Beyond the desktop interactive visualizations

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Topic overview

≡ Motivation

≡ Evaluation criteria

  ≡ Input

  ≡ Devices screen size

  ≡ Data

  ≡ Output / Achievement

≡ Visualization- and interaction-techniques

  ≡ General approaches

  ≡ Geographical data

 ≡ Image data

  ≡ Web pages

≡ Comparison

Motivation

≡ Increasing **popularity** of mobile devices

≡ Increasing **processing power** and **connectivity** of mobile devices

≡ Limitations in **screen size** and reduced **input capabilities**.

➤ How can we visualize large information spaces on mobile devices ?

P. Irani, C. Gutwin, and X. Yang. Improving selection of off-screen targetswith hopping. In Proceedings of the SIGCHI conference on Human Factors in computing systems, pages 299–308. ACM New York, NY, USA, 2006.

Evaluation and classification
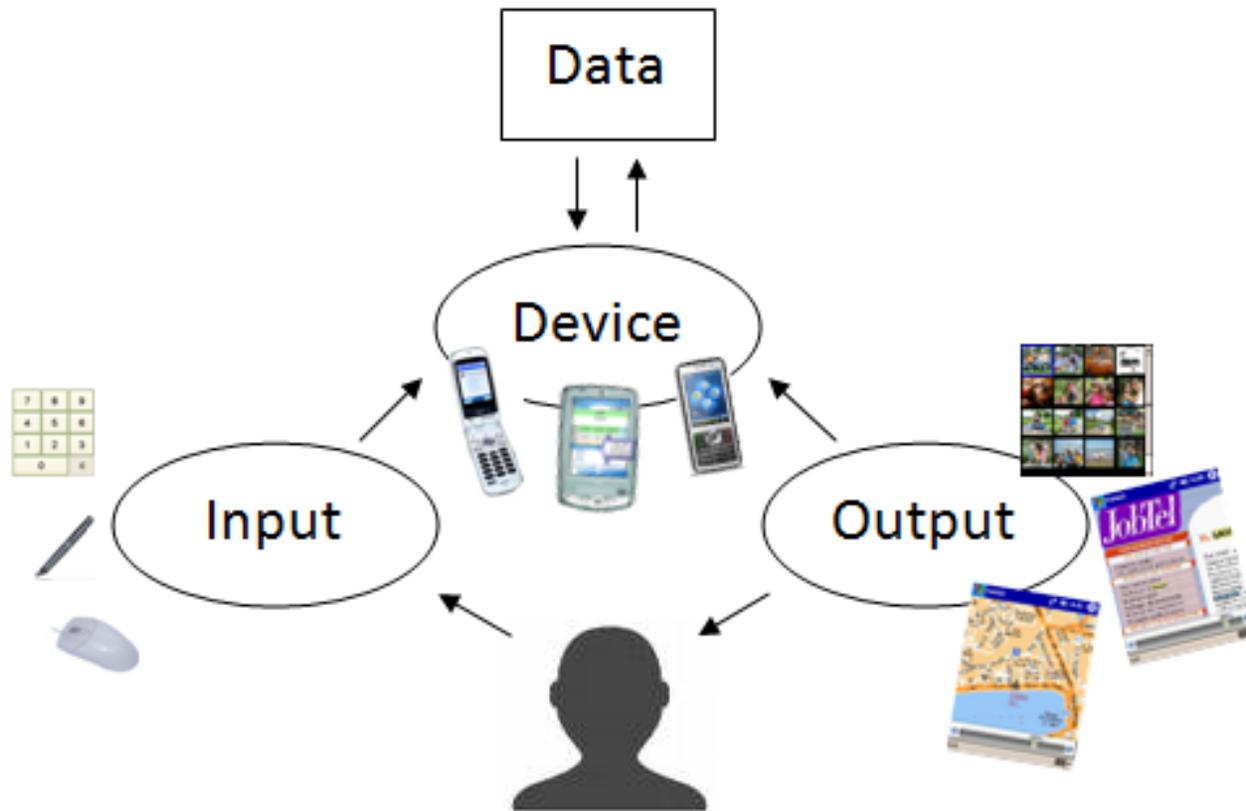
Input criteria

≡ Design space of the input peripherals based on Card and Mackinlay [1]

≡ Sensed property (position, motion or pressure)

≡ Sensing type (touch or mechanical)

≡ Number of dimensions

≡ Analyzed approaches use the following input techniques:

≡ Key

≡ Touch

≡ Tilt

≡ Combination

1: S. Card, J. Mackinlay, and G. Robertson. A morphological analysis of the design space of input devices. ACM Transactions on Information Systems (TOIS), 9(2):99–122, 1991.

Device criteria

☰ Screen Size and the corresponding resolution

    ☰ Large display (handheld, pda)

    ☰ Medium display (blackberry, smartphone)

    ☰ Small display (mobile phones)

Data criteria

☰ The techniques are classified by the types of data they can manage

☰ Possible types are images, vector based maps or plain html files

Output criteria

≡ Main performance indicator

≡ Evaluation is based on Shneidermans taxonomy [1]

  ≡ Overview

  ≡ Zoom

  ≡ Filter

  ≡ Detail-on-Demand

  ≡ Relate

  ≡ History

  ≡ Extract

1: B. Shneiderman. The eyes have it: a task by data type taxonomy for information visualizations. In Visual Languages, 1996. Proceedings., IEEE Symposium on, pages 336–343, 1996.

General approaches

≡ Double Scrollbar Panning

≡ Grab and Drag

≡ Evaluation criteria:

  ≡ Input: Key or Touch / Touch

  ≡ Data: Any 2D graphical data
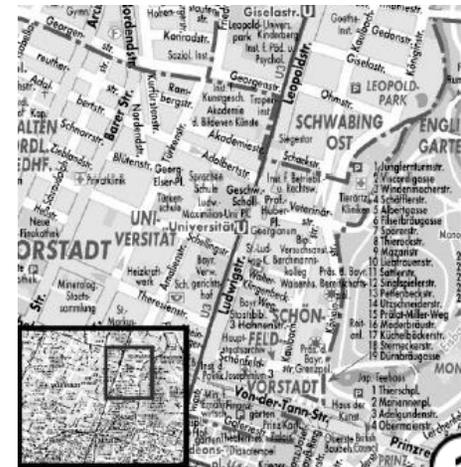
  ≡ Device: Any

  ≡ Output: Panning
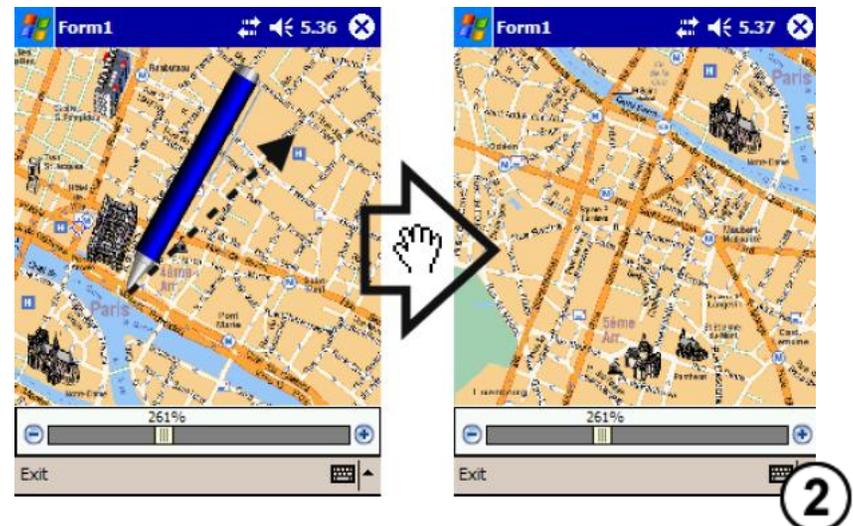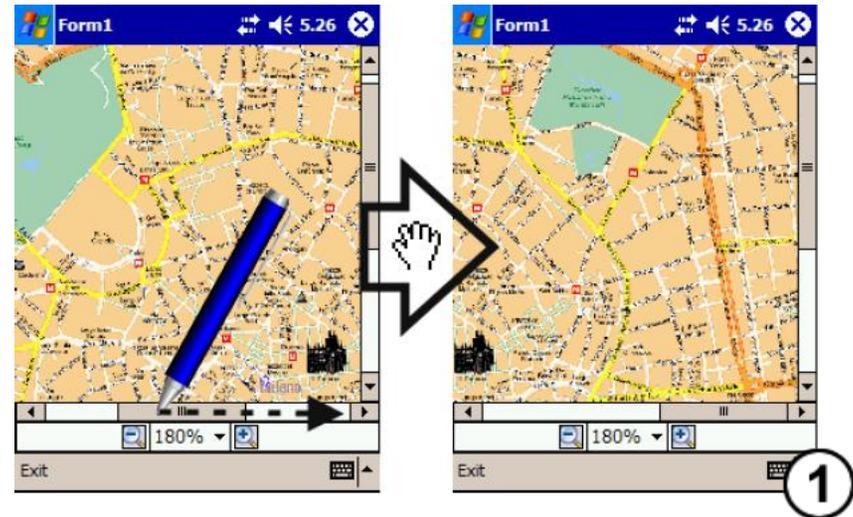
1+2 : S. Burigat, L. Chittaro, and S. Gabrielli. Navigation techniques for smallscreen devices: An evaluation on maps and web pages. International Journal of Human-Computer Studies, 66(2):78–97, 2008.

Overview and Detail techniques

≡ Large Focus Displays

≡ Two corresponding views (small
overview, large detail)

≡ Only for large devices

≡ Achievements: Overview, Panning
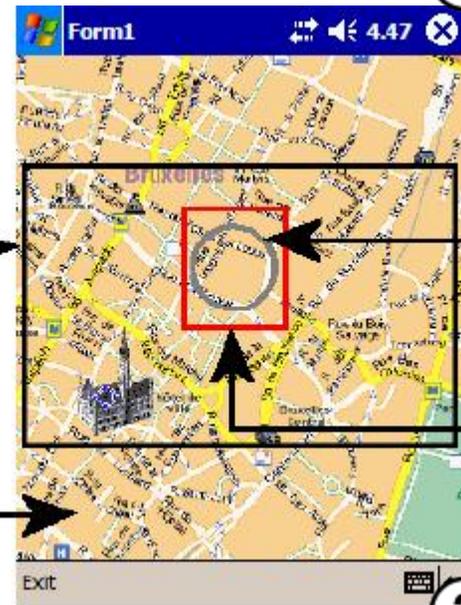
≡ ZEN – Zoom Enhanced Navigator

≡ Full screen detail view

≡ Geometrical Navigation overlay

≡ Achievements: Overview, Panning,
Zooming

1: B. Karstens, R. Rosenbaum, and H. Schumann. Presenting Large and Complex
Information Sets on Mobile Handhelds. E-Commerce and MCommerce Technologies
2: S. Burigat, L. Chittaro, and S. Gabrielli. Navigation techniques for smallscreen devices:
An evaluation on maps and web pages., 2008.

Focus and Context

Fisheye technique:

≡ Uses only one view for context/overview and detail

≡ Small part is shown in detail, context is dissorted

≡ Possibly high processing power requirements
(depending on implementation)

≡ Not suitable for measuring and other spacial tasks

≡ Achievements: Overview, Panning, Zooming
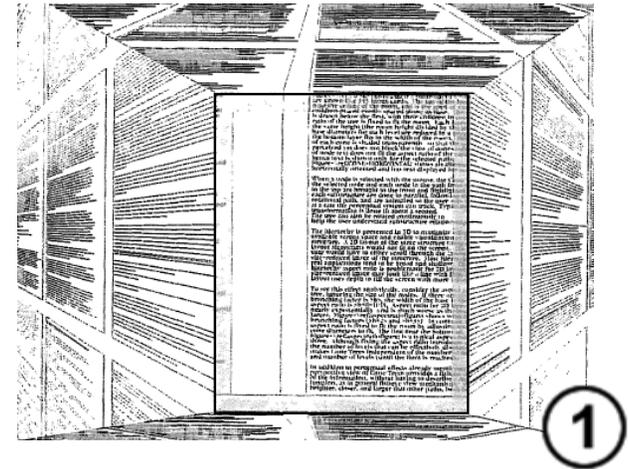
1: G. Robertson and J. Mackinlay. The document lens. ACM New York, NY, USA, 1993.
2: U. Rauschenbach, S. Jeschke, and H. Schumann. General rectangularisheye views for 2D graphics. Computers & Graphics, 2001.

Tilt Based Zooming and Panning

- Uses rotation sensors for all three spatial dimensions and key input

- Acts like holding a picture frame when looking at the 2D data

- Uses SDAZ – Speed Dependent Automatic Zooming

- Can be used one handed

- Achievements: Overview, Panning, Zooming
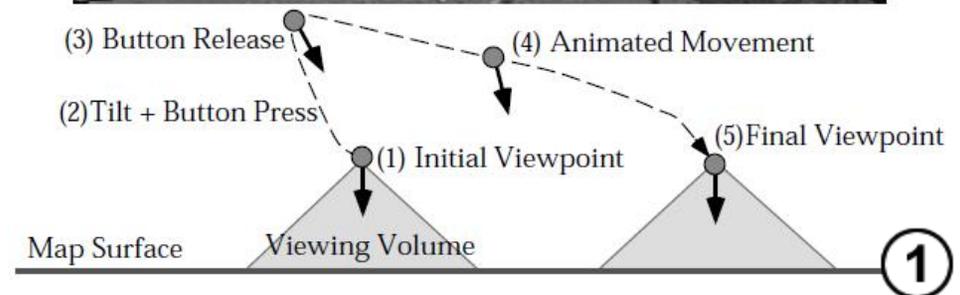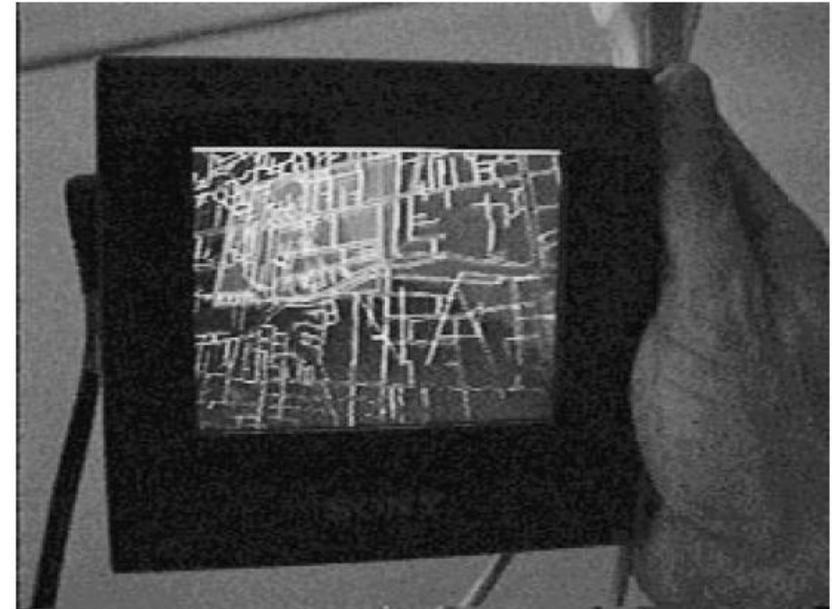
1: J. Rekimoto. Tilting operations for small screen interfaces. In Proceedings of the 9th annual ACM symposium on User interface software and technology, pages 167–168. ACM Press New York, NY, USA, 1996.
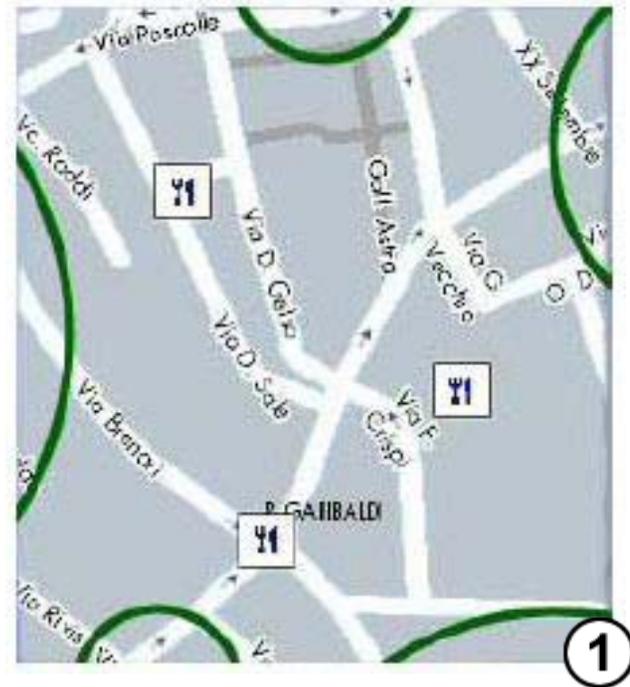
Geographical data

Visualization of off-screen objects:

≡ Problem

- ≡ Only small part of the map displayable

- ≡ Points of Interest easily disappear from screen

≡ Halo

- ≡ Draws circles around off-screen objects

- ≡ Arches shown at the display border indicate points of interest

- ≡ Achieves the overview criteria and is also appropriate for a medium display size


1: S. Burigat, L. Chittaro, and S. Gabrielli. Visualizing locations of offscreen objects on mobile devices: a comparative evaluation of three approaches. In Proceedings of the 8th conference on Human-computer interaction with mobile devices and services, pages 239–246. ACM New York, NY, USA, 2006.

Scenario specific Adaptation and Information Hiding

Map generalization:

≡ Reducing In information depending on the users needs

≡ Takes personal and temporal context information into account

≡ Uses different symbols depending on the age group

≡ Achieves the Shneidermans Filter-criteria
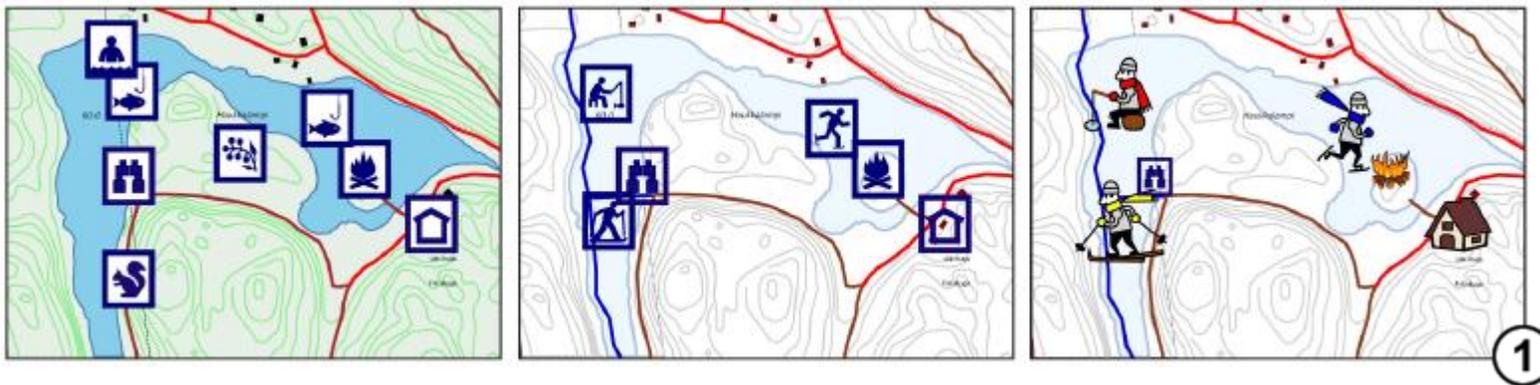
1: A. Nivala and L. Sarjakoski, Adapting Map Symbols for Mobile Users. In Proc. of the International Cartographic Conference, pages 9–16, 2005.

Image data

Auto Zoom:

- The goal is to offer faster browsing in image galleries

- Images are ordered in one column

- Scrolling speed depends on the amount of dragging

- SDAZ is used to help tracking the images

1: D. Patel, G. Marsden, S. Jones, and M. Jones. An Evaluation of Techniques for Browsing Photograph Collections on Small Displays. LECTURE NOTES IN COMPUTER SCIENCE, pages 132–143, 2004.

Web sites

Collapse-to-Zoom:

- ≡ Divides a page into content-blocks using intelligent web-page-analysis

- ≡ Dragging collapses or zooms into blocks

- ≡ Remembers collapsed content

- ≡ Achievements: Overview, Zooming, Filtering, Details-on-Demand, History

- ≡ Only suitable for large screens

about to expand-and-zoom ①

about to collapse column ②

1+2: Patrick Baudisch and Xing Xie and Chong Wang and Wei-ying Ma, Collapse-to-zoom, **ACM Press, 2004**

Conclusion

- Techniques using more specialized data structures can achieve more goals

- Most approaches are based on touch as an input

- Matrix overview of all discussed techniques:

Technique	Input	Device	Data	Output
Double Scroll Bar	Keys or Touch(2D)	S	Any	Panning
Grab and Drag	Touch(2D)	S	Any	Panning
Overview and Detail - Large Focus-Display	Touch(2D)	L	Any	Overview, Panning
Overview and Detail - ZEN	Touch(2D)	L	Any	Overview, Panning, Zooming
Focus and Context - Fisheye	Touch(2D)	L	Any	Overview, Panning, Zooming
Tilt-based	Tilt+Key(3D)	M-L	Any	Overview, Panning, Zooming
Halo, Arrows, CityLights + ZUI	(Touch(2D))	M	Annotated maps	Overview, (Panning, Zooming)
Map Generalization	not specified	M	Vector based maps	Filter
Line Drive	not specified	M	Vector based maps	Filter
Grid-based Image Browsing	Touch(2D)	M	Images	Overview, Panning, Zooming
Pocket PhotoMesa	Touch(2D)	L	Images	Overview, Panning, Zooming
AutoZoom and GestureZoom	Touch(2D)	M	Images	Overview, Panning, Zooming
WEST	Keys or Touch(2D)	L	Simple html sites	Overview, Filtering, Details-on-Demand
Powerbrowser	Keys or Touch(2D)	M	Simple html sites	Overview, Filtering, Details-on-Demand
Web Page Analysis	Touch(2D)	L	Web sites	Overview, Panning, Zooming, Details-on-Demand, History
Collapse-to-Zoom	Touch(2D)	L	Web sites	Overview, Panning, Zooming, Filtering, Details-on-Demand, History, (Extract)

Questions ?