Using split screens to combine maps and images for pedestrian navigation

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Motivation and Approach

- Studies have shown **advantages of map-image combinations**
  - Map view **automatically replaced** with image view (Chittaro and Burigat 2005)
  - **Manual switching** between views (Beeharee and Steed 2006)

- **Split screen** to display maps and images at the same time
  - No active interaction, only gaze switching
  - Overstraining amount of information?

- Interaction prototypes
  - Simple photographs and panoramic images
Split Screen: Simple Photographs
Split Screen: Panoramic Images
Alternating View: Manual Switching
Pre-study of Manual Switching (Baseline)

Touch interaction

Physical gesture

- Is touch or physical gesture better suited for switching views?
Pre-study of Manual Switching

- **Field study**
  - **Within-subjects** design
  - Counterbalanced interfaces and route sections

- **Route**
  - Inner city of Bremen
  - **550m (section A) and 570m (section B)**

- **Participants**
  - **16 volunteers** (10 female, 6 male)
  - Aged between 17 and 54 years
Results

- No differences in time (mean: touch 6:40 min, gesture 6:46 min)

- Less navigation errors with gesture (accumulated: touch 6, gesture 1)
  - Difference statistically not significant

- Higher perceived usability for gesture in questionnaire
  - System Usability Scale, SUS (mean scores: touch 81.7, gesture 91.4)
  - Not significant

- Physical gesture preferred by most of the users
  - 11 of 16 participants prefer the gesture
  - More simple and more intuitive
Results

- View usage (map view/image view)
  - **View switches higher for gesture** (mean: touch 20.3, gesture 29.7)
    - Difference significant
  - **Potentially** less navigation errors because of more view switches
Main Study

- Is manual switching or a split screen **better suited**?
- Do **panoramic photos** offer any benefits over **simple photographs**?

- Manual switching (pitch gesture)
- Split screen (panoramas)
- Split screen (simple photos)
Main Study

- **Field study**
  - **Within-subjects** design
  - Counterbalanced interfaces and route sections

- **Route**
  - Both sections used in pre-study
  - Additional section: **550m (section C)**

- **Participants**
  - **18 volunteers** (13 female, 5 male)
  - Aged between 17 and 61 years
  - Each gained 10€ expense allowance
Results

- Marginally differences in time

- Few errors in all conditions (accumulated)
  - Manual switching: 6
  - Panorama-based split screen: 4
  - Split screen with simple photos: 7

- Higher perceived usability for panorama systems (mean SUS scores)
  - Manual switching: 80.4
  - Panorama-based split screen: 81.5
  - Split screen with simple photos: 68.6
  - Not significant
Results

- **Attitude** towards the systems **better for panorama-based prototypes**
  - 4 questions from Unified Theory of Acceptance and Use of Technology
  - Significant between manual switching and simple photos

- **16 of 18 participants prefer panorama-based system**
  - 11 prefer manual switching
  - 5 prefer the panorama-based split screen

- **General observations**
  - All participants were looking at the device again and again
  - **Distracted from the environment**
  - One participant *overlooked a tram* (stopped by the supervisor)
Conclusion

- Pre-study: Manual switching
  - Physical gesture preferred by most of the users

- Main study: Split screens
  - None of the interfaces clearly outperformed the others
  - Results indicate advantages of panorama-based navigation

- Future work
  - Improve safety (e.g. notify the users of trams)
  - Investigate spatial knowledge acquisition

Thank You! Questions?
References


Results

- **Time (mean) & errors (accumulated)**
  - Touch: 6:40 min (5 errors)
  - Gesture: 6:46 min (1 error)
  - **Differences statistically not significant**

- **System Usability Scale (SUS)**
  - Touch: 81.7
  - Gesture: 91.4
  - **Difference not significant**

- **Map view shares**
  - Touch: 75.8 %
  - Gesture: 73.4 %
Results

- **View switches**
  - Touch: 20.3
  - Gesture: 29.7
  - Difference statistically significant

- **Interview and ranking**
  - 11 of 16 participants preferred the gesture
  - More simple and more intuitive

- **Conclusion**
  - **Physical gesture preferred** by most of the users
  - **Potentially** less errors because of more view switches
Results

- **Time**
  - All runs between 5:13 min and 9:12 min
  - No statistically significant differences

- **Errors (accumulated)**
  - Manual switching: 6
  - Panorama-based split screen: 4
  - Split screen with simple photos: 7

- **System Usability Scale (SUS)**
  - Manual switching: 80.4
  - Panorama-based split screen: 81.5
  - Split screen with simple photos: 68.6