Usage of Multimodal Maps for Blind People: Why* and How*

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INTRODUCTION:
Navigating is not always obvious for a blind person, especially in an unknown environment. This often means that the visually impaired travel less, which influences their personal and professional life.

Many websites offer the possibility of preparing an itinerary. Often, this information is presented in the form of a visual map¹ (allocentered representation) and a corresponding roadmap² (egocentered representation). The roadmap is accessible for visually impaired people using a screen reader (technical aid for the blind for accessing the screen content). However in the roadmap is limited to the important steps of an itinerary and does not help to understand the environment, which is necessary to enable a flexible and autonomous navigation (e.g. a change of itinerary in case of roadwork). Visual maps are very useful for spatial knowledge but are inaccessible.

CLASSICAL APPROACH: tactile paper maps

- Pertinent but with limitations:
  - Information is static
  - Less information can be transmitted than visually
  - Require knowledge of Braille
  - etc.

NEW APPROACH: usage of MULTITOUCHe displays

Advantages of multitouch compared to monotouch:
- Blind people normally use more than one finger at one time
- Multi-point and gestural interaction is possible
- Exploration strategies of tactile maps by the blind can be analyzed

MULTIMODAL APPROACH: interactive multimodal maps

Tactile map placed on touch surface with audio output
- Information on request
- More information can be transmitted than with tactile map

State of the art: usage of MONOTOUCH devices

REQUIREMENTS for multitouch device

- Technology: must be usable with a tactile map placed on its surface
- Accuracy: inaccuracy of finger position can result in errors in audio output [1]
- Number of inputs: real multitouch characteristics, at least 10 inputs
- Size: with preference A4 or A3
- Orientation: with preference landscape
- Programmable interface: access to touch and gestural events

We use Stantum Multitouch display [3].

PRODUCTION of multimodal interactive maps

Embosed map¹

Modified³ map (e.g. in SVG format²)

Add sound and interactivity*

Tactile Map¹

Interactive Map²

¹GIS: Geographical Information System
²SVG (Scalable Vector Graphics): [2] graphical and XML format, usage of labels to distinguish different element types
³Modifications: [4]
- Simplification (decrease information content)
- Usage of textures and symbols for different types of information
- Ensuring readability (distance between tactile elements in map,...)

USAGE of multimodal interactive maps

System

Touch

User

Audio output

RESULTS

Preliminary evaluations:
- Usable
- Pertinent for acquiring spatial knowledge

FUTURE WORK

- Further improvement of interaction techniques
- Analysis of the exploration strategies of tactile maps by blind people
- Formalization of the multimodality: which modalities, how and when?

DISCUSSION

Technical limitations exist:
- Limited choice for technology satisfying our requirements
- Idea: replace printed tactile map with deformable tactile display?

REFERENCES: