Beyond the desktop interactive visualizations

Hauptseminar “Information Visualization - Wintersemester 2008/2009”

Till Ballendat
LFE Medieninformatik
17.02.2009
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?

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

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

General approaches

- Double Scrollbar Panning
- Grab and Drag

**Evaluation criteria:**

- **Input:** Key or Touch / Touch
- **Data:** Any 2D graphical data
- **Device:** Any
- **Output:** Panning

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

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

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

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

Scenario specific Adaptation and Information Hiding

Map generalization:

- Reducing information depending on the users needs
- Takes personal and temporal context information into account
- Uses different symbols depending on the age group
- Achieves the Shneiderman's Filter-criteria

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

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

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:

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