A Method Story about Brainstorming with Visually Impaired People for Designing an Accessible Route Calculation System

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Abstract
In this paper we describe a brainstorming session with visually impaired users, a sighted locomotion trainer, as well as sighted and blind researchers. This brainstorming session was part of a larger project on designing accessible guidance systems for visually impaired people. In this session we specifically addressed the design of an accessible route calculation tool. In a method story, we describe how this session took place and report our insights from this experience on adapting brainstorming to a non-visual world.

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Method stories, participatory design, visual impairment, navigation, assistive technology

ACM Classification Keywords
K4.2 [Assistive technologies for persons with disabilities]

A Brainstorming Session with Visually Impaired People
In this paper, we report about a brainstorming session with visually impaired users that was part of the Navig

project [3]. While in this paper we only report about one concrete brainstorming session, we included users with visual impairment all along a participatory design process [1].

Objectives
Within the Navig project, we worked on an accessible route calculation interface. The aim was to develop a website that allows visually impaired users to request the description of a route between two points of interest. The website should then calculate an itinerary and present it to the user in a textual form that is compatible with screen readers. At the time when the brainstorming took place, we knew that we wanted to design such a tool, but the design was still open regarding many questions, such as which type of information to present, which functions would be supported by the application, etc. The aim of this brainstorming session was: 1) to identify the situations where visually impaired users would require a route calculation system; 2) to generate ideas for the design of the interface and the content of the roadmap.

Date and Time
Wednesday evening from 6pm to 8pm

Participants

- five blind users
- one sighted locomotion trainer as a proxy
- one blind researcher
- five sighted researchers (two of the researchers only served as observers and were not actively involved in the session)

Some of the participants knew each other beforehand. As the brainstorming session was part of a bigger project, several participants had already participated in other design sessions with some of the researchers [1]. In our opinion this had two benefits: 1) it facilitated the memorization of participants' voices; 2) as people had got to know and appreciate each other, the atmosphere of the sessions was generally friendly. However, it also had some downsides (as described in section "dealing with ethical challenges").

Seating Layout
During the whole session, participants were sitting around a table. We kept the seating order fixed because we believe that it facilitates oral identification of the speakers. Blind people memorize the speakers through the voice identity and location.

First phase of the Brainstorming
A first part of the brainstorming session was done in a plenary session, i.e. everyone was seated around the table and freely participated in the discussion. Before starting the actual brainstorming, all participants introduced themselves orally so that blind participants could identify each other based on her/his voice and position in the room.

A sighted researcher animated the session and asked several questions. Between the questions, he gave the blind participants time to reply. Answers were given by the visually impaired users, and the locomotion trainer mainly explained why some of the mentioned aspects were important to blind people. The blind and sighted researchers did not participate in the creation of ideas. The sighted researcher wrote down the ideas, and frequently repeated the whole list in order to facilitate memorization and stimulate creativity. In order to ease memorization, the facilitator analyzed the propositions on the fly, and grouped them in categories. Furthermore, he handled turn taking between participants in order to avoid silence or simultaneous speaking.

Our first intent in the session was to better understand in which situations a visually impaired user would need a route calculation system. Thus, we asked the participants "For which situations would you need to search an itinerary?" Ideas covered a wide range of issues that partially went beyond replying to the question. Here, we report the complete list of replies structured by type (i.e. we have not removed or modified the replies but grouped similar replies):

- characteristics of an itinerary: new, complex, complementary, difficult
- purpose: autonomy, integration into society, security, freedom, equality, right, duty, solidarity
- user experience: curiosity, exploration, fun
- supporting spatial cognition: orientation, overview, creating a mental image, finding something specific, identifying a route
- type of transport used: public transport, walking
- difficulties: roadworks, being tired
- situations: moving to a new city, hobbies, meeting other people, attending events and shows, going for a walk, administrative tasks and public services, work, first time to go to a new work place
- helping others: helping sighted people, helping other visually impaired people, helping one's family
- required information: time, distance, points of interest, points of orientation

Second, we aimed at defining the type of information that has to be presented as part of the description of the itinerary. We were also interested in understanding the importance of the different types of information in order to be able to prioritize after the brainstorming session. Therefore, we asked "What information do you need to understand and follow a route? What is mandatory and what is optional?" First we collected the list of ideas and wrote them down. Then we invited the group to collectively prioritize each item. To do so, the facilitator read the items one by one and collectively assigned a priority index after discussion. This worked well for most items. However, participants did not agree on the priority (rank 1, 2 or 3) concerning accessibility of streets and buildings, and route difficulty. They stated that it depended on the personal skills of the traveler. Finally, this discussion resulted in the following list of features ordered by priority.

Priority 1 (very important)

- distances
- directions
- complexity
- street names
- bus stops, metro stations, and all sort of stops for public transport; identification and timetable of the transport that goes by this station
- traffic lights, traffic lights with audio signal
- roadworks, especially new and unknown ones
- orientation points
- crossings, roundabouts

- bridges
- bicycle lanes and their position with regard to the pedestrian path

Priority 2

- parks
- parkings
- stairs
- public buildings
- noises (e.g. other people, music)
- information points (e.g. tourist information)
- direction of traffic

Priority 3 (less important)

- stores
- obstacles
- sidewalks
- details regarding traffic (density, direction, etc.)
- quiet areas
- crowded spaces
- outdoor seating areas in cafés
- shadows
- smell
- urban equipment (e.g. banks)
- inclination of the street/pavement
- rivers and water in general
- width of the street and sidewalk

Obviously, these suggestions go beyond what is usually proposed by personal guidance systems (e.g. smartphones with GPS). Some data (such as recent and temporary roadworks) is difficult to obtain in real-time and to integrate into a personal guidance system. In fact, some of the current navigation systems contain such information, but for cars and not for pedestrians. Also, we needed to discuss some answers with the visually impaired users or the locomotion trainer in order to understand them better (e.g. that it is difficult for a visually impaired person to walk through a large open space, that noises and crowds can be disturbing).

Third, we were interested in the design of the route calculation system. We asked "what functionalities would you need in a route calculation system allowing you to select, modify and personalize routes?" We collected the following responses:

- Simulating and learning a route before travelling
- Saving and playing back an itinerary
- Saving points of interest within a route
- Identified points of interests along a route should be highlighted during the journey
- Considering public transportation according to different criteria (proximity of the station, safety, complexity to get to the station, etc.)
- Comparing different itineraries according to different criteria (e.g. number of turns, number of crossings)
- Getting additional descriptions for an itinerary (e.g. detailed description of the environment, facts about historic buildings)

Figure 1: A blind participant taking notes on a BrailleNote® during a brainstorming session.

- Saving the users’ comments describing the itinerary
- Adaptability of the user interface to users’ preferences
- Configuring the level of description (verbosity)
- Showing a map of the area

We ended the session after 1 hour to save time for the following phase of the brainstorming.

Second Phase of the Brainstorming

In another phase of the brainstorming session, we identified scenarios where route selection is useful. The aim was to better define the users’ needs. We collectively selected three use cases that were attributed to three different groups, composed each by two visually impaired and two sighted people. We put visually impaired participants in groups according to their level of autonomy in mobility and orientation. Our aim was to allocate experienced travelers to different groups. Sighted participants in each group took notes. One blind person took notes using a BrailleNote® portable device (see Figure 1). Due to the length of the scenario, we do not report them here, but they are available online[1]. The three use cases that we chose were:

1. Select and compare two itineraries
2. Explore and discover a part of the city (streets, buildings, transport and possible activities)
3. Personalize an itinerary, save it and play it back

1 http://bit.ly/CHI16-WS-MS-Naviplan-Scenarios

Finally, each scenario was presented to the whole group and discussed for improvement.

Key points for method stories with visually impaired people

We have chosen to present this method story in a format that is both accessible to visually impaired people and sighted people. As an alternative to an accessible textual document, we could have produced an audio-based description.

As defined by [2], several key points must be addressed in method stories describing participatory design sessions with impaired users. We discuss these key points in the following section.

The Positioning of the Participants’ Impairment in the Codesign Project

The design process was led by the researchers, and users were not involved in the configuration of the design process. Thus we suggest that we are using a participatory design process rather than a codesign process. However having a blind researcher within the design team helped us to take users’ needs into account. As stated above, the described session was part of a bigger project that allowed us to get to know the participants and create a friendly atmosphere over a long-term [1].

The Aim for Equivalence

During the sessions we carefully considered users’ opinions as well as the proxy’s opinion (one sighted locomotion trainer). The researchers did not contribute to the creation of ideas. The facilitator wrote down ideas and repeated them orally in order to create a shared language between sighted and visually impaired people. We think that the way of handling this session allowed visually impaired participants to follow the creation of ideas and to express themselves. We received unanimous positive feedback for this session. It was also a successful way to gather interesting insights for the researchers.

Balancing Viewpoints

Ideas were announced by the visually impaired users. The locomotion trainer explained why the ideas were important (for instance why it is difficult for a blind person to maintain orientation when walking across large open spaces). In this respect, the proxy mainly served as a "translator" between the two communities. Researchers were the facilitators for the session, took notes and observed, but did not interfere with the creation process.

Dealing with Ethical Challenges

All participants in this session were adults and capable of signing their own informed consent form.

As described above, we built up a long-term collaboration with the visually impaired users. As a downside, we observed that participants got very excited about the potential possibilities provided by such technologies. Consequently some of them became frustrated when they realized that a research project does not necessarily lead to a commercial product. This is even more critical when users are involved in a project over a period of several months or years. The more they get involved, the higher their expectations.

The Adjustment of Codesign Techniques

During the brainstorming sessions, we made several adaptations to the common brainstorming process.

First, a large number of participants increases the difficulty to identify speakers based on voices. Some of our sighted researchers thus remained silent. From our experience, we suggest that the group size has to be limited to five to eight participants which is smaller than the common size of brainstorming groups with sighted people.

Second, we had to keep a fixed seating layout to facilitate the localization of participants but also because it is hard for a group of visually impaired people to move around in a small room. This is in contrast with the common course of brainstorming sessions with sighted people where participants are free to move, in particular when gathering and organizing written material such as sticky notes.

Third, the usual sharing of ideas on a white-board was impossible with visually impaired participants. Therefore, a sighted researcher took notes and repeated the list orally. Yet, there is a difference between a visual and a verbal list. Visual information is "durable", "parallel" and accessible at any moment by all participants, whereas verbal information is "fugitive", "serial" and only gives access to one point at any time (see for instance [4]). Thus, participants had to make cognitive efforts to memorize the whole list. To ease memorization, we organized ideas not chronologically but by themes. It would have been possible to use tactile diagrams or braille text, but those documents need to be prepared in advance and cannot be adapted dynamically. We suggest that a perspective for future design sessions would be to use computer supported cooperative work that would allow visually impaired users to jointly access ideas (see for instance [4,5]).

Furthermore, jointly working on artefacts requires participants to be aware about state and content of the artefacts, which is another challenge to be resolved in non-visual brainstorming. As we described above, priorities were assigned to the different items and ideas in a collective discussion. This increases the risk of privileging the opinion of extrovert participants who might be more willing or able to defend their opinion in a group discussion. In a group of sighted people, it is common to ask participants to state their preference with marks added next to each item. Normally this is done by several participants in parallel and is thus usually a quick process. In order to enable a similar process with visually impaired people, it would be possible to ask each participant to state his/her own preference. This could be done orally or by preparing accessible documents on which users can note their priorities. However, it would require additional time, a higher number of facilitators or the use of technological equipment.

Moreover, visually impaired users cannot exchange non-verbal information—such as gestures or gazing. Non-verbal visual communication between sighted people includes gestures, postures, gazing, etc. and plays an important role in social interaction [5]. The semantics of a verbal statement relies on facial expression and gestures of the speaker (e.g. nodding when one agrees). Gestures are also used in detecting intentions to speak, and changing turns between speakers, especially in a large group. When doing a brainstorming session with sighted users, the facilitator only focuses on time management and keeping participants motivated. Yet, as blind people cannot perceive visual communication cues, the facilitator must indicate turn taking intentions when managing a brainstorming session with visually impaired people. He may, for instance, verbalize when he perceives speaking intentions. He must also guide and mediate the communication between participants by giving the floor and avoiding silences or simultaneous speech.

The Data Collection, Analysis and Interpretation

We collected the above mentioned lists of ideas and scenarios created during the brainstorming process. The outcome of this session did not notably differ from other brainstorming sessions that we have done exclusively with sighted participants, which also result in a list of ideas. We used these created ideas as a basis for developing a route selection tool. The tool would indeed provide visually impaired users with the possibility to select a route, but also to save and play GPS tracks from a previous journey, or to compare alternative routes. These ideas clearly originated from the brainstorming session. We also learned that the description of the itinerary should be more complete than what is normally provided by a GPS system. For instance, it should provide a description of the position of the side walk with regard to the street, traffic lights and known obstacles. However, when designing the system we realized that it was not feasible because there is no Geographic Information System that could provide us with this data (even if Open Street Map for instance goes in this direction).

Conclusion

Our experience shows that brainstorming is a possible method for creativity sessions with visually impaired people. We think that this method allows visually impaired people to contribute to the design process as equal partners. However, some adaptations are necessary to make this method accessible without vision. We claim that the facilitator has a more crucial role than in brainstorming sessions with sighted people. As future working directions, we propose to investigate how technology (e.g., CSCW) could be used to jointly work on the creation of ideas.

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