# Updating Local and Global Probability Events During Maze Navigation

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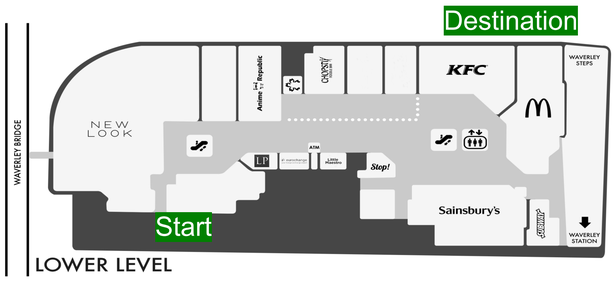
## Research Goal

**The current study aims to investigate how people encode global and local probability information during maze navigation.**

**Hypothesis:** We will test the assumption that there are different mental representations for local and global events, and that these distinct representations capture independent information about event contingencies.

## Do we have distinct representations for the probabilities associated with local and global events?

Local




Global

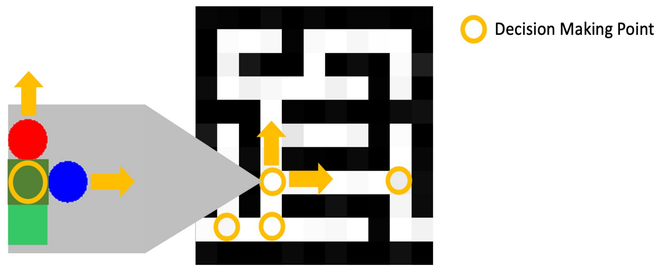
As we navigate in the world, we often navigate towards global goals (e.g., find the food court in a mall) using local landmarks (e.g., I think I smell burger that way). The global (e.g., food courts are to the East) and local (e.g., aromas are stronger along shorter paths) tendencies are not absolute, but probabilistic. Do we have separate probabilistic representations on the local and global events and if so, how are they prioritized?

**Local Events:** Events where the cues are physically or temporally proximate and feedback is immediate and direct.

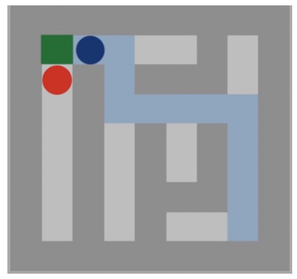
**Global Events:** Events associated with general objectives and feedback is distant in space or time.

## Maze Navigation with Local and Global Probabilistic Cues

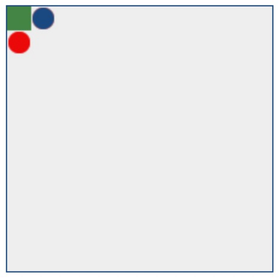
**Maze Generation:** Mazes are randomly generated using a tree growing algorithm coded in python. Across trials, the exit location (global event) can be either bottom left or top right. Participants cannot see the walls of the maze, but only a uniform mask. At each choice point, colored circles indicate the available directions for movement via distinctly colored circles. Particular colors are probabilistically related to the choice that leads to the shortest path (local event).




This figure shows the task schematically. A randomly generated maze has an exit at one of the corners (here shown bottom right). The participant navigates the maze by using arrow keys. The current location is the dark green square, prior position light green square, potential choices red and blue circles.



Transparent Mask



Real Experiiment

In the actual experiments, the maze appears to the participant like the example on the right where a mask covers the layout (shown as an example on the left). Thus, navigation requires combining your knowledge of the general goal direction with local information cued by the learned reliability of the colored circles.

## Procedure

1. Participants are told to move in the maze using as few steps as possible.
2. Participants are presented with one maze and two sliders. They use arrow keys to navigate and the mouse to update sliders which indicate their current estimates of local and global probabilities.
3. Practice trial demonstrate how to navigate in the maze and how to use the sliders to record their estimates of probabilities.
4. Feedback is given when probability estimate deviates more than ± 5 % from the ground truth after completion of certain maze.
5. Participants may report strategies via a post-experiment questionnaire.

## Participants

- University of Waterloo students (ages 18-30) are being recruited online from SONA.
- **Data collection is currently in progress.**

## Experiment Design

**Local Probability (Local Cue Reliability):** The probability of whether the **blue** circle is pointing to the shortest path.

**Global Probability (Global Direction Reliability) :** The probability of whether the exit is at the **bottom left**.

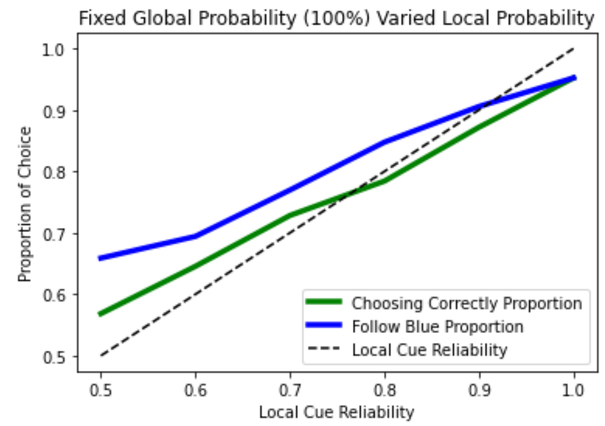
| **Fixed Global Probability (100%) Varied Local Probability Condition 1** (N=22) | | | | | | |
|---|---|---|---|---|---|---|
| Global Probability | 100 | 100 | 100 | 100 | 100 | 100 |
| Local Probability | 50 | 60 | 70 | 80 | 90 | 100 |

| **Fixed Local Probability (80%) Varied Global Probability Condition 2** (N=26) | | | |
|---|---|---|---|
| Global Probability | 60 | 73 | 80 |
| Local Probability | 80 | 80 | 80 |

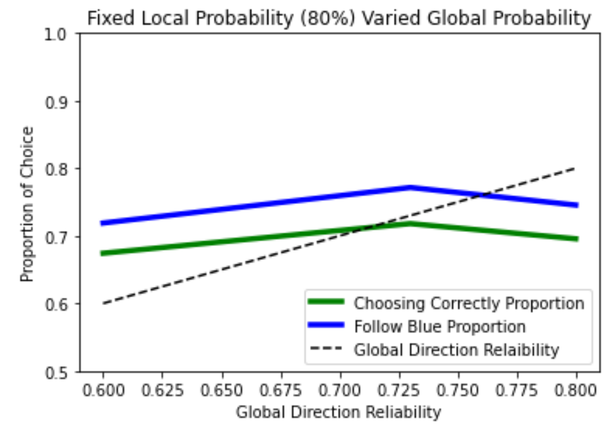
## Preliminary Results

Only first visit to a decision point is included in analysis.

**Participants learned the local cue and roughly matched choice probability to local cue reliability**




**Local cue and global direction reliability both influenced choice with local cue reliability dominant.**

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