Social Network Interaction among Nested Sets in Dynamic Contexts: Disaster Operations as a Laboratory for Social Change

LOUISE K. COMFORT
Professor
Graduate School of Public and International Affairs
University of Pittsburgh
Email: comfort@gspia.pitt.edu

Disaster operations represent a classic laboratory for the study of social network interactions that are constrained by both space and time and that involve multiple modes of communication. Further, these interactions vary significantly at different levels of authority, capacity, and severity of damage to the affected community. At each level of operation, differences in resources, number of skilled personnel, extent of prior knowledge, and experience affect significantly the frequency and type of interactions among organizations in a given community as well as access to outside sources of assistance, and potential strategies for reducing risk and minimizing losses.

One means of extending theories of social network interaction to incorporate the constraining effects of space, time, and different modes of communication on organizational interaction is to address these problems through the lens of complex, adaptive systems. From this perspective, a system is composed of multiple subsystems, many of which include sub-subsystems, nested inside one another, but sharing common goals. These "nested sets" can easily be identified in large-scale disaster operations. For example, in Haiti, the primary actors in delivering public services to quake-shattered Haiti was a set of large, powerful, NonGovernmental Organizations (NGOs) that drew resources from an international donor base and created an organizational operations environment that functioned largely in parallel to, rather than with, the Haitian Government. While the Haitian Government was struggling to resume its limited and fragile delivery of public services, it was heavily outspent and surpassed in performance by international NGOs operating largely in English, instead of the language of the country, French. The inability to track exactly who was doing what tasks in which regions of Haiti now ten months after the earthquake reveals the critical importance of spatial analysis. The interdependence of the tasks that were performed . . . or not performed . . . and the consequences of both types of action shows the key spatial and temporal relationships among actions taken or not taken.

Three streams of literature inform the study of social network interaction in complex systems. First, the Institutional Analysis and Development (IAD) framework proposed by Elinor Ostrom (2005) acknowledges the interaction of social units at different scales of operation within the same broadly defined social system. By identifying a domain of action, for example, disaster preparedness, response, and recovery, Ostrom notes that different "action arenas" will likely emerge in response to an urgent event at different times and

places in an ongoing social process. Within those arenas of action, different "action situations" will emerge that require different response operations that are appropriate to that specific community or context. Ostrom's framework can be used to study the complex problem of interacting "nested sets" in which a given stressor, e.g. an earthquake, triggers action in different geographic locations and generates a cascading effect of failure or informed response in a social and engineered environment.

Second, the concept of "distributed cognition" (Hutchins, 1995) holds that, in complex operations, no single person, unit, or organization has all of the knowledge and skills necessary to manage that operation successfully. Rather, knowledge is generated by multiple persons, units, organizations sharing their perspectives and essentially creating new knowledge that supports informed action to achieve the shared goal. Recognition of the distributed nature of relevant information to support rapid response to disaster events is critical to mobilizing informed, timely response and recovery.

Third, the concepts and measurement underlying "dynamic network analysis" (Carley, 2006, 2001) are central to understanding the complex interactions among organizations of different sizes, scopes of action, and access to resources that characterize disaster operations. Networks of action mobilize, shift, change, and adapt . . . or fail to do so . . . under the changing requirements of a severely damaged community following disaster. Understanding this process and seeking to provide timely, valid information to guide action in damaged environments represents a challenging set of technical and organizational tasks. These three concepts can be integrated through the design and development of a "knowledge commons" (Hess and Ostrom, 2006) that can be developed as an ongoing source of timely, valid information to support action. The critical aspect of a knowledge commons is that information is not only organized around a shared set of goals and actions, but that it is updated and revised as its users gain a better understanding of the problems they encounter. The "knowledge commons" does not perform merely as a database of stored, static information. Rather, it includes the entire process of eliciting information from users, formatting it for readily accessible information exchange to relevant users, and updating the knowledge base as conditions and requirements change in a dynamic environment. The task of creating a knowledge commons for specific domains of organizational action involves both spatial and temporal constraints. The critical difference is that the knowledge commons is designed to support collective action, not simply to inform individual actors. By informing collective action, this process also generates new knowledge in the process.

As government agencies and organizations move to record their operations logs through electronic means, the process creates new sources of data that can be analyzed in ways that document changing patterns of action and interaction among organizations participating in response operations. These electronic logs and situation reports, given appropriate permissions for access to researchers, provide an important source of

information for analysis. Such records provide more reliable data to analyze points at which networks of action are effective or fail.

References:

Carley, Kathleen. (2006). A Dynamic Network Approach to the Assessment of Terrorist Groups and the Impact of Alternative Courses of Action. *Visualising Network Information. Meeting Proceedings RTO-MP-IST-063*, 12–14. Neuilly-sur-Seine, *France: RTO*. *http://www.vistg.net/documents/IST063_PreProceedings.pdf*.

Carley, Kathleen. (2001). Adaptive Organizations and Emergent Forms. Working paper. CASOS. Carnegie Mellon University. http://www.casos.cs.cmu.edu/publications/Abstracts_All/AdaptiveOrganizations_abstract.html.

Hess, Charlotte and Elinor Ostrom, Eds. 2006. *Understanding Knowledge as a Commons: From Theory to Practice*. Cambridge: MIT Press.

Hutchins, Edwin. 1995. *Cognition in the Wild*. Cambridge: MIT Press.

Ostrom, Elinor. 2005. *Understanding Institutional Diversity*. Princeton: Princeton University Press.