

Knowledge of Landmark Configuration does not Improve Metric Performance in Virtual Environment Navigation*

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1 INTRODUCTION

Cognitive maps can be organised topological or topographical. In the first case, places and their adjacency are stored (knowledge of configuration) and in the latter case also all coordinates of the known places are stored.

Metric information can be inferred from

- path integration
- depth perception
- configurational landmark knowledge (global metric embedding, MDS)

We investigated if metric information which does not originate from path integration improves the performance in pointing and distance production.

More specifically, does a central landmark, which visually connects different parts of the composed environment, but is unreachable, improve the metric representation?

2 EXPERIMENTAL SETUP



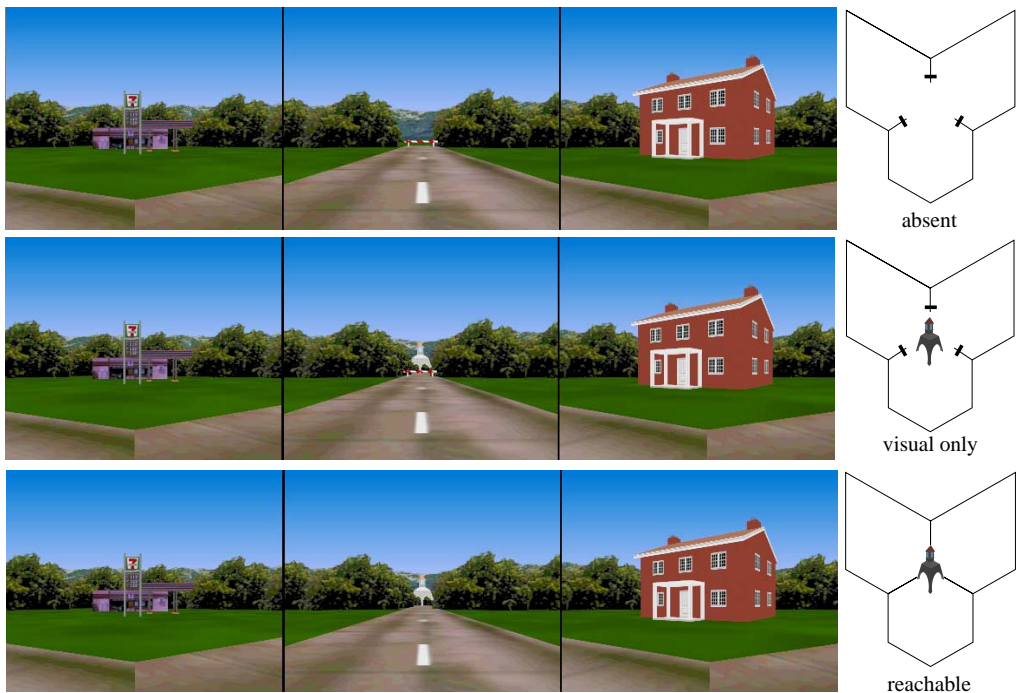
The subjects were seated in front of a projection screen (half-cylindric, 7m diameter, 3.15m height)

Movement within the environment:

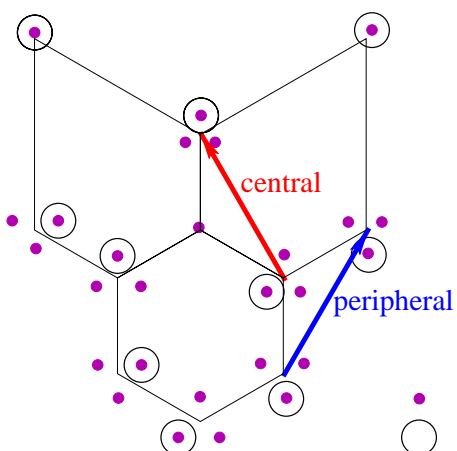
- Translations by a force-feedback bicycle
- Rotations triggered by pressing the buttons of a computer mouse.

Egomotion is simulated with a framerate from 36 Hz.

3 CONNECTIVITY CONDITIONS



4 PROCEDURE



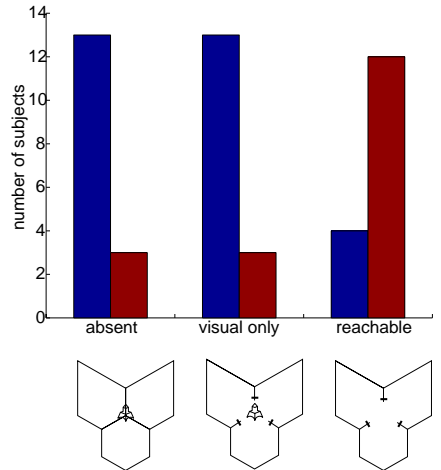
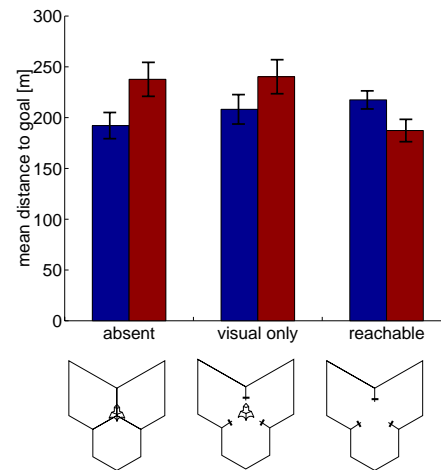
- pretest
- learning phase
- 28 shortcuts
 - * 14 central
 - * 14 peripheral
- old-new-recognition task
- map drawing

• landmark
○ goal

5 RESULTS

Error: mean distance to the goal for peripheral and central paths

Number of subjects doing better for peripheral or central paths



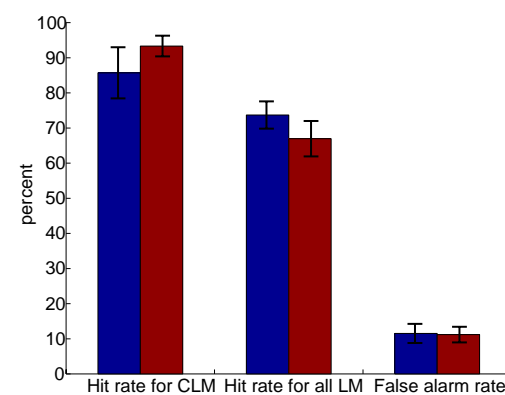
• N = 16 subjects per condition

• Navigation error was measured as the distance from the goal to the location where the subjects stopped.

• The condition "reachable" has significantly smaller errors ($p = 0.013^*$) than condition "visual only".

• The condition "visual only" and the condition "absent" are similar.

6 CONTROL: The central landmark is known



• The central landmark (CLM) is remembered in both conditions.

• Average recognition of all landmarks is reasonable ($d' = 1.8$).

7 CONCLUSION

• The knowledge about the central landmark does not improve the metric representation

• Metric information is inferred from path integration, but not from monocular depth perception (distance of the central landmark from the outer loop)

• The results are consistent with the idea of a topological representation containing local metric information.

• In contrast with global metric information (i.e., topographical map), subjects in the "visual only" condition should be as good as in the "reachable" condition.

8 REFERENCES

Sibylle D. Steck 2000. Integration verschiedener Informationsquellen bei der Navigation in virtuellen Umgebungen. Ph.D. thesis, Eberhard-Karls-Universität Tübingen.

Project page: <http://www.kyb.tuebingen.mpg.de/bu/projects/hexatown/index.html>