

Agent Modeling

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NAPS

Sometime its just better to sleep through it all

Agent Modeling Team

- Lead Scientist:

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(UCF)



**Human Factors
and
Aeronautical
Engineering**

- Primary Scientists:

- Michael Lewis, Ph.D.
- Denise Nicholson, Ph.D.
- Randall Shumaker, Ph.D.

Overview

- Roles of Agents in Teams
- Research Issues:
 - Primary Research
 - Enabling Objectives and Technologies
- Approach:
 - Practical Problems
 - Tasks & Linkages
- Year 1:
 - Mapping the Roles of Intelligent Agents against the CKI Framework



Agent Modeling: Background & Motivation

□ Desired Outcomes

- Develop models & techniques for facilitating interactions for human-agent teams
 - Control of agent teams
 - Many-human/many agent teams
- Develop models & techniques for emulating human performance
 - From literature
 - From archival data
 - Online adaptation to emulate human teammates



One-Of-A-Kind Teams In One-Of-A-Kind Situations

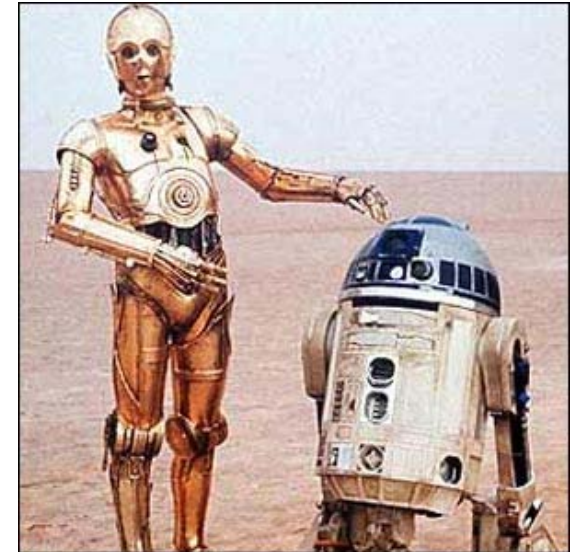


NATO Exercise Noble Javelin 2005



Roles of Agents in Teams

- Agents can act in teams as:
 - Taskwork-functional components:
 - Collecting/storing/processing/retrieval of task data
 - Representation of task data
 - Teamwork-functional components:
 - Process assessment
 - Dynamic function allocation
 - Team “metacognition” and coaching
 - Surrogate team members:
 - Training
 - Research
 - External observers:
 - Data collection for research and training



Research Issues

- Primary questions, in order of precedence:
 - Agents as teamwork-functional components
 - Agents as external observers
 - Agents as surrogate team members
- 6.1 nature of the work:
 - Study wide range of potential variables to model
 - As generalizable across task areas, team sizes, team structures as possible
- Enabling objectives and technologies:
 - Identify and collect critical data
 - Select simulation environment and methods
 - Match computational load to capabilities



Approach: Practical Problems

- Constraints to “Realism”:
 - Open-ended vs. scripted scenarios
 - Complexity of team member signatures
 - Embodied agents
 - Communication modes
 - Behavioral outputs
 - Modeling environment
 - “One-of-a-kind” situations



Approach: Tasks & Linkages

- Collect data to model
 - Theory, metrics, experimentation
- Analyze modeling data
 - Metrics
- Create initial teammate emulation
 - Theory
- Cross-validate model against archival data
 - Metrics
- Conduct single and “double” Turing test & identify human/agent differences



Year 1: Mapping the Roles of Intelligent Agents against the CKI Framework



Agents in Macrocognition

- Externalized cognition allows agents to become *first class* participants by doing things such as:
 - Identifying targets
 - Filtering information
 - Communicating messages
 - ... just like human participants
 - Difficulties exist for processes such as problem conceptualization or sense making that require nonstationarity
-



Agents in Knowledge Building

- ✓ Pattern recognition
 - ✓ ATR and other sensor-driven recognition
 - ✓ Situation classification; example: machine learning for rating credit worthiness
- ? Mental model construction
 - ✓ Yes, if involves match to stored models
 - ✗ No (or extremely difficult) if requires discovery/reorganization

Agents in Team Knowledge Building

- ✓ Knowledge sharing involving deictic pointing
 - ✓ Spatial/geographic references on shared map or screen
 - ✓ Sequence or temporal ordering through timeline
- ? Knowledge sharing requiring NLP
 - ✓ Key words to index stored plans/contexts
 - × “Understand” team dialog & discussions



Agents in Sharing Unique Knowledge

- ✓ Eliciting knowledge from teammates
 - ✓ Queries for empty slots
- Communicating own knowledge
 - Text/speech tend to be too explicit/extensive
 - Graphical expression such as marked-up map deliver information in parallel
- ✓ Identify things to point out/share (recognize expertise)
 - ✓ Overlay models to id potentially missing information from group decisions (critiquing)



Agents in Shared Conceptualization

- ✓ Visualization of data
 - ✓ Automated choice & generation of visual representation (such as SAGE or APT)
- ? Team problem model/common ground
 - × Difficult for agent unless team shares its model
 - ✓ Graphical/map based model could be shared



Agents in Consensus Development

- Can agents vote? Do we want them to negotiate?
- ✓ Option generation
 - ✓ Agent with HTN planner could propose & or critique plans if expressed in accessible form
- ✗ Intuitive decisions, critical thinking
- ? Storyboarding
 - ✓ Maybe if using agent generated or accessible graphics



Agents in Outcome Appraisal

- ✓ Maintain performance logs and other records of problem solving episode for AAR
- ✗ Workspace awareness, activity awareness, etc.



Summary: The Way Ahead

- Integrating agents into a macrocognitive process requires a common (external) representation they can access
- Agent-generated or -accessible graphical displays of maps, timelines, etc. seem the most natural way to achieve this
- The Macro-Cog discrete event simulation appears to allow sufficient access to state variables for agents to be situation aware





RELAXATION

Take time to smell the flowers.
Then eat them.
Then puke them up on the carpet.