

# Human-Like Cognitive Models as a Basis for Cognitive Systems as presented by Chris Forsythe

Christopher E. Davis - chris2d@cs.unm.edu  
University of New Mexico  
Computer Science Colloquia Fall 2003

December 10, 2003

## **Abstract**

Cognitive models using oscillator systems along with a suite of semantic knowledge, episodic memory, and other modules offer potential benefit to human operated control systems. Not only do the cognitive models offer safety checks for the human operator, but they are also capable of explaining how they came to their decision.

Dr. Chris Forsythe gave a brief high-level overview of the cognitive modelling program active at Sandia National Laboratories. Most of his presentation focused on systems capable of second checking a live human operator. The main system focus, as presented, was on an AWAC operator's interface and a semantic association search engine.

The system as presented currently relies on a pre-constructed semantic database, and a cognitive model that is built by observing an individual operator. It appears that episodic memory is available in some form, however this was only alluded to in the lecture. The real "selling point" of this system is the potential interface this system offers to users. Since the system is "trained up" with it's operator, it is a unique solution built expressly for the operator. This is in stark contrast to the "one size fits all" approaches typical AI/expert systems take. Because of the individual knowledge the system possesses it is able to effectively "scale" it's feedback to the operator according to their level of understanding of the problem. This is not a new idea[1][2], however not enough HCI experts

are devoting time and money to the study of this approach. I truly believe that this may be one of the largest revolutions that users will experience during my lifetime. Computer systems should be able to communicate with their users in a way that is meaningful and tailored to the user - instead of the user conforming and tailoring their interaction patterns to the system.

Dr. Forsythe stated that the next additions to the system will include an automated semantic capture system as well as the addition of a contextual processing unit. Both of these goals seem very difficult to me, since other systems have failed at this point. Researchers like Rodney Brooks have spent years trying to surmount the semantic capture problem[1][2]. Programs like the Microsoft Office “paper-clip” rely heavily on context processing[3] and have proved to be an annoyance to many users. Often the simple minded contextual analysis and automation the “paper-clip” introduces are misleading, wrong, and hard to undo. The one saving grace Dr. Forsythe’s system seems to have above the “paper-clip” is that the system will not be automating anything, just second checking. Only time will tell if operators will accept the feedback the system can offer.

One of the more interesting aspects of this system is the notion of creation and retention of individual experts. Instead of trying to unify each expert cognitive model into a single “Uber model” they have instead decided to keep the experts as separate individuals. This appeals to me since it seems that it should be less prone to error. If each expert is built on it’s own set of assumptions, hopefully the common assumptions will not result in a total mis-diagnosis of a situation. As long as there is discord among the experts the operator is able to apply *their* problem solving skills to the problem at hand and weigh the opinions and reasoning of each expert. If on the other hand there were only one expert, if that expert missed a situation then the operator HAS to catch the situation or it will go un-noticed until it may be too late.

Although this system is currently being wasted on defense related programs, I think that it does offer benefits to the civilian market. There are plenty of systems where operators could benefit from a second opinion, and this system could offer that opinion. I could easily envision systems like this operating in civilian air control towers, train depots, truck depots, grocery stores, OS and application interfaces - anywhere a human has to interact repeatedly with a machine. I believe that this system's ability to not only provide a second opinion, but to provide the reasoning behind that opinion are paramount to it's success.

## References

- [1] Adams, B., Cynthia Breazeal, Rodney A. Brooks, Brian Scassellati, "Humanoid Robots: A New Kind of Tool", IEEE Intelligent Systems and Their Applications: Special Issue on Humanoid Robotics, Vol. 15, No. 4, July/August 2000, pp. 25-31.
- [2] Brooks, R.A., Cynthia Breazeal, Matthew Marjanovic, Brian Scassellati, Matthew Williamson, "The Cog Project: Building a Humanoid Robot" in *Computation for Metaphors, Analogy, and Agents*. C. Nehaniv (ed), Lecture Notes in Artificial Intelligence 1562. New York, Springer, 5287, 1999.
- [3] Microsoft Developer Network,  
<http://msdn.microsoft.com/library/default.asp?url=/library/en-us/modcore/html/deovrworkingwithofficeassistant.asp>