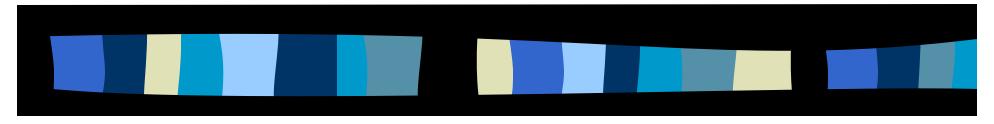
Using a simulated user to explore human-robot interfaces



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Simulated user to test interfaces

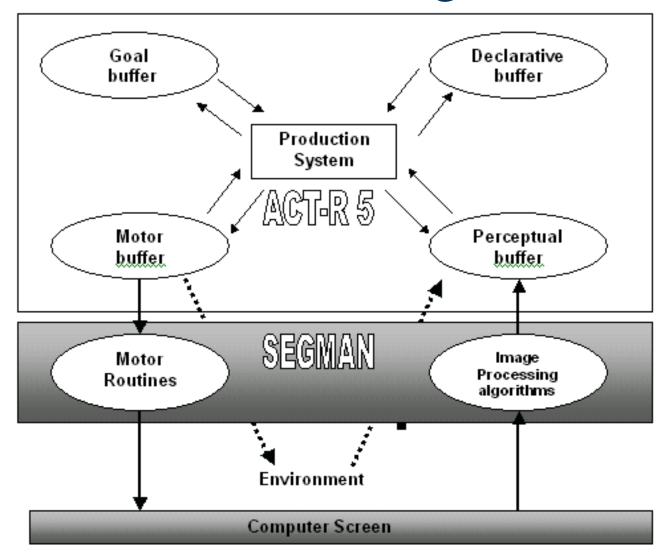
- Interact indirectly with interface
 - Abstract copy (GLEAN, EPIC)
 - Special UIMS (ACT-R/PM, APEX)
- Results in part determined by accuracy of simulation of interface



Direct access to interface

- Cognitive model ACT-R 5
- Eyes & hands SEGMAN
- Allows direct interaction between cognitive model and interface

Act-r 5 and Segman

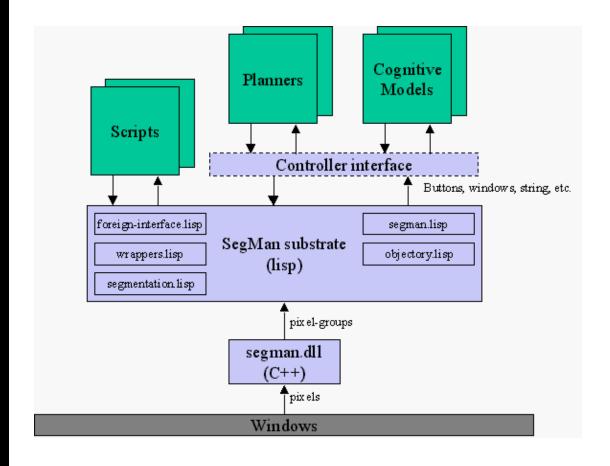




Segman v3.1

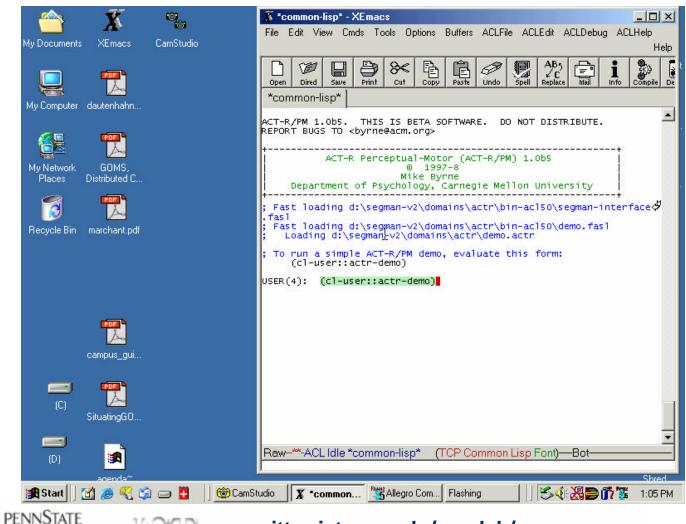
- Sensor module & Effector module
 - takes pixel-level input
 - runs data through processing algorithms
 - builds a structured representation
 - generates mouse and keyboard gestures

Segman v3.1 Diagram





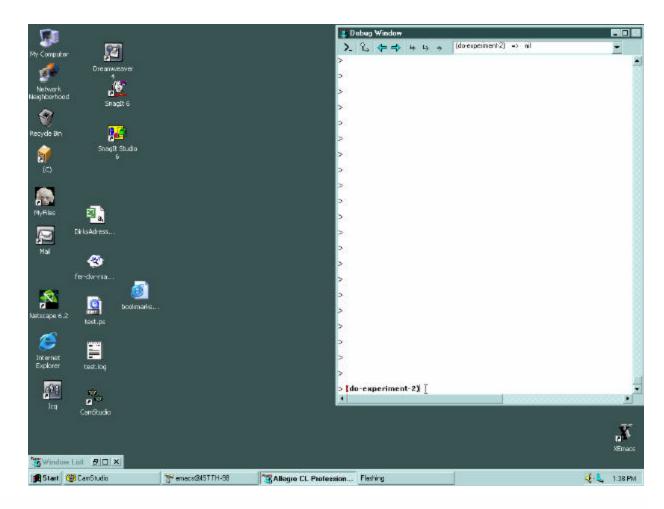
ACT-R 5 and Segman demo 1







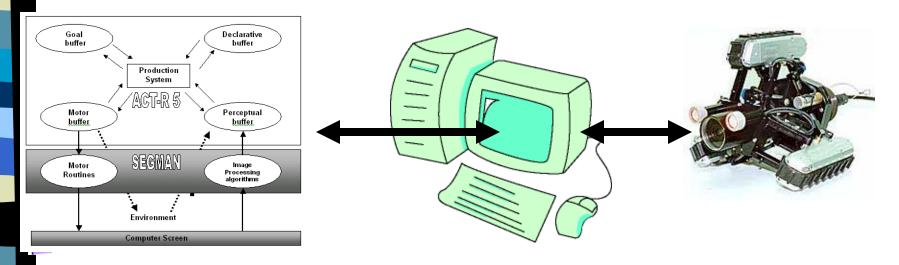
ACT-R 5 and Segman demo 2







Introducing a simulated user



Quantative tool to guide the design process of humanrobot interfaces



Urban Search and Rescue - 1



Teleoperated robots

Mixed-initiative HRI

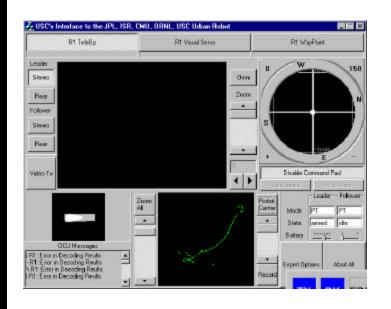








Urban Search and Rescue - 2

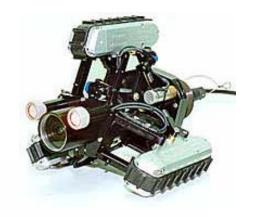












3D Driving Game





- Direct interface
 - "Inside-out" driving
- Driving behavior
 - Real-time
 - Interactive environment
- Extensible code
 - Environment
 - Interface
- Works with unmodified 3D Driving

www.theebest.com/games/3ddriver/3ddriver.shtml



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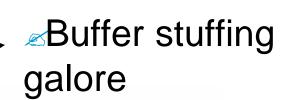
Segman and ACT-R 5 integration

✓ Segman

- position-in-lane information
- left lane + right edgeof the road
- midpoint at 5.5
 degrees below the horizon



- Takes Midpoint
- Steers right or left
- Brakes, accelerates





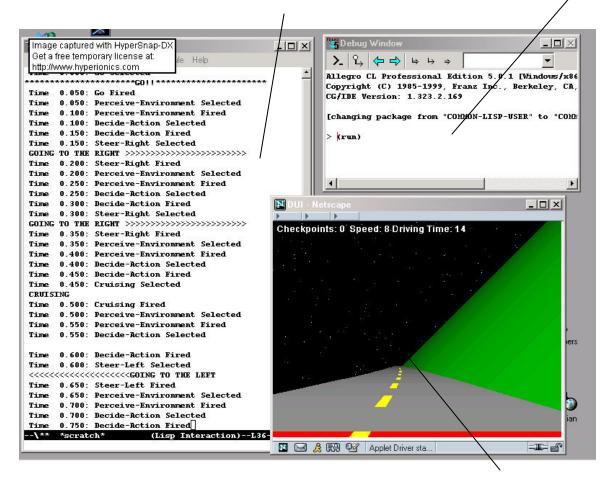


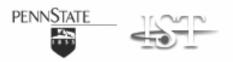
ritter.ist.psu.edu/acs-lab/

Screenshot of desktop

Allegro Debug





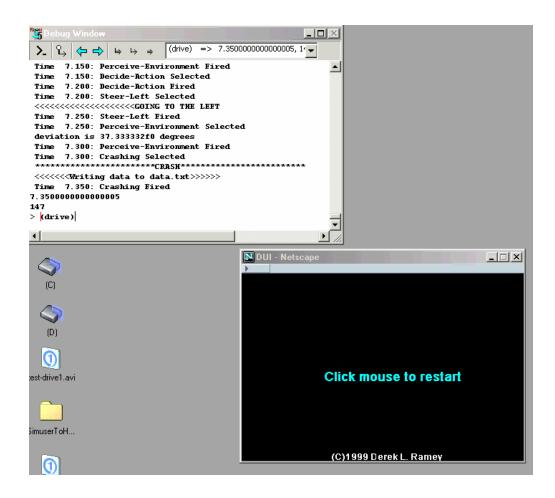


DUMAS

- Driver User Model in Act-r&Segman
- About 30 production rules
- Restricted model of driving behavior
 - Does not use PM fully
 - Does not learn yet
 -



DUMAS demo







Two demonstrations

- Speed and multi-tasking
- Speed
 - Three sets of 10 runs
 - High, medium and slow speed
- Multi-tasking
 - Standard condition = Slow speed
 - Worried condition



Speed Demonstration

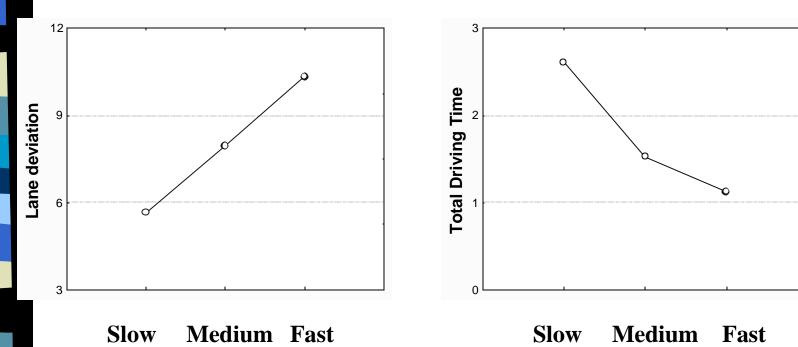


Figure 4. Speed Demonstration: Lane deviation (in degrees) and total driving time (in minutes) of DUMAS in function of speed. Slow corresponds to a driving speed within the range of 15-20, medium 20-25, and fast 30-35 as measured on the spedometer in the simulation.



Multi-tasking

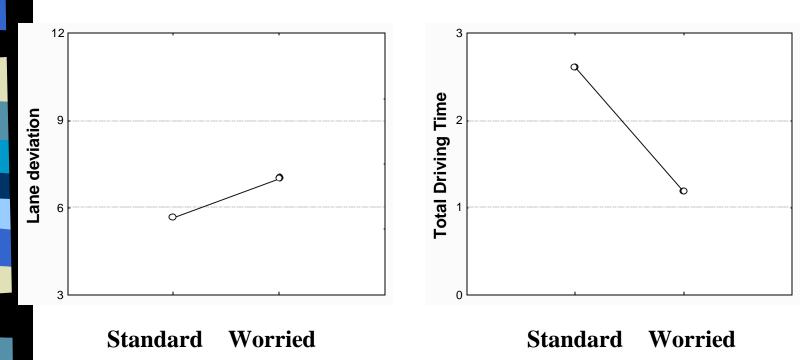


Figure 5: Lane deviation (in degrees) and total driving time (in minutes) of DUMAS in the Standard and Worried condition.



Conclusions

- Quantative tool for HRI
- USR tasks are difficult because
 - Multi-tasking, interference
 - Hard vision problems
 - Noisy, ambiguous, poor quality display
- Surprising parallels
 - Course corrections



Future

- Extend DUMAS
 - To include more PM theory
 - To include more HRI subtasks
 - Multi-tasking (multiple robots)
- Apply to actual HRI's
- Develop theory of HRI development



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Thank you

More on this can be found at ritter.ist.psu.edu/acs-lab/

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