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Feedback Models for Collaboration and Trust in Crisis Response Networks

Topic 9: Collaborative Technologies for Network-Centric Operations

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Abstract

Scholars have devoted increasing efforts to understanding crisis response networks (Denning 2006a, 2006b; Stephenson and Schnitzer 2006), especially in the case of networks comprised of disparate members who acknowledge no higher organizational authority. Coordination within disaster response networks is difficult for several reasons, including the chaotic nature of the crisis, a need for the various organizations to balance shared goals (crisis amelioration) and organization-specific goals, and the lack of a central organizing authority (Denning 2006a, 2006b; Stephenson and Schnitzer 2006). More recently, scholars (Stephenson and Schnitzer 2006) have suggested crisis response networks might be able to coordinate effectively in the absence of a central organizing authority.

Grounded in general system theory (e.g., Bertalanffy 1962, 1968; Kast and Rosenzweig 1972; Senge 1990; Weinberg 1975), and particularly the use of feedback loops (Masuch 1985; Richardson 1999), this paper seeks to understand whether feedback loops comprised of reciprocal resource commitments can engender greater trust and commitment among organizations responding to a crisis. This paper describes a campaign of experimentation set in the Maritime Interdiction Operation, an experimental campaign operated by the Naval Postgraduate School's Center for Network Innovation and Experimentation.

Keywords: Collaboration, Commitment, Crisis Response, Feedback, Networks, Trust

Introduction

Interorganizational relationships can take many forms. Some relationships involve a central organization (in for-profit contexts, e.g., a channel captain (Tuominen 2004)) coordinating the efforts of other partner firms; these firms might be longer-term, more stable partners, e.g., strategic alliances (Vadarajan and Cunningham 1995), or firms assembled ad hoc for a specific task (Achrol 1997). Other arrangements include less centrally-managed alliances among unrelated organizations (Achrol 1997). Recently, scholars have devoted increasing efforts to understanding networks of organizations that form to respond to crises, whether these crises are humanitarian relief efforts, disaster response efforts, or simply the accomplishment of large, urgent projects (Denning 2006a, 2006b; Stephenson and Schnitzer 2006). Denning (2006a, 2006b) has proposed the hastily formed network, a network of unrelated organizations assembled ad hoc around the accomplishment of a specific, urgent task.

How networks of organizations coordinate their efforts has been the subject of some debate in the literature. In the specific case of crisis response networks, scholars generally conclude that coordination is difficult, in part because of the chaotic nature of the crisis response setting (see Stephenson and Schnitzer, 2006, for a brief summary). Along with the nature of the task, the organizational form presents coordination challenges as well. The network of organizations responding to the crisis is comprised of members that share some goals (e.g., crisis amelioration); however, these organizations might also have different (possibly competing) collateral goals, and often operate under constraints specific to their own organization (Stephenson and Schnitzer 2006). Finally, the lack of a central organizing authority has been argued as hindering coordination

(Denning 2006a, 2006b; Stephenson and Schnitzer 2006), although recent scholarship (Stephenson and Schnitzer 2006) suggests crisis response networks might be able to coordinate effectively in the absence of a central organizing authority.

This paper draws on general system theory (e.g., Bertalanffy 1962, 1968; Kast and Rosenzweig 1972; Senge 1990; Weinberg 1975), and in particular a discussion of feedback loops (Masuch 1985; Richardson 1999), to explore how crisis response networks coordinate actions among disparate members who acknowledge no higher organizational authority.

Feedback Loops

A fundamental component of systems theory is control, in which actions interrelate in a series of feedback loops (e.g., Richardson 1999), which represent a “circle...of cause-effect relationships” (Senge 1990). In feedback loops, an action triggers other actions, which may in turn trigger additional actions, ultimately leading back to a causal effect on the original action (Masuch 1985). Over time, this system of actions can change its initial state based on a comparison of the new state to some standard, either normative (value-based) or factual; such changes can be desirable or undesirable, depending on whether the change is toward or away from a desirable state. In this view, positive movements from a normative state are deviation amplifying feedback loops, whereas negative movements from a normative state are deviation minimizing loops. Positive movements from a factual state are termed self-reinforcing feedback loops, whereas negative movements from factual states are self-correcting loops (Masuch 1985).

Some scholars (e.g., Richardson 1999) have noted possible sources of confusion among various literatures over the nature of feedback loops as a construct. This view argues that all literatures understand feedback as being positive or negative, but that the nature of positive and negative feedback appears to vary somewhat. In cybernetics, for example, positive feedback is deviation-amplifying, whereas negative feedback is deviation-minimizing. No value judgment is attached to the amplification or minimization of the deviation in question; that is, no value judgment is attached to the initial state from which the system is deviating. On the other hand, this view suggests, some social science authors have broadened the feedback construct by attaching value labels. In these instances, positive feedback assumes the deviation being amplified represents a desirable change from an undesirable state; conversely, negative feedback assumes the need to minimize an undesirable deviation away from a desirable state. A further confusion comes from some social science scholars' blurring of the construct control with the distinct construct influence (Green and Welsh 1988).

A further classification of feedback loops involves intersecting the normative and factual standards. Figure 1, adapted from Masuch (1985), summarizes these intersections. Some feedback loops generate undesirable changes that pull a system away from a normatively-defined desirable state of stability; the feedback loops self-reinforce the now-objectively (or factually) increasing deviations from the normatively-defined status quo. Other loops can keep a system in an undesirable status quo, i.e., in a state of stagnation; this occurs when deviation amplifying loops have a self-correcting component to them. On the other hand, some loops self-reinforce deviation-counteracting behaviors and pull a system toward a desired goal; in these cases, the status quo is undesirable and

change—thus deviation from the status quo—is desirable. Finally, some feedback loops self-correct deviation counteracting behavior; in these cases, the status quo is desirable, and the feedback loops self-correct against deviations from this desirable state.

Drawing on this brief overview, the following section explores ways in which organizations can engender coordination among disaster response networks through the use of feedback loops.

	Deviation amplifying (Positive movement relative to normative state)	Deviation counteracting (Negative movement relative to normative state)
Self-reinforcing (Positive movement relative to factual state)	Undesirable change (Crisis; pulled farther from desired stability)	Desirable change (Development; movement away from undesired status quo)
Self-correcting (Negative movement relative to factual state)	Undesirable permanence (Stagnation; kept from desired change)	Desirable permanence (Stability; deviations from desired normative state of stability are continually corrected)

Figure 1. Feedback loop summary (adapted from Masuch 1985)

Coordinating Crisis Response Networks

Feedback loops suggest potentially helpful ways of understanding how to enhance coordination among the disparate groups comprising disaster response networks. This section draws on the literature on interorganizational relationships and governance to suggest a possible feedback loop that serves as an example of how to increase coordination among groups. Indirectly, these same feedback loop models can serve a

diagnostic approach to understand why coordination might be lacking (e.g., why the level of collaboration is stagnated at a low level); a self-correcting deviation amplifying feedback loop results in such a pattern of behavior, and this recognition might lead to appropriate introspection and countermeasures to break that pattern.

At many points during a crisis response effort, groups might surmise that greater coordination would lead to synergistic performance in alleviating the crisis situation. In this case, the goal would be movement away from an undesirable state of separate action toward a state of greater coordination. The relational governance literature suggests a possible self-reinforcing, deviation counteracting feedback loop that could pull the organizations from their normatively defined undesirable state of separate action toward a desired state of synergy.

Generally speaking, the relational governance literature suggests that organizations perform better when they trust each other (Smith and Barclay 1997) and are committed to their relationship (Daugherty, Richey, Hudgens and Autry 2003; Doz and Hamel 1998; Gundlach, Acrol and Mentzer 1995; Morgan and Hunt 1994). Trust, the expectation by one party that another party is both credible (reliable) and benevolent (Moorman, Zaltman and Despande 1993; Morgan and Hunt 1994), typically develops from a more calculated to a more relational form (Doney and Cannon 1997; see also Stephenson and Schnitzer 2006).

A second relationship governance construct is communication strategy. Communication strategy, comprised generally of the frequency, direction, modality, and content of communications, can affect both qualitative and quantitative outcomes (Mohr

& Nevin 1990). Distributional channel research suggests a moderating role for constructs such as channel structure, climate and power (Mohr & Nevin 1990). Collaborative communication, specifically, has a stronger effect when relationships are less integrated and less controlled; thus, it is a possible governance mechanism in these situations (Mohr, Fisher & Nevin 1996).

Finally, the commitment of resources to a joint effort has been shown to have a positive effect on knowledge sharing (Wagner and Buko 2005). This finding suggests that resource commitment might positively affect coordination among organizations.

In summary, this literature, supported by an initial partially-confirmatory study by Stephenson and Schnitzer (2006), suggests that an organization (Org 1) might signal another organization (Org 2) that it is both credible and benevolent, by committing resources toward the accomplishment of the desired shared goal of ameliorating the crisis situation. (Note that, while this paper contemplates a network setting, only one organizational dyad is considered here for simplicity of explication.) This resource commitment might involve constructing a communication network where none exists; providing a shared workspace, either real or virtual; or any number of other observable resource investments. Org 1 might further volunteer information it has gathered about the crisis to Org 2, and seek Org 2's advice in how to approach a resolution to the crisis. This resource commitment, along with an initial collaborative communication strategy, signals Org 1's credibility ("we are serious about ameliorating this crisis, and are devoting resources to that goal") and benevolence ("we will share our resources and information with you, and are interested in your opinions, too") to Org 2.

The literature suggests Org 1’s resource commitment and use of collaborative communication strategies should engender trust on the part of Org 2. To the extent this occurs, Org 2 should become more committed to working in a closer relationship with Org 1 to address the crisis; to invest its own resources toward shared goal accomplishment and reciprocate the use of collaborative communication strategies with Org 1. Org 2’s behavior, in return, signals its credibility and benevolence to Org 1, completing the feedback loop and resulting in greater coordination. Figure 2 summarizes this “virtuous” feedback process.

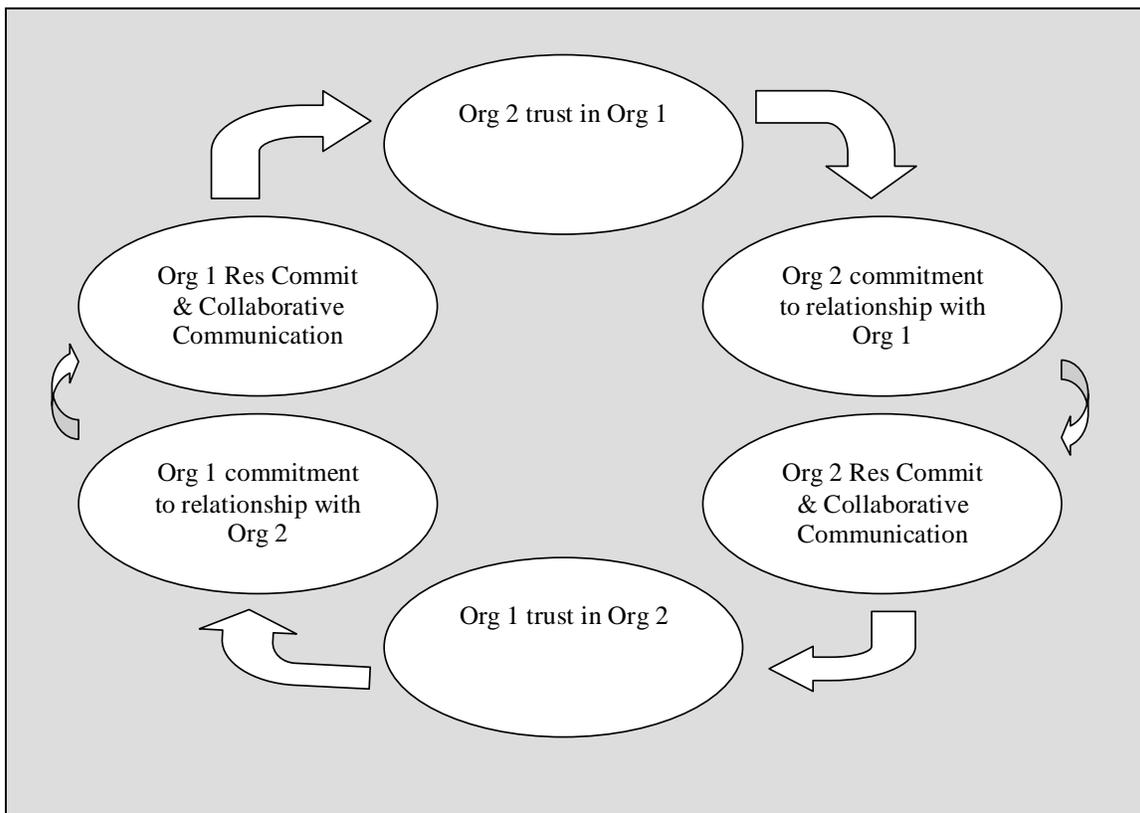


Figure 2. Virtuous feedback process

The literature suggests that both trust (Smith and Barclay 1997) and relationship commitment (Daughtery et al 2003; Doz and Hamel 1998; Gundlach, Acrol and Mentzer 1995; Morgan and Hunt 1994) enhance interorganizational performance. Unfortunately, cooperative behavior among organizations comprising a crisis response network, while desirable, has been an elusive goal (Stephenson and Schnitzer 2006). Grounded in general system theory and particularly the use of feedback loops, and drawing on the interorganizational literature for possible feedback mechanisms, this study explores whether trust and commitment develop among organizations responding to a crisis. To the extent that organizations trust each other, the literature suggests they should become increasingly committed to their relationship, and should enjoy differential performance. This study seeks to understand whether a feedback loop comprised of reciprocal resource commitments and effective communication strategies can engender greater trust and commitment among organizations responding to a crisis. The next section develops the research design for this study.

Research Design

This section describes the research design for the study. It begins by describing the overall design parameters including defining the constructs and variables of interest, presenting hypothesized relationships among the variables, and interpreting the Pareto set of the design, functional and criteria spaces (Statnikov and Matusov 2002) within the context of the study. The section concludes by outlining a campaign of experimentation

to “explore and mature knowledge” (Alberts and Hayes 2002, 2005) of how crisis response networks form.

Design Parameters

This study suggests that networks form in the face of a crisis through the use of resource commitment and collaborative communication, which can serve as signals of trustworthiness by one organization that engender trust on the part of other organizations. The overarching proposition of this study is that reciprocal resource commitments and collaborative communication can serve as a feedback loop creating greater levels of trust and relationship commitment, and thus influencing the structure of the crisis response network.

Constructs and variables. The variables of interest include design space variables, criteria space variables and functional constraints (Statnikov and Matusov 2002).

Design space variables include resource commitment and collaborative communication. Resource commitment is measured using a Likert scale (1 = very little commitment, 7 = substantial commitment) (see, e.g., Daugherty, Autry and Ellinger 2001). Collaborative communication is measured using a scale adapted from Mohr, Nevin and Fisher (1996). This scale assesses the frequency of communication between organizations, whether the communication is bidirectional, the formality of the communication, and the degree to which communication is coercive.

Functional constraints include the communications systems available and environmental factors including the infrastructure available (both physical and economic) and the physical scope of the crisis.

Criteria space variables focus on network characteristics and relational governance. Networks are typically studied in terms of relationships among their members, including the status of members (their centrality and prestige), the nature of a member's relationships (range, density, and embeddedness), and characteristics of any dominant organization(s) (Burt 1980; Gulati 1998; Lorenzoni & Baden-Fuller 1995). In this study, the speed in which the network is formed will be measured in minutes. The status of members will be measured in terms of their centrality within the network and the degrees of separation between organizations, while the nature of relationships will be assessed by counting the range and density of ties to other organizations.

Relational governance variables of interest are trust and relationship commitment. Trust, the expectation that another party is both credible and benevolent (Moorman, Zaltman and Desphande 1993; Morgan and Hunt 1994) will be measured by a survey instrument administered to study participants. This scale is based on one developed by Kumar, Scheer, and Steenkamp (1995). Relationship commitment is the belief that a relationship is both important and worth investing effort to maintain and perpetuate (Morgan & Hunt 1994; Moorman, Zaltman & Desphande 1993; Wilson 1995). Relationship commitment will be measured using a survey instrument adapted from Morgan and Hunt (1994) and Anderson and Weitz (1989).

Relationships among constructs. Greater resource commitment and greater use of collaborative communication strategies should engender greater levels of both trust and relationship commitment. Their effect on trust should be direct, and their effect on relationship commitment will be moderated by trust. Greater levels of trust and commitment will in turn be positively related to various network structure variables,

including strength of ties and number of ties. Greater resource commitment and use of collaborative communication should be positively related to speed of network formation. Infrastructure and scope of crisis will moderate these effects.

Pareto set of criteria. This study hypothesizes that reciprocal feedback loops of relational governance constructs will affect both the formation of crisis response networks and the relationships among the network members as the networks develop over time. Trust and commitment both develop over time, thus network structure could take relatively longer to develop (although “longer” is still relative to the duration of the crisis scenario). Network ties should strengthen over time, perhaps shifting among members as time passes. Clusters among organizations should form over time, and the patterns of these clusters might be expected to change over time as well. These phenomena suggest a Pareto set of outcomes, in which network structure variables develop over time. Stronger ties and a more well-defined network structure should allow greater coordination and enable more effective performance toward alleviating the crisis situation; however, these stronger ties and more stable structure forms over time. The proposed optimal solution is one in which sufficient network structure forms, through the relational governance-based feedback loop, sufficiently quickly to minimize the impact of the crisis.

Campaign of Experimentation

Campaigns of experimentation “explore and mature knowledge” (Alberts and Hayes 2002) about a subject. Following Alberts and Hayes (2002, 2005), this section describes a campaign of experimentation to explore and mature knowledge about how networks form rapidly (e.g., during times of crisis). This section describes the campaign

as flowing from the discovery phase of experimentation, which “generate new ideas” or explore the feasibility and utility of concepts (Alberts and Hayes 2002; 2005), to the hypothesis testing phase, in which proposed hypothesized relationships are tested more formally. This campaign allows for a demonstration phase, if appropriate based on the results of the previous phases. This demonstration phase would most likely assess the role of well-understood and well-measured relational governance constructs in explaining part of the network formation. Each category of experiment will include a description of the specific experimentation infrastructure (or setting), how the individual experiments will be run, the type(s) of data to be collected, and the proposed data analysis methodologies to be used.

Discovery experiments. Discovery experiments are “hypothesis generating” experiments designed to explore the feasibility and utility of the subject area (Alberts and Hayes 2002, 2005). Specific discovery experiments for this study will focus on understanding whether (and if so, how) the feedback loop process operates. Specifically, the discovery experiment validates the measures of collaborative commitment and resource commitment among different network members, and explores both whether these measures are positively correlated between members over time? Positive correlation among these measures over time might suggest the formation of a reciprocal feedback loop. Additionally, the discovery experimentation phase will assess various measures of network formation (formation speed, centrality and degrees of separation within the network, and range and density of ties to other organizations) to see whether they vary systematically with the commitment of resources or use of collaborative communication.

The discovery experimentation phase is envisioned as two phases. In the first phase, members of organizations that have responded to crises will be interviewed to understand their general impressions of whether and how networks formed in responses to these crises. Interviews will be developed, conducted, transcribed and analyzed in accordance with generally accepted qualitative interviewing techniques (see, e.g., Glaser and Strauss 1967; Rubin and Rubin 2005) with the primary goal of gaining greater understanding of whether the constructs under consideration appear to be feasible and useful to the study.

The second phase of discovery experimentation will take the form of a table-top longitudinal scenario designed to test the pattern of resource commitment and collaborative commitment as a possible feedback loop leading to network formation. This table-top exercise will involve a fictional crisis scenario played out using collaborative software (e.g., Microsoft Groove). Participants will be mid-level military officers from the United States Department of Defense (DoD), as well as military members of allied nations and DoD civilian employees, all of whom are seeking graduate degrees at the Naval Postgraduate School. If a sufficient sample size is available, participants will be assigned randomly into organizational groups (i.e., multiple participants assigned to each “organization”); this approach would alleviate possible construct validity (Shadish, Cook and Campbell 2002) concerns over whether organizational trust can be assessed using single individuals to represent different groups. Demographic information will be collected to analyze for possible biases among participants. In the scenario, participants will be allocated resources and will be allowed to communicate (or not) with other participants to respond to a crisis scenario.

Transcripts of the interaction will be analyzed for evidence of collaboration, using Mohr, Fisher, and Nevin (1996) to guide the analysis. Commitments of resources will be coded for correlational analysis to assess patterns of commitment and communication that might indicate the formation of a feedback loop leading to network formation. The data will also be coded to assess the network variables such as speed of formation and strength and number of ties.

Hypothesis testing experiments.

The hypothesis testing phase of the campaign is designed to test formally hypothesized relationships suggested by the discovery phase and by existing theory (Alberts and Hayes 2002, 2005), and discussed previously in the section on “relationships among constructs”. Much like the discovery phase, the hypothesis-testing phase contemplates two steps. In the first step, a table-top simulation exercise will be held. This simulation will be structured similarly to the discovery phase (e.g., random assignment, similar data collection and analysis), but will be qualitatively different (i.e., a different scenario) from that in the discovery phase. Along with analyses of transcripts of interaction, participants will also be interviewed and/or surveyed to assess their beliefs about how existing constructs such as interorganizational trust (Kumar, Scheer, and Steenkamp, 1995; Moorman, Zaltman and Desphande 1993; Morgan and Hunt 1994), resource commitment (Daugherty, Autry and Ellinger 2001), collaborative communication (Mohr and Nevin 1990; Mohr, Fisher, and Nevin 1996), and relationship commitment (Morgan & Hunt 1994; Moorman, Zaltman & Desphande 1993; Wilson 1995) operated during the study. Measurement instruments will be based on those used in these prior studies.

The second phase of hypothesis-testing contemplates a small scale field exercise, in which participants will construct a small scale communication network. Participants will be assigned randomly to groups. Groups will be allocated the necessary resources, but allocations will be unequal, thus requiring some groups to commit greater resources than others to the goal. Group members will be asked afterwards to assess the role of the same constructs listed above in the success of their network formation.

Limitations Every study suffers from limitations, and this proposal is no different. That said, campaigns of experimentation seek to minimize the limitations by building knowledge systematically in a variety of ways. Nevertheless, a brief discussion of some of the limitations, and how they are addressed, follows.

The limitations of qualitative studies, such as the interviews in the discovery phase of the campaign, are well-known; for example, such studies are often criticized for a perceived lack of generalizability and rigor (Glaser and Strauss 1967; Isaac and Michael 1995). Setting aside the accuracy of those criticisms, which can to some extent be countered or even dismissed as irrelevant (e.g., Glaser and Strauss 1967; Isaac and Michael 1995), exploratory qualitative research becomes a strength in the discovery phase of an experimental campaign, which is designed to surface important concepts and explore their utility and feasibility for inclusion in future research. Such exploratory discovery work serves to ground future research in “real world” situations and data (Glaser and Strauss 1967).

Limitations of the simulation studies used in the discovery and hypothesis-testing phases include the perceived lack of ties to real world situations; to an extent, these

concerns are countered by using multiple real world scenarios—at least one in each of the discovery and the hypothesis-testing phases (Alberts and Hayes 2002). Additionally, the scenarios are designed to maximize validity and credibility (Alberts and Hayes 2002). Finally, the simulation design will include random assignment of participants to treatments and will be longitudinal, both of which should improve internal validity (Isaac and Michael 1995; Shadish, Cook and Campbell 2002); conversely, the simulation will aim for a duration that does not risk maturation effects, and the nature of the study—to understand the how networks form and change in a crisis response scenario—limits the threat of mortality (organizations might well choose to leave the network in a real crisis) (Isaac and Michael 1995; Shadish, Cook and Campbell 2002).

On the other hand, in both the simulation and field exercise, the “crisis” is simulated primarily by time and through the use of a scenario. This threatens external validity somewhat, in that scenarios are not likely to replicate the chaos inherent in real crises, but the use of military members as subjects adds elements of credibility and mitigates the threat to external validity somewhat, in that military members are used to rehearsing (“exercising”) for future actual events with much the same intensity as they would use when faced with those actual events. (Isaac and Michael 1995; Shadish, Cook & Campbell 2002).

Conclusion

This proposal describes a campaign of experimentation designed to “mature knowledge” about how crisis response networks form and operate. This paper draws on general system theory (e.g., Bertalanffy 1962, 1968; Kast and Rosenzweig 1972; Senge

1990; Weinberg 1975), in particular the concept of feedback loops (Masuch 1985; Richardson 1999), to explore how crisis response networks coordinate actions among disparate members who acknowledge no higher organizational authority. It blends discovery of new knowledge (the feasibility and utility of various constructs and relationships) with the testing of more formal hypotheses about network relationships. In doing so, it answers the call to better understand how networks operate in times of crisis (Denning 2006a, 2006b; Stephenson and Schnitzer 2006).

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Feedback Models for Collaboration and Trust in Crisis Response Networks

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Crisis Response Networks

- ▶ Interorganizational relationship formats
 - Centralized control (channel captain)
 - ▶ Longer-term (strategic partnerships) or ad hoc
 - Unmanaged arrangements between unrelated organizations
 - Newest hybrid: unmanaged ad hoc networks
 - ▶ Frequently used in crisis response (disaster, humanitarian)
 - ▶ "Hastily formed networks"

Research problem

- ▶ How to coordinate ad hoc disaster response networks?
 - No acknowledged central authority
 - Goal “semi-compatibility”
 - ▶ Some shared goals, some unique goals
 - Task characteristics (intense, chaotic...)

Feedback loops

- Some (possible) confusion between cybernetics and social science interpretations (e.g., Richardson 1999)

	Cybernetics	Social Science
Positive feedback	Deviation amplifying	"Good" (assumes deviation is "good", i.e., away from undesired state)
Negative feedback	Deviation minimizing	"Bad" (assumes deviation is "bad", i.e., toward undesired state)

Feedback loops

	Deviation amplifying (Positive movement relative to normative state)	Deviation counteracting (Negative movement relative to normative state)
Self-reinforcing (Positive movement relative to factual state)	Undesired change (Crisis; pulled farther from desired stability)	Desired change (Development; movement away from undesirable status quo)
Self-correcting (Negative movement relative to factual state)	Undesired permanence (Stagnation; kept from desired change)	Desired permanence (Stability; deviations from desired normative state of stability are continually corrected)

(Adapted from Masuch (1985))

Building Coordination Through Feedback Loops

Resource commitment by Org 1

- Signals Org 1 trustworthiness (credibility, benevolence)
- Leads Org 2 to trust org 1
- Increases Org 2 commitment to relationship with Org 1
- Increases Org 2 commitment of resources to relationship with Org 1
- Increases resource commitment by Org 1

Self-reinforcing, deviation counteracting feedback loop that pulls away from undesirable status quo of no relationship or a lack of coordination

Building Coordination Through Feedback Loops

Effective communication strategy by Org 1

- Signals Org 1 trustworthiness (credibility, benevolence)
- Leads Org 2 to trust org 1
- Increases Org 2 commitment to relationship with Org 1
- Increases Org 2 information flow to Org 1
- Increases information flow by Org 1 to Org 2

Self-reinforcing, deviation counteracting feedback loop that pulls away from undesirable status quo of no relationship or a lack of coordination

Design Parameters

► Overarching proposition:

Reciprocal resource commitments and collaborative communications

- greater trust and relationship commitment
- network characteristics

Constructs and Variables

Design Space

▶ Resource commitment

- Likert scale (1 = very little commitment, 7 = substantial commitment)
- See, e.g., Daugherty, Autry and Ellinger 2001

▶ Collaborative commitment

- Frequency, bidirectionality, formality, coerciveness
- Adapted from Mohr, Fisher and Nevin (1996)

Constructs and Variables: Functional Constraints

- ▶ Communication system
- ▶ Infrastructure
 - Physical
 - Economic
- ▶ Scale/scope of crisis

Constructs and Variables: Criteria Space

- ▶ Network characteristics (Burt 1980; Gulati 1998; Lorenzoni and Baden-Fuller 1995)
 - Member status (centrality, prestige)
 - ▶ Centrality, degrees of separation
 - Member relationships (range, density, embeddedness)
 - ▶ Counts for range, density of ties
 - Dominant organization(s)
 - Speed of formation
 - ▶ Simple count (minutes)

Constructs and Variables: Criteria Space

► Relational governance

- Trust (adapted from Kumar, Scheer and Steenkamp 1995)
- Relationship commitment (adapted from Morgan and Hunt, 1994; Anderson and Weitz 1989)

Relationships

► Propositions

- Greater resource commitment and collaborative communication → greater trust and relationship commitment
 - Trust both direct and indirect (moderating) effect
- Greater trust and relationship commitment positively associated with network characteristics
 - Strength of ties, number of ties
- Greater resource commitment and collaborative communication → faster network formation
- Infrastructure and crisis scope will moderate effects

Pareto Set

- ▶ Networks develop over time (relative to crisis duration)
 - Ties form, strengthen, change
 - Clusters form, change
- ▶ Time is critical in crises
- ▶ Pareto set: trade time for stronger network relationships
 - Stronger = longer to form, more effective response?
 - Weaker = form sooner, respond faster (less effectively?)

Campaign of experimentation: Discovery phase

- ▶ Part 1: Qualitative interviews of crisis response participants (e.g., HFN participants)
 - Assess constructs for feasibility and utility
 - Ground research in real-world data
 - Conduct and analysis using accepted qualitative techniques (e.g., Glaser and Strauss 1967; Rubin and Rubin 2005)

Campaign of experimentation: Discovery phase

▶ Part 2: Table-top simulation

- Tests patterns of resource commitment and collaborative communication--feedback loop?
- Tests patterns of network formation
 - ▶ Centrality, strength and number of ties, etc.
- Participants
 - ▶ NPS students
 - ▶ Collaborative software (Groove?)
 - ▶ Analysis by session coding on constructs above

Campaign of experimentation: Hypothesis testing

► Part 1: Second simulation

- Similar to first in design
- Different scenario
- Add interviews and/or surveys to assess formally hypothesized relationships
- Analyze sessions (coding) and interview/survey results

Campaign of experiments: Hypothesis testing

► Part 2: Field exercise

- Scenario based
- Small network construction
- Random assignment to teams
- Disproportionate resource allocation
- Analysis: observed data and post-hoc interviews/surveys
- Adds real-world element

Limitations

- ▶ Some, but experimental campaign mitigates
 - Qualitative limitations (discovery phase)
 - ▶ External validity, perceived rigor
 - ▶ Strength in discovery phase
 - Simulation limitations
 - ▶ External validity: offset by military “exercises”, multiple scenarios
 - ▶ Internal validity: random assignment, longitudinal
 - But not so long as to risk maturation
 - Mortality not a risk (network members can leave in real world)