
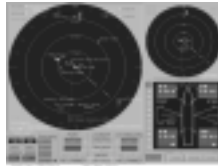


Soar/ Tcl-PM: Including a Widely Applicable Eye & Hand in Soar

Peter Lonsdale
Psych/CS U.of Nottingham
Frank E. Ritter
IST/ Psych/CS Penn State
ritter@istpsu.edu


cognitive
model

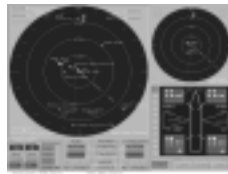


Interaction next Frontier for

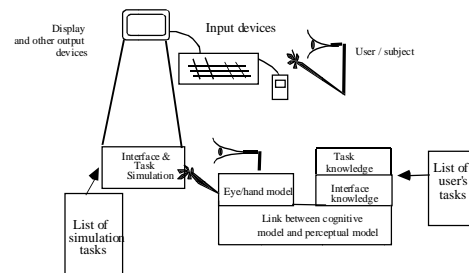
- n Developing better Ψ models
- n Applications
 - Substitute for users in studies, games, simulations
 - Help the user
 - Evaluation of interfaces e.g. predict menu use

The Importance of Interaction

- n Task was just arithmetic
- n Task now seen as
 - Arithmetic +
 - Scanning +
 - Manipulation



Components of Interactive Models



Summary of Interaction Needs

- n Interfaces or a tool to create interfaces
- n A way for the cognitive model to interact with the simulation (i.e., a model eye & model hand)
- n A linkage between the cognitive model & the task simulation

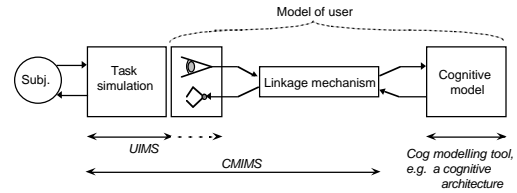
Ways to Tie Models to Interfaces

- n Function calls (ModSAF)
- n Simulated interfaces (EPIC)
- n Embed into specific interfaces (Midas, Apex)
- n Camera and robot or pixel (St. Amant at NCSU)
- £ Embed into an interface tool

User Interface Management Systems (UIMSSs)

- n Systems designed to support interface creation (UIDE)
- n Help managing the interaction communication between the user interface & the application
 - a run-time mechanism controls what happens when keys are pressed, mouse buttons are clicked

Cognitive Model Interface Management System (CMIMS)



Functional Model of Fovea

- n Visual Capabilities/Regularities
 - Fovea (2°), parafovea (5°), periphery (rest)
 - Dynamic eye movements & timing
 - Tracking of moving objects
 - Information lost across saccades
 - Object complexity -> Fixation length
 - Perception based on interface & visible to the modeller (¬Epic)
 - For all interfaces in UIMS (¬ACT-R/PM)

Functional Model of Hand

- n Motor Capabilities /Regularities
 - Mouse button event actions: press and hold; release; click; double-click
 - Mouse on screen
 - Max mouse movement speed (eg 30 cm/s)
 - Sequential movements
 - Typing speed as a parameter
 - a few more details

Sim-eye & Sim-hand Commands

- | | |
|---------------------------|-----------------------------|
| n moveI <dx> <dy> | n look |
| n type <character> | n press mouse |
| n start m-move <dx> <dy> | n release mouse |
| n update m-move <dx> <dy> | n click m-button |
| n hand to keyboard | n double click m-button |
| | n hand to mouse |

Models that Interact

n Simple ATC-like task

Bass, Baxter & Ritter, 1995



n Tower of Nottingham

Jones, Ritter & Wood, 2000



n Test EW task



Soar, Learning in Action

Count problem space

New rule:
If op is add 1+2
then result = 3

IST PENN STATE

Soar/ Tcl-PM

(original version by Harris*)

IST PENN STATE

Simple model to use Soar/ Tcl-PM

- n Search for button
 - Include memory (or not) of found objects
- n Press button
 - Move
 - Click
- n Get next digit

IST PENN STATE

Default Scanning Behaviour

IST PENN STATE

Testing this Model

- n KLM model
 - 23.1 seconds
- n NGOMSL model for 11 digits
 - 28.6 seconds
- n Informal data
 - About 11 seconds

IST PENN STATE

Time to Dial

Time to complete dialling (s)

Eye Size	Memory on	Memory off
20 x 20	15.4	30.2
50 x 50	15.4	31.5
100 x 100	16.2	32.3
150 x 150	16.2	22.3
200 x 200	16.2	24.3

- Big helps not memory
- Big hurts er, shoot

IST PENN STATE

General Lessons — Implementations

- n Multiple languages and architectures
- n Best where model and simulation are in same language
- n Control panel & inspectability are important (usability)

General Lessons — Visual Attention

- n Interaction is an intricate dance, not capturable by a single rule or function call
- n Motor & Perceptual activity is a task not an action
- n Need visual knowledge now

General Lessons — Problem Solving

- n Some variance in behaviour is based on 1st block seen, menu layout, & nearest plane
- n Situates models
 - Dare we say, grounds the models?
- n More accurate and/because does task

Future Plans for Interaction Model

- n 50 telephone interfaces in Tcl/Tk
- n Move towards ACT-R/PM & EPIC
- n Additions to the interaction model
 - Difficult to perceive emergent features in the interface
 - Needs more actions in parallel
 - Needs to be sharable

Further Information

- n Lonsdale, P. R., & Ritter, F. E. (2000). Soar/Tcl-PM: Extending the Soar architecture to include a widely applicable virtual eye and hand. In N. Taatgen & J. Aasman (Eds.), *Proceedings of the 3rd International Conference on Cognitive Modelling*. 202-209. Veenendaal (NL): Universal Press.
- n Ritter, F. E., Baxter, G. D., Jones, G., & Young, R. M. (in press). Supporting cognitive models as users. *ACM Transactions on Computer-Human Interaction*