Team Performance and Training

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Articles

- **Ergonomics Special Issue on Teams: Volume 43, No. 8 (Aug.'00)**
  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

C.R. Paris; E. Salas; J.A. Cannon-Bowers (2001)
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

	Individual	Team
Process	• Cognitive processes • Position-specific task skills	• Information exchange • Communication • Supporting behavior • Team leadership
Outcome	• Accuracy • Latency	• Mission effectiveness • Aggregate latency and accuracy

Enhancing Teamwork

1. Team Selection
2. Task Design
3. Team Training

Enhancing Teamwork:
❶ 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:
❷ 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:
❸ 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:
❸ 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:
❸ 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, fire-fighting 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***

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*

FCE (continued)

- **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 → 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

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