Development of Executable Cognitive Agents Using the COGNET Architecture and *i*GEN™ Toolset

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COGNET/*i*GEN™ is a set of software tools (i.e., a workbench) that enables human performance specialists to develop, test and deploy *cognitive agents* -- software components that exhibit a level of intelligence that mimic human thought processes. Cognitive agents represent the logical transition of research on human information processing to practical application. Cognitive agents also represent a new and growing paradigm for research in decision support, intelligent human-computer interfaces, intelligent tutoring, etc. From an application perspective, cognitive agents empower the user by combining the speed, efficiency and accuracy of the computer with the decision-making capacity, experience and expertise of human experts. From a research perspective, they allow cognitive models to be applied to problems of enhancing the interaction between people and information technology in complex work environments.

COGNET/ *i*GEN™ incorporates computational models of human cognitive processes as a basis for designing and building software agents. At the same time, COGNET/ *i*GEN™ incorporates many practical approaches from software and systems engineering to maximize its ability to meet real-world cognitive agent application needs. This makes it fundamentally different from cognitive architectures, which have been developed as vehicles to test cognitive theories (e.g., ACT-R and theories of memory; EPIC and theories of dual tasking and task performance).

This workshop introduces participants to the concepts of cognitive agents and to the COGNET/ *i*GEN™ method and tools for cognitive agent development and prepares them to undertake the development of cognitive agents applications. This tutorial provides ICCM attendees with a view of the COGNET/ *i*GEN™ cognitive architecture that emphasizes the unique properties of COGNET/ *i*GEN™. It also provides an introduction to the concepts and methods involved in cognitive agents and their development, providing participants with an important perspective linking theory and practice.

The workshop begins with an examination of three major uses for cognitive agents:

- Intelligent training and tutoring – specifically, the use of cognitive agents to provide:
  - embedded models of the student/trainee to track student progress against the knowledge required for the skill being trained;
  - an embedded instructor/tutor that can manage presentation of information, sequence instruction, and provide feedback/remediation; and/or
  - synthetic teammates to facilitate practice and teamwork in a simulated work environment.
- decision support and electronic performance support, in the form of work-centered intelligent interfaces that assist a worker or decision maker in such functions as attention management, situation awareness, and/or contextualizing decision strategies;
- human performance simulation, in the form of simulations of system users to aid design engineering and design evaluation, and/or synthetic players for mission simulations and/or interactive games.

Examples of each type are provided.

The workshop then covers COGNET as a cognitive-agent architecture based on cognitive theory. COGNET is compared to other computational architectures that embody theories of human thought and reasoning, and the features of COGNET that support cognitive agent development are identified. Particular focus is given to the features unique to COGNET/ *i*GEN™ – including metacognition, flexible granularity, and expert-level knowledge structures – and to the constructs that specifically focus on cognitive agent requirements – temporal management, micromodels, parallel execution threads, and external application interfaces. The modeling strategies by which the system can be used to represent complex behaviors such as teamwork, coaching, and cognitive workload self-reporting are discussed, as are the development tools available to support modeling and the integration of models into larger simulations, federations, or other applications.

For more information on the COGNET methodology and *i*GEN™ toolset, go to http://www.cognitiveagent.com.