User Experiences with Voice-Based Descriptive Map Content in a Hiking Context

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Abstract

The task of maps is to communicate geographic information, and, along with interactive map applications, the possibilities of offering different kinds of information to map users have become more extensive. Also, there are a wider variety of communication methods available. In this paper, we first describe the user requirements for informative and descriptive map content within the context of hiking. Based on these requirements, audio descriptions along a hiking path in a national park were composed. Elderly users were chosen as a target group for the field study where a mobile map application on an iPhone was used. It was expected that combining audio with visual information would improve the overall accessibility of the information in a hiking context. User experiences were collected during a field study. Based on the studies, we summarise the most important features regarding the information communicated by a mobile map application.

1 Introduction

With digital maps and devices, the information conveyed through a map application is not limited to the visual extent of the map, and thus, also new content may be communicated to the users. Maps have always offered a means of communicating geographic information by abstracting and modelling real-world phenomena. KOLACNY (1969) first introduced a model for communication of cartographic information that emphasized the role of map use and map user in the cartographic design. Today, the importance of user requirements and target group specific map design is getting more and more important along the use of map applications in mobile devices. In a hiking context, maps have traditionally been used for orienteering and wayfinding; thus, a topographic presentation of the environment has been the primary objective. Today, users are attuned to multimodal interfaces, and instead of having a map application purely for navigation, the same service could also provide other information about the environment. However, according to HUANG et al. (2012), more research is still needed on the spatial knowledge needs of users in a navigation context.

When the presentation of map information is no longer limited to the static dimensions of paper, new modalities of communication emerge. A previous study by REHRL et al. (2012)

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confirmed that voice-based interfaces have a significant potential in pedestrian navigation. Directions such as 'turn left' or 'proceed along your current route' are now commonplace in car navigation systems, but more information could be given in audio format to support the map use and navigation task. We have conducted research on how to use sound to enhance the map use experience (LAAKSO et al. 2010), but a map application might also communicate voice-based information about the surroundings while the user is on the move.

A map application can convey information by several visual and audible means. In addition to traditional map information, application can present, for instance, photos, richer textual information, interactive symbols and audio files. With interactive maps, not all the information has to be constantly visible; instead, it can be acquired when needed. Information may be embedded in symbols or other elements, which can be activated by the user. Furthermore, the information in a mobile application may be triggered automatically based on the user's location.

The purpose of this research was to find answers to two important questions: What kind of information would map users like to receive from a map application when hiking in a forest environment? And, what is the best way to communicate the information when the target group is elderly users? Since the number of elderly users is increasing dramatically in Finland, as in all western countries, this particular user group needs new solutions for navigation. Elderly users may have certain age-related deficiencies in their sight and locomotion, which sets specific requirements for a map application. User experiences with this specific type of information content and communication modality were collected in a field study conducted in a national park. In this paper, we first describe how we collected the user requirements, then how we proceeded to collect the users' experiences; finally, we present the findings of the study and offer some conclusions.

2 Information Requirements in a Hiking Context

An interactive map application enables a multimodal interface to a map; thus, it may include much more information about the environment than a static map. We organised a workshop to gather knowledge about what kind of information users would like a navigator-type map application to communicate in a hiking context. Altogether, 15 participants took part in the workshop. The participants represented potential hikers and map users, but they could be considered as experts in some level being members of staff of the Finnish Geodetic Institute (FGI) or Aalto University. The users were supposed to have a mobile map application with high-quality topographic maps. The participants were asked to write down ten different types of information that they would like a map service to provide, or that they would like to communicate with other users through a map service. The participants gave their ideas in small electronic notes, which were then compiled and organised into groups based on their content. The organisation of the notes was made as group work with a multitouch screen (figure 1). Certain similarities were found and a few topics clearly stood out. The topics that the participants mentioned most often were as follows:

- information on the condition and difficulty of a route,
- observations about the nature around them (flora and fauna),

- announcements and warnings,
- users' own feelings, comments and notes to themselves.

Fig. 1: A multi-touch wall was used to organise the different kinds of hiking-related notes into groups with a similar content

Based on these topics, we selected the content that is relevant to the users while on a hike. Focusing on the informative content, we selected a few spots along a popular hiking route in Nuuksio National Park, near Helsinki, and composed nine descriptions of these spots. The aim was to communicate information to the user that she/he would not be able to directly see while walking in the forest. The information could also be something that is not directly shown on the map. We also chose to include some information that is visible on the map, but which users might wish to avoid having to read while hiking. The audio descriptions can be thought of as a metaphor for a museum tour, during which time additional information is given on interesting subjects. The chosen information topics are as follows:

- Names of lakes and buildings,
- The route options and descriptions of the destinations at the route crossings,
- Instructions and information on available services (free drinking water, guide service, toilets, exhibitions),
- Timely information on route condition and changing circumstances,
- Additional information on nature and geological or historical themes.

The geo-referenced audio descriptions were then embedded into a mobile map application. It was expected that combining audio and visual information would improve the overall accessibility of the information in a hiking context.

3 The Mobile Map Application

To collect user experiences with informative audio descriptions, a field study was carried out while hiking in a forest environment. The map application runs on Apple's iPhone 4, which uses GNSS-based positioning. The maps and audio files were stored locally in the device to avoid the need for data connection, which is often poor in the forest. For the field study, we used simplified topographic maps, which we dubbed simple maps (KOVANEN et al. 2012). The visual content of the simple maps has been reduced and some elements have been enhanced to ease the map reading process. The audio descriptions were stored with their geographic locations, surrounded by a 20 m radius circle as an activation area. Once the user entered the activation area, the corresponding audio description was triggered. Nine voice descriptions were added at points of interest on the two-kilometre walk (figure 2). The descriptions were repeated every five minutes if the user stayed inside the activation area.

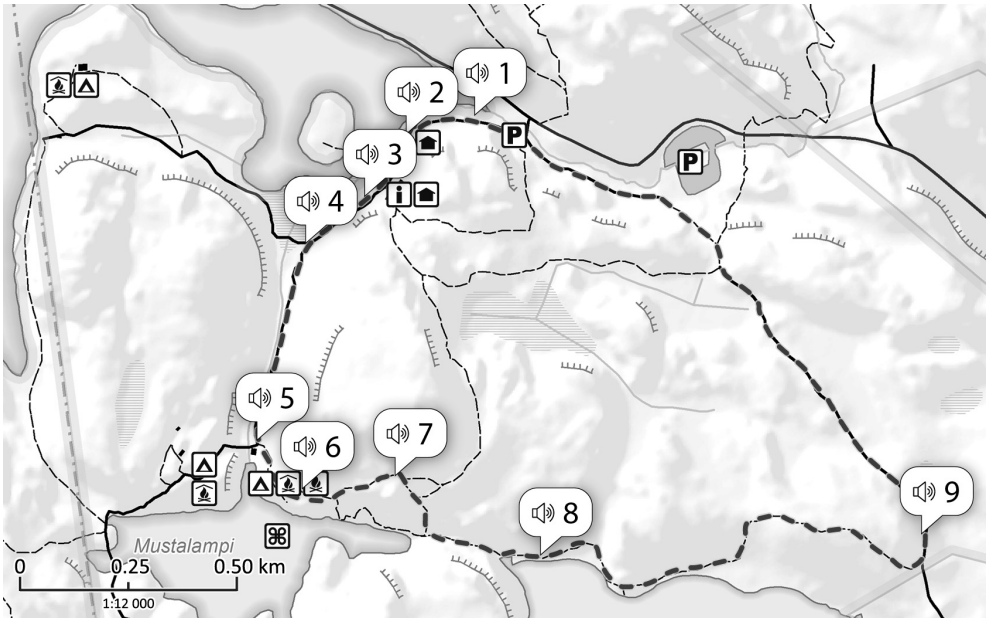

Fig. 2: The 2km walk in Nuuksio National Park included nine audio descriptions. The contents of the audio descriptions are described in table 1.

The audio files were mp3 files, pre-spoken in Finnish with a natural voice. The Finnish language is very challenging for many machine-voice synthesizers, and in earlier user studies (CARMIEN et al. 2011), the synthetic voices from text-to-speech engines were considered unpleasant and incoherent. The application calculated the appropriate directions for the walking path (in front, left, right), which were announced prior to the actual description. The audio descriptions used in the field study are listed in table 1.

Table 1: The audio descriptions in the map application

ID	The audio description
1	Lake Haukkalampi.
2	A guide hut; maps and refreshments for sale. There is a tap for free drinking water outside the hut. The guide hut is open weekdays from half past nine to five, and on weekends from ten to four.
3	A building with dry toilets. Next to it, the Nature Information Hut with a small exhibition inside. Outermost spot, a public recycling point. There are no trash cans in the woods or by the cooking shelters. Opposite to the Nature Information Hut there is a bridge to a small island where you can find tables and benches.
4	A crossing; path to Haukanholma. At Haukanholma, there is a cooking shelter and a campfire site.
5	A firewood shed; take firewood from this shed if you want to have a fire at one of the nearby camp fire sites.
6	Lake Mustalampi. Turf rafts are floating in the water; they came loose from the shore when the dam raised the water level.
7	A dry toilet.
8	Lake Valklampi.
9	A crossing; a new connecting path to the Finnish Nature Centre, Haltia, which is currently under construction at Solvalla.

4 Description of How User Experiences Were Collected

Our user group consisted of ageing users who have age-related deficiencies, more specifically, problems with their vision, dexterity and mobility. The user experience study was carried out as field study in Nuuksio National Park. We had a total of eight users, aged 55 to 70 years old, participate in the field study. Five of the participants were female and three were male. They were interested in spending time in nature, but none of them were experts in hiking or at map reading.

The participants were asked to fill in a background information form, which consisted of questions regarding their experience with mobile devices and mobile map applications as well as with hiking and reading maps. The tasks included navigating with the map application and using the audio functionality of the application while walking along the chosen route. The participants were also asked to pay attention to landmarks or such subjects that they hoped would have been presented on the map application. After completing the tasks, semi-structured interviews were conducted. We organised the field tests for two participants at a time and they were video recorded (figure 3).

Fig. 3: The setting for the field studies

We were interested in how the elderly users would adopt the novel way of using maps, whether the audio feature would improve accessibility and, in general, whether the users would find the map application and the descriptive map content useful. We also wanted to know what kind of information the users would have wanted to have received from the map application.

Notes and transcripts were made from the video recordings. In order to organise the findings from the field studies and interviews, we utilised the affinity diagramming method. The affinity diagramming method (BEYER & HOLTZBLATT 1998, 154-163) is a bottom-up process, in which a common structure arises out of individual observations.

5 Results

The main reason why a mobile map application may become more popular than traditional paper maps is the ability to show the user's position in real time. As could be noticed in the field study, in terms of navigation the users were most interested in learning about their position, the direction they were heading in and the distance to the destination (figure 4).

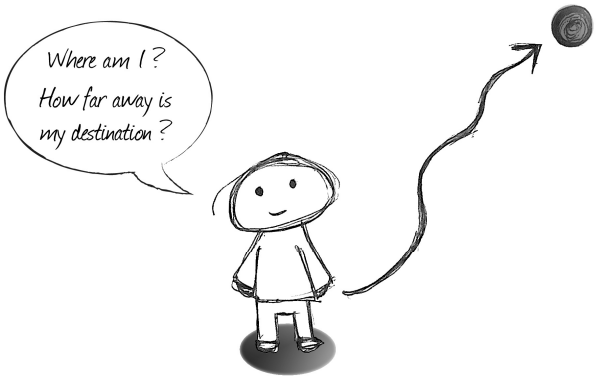

Fig. 4: The position, the direction and the distance information are of user's primary interest

Based on the analysis of user experiences, we summarise the most important features regarding the information communicated by a mobile map application as follows: 1) Reliability, 2) Content and 3) Communication.

1) Reliability

The map application must be accurate and consistent in order to create the feeling of safety for the user. Earlier studies have already demonstrated that safety is one of the main issues for all users in a forest environment (NIVALA et al. 2009). This was also confirmed in this study and emphasised by the elderly users. The audio descriptions did not concern safety related topics but the users reported that the descriptions increased their feeling of safety by making them surer of their location. The users felt that with this mobile map application, they would be more comfortable and confident when going to new places.

We asked the users to rate how much they needed to concentrate on using the application on a scale from one (not at all) to seven (very much): the average score was 2.1. According to the participants, the map application made the hiking experience more interesting and carefree, since they did not have to concentrate on the map because the audio functionality assured them that they were on the right track. The users were pleased to find that they could centre their position on the map with just one click. This ensures that they will always be able to find their location on the map.

2) Content

It is important that the content of the map application is relevant, interesting and up-to-date. In addition to the topographic information, the users were keen to learn more about their surroundings, such as flora and fauna, geology and geographical history. The users were pleased with the idea of a digital 'tour guide' that provides them with additional information during the hike. The users were divided on the question about the number of audio descriptions provided along the route. Four out of eight users wished there would have been more audio descriptions, whereas the other four were pleased to have some descriptions, but otherwise preferred the silence of nature.

The degree of difficulty of the hiking route varied quite much on the two-kilometre walk, ranging from very easy to rather difficult. The users wished there would have been more information about the trails, their current condition and their difficulty in general as well as an estimate of how long it would take them to complete the trail. The users were expecting information at each route crossing or decision point about what path to choose and where the intersecting paths led to. Users found the descriptions of the destinations and the amenities along each path useful at the route crossings. The users also wanted to know how long they still had to walk, in distance and in time.

3) Communication

The map application needs to be easy to use and effortless while hiking. The users agreed that the easiest and most intuitive parts of using the mobile map application were the audio descriptions, which were played automatically at certain locations. It would be useful, though, if the audio descriptions could be replayed, since the users might miss the automatically played descriptions the first time. The same information should also be available in textual format; in certain situations, it is better to be able to read the descriptions from the screen because of the surrounding noise or need for silence. However, the elderly users preferred audio information over text because they did not want to wear their reading glasses while on the hike. None of them were ready to use earphones while walking in the forest.

The application must be useful for the current purpose of the user. Several users suggested that the application could be useful for ‘extempore hiking’, meaning hikes that are not explicitly planned beforehand. It would be easy to just download the maps, have a quick look at the hiking routes and go for a short hike instead of purchasing paper maps and planning the hike in detail. The application could also serve as a direct means of communication between the users and the service provider. The users suggested they could make comments such as ‘The bridge was icy today’ or ‘The firewood shed had no firewood’. Familiar social media tools would be useful for making such comments.

6 Conclusions

When using other than visual modalities for communication, the screen size does not limit the amount of information. Map information may be communicated using reactive data that is visually hidden; the data may be activated automatically in certain locations or by user’s gestures. The mobile map application with location-based audio descriptions increased the feeling of safety among elderly hikers by ensuring that they were on the right track while hiking in the national park. The application was thought to make hiking a more care-free occasion and encouraged the users to visit new places. The audio functionality of the application proved to be both attractive and useful. The participants found the descriptive information of the surroundings interesting and wished that there would have been even more information concerning, for example, the flora or the geographical history of the area.

This study confirms the fact that elderly users are a potential user group for a pedestrian navigation systems and the voice-based descriptive information embedded in a map application proved to be attractive. Map applications in smart phones are increasingly serving as information platforms; users can request information that they are interested in and it can be

communicated multimodally taking into account the time and place (KOVANEN et al. 2013). Audio descriptions are one way of communicating map information to users on the move and especially to elderly users who may have difficulties reading small text or users who find map reading difficult.

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