"Beyond Perceivability": Critical Requirements for Universal Design of Information

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The Cognitive Walkthrough (CW) Method
- A usability inspection method
  - Aimed at evaluating the ease of learning user interfaces
- Analysts are asked to answer questions as to whether the user will successfully perform the required action
  - Yes/No answers and their reasons
- In the current 3rd version (CW3)
  - The number of questions was reduced to 4 (Wharton et al., 1994)

Four Questions in CW3
- (Q1) Will the user be trying to achieve the right effect?
- (Q2) Will the use know that the correct action is available?
- (Q3) Will the user know that the correct action will achieve the desired effect?
- (Q4) If the correct action is taken, will the user see that things are going OK?
The Modified CW (MCW) Method

- Approaches
  - Clarify the intent of CW questions using HCI model
  - Determine CW questions of optimal grain levels based on HCI model

- Extended HCI model
  - The Seven Stages of Action model (Norman, 1986) was extended
  - Distinguish between specifying “object” and “action”
  - “perceiving” and “understanding”

New Set of Questions in MCW

- (MQ1) Will the user intend to achieve the right effect?
- (MQ2) Will the user notice that the correct object is available?
- (MQ3) Will the user know what the correct object refers to?
- (MQ4) Will the user notice that the correct action is available?
- (MQ5) Will the user know that the correct action should be applied to the correct object?
- (MQ6) Will the user be able to apply the correct action to the correct object without fail or difficulty?
- (MQ7) When the correct action is taken, will the user notice the physical change in the system state?
- (MQ8) Will the user know what exactly has happened to the system state?
- (MQ9) Will the user know the current system state is nearer to the completion of the task?

Extended HCI Model

- Distinguish between specifying object and action
- Distinguish between perceiving and understanding

Comparative Evaluation: Objective

- Compare the third version (CW3) and the modified version (MCW)
  - In terms of effectiveness and efficiency in identifying Web design problems

- Effectiveness
  - Measured by the proportions of problems identified by the participants

- Efficiency
  - Indexed by the time spent by the participants for answering the CW questions
Method

- 48 undergraduates without prior experience of using the CW methods
  - Randomly divided into two groups of 24 participants each
  - One group for CW3, and the other for MCW
- Participants in each group were asked to inspect possible problems in two fictitious Web sites
  - Online shopping site and university web site
  - The order of inspecting these two Web sites was counterbalanced across participants within each group

Results: Effectiveness

- Proportions of correct data was analyzed by a two-way ANOVA
  - 2 (CW3 vs. MCW) x 2 (types of Web sites)
- The main effect of the methods was significant ($F(1,46)=10.39$, $p<.005$)
- MCW had a higher mean (.58) than CW3 (.42)

Results: Efficiency

- Task completion time was analyzed by the same two-way ANOVA
- When all the 9 questions were included for the MCW, the MCW [2140 sec.] took significantly longer than the CW3 [1709 sec.] ($F(1,46)=7.77$, $p<.01$)
- MQ4 & MQ5 were about well-learned actions (e.g., mouse click)
- When MQ4 & MQ5 were excluded from the MCW, there was no significance difference between MCW [1748 sec.] and CW3 [1709 sec.] ($F<1$)

Conclusions

- The MCW was more effective than the CW3 in identifying possible Web design problems
- The MCW was comparable with the CW3 in the task completion time, when the trouble-free questions (i.e., MQ4, MQ5) were removed from the MCW
  - “Trouble-freeness” depends on the intended user group
- The finer-grained questions in the MCW allow effective and flexible evaluation of accessibility and usability
  - Design problems are more easily revealed by the explicit distinctions of identifying correct objects/actions and of perceiving/understanding
  - The question set may be customized by removing non-informative questions that will never be answered "No" with respect to the intended user group