## Introduction

You have to get from home to work, and have two routes to choose from. One is constantly jammed, and takes 50 minutes (Route A). The other is free most of the time and takes 35 minutes, but sometimes other cars use it as well and can jam it for more than an hour (Route B). Every morning you have to decide which route to try today.

We ask:
1. How does variance of choices affect our decisions?
2. Does it affect metacognition, e.g. our confidence in our choices?

The Task

We examined choices and confidence ratings made by participants in a two armed bandit task. Four stable experimental conditions were embedded in a continuous design. In all conditions one option had higher mean rewards. The variance of the reward distributions changed across conditions and could be high (H) or low (L).

### Results

We examined the confidence ratings during exploration (choosing the bad option) and exploitation (choosing the good option) separately. Confidence ratings were averaged between trials 10 and 25 of the four experimental conditions. Exploration confidence ratings were overall lower than exploitation ratings (paired t-test t(64) = 8.3, p = 9e-12).

We replicated our findings using a time difference model which tracks only the mean reward:

\[
\begin{align*}
\theta_t &= \frac{1}{\sum_{i=1}^{T} r_{it}} \sum_{i=1}^{T} r_{it} / \beta_t \\
\beta_t &= \alpha + \frac{1}{\beta_t} + \frac{1}{\beta_t} \\
\beta_t &= \gamma (\beta_t - \beta_0) + \frac{1}{\beta_t} \\
\end{align*}
\]

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**Summary**

Participants chose the good option less frequently as the variance of options increased. Metacognitive reports showed dependency on the variance of the chosen option only during exploitation. These observations can be explained if confidence ratings reflect the probability of our choice outcome being higher than a threshold.