MODELING PERFORMANCE IN C4ISR SUSTAINED OPERATIONS: A MULTI-LEVEL APPROACH

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Credits

• Dr. James C. Miller: Air Force Research Laboratory Warfighter Fatigue Countermeasures R&D Program

• Dr. Linda Elliott: Veridian Engineering

• Dr. Michael Coovert: University of South Florida

• 21ST Century Systems, Inc., providing the Agent Enabled Decision Group Environment (AEDGE) software
Issues

• Modeling
  – Agent-based Software Architecture

• Assessment
  – Scenario Design
  – Construct Validity / Measures
  – Multi-level Modeling of Interrelationships

• Application
  – Criterion Performance (Training)
  – Fatigue Models
Software Architecture

• AEDGE- Agent-Enabled Decision Group Environment
  – Federation of IA agents
    • Heterogenous / Distributed / Autonomous / Concurrent
  – Component-based Architecture
  – Hierarchical Collective Agents Network (HCAN)
  – 4 Modules
    * Data Management
    * Control and Adaptation
    * Reasoning
    * User Interface/Visualization
Data Fusion and Decision Support

Figure 1. 21CSI’s AEDGETM Product
Scenario Design

• Operational Relevance
  – C4ISR assets / roles

• Construct Validity:
  Need to ELICIT
  – Individual Decision-making
    • Type / Timing of Decision Errors
  – Team Planning
  – Team Communication
  – Team Coordination
  – Team Adaptive Decision-making
Current Research Goal Modeling of:

MOTIVATION

Measured by:

Team Efficacy survey

Communication data

- Encouragements to each other

- Conscientiousness (Neo PI)
Current Research Goal Modeling of:

FATIGUE

Measured by:

Stanford Sleepiness Scale
Profile of Mood States
Time
Current Research Goal Modeling of:

**COGNITIVE DEMAND**

Determined by complexity of scenario
Current Research Goal Modeling of:

COGNITIVE CAPACITY
In part measured by experience:
ABC Course
1 week AEDGE training
Biographical data
Current Research Goal Modeling of:

- Individual Performance
- Cognitive Capacity
Individual Performance and Decision-Making

Measured by:

- Fuel management
- Asset ownership
- Latency
- ANAM battery: reaction time, short term memory, multitasking
Current Research Goal Modeling of:

Team

Measured by:

Communications

-Strategy

-Sequencing of assets and targets

Handovers
Mission

Measured by outcomes:
Assets lost
Enemies destroyed
Objectives fulfilled
Current Research Goal Modeling of:

Interrelationships
Fatigue Effects

Motivation
Mission
Team
Individual Performance

FATIGUE
Cognitive Demand
Cognitive Capacity
Multi-Level Modeling of Data

• Multiple Measures at different levels & across time
  – Individual Differences
  – Individual performance
  – Team performance
  – Team Outcomes

• MLWin
  – [http://multilevel.ioe.ac.uk/features/index.html](http://multilevel.ioe.ac.uk/features/index.html)

• Consultant: Michael Coover, USF
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