Team Performance and Training

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1. Teamwork in multi-person systems: a review and analysis (C. Paris; E. Salas; J.A. Cannon-Bowers)

2. The potential for social contextual and group biases in team decision-making (P. Jones; P. Roelofsma)
Teamwork in multi-person systems: a review and analysis

Ergonomics (43:8) 1052-1075

- Introduction
- Theoretical overview
- Measuring team performance
- Enhancing teamwork
- Conclusions
Introduction

What distinguishes teams from groups?

- Multiple sources of information
- Task interdependencies
- Coordination among members
- Common and valued goals
- Specialized member roles
- Task-relevant knowledge
- Intensive communication
- Adaptive strategies in response to change
Theoretical Overview

- Much research into teams is result of high-profile team failures (e.g., aircraft, military accidents)
- Authors identify 3 primary teamwork dimensions: KSA
  - **Knowledge (cognitions):** E.g., shared task models, team mission, task sequencing, team role interaction patterns.
  - **Skills (behaviors):** E.g., shared SA, mutual performance monitoring, communication, decision-making, conflict resolution.
  - **Attitudes:** E.g., motivation, shared vision, team cohesion, mutual trust.
- Importance of team mental model
  - Reflects interrelationships between team objectives, individual roles, and relationships among individuals.
- Have enough theories! Need better (validated) models of team performance.
**Team Performance Measures**

- **Challenge:** differentiate teamwork behaviors from individual behaviors → need team task analysis
- **Criteria for performance metrics**
  - Identify processes linked to key team outcomes
  - Distinguish individual / team level deficiencies
  - Describe interactions among team members
  - Assess specific performance feedback
  - Produce reliable evaluations
  - Support operational use.
- **Categories of team skill assessment**
  - Team vs. individual measures
  - Outcome (what happened) vs. process (how) measures
# Team Performance Measures

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<thead>
<tr>
<th>Process</th>
<th>Individual</th>
<th>Team</th>
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<tr>
<td></td>
<td>• Cognitive processes</td>
<td>• Information exchange</td>
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<td>• Position-specific task skills</td>
<td>• Communication</td>
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<td>Outcome</td>
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<td>• Aggregate latency and accuracy</td>
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## Discussion

- Mission effectiveness
- Aggregate latency and accuracy
- Information exchange
- Communication
- Supporting behavior
- Team leadership

**Individual**

- Cognitive processes
- Position-specific task skills
- Accuracy
- Latency

**Team**

- Team leadership
- Mission effectiveness
- Aggregate latency and accuracy
- Communication
- Supporting behavior
- Information exchange
Enhancing Teamwork

1. Team Selection
2. Task Design
3. Team Training
Enhancing Teamwork: Team Selection

- Individual traits (vary with team objectives)
  - KSA’s + personality traits that facilitate team interactions (e.g., initiative, risk & stress tolerance, adaptability)
- Team size (determined by tasks; larger → less effective)
- Team composition
  - Member attributes (age, gender, race, aptitude, etc.)
  - Distribution of attributes within team
- Team stability (i.e., turnover)
- Select or train? (Select personality traits, train KSA’s)
- Predicting team productivity
  - Need to establish mix of individual KSA’s
Enhancing Teamwork: Task Design

- Workload and time constraints
- Team architecture / structure variables
  - **Member proximity**: both physical and psychological
  - **Communication modality** (e.g., interacting via computer limits social cues and discussion, but increases participation → better coordination)
  - **Allocation of functions, e.g.**:
    - Serial structure: performance determined by weakest link
    - Non-hierarchical teams communicate & perform better than hierarchical
- Technology and automation
  - Automated technologies put team tasks at risk
  - Replaces physical activity with cognitive activity, workload same
  - **SA ↓**: monitoring demands, over-reliance on / lack trust in automation
  + Interactive training effective if link task req’ts to team training needs
  + Decision support systems can expedite team decision making
Enhancing Teamwork: Team Training

- Automates controlled behavioral processes
- Makes team more resilient to stress
- Should combine individual and team skills into one training design
- Can’t teach individual skills alone and expect members to magically become a successful team!

Skills to be taught should:
- be proven to impact team success
- require more than simple repetition for development
- be essential for survival (though used infrequently)
Enhancing Teamwork: Team Training (cont.)

- **Train part vs. whole**
  - Part: learn task components first, then gradually integrate to master entire task
  - Whole: members exposed to entire task throughout training

- **Train individuals vs. team**
  - Individual / part; individual / whole; team / part; team / whole
    ... emphasis depends on task complexity and organization

- **Performance feedback (from team leaders)**
  - Consider amount, timeliness, focus of feedback to members
  - Importance with # interdependencies among members
Enhancing Teamwork: Team Training (cont.)

Key team skills to be trained

- Ability to learn continuously → stimulate team growth
- Shared SA (individual mental models → team mental model)
- Shared decision-making in naturalistic settings (NDM)
  - Automatic, cognitive NDM (e.g., tactical decision-making teams)
  - Used when resource- and data-limited
  - If situation similar to previous experience, pattern recognized and course of action immediate … without considering alternatives
  - Notable team failures resulting from faulty NDM (e.g., Vincennes)
  - NDM skills to be trained: recognizing patterns, making fine perceptual discriminations, detecting anomalies, mentally simulating past & future states, improvising, adapting to events
Conclusions

- As scope and complexity of task demands exceed capability of individuals, teams are emerging to meet growing requirements.
- Need to understand and enhance human performance in team settings.
- Important aspects of creating successful teams:
  - Team selection
  - Task design
  - Team training
- Need to improve team task analysis techniques.
- Goal: transform teams of experts → expert teams.
The potential for social contextual and group biases in team decision-making

Paul E. Jones; Peter H.M.P. Roelofsma (2001) Ergonomics (43:8) 1129-1152

- Introduction
- Teams vs. groups
- Team bias and error
- Social contextual and group decision biases in teams
- Conclusions
Introduction

- Focus of this paper: decision-making biases within teams
  - **Biases** investigated: social inference biases and traditional group biases
  - **Teams** of interest: Command & control (e.g., military units, firefighting teams, emergency medical teams, cockpit crews)
Groups vs. Teams

Groups
- More homogeneous, interchangeable members (e.g., jury)
- Decision-making constitutes task itself
- Need: consensus

Teams
- More differentiated, interdependent members (e.g., medical team)
- Decision-making embedded in broader ongoing task
- Need: coordination
- Command & Control Team (focus of this paper)
  - **Members** are specialists and interdependent
  - **Task** is complex and decision-rich
  - **Goals** are central to organization
  - Confronted with ambiguous information from multiple sources
  - Operate in highly dynamic environments with high stress
  - Must be well coordinated, adaptable, and resourceful

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Team Bias and Error

Team bias closely related to team error
- **Error**: team’s decisions fail to achieve intended outcome
- **Bias**: team’s decisions deviates from what normative decision-making models imply
- Team bias may be source of team error

Sources of team error
- **Cognitive**: arise from people’s limited information processing capacity (e.g., probability judgment errors)
- **Organizational**: result from higher-level decisions
- **Social**: result from social influence (e.g., peer pressure) and social projection (tendency to assume others hold same position / opinion / belief as self)
Social contextual and group decision biases in teams

- **Social Projection**
  - False consensus effect (FCE)

- **Social Influence**
  - Groupthink
  - Group polarization
  - Group escalation of commitment
False Consensus Effect

- **Description of FCE**
  - Tendency to see one’s own behavior as typical.

- **Classic FCE demonstration**
  - Students were asked to wear “Repent” sign around campus for 30 min (!!!)
  - Those who agreed estimated that 63.5% of fellow students would also agree
  - Those who refused estimated that 76.7% of others would refuse (i.e., 23.3% would agree)
  - $FCE = 63.5\% - 23.3\% = 40.2\%$

- **Note mathematical basis for FCE (Bayes’ Rule)**
  - Thus, only $FCE > 33\%$ may provide evidence of bias
Psychological mechanisms of FCE

Cognitive Perspectives

- **Selective exposure and cognitive availability**: people tend to associate with similar others; thus, judgments based on biased self-selected sample
- **Salience**: focus of attention tends to be on one’s preferred position or position about which one feels certain
- **Differential construal or resolution of ambiguity**: many social events poorly defined, open to multiple interpretations
- **Causal attribution**: perceived reason for one’s position central to FCE occurring (limited empirical support for this)

Motivational Perspective

- Assuming similarity with others may bolster perceived social support, maintain self-esteem, reduce social tensions
**FCE (continued)**

- **Conditions contributing to FCE**
  - Selectively exposed to similar others
  - Decisions attributed to situation, not disposition
  - Focused on one position, no alternatives considered
  - Highly certain that own position correct
  - Issue very important or involves threat to self

- **Relevance to C&C teams**
  - Consider various target groups: own team members vs. competing team or group
  - FCE may be consequence of having insufficient or no information about target group
  - Cost of gathering information > cost of estimating information
  - Commander / leader might make invalid assumptions about own team members’ anticipated behavior
  - Need more research on FCE within C&C teams
**Groupthink**

- **Description**
  - Tendency for groups to produce poorly reasoned decisions, due to a perceived need for unanimity that results in suppression of dissenting views.

- **Problems with theory**
  - Designed to address major decisions made by highly cohesive groups (e.g., political, military)
  - Critics suggest groupthink concept is incomplete
  - Research has only tested parts of theory, mixed results

- **Psychological mechanisms**
  - Significantly overlapping mental models $\rightarrow$ groupthink
  - But lack of shared mental models causes other problems
**Groupthink (cont.)**

- **Conditions contributing to groupthink**
  - **Highly cohesive groups**
    - Members know each other well and like each other
    - Members have similar norms, attitudes, shared experiences
    - Small team size, close physical proximity of members
    - Group membership provides heightened status for members
    - Rewards for team performance
    - Opposing theory: cohesive, familiar groups might exhibit fewer groupthink tendencies because members are secure enough to challenge one another, but can reach agreement
  - **Strong directive leadership**
  - **Time pressure**
  - **Important and complex decisions to be made**
Groupthink (cont.)

- Relevance to C&C teams
  - No known research testing validity of groupthink at team level (questionable, since empirical evidence mixed for groups)
  - However, many factors contributing to group cohesion are consistent with C&C teams
  - Hierarchical and disciplined environment of many C&C teams → unwillingness to rock the boat → potential for groupthink
Group Polarization

♦ **Description**
  - Position held by majority of group members intensifies with discussion.
  - Special cases: risky shift, cautious shift

♦ **Psychological mechanisms**
  - Social comparison theory
    - Person compares self with others in group, tries to present self as better than average (i.e., similar to group but better).
    - Each member of group doing this → group shifts in direction of greater perceived social value.
  - Persuasive arguments theory
    - Polarization is function of # and persuasiveness of arguments.
    - Individuals more exposed to arguments favoring majority view.
Polarization (cont.)

- **Conditions contributing to group polarization**
  - Group discussion of important decisions, when initial views of individuals are similar.
  - Research sparse re: relationship between magnitude of polarization and decision / group characteristics.

- **Relevance to C&C teams**
  - Bias may be highly relevant during discussion-oriented activities of C&C teams, not so relevant for tactical or strategic planning issues.
  - Little research re: how time pressure, level of uncertainty, and incomplete information (common in C&C teams) affects tendency for group polarization.
Group Escalation of Commitment

Description
- Tendency for individuals to continue supporting a course of action, despite evidence that it is failing.
- Research to date focused on individuals, but groupthink and risky shift phenomena suggest groups escalate more than individuals. No known research on team escalation.

Psychological theories
- Cognitive dissonance or self-justification: individual wants previous behavior to look rational: “saving face”.
  - **Group**: self justification less important (individuals feel less responsible for group actions than own actions).
  - **Team**: interdependence → escalation plausible.
- Prospect Theory: risk-taking depends on whether perceived choice is for certain / uncertain gains (positively framed) or certain / uncertain losses (negatively framed)
**Group Escalation (cont.)**

- **Conditions contributing to bias**
  - Same group making current decision as initial (failed) decision
  - Can show initial failure beyond control of decision-makers
  - Level of disappointment after initial failure
  - Relationship perceived between two decisions
  - Highly cohesive group making decision

- **Relevance to C&C teams**
  - Members personally responsible for specific decisions
  - Strong leadership
  - Escalating commitment seen as desirable
  - More relevant to discussion activities than task execution
  - Special case: competitive situation (e.g., price wars)
Conclusions

- Tricky distinction between teams and groups
- Distinction between biases emanating from:
  - *Social projection* (assume similarity with others; non-discussion based)
    - False Consensus Effect
  - *Social-influential* (group biases; discussion based)
    - Groupthink
    - Group Polarization
    - Group Escalation of Commitment
- Relevance to Command & Control Teams
  - *Biases promoted by important / novel decisions, high levels of uncertainty, time pressure, team cohesion (typical in C&C)*
- Most research on decision biases focuses on individuals; more needed for team biases

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Discussion Topics

- How is team performance relevant to your own research?
- How do individual team members contribute to a shared team mental model and team SA?
- How can existing task analysis techniques (e.g., CTA) be adapted to provide a useful tool for team task analysis?
- Do some biases (e.g., false consensus, etc.) have more potential to impact certain types of team decision-making than others?
Related Articles

- Complete table of contents for Ergonomics (43:8), August 2000
- Other articles of interest