

AmauroMap – Interactive Online City Map for Blind and Visually Impaired People

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1 ABSTRACT

AmauroMap aims to give blind and visually impaired people access to interactive digital city maps. The project is not about linear navigation from A to B, moreover it is about the creation of cognitive maps by interactively exploiting a digital map. The system applies for the preparation of unknown routes. The technical innovation is the automatic derivation of spatial information from digital vector maps which makes it possible to use the system on a large area. The output will be a textual description of the visual map that can be accessed either with a braille display or a screenreader. The challenge is to describe the elements of the map in a way that respects the requirements of the target group. Therefore, a key element of the project is an empirical study about the orientation of blind and visually impaired people in the urban space.

2 INTRODUCTION TO AMAUROMAP

Today cities can be discovered easily and in a comfortable way from home with the help of interactive online maps. Although digital maps become more and more popular, they still belong to those elements of the web which are not accessible for all user groups. So far especially blind people do not get the chance to discover online city maps. AmauroMap tries to make this access possible.

The term “AmauroMap” is derived from “amaurosis” which is the ancient Greek term for blindness and indicates an interactive online map for blind and visually impaired people with the aim to support the preparation for unknown routes. The approach is to describe the visual map in words. So far there are mainly research and development activities in the field of navigation for blind people. However, AmauroMap does not want to navigate the user, but the user to navigate itself by interactively exploiting digital city maps. The goal is to get a better image of the city; this image – or cognitive/mental map – should include information about streets, intersections, blocks, points of interest, possible causes of risk, etc. (see figure 1) and their relation to each other. The elements of the map are described in a semantic way that is adapted to the requirements of blind and visually impaired people. As research activities are rather low and literature is rare in the field of orientation of blind people, AmauroMap works on an empiric study on the orientation of blind people and their requirements on a map for blind and visually impaired people. What needs to be stressed out is the innovative automatic annotation of the spatial description so that a large area can be covered.

The project AmauroMap is supported by the Internet Foundation Austria within the Netidee programme.

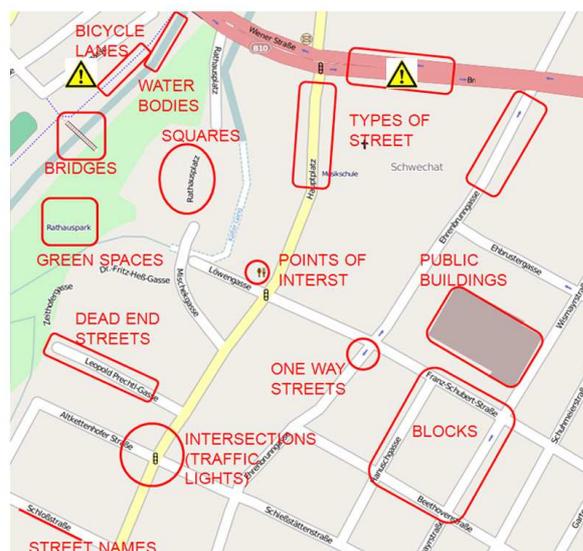


Fig. 1: Describable spatial information. Data source: Open Street Map

3 COGNITIVE MAP APPROACH

The theoretical background of the project is the “mental maps” or “cognitive maps” approach (TOLMAN 1948). Each person has an individual mental image (or map) of the surrounding which is important for orientation and wayfinding. In this regard LYNCH (1960) defines five elements of the urban space which are needed for the creation of cognitive maps: paths, edges, nodes, districts and landmarks (see figure 2). According to GOLLEDGE et al. (1996) blind people develop certain wayfinding skills by “studying” the surrounding area and memorising those elements. AmauroMap builds on this structure.

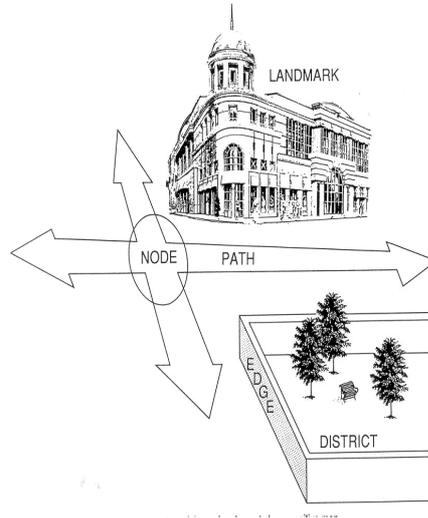


Fig. 2: Elements of the urban space according to LYNCH (1960) (Source: University of Eichstaett)¹

4 EMPIRICAL STUDY ON THE ORIENTATION OF BLIND AND VISUALLY IMPAIRED PEOPLE

4.1 Methodology

Qualitative guided interviews with blind and visually impaired people, mobility trainers as well as representatives of organisations for blind and visually impaired people give information about the orientation of the target group. The interview partners have different profiles, meaning that they differ in the degree of visual impairment, age and the age when the blindness occurred, mobility, sex, education and the use of additional devices such as navigation systems, guide dogs, white canes or information systems such as POPTIS.² For a successful realisation of AmauroMap it is necessary to know the user’s needs as clear as possible. The key questions asked are what are the important landmarks for orientation? What information is required in a map for a successful wayfinding? What should the spatial description be like so that it is understandable and useful?

4.2 Results

The interview results show that on a micro-level orientation points are extremely individual. Every route has specific orientation points and every person perceives them in a different way. Some people concentrate stronger on tactile landmarks, whereas others perceive acoustic or olfactory ones more easily. Especially the perception of acoustic landmarks varies a lot between the respondents; some are even able to hear objects such as walls, telephone boxes, etc. when they come close to them. For the interview partners the degree of importance of the following elements in a map is different: the information about the width of a street in meters, the number of driving lanes, one-way streets, the length of the street, stairways, the material of the surface (asphalt, cobblestone, etc.), pedestrian crossings as well as the shape and number of corners of blocks and parks. Some consider those elements to be important, whereas others do not at all.

¹ http://www.ku-ichstaett.de/Fakultaeten/PPF/fachgebiete/Psychologie/lehrstuehle/psycho2/Lehre/info/SS05/UpsySem/HF_sections/content/Kevin%20Lynch.ppt, Dec. 2009

² POPTIS is a system by the Vienna Transportation System (Wiener Linien) which gives blind people detailed directions in the Vienna subway network.

In general essential orientation points for blind people are guidelines (which can be tactile systems on the ground, house walls, pavement edges) and fixed landmarks that can either be perceived acoustically (streets, intersections), olfactory (bakery, coffee shop) or which can be touched (immobile objects). The interviews show that it is strongly recommended that the map includes information about street names, the type of street (motorway, a main road, residential road, pedestrian area, etc.), the shape of the street (straight or curved), intersections and the number of intersecting streets as well as the angle between the intersecting streets, acoustic traffic lights, tactile systems, pavements, bicycle lanes, bus stops, bridges, underpasses, dead end streets, pedestrian refuge islands, tramway lanes, entrances of houses/passage ways/garages/parks, house numbers in the destination area or on demand, water bodies and points of interest (shops, public buildings, cultural spots). Also it is important to differ between the left and the right side of the street.

“Noise is for the blind as fog is for the sighted.” (Quote from one interview) Risks for orientation are mobile/dynamic landmarks, noise, missing guidance systems (house walls, pavement edges), construction works, barriers in the height of the head, and the crossing of squares. The “shared space concept” was mentioned several times by the interview partners as a big threat for the community. Shared space is an urban design concept that favours the integrated use of the urban space and was developed in 2003 by Hans Mondermann. The aim is not to separate between different road users (motorised vehicles and pedestrians). Especially for blind people this is a dangerous approach as a clear division between pedestrian areas/pavement and the running track is required. (Schmidt-Block/Böhringer)

4.3 Importance of the Empirical Study for the Development of AmauroMap

What conclusion can be made of the empirical study and what is the input for the development of the city map?

The interviews clearly show that the majority of blind people need to prepare for new routes in advance; only a minority says not to need any information in advance when exploiting unknown areas. In general preparation is not easy to do as the possibilities are limited. The main sources for new information are family, friends, systems like POPTIS, or tactile maps. The last two are indeed a big support but difficult to maintain. They are developed manually and do not cover large areas. Therefore there is a need beyond the blind community for a system like AmauroMap that supports the preparation of routes.

“Every irritation means new orientation.” (Quote from an interview) Blind people have to study new routes; mobility is highly controlled and not random at all, so a high density of information is important. The map has to contain as much information as possible, BUT in a categorised and layered way; so the user should be allowed to make a user-specified selection (see figure 3). It has to be mentioned that not every information that the user group asks for can be included in the map because the digital data is not available or does not exist; for instance this is the case for construction sites, mailboxes, traffic sights in the height of the head, etc. To formulate a clear and understandable textual description mobility trainers are consulted; also the empiric study gives information about they way geometric shapes can be described the best way.

Information about the section of a street			
Automatic display	On demand	On demand	On demand
Type of street section [e. g. motorway (= danger), main road, residential road, pedestrian area, etc.], name of the street section, description intersections at both ends of the street section.	Gives detailed information about the section of the street, i. e. width of the street, shape of the street, etc.	Availability of tactile systems and acustic traffic lights.	Landmarks such as bridges, underground passages, bus stops, stairs, etc.
All threads and risks! The interviews show that it is not the shortest route which is the most attractive, but the safest one.	Gives information about points of interest available on each side of the street, which should be again classified: public buildings/cultural facilities/medical facilities/shops/etc.	others	others
user-specified	others	others	others

Fig. 3: Overview of categorised output information (first draft)

5 TECHNICAL APPROACH

Already existing digital maps for blind people are in general based on a manual allocation of attributes to objects in the map which means big efforts in work and a reduction of the map on a small area. AmauroMap develops a GIS-based method to create the spatial description automatically. The spatial description will be derived from vector data so that a large-scale mapping is possible. This method makes it possible to describe the shape of crossings, blocks, etc. in words and in a standardised way. For the programming of the prototype open source software (PostgreSQL, PostGIS, GeoServer, PHP) and free datasets (Open Street Map) will be used. The way the textual description is accessed can be chosen by the user. The empirical study shows that the majority but not all blind and visually impaired people are aware of Braille. So the technology chosen for having access to the text can be either a Braille display or a screenreader. In addition to the textual description there is going to be a visual map for sighted people.

6 CONCLUSION AND OUTLOOK

AmauroMap is supported by the Internet Foundation Austria IPA within the Netidee programme from November 2009 until October 2010. Within the first six months of the project there have been detailed research on literature and comparable ongoing projects, strong dissemination activities, establishment of contact to the blind and visually impaired community as well as researchers and developers and first programming activities. The outcome of the first year will be a prototype with basic functions adapted to the users' needs. The focus is on user orientation; the users are involved in the development of AmauroMap from the beginning. The interview partners will be asked to test the system in various phases and to give feedback. Also the community will be invited to add personal information to the system that can be shared with others. The results of AmauroMap will be open to the community. The aim is to continue and push forward the project on long term and in cooperation with further partners.

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