Human-Computer Interaction: Cognitive Walkthrough

Dr Kami Vaniea
Inspection techniques

- Inspection techniques are a class of methodologies where the evaluation is done by one or more experts without involving participants or potential users.

- **Pros:**
  - Cheaper and faster to run than studies on users.
  - Leverage the knowledge of experts.

- **Cons:**
  - Experts are not users and may miss issues a real user would identify.
  - Bias towards more common errors which may be less problematic.
  - Different inspection techniques define “usability” differently.

- **Examples:**
  - GOMES, expert interviews, body storming, heuristic evaluation, cognitive walkthrough, ergonomic analysis.
GOMES

- Inspection methodology where expert breaks down subtasks into physical actions like: “type y key” or “move hand to mouse” or “move eyes to look at box”.

- They then calculate how long the actions would take an average person to accomplish.
## Compare two designs using GOMES

<table>
<thead>
<tr>
<th>Design A: drag the file into the trash can[29]</th>
<th>Design B: use the short cut “control + T”[30]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>method encoding (operator sequence)[31]</strong></td>
<td><strong>method encoding (operator sequence)[32]</strong></td>
</tr>
<tr>
<td>1. initiate the deletion (M)</td>
<td>1. initiate the deletion (M)</td>
</tr>
<tr>
<td>2. find the file icon (M)</td>
<td>2. find the icon for the to-be-deleted file (M)</td>
</tr>
<tr>
<td>3. point to file icon (P)</td>
<td>3. point to file icon (P)</td>
</tr>
<tr>
<td>4. press and hold mouse button (B)</td>
<td>4. press mouse button (B)</td>
</tr>
<tr>
<td>5. drag file icon to trash can icon (P)</td>
<td>5. release mouse button (B)</td>
</tr>
<tr>
<td>6. release mouse button (B)</td>
<td>6. move hand to keyboard (H)</td>
</tr>
<tr>
<td>7. point to original window (P)</td>
<td>7. press control key (K)</td>
</tr>
<tr>
<td><strong>Total time</strong></td>
<td><strong>Total time</strong></td>
</tr>
<tr>
<td>$3P + 2B + 2M = 3 \times 1.1 \text{ sec} + 2 \times 1.1 \text{ sec} + 2 \times 1.35 \text{ sec} = 6.2 \text{ sec}$</td>
<td>$P + 2B + 2H + 2K + 2M = 1.1 \text{ sec} + 2 \times 1.1 \text{ sec} + 2 \times 1.4 \text{ sec} + 2 \times 2 \text{ sec} + 2 \times 1.35 \text{ sec} = 5.2 \text{ sec}$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>operator</th>
<th>time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>total typing test time/total number of non-error keystrokes</td>
</tr>
<tr>
<td></td>
<td>Guidelines:[11][12]</td>
</tr>
<tr>
<td></td>
<td>.08 (135 wpm: best typist)</td>
</tr>
<tr>
<td></td>
<td>.12 (90 wpm: good typist)</td>
</tr>
<tr>
<td></td>
<td>.20 (55 wpm: average skilled typist)</td>
</tr>
<tr>
<td></td>
<td>.28 (40 wpm: average non-secretary typist)</td>
</tr>
<tr>
<td></td>
<td>.50 (typing random letters)</td>
</tr>
<tr>
<td></td>
<td>.75 (typing complex codes)</td>
</tr>
<tr>
<td></td>
<td>1.20 (worst typist and unfamiliar with the keyboard)</td>
</tr>
<tr>
<td>P</td>
<td>1.1[11][12]</td>
</tr>
<tr>
<td>H</td>
<td>0.4[11][12]</td>
</tr>
<tr>
<td>D</td>
<td>$0.9n_D + 1.6</td>
</tr>
<tr>
<td>M</td>
<td>1.35[11][12]</td>
</tr>
<tr>
<td>R</td>
<td>system dependent[11][12]</td>
</tr>
<tr>
<td>B (mouse button press or release)</td>
<td>0.1[13]</td>
</tr>
<tr>
<td>Click a Link/ Button</td>
<td>3.73[14]</td>
</tr>
<tr>
<td>Pull-Down List (No Page Load)</td>
<td>3.04[14]</td>
</tr>
<tr>
<td>Pull-Down List (Page Load)</td>
<td>3.96[14]</td>
</tr>
<tr>
<td>Date-Picker</td>
<td>6.81[14]</td>
</tr>
<tr>
<td>Cut &amp; Paste (Keyboard)</td>
<td>4.51[14]</td>
</tr>
<tr>
<td>Typing Text in a Text Field</td>
<td>2.32[14]</td>
</tr>
<tr>
<td>Scrolling</td>
<td>3.96[14]</td>
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Heuristic Evaluation

- Basic idea: Have an expert evaluate an interface based on a common set of criteria (heuristics).
- Experts have a broad knowledge of human behavior as well as subject specific knowledge, so their opinion is valuable.

**Pros**
- Can be done by even a single person.
- No ethics, recording, or other human-related problems.
- Minimal expense to find a large number of potentially expensive problems.

**Cons**
- Experts are not the same as end users, they will miss some things.
- Heuristics are the most common types of problems, but they do not represent all problems.
Recall and Recognition both supported (good).

Help and documentation present (good) but not co-located (less good).
Cognitive Walkthrough

- A method that evaluates whether the order of cues and prompts in a system supports the way people process tasks and anticipate the “next steps” of a system.

When to use it:
- Initial evaluation of a system
- Low budget
- Walk-up-and-use systems or first-use situations
- Have access to HCI experts

When to not use it:
- Formal evaluation of your own system with you as an evaluator.
- Systems a user will use frequently.
Cognitive Walkthrough Process

- Briefing session to tell experts what to do.
- Evaluation period of 1-2 hours where:
  - Each expert works separately.
  - Take one pass to get a feel for the product.
  - Take a second pass to focus on specific features.
- Debrief session in which experts work together to prioritize problems.
  - Use most important problems to design a study to test if the identified problems are ones that hinder end users.
  - Write a report for the client explaining the problems found and the relative importance of each problem.
Number of evaluators & problems

Figure 15.1 Curve showing the proportion of usability problems in an interface found by heuristic evaluation using various numbers of evaluators. The curve represents the average of six case studies of heuristic evaluation.

Each evaluator:

Materials needed

- Persona
- Task persona is trying to accomplish
- List of “correct” steps
- Way to record answers to the 4 questions
- Way to record issues found
- Optionally: List of the heuristics

Process

- For each “correct” step:
  - Answer the four questions
  - Record any identified problems (poor aspects)
  - Record any notable good things (good aspects)
- After completing all steps, review the aspects recorded by other evaluators.
- Discuss most serious issues.
The four questions

1. Will users want to produce whatever effect the action has?
2. Will users see the control (button, menu, label, etc.) for the action?
3. Once users find the control, will they recognize that it will produce the effect they want?
4. After the action is taken, will users understand the feedback they get, so they can confidently continue on to the next action?
Task: Open the Tasks lecture slides in DrawboardPDF.
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Francis MSc student studying AI who worked in industry previously. More familiar with American English than British English. Uses a Windows laptop and an Android smartphone.
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Usability Aspect Report (UAR)
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- Similar to a bug report, but for usability issues.
- Can be about good or bad interface aspects.
- Should link to a heuristic.
### HE-01

**Problem/Good Aspect:** Problem

**Name:** “Tabs” term is confusing

**Evidence**

**Heuristic:** Consistency and standards

**Interface aspect:** Interface uses the term “tabs” to refer to documents that are open concurrently.

**Explanation:** When trying to open a new document for the first time the user must select “Tabs” and then a + sign under a list of tabs. But the user is most likely trying to open a “document” or a “pdf” and may not associate these concepts with a “tab” since tabs are more often used for websites while “document” is more often used for PDF readers. The UI for Drawboard also does not have a tab UI element.

**Severity or Benefit Rating:** Low

**Justification:** There are few other options, most tech literate users would figure it out.

**Frequency:** Medium

**Impact:** Low

**Persistence:** High (happens every time)

**How I weight the factors:** The issue will impact new and infrequent users more than those that use it often and become familiar with the language used. The term “tab” is also likely familiar to this persona and not very dissimilar to “document”.

**Possible solution and/or tradeoff:** Change terminology to “document”, “file” or similar word.

**Relationships:** None
Visibility of system status
Visibility of system status

Me adding a Q&A session to my Google calendar.

Saving.

Then adding a reminder.
Is the reminder saved?
Visibility of system status

I click the back button without clicking “save” and get a warning.
**Name:** Saved status not visible for calendar changes

**Evidence**

**Heuristic:** Visibility of status  
**Interface aspect:** No visual indication of the saved state of the document.

**Explanation:** When a calendar event element is changed it is not clear if it is automatically saved or not. As a result a user may try and leave the page when it is not saved.

**Severity or Benefit**

**Rating:** Low  
**Justification:** A warning box pops up preventing accidental loss of data.  
**Frequency:** Medium  
**Impact:** Low  
**Persistence:** High (happens every time)  
**How I weight the factors:** The error is very recoverable and the warning is clear, so this may be an issue but it is a low importance one.

**Possible solution and/or tradeoff:** Automatic saving is possible, but that may lead to other issues

**Relationships:** None
Task: Delete a node from a mindmap
1. Will users want to produce whatever effect the action has?

2. Will users see the control (button, menu, label, etc.) for the action?

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4. After the action is taken, will users understand the feedback they get, so they can confidently continue on to the next action?
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# Cognitive Walkthrough outcome

<table>
<thead>
<tr>
<th>Q1: produce effect</th>
<th>Q2: see control</th>
<th>Q3: recognize effect</th>
<th>Q4: understand feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Push and hold</strong></td>
<td>No. User wants to delete, not select. There are + symbols elsewhere to add a node, user may attempt to find a - symbol to directly delete rather than trying to select the node.</td>
<td>No. The control is invisible so there is no way to see it. User may also try tapping rather than a long hold, which will also prevent them from seeing it.</td>
<td>Yes.</td>
</tr>
<tr>
<td><strong>Drag circle</strong></td>
<td>Yes.</td>
<td>Yes.</td>
<td>No. The black hole in the corner is not obviously a way to delete nodes. Users may see it, but they are likely to not recognize it as a way to delete.</td>
</tr>
<tr>
<td><strong>Tap “delete” button</strong></td>
<td>Yes.</td>
<td>Yes.</td>
<td>Yes.</td>
</tr>
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