Need for Community of Interest for Context in Applied Decision Making

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November 13, 2013
Coping With Massive Amounts of Information

- The Glare of War -

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Common Tactical Picture Workshop
8-9 July 1998
A Simple Model for Decision Making

Decision

Experience

Understanding

Knowledge

Information

Context

Real World

Perception
Eventually, Stevie looked up: His mother was nowhere in sight, and this was certainly no longer the toy department.
Building Knowledge from Information

- World Model
- Current Context
- Relevant Model
- Information Based on Observations
- Directed Search for Information
- Tailoring of Model
- Multiple Alternatives (Hypotheses) Regarding the Current Situation
- Correlation
- Interpretation of the Observed Information
- Knowledge and Assumptions
The Perception Map

- KNOWN
- ASSUMED
- JUDGMENT
- EXPERIENCE
- INTUITION
- KNOWN
- UNKNOWNS
- UNKNOWN
- UNKNOWNS
- SURPRISES
Information Oriented Support

Information

Understanding

Knowledge

Perception

Decision-Maker

Information

Real World
Impact of Presentation Form

Increasing Effectiveness

Increasing Information Delivery Rate

Graphic

Formatted

Narrative
Knowledge Oriented Support
Information Report vs Knowledge Update

Real World Track Information

Real World Information With Linear Extrapolation Model

required accuracy
Update Based on Significant Changes

Velocity = 1000 ft/sec
Allowed $\Delta = 1000$ ft
$T_i = 1$ sec

<table>
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<th>$T_k$(sec)</th>
<th>$T_k/T_i$</th>
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Potential to Throttle Back on Information Delivery Based on Ability to Infer Knowledge

![Graph showing correlation of perception model with real world and accuracy update requirement.](image)
Gain in Knowledge Value per Delivered Bit

Delivered Data Enhances Confidence in Perception

Minimal Knowledge Beyond Current Report

Delivered Data Enhances Both Confidence and Perception

Potential Gain* in Value per Bit

Validity of Perception Model

High

Low
Presentation of Knowledge

Summary Presentation

Decision-Maker

Background and Amplifying Information
"We'll ask you one more time, stranger—if you're really a cowboy from the Rio Grande, then why ain't your legs bowed or your cheeks tan?"
Building Understanding from Knowledge

Review and Revision of the Context

- Context Model
- Perception of the Situation
- Knowledge and Assumptions

Multiple Alternatives (Hypotheses) Regarding the Current Situation

Correlation

Interpretation of the Perceived Situation

Directed Search for Information
Appreciation: A Higher Form of Reasoning

• Knowledge
  – Matching Available Information to Known Entities and Behaviors in the Real World

• Understanding
  – Matching the Knowledge With One or More Likely States Based on the Context of the Problem

• Appreciation
  – Interpreting the Currently Understood Situation and Desired End States to Determine Responses
Domains of Information Utility vs Overload

- Increasing $C^2$ Complexity
- Increasing Information Availability

- Information Inadequacy
- Knowledge Support
- Information Support
- Reasoning Support
- Information Overload
Available Aids Can be Embedded in Tactical Displays and Information Management

- **Knowledge**
  - Correlators
  - Multi-Hypothesis Trackers
  - Uncertainty Displays and Cues
  - Alerting and Reporting Agents

- **Understanding**
  - Multi-Hypothesis Trackers
  - Uncertainty Displays and Cues
  - Visualization
  - Alerting and Reporting Agents

- **Appreciation**
  - Case-Based and Constraint-Based Reasoning
  - Simulation
The New Challenge

• The Fog of War
  – Uncertainty
  – Ambiguity
  – Assumptions
  – Unknown Unknowns

• The Glare of War
  – Massive Inputs of Information
  – Mix of Relevant and Marginally Useful Information
  – Heterogeneous Forms of Information and Presentation
  – Hiding of Important Information

Too Much Information Can Be As Bad As Too Little. The Key Is In The Management And Presentation.