

Determining Hierarchy of Landmarks in Spatial Descriptions

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1. Introduction

Communicating wayfinding instructions involves selective inclusion of spatial elements that may guide a person to reach the destination. These spatial elements could provide someone an idea of the place layout depending on how instructions are structured. Allen (1997) discussed methods of how a person is able to communicate route instructions well in ways that are easily comprehensible that could also be applied to navigation systems. This means that route instructions should be appropriate to a certain environment as well as the type of people. The quality of route instructions is important for effective wayfinding, but having lengthy or brief instructions does not translate into either good or bad verbal route instructions (Lovelace et al, 1999). Moreover, Weissensteiner and Winter (2004) investigated the importance of narratives in providing wayfinding instructions as it engages the person to the environment thereby, creating a picture of the unfamiliar area and its surroundings. Without landmarks, it will be hard for people to find their way especially those who do not prefer following absolute directions. Raubal and Winter (2002) addressed the importance of enriching wayfinding instructions with local landmarks by providing measures to identify the saliency of a specific feature. Richter and Klippel (2005) highlighted that the structure of the environment plays a major role on how wayfinding instructions should be written. In this study, we investigate the types of landmark information participants include in verbal route descriptions and sketch maps. We focus our analysis on the composition of landmarks in the spatial descriptions whether participants are confined in giving only local landmarks in the route instructions.

1.1 Types of landmarks

In this paper, we classify landmarks into local and global landmarks. Local landmarks refer to landmarks along the route (LLAR) or landmarks at decision points (LLDP) with turning action. Local landmarks are mostly used in today's navigation instructions guiding people in a new environment by following turn by turn directions. But, people may tend to include global landmarks that are also helpful reference objects in wayfinding. Global landmarks (GL) are identified as either point or regional features situated off-the route. Point-like features refer to specific buildings while regional features are landmarks with an area extent (e.g. lake, mountain, city center). These may not necessarily be visible landmarks which are located along the route but they could also be point or regional features that are distant but could be useful information for orientation. Distant landmarks which are less exploited in verbal instructions provide someone global orientation (Couclelis, 1996; Winter et al, 2008) which might help one capture a survey knowledge of an unfamiliar environment.

1.2 Hierarchy in spatial descriptions

Hierarchy of spatial objects is evident on how landmarks and paths are clustered based on its functionality. This has been investigated in the development of the anchorpoint theory (Golledge, 1997). As what the author emphasized, anchorpoints do not only refer to well-known and mostly used place in the environment. Taylor and Tversky (1992) found out that there was a correlation between the order of elements drawn and the order on how it was mentioned in the spatial descriptions. It occurred in their study that there is hierarchical structure in people's sketch maps at different environmental scales.

Extensive research on global landmarks is limited. Steck and Mallot (2000) developed a virtual environment and looked at how people refer to local and global landmarks in the navigation task. In this particular task, the authors defined global landmark as a reference frame which does not change if the participant move even at short distance. Examples of the global landmarks used were mountain, city skyline and TV tower. Local landmarks, on the other hand, refer to visible objects near the route and seen from a small distance. It resulted that both local and global landmarks were used for wayfinding decision tasks. Winter et al (2008) developed an approach showing hierarchical communication of space through partitioning of landmarks. Landmarks have been considered either a point in the route or a component of a region. In their study, a wayfinding instruction was developed such that the person is first directed to a prominent feature and from there instructions to the real destination were provided.

2. Results

We asked 17 university students in Muenster, Germany to provide wayfinding instructions to someone unfamiliar of the city through text and sketch map. From the initial result, all

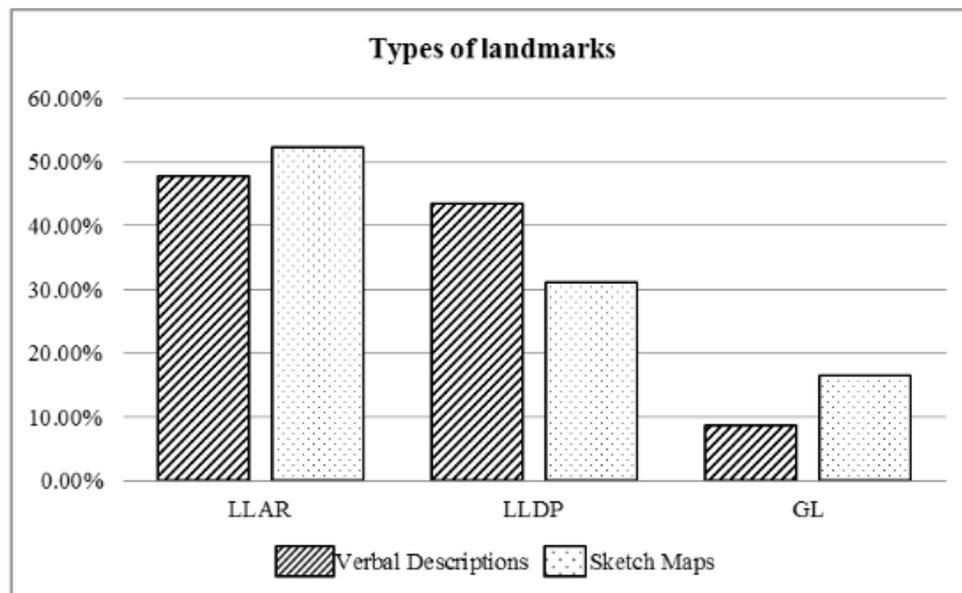


Figure 1: Frequency of landmarks in verbal descriptions and sketch maps.

participants included both types of local landmarks along the route and at decision points. Majority of the participants, 70.59% and 76.47% have included global landmarks in their verbal descriptions and sketch maps, respectively. Figure 1 shows the frequency of the types

of landmarks included in both spatial descriptions with more local landmarks along the route and followed by local landmarks at decision points and finally, global landmarks.

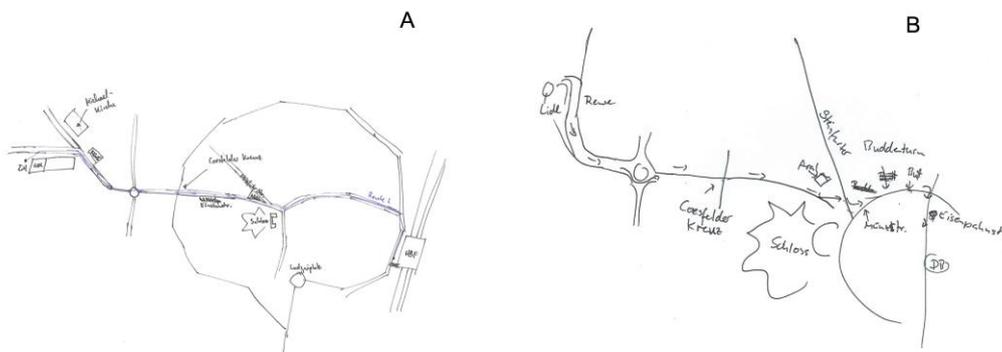


Figure 2: Example of sketch maps with global and local landmarks.

Prominent landmarks are oftentimes used as reference objects in providing instructions. In the case of Muenster, the castle (Schloss) and the Promenade were the prominent landmarks frequently used as reference objects in giving wayfinding instructions. The Promenade defines a boundary for people to refer to the location of the city center which is basically described as the area inside it (see Fig. 2).

Given that the participants combined local landmarks and global landmarks in their wayfinding instruction, we took this into account in our preliminary analysis of identifying presence of hierarchy in the spatial descriptions and incurred the following observations:

a) Participants provide a global orientation by giving a distant region which does not necessarily have to be along the route but providing an idea of the direction of travel. One example states: *“From there, you drive to the direction of the castle. But you turn left before the castle”*.

b) Participants summarize the route and describing afterwards what other landmarks and streets to see along the route in sequence.

c) With regard to sketch maps, some maps were structured showing a ‘landmark within a landmark’ concept wherein a landmark point feature is a component of a regional landmark as shown in Figure 2a.

3. Conclusion and Future Work

The result of the preliminary analysis suggests that both local and global landmarks have been used in giving route descriptions. It showed that participants include more landmarks along the route where there is no turning action. We observed also an inclusion of off route distant landmarks in both spatial descriptions. Global landmarks could be considered important in wayfinding but its function and potential use for during wayfinding is not extensively studied.

We are currently investigating how to systematically analyze the hierarchical structure of objects in spatial descriptions. The number of participants that have included global landmarks in the sketch maps is an indicator suggesting that these are also important elements in giving wayfinding instructions. This aspect is not extensively investigated which is why we consider the importance of combining global landmarks and local landmarks in

wayfinding instructions. We find this approach valuable in developing more meaningful instructions that may instill spatial layout learning and not only focusing on procedural steps.

Furthermore, we intend to explore the role of global landmarks in more details. In our present study, we grouped distant landmarks (either regional or point-like) that may serve the role of maintaining orientation in category of global landmark. It will be worthwhile for us to further explore the roles of different distant landmarks due to their shape, location, or distance.

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References

- Allen, G.,1997, From knowledge to words to wayfinding: Issues in the production and comprehension of route directions. In Hirtle, S., Frank, A., eds. : *Spatial Information Theory A Theoretical Basis for GIS* 1329. Springer Berlin Heidelberg, 363-372.
- Couclelis, H., 1996, The Construction of Cognitive Maps. Springer Netherlands,133-153.
- Golledge, R., Stimson, R. J., 1997, Spatial Behavior: A Geographic Perspective. The Guilford Press, New York.
- Lovelace, K., Hegarty, M., Montello, D, 1999, Elements of Good Route Directions in Familiar and Unfamiliar Environments. In : *COSIT '99 Proceedings of the International Conference on Spatial Information Theory: Cognitive and Computational Foundations of Geographic Information Science*, pp.65-82.
- Raubal, M., Winter, S., 2002, Enriching Wayfinding Instructions with Local Landmarks. In Egenhofer, M., Mark, D., eds. : *GIScience '02 Proceedings of the Second International Conference on Geographic Information Science*, pp.243-259.
- Richter, K.-F., Klippel, A.,2005, A Model for Context-Specific Route Directions. In Christian Freksa, M., ed. : *Proceedings of the 4th international conference on Spatial Cognition: reasoning, Action, Interaction*, pp.58-78.
- Steck, S., Mallot, H.,2000, The role of global and local landmarks in virtual environment navigation. Presence: *Teleoperators and Virtual Environments* Vol. 9 Issue 1, 69-83.
- Taylor, H., Tversky, B., 1992, Descriptions and depictions of environments. *Memory and Cognition* Vol. 20, Issue 5, 483-496.
- Weissensteiner, E., Winter, S.2004, Landmarks in the Communication of Route Directions. In : *Third International Conference, GIScience 2004, Lecture Notes in Computer Science*, vol. 3234, pp.313-326.
- Winter, S., Tomko, M., Elias, B., Sester, M.,2008, Landmark hierarchies in context. *Environment and Planning B: Planning and Design* 35 (3), 381-398.