Chapter 15

Analytical evaluation
Aims:

• Describe the key concepts associated with inspection methods.
• Explain how to do heuristic evaluation and walkthroughs.
• Explain the role of analytics in evaluation.
• Describe how to perform two types of predictive methods, GOMS and Fitts’ Law.
Inspections

- Several kinds.
- Experts use their knowledge of users & technology to review software usability.
- Expert critiques (crits) can be formal or informal reports.
- Heuristic evaluation is a review guided by a set of heuristics.
- Walkthroughs involve stepping through a pre-planned scenario noting potential problems.
Heuristic evaluation

• Developed Jacob Nielsen in the early 1990s.
• Based on heuristics distilled from an empirical analysis of 249 usability problems.
• These heuristics have been revised for current technology.
• Heuristics being developed for mobile devices, wearables, virtual worlds, etc.
• Design guidelines form a basis for developing heuristics.
Nielsen’s original heuristics

• Visibility of system status.
• Match between system and real world.
• User control and freedom.
• Consistency and standards.
• Error prevention.
• Recognition rather than recall.
• Flexibility and efficiency of use.
• Aesthetic and minimalist design.
• Help users recognize, diagnose, recover from errors.
• Help and documentation.
Discount evaluation

• Heuristic evaluation is referred to as discount evaluation when 5 evaluators are used.

• Empirical evidence suggests that on average 5 evaluators identify 75-80% of usability problems.
No. of evaluators & problems

Proportion of Usability Problems Found

Number of Evaluators

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3 stages for doing heuristic evaluation

• Briefing session to tell experts what to do.

• Evaluation period of 1-2 hours in which:
  – Each expert works separately;
  – Take one pass to get a feel for the product;
  – Take a second pass to focus on specific features.

• Debriefing session in which experts work together to prioritize problems.
Advantages and problems

• Few ethical & practical issues to consider because users not involved.
• Can be difficult & expensive to find experts.
• Best experts have knowledge of application domain & users.
• Biggest problems:
  – Important problems may get missed;
  – Many trivial problems are often identified;
  – Experts have biases.
Heuristics for websites focus on key criteria (Budd, 2007)

• Clarity
• Minimize unnecessary complexity & cognitive load
• Provide users with context
• Promote positive & pleasurable user experience
Cognitive walkthroughs

• Focus on ease of learning.
• Designer presents an aspect of the design & usage scenarios.
• Expert is told the assumptions about user population, context of use, task details.
• One or more experts walk through the design prototype with the scenario.
• Experts are guided by 3 questions.
The 3 questions

• Will the correct action be sufficiently evident to the user?
• Will the user notice that the correct action is available?
• Will the user associate and interpret the response from the action correctly?

As the experts work through the scenario they note problems.
Pluralistic walkthrough

- Variation on the cognitive walkthrough theme.
- Performed by a carefully managed team.
- The panel of experts begins by working separately.
- Then there is managed discussion that leads to agreed decisions.
- The approach lends itself well to participatory design.
A project for you ...

http://www.id-book.com/catherb/

• provides heuristics and a template so that you can evaluate different kinds of systems.

• More information about this is provided in the interactactivities section of the id-book.com website.
Analytics

• A method for evaluating user traffic through a system or part of a system
• Many examples including Google Analytics, Visistat (shown below)
• Times of day & visitor IP addresses
Social action analysis
(Perer & Shneiderman, 2008)
Predictive models

• Provide a way of evaluating products or designs without directly involving users.
• Less expensive than user testing.
• Usefulness limited to systems with predictable tasks - e.g., telephone answering systems, mobiles, cell phones, etc.
• Based on expert error-free behavior.
GOMS

• Goals – what the user wants to achieve eg. find a website.
• Operators - the cognitive processes & physical actions needed to attain goals, eg. decide which search engine to use.
• Methods - the procedures to accomplish the goals, eg. drag mouse over field, type in keywords, press the go button.
• Selection rules - decide which method to select when there is more than one.
Keystroke level model

• GOMS has also been developed to provide a quantitative model - the keystroke level model.

• The keystroke model allows predictions to be made about how long it takes an expert user to perform a task.
## Response times for keystroke level operators (Card et al., 1983)

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
<th>Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Pressing a single key or button</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average skilled typist (55 wpm)</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Average non-skilled typist (40 wpm)</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Pressing shift or control key</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Typist unfamiliar with the keyboard</td>
<td>1.20</td>
</tr>
<tr>
<td>P</td>
<td>Pointing with a mouse or other device on a display to select an object.</td>
<td>0.40</td>
</tr>
<tr>
<td>P1</td>
<td>Clicking the mouse or similar device</td>
<td>0.20</td>
</tr>
<tr>
<td>H</td>
<td>Bring ‘home’ hands on the keyboard or other device</td>
<td>0.40</td>
</tr>
<tr>
<td>M</td>
<td>Mentally prepare/respond</td>
<td>1.35</td>
</tr>
<tr>
<td>R(t)</td>
<td>The response time is counted only if it causes the user to wait.</td>
<td>t</td>
</tr>
</tbody>
</table>

This value is derived from Fitts’ Law which is discussed below.
Summing together

\[ T_{\text{execute}} = T_K + T_P + T_H + T_D + T_M + T_R \]
Using KLM to calculate time to change gaze  (Holleis et al., 2007)
Fitts’ Law (Fitts, 1954)

- Fitts’ Law predicts that the time to point at an object using a device is a function of the distance from the target object & the object’s size.
- The further away & the smaller the object, the longer the time to locate it & point to it.
- Fitts’ Law is useful for evaluating systems for which the time to locate an object is important, e.g., a cell phone, a handheld devices.
A project for you ...

- Use the web & other resources to research claims that heuristic evaluation often identifies problems that are not serious & may not even be problems.
- Decide whether you agree or disagree.
- Write a brief statement arguing your position.
- Provide practical evidence & evidence from the literature to support your position.
A Project for you ...Fitts’ Law

Visit Tog’s website and do Tog’s quiz, designed to give you fitts!

http://www.asktog.com/columns/022DesignedToGiveFitts.html
Key points

• Inspections can be used to evaluate requirements, mockups, functional prototypes, or systems.
• User testing & heuristic evaluation may reveal different usability problems.
• Walkthroughs are focused so are suitable for evaluating small parts of a product.
• Analytics involves collecting data about users activity on a website or product.
• The GOMS and KLM models and Fitts’ Law can be used to predict expert, error-free performance for certain kinds of tasks.