Innovation in Scientific Multiteam Systems: Confluent & Countervailing Forces

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Acknowledgment: This research was made possible by support from the National Science Foundation, OCI-1056217 & SBE-1063901.


Human
Genome
Project
nature
the human genome
Science
THE HUMAN GENOME
GENOME RESEARCH
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PNAS
JMB
DNA the Molecule of Life
chromosomes
cell
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gene
DNA


Human
Science
GENOME RESEARCH

PATH

Organization:

- The Program for Appropriate Technology in Health (PATH)

Goal:

- Global health; Vaccine development and distribution

Teams:

- **University research labs** develop a vaccine that is safe for human testing
- **Pilot clinics** test trial vaccines with adult populations
- **Medical units** test trial vaccines on children in the community
- **Statistical groups** closely monitor the testing
- **Pharmaceutical companies** work with the PATH team to develop manufacturing protocol
- **Community public and private sectors** help to facilitate implementation of new vaccine

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Non-Science Teams

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PATH

University Labs

Vaccine Testing

Local Distribution

Vaccine Production

Monitoring

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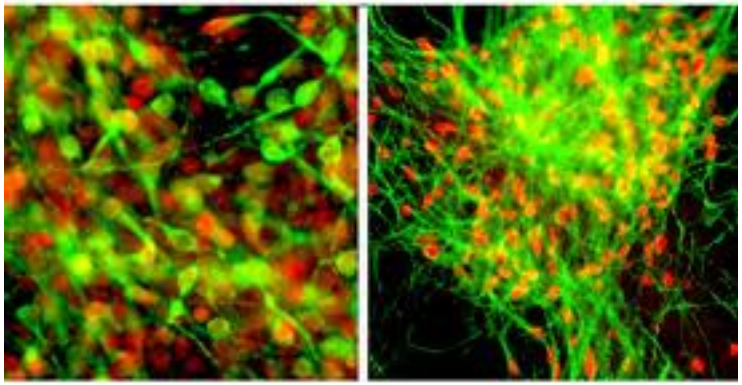
Team Science

"…the increased focus on collaborative research projects that create a team of scientists to address some complex phenomenon (Fiore, 2008, p. 254)"



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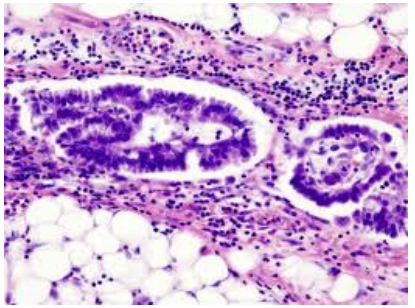
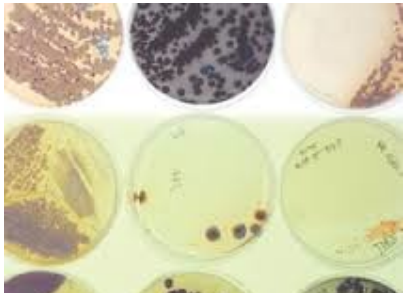
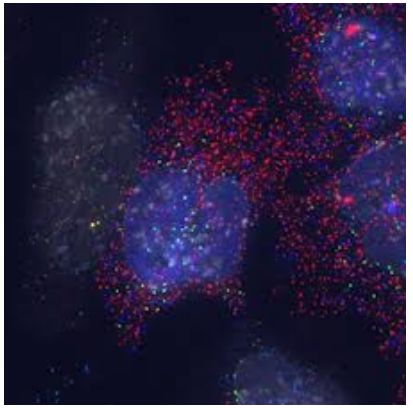
Why Team Science?

"This increasing commitment to transdisciplinary collaboration in science and training stems from the inherent complexity of contemporary public health, environmental, political, and policy challenges (e.g., cancer, heart disease, diabetes, AIDS, global warming, inter-group conflict, terrorism), and the realization that an integration of multiple disciplinary perspectives is required to better understand and ameliorate these problems (Stokols et al., 2008, p. S96)."







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What are *teams* and what makes them *work*?

The Science of Teams

What Is a Team?

A team can be defined as (a) two or more individuals[3] who (b) socially interact (face-to-face or, increasingly, virtually); (c) possess one or more common goals; (d) are brought together to perform organizationally relevant tasks; (e) exhibit interdependencies with respect to workflow, goals, and outcomes; (f) have different roles and responsibilities; and (g) are together embedded in an encompassing organizational system, with boundaries and linkages to the broader system context and task environment (Alderfer, 1977; Argote & McGrath, 1993; Hackman, 1992; Hollenbeck et al., 1995; Kozlowski & Bell, 2003; Kozlowski, Gully, McHugh, Salas, & Cannon-Bowers, 1996; Kozlowski et al., 1999; Salas, Dickinson, Converse, & Tannenbaum, 1992).

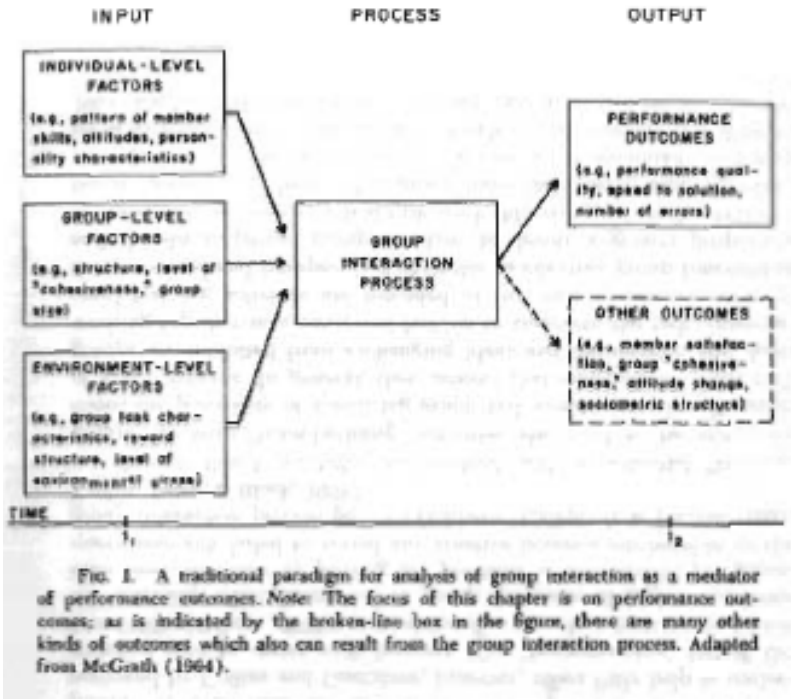

FIG. 1. A traditional paradigm for analysis of group interaction as a mediator of performance outcomes. *Note:* The focus of this chapter is on performance outcomes; as is indicated by the broken-line box in the figure, there are many other kinds of outcomes which also can result from the group interaction process. Adapted from McGrath (1964).

Kozlowski & Ilgen (2006)

Hackman & Morris (1975)

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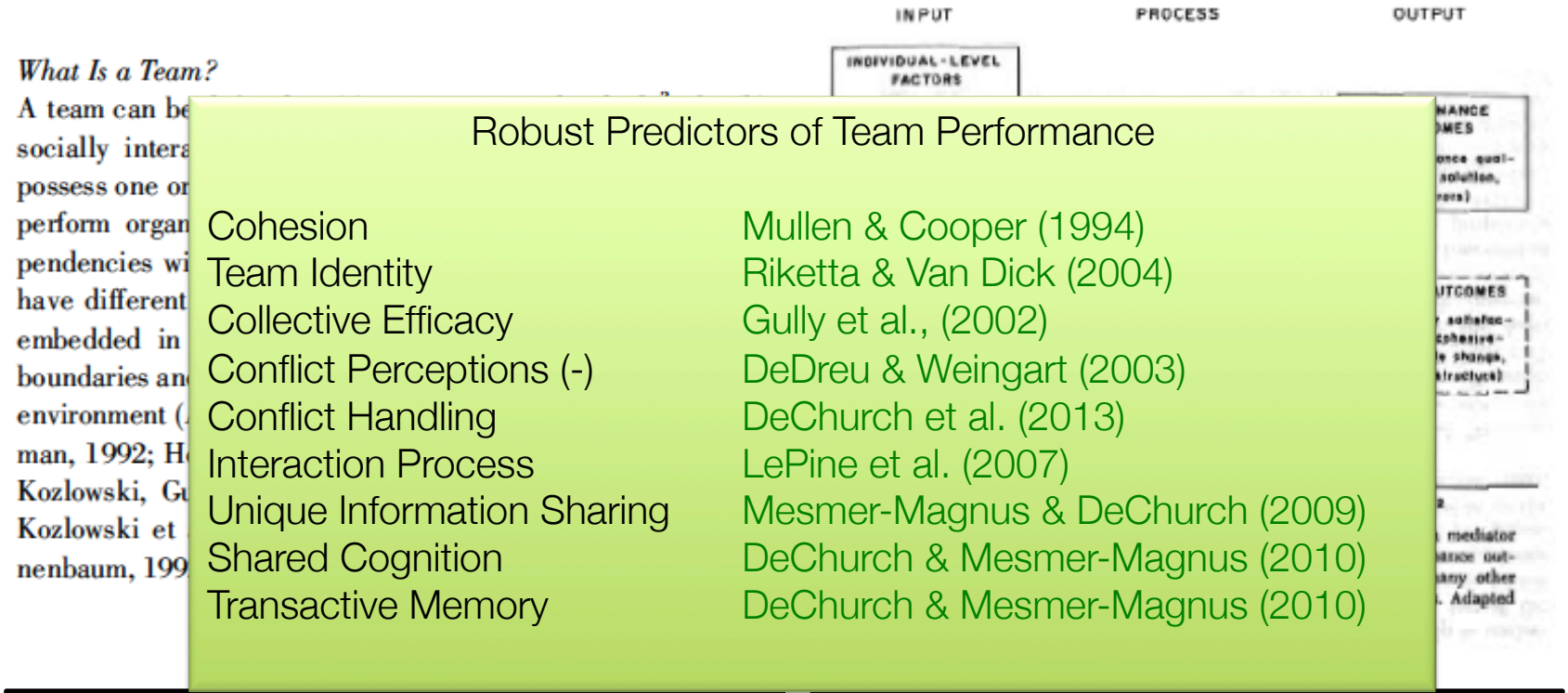

Robust Predictors of Team Performance

Cohesion	Mullen & Cooper (1994)
Team Identity	Riketta & Van Dick (2004)
Collective Efficacy	Gully et al., (2002)
Conflict Perceptions (-)	DeDreu & Weingart (2003)
Conflict Handling	DeChurch et al. (2013)
Interaction Process	LePine et al. (2007)
Unique Information Sharing	Mesmer-Magnus & DeChurch (2009)
Shared Cognition	DeChurch & Mesmer-Magnus (2010)
Transactive Memory	DeChurch & Mesmer-Magnus (2010)

Kozlowski & Ilgen (2006)

Hackman & Morris (1975)

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What are *multiteam systems* and what makes them *work*?

1992: 4). Building on the notion of a single team, MTSs are defined as: *two or more teams that interface directly and interdependently in response to environmental contingencies toward the accomplishment of collective goals. MTS boundaries are defined by virtue of the fact that all teams within the system, while pursuing different proximal goals, share at least one common distal goal; and in doing so exhibit input, process, and outcome interdependence with at least one other team in the system.* In

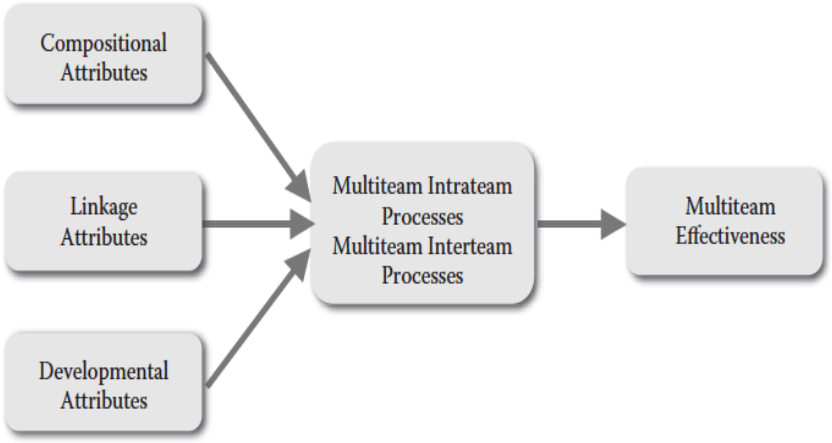

FIGURE 1.1
A model of multiteam system effectiveness.

Mathieu, Marks, & Zaccaro (2001)

Zaccaro, Marks, & DeChurch (2012)

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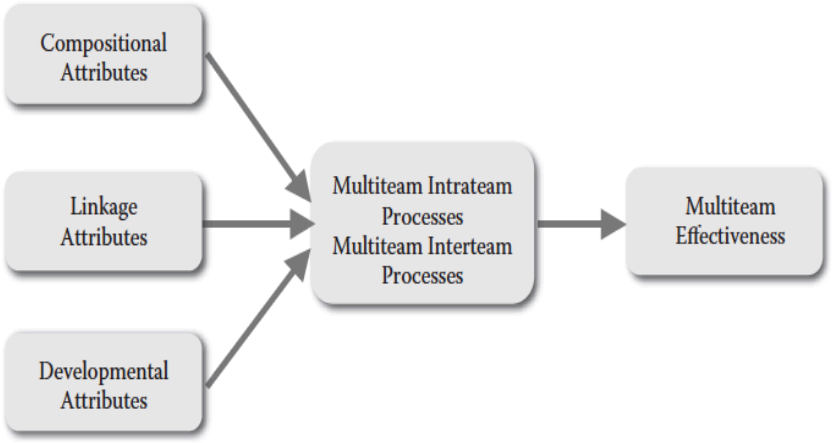

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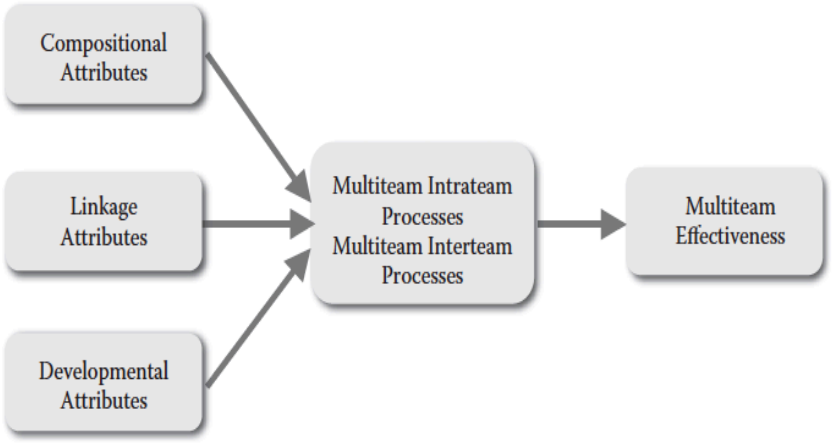

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Optimal Distinctiveness

"Optimal distinctiveness theory (Brewer, 1991) holds that individuals strive for an optimal balance between being considered as individuals with idiosyncratic attributes and being recognized as members of social groups. Thus people want to fit in and stand out at the same time, and this balance can best be achieved by belonging to smaller categories rather than to large inclusive groups. This should lead to a preference for the workgroup instead of the organization as a target for identification (Van Knippenberg & Van Schie, 2000). (Riketta & Van Dick, 2005, p. 493)"

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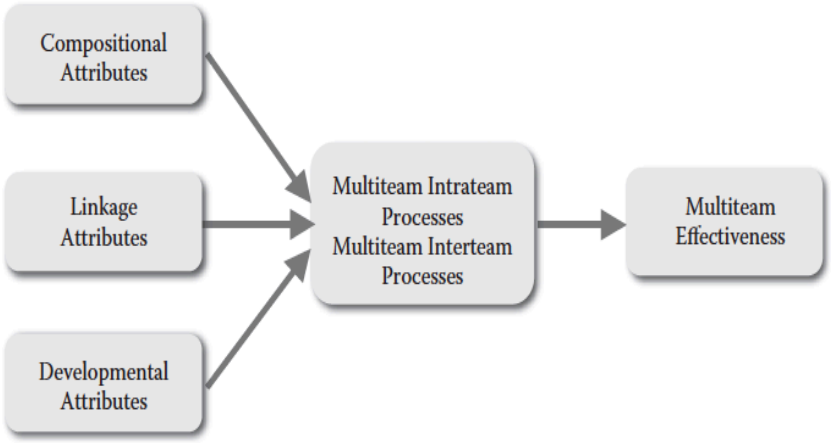

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Zaccaro, Marks, & DeChurch (2012)

Optimizing MTS Effectiveness:

Confluent Forces

Countervailing Forces

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Confluent Forces

"The popular definition of confluence is flowing together, and we use this definition to describe the multilevel forces that emerge at the team and between team levels of analysis and jointly determine the effectiveness of MTSs (DeChurch & Zaccaro, 2013)"

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Confluent Forces in Multiteam Systems

Inter-Team Action Process	4%[1] - Marks, DeChurch, Mathieu, Panzer, & Alonso (2005)
Inter-Team Transition Process	11%[1] – Marks et al. (2005)
Inter-Team Coordination	3-4%[2] - DeChurch & Marks (2006)
Inter-Team Coordination	20%[1,3] -Davison, Hollenbeck, Barnes, Sleesman, & Ilgen (2011)

[1]*Variance in MTS performance explained after controlling team level process*
[2]*Variance in MTS performance explained after controlling team level process & team performance*
[3]*Task required extensive problem solving*

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Implications of Confluence For Team Science:
Design interventions that connect teams


TBM

PRACTICE TOOLS TEAM SCIENCE

Charting a course for collaboration:
a multiteam perspective

Raquel Asencio, MS,[1] Dorothy R Carter, BS,[1] Leslie A DeChurch, Phd,[1] Stephen J Zaccaro, Phd,[2] Stephen M Fiore, Phd[3]

Multiteam Charters

Specify norms for interacting across teams

Lay out a priori expectations

Develop a leadership structure to link different teams

Implications

Practice: For maximal coordination and collaboration between-teams, managers of MTSs should create a multiteam charter that specifies between-team norms for communication and leadership processes.

Policy: Those who provide resources to MTSs such as funding agencies and policy makers should take a MTS perspective and make the development of a multiteam charter a priority for collectives of researchers and/or practitioners that fit a MTS structure.

Research: In order to further build upon the existing evidence base of this practical tool, future research should continue to evaluate the efficacy of the propositions laid out for multiteam charters.

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Implications of Confluence For Team Science:
Design interventions that connect teams

Multiteam Leadership

Leadership planning for between-team interaction

Leadership updating & relaying information about other teams to one another

Journal of Applied Psychology
2006, Vol. 91, No. 2, 311–329

Leadership in Multiteam Systems

Leslie A. DeChurch
Florida International University

Michelle A. Marks
George Mason University

This study examined 2 leader functions likely to be instrumental in synchronizing large systems of teams (i.e., multiteam systems [MTSs]). Leader strategizing and coordinating were manipulated through training, and effects on functional leadership, interteam coordination, and MTS performance were examined. Three hundred eighty-four undergraduate students participated in a laboratory simulation modeling a 3-team MTS performing an F-22 battle simulation task ($N = 64$ MTSs). Results indicate that both leader training manipulations improved functional leadership and interteam coordination and that functional leader behavior was positively related to MTS-level performance. Functional leadership mediated the effects of both types of training on interteam coordination, and interteam coordination fully mediated the effect of MTS leadership on MTS performance.

Keywords: teams, multiteam, leadership, coordination

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Countervailing Forces

"Countervailing forces are combinations of teamwork processes and properties that operate differently at different levels of analysis (e.g., team cohesion benefits team performance but compromises information sharing between teams).

A countervailing force occurs when a process or emergent state has both positive and negative consequences. (DeChurch & Zaccaro, 2013)"

	Local (Team) Optimization	**Global (MTS) Optimization**
Level of Origin of the Process or State	Consequences are beneficial locally beneficial but harmful globally	Consequences are harmful locally but beneficial globally
Manifests at the team level	Type I	Type II
Manifests at the MTS level	Type III	Type IV

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Cohesion

Countervailing Forces

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Conflict

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Decentralized Planning

Countervailing Forces

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Identity

Type IV Countervailance Example

MTS process that is harmful to teams but beneficial to the system

Bridging ties…

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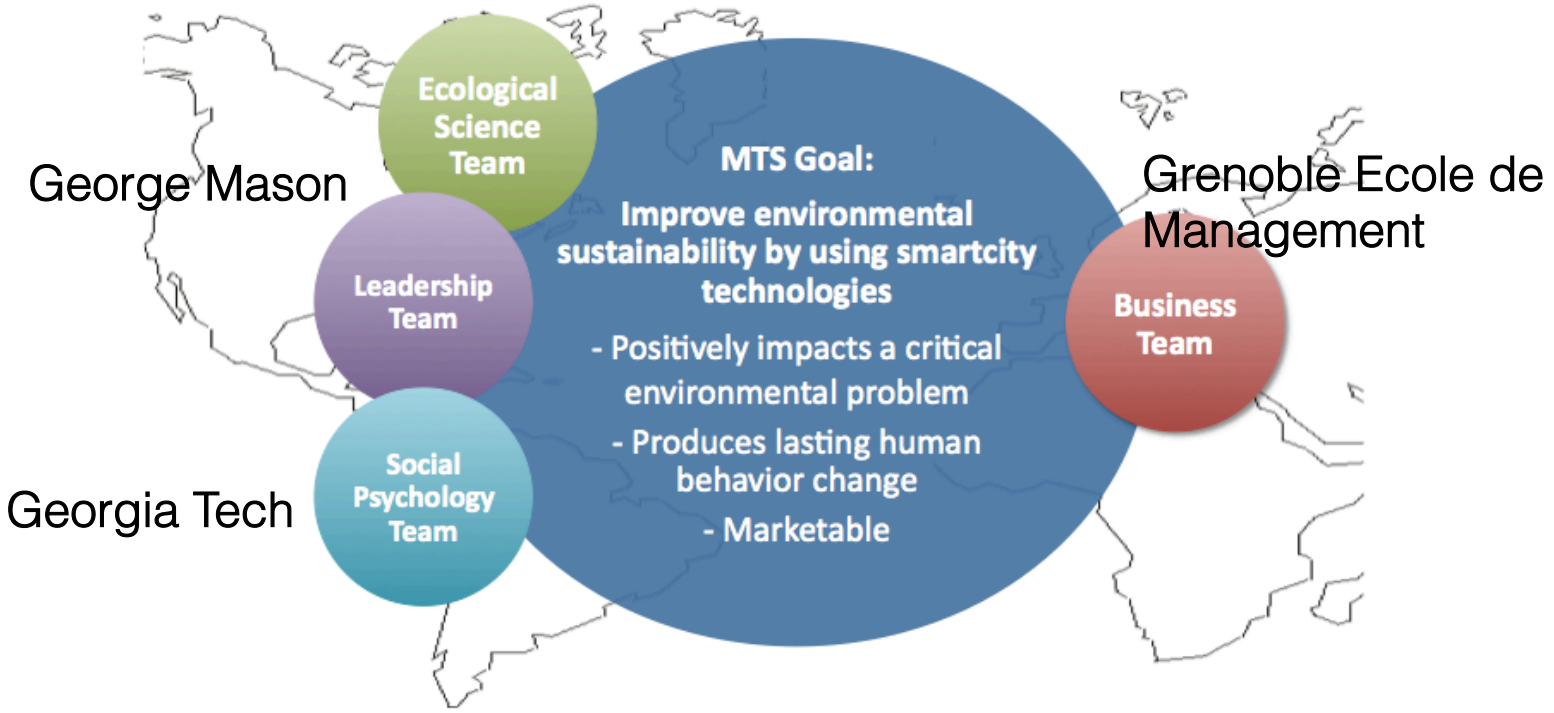
Social Identity in Cross-Functional Multiteam Systems

Asencio, Murase, DeChurch, Chollet, & Zaccaro (2013)

128 Science Teams working in 33 MTSs (2 Science & 2 Support Teams)
Ecology, Psychology, Business, Leadership
8-week interdisciplinary course project
Teams distributed across 3 Universities & 2 Countries



Social Identity in Cross-Functional Multiteam Systems

Asencio, Murase, DeChurch, Chollet, & Zaccaro (2013)

Impact of between-team bridging ties…?

Social Identity in Cross-Functional Multiteam Systems

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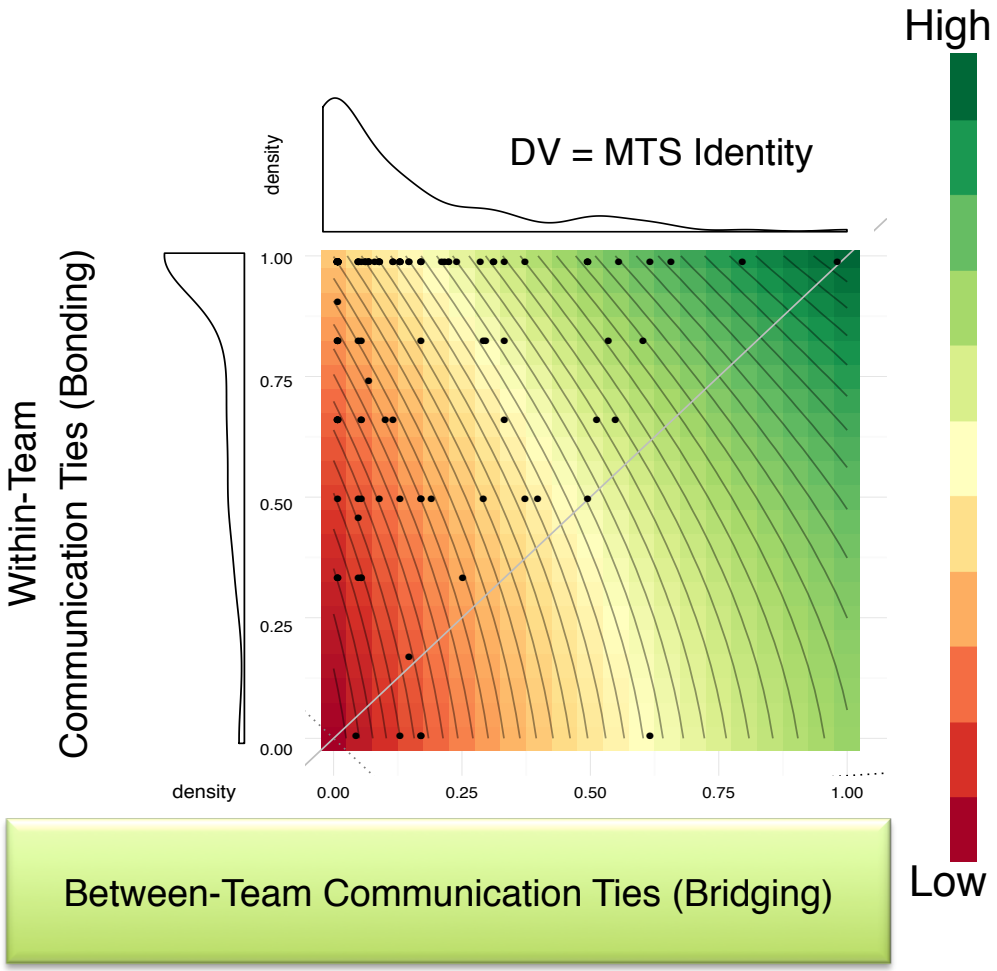
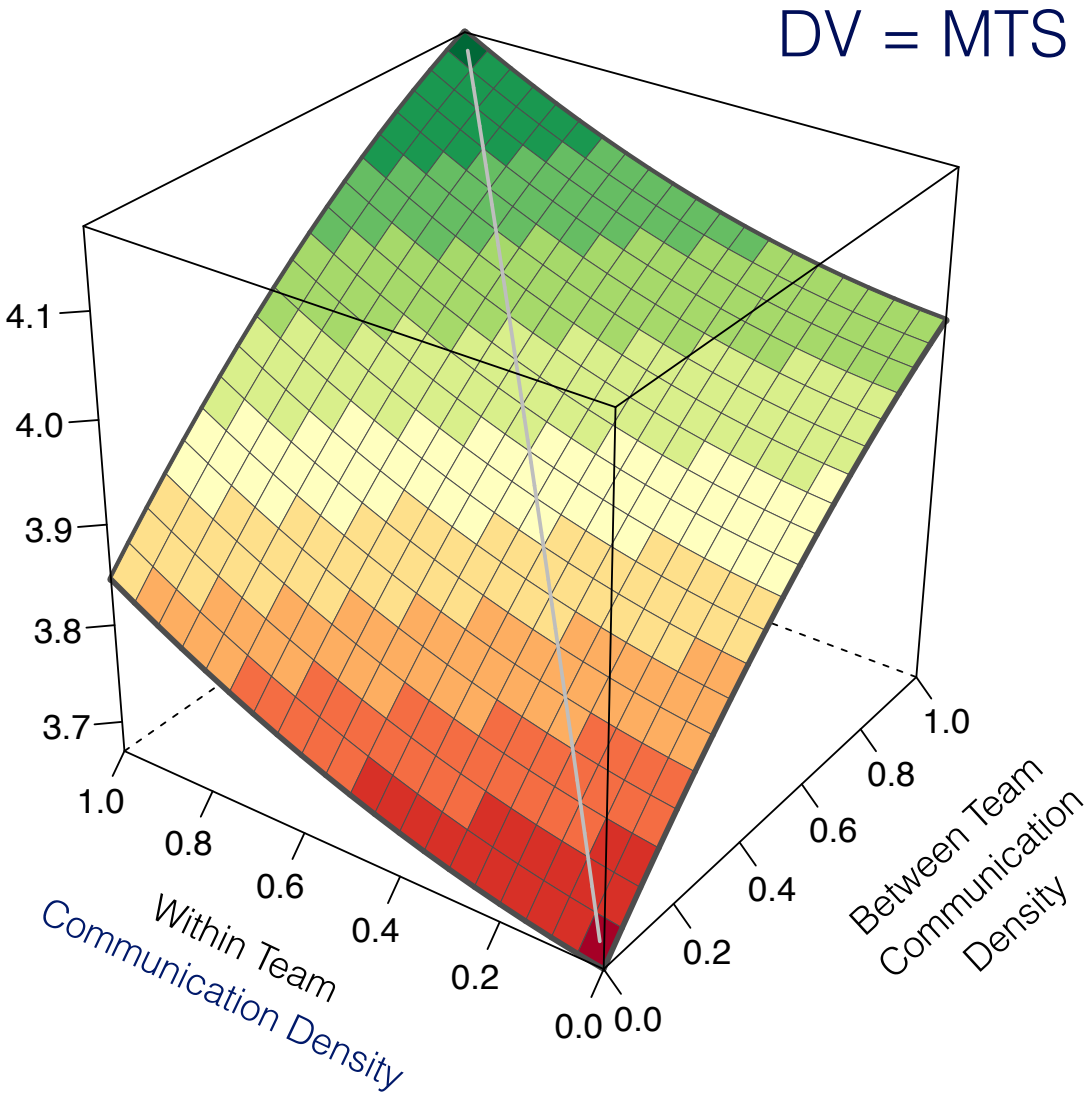


MTS optimization

Using communication ties (within & between teams) to optimize attachment to the MTS



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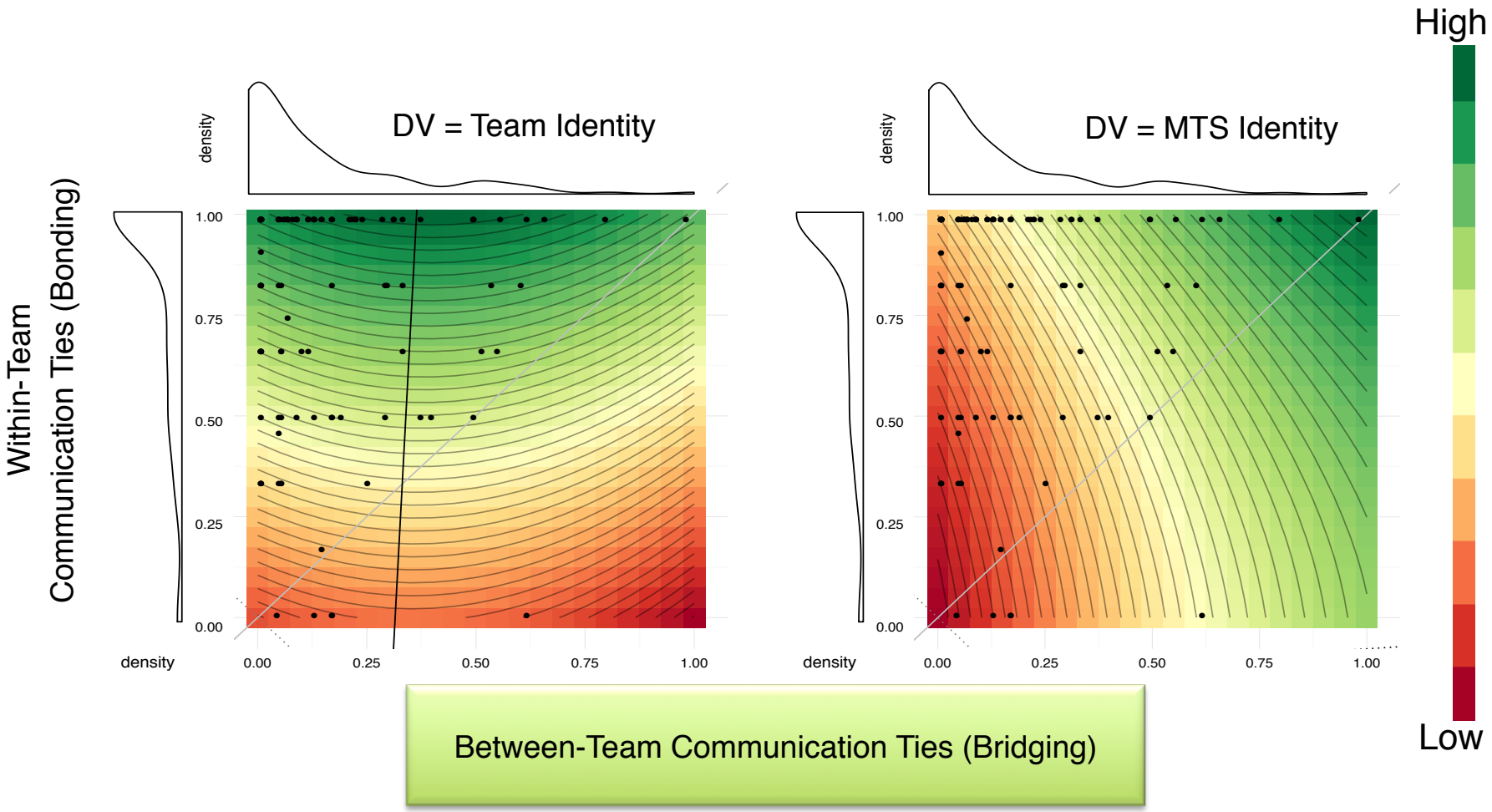
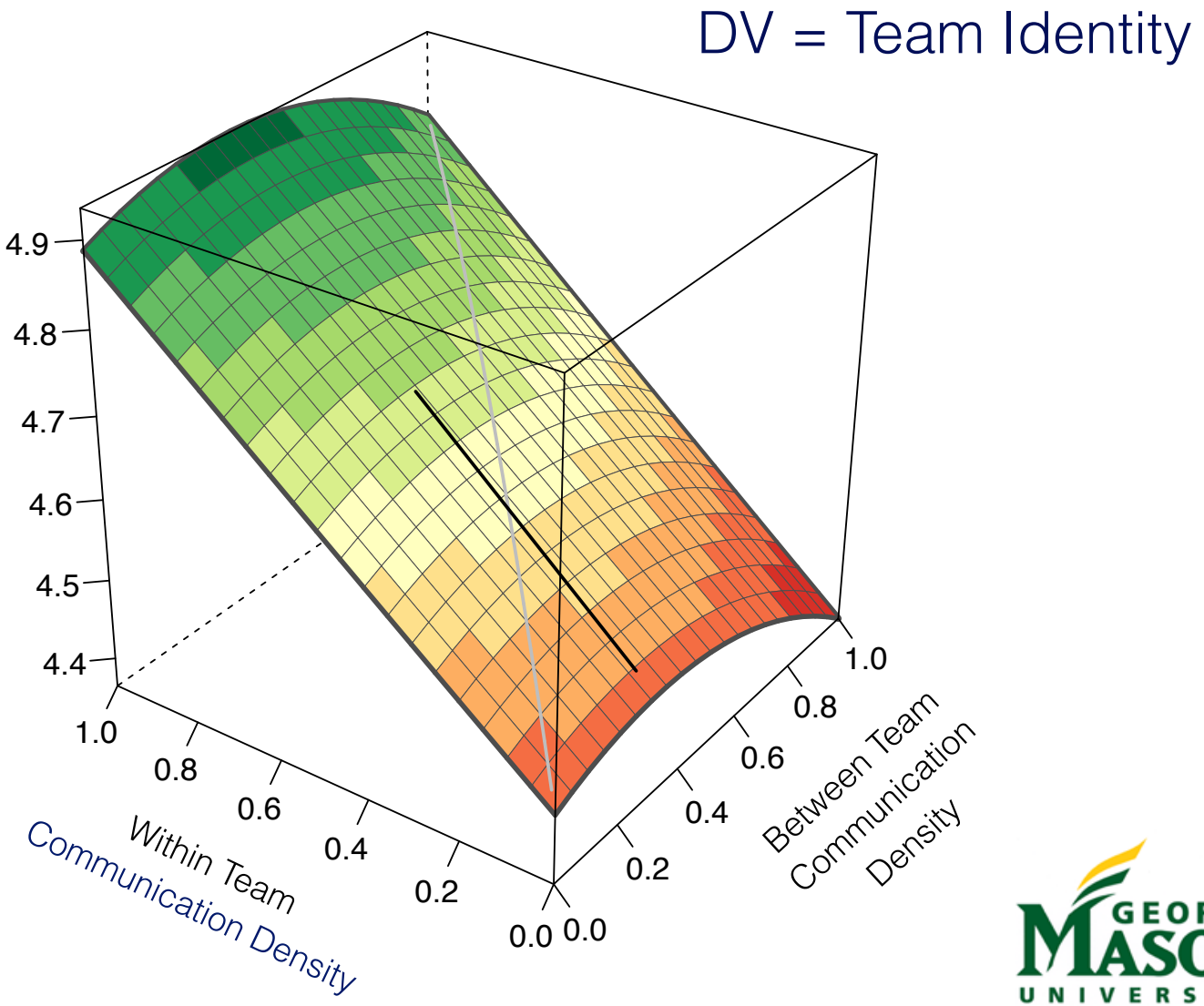


Team optimization

Using communication ties (within & between teams) to optimize attachment to the team



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Countervailing Forces

Type V - Finding the “sweet spot” to optimize at both levels

	Local (Team) Optimization	Global (MTS) Optimization	Glocal (Team & MTS) Optimization
Level of Origin of the Process or State	Consequences are beneficial locally beneficial but harmful globally	Consequences are harmful locally but beneficial globally	
Manifests at the team level	Type I	Type II	Type V
Manifests at the MTS level	Type III	Type IV	

Implications for Team Science

- Science teams are formed to address the "inherent complexity of contemporary public, health, environmental, political, and policy challenges (Stokols et al., 2008)"
  - As the complexity of a scientific problem increases, the entity needed to solve it moves from a team to a MTS
- MTSs are governed by both confluent and countervailing forces
- Success requires both local and global optimization

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Thank you!

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