Cognitive Models for Training Simulations

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Appendix A

Overview of Software Packages

ACT-R	A cognitive architecture implementing a hybrid approach toward the modeling of cognition (Anderson and Lebiere, 1998). ACT-R constitutes a unified theory of cognition and is based on detailed findings concerning the functioning of human memory and of learning and problem-solving processes, see Section 2.3.2.
AI-implant	A commercial AI tool that can be used to simulate synthetic entities that make context specific decisions, and move in a realistic fashion within their environment. Its main use is simulating crowd behavior (Presagis, 2009).
COGNET	A framework for creating and exercising models of human operators engaged in primarily cognitive, as opposed to psychomotor tasks. COGNET's original use was the development of user models for intelligent interfaces, but it has also been used to model operators and opponents in simulators. The primary assumption underlying COGNET is that humans perform multiple tasks in parallel (Zachary et al., 1992, 1996).
CoJACK	A recent cognitive architecture that is used in simulation systems to underpin virtual actors, and created by adding a cognitive modeling layer on top of JACK, see below. CoJACK models the structural properties of the human cognitive system and constrains the models that can be implemented therein by only allowing the definition of models that fit within its structural boundaries. It models variation in human behavior by supporting behavior moderators such as stress, morale and fear, each implemented as an overlay (Norling and Ritter, 2004; Evertsz et al., 2008a).

CLARION	A cognitive architecture that explicitly distinguishes implicit from explicit processes and focuses on capturing the interaction between these two types of processes. It consist of four distinct subsystems: the action-centered subsystem, the non-action-centered subsystem, the motivational subsystem, and the metacognitive subsystem. Each of these subsystems has a dual representational structure, so incorporates implicit as well as explicit representations (Sun, 2002a).
D-Cog	Distributed Cognition (D-Cog) is a theoretical framework that takes a distributed, socio-technical system rather than an individual mind as its primary unit of analysis. This framework is explicitly cognitive in that it is concerned with how information is represented and how representations are transformed and propagated in the performance of tasks (Hutchins, 1995; Perry, 2003).
EPIC	A symbolic cognitive architecture developed for modeling human multiple-task performance, with as main focus the provision of a detailed account of human perceptual and motor operations. A parsimonious production system is used as cognitive processor, which is surrounded by separate sensory and motor processors. EPIC assumes that all capacity limitations are a result of limited structural resources, rather than a limited cognitive processor (Kieras and Meyer, 1997).
JACK	The JAVA Agent Compiler Kernel (JACK) is an extension to JAVA which implements a BDI architecture. It can be used to create a runnable JAVA program that instantiates a BDI agent. The agent's beliefs are represented with a database, its desires as events that can trigger plans, with these plans representing its intentions (Busetta et al., 2000).
Jason	An interpreter for an extended version of AgentSpeak (Rao, 1996), a BDI agent-oriented logic programming language. Jason is implemented in Java (Bordini et al., 2007) and forms a BDI agent. The agents belief state is the current state of the agent, which is a model of itself, its environment, and other agents. The agents desires are the states that the agent wants to bring about based on its external or internal stimuli, while its intentions are active, partially instantiated, plans that the agent adopts in an attempt to achieve its desires.
Java	An object-oriented, structured, imperative programming language, released in 1995 and originally developed by Sun Microsystems. Java applications are typically compiled to byte code that can run on any Java virtual machine (JVM) regardless of computer architecture.
Jess	A rule engine and scripting environment written in Java. Using Jess, Java software can be build that has the capacity to 'reason', using knowledge in the form of declarative rules (Friedman-Hill, 2003).

LeadsTo	A language and software environment developed to model and simulate dynamic processes in terms of both qualitative and quantitative concepts. Dynamic processes are modeled by specifying the temporal dependencies between state properties in successive states. The LeadsTo language is a declarative order-sorted temporal language, extended with quantitative means. The software environment performs simulations of LeadsTo specifications, generates simulation traces for further analysis, and constructs visual representations of traces. (Bosse et al., 2007).
PMFserv	An agent-based architecture with the flexibility to act as meta-level emotional arbitrator for others' cognitive architecture, or to provide a fully functional stand-alone system to simulate human decision-making. It provides a framework that permits examining the impacts of stress, culture, and emotion upon decision-making, and is mainly used to simulate crowd behavior (Silverman et al., 2006).
Prolog	A declarative, logic programming language, originally designed by Alain Colmerauer in 1972.
Soar	A symbolic cognitive architecture based on a production system and proposed by Newell (1990) as 'a candidate unified theory'. Soar implements goal-directed behavior as a search through a problem space, for which at each cycle first the current state is elaborated on, after which a decision is made which production rule (operator) may fire, see Section 2.3.2.
VBS2	Virtual Battlespace 2 is an interactive, three-dimensional training system providing a synthetic environment suitable for a wide range of military (or similar) training and experimentation purposes. VBS2 offers both virtual and constructive interfaces onto high-fidelity worlds and is used for mission rehearsal, tactical training and simulated combined arms exercises (Bohemia Interactive Australia, 2009).

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