What You Read Is What You Learn: Following Different Types of Route Instructions

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Abstract
This exploratory work evaluated the type of route instruction participants find helpful during a wayfinding task in different real-world environments. Many people today depend on navigation applications to search for an unfamiliar destination. However, some people may struggle when following only instructions (without the map) that contain precise information such as street names, distances, and cardinal directions like what is indicated in navigation apps, unlike human-generated instructions with more landmarks. This study conducted a between-subject experiment design on adult participants unfamiliar with the study areas' routes. They were assessed for familiarity and randomly assigned to each site (a university campus and a park) with different spatial layouts. They received two types of instructions for a pre-defined route. One group first received the human-generated instructions and changed to machine-generated instructions in the second half of the route. After the wayfinding task, they were asked to draw a sketch map to assess their acquired knowledge. The results showed more deviations and stops when following machine-generated instructions, specifically in the park with a circular layout. The sketch maps showed what they learned along the route and revealed survey and route-like characteristics. The study suggests that the type of route instructions affects the wayfinding performance of people and what they learn in an unfamiliar environment. The paper contributes to studies that restructure machine-generated route instructions into nature-like instructions for humans to follow easily.

Keywords: Spatial Learning, Route Instructions, Sketch Maps

Introduction

Can you recall the time you got lost in a new area? Navigating one's way in an unfamiliar environment can be challenging. Some may find it difficult or easy. People use different strategies to navigate unfamiliar areas. Traditional paper maps, instructions from other people, and sketch maps are some common tools used during wayfinding. Nowadays, most people use web mapping platforms like Google Maps, Here Maps, and OpenStreetMap, to name a few, before heading to their destination and providing route instructions from the origin. These applications have been widely used as it is advantageous when traveling to an unfamiliar area changing how one interacts with the environment. Oftentimes, what happens is that the user becomes too focused on passively following the navigational system without paying much attention to the environment (Schwering et al, 2017). Hence, people seldom acquire survey knowledge which refers to an overall view of the environment. A person may acquire survey knowledge or route knowledge during wayfinding (Golledge et al, 1995). Route knowledge is based on the ordering of paths or features based on the travel route; and survey knowledge is considered a 'two-dimensional' knowledge layout of a place -where a person can create spatial relations of spatial elements even if there was no direct contact with the place. Siegel and White (1975) claim that people learn first landmarks. Afterward, they learn the path and the route. Studies have shown that using these navigation tools leads to differences in learning the environment being traveled (Münzer et al, 2012; Krukar et al, 2020). Many people are becoming dependent on using navigational devices or smartphones to find their way in an unfamiliar environment. However, too much dependency on technology may affect acquired knowledge of the environment especially when one blindly follows the system.

What if there is no map available and users are asked to follow only the textual route instructions? Some people may find it difficult to follow only instructions that contain precise information such as street names, distances, and cardinal directions as included in navigation systems, unlike human-generated instructions that contain more landmarks. Lovelace et al. (1999) investigated what to consider when making good route instructions for both unfamiliar and familiar environments. The authors emphasized that the quality of information is relevant for effective wayfinding. The quality of route directions could be assessed by the number of elements included in the instructions, people's rating of the directions, and knowing how well it has facilitated wayfinding task completion.

Ishikawa and Kiyomoto (2008) evaluated participants' wayfinding performance following route instructions in a shifting reference frame – absolute (e.g. go north) and relative (e.g. turn left; turn right). One group started with absolute instructions and then shifted to relative instructions in the second half of the route. The study found that participants had more errors when instructions shifted to absolute instructions. A similar procedure is employed in this research, assessing route instructions – human-generated and machine-generated. The human-generated instructions include landmarks and relative instructions but with modification by adding one or two street names; whereas the machine-generated instructions are instructions taken from Google Maps.

Meiliger and Knauff (2008) studied how people find their way in an unfamiliar environment by comparing verbal route instructions and schematic maps. The authors looked at both how participants acquired survey and route knowledge. They acknowledged the importance of maps and verbal instructions or language in wayfinding. Anacta et al (2014) evaluated both verbal instructions and sketch maps following the study design of Ishikawa and Kiyomoto

(2008). The results demonstrated that not only landmarks at decision points are often included but also those situated along the route as shown in their sketch maps. Participants tend to draw streets and landmarks not included in the textual instructions. In wayfinding, some studies show that men are more into orientation strategy (which refers to cardinal directions) while women use route strategy referring mostly to landmarks. Scholl et al (2000) found in their study that men prefer cardinal direction for orientation in an unfamiliar environment. Females are better at following spatial navigation when landmarks are provided (Kim et al, 2007). It is in dynamic navigation following Euclidean instructions that men outperformed women. Women use topographical rather than Euclidean navigational strategies (Silverman and Choi, 2006). Gender differences will not be part of the analysis in this study but could be worth investigating in the future, whether a gap is still evident.

This study is influenced by the work of Krukar et al (2020), which tested different types of instructions (machine-generated and orientation-based instruction). The orientation wayfinding instructions provide someone with an idea of the spatial layout of the environment which eventually helps one build survey knowledge or an overview of the environment travelled. This differs from machine-generated instructions, which mostly provide turn-by-turn instructions including cardinal directions and exact distances. This type of instruction leads mostly to acquiring route knowledge. In the current study, the wayfinding task will be conducted in a real environment as a follow-up research which was done through an online activity (Anacta, 2024). Here, the participants will also be asked to draw the route from memory after the activity to assess the sketch map characteristics.

This research will benefit all sectors of the community because people experience both giving and following wayfinding instructions. The results will provide insights into the differences in how people acquire knowledge in varying environments during wayfinding and a way of finding a better way of communicating route instructions such that the person does not only see the destination but also learns something about the environment.

The research questions (RQ) addressed in this study are:

RQ1: What do people learn when they follow certain types of instruction in a real environment?
RQ2: What characteristics do humans' sketch maps reveal on how they visually structure the described route during wayfinding?

Method

Participants

There were 12 participants (6 males, 6 females) aged 18 years and above who took part in the experiment (M=23.42 yrs, SD=1.56). They are not familiar with the route in both study areas. A questionnaire was given to assess the level of familiarity.

The participants were recruited via an advertisement posted on social media. Then snowball sampling was used to gather more participants who would meet the criteria. Only those who have not been or do not frequent most places in the study sites were contacted to participate. They received remuneration for participating.

Study Area

The study areas are the University of the Philippines Diliman (UPD) campus and the Quezon Memorial Circle (QMC). Both are located in Quezon City, Philippines. The two sites were selected because they have different street layout.

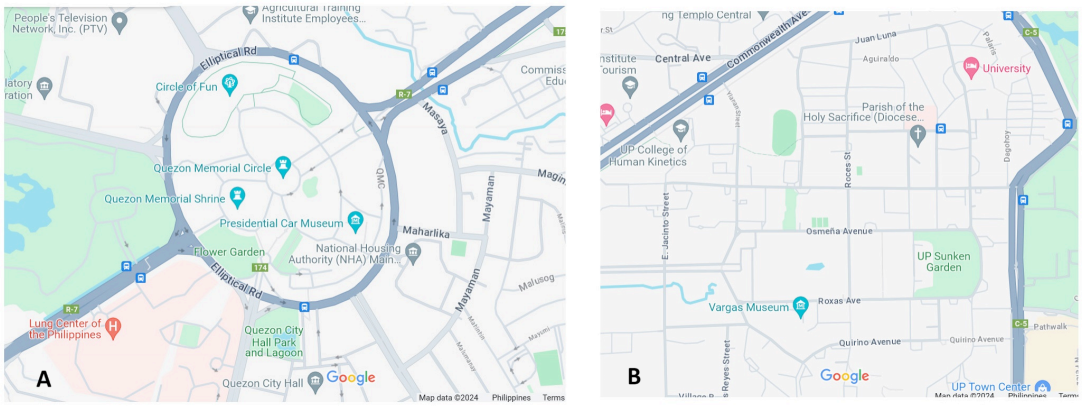

Figure 1: Study Areas (A: QMC and B: UPD)

Procedure

Before conducting the wayfinding task, the experimenter provided the participants with the activity instructions and asked them to sign the informed consent form. They were assigned randomly to the two study sites. The activity was done individually. Then the experimenter followed the participant without conversation. Each participant received a route instruction that changed from one type to another type of instruction (e.g. Machine-generated to Human-generated).

An example of machine-generated instructions:

1. *Head southeast on QMC toward Drop Off Ln. Go for 150 m (2 min)*
2. *Turn right at Drop Off Ln. Go for 37 m (1 min)*

An example of human-generated instructions:

1. *From the entrance gate, go straight into the park until you reach the end of the street and turn right. You go past QCX on the left and garden stalls on the right. You will cross an intersection.*
2. *Go around the roundabout of Liwasang Aurora fountain. Go past Pedal and Paddle and the Liwasang Aurora Amphitheater on the right. Turn right at the second street.*

After the wayfinding activity, participants are asked to draw a sketch map for a maximum of 15 minutes.

For the wayfinding performance, the number of stops and deviations were counted. If a participant made a stop for 10 seconds or longer, then this is considered a stop. If they deviated for 50 meters, the experimenter asked the participant to go back to the last correct route. In analyzing sketch maps characteristics, the criteria for maps showing route-likeness and survey-likeness developed by Krukar et al, (2020) and applied in a different setting by Anacta (2024) are employed in the analysis.

Results and Discussion

For the wayfinding measures, there were 21 stops and 47 deviations. Although, not significant, male participants incurred more wayfinding measures (Stops: 10 female, 11 male; Deviations: 23 female, 24 male). This preliminary result is not conclusive and more participants are needed. The average time spent was around 17 minutes for both types of instruction. Similar to the study of Ishikawa and Kiyomoto (2008), there were more deviations and stops when following machine-generated instructions. Although there is not enough difference here, human-generated instructions also appeared confusing for some participants. Some mentioned that they would have difficulty finding a specific landmark when new in an area because they do not know what it looks like. This explains the number of stops and deviations participants incurred during the wayfinding activity. For the machine-generated instructions, estimating distances was difficult for many participants.

About the type of environment, there were more deviations and stops at the QMC (Stops: 16; Deviations: 29) than at the UPD campus (Stops: 5; Deviations: 18). It shows that the circular type of environment can be more challenging during wayfinding than the grid-like environment. This could mean that when giving instructions, one would consider the type of environment.

The sketch maps showed both route-likeness (56.94%) and survey-likeness (45.83%), similar to the studies of Krukar et al (2020) and Anacta (2024). Even if instructions do not include more global information (i.e. distant landmarks), participants tend to include some features they see off the route.

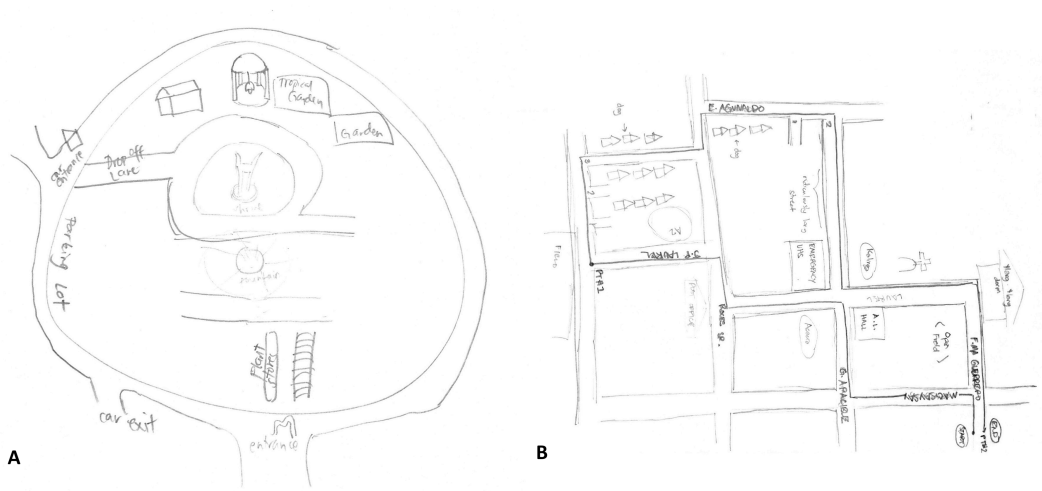

Figure 2: Example of Sketch Maps (A:QMC and B:UPD)

Conclusion

The findings of the study suggest that most participants prefer human-generated route instructions. However, some would prefer machine-generated instructions if it is their first time driving in the area. The type of instructions affects wayfinding performance as shown in some errors made. This also affects what people learn through sketch maps. Some may recall features included in the instructions or seen during wayfinding. Human- and machine-

generated instructions result in both survey-like and route-like maps (even if some instructions do not contain global information).

Some limitations of this work include the number of participants and sketch map analysis that can further explain what people learn during wayfinding. In the future, it would be helpful to apply the same study design using eye-tracking as well as navigation tools in augmented reality and virtual reality. The paper contributes to studies that structure nature-like instructions from machine-generated route instructions for humans to follow easily.

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