Exploring the usability of adaptive menus with a simple object system

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Overview

• The ACT-R simulation tool space.

• Simple Object System - ACT-R/SOS.

• An example: Modelling user interactions with adaptive menus.
The ACT-R simulation tool space

• Interaction with external applications or environment
  – ACT-R/IF, sim-eye, sim-hand, SegMan, VisMap, ACT-R robots, and Intelligent Human Computer Interfaces

• High fidelity simulated task environments
  – ACT-R/PM

• Low fidelity simulated task environments
  – ACT-R/SOS

Simple Object System - ACT-R/SOS

• What is it?
  – Tool to build low fidelity simulated environments to run against ACT-R cognitive models.
  – Assumes a perceptual index mechanism.
  – Definition of object classes and declarative chunks
    (define-sos-object-class class2
     :inherit-from (class1)
     :chunk-slots (c1 c2 c3)
     :application-slots (a1 a2))
Simple Object System - ACT-R/SOS

• What is it?
  – Buffer based
    (defparameter *perception* nil)
    (define-perception-function find-object
      :selection-function
        #'(lambda (finst-ob found-obs)
          (if finst-ob finst-ob
            (nth (random (length found-obs)) found-obs)))
      :cost-function
        #'(lambda (finst-ob found-obs)
          (if finst-ob 0.05 (* 0.05 (length found-obs)))))
    (define-buffer perception *perception*
      :plus-rhs find-object)

• Why bother?
  – Cognitive modelling and simulation development through successive refinements.
  – Minimize development time.
  – Make mechanisms of perception and motor action as explicit as possible in the model.
  – Learning ACT-R.
  – Link to ACT-R/PM as a device plugin.
    (yet-another-task23
      isa to-do-list-item
      list to-do-list45
      description sos-as-an-ACT_R/PM-device-plugin)
Simple Object System - ACT-R/SOS

• Who would be interested anyway?
  – People who want to learn ACT-R.
  – People who want to generate some hypothesis based on simulation results.
  – People who want to explore buffer computational properties.
  – People who want to use simulated users for usability testing.
  – People on the rush, they just want to get going.

An example: Simulation of adaptive menus

• Motivation for the simulation
  – Are adaptive user interfaces usable?
  – Adaptive menus must be better.

• Adaptive menu options
  – Random: it says it all, never the same
  – Fixed: it says it all, always the same
  – Stacked: last chosen goes on top, pushing down the rest
  – Frequency: Sorted based on frequency access
  – Activation: Sorted based on activation (frequency and time)
Distribution of menu items

• A simulated subject sees 10 successive sets of 30 targets in the four adaptive menu conditions.
  – Random targets 1-30: ("t08" "t08" "t08" "t08" "t11" "t11" "t02" "t02" "t05")
  – Early targets 1-15: ("t07" "t07" "t07" "t07" "t10" "t10" "t10" "t01" "t01" "t04")
  – Late targets 16-30: ("t09" "t09" "t09" "t09" "t12" "t12" "t12" "t03" "t03" "t06")

• The model is reset for each menu condition.

• Parameters
  – Subsymbolic Computations, Randomness,
    Base level learning 0.5

• Productions.
  – get-new-target, retrieve-target-position (with success or failure), scan-
    menu-for-target (upward or downward), test-target-success, add-
    target-to-menu.

Simulation results

![Graph showing average number of scans to find a target over learning cycles]
Current research

• Usability testing with simulated users.
  – Robert West and COGNOS.
• Modelling media player usage while viewing video content related to self-performance of ensemble music playing.
  – MusicGrid: NAC, CRC, School boards, NRC Canada.
• Modelling quality of experience judgments and person-person interaction.
  – Advanced collaborative environments: NRC, CRC, NewMic.

Thank you :)”

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