Team Science In Multi-Team Systems

Marshall Scott Poole
University of Illinois Urbana-Champaign
Multi-Team Systems

- Concept articulated by Mathieu, Marks, & Zaccaro
- Networks of Teams

**Definition:**

- Two or more teams that interface directly and interdependently in response to environmental contingencies toward the accomplishment of collective goals
- All teams in the MTS, while pursuing different proximal goals share at least one common distal goal
- Each team exhibits input, process, and outcome interdependencies with at least one other team in the system

Multiteam System
for handling severely injured accident victims
Interdependence in MTSs

- Functional Interdependence: Entities have mutual reliance, determination, influence, and shared vested interests in processes they use to accomplish work activities

  - **Input interdependence**: Extent to which teams share inputs such as people, facilities, equipment, and information; used in the attainment of more proximal goals
  
  - **Outcome interdependence**: Extent to which outcomes depend on the performance of other teams
  
  - **Process interdependence**: The amount of interteam interaction required for goal accomplishment

    - pooled, sequential, reciprocal, intensive interdependence
Goal Hierarchies in MTSs

Hierarchies of goals:

- Collective goals
- Sub-system of teams goals
- Team goals

Performance episodes

- Multitasking
MTS Goal Hierarchy

Goal$_3$: Patient survival

Goal$_2$: Repair patient

Goal$_1$: Extract & stabilize Injured motorist

Team 1
Fire fighters

Team 2
Emergency medical technicians

Team 3
Surgical team

Team 4
Recovery team
To What Extent Does the MTS Model Extend to Scientific Teams?

- MTS Articulated Primarily for "Action Teams"
  - High Role Differentiation
  - High Integration Needs
  - Brief Performance Events
  - Recognition Primed Decision-Making
  - Clear Goals

- Scientific Teams are "Project/Development Teams"
  - High Role Differentiation
  - Lower Integration Needs
  - Extended Performance
  - Reflective Decision-Making and Problem-Solving
  - Goals More Ambiguous

To What Extent Does the MTS Model Extend to Scientific Teams?

Similarities:
- Goal Hierarchies
- Multi-Tasking
- Interdependencies

Other Differences:
- Fluid Team Arrangements
- Less Clear Boundaries
- Dynamic Goals
An Example: The Virtual Worlds Observatory Project

- Objective is to study behavior in virtual worlds
- Data downloads from EverQuest II and Second Life + Surveys + Experiments

PIs at 4 Institutions:
- Northwestern (Contractor)
- USC (Williams)
- Minnesota (Srivastava)
- UIUC (Poole)

Teams of graduate students and postdocs at each institution plus connections to scholars at U of Michigan, U of Chicago, and Indiana University
An Example: The Virtual Worlds Observatory Project

- **Four Funded Projects:**
  - NSF: General Studies of Virtual Worlds
  - ARI: Studies of Networks and Teamwork
  - AFRL: Studies of how RW characteristics can be predicted using VW characteristics/behavior
  - BBN: Experiments in VW to test how dynamics in configurations of communication, information, and social networks affect performance and outcomes for teams

- **In practice:** One big project to explore and understand VWs where each of the four projects specifies subgoals and individual investigator and grad student interests specifies sub-sub-goals
An Example: The Virtual Worlds Observatory Project

- Teams form around individual projects, e.g.:
  - Economics of VWs
  - Trust in VWs
  - Gold Farming
  - Gender
  - Teamwork

- Project Teams typically include members from several of the universities

- Project Teams work virtually and the entire project comes together 2-3 times a year at “All Hands” meetings

- PI Team Provides Coordination/ General Strategic Direction
An Example: The Virtual Worlds Observatory Project

- Project Teams have overlapping memberships, which leads to knowledge transfer and new ideas
- Logical interdependencies are not realized in practice
- Turnover will start to affect teams in one-two years
- Individual and Team/MTS goal alignment issues
Factors Shaping Effectiveness of MTSs

- Shared Mental Models
  - Task
  - Team
  - Team Interaction

- Leadership
  - Links MTS with other units and environment
  - Links Teams within the MTS to each other
  - Establishes Strategic and Operational Directions for Teams and MTS
  - Facilitates within and between team operations to foster goal accomplishment
Factors Shaping Effectiveness of MTSs

- Information Technology
  - Within Teams
  - Between/Among Teams
  - Applications and Tools
  - Feedback (on Team Effectiveness)

- Reward Systems: Should include components for:
  - Individual performance
  - Team performance
  - MTS performance
Additional Factors Shaping Scientific MTSs?