

1. Project name: The neural representations of confidence in human reinforcement learning task

2. Lead researcher: Chih-Chung Ting

3. Data steward: Chih-Chung Ting

4. Research question(s): The confidence is a crucial element for assessing beliefs of uncertainty/reliability that influence our choices overtime, like reinforcement learning. The recent studies have showed that confidence judgments were modulated by the valence outcome in both perceptual and value-based decision (Lebreton et al., 2017; Lebreton et al., 2019). Specifically, confidence in gain only condition is higher than loss only condition, despite both conditions share the same difficulty. However, little is known about how neural represent confidence and engage in reward and punishment learning. To fill in the gap, we will follow previous study (Lebreton et al., 2019; Ting et al., 2020) and apply the same probabilistic learning task with confidence rating in the MRI scanner.

5. Data to be gathered (including location): Spinoza Centre: All participants read instruction, MRI-prescreening and provided informed consent before the experiment. The behavioral and physiological data (i.e., BOLD signals) were gathered using computers at Spinoza Centre in Roeterseiland Campus.

Location: Roeterseiland, building L Nieuwe Achtergracht 129 1018 WS Amsterdam.

6. Method of data collection (in case of personal data indicate the basis (*grondslag*)):

We will hire subjects from UvA and prescreen them through a battery of questionnaires to ensure that subjects will be safe and comfortable in the MRI scanner.

The experiment will start from instruction and training session. In the MRI scanner, subjects are asked to accumulate and maximize payoff by choosing one of two symbols in each trial. In the 2(feedback valence: Gain or Loss) x 2(information: partial or completed) within-subject design, totally 4 conditions are used and represented by 4 pairs of symbols. Specifically, eight symbols are divided into four fixed combinations and are constantly arranged to four conditions. Each pair of symbols indicate a specific condition and the possible outcomes. For example, in the gain domain, the outcome is either + €1 or + €0.10. In contrary, -€1 or - €0.10 are possible outcomes in the loss domain. The probabilistic outcome of option is determined by reciprocal probabilities, 75% or 25%. The probabilities are certainly associated with the options. Subjects will be asked to make incentivized confidence judgments toward their choice before the outcome in each trial. Confidence judgments will be incentivized by Matching Probability (MP) mechanism, a well-validated method from behavioral economics adapted from the Becker-DeGroot-Marschak auction (Becker et al., 1964; Ducharme and Donnell, 1973). After completing learning task, subjects were instructed to perform an additional task, which is used to assess their preferences of option. All tasks are implemented using MatlabR2015a® (MathWorks) and the COGENT toolbox.

7. Individuals involved in data gathering, data manipulation/editing and with access to the data: Chih-Chung Ting; Tiffany Matej; Jan Engelmann; Mael Lebreton

8. Data Protection Impact Assessment: N/A

9. Data editing/manipulation steps (e.g. SPSS Syntax files, R scripts). Data is analyzed using Matlab and Matlab-based toolbox: SPM.

10. Where and how will the data be stored (including temporary storage for research use) and security measures applied: Data is anonymized and is stored on figshare.

11. Approval EBEC (Economics & Business Ethics Committee) obtained: approval yes/no. We obtained ethical permission from ERB (The Faculty Ethics Review Board of the Faculty of Social and Behavioural Sciences).

12. Intellectual property, copyright and ownership of the data: Chih-Chung Ting; Jan Engelmann; Mael Lebreton