Christian's Research Review

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SpaceSense: Representing Geographical Information to Visually Impaired People Using Spatial Tactile Feedback

Citation

(Yatani, Banovic, and Truong 2012)

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Timbremap: Enabling the Visually-Impaired to Use Maps on Touch-Enabled Devices

Citation

(Su et al. 2010)

Introduction

> Mapping applications on mobile devices have gained widespread popularity as a means for enhancing user mobility and ability to explore new locations and venues. Visually impaired users currently rely on computer text-to-speech or human-spoken descriptions of maps and indoor spaces. Unfortunately, speech-based descriptions are limited in their ability to succinctly convey complex layouts or spacial positioning.

Study

> This paper presents Timbremap, a sonification interface enabling visually impaired users to explore complex indoor layouts using off-the-shelf touch-screen mobile devices. This is achieved using audio feedback to guide the user's finger on the device's touch interface to convey geometry. Our user-study evaluation shows Timbremap is effective in conveying non-trivial geometry and enabling visually impaired users to explore indoor layouts.

Conclusion

> This paper contributes an implementation and user study with visually impaired participants using two sonification hinting modes, both of which were effective in conveying shape geometry to participants. In addition, we qualitatively show that a participant is able to use the presented sonification interface for an indoor floor-plan exploration application, and is able to piece together a map larger than can be displayed in one screenful.

Lessons Learned

- Timbremap

Further Questions

- Is this open-source?
- How can we use it?
- How difficult is it to use?

Visually Augmented Audio-Tactile Graphics for Visually Impaired People

Citation

(Götzelmann 2018)

Introduction

Tactile graphics play an essential role in knowledge transfer for blind people. The tactile exploration of these graphics is often challenging because of the cognitive load caused by physiological constraints and their complexity. The coupling of physical tactile graphics with electronic devices offers to support the tactile exploration by auditory feedback.

Study

As a proof-of-concept, we carried out a feasibility study including working prototypes of a com- mon type of audio-tactile graphics, i.e., audio-tactile maps. These prototypes used the capacitive codes proposed in the last section and adapted the obtained technical parameters for designing the tactile elements. Multiple approaches exist to generate tactile maps and to automatically as- sign verbal explanations and visual augmentations to graphical elements of the map. These maps, called LucentMaps, were translucent to be visually augmented. For this study, we implemented a mobile application for detection of the tactile graphics, to provide verbal feedback and to visually augment parts of the graphics the user is interacting with.

Conclusion

Based on the developed generic concept on visually augmented audio-tactile graphics, we presented a case study for maps. The maps used for the case study can be semi-automatically generated by existing approaches (e.g., Reference [13]). We designed an interaction concept and adapted our approach to the needs for the audio-tactile exploration of maps. Finally, it was implemented prototypically and tested with a user study with visually impaired people. All the participants were able to couple the tactile graphics with a standard tablet computer within seconds and to interact with the 3D printed tactile maps. They visibly enjoyed the interaction with the visually augmented tactile maps.

Lessons Learned

- 3d printing a map and adding audio feedback is a fantastic way to provide information

Further Questions

- What's the easiest way to add audio feedback to the 3d prints?

Differences between blind people's cognitive maps after proximity and distant exploration of virtual environments

Citation

(Cobo et al. 2017)

Introduction

According to the authors,

> There have been three traditional hypothesis about whether blind people can understand and manipulate spatial concepts.

1. Deficiency
    - Argues that blind people are unable to develop spatial thought
2. Inefficiency
    - Blind people *can* understand spatial thought, but cannot understand to the same level as someone who is not blind
3. Difference
    - Blind people are just as capable of spatial thought

Many studies have been done, and a significant portion seem to support the Difference hypothesis.

Study

The authors developed an Android app using Unity3D. This app allowed participants to "explore" and/or "look" around a room containing furniture, objects, etc, by using the touchscreen and the gyroscope.

The authors wanted to specifically test "distant-exploration" and its effectiveness:

> We propose a distant-exploration approach where blind people can explore the room by controlling the direction of the avatar's line of sight. Feedback regarding obstacles beyond the reach of the cane may be obtained with no need of making the avatar to walk along the virtual space.

Conclusion

The authors found a significant difference in understanding and required exploration time when using the "distant-exploration" approach. The sample size was limited though, and more research is needed to come to a sound conclusion and methodology.

Lessons Learned

Further Questions

1. What were the feedback forms used?

Image Accessibility for Screen Reader Users: A Systematic Review and a Road Map

Citation

(Oh, Joh, and Lee 2021)

Introduction

Oh, Joh, and Lee (2021) reviewed 33 papers (using PRISMA guidelines) with two goals in mind:

1. Understand the current accessibility solutions for screen reader users to "view" images
2. Identify gaps in understanding and suggest a research roadmap

They discovered several things:

- The types of images, visual information, input devices, and feedback modalities that have been studied to assist in image accessibility on touchscreen devices
- Very little research has been done on the automation of image-related information
- Input from target users is *very* important when designing new accessibility solutions

Study

Note: BLV = Blind/Low Vision

The authors had five questions for their review:

> RQ1. What types of images have been studied for image accessibility?
>
> RQ2. What types of image-related information has been supported for BLV people?
>
> RQ3. How has image-related information been collected?
>
> RQ4. How has image-related information been delivered?
>
> RQ5. How have BLV people been involved in the design and evaluation process?

Most of the reviewed papers focused on specific types of images. Here were the main three:

Specific Image Type	Number of Papers
Maps	10
Graphs	6

Specific Image Type	Number of Papers
Geometric Shapes	4

Conclusion

The authors came to several conclusions:

1. Image types other than maps, graphs, and geometric shapes are rarely studied
2. Only about 1/3 of the papers provide multi-modal feedback
3. The lack of an automated way to retrieve image-related information is currently an important barrier in making large-scale solutions
4. Studies should get BLV individuals involved early in the process, as their feedback is very important when making design decisions

Lessons Learned

Further Questions

Accessible Maps for the Blind: Comparing 3D Printed Models with Tactile Graphics

Citation

(Holloway, Marriott, and Butler 2018)

Brief Summary

Several studies were done on the effectiveness of Orientation and Mobility (O&M) training for people with blindness and severe vision impairment using 3D models. These studies seem to suggest that 3D models are preferred and more effective than the tactile equivalents for 2D graphics. 3D models can also be enhanced using interactive audio labels.

Main Study: Comparing Tactile Maps & 3D Prints

- 3D models were preferred

Preferred format by map type, as revealed through use (neighborhood map) or self-reporting (park maps and station plans)

map	tactile graphic	both	3D model
neighborhood	5	2	9
park	3	0	13
station	4	1	11

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