# A homing task that could not be done by image matching

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# Introduction

When an individual navigates to return to a previously-visited location, 'home', they could do so either by building a 3D representation of the space or by matching the views from that location (Gootjes-Dreesbach et al., 2017). The present study aimed to investigate this question when an imagingmatching strategy is impossible.

# Methods

#### **Apparatus:**

- 10 participants completed the task in 3 different rich scenes. They were allowed to walk freely in the physical room which was 5x3 metres.
- The scenes were delivered via an nVisor SX111 headmounted display and participants were tracked iVicon tracking equipment.

#### Task:

• The task included 2 intervals. During the first interval, the learning phase, participants started at one out of 4 possible locations and memorized their location, 'home'. During this interval, their movements were restricted to  $\pm 0.5$ metres.





- They were then teleported to another location, 'search phase', and had to go back to 'home'.
- To exclude an image matching strategy participants' view was restricted to a 90° FOV by a cone-shaped occluder in both intervals.
- During the learning phase, participants' view was always towards the middle of the room.
- During the search phase, the cone's orientation was rotated by 0°, 90° or 180° relative to the view of the learning phase. Thus, although participants could freely move in the room, their direction of view remained the same.





Bottom row: Data replotted in a coordinate frame dependent on participants' path (see Box below).

#### Box: Model 2 🔾

- Four objects were located in the middle of the room to help participants orient themselves.
- Participants tented to choose a path that allowed them to see the objects.
- The midpoint of the locations from where the objects could be seen, defined a line to the target (dotted line in Fig).
- Model 2 predicted that the end location along this line. 🔘

## Results

- parameters). 🔘

### Likelihood ratio:

# Conclusion

#### References

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• The task is not impossible to perform.

• However, there were consistent errors when the view in the second interval was rotated by 90° or 180° compared to the view of the first interval.  $\bigcirc$ 

• The reported locations were systematically shifted based on the viewing direction in interval 1 (here, north). This is model 1 (2

• However, there is a way to describe the data using a single parameter that is dependent on the path that the participant took. This is model 2 (1 parameter, see **Box**).

• Model 2, that was based on the path participants took, provides a better prediction of the data (RMSE: 0.35; BIC: 1.39) than model 1 (RMSE: 0.43; BIC: 17.27).

• By design, we excluded an image matching strategy.

Participants displayed systematic errors.

• The best account for the errors depends on the path participants took to get to the target.

Gootjes-Dreesbach, L., Lyndsey, C., Fitzgibbon, P. A. W., & Glennerster, A. (2017). Comparison of view-based and reconstruction-based models of human navigational strategy. Journal of Vision, 17(9), 23–25. https://doi.org/10.1167/17.9.11

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