Environments that are divided into different regions lead to hierarchical encoding of space. Such hierarchical representations of space produce systematic distortions in distance estimations, directional estimations, spatial priming and recall of landmarks (e.g., Stevens & Coupe, 1978, McNamara, 1986, Hirtle & Jonides, 1985). Here we present an experiment that investigates the influence of regionalized environments on human navigation behaviour.

In a prior experiment we have shown that human navigation behaviour is influenced by environmental regions. Displayed in the figure below is an example for a navigation task in this experiment.

Subjects were asked to find the shortest route connecting three target places (red circles) within an environment that was divided into three regions (background colors). Although alternative optimal paths were present subjects reliably preferred routes that crossed fewer region boundaries (red lines represent subjects route choice behavior).

**#3 Prior Findings**

We evaluated how often subjects chose the alternative that allowed for fastest access to the target region. Only error-free trials were included in the evaluation (subjects found one of the shortest possible paths in over 90% of the navigation tasks).

**#4 The Experiment**

**Motivation**: With this experiment we wanted to discriminate between the possible explanations mentioned above.

**The Environment**

Displayed to the right is a birds eye view of the environment. Two islands contained six places each. The places were interconnected by roads and bridges and could be identified by unique pop up landmarks.

**The Test Routes**

Subsequent to an exploration and training phase subjects were asked to navigate the shortest possible route connecting a start place (grey circle) and a target place (red circle). Route types (A,B,C) differed in the spatial configurations of start- and target-place. All route types allowed for at least 2 alternative short paths.

**Possible strategies explaining the observed effect:**

- S1: Region boundaries are over represented in spatial memory (routes that cross fewer region boundaries appear to be metrically shorter).
- S2: Region persistence (subjects tend to stay in a region as long as possible).
- S3: Shortest approach to target region (enter the region that contains the target place as fast as possible).

**Variable of Interest**

We evaluated how often subjects chose the alternative paths that allowed for fastest access to the target region. Differences between route types are subject of current research.

The psychology of learning and memory. Psychology Press. New York.

**#5 Results**

The figure to the right shows typical results for navigation tasks of type A. The thickness of the red lines indicate the frequency with which subjects chose one of the alternative paths. The data plot and the table below summarize results for all route types.

<table>
<thead>
<tr>
<th>Type</th>
<th>Followed strategy S3</th>
<th>t-test against chance level (90/95)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>59.5 %</td>
<td>t&lt;3.6, d=26, p=0.01 **</td>
</tr>
<tr>
<td>B</td>
<td>70.3 %</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>66.7 %</td>
<td>t&lt;2.4, d=26, p=0.01 **</td>
</tr>
</tbody>
</table>

Taken together we find for all navigation tasks that subjects prefer routes that allowed for fastest access to the target region. Differences between route types are subject of current research.

**#6 Conclusions**

Subjects preferred to enter the target island sooner rather than later when start- and target place were located on different islands. In combination with the results of prior experiments (see #3) these finding suggests that neither an encoding error (S1: over representation of region boundaries) nor persistence effects during navigation (S2) account for the observed effects. The strategy S3 (shortest approach to target region) is consistent with results of both experiments.

We therefore conclude that route planning is based on region connectivity not place connectivity alone. We suggest that route planning uses coarse space information (regions) for the goal but fine space information for the current location.

**#7 References**


McNamara, T.P. (1986). Memory’s view of space. The psychology of learning and motivation, 27, 147-186.


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