SOS

A Simple Operating System for modeling HCI with ACT-R

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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

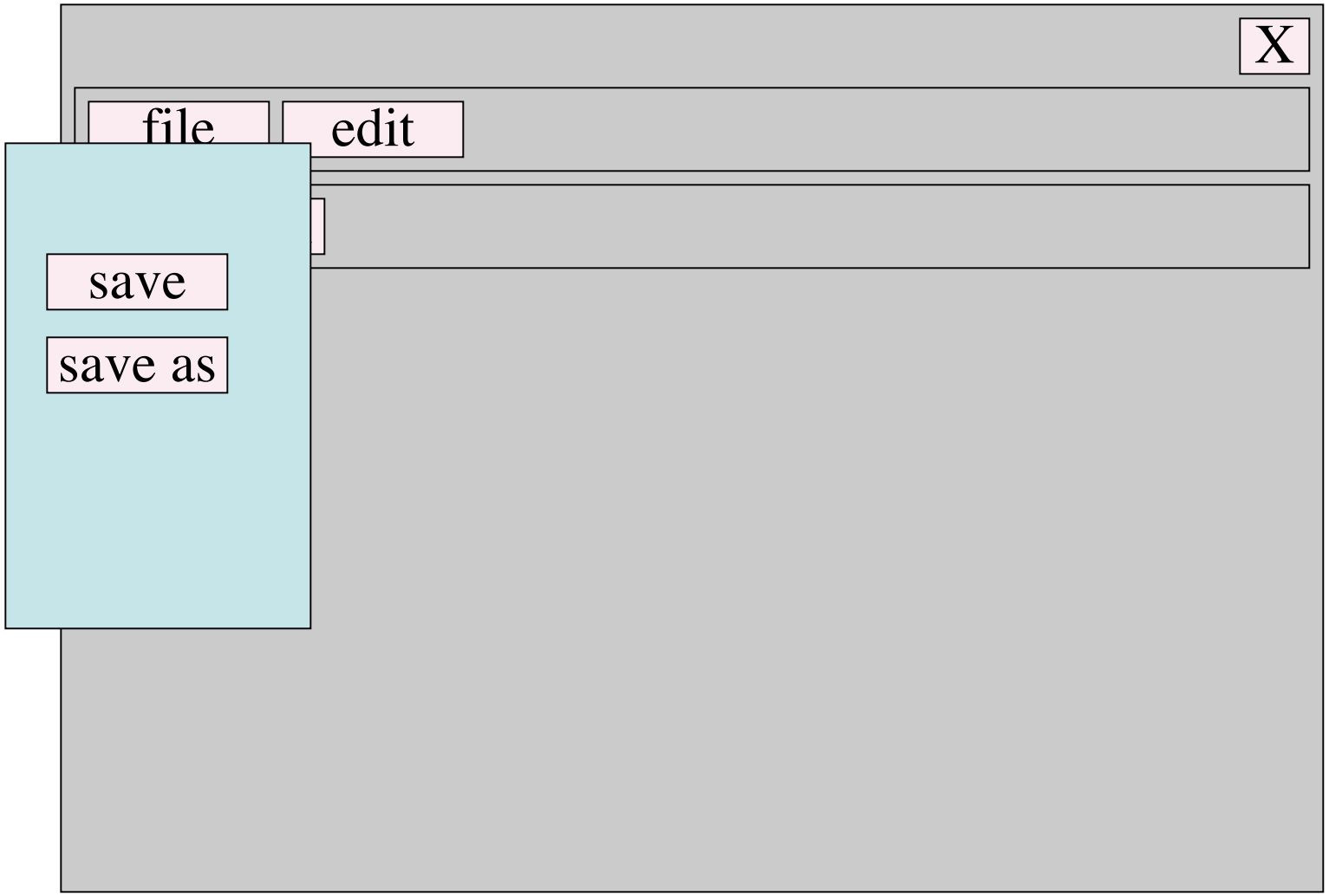
Interface prototyping

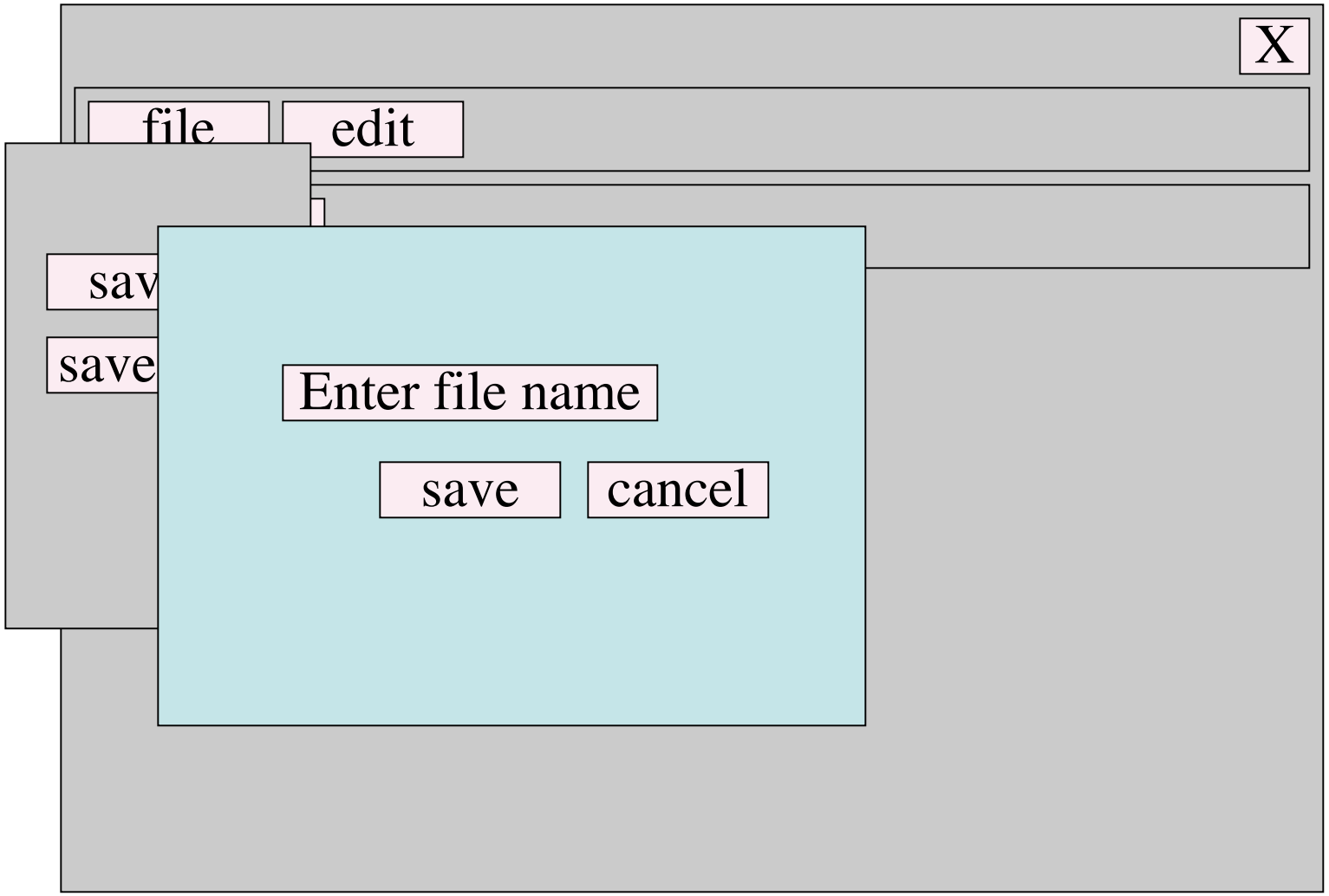
- Characteristics of rapid prototype testing
  - Task is usually not time pressured
  - Errors are not catastrophic, easy to correct
  - Visual elements are usually static, fairly obvious, and often familiar
  - Only limited functionality has been specified
  - Prototyping and testing is time pressured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


X
file
edit
save-icon


X
file
edit
save
save as


X
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save
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