GOMS COMPARISON OF ADW TEAM PERFORMANCE WITH AND WITHOUT AN AUTOMATED TASK MANAGER CONCEPT

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The Multi-Modal Watch Station
Overview

- Design Goal – Reduce Information Overload Bottleneck for AEGIS ADW Team

  - ‘Hook and Look’ visual search for actionable air tracks
  - The environment consists of events not tasks
  - Tasks are in the eye of the observer; miss an event and the task does not exist
Overview

- Hypothesis – Automated Task Manager Concept Improves Task Throughput, Latency
  - Rule-directed, ‘Super – Google’, search engine
  - Continuous search of all available data bases
  - Discovers and ranks tasks, does not do them
Overview

Retrospective models of team exercises with and without ATMC – ambiguous results

- Teams revert to Aegis command hierarchy and local comms ‘chatter’

- Behaviors, personalities, interactions differ widely across teams

- Models cannot represent behaviors that cannot be defined
Overview

Prospective models of ‘ideal’ teams – clean results, certain advantages for ATMC

- Compare performance w/wo ATMC - all other things being equal
- Give both model teams the ‘best’ strategies as determined from the design and observations in the exercises
- Use minimal direct commands, no ‘chatter’, visual search brackets
The Tacsit Display
The Task Manager Display
The Tacsit Display
GLEAN: GOMS Language Evaluation and Analysis Tool
ADW Team Model: without ATMC

Monitor Air Situation

Alternative Information Capture Strategies:
- Universal Visual Interrupts
- Visual Interrupts During Deliberate Search
- 5 sec Visual Object Appear / Change Status

Universal Auditory Interrupts for:
- Announcements of Events, Actions
- Verbal Information offered, requested
- Supervisor Directions for Load Balancing

CANDIDATE AIR_TRK
- Confirm ID
- Confirm Suspicious

CANDIDATE MEMORY

SUSPECT AIR_TRK

SUSPECT MEMORY

Issue New trk, ESM Verbal Rpt

CONDUCT THREAT ASSESSMENT

Actionable Air_Trk
ADW Team Model: with ATMC

SELECT FROM TASK MANAGER

Conduct Threat Assessment

Review Order of Battle
Review Trk Profile
Review Geo Pol Situation
Review Rules of Engage

ACTIONABLE AIR_TRK

RESPOND TO AIR THREAT

Issue Update Trk Verbal Rpt
Issue ESM Verbal Rpt

Query
Warn

Illuminate
Cover w/B
Req DCA
Engage w/B
Conditions Tested:

1. ATMC vs Hook/Look
2. Universal Event Capture vs Deliberate Search
3. Three vs Four Member Team
4. Autonomous Actions vs Command-Directed
5. Verbal Announcements of Event Capture, Actions vs No Verbal Information Sharing
### PREDICTIONS: NO ATMC VS ATMC

<table>
<thead>
<tr>
<th></th>
<th>% Total</th>
<th>% Within time</th>
<th>Latency</th>
</tr>
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<tbody>
<tr>
<td><strong>NO ATMC</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Query Task</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Autonomous 3m team, universal capture</td>
<td>75%</td>
<td>58%</td>
<td>423</td>
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<td>Cooperating 4m team, deliberate search</td>
<td>67%</td>
<td>58%</td>
<td>367</td>
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<tr>
<td><strong>Warning Task</strong></td>
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<tr>
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<td>100%</td>
<td>164</td>
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<tr>
<td>Cooperating 4m team, deliberate search</td>
<td>90%</td>
<td>100%</td>
<td>189</td>
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<tr>
<td><strong>ATMC</strong></td>
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<tr>
<td><strong>Query Task</strong></td>
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<tr>
<td>Autonomous 3m team</td>
<td>100%</td>
<td>75%</td>
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<tr>
<td>Commanded IQC1 3m</td>
<td>100%</td>
<td>75%</td>
<td>284</td>
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<tr>
<td><strong>Warning Task</strong></td>
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<tr>
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<td>100%</td>
<td>90%</td>
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<td>Commanded IQC1 3m</td>
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<td>50%</td>
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</table>
Conclusions So Far:

1. Three-member team with ATMC can perform all required Query and Warning tasks.

2. Three- or four-member teams without ATMC can not do all required Query and Warning tasks:
   - Even with Universal Capture
   - Even with Verbal Information Sharing
Conjectures So Far:

1. ATMC is a ‘universal visual capture’ capability with very fast rule-based decision-making.

2. ATMC can replace most local commands and inter-team ‘chatter’, maybe even one whole team member.

3. Near-autonomous operations may be better than highly directed operations for all teams.
Modeling Lessons Learned:

1. Empirical testing with real teams is difficult, expensive, and limited in coverage.

2. Retrospective GOMS modeling with real teams is difficult given all (1) above.

3. Prospective GOMS modeling is easy and cheap.

4. Do it early and often in system design, before testing prototypes with real teams.