Shared Awareness in Modern Military Operations

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Outline

• Shared Awareness
  • Similarity vs. accuracy
  • Measurement

• Modern Military Operations
  • Command Intent and self-synchronization

• Research
  • PLATT experiment
  • Results
    • validation measurement instrument
    • Individual traits

• Conclusions and discussion
Shared Awareness

- **Social Psychology > social cognition + team communication > mental models > team mental models:**
  - Task- and teamrelated (stable)
  - Situation (flexible)

- **Similarity vs. accuracy**
  - Modern military operations
Mental Model Similarity

• Similarity and effective teams
  • Shared Situation Awareness (Endsley, 1995)

• Fostering mutual expectations
  • Coordination and predictions about behavior and needs of teammates
  • Implicit coordination
  • Example: Cross-training

• Empirical link is established/references:
  • Cooke, Salas, Cannon-Bowers, Stout (2000)
Mental Model Measurement

• **Methods**
  - Similarity ratings, surveys, paper-and-pencil tests
  - Interviews
  - Observations
  - Process tracing

• **Issues**
  - Cumbersome for respondents
  - Retrospective, evaluative

• **Similar knowledge principle simplistic**
  - Cannon-Bowers and Salas (1997); Klimoski and Mohammed (1994)
  - Complex tasks, heterogeneous teams
Team Knowledge Perspective

• **Compatible or complimentary knowledge**
  - Knowledge distribution

• **Advancements in measurement**
  - Computer-mediated tasks
  - Tasks that elicit complex team processes
  - Interdependent roles, use of information
  - Respondent-friendly
    - digital questionnaires
    - communications analysis
    - team process tracing
SA and Modern Military Operations

- **Modern Military Ops**
  - New environment (complexity, dynamic)
  - Heterogeneous teams (crisis-response operations)
  - Communication (distributed teams)

- **Information sharing in modern military operations**
  - Command intent
  - Mission command, delegation of authority

- **Synchronization of team effort**
  - Implicit coordination
  - “Knowing what to do in the light of the overall goal”
Self-Synchronization

- **Concept**
  - Cognitive processes
  - Behavior
  - Team effectiveness

- **Dimensions**
  - Horizontal
    - Coordination with other teams on the same level
  - Vertical
    - Translation of overall objectives to the present situation
  - Response to changes
    - Ability to adapt to changes
  - Initiative taking
    - Own initiatives and those of team members and other entities
Self-Synchronization

- **Measurement**
  - 20-item questionnaire

<table>
<thead>
<tr>
<th>Items</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td>“The roles and responsibilities of other entities were clear to me”</td>
</tr>
<tr>
<td>Vertical</td>
<td>“I knew what I had to do, even when I had no instructions from my superior”</td>
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<tr>
<td>Changes</td>
<td>“The consequences of incidents were clear to me”</td>
</tr>
<tr>
<td>Initiatives</td>
<td>“I felt uncomfortable when others came up with ideas”</td>
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</tbody>
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- **Individual traits**
  - ICCRTS 2006
  - Personality
    - Neuroticism, extraversion, openness to experience, agreeableness, conscientiousness
  - Need for Cognition
    - Order, predictability, decisiveness, ambiguity, closed mindedness
Research

• **Goals:**
  - Validation of instrument
  - Individual traits
  - Model testing

• **Planning task for teams (PLATT)**
  - Interdependence
  - Distribution of knowledge
  - Roles and responsibilities

*Figure 1: Theoretical model*
PLATT

- 35 min., three-person (S2, S3, S4)
- Distributed work environment, shared projection
- Dynamic team planning task
  - Evacuation planning
- Effective communication
- Incidents

Figure 2: Planning Task for Teams
Procedure

• **Procedure:**
  • Questionnaires
  • Video-instruction
  • Training, mini-case
  • Break
  • PLATT task
  • Debriefing

• **Measurement SA**
  • “What do you think is the best way to Popintsii?”
  • Mental model similarity AND accuracy

*Figure 2: Planning Task for Teams*
Method

• Scale analysis
  • Explorative FA (varimax)
  • Inter-item reliability

• Individual traits
  • Regression analysis (stepwise)

• Preliminary results
  • … SA and team performance not yet considered
Results Scale Analysis

- **Factor-analysis (varimax)**
  - four factors with an eigenvalue >1
  - Consistent with dimensions
  - SeSyvert

- **Internal consistency is high**
  - Cronbach’s alpha is .898

- **Conclusions**
  - Self-synchronization is a multifactor concept
  - And can be measured with the instrument
  - Size of first factor

*Figure 3: Scree-plot*
Results Individual Traits (I)

- **Personality**
  - NEO-FFI (35 teams, N = 105)

- **Horizontal dimension**
  - No relationship

- **Vertical relationship**
  - $R^2 = 0.075$, $p < .01$

$$N \rightarrow -.274 \rightarrow SeSy_{vert}$$
**Results Individual Traits (II)**

- **Response to change**
  - $R^2 = .092$, $p < .05$

- **Initiative taking**
  - $R^2 = 0.037$, $p < .05$

\[ N \xrightarrow{-.220} SeSy_{rchange} \]

\[ O \xrightarrow{.215} SeSy_{rchange} \]

\[ N \xrightarrow{-.193} SeSy_{ini} \]
Results Individual Traits (III)

- **Need for Closure**
  - NFC-scale, 35 teams (N = 105)

- **Horizontal dimension**
  - No relationship

- **Vertical dimension**
  - \( R^2 = 0.086, p < .01 \)

\[
\begin{align*}
D & \rightarrow -0.251 \rightarrow \text{SeSy}_{\text{vert}} \\
A & \rightarrow 0.200 
\end{align*}
\]
Results Individual Traits (IV)

• **Response to change**
  • $R^2 = 0.081, p < .01$

A  \[.285\]  \rightarrow  \text{SeSy}_{rch}

• **Initiative taking dimension**
  • No relationship
Conclusions

• Measurement instrument for self-synchronization
  - 1st validation, work in progress

• Individual traits
  - Personality : neuroticism, openness to experience
  - Need for Cognition : decisiveness, ambiguity, closed mindedness

• To do list
  - SA and team performance measures
    - Ratio similarity/accuracy
  - Self-synchronization cognition – behavior relationship
    - Qualitative data analysis, process tracing
  - Model testing
Autumn 2007

- Publication results Spring

- Experiment Netherlands Defense Academy
  - Cadets
  - Leadership training
  - Command Intent (information sharing)
  - Adjusted scale
Questions?

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