HUMAN COMMUNICATION RESEARCH

Human Communication Research ISSN 0360-3989

ORIGINAL ARTICLE

From Microactions to Macrostructure and Back: A Structurational Approach to the Evolution of Organizational Networks

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Structuration theory (ST) and network analysis are promising approaches for studying the emergence of communication networks. We offer a model that integrates the conceptual richness of structuration with the precision of relevant concepts and mechanisms offered from communication network research. We leverage methodological advancements (i.e., stochastic actor-oriented models) to test hypotheses deduced from ST using longitudinal communication network data collected over a two-year period. Results indicate that while structural rules external to a social network play a significant role, internal structural rules that emerge from the aggregate of individual actions during previous time periods also predict current structures, and that the reification influence of the latter is greater than that of the external factors.

doi:10.1111/j.1468-2958.2011.01404.x

Structuration theory (ST) (Bourdieu, 1977, 1990; Giddens, 1976, 1979, 1984) emerged over three decades ago as a conceptual framework aiming to overcome the traditionally dualistic thinking prevalent in research that utilized either micro or macro explanations for communication phenomena. Until then, scholars had struggled to provide an adequate account of how individuals (the microlevel) may act in creative and unexpected ways in the face of the overarching influence of macrolevel structural institutional forces (for critiques, see DeSanctis & Poole, 1994; Orlikowski, 2000; Orlikowski & Robey, 1991). Giddens (1984) went beyond this micro–macro dichotomy, suggesting structuration as a theoretical framework for integrating the simultaneous influence of theoretical mechanisms consistent with both perspectives. Proponents of structuration argue "it is improper to conceive of a social system merely as the product of either deliberate human action or institutional forces" (Orlikowski & Robey, 1991, p. 146). Hence, while institutional influences exist as

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rules or norms of appropriate and acceptable communicative behavior within a social system, they do not completely determine action on the part of knowledgeable human agents. Structuration is "best viewed as a metatheory or perspective on all human action, rather than as a theory pertaining to a specific domain or aspect of human activity" (Yates, 1997, p. 160). Consistent with its abstract nature, ST (or adaptations thereof) has been applied to understanding a wide variety of topics, many of which are summarized (together with relevant studies) in Table 1.

At about the same time ST was emerging, social network analysis also began to gain prominence in communication research (e.g., Barnett, 1988; Contractor & Eisenberg, 1990; Farace, Monge, & Russell, 1977; Monge & Contractor, 2003; Monge & Eisenberg, 1987; Rogers & Agarwala-Rogers, 1976; Rogers & Kincaid, 1981; Stohl, 1995). A network consists of a set of nodes (often individuals) and the

Table 1 Issues Explored Using Structuration Theory in Prior Research

Topic	Representative Articles
Small-group decision making	Poole, Seibold, and McPhee (1986) Seibold and Meyers (2007)
Organizational climate	Bastien, McPhee, and Bolton (1995) Poole (1994)
Family routines surrounding communication with in-laws	Prentice (2008)
Patterns of racism in sports and newspaper coverage	Halone (2008) Durham (2002)
Role of leadership in internal branding	Vallaster & de Chernatony (2006)
Patterns of media use in organizations	Orlikowski (2000) Orlikowski and Robey (1991) Yates and Orlikowski (2002)
Influence of technology on organizational structures	Barley (1986, 1990) Black, Carlile, and Repenning (2004) Zack and McKenney (1995)
Organizational culture	Witmer (1997)
Misuse of family leave policies in organizations	Kirby and Krone (2002)
Negotiation of work-life issues in organizations	Hoffman and Cowan (2010)
Business history	Yates (1997)
Discrepancies in usage of group decision support systems	DeSanctis, Lewis, and Desharnais (1992) Poole and DeSanctis (1992)
Development of genres of organizational communication	Yates, Orlikowski, and Okamura (1999) Yates and Orlikowski (1992)
Development of interfirm networks	Sydow and Windeler (1998)
Building of an organization's capability to adapt to hypercompetitive environments	Staber and Sydow (2002)

collection of ties between them. Network analysis has been frequently applied to the study of organizations, where the nodes are members of the organization and the ties are communication links among them (see Carrington, Scott, & Wasserman, 2005 or Wasserman & Faust, 1994 for comprehensive introductions to social network analysis). Conceptually, the emergent communication network reflects the informal structure of an organization and represents interactions that arise (Johnson, 1992; Monge & Eisenberg, 1987) to augment formally mandated communication relationships. Whereas the formal structure is codified in organizational charts, the emergent communication network is the organization's "grapevine." Outcomes influenced by patterns in emergent communication networks include turnover (Feeley, 2000; Feeley & Barnett, 1997; Feeley, Hwang, & Barnett, 2008; Krackhardt & Porter, 1985, 1986), job satisfaction (Pollock, Whitbred, & Contractor, 2001), perceptions of influence (Brass, 1984), and successful job searches (Granovetter, 1985, 1992). Recently, scholarship (e.g., Contractor, Wasserman, & Faust, 2006; Monge & Contractor, 2003; Powell, White, Koput, & Owen-Smith, 2005) has demonstrated that the increased use of agile organizational forms has underscored the need to understand network emergence.

Both ST and communication network analysis have received criticisms. In the case of structuration, empirical validation is made more challenging by the high level of abstraction of the theory itself (Barley & Tolbert, 1997; Pozzebon & Pinsonneault, 2005; Yates, 1997). This has led to concerns such as whether structuration has been mostly applied at a metaphorical level, whether structuration is a theory in the generally accepted sense of the term, what an adequate test of ST would look like, whether such a test is necessary or even desirable, and whether structuration is falsifiable (Contractor & Seibold, 1993). In the context of studying the appropriation of technology in organizations, the response to some of these concerns has led to the development of a more sociomaterial approach to the emergence of networks (Leonardi, 2009; Leonardi & Barley, 2008, 2010; Orlikowski, 2007; Orlikowski & Scott, 2008; Pentland & Feldman, 2007). In the case of networks, scholars have lamented the lack of a better understanding of the theoretical mechanisms of network emergence (Ahuja, Soda, & Zaheer, 2007; Brass, 1995; Contractor et al., 2006; Contractor, Monge, & Leonardi, 2011; Galaskiewicz, 2007; Monge & Contractor, 2003; Salancik, 1995).

One viable strategy for conceptual and empirical advancement is integrating a network approach into a structuration framework (Barley, 1990; Haines, 1988; Sydow & Windeler, 1998; Zack & McKenney, 1995); we offer one strategy for answering this challenge. Social network analysis has benefited from increasingly sophisticated methodologies, yet would benefit from the conceptual richness of structuration. ST, which is richly evocative although highly abbreviated, would benefit from leveraging social network techniques to operationalize central constructs and mechanisms using potentially more creative and precise approaches (Poole, 1997). Our purpose here is *not* to discuss the relative merits of differing ontological and methodological approaches (for more on this, see Burrell & Morgan, 1979; Perrow, 1986; Pfeffer, 1982). Instead, we introduce a conceptual and methodological

strategy for broadening empirical approaches to the study of ST. We believe that structuration provides a robust theoretical foundation for network scholarship, while network methodologies and empirical results from communication network studies inform and allow for empirical examination of hypotheses implied by structuration.

In the following section, we describe how social network analysis may be fruitfully integrated with structuration for their mutual benefit, by including a summary of relevant structuration and network concepts and presenting our hypotheses. Then, we describe a study testing these hypotheses through the analysis of the emergence of a communication network over a two-year period. Key to this section is the introduction of an analytic strategy that takes advantage of stochastic actor-oriented models for network emergence as implemented in the *Simulation Investigation for Empirical Network Analysis* (SIENA) software (Boer, Huisman, Snijders, & Zeggelink, 2003). SIENA allow simultaneous estimation of how microdecisions (i.e., the individual actors' behaviors regarding the instantiation of new relationships and the maintenance and/or dissipation of existing ones) affect the emergence of a macrostructure (i.e., patterns in the entire network) and how this macrostructure feeds back and influences (i.e., enables and constrains) subsequent actor behavior (Snijders, 2005; Snijders, Steglich, Schweinberger, & Huisman, 2007). We wish to emphasize that this analytic strategy was developed specifically to overcome the limitations of cross-sectional variance approaches that are inappropriate for applying ST. Next, we present the results of the study, and conclude with a discussion of these results, along with the study's strengths, limitations, and implications for future research.

ST and communication network studies

ST defines a social system as a system of *human practices*, which are patterns of activities and behaviors in which agents in the system engage (Poole & McPhee, 2005).[1] "ST defines systems as observable patterns of relationships in practices" (p. 174); in our study, we analyze the communication behavior of members (agents) of an organization. *Structure* refers to the rules and resources agents follow or use when enacting the practices of the system. A *rule* is "any principle or routine that guides people's actions" (Poole & McPhee, 2005, p. 174). Network analysis conceptualizes observable patterns in communicative behavior as the structure of a communication network (Wasserman & Faust, 1994) and generative mechanisms as the rules that shape that structure (Monge & Contractor, 2003); thus, although it might be terminologically confusing, the *systems* concept in ST corresponds to the concept of *structure* in the network literature and the concept of *structure* in ST refers to the *generative mechanisms* in the network literature.

A central tenet of the structuration process is the *duality of structure,* which states that as agents utilize existing structural rules when acting in a social system, they concurrently reproduce the social system. The rules developed in the prior history of the system act as antecedents shaping current behavior, and by enacting these behaviors, these same rules are being reified, thereby influencing future activities.

Rather than being separate and concrete entities, rules exist only to the extent they are instantiated by the actions of agents in the system. As agents (either consciously or subconsciously) behave consistently with existing rules, these same structures are reproduced or reified and continue to have future influence. Any agent in a social system may act in a way contrary to the structure, and while a single act will not likely alter the existing structure, a critical mass of such behaviors can bring about change. Duality of structure implies that structures in a social system are simultaneously the antecedents of agents' current actions and the outcomes of the aggregate of agents' previous individual behaviors; over time, these structures act as enabling and constraining communication behavior and are reified and/or changed by them as they unfold. Individual agent action is partially responsible for the emergence of macrostructure, which in turn affects the individual behavior; in this sense, structure is both an antecedent to and an outcome of individual choices.

While ST provides an elegant accounting for how structural rules both influence and emerge from communication behavior, it gives little guidance for precisely articulating the structures (in ST parlance or generative mechanism in network terminology) in the system (in ST parlance or structure in network terminology). In the networks literature, there has been a growing interest in the development of multitheoretical and multilevel models to understand the emergence of networks (for theoretical overviews, see Contractor et al., 2006; Monge & Contractor, 2003; for an empirical example, see Su, Huang, & Contractor, 2010). We argue that these influences, which have been empirically validated by prior studies, *function as rules affecting the communicative behavior of agents in the social system*—in this case, members of an organization. Figure 1 illustrates our structuration model of network emergence. There are two types of rules (or generative mechanisms) included in the model: external (or exogenous) rules, which exist independently of the communication ties in the network itself, and internal (or endogenous) rules, which are the human practices agents enacted in the prior history of the system that impact subsequent behavior. Each of these is explained in more detail below.

External structural rules

External structural rules are factors exogenous to a network and are based on theoretical mechanisms, which previous studies have identified as influencing communication behavior on how the communication network emerges. For instance, two actors in a network will be more likely to communicate if they are physically proximate to one another (Festinger, Schachter, & Back, 1950; Monge, Rothman, Eisenberg, Miller, & Kirste, 1985; Rice, 1993) because of them being exposed to each other, which will ease interaction. The source of this influence, spatial location, is external to the communication network that emerges from individual agents' behaviors. Yet it may act as an enabling mechanism; if i and j are physically proximate and i *does not communicate* with j at time $t - 1$, i will be more likely to communicate with j at time t. It may also act as a constraining influence; if i and j are physically proximate and i *does communicate* with j at time $t - 1$, it will be more difficult for i

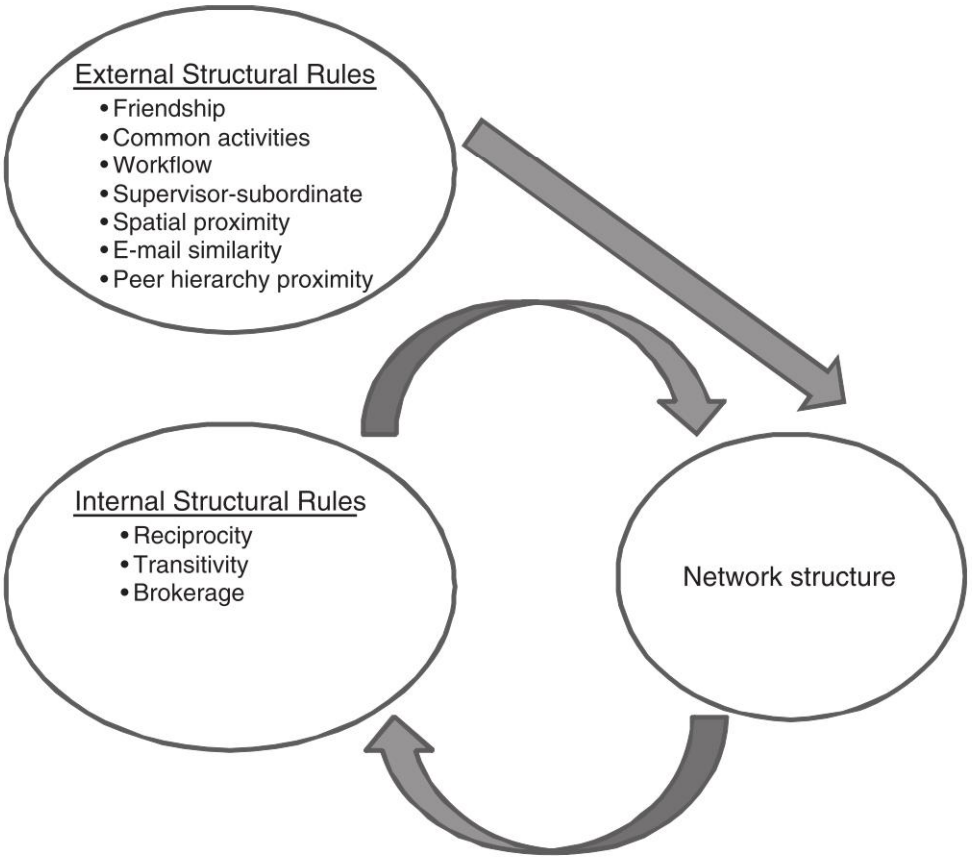

Figure 1 Structurational model of network emergence.

to discontinue communication with *j* at time *t*. The tendency for proximate actors to be more likely to communicate is a structural rule of the social system.

We include seven rules that theories and previous studies demonstrate influence the probability of a communication tie from actor *i* to actor *j*. These rules act as external structural rules because they are exogenous to the network, in the sense that they are not part of, nor emerge from, the communication network itself. These seven external rules are friendship, participation in common activities, connection in the workflow network, having a supervisor–subordinate relationship, spatial proximity, e-mail proximity, and peer hierarchy proximity. They are listed in the top circle in Figure 1, indicating their continued influence on the structuration of the communication network. Table 2 identifies each rule, provides a summary of the nature of its impact on the emergence of a communication network, and cites prominent studies associated with each. On the basis of prior theory and research, we suggest a set of seven exogenous rules collectively referred to here as Hypothesis 1:

H1: External structural rules will significantly influence the structuration of the emergent communication network.

Table 2 Variables, Theories, and Summary of Influence of External Structure Rules on Emergent Communication Networks

Variable	Underlying Theory	Effect/Underlying Mechanism
Friendship	Uncertainty Reduction Theory	Friendship decreases uncertainty. In high uncertainty situations, people will communicate more with their friends (Albrecht & Adelman, 1984; Albrecht & Bach, 1997; Albrecht & Hall, 1991; Berger, 1987; Berger & Calabrese, 1975).
Participation in common activities	Activity Focus Theory	Interpersonal interactions in organizations are structured around common activity foci. People engaging in common activities are more likely to develop interpersonal relationships and therefore to communicate, as they are exposed to one another and meet those with common interests (Corman & Scott, 1994; Feld, 1981; McPhee & Corman, 1995).
Connection in the workflow network	Coordination Theory	Within the context of coordination theory (Crowston, 1997; Malone & Crowston, 1994), workflow is one of two mechanisms affecting communication. Employees depend on each other for resources such as information on what tasks to do next or on progress on past tasks, and for work skills and knowledge needed to complete tasks. A mutual dependency in the workflow will therefore increase the likelihood of communication between two employees (Brass, 1981; Van de Ven & Ferry, 1980).
Supervisor–subordinate relationship	Coordination Theory	Within the context of coordination theory (Crowston, 1997; Malone & Crowston, 1994), hierarchy is one of two mechanisms affecting communication. Hierarchy influences emergent communication patterns in two ways: via supervisor–subordinate (vertical) relationships and via peer (horizontal) relationships among managers. Supervisor–subordinate communication patterns are related to the nature of the relationship because the supervisor needs to communicate directions, procedures, and feedback, while the subordinate usually requests task-related clarification. Thus, the presence of a supervisor–subordinate relationship increases the likelihood of a communication tie between any two actors in the network (Jablin, 1979, 1987).

Table 2 *Continued*

Variable	Underlying theory	Effect/Underlying mechanism
Spatial proximity	Physical Proximity Theory	Employees physically colocated are more exposed to one another, which in turns increases the likelihood of communication (Allen, 1978; Conrath, 1973; Kraut, Egido, & Galegher, 1990; Festinger et al., 1950; Monge et al., 1985; Rice, 1993; Van den Bulte & Moenaert, 1997; Zahn, 1991).
E-mail proximity	Electronic Proximity Theory	E-mail creates electronic proximity by facilitating interaction between employees who are not co-located and allowing them to resort to asynchronous communication (Constant, Sproull, & Kiesler, 1996; DiMaggio, Hargittai, Neuman, & Robinson, 2001; Haythornthwaite & Wellman, 2001; Hinds & Kiesler, 1995; O'Mahony & Barley, 1999; Rice, 1994; Wellman, Salaff, Dimitrova, Garton, Gulia, & Haythornthwaite, 1996; Zack & McKenney, 1995).
Peer hierarchy proximity	Coordination Theory	Within the context of coordination theory (Crowston, 1997; Malone & Crowston, 1994), hierarchy is one of two mechanisms affecting communication. Hierarchy influences emergent communication patterns in two ways: via supervisor–subordinate (vertical) relationships and via peer (horizontal) relationships among managers. As for the latter, due to the need to coordinate the activities of their subordinates, individuals higher in the hierarchy (usually managers) need to communicate more with their peers than with individuals at lower hierarchical levels, in order to make sense of and enact the environment in which the organization is embedded (Daft & Weick, 1984).

Internal structural rules

ST emphasizes the importance of reified rules for understanding agents' communication behavior. In addition to the rules exogenous to the communication network, extant patterns of who is communicating with whom will also influence subsequent behavior. Consider a communication network today, which will have observable patterns of which network actors are communicating with each other. For the subsequent time period, for all other actors in the network a focal actor will either: (a) initiate

a communication tie, (b) maintain a tie if one already existed, (c) dissolve a tie that existed previously, or (d) continue to have no tie. The focal actor's communicative behavior will be influenced by the patterns in the previous time period.

The patterns in the aggregate of all actors' communicative behaviors represent the structure of the communication network. Consistent with the duality of structure concept, communication structure emerges from individual behavioral decisions (microbehavior impacting structure). Furthermore, in subsequent time periods these structures impact future communication behavior by each given actor (macrostructural impact on microbehaviors). Each actor's tendencies to behave in a manner consistent with existing structures can be seen as the microbehavior that happens within the set of opportunities and constraints posed by the macrostructure, but at the same time may end up influencing it. Given that these sets of preferences occur over time within the ongoing communication relationships between network actors, we consider them internal (or endogenous) structural rules. We posit three internal rules that are likely to shape communication networks over time: reciprocity, transitivity, and brokerage.

Reciprocity is a measure of the tendency toward mutual interactions among network members (Brass, 1995). In the case of a communication tie, a reciprocity effect would mean that if actor *i* communicates with *j*, then over time *j* will be more likely to communicate with *i*. Thus, reciprocity occurs at the dyadic level of analysis, and is an indication of the extent to which social exchange is influencing the communication network. Social exchange theory (Blau, 1964; Emerson, 1962, 1972a, 1972b; Homans, 1950, 1974) explains reciprocity in dyadic interactions on the basis of the resources each actor has to offer. If Dave perceives Mark as potentially having valuable resources, he will initiate a communication tie. Mark will reciprocate only if he feels Dave has valuable resources for him.

Transitivity occurs at the triadic level of analysis. A triad is a set of three actors and the relationships between them (Wasserman & Faust, 1994), and it is said to be transitive if, when there is a relationship from *i* to *j*, and from *j* to *k*, then there is also a relationship from *i* to *k*. Research consistently shows transitivity is an important characteristic of social networks (Fararo & Sunshine, 1964; Holland & Leinhardt, 1972; Rapoport, 1953, 1963; Wasserman & Faust, 1994). Balance theory (Heider, 1958) explains the emergence and dissolving of communication ties in triads on the basis of cognitive dissonance. An actor will initiate communication ties with friends of friends and dissolve ties with friends of enemies and enemies of friends. For example, if Tom and Bill are friends and Jane is a friend of Bill, chances are that Jane will become friends with Tom, making the triad transitive. To the extent that communication between individuals is motivated and/or accompanied by positive affect, balance theory will lead to transitive structures.

An individual occupies a *brokerage* role in a communication network if he/she connects two disconnected actors (Burt, 1992, 2005). Individuals in a brokerage role will draw a competitive advantage from their positioning, both by collecting a higher volume and better quality of information from their contacts and by

exercising greater control over the information flow. For example, in the case where Tom interacts with John, but Mike does not, Tom may forge a tie with Mike that would give him control over the information flow between the other two actors. A self-interest mechanism drives certain entrepreneurial individuals to seek to locate themselves in advantageous positions in communication networks for either cultural (e.g., because of a Calvinist profit-seeking ethic) or psychological (e.g., a need to achieve; McClelland, 1961) reasons. Thus, we propose a set of three internal (or endogenous) rules collectively termed as Hypothesis 2:

H2: Internal structural rules (tendencies toward reciprocity, transitivity, and brokerage) will significantly influence the structuration of the emergent communication network.

Hypothesis 2 predicts that the aggregate of the microbehaviors of individual actors will result in the macrostructure of the communication network. The resulting communication structure at the end of one time period represents both opportunities and constraints for network actors in the subsequent time period. For instance, if actors' tendencies toward reciprocity create a network structure that is increasingly complete where each actor is connected to all others, then this automatically reduces the opportunities for the alternative microbehavior of brokerage (because there will be increasingly fewer disconnected others in the network). This illustrates how microbehaviors affect structure, and in turn how structure affects future microbehaviors; in this self-organizing sense, *structure generates structure*. We suggest that this provides a reasonable approximation of a test of the duality of structure, one of the basic tenets of ST.

ST implies that as internal structural rules are followed consistently over time, their influence over individual actions increases. It is through this reifying process that norms for behavior develop and increase in strength, suggesting that, over time, the co-evolution of microbehaviors and structures will become stronger than any external influence that may impact such structures. Therefore, if indeed ST is at work, we would expect that the mechanisms generated by the communication network itself (the internal or endogenous structural rules) will have a more powerful effect on the emergence of the communication network than those mechanisms that are not generated by the network (the external or exogenous structural rules). On the basis of this reasoning, we posit:

H3: The relative influence of the internal structural rules on the structuration of the emergent communication network will be greater than that of the external structural rules.

Methods

Empirical setting and procedures

The participating organization was the Directorate of Public Works (hereafter DPW) of a military base of approximately 35,000 located in the southeast of the

United States, whose members were civilians. The DPW is organized into five functional departments. Administration acts as an interface between the directorate and the rest of the base and coordinates the activities of the other departments. Engineering Plans and Services focuses on maintaining the existing infrastructure and buildings and developing future plans for expansion. Facilities Management manages budgets and oversees ongoing construction. Housing assures the residency needs of military personnel and their families are met. Environment enforces compliance with environmental regulations.

DPW members participated in a series of 13 structured interviews that took place every two months just over a two-year period. The response rate for each data collection was 100%. Our analysis used the data for the 55 employees who were employed for the duration of the study. The average age of these employees was 45, ranging from 28 to 60 years; 40 were male and 46 were White. These employees had worked at the base for an average of 11 years, ranging from 2.8 to 28 years.

Instrumentation

Communication networks

For each of the 13 data collection periods, employees were given the roster of the DPW and then asked to read each name in this roster. Respondents estimated the amount of task communication per week they had with each person with whom they interacted in the previous two months. Communication was defined as "conversations in person, in meetings, by phone, via electronic mail, or by memoranda." Thirteen 55 by 55 asymmetric matrices were developed (one for each time period), where cell *ij* equaled the number of minutes per week *i* reported communicating with *j*. Each matrix was then dichotomized so that cell *ij* equaled 1 if *i* reported communication to *j*, and 0 otherwise; this was necessary for our analysis using SIENA. We coded for the presence/absence of communication because our research interest focuses on the emergence of communication structure over time, which is defined as the pattern of existing communication links. Leaving out ties that are below a given threshold would result in a loss of critical data on who is communicating with whom.[2]

External structural rules

Seven relations representing the external structural rules were used in our analysis. To identify the *friendship* network, employees were given a roster of organizational members and were asked to identify those employees they considered to be their friends. These data were entered into a 55 by 55 asymmetric matrix, where cell *ij* equaled 1 if *i* reported *j* as a friend. To identify which employees worked on *common activities*, we utilized the Theme Machine, a theme-extracting software (for a detailed description of the software, see Lambert, 2001). Specifically, the formal job descriptions of all employees were entered into text files, where each sentence of text was treated as a separate document. The software assigned term weights based on the frequency with which words appeared in the total set of documents, computed similarities between documents based on both the number of common words and the

term weights, and clustered documents on the basis of their similarities. We had 161 clusters, which, after dropping clusters based on non-activity-related language and collapsing those that referred to the same activity in slightly different terms, became 130 unique tasks. We printed each of them on an index card and asked employees to identify the tasks they performed and group these tasks into activity piles so that tasks that contributed to a common activity were together; these piles were taken to be activity foci in DPW. Employees were then asked to name others in the organization with whom they worked while performing each activity. These data were entered into a 55 by 55 matrix, where cell *ij* equaled the number of common activities *i* reported doing with *j*. The *workflow* network was measured by looking at DPW employees' use of a specific government form, which indicated and tracked the principal activities performed in the organization. Employees were asked to report the number of these forms they gave to and received from colleagues during a typical work week. These data were entered into two 55 by 55 matrices. In the first, cell *ij* equaled the number of forms *i* reported giving to *j*; in the second, *ij* equaled the number of forms *i* reported receiving from *j*. A third matrix was then developed, where cell *ij* equaled the sum of the correspondent two *ij* cells in matrices 1 and 2, giving an index of the strength of the workflow link between *i* and *j*. *Spatial proximity* was operationalized with a matrix where cell *ij* equaled 3 if *i* and *j* shared the same office, 2 if *i* and *j* were in adjacent offices, 1 if *i* and *j* were in the same building, and 0 otherwise. *Supervisor–subordinate* relationships were identified by developing a matrix where cell *ij* equaled 1 if *i* was *j*'s supervisor, and 0 otherwise. *E-mail proximity* was measured by asking employees the number of minutes per week of electronic task communication they had. An employee was considered to have adopted e-mail if he/she reported at least one minute of task communication via e-mail with at least one other employee. A symmetric matrix was constructed in which cell *ij* equaled 1 if *i* and *j* had both adopted e-mail, and 0 otherwise. To identify *peer hierarchy proximity*, employees were coded for their appropriate hierarchical level (1 = support staff/technician, 2 = specialist/engineer, 3 = team leader, 4 = area chief, and 5 = division chief). Because employees who share managerial responsibility higher up in the hierarchy will be more likely to communicate with one another for coordination purposes (Daft & Weick, 1984), we developed a hierarchy proximity network where cell *ij* was 1 if *i* and *j* were both located at the higher hierarchy levels of 4 or 5, and 0 otherwise.[3]

Internal structural rules

Three internal structural tendencies toward reciprocity, transitivity, and brokerage were included in the model. The parameter attached to the reciprocity effect indicates the tendency for actors to reciprocate ties to others. The parameter attached to the transitivity effect indicates the preference of actors for initiating and maintaining ties that create transitive triads. The parameter attached to the brokerage effect corresponds to a preference for bridging gaps between other unconnected actors. These three factors were utilized to assess the degree of self-organization—whether "structure begat structure"—during the emergence of the communication network.

Analysis

Given the process nature of ST, analytic strategies should be both longitudinal and dynamic in their approach. Additionally, conceptualizing the duality of structure as an approach to overcome the micro–macro dichotomy offers considerable challenges for researchers seeking to apply ST, essentially eliminating a variety of methodological strategies from consideration. To address these concerns, we utilized a stochastic actor-oriented model implemented using SIENA (Snijders, 2001, 2005; Snijders et al., 2007). Stochastic actor-oriented models have emerged as an influential approach for understanding the emergence of networks where individuals (at the microlevel) actively seek to forge ties that are enabled and constrained by extant structures (at the macrolevel). They assess the influence of a variety of exogenous and endogenous tendencies on the emergence of networks and "estimate parameters expressing their strengths, while controlling for other tendencies" (Snijders, van de Bunt, & Steglich, 2010). They have been used to understand network evolution in a variety of fields, such as sociology, psychology, and management (for a complete description, see Van de Bunt & Groenewegen, 2007; Snijders et al., 2010), and have recently been applied for studying the emergence of intra- as well interorganizational networks (Van de Bunt & Groenewegen, 2007). In this approach, the network is modeled as a locally self-organizing system, in which network structure is both an emergent property of individual action and a constraint for such action. Because in the analysis of structuration the dual role of networks as both antecedent and consequence in a dynamic feedback process is crucial, stochastic actor-oriented models are more appropriate than the traditional variance-based approaches to examine ST. This stands in contrast to other network analytic methods where networks are treated as either outcome variables (consequences) or as predictor variables (antecedents), but not in both roles in the same analysis (Borgatti & Foster, 2003).[4]

There is a natural parallel between the conceptualization of structuration and the analytic approach of stochastic actor-oriented models. First, both recognize the importance of incorporating the simultaneous influence of multiple factors over time. Second, both explicitly emphasize the importance of each individual agent's microbehaviors while recognizing the influence of a variety of macrostructural rules. Third, both incorporate the importance of structural influences over time. Structuration predicts that extant structures reified over time will enable and constrain individual activity. Stochastic actor-oriented models instantiate this by aggregating, at any moment in time, the relational patterns of individuals to identify local structural properties and by utilizing these properties as predictor variables that explain subsequent changes in the network structure.

The 10 structural rules (seven external, three internal) simultaneously influence each actor's decisions on whether or not to initiate (or sever) a communication tie. For instance, the presence of a workflow tie between two actors is an example of an external structural rule that operationalizes the structural rule that states these two actors will be more likely to communicate with each other. The tendency to fill brokerage roles is an example of internal structural rule that states an actor *i* will take

the opportunity to create ties with actors j and/or k when it will indirectly connect these two unconnected actors.

In addition to the theoretically expected effects, agents' decisions are also assumed to show traces of residual noise. Formally, in stochastic actor-oriented models of network emergence actors i are assumed to behave as if they optimized a probabilistic (or stochastic) objective function f_i, in which the theoretically expected effects figure as a deterministic part and the residual unexplained change as a random component. This random factor may be viewed as acknowledging the inherently unpredictable nature of human agency emphasized in ST (Giddens, 1984). While an individual's action at any given moment in time may be inconsistent with the structures utilized in our model (i.e., be essentially random and unpredictable), it remains an empirical question whether these structures nonetheless form the backbone of the observed communication patterns. For the mathematical details of the model and its estimation, we refer the reader to Snijders (2005).

Model fit

The relative fit of the models is obtained by a variant of a score test statistic that allows examination of whether adding more variables to a simple model improves its fit to the data (Schweinberger, 2004). The resulting score test statistic, the *c-statistic* (a change statistic) is chi-square distributed, with the number of parameters tested for inclusion as the degrees of freedom. The *c-statistic* can be interpreted similarly to an F test for nested regression model in that they both express the increase in fit for a model by including variables or blocks of variables of interest. Therefore, as it assesses the impact of the variables for which it was calculated on the fit of the overall model, the size of the *c-statistic* provides a good indication of which one among alternative model specifications best accounts for the observed data.

Hypotheses testing

Hypothesis 1 predicts that the block of seven external structural rules will significantly influence the emergent communication network. Hypothesis 2 predicts that the block of three internal structural rules will significantly influence the emergent communication network. Two types of analysis were run to test these hypotheses. First, a full model was run that included both the block of seven external rules (friendship, common activity, workflow, supervisor–subordinate relationship, spatial proximity, e-mail proximity, and peer hierarchy proximity) and the block of three internal rules (reciprocity, transitivity, and brokerage). This provides baseline evidence that our model successfully accounts for at least some of the structuration process of the emergent network. Subsequently, two models were run, one that included only the block of internal factors and one that only had the block of external factors, and *c-statistics* were calculated for each. A significant *c-statistic* indicates that the block that was left out significantly influenced the structuration of the emergent network. Hypothesis 3 predicts that the influence of the internal structural rules would be

greater than that of the external rules. This hypothesis is evaluated by comparing the relative sizes of the *c-statistics* for the blocks of internal and external factors to see which block has the strongest influence on the emergence of the communication network.

Results

To get a first impression of the relationship between communication and the other variables included in our model, Table 3 summarizes the correlations between all the variables in the study. These correlations were calculated using the quadratic assignment procedure (QAP), a nonparametric significance test for testing for correlations between network variables (Krackhardt, 1988). While the external factors are represented by single matrices and immediately fit the QAP input format, both the dependent variable communication and the three variables representing the internal rules had to undergo some treatment to fit this analysis. Communication was averaged over the 13 measurement points, while the three internal variables were first calculated per each dyad and measurement point, and then also averaged (for example, entry *ij* of the transitivity matrix gives the average number of transitive triplets that a communication tie x_{ij} closes). Results in Table 3 suggest that all external and internal factors, when taken individually (and cross-sectionally), are significantly associated with the emergence of communication. This provides tentative support that the hypothesized factors are potentially important influences on the structuration of this network and warrants inclusion in our models.

Table 4 summarizes the results of the models testing Hypotheses 1 through 3. Model 1 includes all seven external and three internal structural rules. Inspection of the individual coefficients provides an indication of the strength of the influence of these individual variables. Specifically, it shows that the emergence of the network was influenced by four of the seven external generative mechanisms (friendship, workflow, supervisor–subordinate relations, and spatial proximity). The remaining three external rules (common activity, e-mail proximity, and peer hierarchy proximity) did not significantly influence the emergence of the network. In addition, all three internal generative mechanisms (reciprocity, transitivity, and brokerage) significantly influenced the structuration of the network. Hypothesis 1 predicts that the block of seven external structural rules will significantly influence the structuration process of the emergent communication network. Model 2, which included only the three internal factors, enables us to calculate the *c-statistic* for the block of seven external factors that were left out of the analysis. The significant *c-statistic* finding ($c = 262.873$, $p < .001$) means that the addition of the block of variables posited in Hypothesis 1 would significantly improve our model; the highly significant *c-statistic* provides support for Hypothesis 1.

Hypothesis 2 predicted that the block of internal structural rules would significantly influence the structurational process on the emergent communication network. Model 1 indicates that reciprocity, transitivity, and brokerage have

Table 3 Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11
1. Communication	—	0.286*	0.120*	0.217*	0.156*	0.370*	0.237*	0.073*	0.821*	0.534*	0.865*
2. Friendship		—	0.028	0.042	0.028	0.219*	−0.018	0.033	0.240*	0.157*	0.266*
3. Common activity			—	0.062*	0.126*	0.145*	0.022	0.088*	0.134*	0.083*	0.168*
4. Workflow				—	0.246*	0.174*	0.114*	0.041	0.162*	0.107*	0.226*
5. Supervisor–subordinate					—	0.227*	0.032	0.080*	0.135*	0.223*	0.200*
6. Spatial proximity						—	0.016	−0.020	0.193*	0.106*	0.456*
7. E-mail proximity							—	0.057	0.317*	0.153*	0.212*
8. Peer hierarchy proximity								—	0.081*	0.112*	0.087*
9. Transitivity									—	0.417*	0.794*
10. Brokerage										—	0.554*
11. Reciprocity											—

(*$p < .05$.)

Table 4 SIENA Longitudinal Models Analyzing the Emergence of the Network Structure

	Model 1	Model 2	Model 3
Outdegree	−1.428 (0.034)**	−1.523 (0.04)**	0.009 (0.036)
Friendship	0.529 (0.055)**	—	0.795 (0.072)**
Common activity	0.037 (0.035)	—	0.079 (0.053)
Workflow	0.846 (0.113)**	—	0.870 (0.163)**
Supervisor–subordinate	1.636 (0.341)**	—	1.887 (0.389)**
Spatial proximity	1.353 (0.124)**	—	1.418 (0.151)**
E-mail proximity	0.077 (0.036)	—	0.497 (0.055)**
Peer hierarchy proximity	0.796 (0.396)	—	1.100 (0.632)
Reciprocity	0.670 (0.063)**	1.372 (0.081)**	—
Transitivity	0.049 (0.003)**	0.043 (0.004)**	—
Brokerage	−0.066 (0.012)**	−0.1546 (0.014)**	—
C-statistics			
Friendship	—	147.512**	
Common activity	—	6.638*	
Workflow	—	50.071**	
Supervisor–subordinate	—	40.153**	
Spatial proximity	—	116.618**	
E-mail proximity	—	0.805	
Peer hierarchy proximity	—	3.344	
Block of internal factors	—	—	1,634.131**
Block of external factors	—	262.873**	—

(*$p < .01$. **$p < .001$.)

significant influences ($p < .001$) on the structuration process, providing support for Hypothesis 2. Further evidence is provided by Model 3, which included only the seven external factors. This allows us to calculate the *c-statistic* for the block of variables representing the internal rules. The significant result for this test ($c = 1{,}634.131$, $p < .001$) provides additional support for Hypothesis 2.

Hypothesis 3 predicts that the influence of the internal structural rules will be greater than the influence of the external rules. This may be examined by comparing the *c-statistics* for the block of external factors in Model 2 ($c = 262.873$) with the same statistic for the set of internal factors in Model 3 ($c = 1{,}634.131$). Because the *c-statistic* for the block of internal factors is more than six times that for the external factors, this clearly indicates that the internal rules play a much greater role in structuring the communication network than the external rules.

There is an additional point that provides support for our findings with regards to Hypothesis 3; given that the external block contains a larger number of factors than the internal block (seven versus three), one could expect a larger *c-statistic* for the external block simply because of the number of variables. This is not the case here, providing further evidence to support Hypothesis 3.

Discussion

ST (Giddens, 1984) and communication network analysis remain important approaches for understanding a wide range of communication and social phenomena. Scholars have suggested that the methodological sophistication of social network analysis be integrated with the conceptual richness of structuration (Barley, 1990; Haines, 1988). We answer this call and report what may best be described as a modest attempt at a more precise, testable, and falsifiable set of hypotheses based on structuration. While there have been several attempts at specifying and executing computer simulations of complex systems (e.g., Contractor & Grant, 1996; Contractor & Whitbred, 1997; Corman, 1996; Levitt et al., 1994; Lin, 1994), including specifically in the area of ST (Contractor & Seibold, 1993), this study is among the first to use an analytic approach that allows the longitudinal analysis of the structuration of an emergent organizational network.

Our results support three basic findings. First, factors that are external to the network (i.e., external structural rules) have significant influence on the emergence of the communication network. Second, our analysis demonstrates that agents' individual communication behaviors result in macrostructures in a communication network, and these patterns enable and constrain how structurational rules influence future agent behaviors. As such, this may be considered a test of the duality of structure, one of the basic premises of ST. Third, our results show that the influence of the internal structural rules is substantially larger than those of the external structural rules. This lends further credence in support of a structurational argument because the endogenous microbehaviors directly associated with the communication structure were a stronger predictor of its emergence than those mechanisms that were external to it.

Practical implications

ST emphasizes that while social systems have observable patterns in agents' behaviors, this seeming stability emerges from continual self-organizing dynamic process. Our analysis showed that in the case of an emergent communication network in an organization, the impact of internal structural rules that emerged in the previous history of the organization was much greater than the influence of rules grounded outside the network. As implied by structuration, the internal rules reified according to the principle of the duality of structure greatly enabled and constrained subsequent agent behaviors, thus further strengthening these same rules. The message for managers and practitioners is simple—once a communication network has emerged, it is very challenging to implement desired strategic adaptations to the structure of the network structure. This may help explain why bureaucratic organizations often struggle to become more agile in response to a more competitive environment. Our results suggest it is overly simplistic to state that members of such organizations are "stubborn" or "behind the times." Rather, ST illustrates that changing such established networks *requires changing the very rules/underlying mechanisms that have (a) emerged from within the system over time, (b) been reified over the historical*

development of the system, and (c) become drivers of the emergence of the system. Entrepreneurs and managers of start-up companies should be cognizant of these observations and take strategic steps early in the structuration process of the emergent network to encourage a network that is appropriate for both their business and stakeholders.

Despite the important constraints of established internal structural rules that remain difficult to directly influence, practitioners and managers are often faced with the challenge of making an established network more agile. Our results found that, in addition to the rules endogenous to the communication network, there were four external mechanisms that enable and constrain the emergence of the communication network: friendship ties among members, being spatially proximate, having a stronger workflow link, and having a supervisor–subordinate relationship.[5] To better illustrate these results, we calculated the *c-statistics* for each of the individual external factors to see how they individually affect the fit of the overall model. These results are displayed in Figure 2; consistent with our results, these four rules indeed showed the highest *c-statistics*, meaning that the model fit would benefit the most from their addition. The findings that network actors are more likely to initiate and maintain communication if one is the formal supervisor of the other and if they are strongly connected in a workflow network is expected, given the bureaucratic nature of the DPW, and not easily amendable to quick intervention strategies. In the case of friendship, organizations often provide opportunities for their members to develop interpersonal social relationships, such as retreats and social activities. While these are frequently viewed as a means to improve climate, our results suggest they may also provide opportunities to encourage those who are not currently interacting to forge potentially beneficial ties. Of course, managers must balance the potential benefits of encouraging socially supportive relationships in the workplace with the possibility of these becoming detrimental (Whitbred, 2008). Proximity is easier to

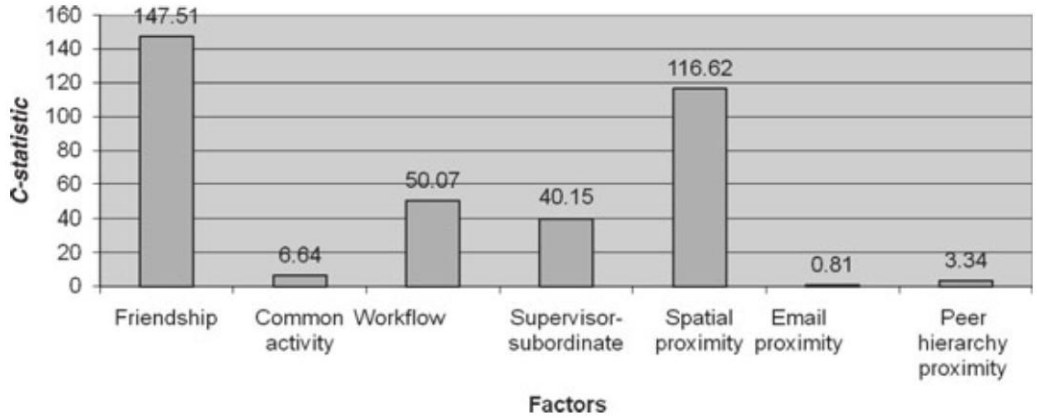

Figure 2 *C-statistics* indicating the influence of external rules on emergent network structuration.

manipulate because simply moving desks and offices will likely alter the social system. This is particularly salient in the context of strategic alliances and interdisciplinary project teams; to fully trigger creative innovation to the benefit of all participating parties, our results suggest that locating agents close to one another will stimulate the necessary interaction. In cases where physical co-location is not possible, such initiatives should move beyond listservs, conference calls, and electronic meetings and take advantage of virtual office environments.

Strengths, limitations, and future research

This study has three major strengths. The first is the utilization of a model that posits multiple theoretical mechanisms at multiple levels of analysis (e.g., reciprocity at dyadic level and brokerage at triadic level). The second is the quality of the network data set (with 100% response rate) that extended over a longer period of time (13 observations over two years) than is typically available. Third, we leveraged recent developments in stochastic actor-oriented models implemented in SIENA to examine the structuration of an emergent communication network. Our approach incorporated a wide assortment of findings from previous theory and research and provided an empirical test of implications of structuration, while overcoming at least some of the criticisms leveled against previous attempts to test structurational processes. A stochastic actor-oriented strategy allows the influence of both external and internal structural rules to occur simultaneously and to influence and be influenced by the communicative activities of each individual actor. In this case, the activity was whether *i* initiated a tie with *j*, *i* dissolved a tie with *j*, *i* maintained a tie with *j*, or *i* continued to have no tie with *j*. Thus, the structures at the current time period are the result of both individual action and the structures from the previous time period. We hope that our approach opens up new avenues based on network approaches that would enhance the rich tradition of ST and empirical research to better understand emergent organizational processes.

Our study has several limitations. First, it can be argued that our actor-oriented approach is a violation of the duality of structure concept because it separates, for purposes of analysis, the two inextricably linked facets of duality—systems (in ST parlance or structure in network terminology) and structures (in ST parlance or generative mechanisms in network terminology). We respond to this criticism in two ways. First, scholars (e.g., Archer, 1982) have argued that to avoid empirical conflation an "analytical dualism" is justified to facilitate analysis seeking to bridge the micro–macro gap. In our study, we incorporate a distinction between individual communicative rules and generative mechanisms and the resulting social structures. This concession seems defensible given the type of analysis that is then possible. Second, our approach is an example of temporal bracketing, which was identified by Pozzebon and Pinsonneault (2005) as a general strategy for studying structuration. There is no doubt that with data collected every two months we cannot claim a moment-by-moment account of the emergence of the network, but we argue this is a valuable complementary analytic strategy that provides a robust accounting of

the emergence of the network over time. This concern is further mitigated by the fact that the stochastic actor-oriented model implemented in SIENA is specifically designed to model continuous changes in the structure being analyzed utilizing data collected only at discrete intervals.

A second limitation is that the communication data were dichotomized. This was required by technical constraints in the current implementation of SIENA and necessitated a loss of information. However, as we are interested in how the emergence of structure (namely, the instantiation of internal structural rules) affects future instantiations of the communication network, analyzing the existence or absence of communication between network members is at the same time appropriate and represents a more conservative test (successful, in our case) of the presence of structuration than using the strength of ties. Future research may wish to explore whether structuration processes vary depending on whether *only* stronger or *only* weaker ties are included in the network. A third limitation is the fact that the external structural rules were time invariant. That is, for instance, that friendship was measured only at one point in time and our model does not account for the distinct possibility that friends might have emerged or dissolved over the course of the two-year duration of the study. A fourth limitation concerns our measure of e-mail adoption. While our operationalization relied on whether or not two actors both used e-mail, an alternative approach would have been to access e-mail logs and develop a valued matrix where cell *ij* provides the number of e-mails sent between two actors; because of privacy concerns we did not have access to such data, but future studies may want to take this into consideration.

A fifth limitation is that there are additional internal and external structural rules that could be incorporated into models such as ours. For example, homophily due to gender or ethnicity would predict that those who are of the same gender and ethnicity will be more comfortable with one another, and thus more likely to communicate (McPherson, Smith-Lovin, & Cook, 2001). We made decisions on which variables to include based on practical considerations about the number of factors we were incorporating and our understanding of the organization studied. DPW is a government bureaucracy, which may limit the possible influence of such demographic factors on internal communication networks. While future research certainly should consider alternative structural rules, we would like to emphasize that the inclusion or exclusion of any individual variable does not undermine our specific findings nor the general methodological approach advocated here.

One final issue we did not address is agency, which is the extent to which agents in the system were consciously aware of the rules and resources they were reifying when exhibiting communication behavior. Poole and McPhee (2005) identify three levels of consciousness. ''Discursive consciousness'' is when agents are aware of rules and resources and use them to account for their actions. ''Practical consciousness'' is when agents utilize resources but cannot put them into words. ''The unconscious'' are influences on behaviors when agents are not aware of them. It is beyond the scope of this study to situate our 10 rules in one of these three categories, and it is likely that

the same rule would be in different categories for different individuals and perhaps for the same individual at different time periods. Even though it is difficult (if not impossible) to assess levels of consciousness when examining a complete network, that does not imply the issue is irrelevant. For instance, the brokerage rule implies that some individuals will seek to place themselves in a position of competitive advantage by connecting with disconnected others. An examination of agency would bring to light whether such individuals are consciously seeking this advantage, an issue discussed in detail by Burt (2005). Future research should follow the strategy of analyzing which rules emerge as important in a given system, and then conduct in-depth interviews with individuals to tease out the extent to which they might be conscious of these rules.

Three additional avenues for future research are suggested by our study. First, communication is but one of many relations that play critical roles in effective organizational functioning. One should examine which structurational rules help us understand the emergence of other relations, such as advice or trust, by comparing our results to similar analysis performed on different types of relationships. Second, it is an open question as to whether structuration processes vary between different organizational forms. This study took place in a bureaucratic organization; while this may limit the generalizability of our results, it also points to additional empirical questions of generalizability for future research. Contingency theories (Burns & Stalker, 1961; Lawrence & Lorsch, 1967; Mintzberg, 1979; Perrow, 1967; Thompson, 1967) argue that the appropriateness of a mechanistic/bureaucratic or an organic/fluid organization structure depends on the level of turbulence in the surrounding environment. Newer virtual organizational forms (DeSanctis & Monge, 1999; Monge & Contractor, 2003) lack the formalized structures present in traditional organizational forms, while newly formed strategic alliances will likely struggle to reconcile different sets of existing structural rules. Future research should focus on establishing whether the structuration of social networks will vary depending on the nature of the organization and, if so, which structural rules would emerge as being most important in these other contexts. Finally, we studied an existing organization with structural rules that were already established. Thus, we were unable to investigate the process through which such rules emerged in the first place. It would be of interest to study entrepreneurial start-ups to track the initial formation of structural rules and the emergence of their communication networks. This is a future program of research for which we hope this study has provided an overall framework.

Acknowledgments

The authors wish to acknowledge the following funding sources that contributed to the development of materials presented in this article: Army Research Institute W91WAW-08-C-0106/P00004; Army Research Laboratory under Cooperative Agreement Number W911NF-09-2-0053; Air Force Research Laboratory FA8650-10-C-7010; and National Science Foundation Grants: CMS-9980109, BCS-0940851,

CNS-1010904, OCI-0904356, IIS-0838564, and IIS-0841583. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Army Research Laboratory, Air Force Research Laboratory, the National Science Foundation, or the U.S. government.

Notes

1 When an abstract theory such as structuration has been applied to a wide variety of contexts, it is inevitable that there will be some variations in the names used for concepts and their accompanying definitions. We have used the concepts and definitions provided in Poole and McPhee (2005) to ensure clarity and consistency with those most commonly accepted in the field of communication.

2 We discuss this issue further in the discussion section.

3 An alternative that often appears in network studies uses the absolute value of the difference in hierarchical levels between two employees as cell entries in a matrix. For example, if person 1 was a division head at level 5, person 2 was a middle manger at level 3, and person 1 was an entry-level worker at level 1, the cell entry from person 1 to person 2 would be 2 (5−3); from person 1 to person 3 would be 4 (5−1); and from person 3 to person 1 would be 2 (3−1).

4 An alternative technique is the QAP (Krackhardt, 1988), which can be used in cross-sectional studies to test for relationships between external factors and a given network. While a longitudinal variant of QAP has been proposed (Dekker, Franses, & Krackhardt, 2003), the method is inherently incapable of testing hypotheses about the internal structural effects such as those we are focusing on. This is because QAP assesses parameter significance by way of permutation tests, which change the structure of the dependent network while maintaining it isomorphically equivalent to the original one. However, one cannot—at the same time—permute the actors (in a dependent network) and not permute them (in an independent network) when dependent and independent networks are the same, as they are in the case of internal structural rules. This makes it impossible to use QAP to identify the strength of structural characteristics such as transitivity in a dependent network.

5 These results are consistent with the multitheoretical multilevel (MTML) framework (Contractor et al, 2006; Monge & Contractor, 2003), which recommends that network studies incorporate multiple theories that cross multiple levels of analyses to provide a more comprehensive understanding of the underlying forces shaping emergence.

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De las Micro-Acciones a la Macro-Estructura y vice versa: Una Examinación Estructural de la Evolución de las Redes Organizacionales

La teoría de la estructuración (ST) y el análisis de red permanecen los enfoques prominentes para el estudio de los fenómenos de la comunicación. La investigación de la ST ha sido criticada como mayormente metafórica, mientras que la erudición de la red ha sido juzgada como vacía de enfoque sobre los procesos emergentes. Ofrecemos un modelo que integra la riqueza conceptual de la estructuración con los conceptos apropiados y los hallazgos en la investigación de las redes de comunicación. Influenciamos los avances metodológicos (a saber, los modelos orientados al actor) para poner a prueba las hipótesis de estructuración usando los datos de comunicación longitudinales colectados sobre un período de dos años. Los resultados indican que mientras que las reglas externas estructurales de un sistema social de red juegan un rol, las reglas estructurales que emergen de las acciones de ese agregado de individuos en tiempos previos predice también las estructuras corrientes, y que la influencia de estas reificaciones es mayor que aquella de los factores externos.

Palabras claves: estructuración, dualidad de estructura, comunicación de red emergente

Von Mikrohandlungen zur Makrostruktur und zurück: Ein Strukturansatz der Evolution von Organisationsnetzwerken

Strukturationstheorie und Netzwerkanalyse bleiben prominente Ansätze für die Untersuchung von Kommunikationsphänomenen. Strukturationstheorieforschung wird als eher metaphorisch kritisiert während Netzwerkforschung hinsichtlich des fehlenden Fokus auf sich entwickelnde Prozesse beurteilt wird. Wir bieten ein Modell, das die konzeptionellen Vorteile der Strukturationstheorie mit passenden Konzepten und Forschungsergebnissen zu Kommunikationsnetzwerken verknüpft. Wir nutzen die methodologischen Entwicklungen (z.B. akteurszentrierte Modelle) um Strukturationshypothesen anhand von Längsschnitt-Kommunikationsdaten, die über den Zeitraum von zwei Jahren erhoben wurden, zu testen. Im Ergebnis wird deutlich, dass strukturelle Regeln von außerhalb des sozialen Netzwerksystems von Bedeutung sind, solche strukturellen Regeln allerdings, die sich aus dem Aggregat individueller Handlungen der Vergangenheit ergeben, ebenfalls aktuelle Strukturen prognostizieren. Der Einfluss dieser Verdinglichung ist größer als der Einfluss externer Faktoren.

Schlüssebegriffe: Strukturation, Dualität der Struktur, emergierende Kommunikationsnetzwerke

Allers-retours entre micro-actions et macro-structure : une approche structurationnelle à l'évolution des réseaux organisationnels

La théorie de la structuration (TS) et l'analyse de réseaux sont encore des approches importantes dans l'étude des phénomènes communicationnels. La recherche en TS a été critiquée parce qu'elle serait surtout métaphorique, alors que la recherche sur les réseaux a été accusée de ne pas assez s'intéresser aux mécanismes en émergence. Nous offrons un modèle qui combine la richesse conceptuelle de la structuration et les concepts et les résultats appropriés tirés de la recherche sur les réseaux de communication. Nous tirons profit des avancées méthodologiques (p. ex. les modèles axés sur l'acteur) pour mettre à l'épreuve les hypothèses tirées de la TS en utilisant des données communicationnelles longitudinales recueillies au cours d'une période de deux ans. Les résultats indiquent que si les règles structurelles externes à un système de réseau social jouent un rôle, les règles structurelles qui émergent de l'ensemble d'actions individuelles dans des périodes de temps précédentes prédisent aussi les structures actuelles, et que l'influence de ces réifications est plus grande que celle des facteurs externes.

Mots clés : structuration, dualité de la structure, réseaux de communication émergents

미시행위들로부터 거시구조와 지원: 조직적 네트웍의 진화에 대한 구조진화적 접근

구조화과정이론 (ST)과 네트웍 분석은 커뮤니케이션 현상을 연구하는데 매우 유용한 접근들이다. ST연구는 형이상학적이라고 비판받아온 반면, 네트웍접근은 출현과정에 대한 초점이 부족하다는 지적을 받아왔다. 우리는 구조화과정의 개념적 풍부성을 커뮤니케이션 네트웍들로부터의 적정한 개념과 연구발견과 통합하는 모델을 제공했다. 우리는 2년동안에 걸쳐 확보된 종적 커뮤니케이션 데이터를 사용한 구조화과정 가설들을 테스트하기 위한 방법론적 진전을 단행했다. 결과들은 사회적 네트웍 체계에 대한 구조화과정 규칙들이 중요한 역할을 한 반면, 이전에 나타난 개인적 행위들의 집합체로부터 나온 구조화과정 규칙들 역시 현재 구조를 예측한다는 것을 보여주고 있으며, 이러한 반복의 영향력이 외적인 요소들의 영향력보다 큰 것으로 나타났다.