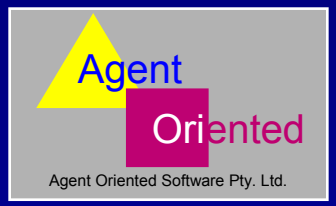

Modeling Human Variability in Computer Generated Forces

Emma Norling

representing Agent Oriented Software Limited, UK

This work is funded by the Synthetic Environments, Simulation and Support Domain of the UK MoD's Corporate Research Program

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Overview

- Agent Oriented Software (UK) has recently been awarded a contract to improve the representation of human variability in computer generated forces for the UK Ministry of Defence (MOD)
- This presentation focuses on the cognitive modeling and behavior moderators aspects of the project

Cognitive modeling in the UK Ministry of Defence

Up until 2000….

- 1994 Soar (Sheppard, Nottingham & Portsmouth Universities)
- 1996 Broad Agents (Hepplewhite & Baxter)
- 1997 UK Stow (DERA Fort Halstead & Portsdown West)
- 1998 IMPE-based human science server to ModSAF (Russell, Belyavin, Sheppard)
- 1998-2000 RCAB (Sheppard, RMCS Shrivenham & Portsmouth University)

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Current State

- Impressive advances in CGFs
- Relatively little improvement in representation of human behavior in CGFs
- Focus has been on normative behavior
- Interest has now shifted:
  - How do known factors affect individual and unit behavior?

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Current UK Program

- MoD recognized these limitations & lack of progress in improving modeling
  - funded by the Synthetic Environments Coordination Office (SECO), under MoD's Corporate Research Program
  - research completed in December 2002
  - contract award and substantial 2-year program started Feb 2003
- Contract focuses on
  - modeling of human behavior
  - representing the effects of external and internal moderating influences on the CGF entity and unit behavior in an effective and practical manner

International Team

- Prime Contractor *Agent Oriented Software Limited, UK*
  - Project manager: Andrew Lucas
- Software Development
  - Andrew Lucas, Martyn Fletcher *Agent Oriented Software Limited, UK*
  - Ralph Rönnquist, Dennis Jarvis *Agent Oriented Software, Australia*
- Cognitive modeling
  - Frank Ritter *Penn State University*
  - Emma Norling *University of Melbourne/Ramjet Software, Australia*
- Demonstration & CGF interfacing
  - Simon Russell, Jeremy Baxter *QinetiQ, UK*
- MoD scientific expertise
  - Colin Sheppard, Ian Greig *Dstl, UK*
- MoD customer
  - Roy McNee *Ministry of Defence Synthetic Environment Coordination Office*

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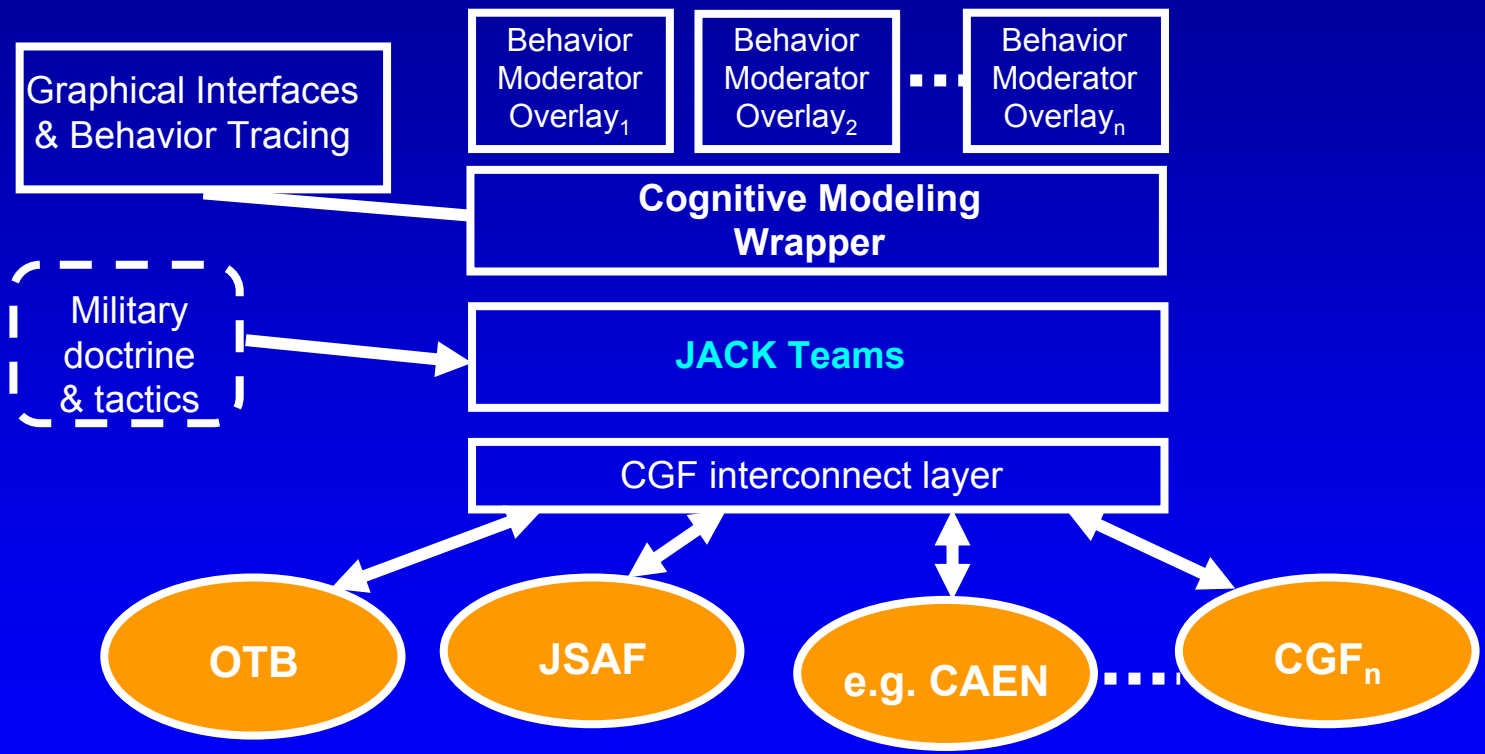
Behavioral Modeling System



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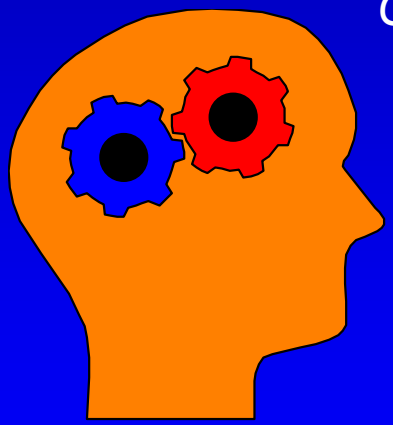
BDI Agents

Human

Beliefs - perceived understanding of the world

Goals or desires

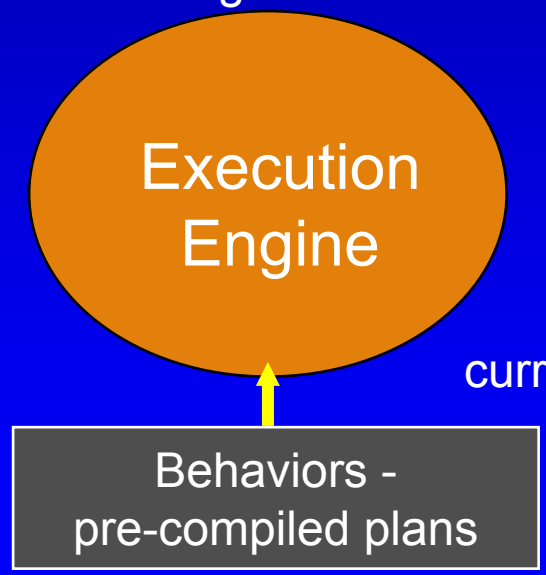


Accumulated experience and behaviors

Belief, Desire, Intentions Agent

Beliefs - database of perceived world knowledge

Goals or desires



Intentions - currently executing plans

Ref. Wooldridge 2000 "Reasoning about Rational Agents"

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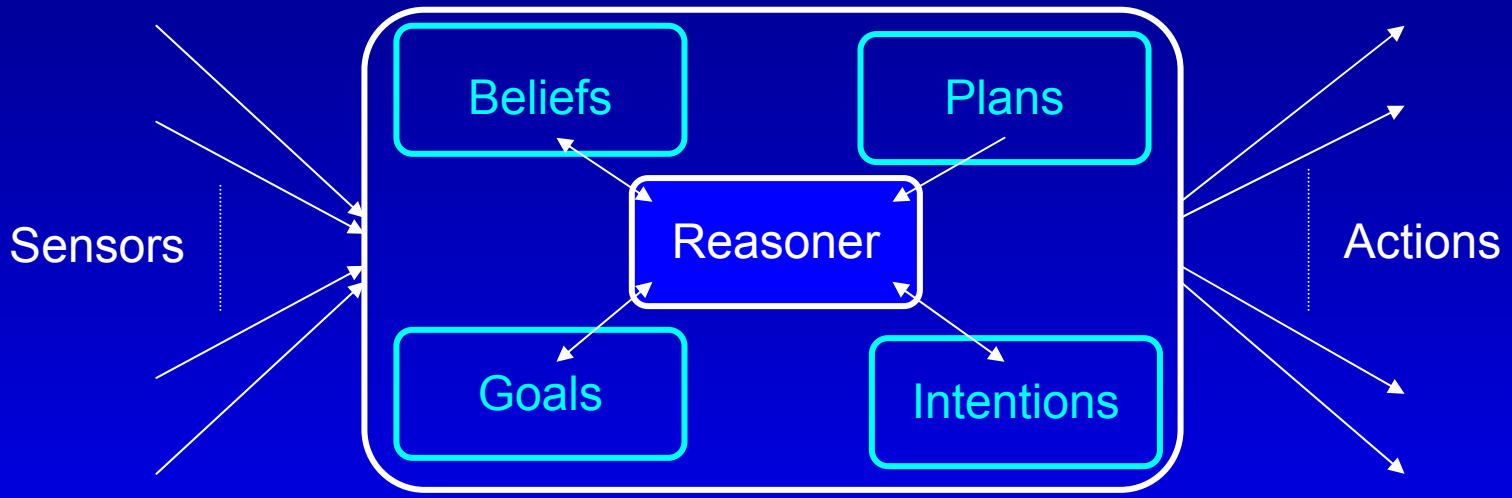
BDI Agents and JACK



- JACK implements BDI reasoning, and also includes other features, such as
  - explicit representation of teaming,
  - development GUI,
  - debugging/tracing environment

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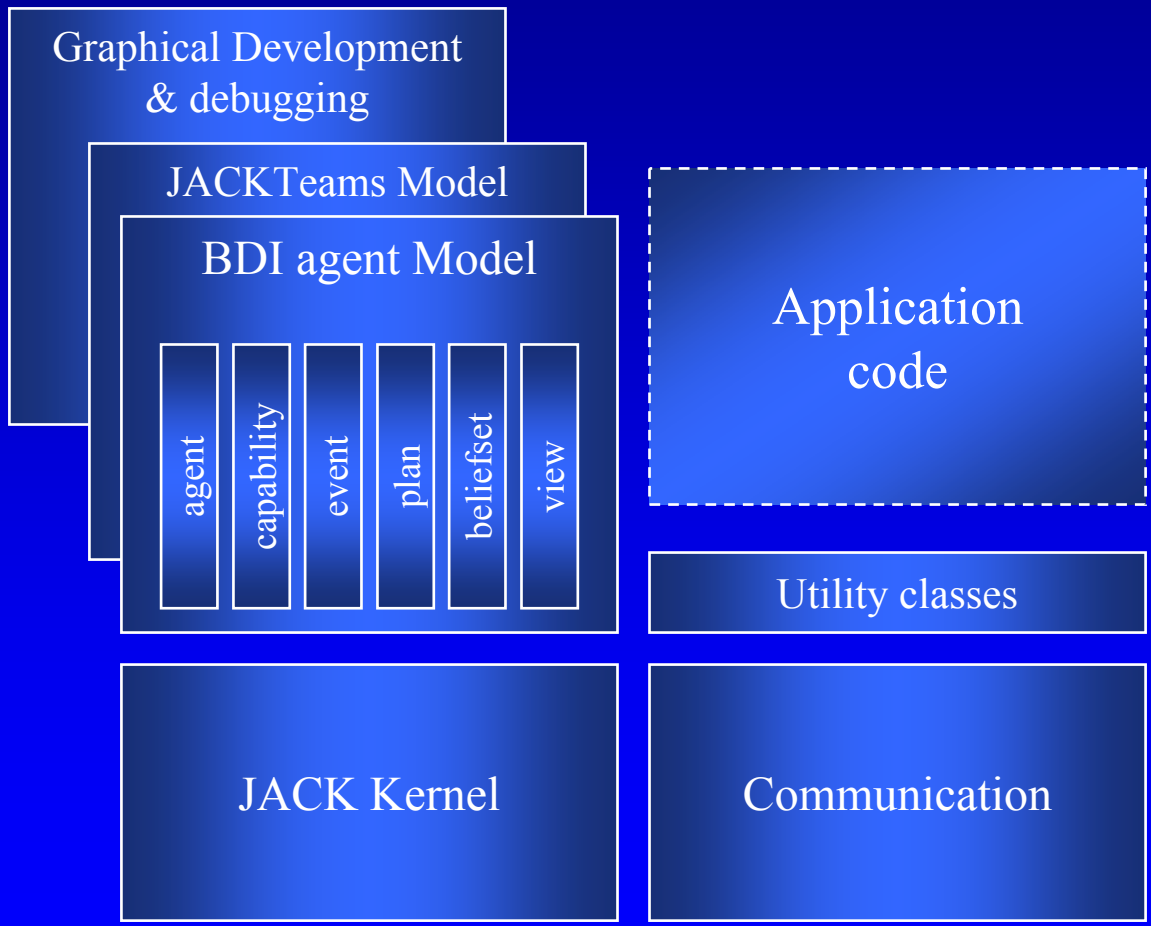
JACK Component Architecture



Cognitive modeling & Human Variability in JACK

- BDI is based on how we *think* that we think, rather than the actual mechanism in the brain
  - This is a benefit in human modeling: models are relatively intuitive to build and to understand when running
- Most human variability data is at a lower level – e.g. effects on processing time or memory capacity

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Challenge: A cognitive architecture wrapper that represents the necessary components of cognition but maintains the ease-of-use of a BDI system

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Extending JACK

- Previous work has demonstrated:
  - the P/M models that have been implemented in Soar/ACT-R can be implemented in JACK (Norling and Ritter, 2001)
  - a human-like decision-making strategy can override the standard decision-making strategies of JACK agents (Norling, PhD thesis, forthcoming 2003)
- Perhaps the biggest problem in the current system is the representation of memory:
  - beliefsets are prolog-like databases, views are java code

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Current Status

- Identifying the effects of key behavioral moderators, e.g.
  - Stress
  - Fatigue
  - Sleeplessness
  - Stimulants (e.g. Caffeine)
  - Pre-task appraisal
  - Amphetamines(?)
  - …?
- Limited by available data – resources not available to conduct experiments

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Current Status

- Preliminary stages of the development of the cognitive architecture wrapper for JACK Teams, influenced by
  - Implementation of JACK Teams
  - Cognitive elements that will be influenced by behavior moderators

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Program Outcomes

- Model representing the effects of external and internal moderating influences on CGF entity and unit behavior in an effective and practical manner
- Implementation of Cognitive Modeling Architecture as a layer on top of JACK Teams
- Lightweight generic interface layer, facilitating integration with CGFs
- Demonstration of the project's output using CGF entities within the OneSAF Test Bed (OTB)