

# The Use of Local and Global Landmarks across Scales and Modes of Transportation in Verbal Route Instructions

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**Abstract.** Landmarks are acknowledged as means to making wayfinding instructions simpler and intuitive. Research endeavors have showed that landmarks are frequently used in human-given instructions for wayfinding. In the presented study, we further explore the use of landmarks in verbal descriptions for routes that cover different scales and require different modes of transportation. Twenty-one participants from the authors' university participated in this study to give verbal descriptions of three different routes which are different in length as well as in mode of transportation. Results show that previously identified local and global landmarks are predominantly used in verbal descriptions regardless of scales. Furthermore, the use of local and global landmarks changes with the mode of transportation and scale. That is, when the length of route is very long, this requires transportation mode to be driving in a car, the use of global landmarks increases. This study sheds light on future work of providing landmarks in wayfinding instructions that facilitate not only the ease of wayfinding but also spatial orientation.

**Keywords:** local landmarks, global landmarks, verbal descriptions, scale, wayfinding

## 1 Introduction

Landmarks are important elements in the environment that serve as indicators to identify locations in large-scale environment [1, 2]. In wayfinding they are frequently referred to for (re-)orientation at decision-making points [3]. Besides landmarks at decision points, research [4] has started to investigate also the roles of landmarks along routes for maintaining orientation. Potential use of landmarks in wayfinding instructions is well recognized. Researchers have suggested using landmarks as a primary or complementary source in wayfinding instructions [5, 6] where it serves a crucial role in human spatial orientation [7]. Location of landmarks on the route has gained different claims from many researchers. At first, Denis [3,8] suggested that wayfinders often use landmarks for the purpose of reorientation which happens at decision points where a change of direction is necessary to reach the destination. Dif-

ferently, Lovelace and colleagues [9] concluded from their study that landmarks are important at locations where reorientation is needed but also crucial at points where change of direction is possible. Raubal and Winter [5] suggested the use of local landmarks for wayfinding instructions by providing measures to identify the salience of a specific feature in an environment. Furthermore, Richter and Klippel [10] addressed that the route direction should also be context specific wherein the structure of the environment should be a considered in giving wayfinding instructions.

Most of the existing studies as introduced above focus on the roles and use of local landmarks that are on a described route. This paper investigates also landmarks that are distant from the route as we argue that those landmarks in distance are most important for global orientation or confirming heading direction [11]. In this paper, we term this type of landmarks global landmarks. Based on previous findings [4], we not only address local landmarks at actual or potential decision points [9] but also landmarks along a route as well as global landmarks. We examine routes at different scales based on different distances from within-city to inter-city route and mode of transportation (biking and driving). The presented study further contributes to providing a more comprehensive understanding of landmarks regarding their locations and their use in verbal route instructions.

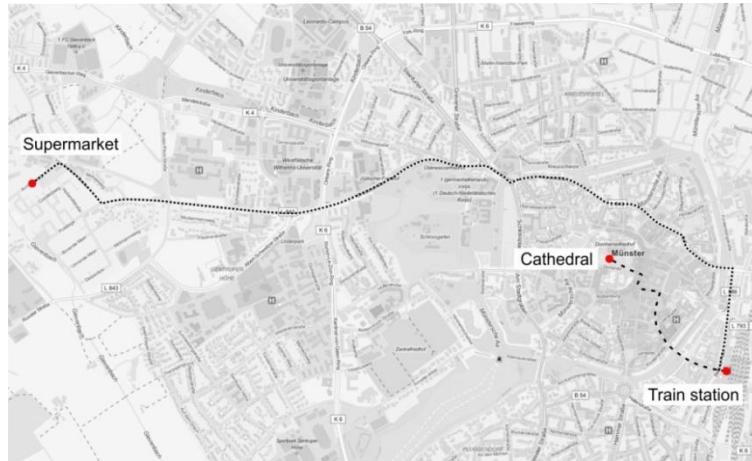
## **2 Methods**

### **2.1 Participants**

Twenty-one university students (10 males, 11 females) who are familiar with the study area participated in the experiment. Their mean age is 22.95 ( $SD = 2.94$ ). They must have already stayed in one of the university dormitory complex for six months or longer. The participants come from different disciplines of study. They received 10 Euro as remuneration for their participation.

### **2.2 Routes**

Three routes were selected in the experiment that cover different scales and require different modes of transportation. The first route, with the shortest distance (approx. 1.2 km), is within the city center. The route starts from the central train station and goes to the Cathedral in the center of the city. The second route covers the city with a distance of approximately 5.2 km. It started from a supermarket near the dormitory and goes to the central train station. The third route is at an environmental scale and ranges between cities as it starts from the dorm where participants live and ends at their hometown in another city within Germany. So the length of the third route varies due to different cities. The typical length of the route 3 is about 18 km. Route 1 and Route 2 are illustrated in Figure 1.



**Fig. 1.** Routes selected for collecting verbal route instructions. Route 1 from train station to Cathedral and route 2 from dorm to train station are illustrated. Due to the various destinations of route 3 we didn't include its illustration here. Source: Openstreemaps.org

### 2.3 Procedure

Once participants gave their consent to participate in this study, they are asked to give the verbal route descriptions to someone new in the area. All participants were given the same laptop, with no time limit, to write down the verbal route instructions in a document. As all participants are German native speakers, all written instructions were first translated and then used for analyses based on the following framework.

## 3 Results

We counted all the landmarks based on their characteristics particularly on the location on the route. With local landmarks, we paid close attention whether a local landmark is along a route or at potential or actual decision point. Global landmarks, on the other hand, were categorized into global landmarks that are point-based such as buildings and global landmarks that are regional (e.g. City center, city of Dortmund, etc). Table 1 shows the percentage of landmarks described in route instructions based on their locations in routes.

**Table 1.** Percentage of local landmarks with regard to their locations on route (LLAR = local landmark along route, LLDP = local landmark at decision point, GLP = global landmark point-based, GLR = global landmark regional)

Landmarks	Route 1 (%)	Route 2 (%)	Route 3 (%)
LLAR	53.91	51.32	39.02
LLDP	33.91	38.62	27.32
<b>Total LL</b>	<b>87.82</b>	<b>89.94</b>	<b>66.34</b>
GLP	5.22	5.82	1.95
GLR	6.96	4.23	31.71
<b>Total GL</b>	<b>12.17</b>	<b>10.05</b>	<b>33.66</b>

We then carried out a chi-square test of independence to examine the relation between landmark location and route. With local landmarks, it was not surprising that the relation is not significant  $X^2(2, N = 245) = .526, p > .10$ . This result shows that the location of local landmark used in verbal instruction does not differ among the routes. With global landmarks, chi-square test shows that the relation is significant  $X^2(2, N = 56) = 12.82, p < .01$  which are more likely to be used for route 3 than other routes.

## 4 Conclusion

Studies suggest that one possible way of making wayfinding systems more effective is using landmarks in route instructions [5,12]. These studies have motivated researchers to further investigate the use of landmarks in wayfinding instructions. In this paper, we present a study that investigates the use of landmarks in different scenarios in terms of scale and mode of transportation. It is apparent that local landmarks are mostly used in the verbal descriptions but global landmarks and potentially effective elements for designing navigation systems that could support efficient wayfinding and spatial orientation in new environments. It is observed that when a route covers a very long distance which requires driving, the use of global landmarks, particularly regional global landmarks, significantly increases to support a wayfinder's orientation. In general, scale and mode of transportation leads to different use of global landmarks. This motivates us to further explore the exclusive roles of scale and mode of transportation in our on-going studies. We are going to compare the verbal route instructions given for the same route but using different modes of transportation, as well as for different routes using the same transportation. Furthermore, we have only addressed verbal route descriptions in this paper. As an important medium of providing route instructions, visual descriptions such as sketched maps are necessary for us to address and compare them with verbal instructions. Such research will contribute to a more comprehensive understanding of human route instructions but also shed light

on the future improvement of navigation systems for more cognitively efficient products.

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