Neurobiological and computational mechanisms
of complex planning in navigation

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1 – Introduction

Question.
Do people take uncertainty into account when planning?

Motivations.
> Planning. Complexity in planning. Complexity in EDM (Economical Decision-Making) is critical for sequential decisions. Optimality in such complex decisions is still a matter of research.

> Learning. Direct reward limits. In current research, reward is a direct consequence of each decision. This doesn't always happen in real life.

> Risk. Mean-heuristics limits. Most of experiments work with a linear relationship between reward and performance on trials. That implies that we actually can perform optically without taking into account the risk (or the variance). Most of heuristic models work just with the mean estimation. There can be shown that, in more general experiments, risk estimation is needed.

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2 – Background

> Planning. Explotation/Exploration trade-off. Talk about the n-armed bandit task?
> Learning. Model-based learning. When reward is not a direct consequence of decisions, fast learning becomes harder for *free-model* RL. *Model-based* learning is a powerful and more complex explanation for those kind of situations.
> Risk. Risk aversion. Aversion to risk has already been observed and described by some theories (eg, Expecetd Utility Theory, Prospect Theory). So humans take into account risk and uncertainty.

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3 – Aims

Understand both behavioural/computational and neurobiologically:

> Planning. Exploration/Explotation trade-off. How humans deal with this trade-off when the environment involves different kind of decisions (in opposition to the n-armed bandit task).
> Learning. Computational models. Build computational models suitable to observed human behaviour, identifying latent parameters and variables with fMRI BOLD signals.
> Risk. Risk utility. Show how human performance, by taking risk into account, may lead to better performance than optimal models working only with average values.

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4 – Task

Description
Description of the task
Demonstration of the task?

Interests
We can take both the time or the money as rewards with which to work.
If the reward is the money, subjects won't get an evaluative feedback of their actions until the end of the journeys.
We have control over uncertainty.

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5 – Results

(need to verify those hypothesis with the data)

> People learn which lines are faster
> People optimize their jounreys rapidly (in less than 10 trials, at least)
> Probability of taking each line across trials, in function of their speed.
> Comparison to computational models
    - counter model: counting stations
    - estimation models: extreme explotation
    - estimation models: extreme exploration
- estimation models: generalize uncertainty from other lines

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6 – Future directions

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