SOS

A Simple Operating System for modeling HCI with ACT-R

Robert L. West, Department of Psychology, Carleton University, Canada

Bruno Emond, Institute for Information Technology, National Research Council, Canada.
Rapid Prototyping

- Commonly used by commercial software companies for evaluating interface designs
- Ideally, used early in the design process
- Testing is usually done on 5 to 7 subjects
- Rapid, iterative testing of different designs
- Testing done on low fidelity mock ups with limited functionality
Problems

• Testing 5 to 7 users is not enough
  – Individual differences
  – Permutations
• Hard to find motivated subjects
• Problems with reusing subjects
• No theory development
• No way to check the validity of the results

• Solution
  – Augment the process by testing simulated users created with ACT-R
Advantages

• Virtually unlimited n
• Fully motivated subjects
• Subjects unaffected by mockup quality
• Provides a basis for developing theory and validity testing
• Can test longer term learning
• Can model experts, novices, etc.
• Can test permutations

• Disadvantages
  – Hard to evaluate visual/attentional characteristics, e.g., how intuitive is an icon, will something be noticed??

• Solution
  – use real subjects to do this
Interface prototyping

• Characteristics of rapid prototype testing
  – Task is usually not time pressured
  – Errors are not catastrophic, easy to correct
  – Visual elements are usually static, fairly obvious, and often familiar
  – Only limited functionality has been specified
  – Prototyping and testing is time pressured

• 2 related issues
  – How can the system be made as easy to use as possible
  – What is the minimum needed to allow ACT-R to be effective for rapid prototyping
SOS

• Stands for Simple Operating System
• SOS breaks all interfaces down into containers and objects.
  – Containers contain objects and other containers and can be opened or closed
  – Objects provide information (e.g., labels, text) and can trigger actions (e.g., a button can trigger the opening of a container)
• No visual display - just text report
• We argue that most Windows based software programs can be mocked up using this simple approach
Enter file name

save  cancel
Problem space

• More generally, SOS is a type of problem space representation
• The current node is represented by the contents of the available containers
• Operators are represented by the objects that trigger actions (i.e., change the available containers)
• Objects are simply triggered, but they’re treated differently by the simulated user based on the way they’re labeled
Finding and activating objects

• Objects and containers have locations
• The location is needed to trigger it
• The simulated user can search:
  – A specific location
  – Within specific containers
  – Across the whole screen
• If the object is found a chunk with it’s location is placed in the visual buffer
• If it is not found a failure chunk is placed in the visual buffer
• Average times are used for finding and activating
Easy to use

- (sos::define-object-type button-holder (sos::container))
- (sos::define-object-type button (sos::object) type)

- (sos::add-sos

- (menu-bar
  - isa-sos button-holder
  - location loc1
  - available t
  - is-part-of program-window
  - has-parts
    - (file-menu-open))

- (file-menu-open
  - isa-sos button
  - type file-menu-open
  - location loc6
  - available t
  - is-part-of file-menu-bar
  - ;; is-part-of icon-menu-bar ;;; not in the expected place
  - actions ((sos::open-container file-menu)))
SOS relationship to GOMS

• Engineering/modeling approach applied to learning a new interface

• Idea that using average times will provide a reasonably accurate model of average behavior (i.e., identify major problems, identify most problems)

• Focus on top down, knowledge driven behavior (i.e., as opposed to situated action, affordances, etc.)
Simulated user relationship to GOMS

- Usability testing conceived of in GOMS terms
  - Instructions = unit tasks
  - Unit tasks completed by applying methods
  - Methods made up of operators (looking and activating)

- Attempts to build a GOMS model of the task in declarative memory by adapting and adjusting default methods

- Strategy and error correction based on production system - i.e., an expert system for exploring
Extending SOS

• Vision
  – Bottom up attention
  – Object salience
  – Hands
  – Object based attention index
  – Agents
Conclusions so far

- Exploring novel interfaces is a very interesting and challenging domain
- Ultimate goal – to model the process from exploring to expert user
- Building a working model tells you a lot about an interface design
- SOS is also useful in other domains - objects and containers are not limited to interfaces
- Large software companies should invest large amounts of money into ACT-R modeling