Usability Evaluation of context-aware mobile systems: A review

Stavros Garzonis
Mobile Service Discovery

- Humans discovering mobile services
- How can context awareness assist in that?
- Evaluating context-aware mobile services could help
- But how do I do that??
Decisions, decisions...

- Field or Lab?
- Experts or Users?
- Task-based or exploratory learning?
- Co-operative or ‘strict’ think-aloud?
- Direct/Indirect Observation, Field Questionnaires and/or Logging?
- Grounded or Discount Analysis?
Taking into account...

- Low HW capabilities
- Limited Input/Output (UI)
- Mobility
  - Limited Attention, unstable hands etc.
- Dynamic Context
- Sensing Context & adapting
What literature has to offer

- Guidelines for field evaluations
  - Rowley (1994)
- Evaluation Techniques specifically for mobile devices
  - Brewster 2002: Earcons
  - Pirhoen, Brewster, Holguin 2002: TouchPlayer
- Evaluation Methods specifically for mobile services
  - Vetere et al. 2003: Heuristic Walkthrough
- Field or Lab debate
  - Kjeldskov et al. : Comparing 4 evaluation studies
  - Kjeldskov & Stage: Comparing 6 evaluation studies
  - Kjeldskov et al. : Is it worth the hassle?
Walking Through Mobile Use: Novel Heuristics and their Application

F. Vetere, S. Howard, S. Pedell, S. Balbo
The University of Melbourne

OzCHI 2003
Traditional Usability Heuristics do not...

- Capture problems associated with changing context of use
- Explicitly deal with dynamic context
  - thus missing out ‘social transitions’
‘Mobile Heuristic Walkthrough’

A hybrid evaluation technique of
Cognitive Walkthrough and
Heuristic Evaluation

with added Heuristics to capture the social aspects of mobility
Evaluating the method

- Evaluators did not have a sense of real world context
- Cognitive workload of being expert and user is “rather high”
- The concept of ‘locale’ will probably need instantiating for each application
- Current heuristics provide more concrete results and redesign implications
To Field or not to Field?

- 41% of Mobile HCI involved evaluation
- 71% was done in labs

Kjeldskov & Graham (2003)

<table>
<thead>
<tr>
<th>LAB</th>
<th>FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faster &amp; Cheaper</td>
<td>Time Consuming &amp; Expensive</td>
</tr>
<tr>
<td>Unnatural Setting</td>
<td>Real Context</td>
</tr>
<tr>
<td>Experimental Control</td>
<td>Uncontrolled Environment</td>
</tr>
<tr>
<td>Easier to collect data</td>
<td>Harder to record or think-aloud</td>
</tr>
<tr>
<td>Easier to find participants</td>
<td>Might involve travelling</td>
</tr>
</tbody>
</table>
Evaluating the usability of a mobile guide: the influence of location, participants and resources

J. KJELDSKOV, C. GRAHAM, S. PEDELL, F. VETERE, S. HOWARD, S. BALBO, J. DAVIES

The University of Melbourne & Aalborg University

Behaviour & Information Technology 2005
Comparing 4 approaches

- Field Evaluation
- Laboratory Evaluation
- Heuristic Walkthrough
- Rapid Reflection
Results

• All methods found 59% of the all the problems
• All methods found 80% of the critical problems
• Field Evaluation was the most effective in serious problems
• Field Evaluation was the least effective in cosmetic problems
• Only ONE Serious Problem was mutually identified by all four methods
• Field and lab had considerable overlapping None of the cosmetic problems was found by all techniques
• Lab and HE identified the same set of cosmetic problems.
LESSONS LEARNED

- Critical Problems are most probably detectable, regardless the technique.
- Lab evaluation tend to produce more device-centred findings (e.g. labelling)
- Field evaluation misses out most of the cosmetic but was most effective in finding the serious problems
- Rapid Reflection proved very cost-effective but exhaustive data collection and analysis is good for building theoretical foundations
New techniques for Usability Evaluation of Mobile Systems

J. Kjeldskov & J. Stage

The Aalborg University

International Journal of Human-Computer Studies (IJHCS) 2004
Evaluating against 6 conditions

1. Sitting on a chair at a table
2. Walking on a treadmill at constant speed
3. Walking on a treadmill at varying speed
4. Walking at constant speed on a course that is constantly changing
5. Walking at a varying speed on a course that is constantly changing
6. Walking in a pedestrian street
Results

- The sitting technique was the most effective
- But mainly identifies more cosmetic problems
- Techniques involving movement & navigation find UI layout problems
Is it worth the hassle? Exploring the Added Value of Evaluating the Usability of Context-Aware Mobile Systems in the Field

J. Kjeldskov, M. B. Skov, B. S. Als and R.T. Hoegh
Aalborg University

MobileHCI 2004
# Results

<table>
<thead>
<tr>
<th></th>
<th>Laboratory</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person-Hours spent</td>
<td>34</td>
<td>65</td>
</tr>
<tr>
<td>Problems found</td>
<td>97.3 %</td>
<td>62.2 %</td>
</tr>
<tr>
<td>Uniquely identified</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Critical</td>
<td>100 %</td>
<td>87.5 %</td>
</tr>
<tr>
<td>Serious</td>
<td>94.7 %</td>
<td>52.6 %</td>
</tr>
<tr>
<td>Cosmetic</td>
<td>100 %</td>
<td>60 %</td>
</tr>
</tbody>
</table>
Distribution of Identified Usability Problems
Context-aware related problems

- Both condition identified all 7 context-aware related problems.
- Pushing Information was found to be more annoying in the field
- Lack of data entry validation was picked up only in the field
BUT...

- The evaluation time in the lab lasted twice as in the field per participant
- The nurses participating in the field were less experienced
Summary

- There are not any evaluation methods to effectively address the specific challenges of context-aware mobile devices.
- The major difference between Field and Lab evaluation is in cosmetic problems.
- The studies mentioned used 5 or 6 participants per condition.
Suggestions

☐ Field or Lab?
☐ Experts or Users?
☐ Task-based or exploratory learning?
☐ Co-operative or ‘strict’ think-aloud?
☐ Direct/Indirect Observation, Field Questionnaires and/or Logging?
☐ Grounded or Discount Analysis?
References 1

- Brewster, S. 2002, *Overcoming the lack of screen space on mobile computers*. Personal and Ubiquitous Computing, 6, 188-205


References 3


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