Memory Load: A Factor That Links the Usability of Individual Interaction Components Together

Abstract
An underlying assumption of component-based software engineering for interactive systems is that the overall usability of a new assembled system mainly depends on the usability of its individual components. This paper challenges this assumption by providing empirical evidence from a laboratory experiment. Here, users were asked to solve equations with two calculators, one with a large display and one with a small display. The results show a significant change in the way users solve equations when using calculators with large versus small displays. Therefore, when constructing a new system out of ready-made components, developers should still evaluate the new system as a whole since usable components tested in isolation might still have a negative effect on the way users interact with other components.

Research Question
Can memory load cause components to affect each other’s usability negatively? This would make an overall usability prediction of a system based on the usability of the individual components less valid.

Experimental Setup

Calculators
- Two interaction components: Editor and Processor.
- Two versions of the Editor: Large display and Small display.

Tasks
- Calculate the cost of several building projects based on a textual description.
- Two types of equations: easy (no brackets needed), and difficult (nesting depth of 2 brackets).

Results

Experimental Hypothesis
Mental effort creates a link between the Editor version and the interaction strategy with the Processor.

Design & Participants
- 2x within-subject design: editor (small or large), equation difficulty (difficult, or easy).
- 24 students of Technische Universiteit Eindhoven.

Implications
- Mediating components can cause a bottleneck in the interaction with higher-level components.
- Although components can be designed and tested in isolation, a final overall usability tests remains necessary.