Different strategies of global and local landmark usage in virtual environment navigation*

S. D. Steck, H. A. Mallot
email: sibylle.steck@tuebingen.mpg.de, web: www.kyb.tuebingen.mpg.de

HEXATOWN PROJECT

Max–Planck–Institut für biologische Kybernetik ● Tübingen

1 INTRODUCTION

In visual navigation, landmarks can be used in a number of different ways. The visual input contains various types of information such as local position information (views, local landmarks), compass direction (e.g., global landmarks), or egomotion (optic flow).

In previous experiments using a desk–top virtual environment (Geiger et al. 1998) we found that global landmarks were only rarely used. Here we use a large visual field and more salient global landmarks to investigate the role of global and local landmarks in virtual environment navigation.

Hypothesised strategies:

- "place–recognition–triggered response"
  - global landmarks provide compass directions
  - e.g., "walk north (or towards the distant mountain) when arriving at Central Square"
- "view–recognition–triggered response"
  - local landmarks
  - e.g., "go left when facing the city hall"
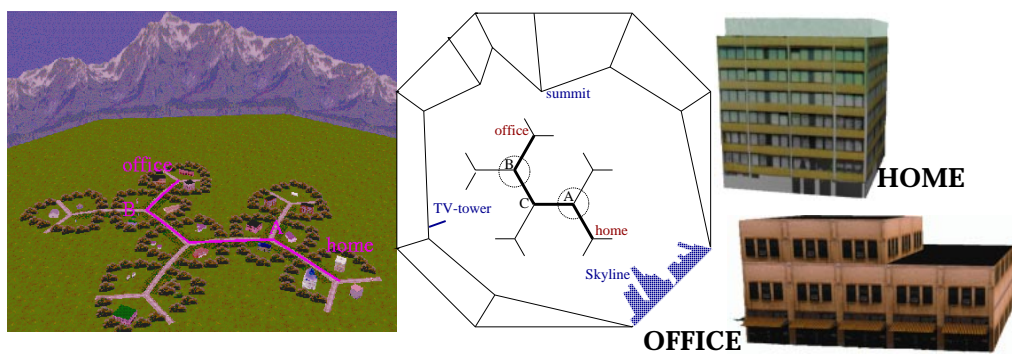
2 EXPERIMENTAL SETUP

The subjects sat in front of a projection screen (half–cylindric: 7m diameter, 3.15m height).

They moved within the virtual city of Hexatown (Gillner and Mallot 1998, see picture below) by pressing the buttons of a computer mouse.

Egomotion is simulated with a framerate of 36 Hz.

3 EXPT. 1: CUE CONFLICT

HOME

OFFICE

Training I:
After an exploration of the unknown city, subjects had to learn the fastest way (without unnecessary turns) back and forth between home and office. Subjects also had to point to two global landmarks, to ensure they had been noticed.

Training II:
Subjects were transported from all three possible directions to place A or B. From there they had to find a goal (home or office) which was presented as a picture.
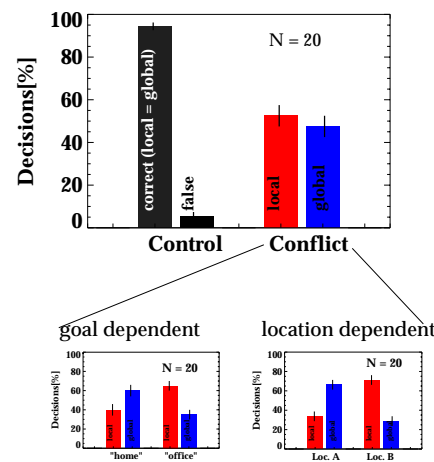
Test:

CONTROL

CONFLICT

Subjects were transported as in Training II, but after their movement decision, the trial was terminated to avoid feedback.

The conflict condition showed conflicting information in local and global cues.

4 RESULTS CUE CONFLICT

- 12 out of 32 recognized the cue conflict.
- The performance of the subjects in the control condition was very good (94.4%).
- In the conflict condition different landmark types were used, due to different goals and and due to different locations.
- Some subjects showed a clear strategy.
- Do those subjects store information about the neglected landmark type?

5 EXPT.2: CUE REDUCTION
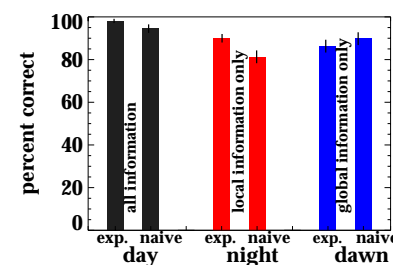

DAY

NIGHT

DAWN

Same **training**, but different **test** conditions (cue reduction).

local and global landmarks

local landmarks only

global landmarks only

6 RESULTS CUE REDUCTION

- Good overall performance (90.2% correct answers).
- The good performance indicates that information neglected in Expt. 1 (experienced subjects) still was present in memory.
- No significant difference between naive and experienced subjects.

exp.: experienced subjects (N=20), naive subjects (N=16)

7 CONCLUSION

- Both types of landmarks are used in the decision for the wayfinding task.
- Some subjects used only local landmarks, others only global landmarks, and still other subjects used local landmarks at one location and global landmarks at the other location.
- Nevertheless both types of landmarks are stored in memory. Although some subjects used only one landmark in the conflict experiment, they were able to perform both single landmark tasks in the "Cue Reduction Experiment".

8 REFERENCES

Geiger, Mallot & Gillner 1998 "Integration of local and global landmarks for route finding in virtual environments.", Visuelle Wahrnehmung: Beiträge zur 1.Tübinger Wahrnehmungskonferenz, 75.

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