained by retrospective beliefs 4/ Learning Rate in AN ↓ vs HCs 5/ ↓ Performance (IAcc) confidence in AN vs HCs

## Gastric Interoception



### Experiment 2: Preliminary Results

1/ ↑ predicted fullness vs HCs 2/ ↓ fullness after drinking vs predicted 3/ ↑ Prediction Error in AN vs HCs 4/ ↓ Belief Updating in AN vs HCs

## Discussion & Conclusions

1/ Pessimistic beliefs ⇔ prognosis; influenced by illness duration, state & trait effects

2/ Metacognitive difficulties at the retrospective & prospective levels

3/ What counts is the importance of the belief rather than subjective uncertainty (in both modalities)

