

Shared Awareness in Modern Military Operations



Presentation 12th ICCRTS

June 20, 2007 in Newport, RI

B. J. A. van Bezooijen

TNO, Netherlands Defense Academy, Tilburg University

P. J. M. D. Essens

TNO Defense, Security, and Safety



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)
 - Cooke, Salas, Kiekel, Bowers, and Cannon-Bowers (2003)

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
 - Cooke, Salas, Cannon-Bowers, and Stout (2000)
- **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 others 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

Items	Examples
• Horizontal	“The roles and responsibilities of other entities were clear to me”
• Vertical	“I knew what I had to do, even when I had no instructions from my superior”
• Changes	“The consequences of incidents were clear to me”
• Initiatives	“I felt uncomfortable when others came up with ideas”

- **Individual traits**

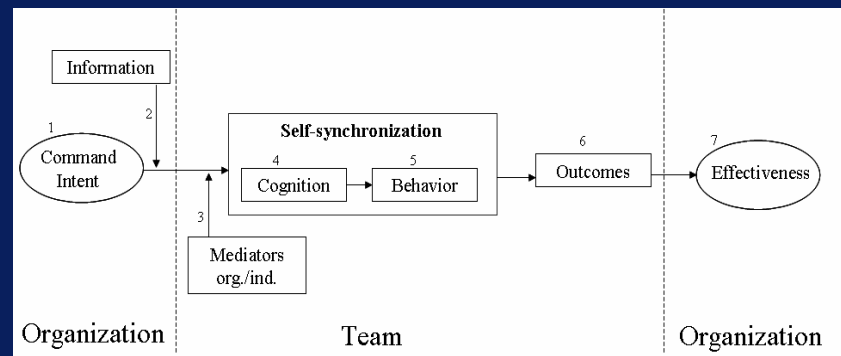
- ICCRTS 2006
- Personality
 - Neuroticism, extraversion, openness to experience, agreeableness, conscientiousness
- Need for Cognition
 - Order, predictability, decisiveness, ambiguity, closed mindedness

Research

- **Goals:**

- Validation of instrument
- Individual traits
- Model testing

Figure 1: Theoretical model



- **Planning task for teams (PLATT)**

- Interdependence
- Distribution of knowledge
- Roles and responsibilities

PLATT

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

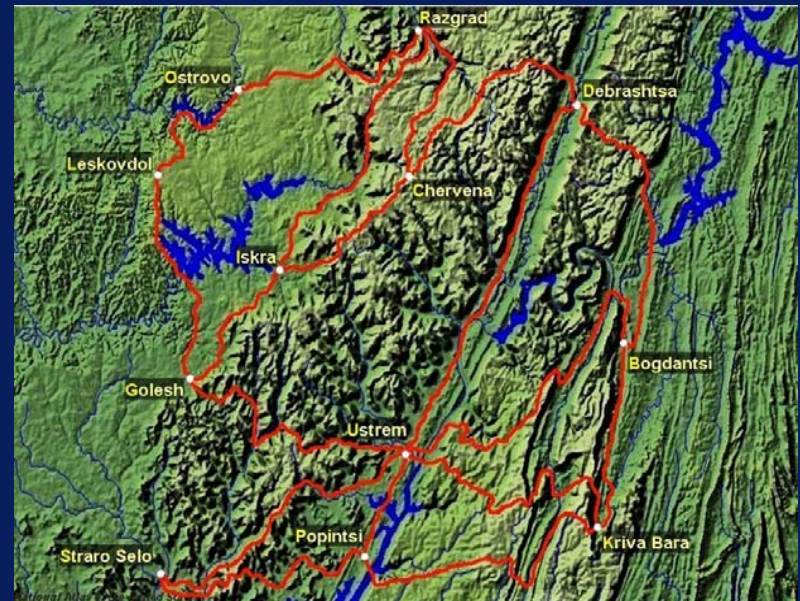


Figure 2: Planning Task for Teams

Procedure

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

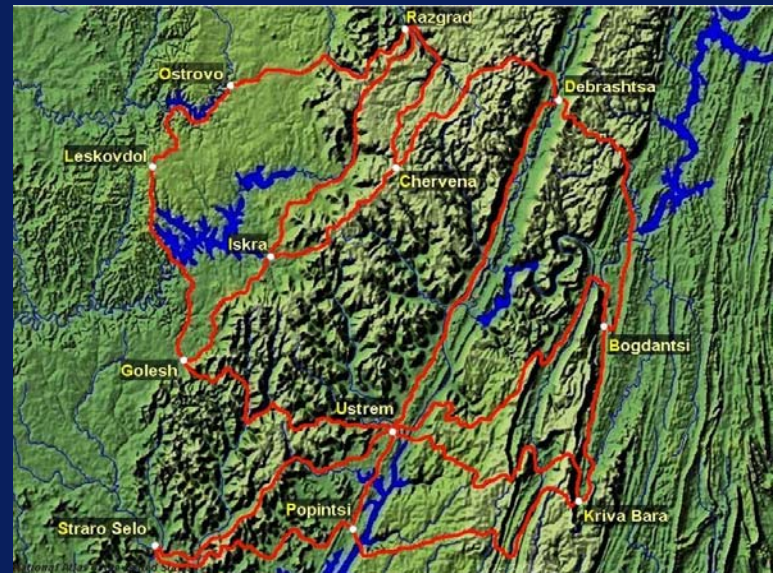


Figure 2: Planning Task for Teams

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

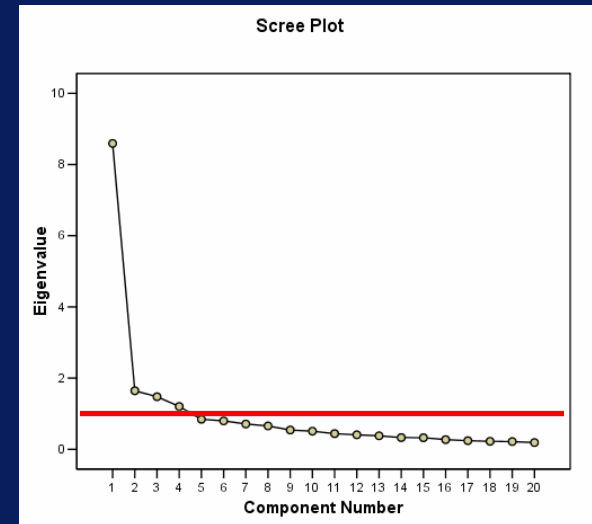
Method

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



Results Individual Traits (II)

- **Response to change**

- $R^2 = .092, p < .05$



- **Initiative taking**

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



Results Individual Traits (III)

- **Need for Closure**
 - NFC-scale, 35 teams ($N = 105$)
- **Horizontal dimension**
 - No relationship
- **Vertical dimension**
 - $R^2 = 0.086$, $p < .01$



Results Individual Traits (IV)

- **Response to change**

- $R^2 = 0.081, p < .01$



- **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?

E-mail addresses:
bart.vanbezooijen@tno.nl