Tri-service Cognitive Modeling Challenge Project meeting, Keynote presentation, 5dec2011

Diversions and Resources

Frank E. Ritter, College of IST, Penn State

Acknowledgments

ONR (N00014-11-1-0275; N091-086/P10008; N00014-10-1-0401; #W911QY-07-01-0004; N00014-03-1-0248) DTRA(HDTRA1-09-1-0054); UK MoD (RT/COM/3/006); Darpa (N66001-1047-411F); DMSO.

Jokes

- ☺ How many (Soarer, connectionists, cognitive modellers) does it take to change a light bulb?
- ☺ What do you get when you cross a mountain climber and a cognitive modeller?
- ☺ Massively parallel connectionist networsk conference...
- ☺ I don't believe that Baysian statistics are useful to represent human cognition, but, I'm willing to reconsider my position if you have any good evidence.

📖 are at http://acs.ist.psu.edu/papers

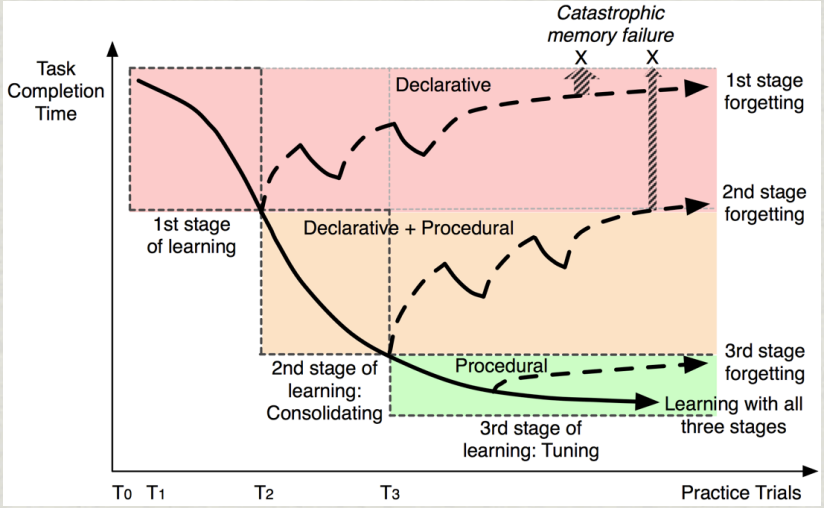
Learning-Users

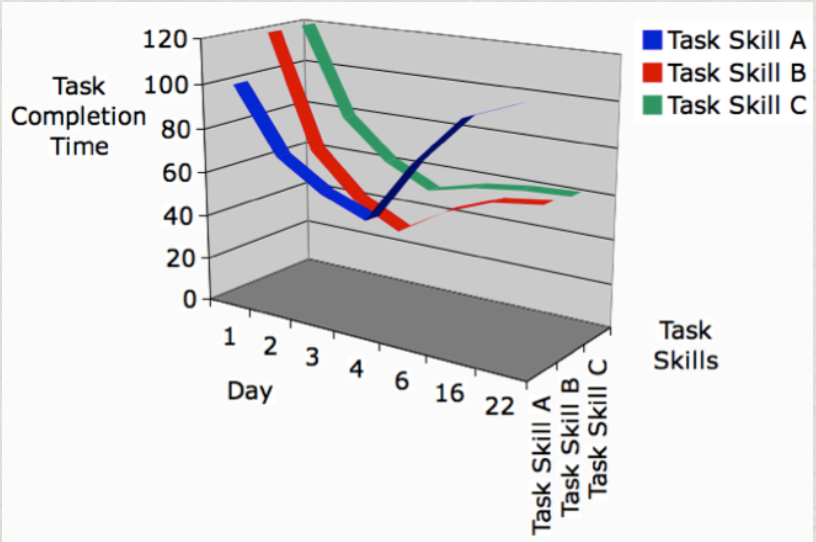
- One of the strengths/ weaknesses is the members of the community
- New users

Learning: & Forgetting

- Kim, J. W., Ritter, F. E., & Koubek, R. J. (in press). An integrated theory for improved skill acquisition and retention in the three stages of learning. *Theoretical Issues in Ergonomics Science.*

three stages of forgetting v2.graffle

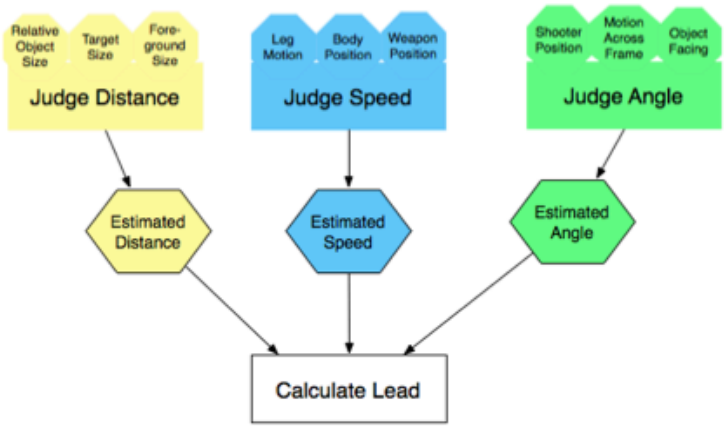




Learning & Forgetting-Tutoring

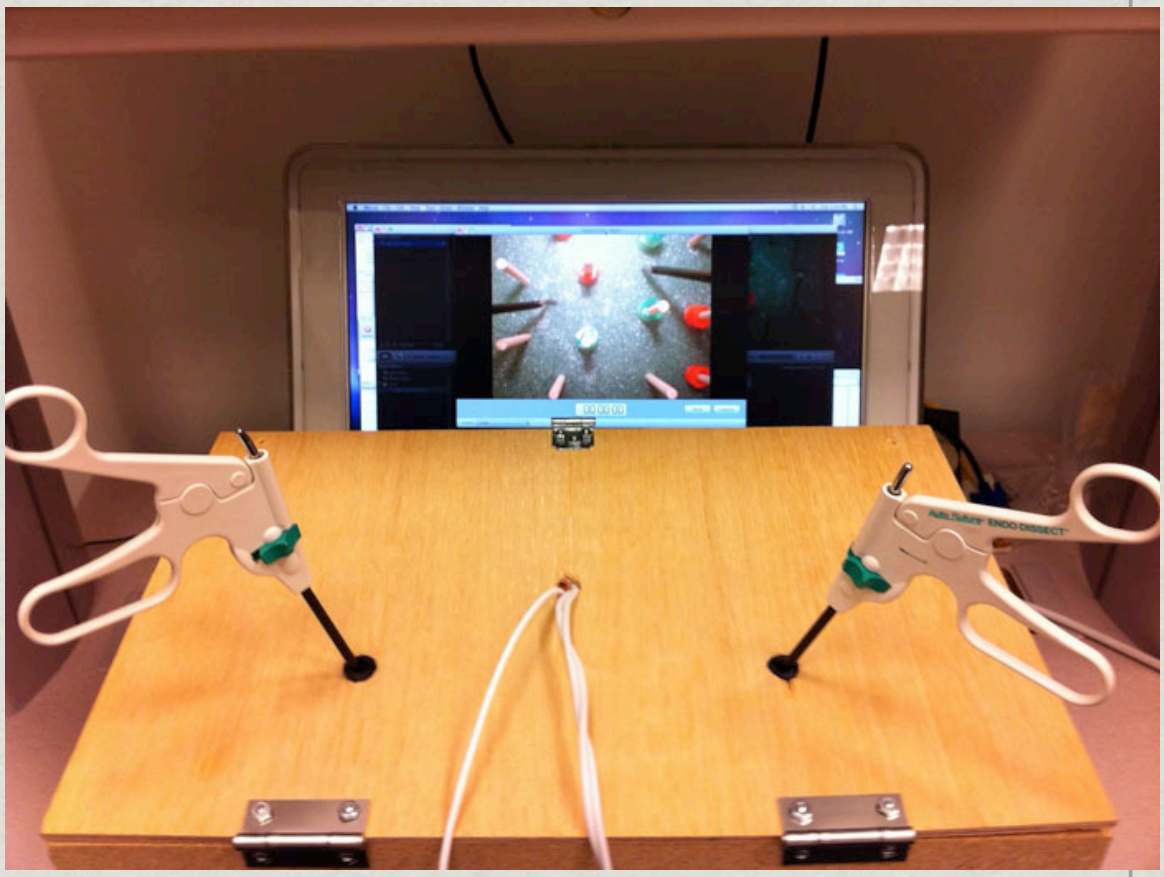
- Testing within the context of a Moving Target Tutor created with MCWL
- Moving towards a PSCM model in tutor as tutored knowledge, expert model, and student model framework

Figure 1. Practicing subskills in the MTT.



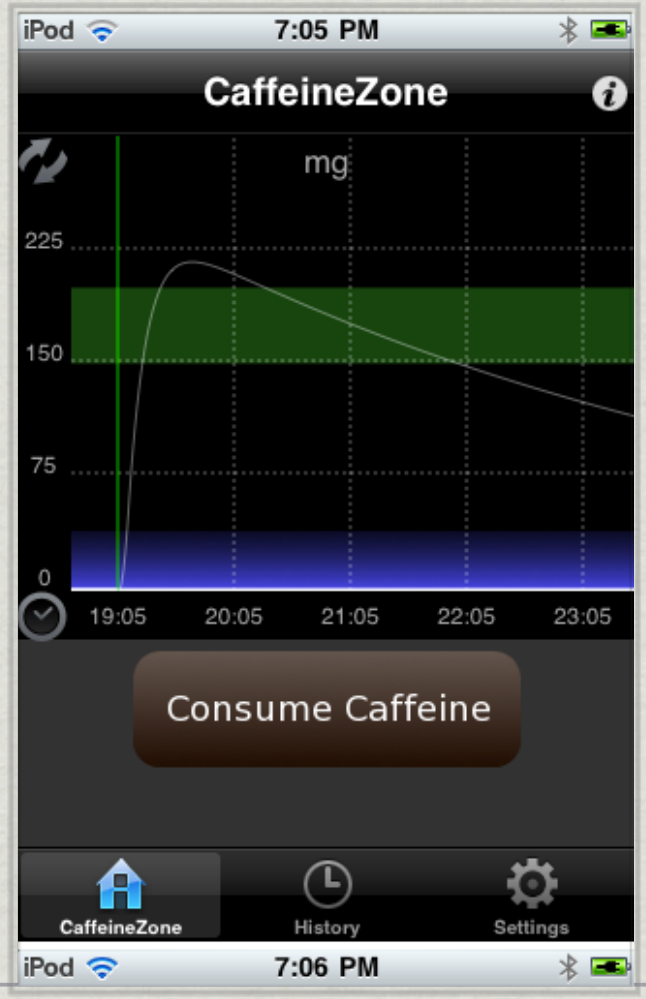
Learning
& Forgetting-Testing

- Testing within the context of MIS with Joe Sanford and Dr. Joseph Siu (Nebraska)



Moderators CaffeineZone.net

- Provides tool to describe and use caffeine
- Available on the iTunes store, free version and soon a paid, ad-free version
- Intended to be free to the military
- Done with ONR, then Applied Cognitive Systems LLC and Dr. Martin Yeh (CSE, PSU



Moderators:
Social impacts on cognition

- Start to represent the effects of social aspects on cognition and behavior
- How can you break the will of an agent with no will?

$$p_a = \frac{1}{1 + \left(\frac{1}{t_d} * e^{\frac{1*\left((d_{friend}* \sqrt{g_{size}}) + \frac{d_{leader}}{1+k} \right)}{g_{size}* d_{observer}*(c+k)}} \right)}$$

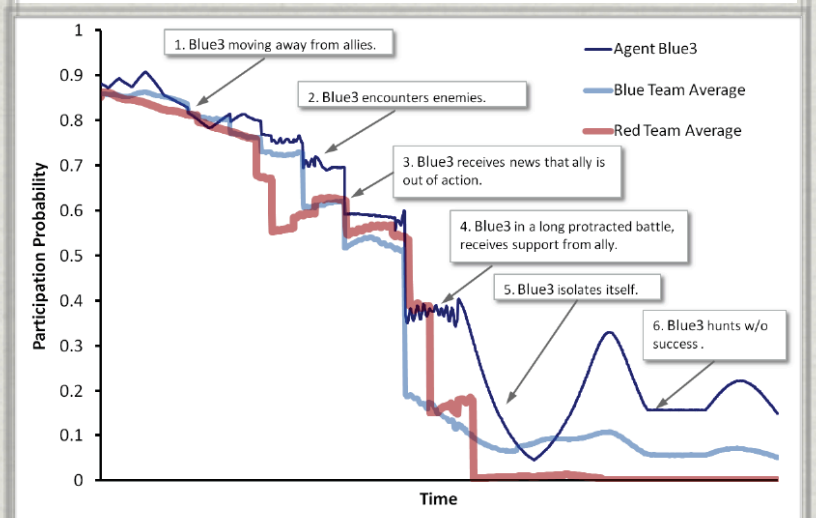


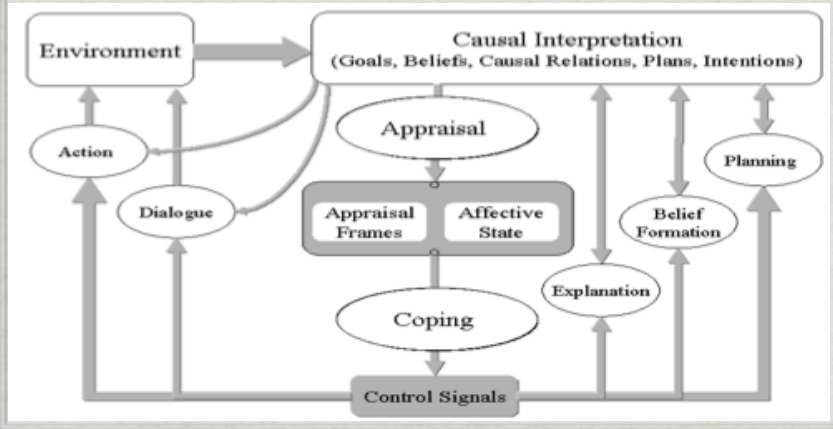
Figure 4: Trace of agent's participation values in an 8x8 battle.

[📖 Morgan, J. H., Morgan, G., & Ritter, F. E. (2010). A preliminary model of participation for small groups. *Computational and Mathematical Organization Science, 16,* 246-270.]

Grossman, D. (1996). *on killing: The psychological cost of learning to kill in war and society*. New York, NY: Back Bay Books, Little Brown.

Moderators:
Appraisal

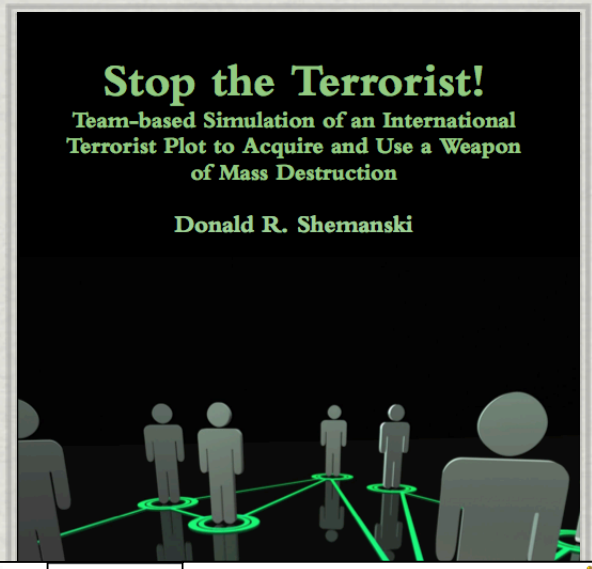
- Start to represent the effects of appraisal
- Not buildable upon — as source code

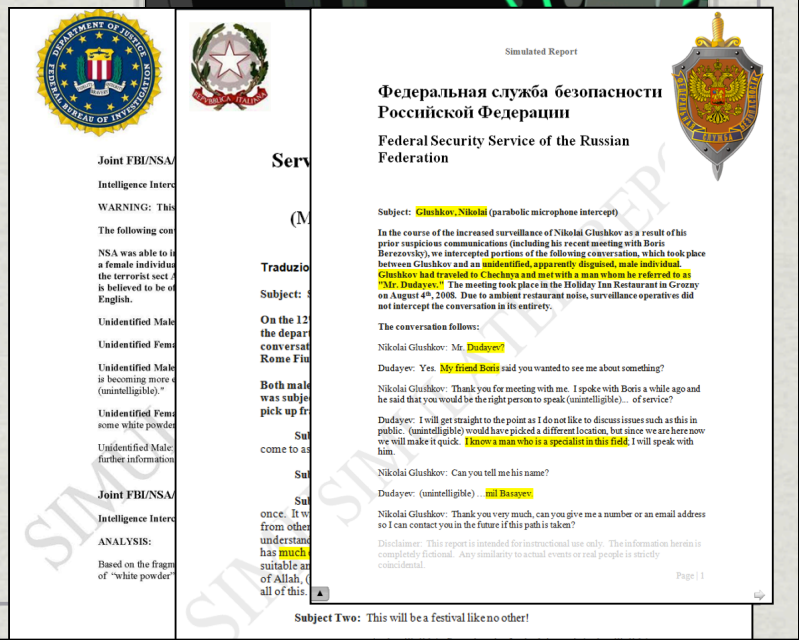


[📖 Gratch, J., & Marsella, S. (2004). A domain-independent framework for modeling emotion. Journal of Cognitive Systems Research, 5(4), 269-306.]

Networks and Cognition: Terrorism scenarios

- Scenario for use in teaching and simulation of terrorism networks
- Created by a former FSO
- One more created, 2 more being created





Network and Cognition:
ANA—A Network Analysis tool

- Provides visualizations of networks and network evolution

[📖 Orendovici, R. (2011). *Social network analysis and simulation of the development of adversarial networks.* Unpublished MS thesis, Penn State.]

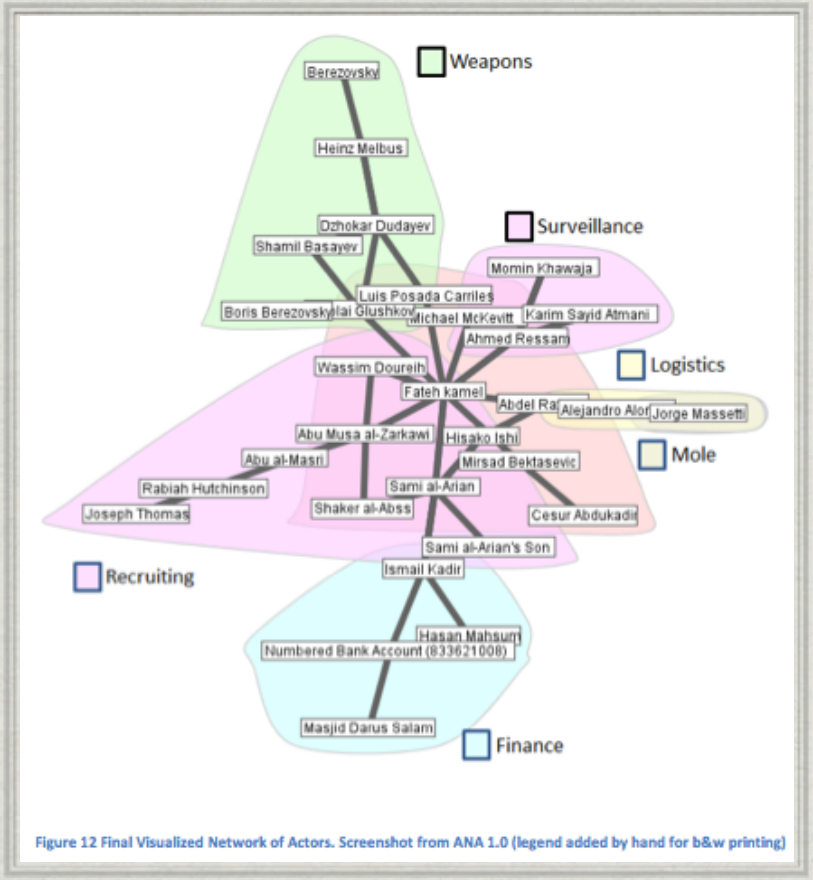


Figure 12 Final Visualized Network of Actors. Screenshot from ANA 1.0 (legend added by hand for b&w printing)

Network and cognition:
VIPER & Intelligent Heterogenous Agent Networks

- Provides visualizations of networks and network evolution

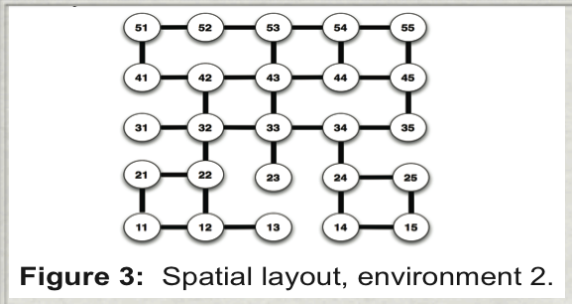
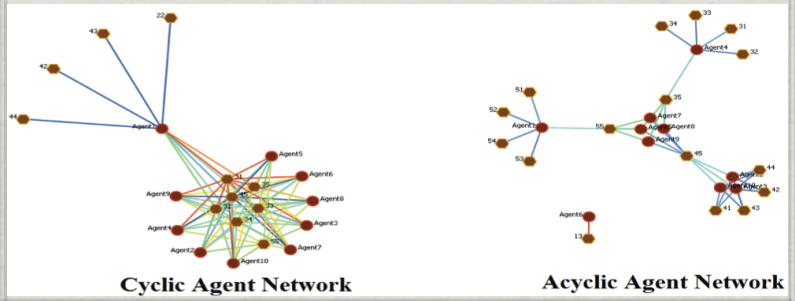
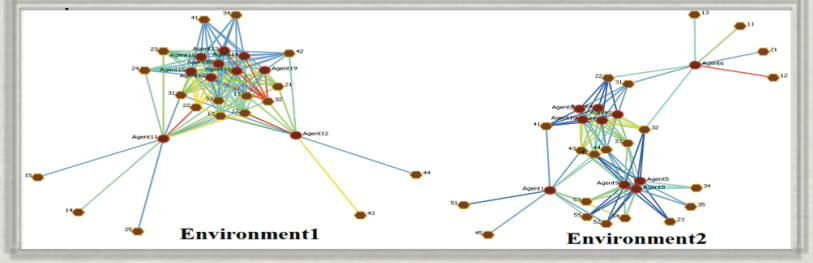


Figure 3: Spatial layout, environment 2.





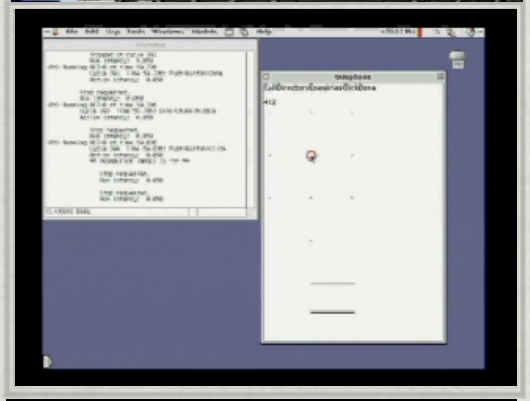
[📖 Zhao, Cw., Hiam, J. W., Morgan, J. H., Ritter, F. E. (2011). A multi-strategy spatial navigation model in a text-based environment. In *Proceedings of the 20th Conference on Behavior Representation in Modeling and Simulation.* 251-258. 11-BRIMS-036.]

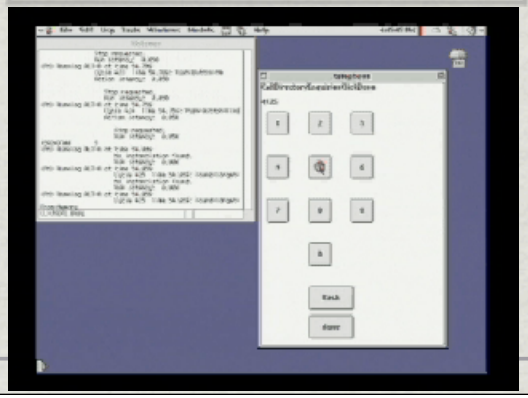
Interaction: Early Sim-eye & -hand

- Joke on interaction
- Provide models access to simulations and thus knowledge

📖 Ritter, F. E., Baxter, G. D., Jones, G., & Young, R. M. (2000). Supporting cognitive models as users. ACM Transactions on Computer-Human Interaction, 7(2), 141-173.

short-nott.2.mov



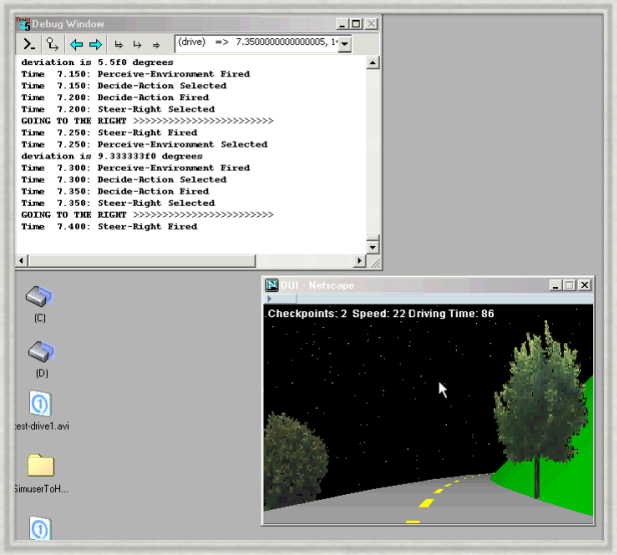


Interaction: Bitmap based interaction

- Provides models access to simulations and thus knowledge

📖 Ritter, F. E., Baxter, G. D., Jones, G., & Young, R. M. (2000). Supporting cognitive models as users. ACM Transactions on Computer-Human Interaction, 7(2), 141-173

pb270194.mov



📖 Ritter, F. E., Kukreja, U., & St. Amant, R. (2007). Including a model of visual processing with a cognitive architecture to model a simple teleoperation task. Journal of Cognitive Engineering and Decision Making, 1(2), 121-147.

Interaction: SegMan

- Lets models test interfaces and theories
- could save 30 years/day

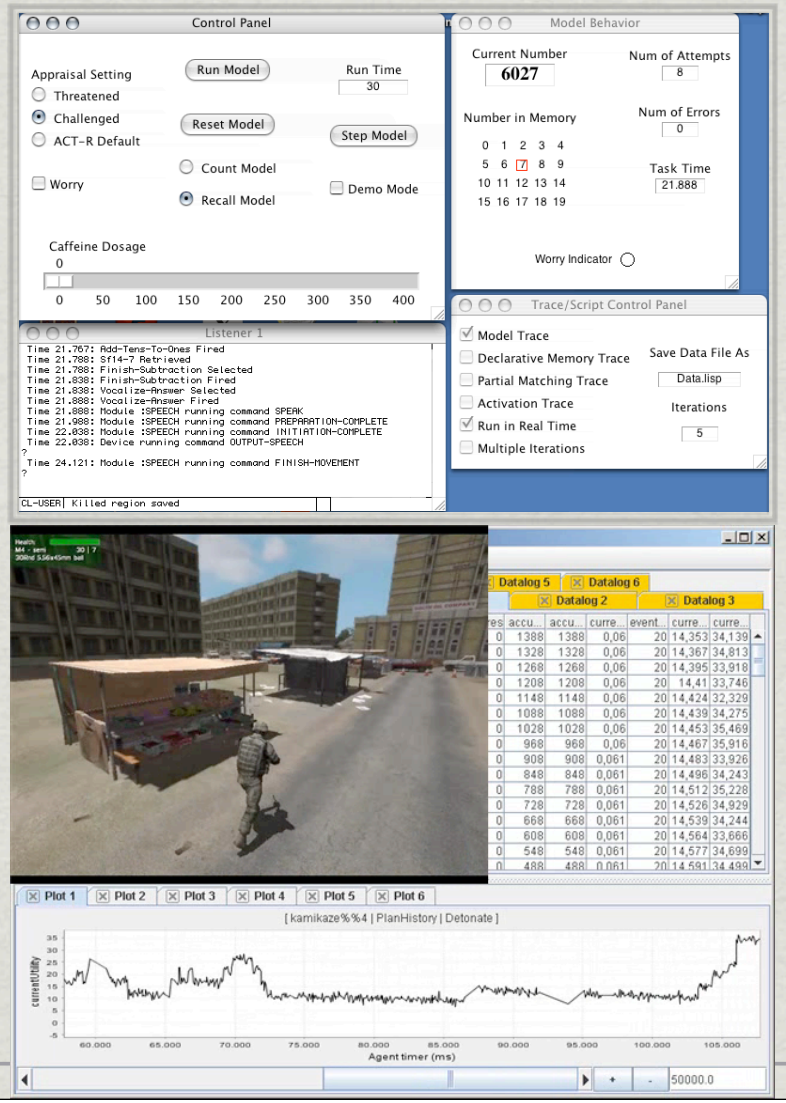
📖 St. Amant, R., Horton, T. E., & Ritter, F. E. (2007). Model-based evaluation of expert cell phone menu interaction. ACM Transactions on Computer-Human Interaction, 14(1), 24 pages.

pb270194.mov

reifers-demo804.mov

Moderators: Challenge and threatened

- Model of challenged and threatened behavior

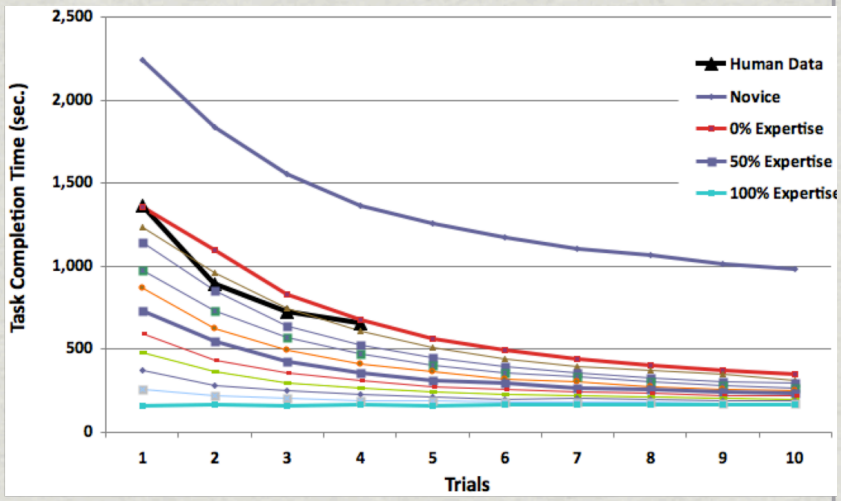


Ritter, F. E., Reifers, A. L., Klein, L. C., & Schoelles, M. J. (2007). Lessons from defining theories of stress for architectures. In W. Gray (Ed.), Integrated models of cognitive systems (pp. 254-262). New York, NY: Oxford University Press. challenge-no-worry5nov04.mov

Evertsz, R., Pedrotti, M., Busetta, P., Acar, H., & Ritter, F. E. (2009). Populating VBS2 with realistic virtual actors. In Proceedings of the 18th Conference on Behavior Representation in Modeling and Simulation, 09-BRIMS-04. civilian_fear.mov

Resources for Usability:
High-level Languages like Herbal

- 🕮 A review of high-level languages
- 🕮 Modeling differences in expertise
- ❋ 20 min. non-repetitive task
- ❋ 9 rules+540 facts/543 rules per model, 10K total learned rules
- ❋ N=40 human subjects



[🕮 Ritter, F. E., Haynes, S. R., Cohen, M. A., Howes, A. John, B. Best, B., Lebiere, C., Jones, R. M., Crossman, J. Lewis, R. L., St. Amant, R., McBride, S. P., Urbas, L. Leuchter, S., Vera, A. (2006). High-level behavior representation languages revisited. In *Proceedings of ICCM - 2006- Seventh International Conference on Cognitive Modeling,* 404-407. Edizioni Goliardiche: Trieste, Italy.

[🕮 Paik, J., Kim, J. W., Ritter, F. E., Morgan, J. H., Haynes, S. R., & Cohen, M. A. (2010). Building large learning models with Herbal. In D. D. Salvucci & G. Gunzelmann (Eds.), Proceedings of ICCM - 2010- Tenth International Conference on Cognitive Modeling (pp. 187-191).

Resources: Modelling Methodology

- Noted as needed
  📖Ritter (1993), 📖Ritter et al. (2003), Booher & Minniger (2003)
- Basic psychology of interest
  (Anderson, CP&II; 📖 Ritter, Churchill, & Baxter, *The ABCS*, accepted, Springer)
- *How to run studies*
  📖(Ritter, Kim, Morgan, & Carlson, accepted, Sage)
- How to test models
  - Grant (1962) Testing the null hypothesis and the strategy and tactics of investigating theoretical models. *Psych Rev, 69*(1), 54-61.
  - Gluck & Pew (2005)
  - Cognitive science special issue (Busemeyer, Gluck, & Bello, 2008)
  - Number of times to run models (Ritter et al., in press)

Non-Conclusions

Not (My) Issues for your Challenge

- Language
- Simple network statistics
- Where do networks statistics come from?
- How does physiology support cognition?
- Multiple-levels of representation
- Individual differences
- The domains I used, including Driving
- Terrorism

- People are purple - Frank Ritter, US/UK OOS Programme Agreement Workshop, April 2006.
- The point is insights
- Reuse

Conclusions

Issues for your Challenge Project

- Encourage the Community of practice that arises (will arise) (Newell, 1990, p. 503)
  - bringing more in
  - teaching them (method and teaching materials)
  - helping them prosper
- Learning, forgetting, and the rest of the hard, traditional cognitive bits
- Social aspects of cognition, including networks
- Moderated aspects of behavior and of will
- Explanations (Newell, 1990, p. 503)
  - We need some good jokes as a way to present our stories ☺
  - Require source code and data (Thimbleby, 2004 "Give your computer's IQ a boost," Review of Journal of Machine Learning Research. *Times Higher Education Supplement*, No. 1588, p. 1526.
  - We need good diagrams, displays, and scenarios to explain our models
  - We need good movies to explain our models
- We need models easy to use and reuse (Newell, 1990, p. 503)
  - These seem to be architecture, which is surprising
  - These seem to be general software
  - ACT-R/PM does not go far enough, we will have to have something like SegMan
- Resources we have: theories, models, conferences, books, FAQs, datasets, architectures, XML