Lecture 8: Qualitative Evaluation

Shengdong Zhao


Acknowledgement:
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Announcements

• G2 is due next week
The Design Process

[Koberg & Bagnall]

Design Thinking Workshop
Naturalistic approach

• Observation occurs in realistic setting
  – real life

• Problems
  – hard to arrange and do
  – time consuming
  – may not generalize
Usability engineering approach

Is the test result relevant to the usability of real products in real use outside of lab?

Problems
- non-typical users
- non-typical tasks
- different physical environment
- different social context
  - experimenter vs. boss

• Partial Solution
  - use real users
  - task-centered system design tasks
  - environment similar to real situation
Discount usability evaluation

• Low cost methods to gather usability problems
  – approximate: capture most large and many minor problems

• How?
  – Qualitative:
    • observe interactions
    • gather explanations
    • produces description
    • anecdotes, transcripts, problem areas, critical incidents…
  – Quantitative*
    • count, log, measure user actions
    • speed, error rate, counts of activities
Qualitative vs. Quantitative

Words

This week

Numbers

Three weeks later
Discount usability evaluation

• Methods
  – Inspection
  – extracting the conceptual model
  – direct observation
    • think-aloud
    • constructive interaction
    • Retrospective Think Aloud
  – query techniques (interviews and questionnaires)
  – continuous evaluation (user feedback and field studies)
**Inspection**

- Designer tries the system (or prototype)
  - does the system “feel right”?
    - benefits
      - catch major problems early
  - problems
    - not reliable
    - not valid
    - intuitions can be wrong

- Inspection methods
  - task centered walkthroughs
  - heuristic evaluation
Heuristic Evaluation
Usability Heuristics

“Rules of thumb” describing features of usable systems
  – Can be used as design principles
  – Can be used to evaluate a design

Example: *Minimize users’ memory load*

Pros and cons
  – Easy and inexpensive
    • No need users
    • Catch many design flaws
  – More difficult than it seems
    • Not a simple checklist
    • Cannot assess how well the interface will address user goals
Heuristic Evaluation

Developed by Jakob Nielsen (1994)
Original Heuristics

H1-1: Simple and natural dialog
H1-2: Speak the users’ language
H1-3: Minimize users’ memory load
H1-4: Consistency
H1-5: Feedback
H1-6: Clearly marked exits
H1-7: Shortcuts
H1-8: Precise & constructive error messages
H1-9: Prevent errors
H1-10: Help and documentation
Revised Heuristics

Also developed by Nielsen.
- Based on factor analysis of 249 usability problems
- A prioritized, independent set of heuristics
Revised Heuristics

H2-1: Visibility of system status
H2-2: Match system and real world
H2-3: User control and freedom
H2-4: Consistency and standards
H2-5: Error prevention
H2-6: Recognition rather than recall
H2-7: Flexibility and efficiency of use
H2-8: Aesthetic and minimalist design
H2-9: Help users recognize, diagnose and recover from errors
H2-10: Help and documentation
Heuristic: Visibility (Feedback)

H2-1: Visibility of system status
Heuristic: Visibility (Feedback)
Users should always be aware!

Feedback: Toolbar, cursor, ink
Heuristics (H2-2): Match System & World
Heuristics: Match System & World

Speak users’ language

• Withdrawing money at ATM

• Use meaningful mnemonics, icons and abbreviations
Heuristics (2-3) : Control & Freedom

“Exits” for mistaken choices, undo, redo
Don’t force down fixed paths …
Heuristics: Control & Freedom

• Mark exits: Users don’t like to be trapped!

• Strategies
  – Cancel button (or Esc key) for dialog
    • Make the cancel button responsive!
  – Universal undo
Heuristics: Consistency

H2-4: Consistency and standards
Heuristics: Errors and Memory

H2-5: Error prevention

H2-6: Recognition rather than recall
  - Make objects, actions, options, & directions visible or easily retrievable
Heuristic: Errors and Memory

• Promote recognition over recall
  – Recognition is easier than recall

• Describe expected input clearly
  – Don’t allow for incorrect input
Heuristics: Flexibility

H2-7: Flexibility and efficiency of use

– Accelerators for experts (e.g., gestures, shortcuts)
– Allow users to tailor frequent actions (e.g., macros)
**Heuristics: Aesthetics**

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<thead>
<tr>
<th>Form Title</th>
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<tr>
<td>Q&amp;D Software Development Order Desk</td>
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<table>
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<table>
<thead>
<tr>
<th>E-Mail response to (will not appear on)</th>
<th>Alternate (for mailto forms only)</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="mailto:dversch@q-d.com">dversch@q-d.com</a></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scrolling Status Bar Message (max length = 200 characters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WebMania 1.5b with Image Map Wizard is here!***</td>
</tr>
</tbody>
</table>

**H2-8: Aesthetic and minimalist design**
- No irrelevant information in dialogues
Heuristics: Help Users

H2-9: Help users recognize, diagnose, and recover from errors
Good Error Messages

From Cooper’s “About Face 2.0”
H2-10: Help and documentation
- Easy to search
- Focused on the user’s task
- List concrete steps to carry out
- Not too long
Heuristics: Docs
The Process of Heuristic Evaluation
Phases of Heuristic Eval. (1-2)

1) Pre-evaluation training

2) Evaluation
   - Individuals evaluate interface then aggregate results
   - Work in 2 passes
     • Overview -> Details
   - Each evaluator produces list of problems
Phases of Heuristic Eval. (3-4)

3) Severity rating
   - Cosmetic << minor << major << catastrophic

4) Debriefing
   - Discuss outcome
   - Suggest solutions
   - Assess difficulty to fix
Examples

Can’t copy info from one window to another
- Violates “User control and freedom” (H2-3)
- Violates “Recognition rather than recall” (H2-7)
- Violates “Flexibility and efficiency of use” (H2-8)
- Fix: allow copying

Typography uses mix of upper/lower case formats and fonts
- Violates “Consistency and standards” (H2-4)
- Slows users down
- Fix: pick a single format for entire interface

- Probably wouldn’t be found by user testing
Severity Rating

Used to allocate resources to fix problems

Estimates of need for more usability efforts

Combination of
  – Frequency
  – Impact
  – Persistence (one time or repeating)

Should be calculated after all evaluations are in

Should be done independently by all judges
Levels of Severity

0 - don’t agree that this is a usability problem

1 - cosmetic problem

2 - minor usability problem

3 - major usability problem; important to fix

4 - usability catastrophe; imperative to fix
Severity Ratings Example

1. [H2-4 Consistency] [Severity 3][Fix 0]

The interface used the string "Save" on the first screen for saving the user's file, but used the string "Write file" on the second screen. Users may be confused by this different terminology for the same function.
Debriefing

- Conduct with evaluators, observers, and development team members
- Discuss general characteristics of UI
- Suggest improvements to address major usability problems
- Development team rates how hard things are to fix
- Make it a brainstorming session
  - Little criticism until end of session
Number of Evaluators

Single evaluator achieves poor results
- Only finds 35% of usability problems
- 5 evaluators find ~ 75% of usability problems
- Why not more evaluators???? 10? 20?
  - Adding evaluators costs more
  - Many evaluators won’t find many more problems

But always depends on market for product:
- popular products ➔ high support cost for small bugs
Decreasing Returns

Problems Found

Benefits / Cost

Caveat: Graphs are for a specific example
Summary

• Heuristic evaluation is a discount method

• Have evaluators go through the UI twice

• Have evaluators independently rate severity

• Combine the findings from 3 to 5 evaluators

• Discuss problems with design team

• Cheaper alternative to user testing
  – Finds different problems, so good to alternate
In-class Exercise
**Welcome, Ben Bitdiddle.**

You have 2 item(s) in your shopping cart.
To remove an item, check "Remove" box & click "Recalculate".
Shipping Calculator below.

*There is a problem with your order.*

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Quantity</th>
<th>UnitPrice</th>
<th>ExtPrice</th>
</tr>
</thead>
<tbody>
<tr>
<td>323022</td>
<td>Pinnacle Clean Plus Version 4.0 Retail <em><strong>(Free 2nd Day)</strong></em></td>
<td>1</td>
<td>$61.00</td>
<td>$61.00</td>
</tr>
<tr>
<td>80098-21</td>
<td>Corsair VS1GBKIT400 1GB Kit DDR400 PC3200 Value Select Memory Retail (out of stock)</td>
<td>1</td>
<td>$179.00</td>
<td>$179.00</td>
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</table>

Subtotal: $240.00

For more information about tax, please [click here](#).

**Shipping Promotion details.** Please read.

*Note: Discount will be applied during check out*

**Coupon Code:** [Enter Coupon Code]  [Apply]

**Ship to Zip Code:** [Enter Zip Code]  [Calculate Shipping Charge]

Have not made up your mind? Save all the items in your shopping cart!

**Cart Title:** [Enter Cart Title]  [Save Shopping Cart]

Return to old shopping cart:

**Cart Name:** [Enter Cart Name]  [Load Shopping Cart]
Discount usability evaluation

• Methods
  – Inspection
  – extracting the conceptual model
  – direct observation
    • think-aloud
    • constructive interaction
    • Retrospective Think Aloud
  – query techniques (interviews and questionnaires)
  – continuous evaluation (user feedback and field studies)
Conceptual model extraction

• How?
  – show the user static images of
    • the prototype or screens
  – ask the user explain
    • the function of each screen element
    • how they would perform a particular task

• What?
  – Initial conceptual model (first time)
  – Formative conceptual model (later)

• Value?
  – good for eliciting people’s understanding before & after use
  – poor for examining system exploration and learning
Direct observations

• Evaluator observes users interacting with system
  – in lab:
    • user asked to complete a set of pre-determined tasks
  – in field:
    • user goes through normal duties

• Value?
  – excellent at identifying gross design/interface problems
  – validity depends on how controlled/contrived the situation is
Simple observation method

• User is given the task
• Evaluator just watches the user

• Problem
  – does not give insight into the user’s decision process or attitude
Think aloud method

Users speak their thoughts while doing the task
• gives insight into what the user is thinking
• most widely used evaluation method in industry

Hmm, what does this do? I’ll try it... Ooops, now what happened?
Initial Conceptual Model and Think Aloud Exercise

Techniques used:
• Conceptual Model
• Think Aloud
Think aloud method

Users speak their thoughts while doing the task
• gives insight into what the user is thinking
• most widely used evaluation method in industry

• However:
  – unnatural (awkward and uncomfortable)
  – hard to talk if they are concentrating
  – may alter the way users do the task
Problems of Think aloud method

However:

- unnatural (awkward and uncomfortable)
- hard to talk if they are concentrating
- may alter the way users do the task

Hmm, what does this do? I’ll try it... Ooops, now what happened?
Constructive interaction method

• Two people work together on a task
  – monitor their normal conversations

Co-discovery learning
  – use semi-knowledgeable “coach” and novice
  – only novice uses the interface
    • novice ask questions
    • coach responds
  – gives insights into two user groups

Oh, I think you clicked on the wrong icon
Now, why did it do that?
Problems of Think aloud method

However:

- unnatural (awkward and uncomfortable)
- hard to talk if they are concentrating
- may alter the way users do the task

Hmm, what does this do? I’ll try it... Ooops, now what happened?
RTA – Retrospective Think Aloud

• Users first complete the task and verbalize after
• Process is observed and recorded with notes

• Benefits
  – Verbalizing on a higher level
  – More relaxed
  – Fabrication not a problem

Ref: Zhiwei Guan, Shirley Lee, Elisabeth Cuddihy, Judith Ramey
Comparing Eye-tracking Patterns

Source: Dr L Ball, Lancaster University
What you have learned

• Why do we need evaluation?
• Different stages where usability evaluation applies
• What a usability room look like?
• A number of discounted usability evaluation methods
  – Inspection
  – Initial Conceptual Model
  – Direct observation
    • Think aloud
    • Constructive interaction method
    • RTA (Retrospective Think Alound)
Steps to Prepare and Conduct a User Study
Preparing for a User Test

• Objective: narrow or broad?
• Design the tasks
• Decide on whether to use video/audio
• Choose the setting
• Representative users
User Test

• Roles:
  – Greeter
  – Facilitator: Help users to think aloud…
  – Observers: record “critical incidents”
Critical Incidents

• Critical incidents are unusual or interesting events during the study.
• Most of them are usability problems.
• They may also be moments when the user:
  – got stuck, or
  – suddenly understood something
  – said “that’s cool” etc.
The User Test

• The actual user test will look something like this:
  – Greet the user
  – Explain the test
  – Collect Demographic Information
  – Get user’s signed consent
  – Demo the system
  – Run the test (maybe \( \frac{1}{2} \) hour)
  – Post-Interview & Questionnaire
  – Debrief
10 Steps to better evaluation
10 steps to better evaluation

1. Introduce yourself
   – some background will help relax the subject.
10 steps

2. Describe the purpose of the observation (in general terms), and set the participant at ease
   – You're helping us by trying out this product in its early stages.
   – If you have trouble with some of the tasks, it's the product's fault, not yours. Don't feel bad; that's exactly what we're looking for.
10 steps (contd.)

3. Tell the participant that it's okay to quit at any time, e.g.:
   - Although I don't know of any reason for this to happen, if you should become uncomfortable or find this test objectionable in any way, you are free to quit at any time.
10 steps (contd.)

4. Talk about the equipment in the room.
   - Explain the purpose of each piece of equipment (hardware, software, video camera, microphones, etc.) and how it is used in the test.
5. Explain how to “think aloud.”
   – Explain why you want participants to think aloud, and demonstrate how to do it. E.g.:
   – We have found that we get a great deal of information from these informal tests if we ask people to think aloud. Would you like me to demonstrate?
10 steps (contd.)

6. Explain that you cannot provide help.
10 steps (contd.)

7. Describe the tasks and introduce the product.
   - Explain what the participant should do and in what order. Give the participant written instructions for the tasks.
   - However, don’t demonstrate what you’re trying to test.
10 steps (contd.)

8. Ask if there are any questions before you start; then begin the observation.
10 steps (contd.)

9. Conclude the observation. When the test is over:
   – Explain what you were trying to find.
   – Answer any remaining questions.
   – Discuss any interesting behaviors you would like the participant to explain.
10. Use the results.
   - When you see participants making mistakes, you should attribute the difficulties to faulty product design, not to the participant.
Using the Results

• Update task analysis and rethink design
  – Rate severity & ease of fixing problems
  – Fix both severe problems & make the easy fixes
• Will thinking aloud give the right answers?
  – Not always
  – If you ask a question, people will always give an answer, even it is has nothing to do with the facts
  – Try to avoid leading questions
Questions?

High-order summary:
• Follow a loose master-apprentice model
• Observe, but help the user describe what they’re doing
• Keep the user at ease
How many users should you observe?

• Problems
  – observing many users is expensive
  – but individual differences matter
    • best user 10x faster than slowest
    • best 25% of users ~2x faster than slowest 25%

• Partial solution
  – reasonable number of users with reasonable range
  – big problems usually detected with 3-5 users
  – small problems / fine measures need many users
In-class Exercise
In-class Exercise

• Procedure
  – Greet the user
  – Explain the test
    • (How to be consistent?)
  – Collect demographic information (how?)
  – Get user’s signed consent
  – Demo the system
    • (how to be consistent in demoing the system to different users?)
  – Run the test (maybe ½ hour)
    • (What test and how to conduct it?)
  – Post-study questionnaire
    • (What type of questions you want to ask?)
  – Debrief

• Work in pairs, and describe briefly what will you do in each step
What we have prepared?
Pre-Study Questionnaire

**PRE-QUESTIONNAIRE**

Age: ___ → Gender □ M □ F → Occupation: _____________

Are you: □ Left-handed □ Right-handed

How often do you use a computer a day, overall?
□ less than 1 h □ 1-2 hours □ 3-4 hours □ 5-6 hours □ more than 6 h

How familiar are you with text editors?
□ never use them □ not very familiar □ familiar □ expert

Which text editors are you the most familiar with (if it applies)?
# Example Questionnaires

http://oldwww.acm.org/perlman/question.html

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Instrument</th>
<th>Reference</th>
<th>Institution</th>
<th>Example</th>
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<td>QUIS</td>
<td>Questionnaire for User Interface Satisfaction</td>
<td>Chin <em>et al.</em>, 1988</td>
<td>Maryland</td>
<td>27 questions</td>
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<td>PUEU</td>
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<td>Davis, 1989</td>
<td>IBM</td>
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<td>NAU</td>
<td>Nielsen's Attributes of Usability</td>
<td>Nielsen, 1993</td>
<td>Bellcore</td>
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<td>Nielsen's Heuristic Evaluation</td>
<td>Nielsen, 1993</td>
<td>Bellcore</td>
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<td>Lewis, 1995</td>
<td>IBM</td>
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<td>Perlman, 1997</td>
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# A Simple Questionnaire

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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>NA</th>
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<tbody>
<tr>
<td>1. Learnability</td>
<td>bad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>good</td>
</tr>
<tr>
<td>2. Efficiency</td>
<td>bad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>good</td>
</tr>
<tr>
<td>3. Memorability</td>
<td>bad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>good</td>
</tr>
<tr>
<td>4. Errors (Accuracy)</td>
<td>bad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>good</td>
</tr>
<tr>
<td>5. Subjective Satisfaction</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>good</td>
</tr>
<tr>
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<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
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A More Comprehensive One

<table>
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<tr>
<th>PERCEIVED USEFULNESS</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Using the system in my job would enable me to accomplish tasks more quickly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>2. Using the system would improve my job performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>3. Using the system in my job would increase my productivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>4. Using the system would enhance my effectiveness on the job</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>5. Using the system would make it easier to do my job</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>6. I would find the system useful in my job</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERCEIVED EASE OF USE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Learning to operate the system would be easy for me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>8. I would find it easy to get the system to do what I want it to do</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>9. My interaction with the system would be clear and understandable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>10. I would find the system to be flexible to interact with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>11. It would be easy for me to become skillful at using the system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
<tr>
<td>12. I would find the system easy to use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>likely</td>
</tr>
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### Even More Comprehensive

<table>
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<tr>
<th>OVERALL REACTION TO THE SOFTWARE</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
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Next Time

• G2 Presentation