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Place Recognition

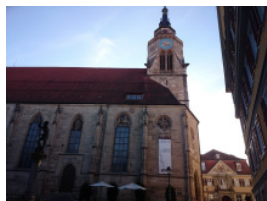
In human place recognition, spatial longterm memory is supposed to be organized in a map or graph-like representation. Previous studies showed that the recall of places from longterm memories was influenced by mental travel passing through the place (Basten et al. 2012), by recall position relative to the place, familiarity of landmarks on a place, (Röhrich et al. 2014), body orientation (Meilinger et al. 2015), etc.



The plots show the average orientation of sketchmaps for the “Holzmarkt” and “Marktplatz” squares of downtown Tübingen for a sample of recall locations (A-J), see Röhrich et al. *PlosONE* 2014.

Question

How can the sketchmap experiment be transferred into the lab, using virtual environments and within-subjects comparisons?



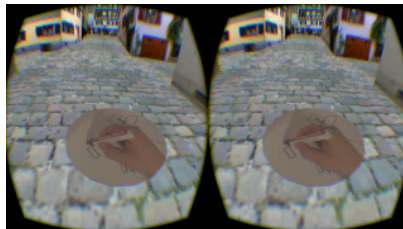
Real World View



Virtual Environment View



Drawing desk with camera



Participants hand drawing sketch map

Experimental Setup

Apparatus

- 3D virtual model of the historic City of Tübingen
- Head mounted Display (Oculus Rift)
- Drawing desk with camera to display participant’s hand in VR for drawing
- Subjects could move freely within the city by using a gamepad and control movement direction via head turn

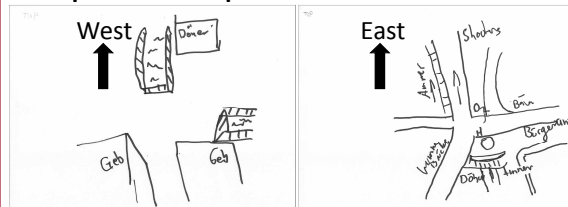
Experiment

- Participants had to absolve a training-phase by walking an unknown route through the virtual city as instructed by the experimenter
- At the end of the training route they drew a sketch map of a well known place in Tübingen that was outside of the virtual environment

Task

- Participants walked an unknown route guided by arrows
- At three locations along the route participants were stopped and asked to draw one of three target places
- Participants started their route either at the east or in the west
- For each target place there were two different drawing locations
- One target place was within the route, two were off the route

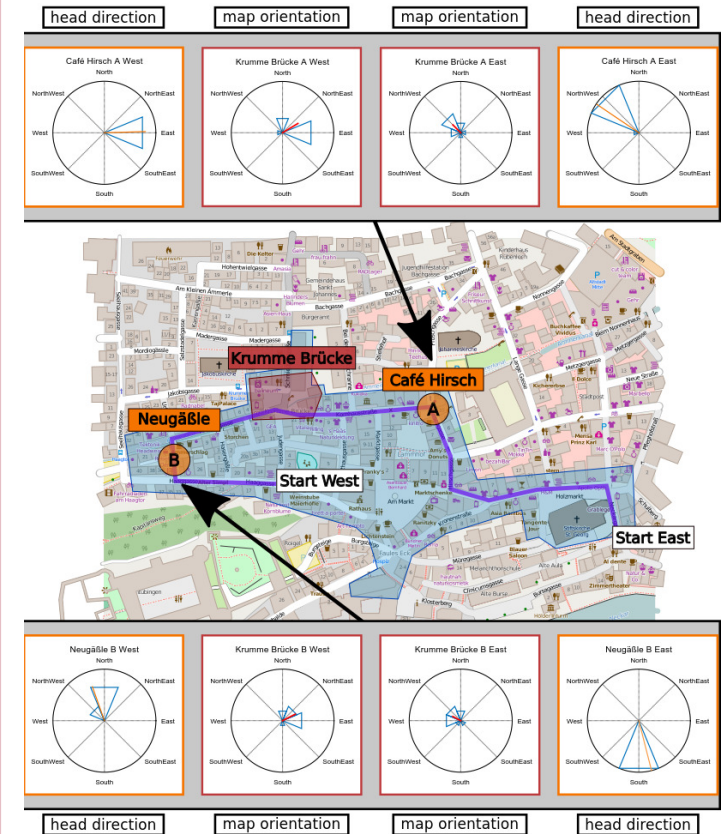
Sample sketch maps



Sketch Map Orientation

- Sketch maps were rated by three independent raters
- Orientation where two of three raters agreed was chosen
- Distributions of orientations were plotted as circular histograms

Results and Conclusion



- **Top Row of Histograms:** at “Café Hirsch”, sketches of “Krumme Brücke” align with current heading and expected or experienced passage direction.
- **Bottom Row of Histograms:** at “Neugäßle”, sketches of Krumme Brücke are oriented 90° right of current heading, but aligned with expected or experienced passage direction.
- Sketch map orientation can be explained by memory of recent passage or by imagery of mental travel to target.

