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# Emergent leadership in virtual teams: what do emergent leaders do?

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## Abstract

We conducted an exploratory study to examine the behaviors and roles that are enacted by emergent leaders in virtual team settings. Specifically, we analyzed quantitative and qualitative data to identify differences between team members who emerged as leaders and as non-leaders in terms of their behavior as manifested in their electronic mail messages. The longitudinal study involved seven ad hoc and temporary virtual teams composed of senior executives of a US federal government agency who participated in an executive development program at a university.

The study indicated that overall, the emergent leaders sent more and longer email messages than their team members did. The number of task-oriented messages, particularly those that were related to logistics coordination, sent by emergent leaders was higher than that of non-leaders. However, there were no differences between emergent leaders and non-leaders in terms of expertise-related messages. No significant differences in relationship-oriented and technology management messages between emergent leaders and other team members existed. Furthermore, the emergent leaders enacted three roles: initiator, scheduler, and integrator. These findings are discussed and their implications for research and practice are described in the paper.

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## 1. Introduction

“There is no substitute for a manager’s keeping a finger on a company’s pulse, and the best way to do that in a virtual company is to be virtual. Sitting in a central office without plugging into virtual culture is almost a guarantee of failure.”—William R. Pape, co-founder and former CIO of VeriFone Inc., Redwood City, CA.

A frequently studied topic in management and social psychology literature is leadership. These studies primarily have been conducted in traditional organizational settings in which leaders and followers are in close proximity to each other and, for the most part, communicate face-to-face. Yet, globalization and advanced information and communication technologies are fueling a transition toward new organizational forms such as virtual teams. Despite its popularity in traditional management literature, leadership is only recently being studied in virtual team settings (Avolio & Kahai, 2003; Cascio & Shurygailo, 2003; Kayworth & Leidner, 2001–2002; Zigurs, 2003). We argue that conditions and special circumstances of virtual team environments require focused studies of leadership. For example, effective communication is crucial to leadership development. However, research comparing communication effectiveness of virtual and traditional teams has found that virtual teams communicate less effectively than their traditional counterparts (McDonough, Kahn, & Barczak, 2001; Powell, Piccoli, & Ives, *in press*). This downfall can be attributed to the potential communication challenges in virtual environments. Examples include the absence of non-verbal cues (Sproull & Kiesler, 1986), time delays in receiving feedback, and a lack of mutual understanding and a shared frame of reference among the team members (Cramton, 2001). These and other idiosyncrasies and challenges of virtual teams (described in greater detail later in this paper) motivate additional studies and the investigation of transferring existing leadership models to new contexts.

Our study aims to contribute to this important and emerging area of leadership research. For the purpose of this study, we draw on literature on virtual teams (DeSanctis & Monge, 1999; Jarvenpaa & Leidner, 1999; Powell et al., *in press*), to define a virtual team as a temporary, geographically dispersed team whose team members interact primarily through electronic media. Although, virtual teams can take many different shapes in terms of their membership, past field studies show that, in order to address specific problems, virtual teams in real organizations are often composed by domain experts from multiple organizations or departments within an organization (Majchrzak, Rice, Malhotra, King, & Ba, 2000; Maznevski & Chudoba, 2000). Therefore, we focus on self-managing virtual teams that are composed of individuals with expertise and knowledge in different domains.

There are several conceptualizations and definitions of leadership (for a comprehensive review, see Bass, 1990). Here, we subscribe to Yukl’s definition of leadership as “influence exerted ... over other people to guide, structure, and facilitate relationships in a group...” (Yukl, 1998: p. 3). Furthermore, given our focus on the study of ad hoc, self-managing, and temporary virtual teams of peers, we focus

on emergent, as opposed to designated, leadership. That is, we conceive of leadership as spontaneously accorded by fellow team members and as an emergent phenomenon that develops over time through group processes. In the context of our study, leadership status is not necessarily based on an organizational position or designated authority. Instead, leaders emerge and earn their status through incremental influences and contributions to the team (Hollander, 1960, 1961a).

Drawing from various leadership theories, we investigate emergent leadership in virtual teams. We focus specifically on the two following research questions:

1. *What behaviors differentiate emergent leaders from other members in virtual teams?*
2. *What roles are performed by the emergent leaders in virtual team settings?*

In answering these questions, we investigate the potential systematic differences between behaviors of emergent leaders and other members of seven virtual teams through the collection and analysis of both qualitative and quantitative data. We begin by reviewing existing virtual team literature and leadership theories; we then proceed to discuss the methodology used to investigate our research questions. Finally, we present the data analysis approach and the results, followed by a discussion that includes implications for future research and practice.

## **2. Research and theoretical foundations**

### *2.1. Virtual team research*

Research on virtual teams has begun to identify several key challenges in team processes that arise from teams' reliance on computer-mediated communication (CMC) tools as their primary means of communication (see Powell et al. (in press) for an extensive review of virtual team research). These challenges can be organized into three categories: socio-emotional support, coordination (logistics and task expertise), and technical uncertainty.

First, the reduction of social and contextual cues in CMC has been suggested as one of the prime challenges. Relative to face-to-face environments, CMC reduces peripheral communication cues, such as non-verbal cues, thus focusing more attention on task and leading to a more task-oriented environment (Daft & Lengel, 1986; Kiesler & Sproull, 1992). For example, Sussman and Sproull (1999) found that individuals were more direct and forthcoming when delivering bad news through electronic mail than they were in face-to-face communication. While a number of studies have found that social and emotional bonding among individuals can be developed in virtual environments (Chidambaram, 1996; Hart & McLeod, 2003; Rasters, Vissers, & Dankbaar, 2002; Walther, 1995, 1996), ad hoc and temporary virtual teams may engage in a lower level of socio-emotional interactions and support relative to their counterparts in face-to-face environments (Jarvenpaa & Leidner, 1999; Powell et al., in press).

Socio-emotional support is important to the relational development of teams (e.g., development of trust and group cohesiveness); and weak relational development may, in turn, impact team performance. For example, [Iacono and Wiseband \(1997\)](#) found that trust among virtual team members played an important role in team performance. In-depth case analyses by [Jarvenpaa and Leidner \(1999\)](#) showed that one-third of the virtual teams in their study that started the project with high trust ended with low trust and low performance. They also noted that teams that maintained high levels of trust throughout the project performed well, as did teams that overcame initially low levels of trust. In another study, [Crisp and Jarvenpaa \(2000\)](#) found that while the overall trust level in virtual teams *decreased* over time, some teams managed to enhance or sustain their trust level. Based on these findings, researchers argue that leaders of virtual teams need to expend a relatively high level of effort on relational development and socio-emotional interactions to promote trust within the team unit ([Cascio & Shurygailo, 2003](#); [Zigurs, 2003](#)).

Second, the removal of contextual cues in virtual team communication also creates new challenges in team coordination. [Maznevski and Chudoba \(2000\)](#) found that the virtual teams they studied coordinated various activities through the temporal rhythms of various communicative incidents including intense face-to-face meetings. Other studies found that frequent and predictable communication became the basis of effective coordination in virtual teams ([Jarvenpaa, Knoll, & Leidner, 1998](#); [Jarvenpaa & Leidner, 1999](#); [Johansson, Dittrich, & Juustila, 1999](#); [Kayworth & Leidner, 2001–2002](#)). In addition, other recent studies of virtual teams have revealed the need for coordination of the team members' task-related knowledge and expertise which exceed the logistical coordination. Such knowledge and expertise includes: knowing who knows what ([Cramton, 2001](#); [Yoo & Kanawattanachai, 2001](#)); knowledge dissemination ([Sole & Applegate, 2000](#); [Yoo, Kanawattanachai, & Citurs, 2002](#)); and knowledge transfer among team members ([Citurs & Yoo, 1999](#); [Cramton, 2001](#)). While these problems of "mutual knowledge" are not unique to virtual teams, the separation in time and space and a decrease in spontaneous interactions among virtual team members increase the difficulties of expertise coordination.

Finally, managing technology-related uncertainties and problems is another important challenge facing virtual teams ([Powell et al., in press](#); [Saunders, 2000](#)). [Majchrzak et al. \(2000\)](#) found that virtual team members continually adapt the way they use electronic communication technology in order to address their group process needs adequately. They noted that the alignment between the features of the communication tools and the social structures of virtual teams plays an important role in the team interactions. Similarly, [Orlikowski and Yates \(1994\)](#) found that professionals in a virtual team setting who are working to set up the specification for new software created and adapted various communication practices in order to suit a given set of conditions. Additionally, [Suchan and Hayzak \(2001\)](#) found that the reliability of communication tools played an important role on virtual team performance. Thus, interactions and activities focused on the use and

adaptation of communication technology constitute a key component of virtual team processes.

According to the vast body of literature on leadership (summarized below), leaders typically provide information or structures to address uncertainties and challenges that their teams face (Fiedler, 1967; House, 1971; House & Mitchell, 1974; Kerr & Jermier, 1978; Stogdill, 1974; Yukl, 1998). This implies that leaders in virtual teams may need to enact and maintain a sufficient level of socio-emotional interactions among their team members, and to provide for logistics and task-related expertise coordination. Furthermore, virtual team leaders may need to play the role of the “lead user” of communication technology in order to reduce and manage the technology-related uncertainty inherent in virtual team settings. We set out to explore if emergent leaders in virtual team environments exhibit higher levels of these behaviors relative to the rest of their team members.

The following section draws from an extensive body of leadership literature to address various dimensions of the leadership emergence in virtual teams.

## *2.2. Leadership perspectives*

While there are several theories that aim at explaining leadership, these theories can be generally categorized into three groups: trait, behavioral, and contingency (Forsyth, 1990; Kayworth & Leidner, 2001–2002; Lord, 1977). Trait theories focus mainly on identification of personal and innate attributes that contribute to the effectiveness of leaders. A large body of work in this category has examined the relationship between leadership and a variety of physical, cognitive, and personality traits. Examples include: physical appearance, intelligence, and introversion–extroversion traits. Despite significant efforts by early leadership scholars, however, trait theories have failed to identify a specific set of individual traits that consistently differentiate between effective leaders and non-leaders.

The behavioral leadership perspective, on the other hand, focuses on observable activities of leaders. The Ohio State Leadership Studies represent one of the first attempts at the formal and empirical investigation of leadership behavior (Hemphill & Coons, 1957; Shartle, 1950). These studies were followed by a large number of additional studies and, in essence, provided the foundation for the development of various behavioral models of leadership. Examples of these later models include: Theory X versus Theory Y (McGregor, 1960), autocratic versus participative leadership (Likert, 1961, 1967), and most recently, transactional and transformational leadership (Burns, 1978). Consistent with the Ohio State studies, these later models roughly identified two clusters of leadership behaviors: (a) task-oriented behavior (goal setting, coordination and scheduling of team activities, and provision for required task knowledge), and (b) human relations behavior (socio-emotional support, conflict resolution, and facilitation of team member participation). Despite the popularity of the behavioral perspective and the consistency in the classification of leader behavior, the behavioral theories failed to identify a clear and consistent relationship between various leader behaviors and leadership effectiveness, which in turn led to the development of the contingency theories of leadership.

The contingency theories of leadership assume that the effectiveness of leader behaviors—that is, task or relationship orientation of the leader—depends on the context and situational factors such as task and organizational conditions (House, 1971; Katz, 1977). For example, Fry, Kerr, and Lee (1986) indicated that task-oriented leader behavior was more effective (i.e. resulted in better team performance) than relational behavior for teams with a high degree of task interdependence.

Although the contingency view of leadership provided a richer model for predicting leadership effectiveness, it did not completely capture or explain all leadership situations. Recently, two different streams of efforts have been made to expand the contingency models: leadership substitute theories and behavioral complexity theory. Leadership substitute theory (Howell, Bowen, Dorfman, Kerr, & Podsakoff, 1990; Kerr & Jermier, 1978; Podsakoff, 1996; Podsakoff, Niehoff, MacKenzie, & Williams, 1993) address the issue by suggesting that some situational factors can “substitute,” “amplify,” or “neutralize” the effects of a leader’s behavior. For example, Sheridan, Vredenburg, and Abelson (1984) reported that group members’ education, group cohesion, and available technology all substituted for leadership. Other substitutes for leadership identified by researchers include: complex structure of the group’s task (Jones, 1983), predictability of group’s work flow (Wall, 1986), organizational structure and formalization (Comstock & Scott, 1977), and group processes (Smith, 1984).

Behavioral complexity theory suggests that effective leaders need to be able to display a set of various complex behaviors that are often paradoxical and contradictory in order to cope with the complex reality of today’s organizations (Denison, Hooijberg, & Quin, 1995; Hooijberg, 1996; Hooijberg, Hunt, & Dodge, 1997). Denison et al. (1995) identify eight leadership roles: innovator, broker, producer, director, coordinator, monitor, facilitator, and mentor. Behavioral complexity theory expands and complements the behavioral and contingency perspectives of leadership by postulating that no one single key behavior affects leadership effectiveness in complex managerial situations. Instead, leaders need to perform a portfolio of roles simultaneously.

The different perspectives taken by leadership theories also offer different scenarios for emergent leadership in virtual team settings. For example, several behavioral leadership researchers have shown that emergent leaders tend to participate most actively in the team interaction process (Bales, 1953; Mullen, Salas, & Driskell, 1989; Regula & Julian, 1973; Sorrentino & Boutillier, 1975). In addition, Hollander (1960, 1961b) found that a team member must gain “idiosyncrasy credits” from other members by demonstrating task competence and by conforming to the expectancies that members have of him or her. Once these credits are gained, it becomes appropriate, in the eyes of the other team members, for the prospective leader to assert influence. Stogdill (1974) found that technical contributions and task-relevant activities were the most frequently suggested behaviors predicting emergent leadership. However, interestingly, past research in CMC suggests that both emergent and designated leadership is much less vivid in CMC environments than in face-to-face team environments (Barkhi, Jacob, Pipino, & Pirkul, 1998;

Hiltz, Johnson, & Turoff, 1991; Ho & Raman, 1991; Lim, Raman, & Wei, 1994; Sosik, Avolio, & Kahai, 1997; Strickland, Guild, Barefoot, & Paterson, 1978).

Similarly, we can find somewhat different predictions regarding contingency, leadership-substitute, and the behavioral complexity theories. Contingency and leadership-substitute perspectives would suggest that certain factors might moderate or replace the impact of leadership behaviors. Avolio and Kahai (2003), for example, have suggested that the anonymity feature of some CMC environments would substitute transformational leadership by encouraging collective behaviors and flexibility in interactions among team members. Similarly, Zigurs (2003) has argued that some technological features and other team members can be substitutes for some of the leadership role in virtual settings. However, the behavioral complexity theory would suggest that leaders in virtual teams should show a varied and complex set of behaviors in order to be effective (Kayworth & Leidner, 2001–2002).

Given the lack of established leadership theories in virtual organizational and team settings and the variations in the findings of the existing studies of virtual team leadership, we undertook an exploratory study of this phenomenon. Our study consisted of qualitative and quantitative data analyses to identify differences between team members who emerged as leaders and non-leaders in terms of their behaviors manifested in their electronic mail communications. We further examined the differentiating roles (behavioral patterns) that emergent leaders exhibited relative to their team members. The exploration of such differences can lead to the construction of a theoretical framework which identifies factors that predict emergent leadership and leadership effectiveness in virtual team settings.

### 3. Research study

#### 3.1. Research setting

We studied emergent leadership among 63 senior US government agency executives who were participating in a senior executive development program at a large state university. The executives were divided into seven virtual teams, and each team had between eight and ten members. The sample consisted of 46 men and 17 women; the average age was 49; there were 17 with Bachelor's degrees, 39 with Master's degrees, 2 with Ph.D.s, and 5 with other degrees. There were no statistically significant differences among the teams on any of the demographic variables collected in the study.

As a part of the executive development program, executives participated in a 10-week virtual team project. To create a virtual team environment, team members were carefully recruited from different regions of the US to ensure that no team members were located in the same geographical space. Team members were asked to communicate via e-mail through a single listserv address<sup>1</sup> as a primary com-

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<sup>1</sup> A different Listserv address was used for each team.



munication vehicle during the project, although they were allowed to use other means of communication (telephone and fax). Prior to the virtual team project, executives had participated in a residential module of the executive development program at the university campus, but once the virtual team project began, there was no face-to-face meeting among team meetings. In other words, the team members knew each other but had no history of working with each other as a team.

In the project, the participants were asked to assume the role of a consultant team to the mayor of a town for a community planning and development project. The goal of the project was to develop a specific strategy to increase the home ownership rate within the town from the current rate of 38–51% (or greater) by the year 2006. At the end of the project, each team was to submit a report to the mayor containing specific recommendations on the attributes of the customers (e.g. age and income mix), financing options, and annual housing production levels (new construction and/or rehabilitation of old construction), as well as specifications of resource levels, sponsors, and partners. All teams were given census, demographic, and economic data for the town and the surrounding region. Other relevant materials, including statistics on employment, crime, education, and the town's housing and community development profiles, were provided by the mayor's office. The teams were free to use additional information from any other sources that they deemed useful for the project. Project materials were made available to the teams on the World Wide Web. The teams had to submit their interim report by the end of the fourth week and their final report by the end of the tenth week.

For each of the seven teams, we identified an “emergent leader” and “others.” The literature suggests that emergent leaders can be identified in several different ways. First, they can be identified by a voting procedure in which the person acquiring the most votes is deemed the emergent leader (Baird, 1977; Wentworth & Anderson, 1984). Second, group members' leadership perceptions can be measured by a set of Likert-type scales or semantic differential items on a questionnaire (Hollander, 1960; Lord & Alliger, 1985; Strickland et al., 1978). Third, sociometric techniques may be employed in which each individual is asked to list, in rank order, the members who he/she would most prefer as leader, friend, roommate, and so on (Stogdill, 1974). By analyzing the interpersonal choice pattern, one can identify an emergent leader of the group. However, as Hollander (1961a) pointed out, due to the “social desirability” factor, the usefulness of sociometric techniques in identifying an emergent leader is questionable. Finally, emergent leaders can also be identified by a rater who observes group members' behaviors and interaction patterns using a predefined coding system (Anderson & Wangerg, 1991; Lord, 1977).

Since members' behavior and activities cannot easily be observed in a virtual team environment, we identified emergent leaders using the first two methods. First, at the end of the project, we asked this question: “If you were told today to pick who has emerged as the informal leader of your team for the project, based on your experience with your team, who would you pick (including yourself)?” The variable was coded 1 for the person who received the largest number of votes in



each team and 0 for other members. All seven teams had a clear emergent leader who received more than 50% of votes. On average, each emergent leader received 5.3 votes with a standard deviation of 1.8. This was used as a primary variable to identify the “emergent leader” of each team for our analysis. The mean and the standard deviation of the number of votes for other members were 0.7 and 1.8, respectively.

In order to verify the identification of emergent leaders, we examined the differences in the average score of leadership perceptions at the conclusion of the study. Following the method used by Lord and Alliger (1985), we derived measurements of leadership perceptions from the questionnaire collected at the end of the project in which each member rated the other group members on a variety of perceptual items. Ratings given to each subject by the other team members were averaged. Leadership perceptions were measured on five-point scales (where lower scores indicate less contribution) indicating the amount of the ratee’s contribution to task performance, the level of leadership the rated individual exhibited, how willing the rater would be to choose the ratee as the formal leader on a similar project, the extent to which the rated individual exerted control over group activities, and the extent to which the rated individual exerted influence over other group members. These five items were all loaded on one factor with a reliability (using Cronbach’s alpha) of 0.95. Since the significant disparity in the sample size between the “emergent leader” group and “other members” group (7–56) caused a violation of the assumption of homogeneity of error variances of ANOVA, we used the non-parametric Wilcoxon–Mann–Whitney test to examine the mean differences between the two groups. Siegel and Castellan (1988) noted that the Wilcoxon–Mann–Whitney test closely approximates the power of the parametric *t*-test for tests of two independent samples. The results were significant ( $Z$ -value =  $-4.036$ ,  $p < 0.001$ ), validating our identification of emergent leaders. Based on these results, we identified an emergent leader for each team.

### *3.2. Data collection and analysis*

The primary data for our study consisted of the electronic mail messages sent by the participants through a Listserv during the 10 weeks of the project and several perceptual measures collected via a questionnaire.

#### *3.2.1. Analysis of electronic mail messages*

A systematic content analysis of the 310 e-mail messages was performed by one of the authors and a research assistant who was blind to the research questions. The goal of the content analysis was to explore the potential differences between emergent leaders and other team members in their interactions through e-mail and in the contents of their messages. Following the recommendations by Krippendorff (1980) and Boyatzis (1998), the unit of analysis was individual messages.

In the absence of a coding scheme to analyze the contents of e-mail messages for emergent leadership research, we developed our own coding scheme by drawing on the existing body of leadership literature (Boyatzis, 1998). As described in the

previous section, the behavioral leadership literature identifies task-oriented behaviors and human relations-oriented behaviors as two primary dimensions of leadership. Thus, we initially started our analysis of the e-mail messages by classifying them into these two categories. Consistent with the virtual team literature, however, we soon discovered that some of the messages were not related to either task- or relationship-oriented dimensions of group interactions: these were messages related to the use of e-mail and Listserv systems. Based on this observation, a third category was added to code the messages. Furthermore, building upon behavioral leadership theories discussed in the previous section, task-oriented messages were further classified into logistical coordination and expertise coordination, following Faraj and Sproull (2000). Thus, we coded messages into three categories: task-oriented (logistics and expertise), relationship-oriented, and technology-oriented. Examples of each category are provided in the Appendix A. Although a more extensive coding scheme might have provided some additional insights, we decided to use this relatively simple coding scheme given the exploratory nature of this study. Note that our goal was to determine whether there were any systematic differences between emergent leaders and the other team members in their electronic mail interactions.

To check the reliability of the coding scheme, the two coders jointly coded several e-mail messages until they achieved 100% agreement. The coders then coded 27 messages independently and compared the results to check the inter-rater reliability; the calculated inter-rater reliability was 80%. After establishing the reliability of the coding scheme, the research assistant completed the rest of the coding.

Of 310 messages, four messages were dropped from the analysis because the senders of those messages could not be identified. This resulted in a total of 306 messages available for content classification.

### 3.2.2. *Message lengths*

The length of each e-mail message was measured by counting the number of words used in the main body of a message. We removed the header of the message and, if the message was a reply, we deleted the copy of the original message. The average length of the message was 139.12 words per message, with a standard deviation of 144.93.

### 3.2.3. *Other measures*

At the outset of the project, we collected participants' background information including age, organizational tenure, and educational background. In addition, the participants' perceived e-mail skill was measured.

## 4. Quantitative findings

Our quantitative analysis focused on answering the first research question by identifying potential differences in the number and type of e-mail messages between the emergent leaders and other members of the groups. First, we examined the

overall distribution of the message types and the volumes across teams (see Table 1). We found that task-oriented messages were dominant (over 55%). This is consistent with the prevailing view in CMC literature that e-mail communication within virtual teams is mostly task-oriented.

Next, we examined the differences between the emergent leaders and the other team members in terms of the number and the type of e-mail messages generated. Due to the significant disparity in the sample size between the emergent leaders and other team members, we used the non-parametric Wilcoxon–Mann–Whitney test. Specifically, we examined the differences in the total number of messages, the total number of task-oriented messages, the total number of human relation-oriented messages, and the total number of technology-oriented messages between the emergent leaders and others. As displayed in Table 2, the results showed that the emergent leaders sent out significantly more e-mail messages than did the other members, both overall and in each of the three message categories. In fact, in each team, the emergent leaders sent the most messages. We also examined differences in the participants' age, number of years with the organization, and number of years in the current position, in order to investigate whether the emergent leaders differ from the other team members on these variables. None of the demographic variables, such as age and tenure at the job, differentiated the emergent leaders from the rest of the group members. In terms of potential gender effect, two of the emergent leaders were female. This gender mix among emergent leaders (2:5) was consistent with the gender ratio of the entire participants (approximately 26% were female). Thus, in our study, gender did not seem to affect the leadership emergence.

We then examined how the emergent leaders differed from the other team members in terms of the types of e-mail messages they sent out during the project. Although the results of Table 2 might suggest that the emergent leaders sent more messages in all three categories, the high correlations among these variables make it difficult to interpret these results in terms of the differences in e-mail message types. In other words, the data suggest that those members who sent more task-oriented messages than other members also sent more human relation-oriented and technology-oriented messages. Therefore, to understand the relationship between

Table 1  
Distribution of electronic mail messages

Team	Task-oriented messages	Relationship-oriented messages	Technology-oriented messages	Total
1	64	17	24	105
2	13	8	10	31
3	34	10	13	57
4	17	8	9	34
5	16	12	6	34
6	15	9	0	24
7	13	4	4	21
Total	172	68	66	306

Table 2  
Differences between emergent leaders and other members

	Mean (S.D.)		Z-value	p-value (2-tailed)
	Leaders	Others		
Total number of messages	12.3 (8.5)	3.9 (4.8)	−3.465	<0.001
Task-oriented messages	7.6 (4.9)	2.1 (3.1)	−3.288	0.001
Relationship-oriented messages	2.4 (2.7)	0.9 (0.9)	−1.877	0.078
Technology-oriented messages	2.3 (1.9)	0.8 (1.6)	−2.703	0.009
Number of votes	5.3 (1.8)	0.1 (0.3)	−6.259	<0.001
Age	48.4 (3.3)	48.9 (8.7)	−0.663	0.527
Number of years with the organization	22.8 (2.9)	20.1 (7.3)	−0.763	0.459
Number of years at the current position	4.1 (2.6)	4.4 (4.4)	−0.578	0.585
Perceived e-mail skill	3.4 (0.7)	3.5 (0.7)	−0.068	0.957

emergent leadership and a message type (for example, task-oriented messages), we needed to partial out the relationship between emergent leadership and the other two message types (e.g., human relation- and technology-oriented messages). Based on this, we conducted a series of partial correlation analyses. We examined the partial correlation between the number of messages of one type and emergent leadership in terms of the total number of votes and the leadership perception scores, while controlling the influence of the number of messages of the other two types.

As shown in Table 3, only the number of task-oriented messages was significantly related to emergent leadership after other types of message were controlled for. This suggests that, in our data set, although the emergent leaders sent out more messages in all three categories, the number of task-oriented messages differentiated the emergent leaders from the rest of the group members.

To further understand the nature of task-oriented messages that were sent by emergent leaders, we examined the differences between emergent leaders and other team members in terms of the types of task-oriented messages they sent (see Table 4). As noted earlier, we coded task-oriented messages into messages that were related to logistics and expertise coordination. We found that there were no differences between emergent leaders and other team members in terms of the fre-

Table 3  
Results of partial correlation analyses

	Task-oriented messages	Relationship-oriented messages	Technology-oriented messages
Total number of votes	0.32**	0.16	−0.20
Leadership perception score	0.38**	0.04	−0.08

Note: For each message type, the impact of the other two message types were partialled out.

\*\*  $p < 0.01$ .

Table 4  
Analysis of task-oriented messages

	Mean (S.D.)		Z-value	p-value (2-tailed)
	Leaders	Others		
Logistics	4.9 (2.7)	0.8 (1.1)	−2.482	0.019
Expertise	2.7 (3.1)	1.3 (2.3)	−0.398	0.724
Total (task-oriented) messages	7.6 (4.9)	2.1 (3.1)	−3.288	0.001

quency of expertise related messages. However, emergent leaders sent logistics-related coordination messages significantly more than other team members. Therefore, we can conclude that in this study emergent leaders distinguished themselves in logistical coordination, rather than through expertise contributions.

Finally, we examined the length of individual messages by analyzing the number of words in each message. Among the 306 messages, 86 were sent by emergent leaders and 220 were sent by other members. Using a two-way analysis, we examined the differences in message length between the emergent leaders and the other members and among the three message categories. Table 5 shows the results of the analysis.

We found that messages sent by the emergent leaders (mean = 168.52 words per message, standard deviation = 139.12) were significantly longer than the ones by other members (mean = 127.83, standard deviation = 145.82). The two-way ANOVA also revealed a significant difference among the message length of the three message types. A post hoc analysis using the Duncan test showed that technology-oriented messages (mean = 74.28, standard deviation = 72.73) were significantly shorter than both task-oriented (mean = 165.46, standard deviation = 167.33) and human relation-oriented messages (mean = 136.54, standard deviation = 115.89). There was no difference between task- and human relation-oriented message length.

Table 5  
Analysis of message length (in words)

	Mean (S.D.)	<i>F</i> -value	<i>p</i> -value
<i>Leadership</i>			
Emergent leaders	168.5 (139.8)	5.246	0.023
Other members	127.8 (145.8)		
<i>Message type</i>			
Task-oriented messages	165.5 (167.3)	7.125	0.001
Relationship-oriented messages	136.5 (114.9)		
Technology-oriented messages	74.3 (72.7)		
Leadership × message type		1.141	0.321

## 5. Qualitative findings

From the quantitative analysis, we found that emergent leaders in virtual teams send more messages, in particular ones related to task coordination, than other members. In order to understand the behavioral patterns of emergent leaders (Research Question 2), we conducted additional qualitative analysis of the messages sent by the emergent leaders to see what role these emergent leaders actually played. We used the grounded theory method in analyzing the messages sent by the emergent leaders (Glasser & Strauss, 1967; Strauss & Corbin, 1998). The process involved repeated reading of messages to identify behavioral patterns that the emergent leaders exhibited through their e-mail messages. Once a pattern was identified, we went back to the data set either to confirm or refute the hypothesized pattern. We examined not only the contents of the messages, but also the timing of the messages. We also tried to discern the context in which the messages were sent and received by, for example, examining other messages around the focal messages to see if they were responses or the beginning of a new thread. Through this analysis, we identified three roles (behavioral patterns) among emergent leaders of these seven teams: the initiator, scheduler, and integrator.

### 5.1. Initiator

Of seven emergent leaders, three sent the very first message to the team (Teams 1, 2, and 4). In two other teams, the emergent leaders (Teams 3 and 7) sent the second message. The two remaining leaders explicitly explain the reason why they were not able to communicate sooner (the leader of Team 5 initially had the wrong e-mail addresses and the leader of Team 6 was away at a training assignment for her job). The first message from each of the emergent leaders (whether or not it was the first message of the team) showed the initiation of structuring behavior and included concrete suggestions for how to organize the team's activities. For example, the following message from Dan<sup>2</sup>, who emerged as the leader of Team 1, was a typical first message from these emergent leaders.

From: Dan  
To: Team 1  
Date: Day 1

I guess that you all have received your package [on the project] from Andrea! If you are like me this is a busy time of the year with end of the fiscal year goals and also with various events involving Headquarters staff!!! However, our first deadline is September 11, so we must get started. After we have all had time to digest the vast amount of information that the WWW has to offer, maybe we should have a conference call to discuss our assignments and strategy.

---

<sup>2</sup> All names are disguised.

Please send your comments and possible schedule for a call to our Listserve team members.

Talk to you soon!

Dan

On the other hand, the first messages from non-leaders typically focused on technological uncertainty. For example, the following message was from Bill on Team 3:

From: Bill  
To: Team 3  
Date: Day 4

Just testing to determine who is listening!

It seems that the person who sent out the first task-structuring message makes an important first impression on the other members. This finding is consistent with earlier accounts in legal literature about the manner in which the forepersons emerge in juries. [Diamond and Casper \(1992\)](#) and [Sannito and Arnolds \(1982\)](#) reported that, more often than not, the juror to speak first became the foreperson of the jury.

## 5.2. Scheduler

The emergent leaders of six teams (all except Team 7) took the initiative of setting up the temporal rhythm of the project by coordinating the scheduled conference calls for the team. The electronic mail messages we read clearly suggest that these teams scheduled conference calls on a regular basis, and seemed to have used those calls as a major coordination mechanism. For example, according to the e-mail messages, we could identify 5–22 scheduled conference calls for these teams during the project. These conference calls were typically followed by a flurry of electronic mail messages that contained the summary of the discussion, the data requested during the conference call, the schedule for the next conference call, or excuses for absence from the conference calls. Teams 1, 2, 4, and 6 scheduled recurring conference calls for every 7–10 days throughout the project. Emergent leaders scheduled, set up, and often sent reminders for these conference calls.

Team 3 had the most conference calls. They scheduled conference calls daily for 3 weeks during the first interim report of the project (which was due at the end of the fourth week of the project) and for another 2 weeks for the final report of the project. Initially, these conference calls were scheduled by the leader, but later another person began scheduling the conference calls.

Team 5 demonstrates how emergent leaders used the scheduling of conference calls to provide a structure for the task. Team 5 did not start the project with any



scheduled conference calls. As noted earlier, Jim, who eventually emerged as the leader, could not communicate with others during the first 2 weeks of the project due to a technical problem with his e-mail. During that period, the team members exchanged e-mail messages raising concerns about the technology (Listserv) and the lack of structure of the project. For example, here are the first two messages generated by the team during that 2-week period:

From: Ken  
To: Team 5  
Date: Day 3

Hey, folks. I just got this mess yesterday; I AM on travel most of next week and the instructor wants something by Wednesday!!! Not only that, but Hurricane is bearing down on us as I type!!! Well, now that I got that off my chest... shall we proceed?

How do we jump-start this baby? I tried to download info off the web site but can't read it; our [tech support] says he can't figure it out either (suspect it was sent in WORD and we all have WORDPERFECT). Ain't that just great!

Anyway, I'm calm now. Any ideas out there?

PS: anyone know what the heck a listserve is???

From: Amy  
To: Team 5  
Date: Day 4

My [tech support] was working on getting me the information yesterday afternoon. I will check on her later this morning and let you know whether she was successful in printing it for me.

Amy

The team floundered for about 2 weeks until Jim started participating actively. Facing the fast approaching deadline and the team's confusion due to low task structure, Jim created a temporal structure first in order for the team to "get their act together."

The following message was the second message that Jim sent once he resolved his e-mail problem:

From: Jim  
To: Team 5  
Date: Day 15

In order to get our act together I will try to set up a conference call for next Monday (9/23) at 11 am. Please provide me with your phone number so I can arrange the call. At the same time I would appreciate your fax numbers. Also please send me any ideas, problems or other topics to be discussed. I realize this is the yearend but if we are to get something together before 10/2 we need to get moving.

I have been able to get just about everything downloaded but do not have mapinfo software or know anything about mapinfo so hopefully we can discuss this Monday along with potential assignments. Thanks.

This message was followed by a series of e-mail messages sent by other team members with their phone and fax numbers and potential discussion topics. On 9/26, only 3 days after the scheduled conference call, Jim managed to circulate the draft of the interim report, which was due on 10/2 (the end of the fourth week). Another e-mail sent by Jim shortly after the interim report was submitted indicated that the team had assigned members to specific tasks for the final report. The team had at least two more conference calls with approximately a 2-week gap between them before they finished their project. This example suggests that setting and managing the temporal rhythm of virtual teams is an important leadership behavior.

Given that these teams did not hold any face-to-face meetings during the project, the conference calls seemed to play the role of temporal anchor for their activities, similar to the role that face-to-face meetings played in [Maznevski and Chudoba \(2000\)](#).

### 5.3. Integrator

Several individuals who emerged as leaders in our study carried a significant load of integrating other team members' work into the teams' final deliverables. The emergent leaders of Teams 2, 5, 6, and 7 became the individuals who integrated the various components of the projects completed by other team members. In particular, the emergent leaders personally compiled the final document and, thus, became the central hub for task completion. While different teams had different approaches and structures for the assigned task, the emergent leaders of these teams became the "check point" of deliverables before they were sent out. For example, the following are messages from Team 2:

From: Pete  
To: Team 2  
Date: Day 18

I apologize for not being able to participate in the conference call but I understand from Andy that any ideas or input we may have should be sent to Joe [team leader].

From: Mike  
To: Team 2  
Date: Day 51

Attached as le HAGDEL.2MD is my input for deliverable #3. Joe, please feel free to correct whatever is needed. Looking forward to our final conference call.

It is clear from these messages that the team members understood that all the materials and ideas needed to be forwarded to Joe. And in subsequent e-mail messages, other team members sent their own analyses and writings to Joe: he became the spokesperson for the team to the instructor of the project. Emergent leaders of Teams 5 and 6 also performed the similar role of integrating the team report. Through conference calls, tasks were assigned to the team members and the leaders received the team members' contributions for the final deliverables.

While the emergent leader of Team 7 also performed the integrator role, he did not rely on conference calls to assign different tasks and request specific information from other team members. Instead, he used e-mail messages to directly solicit expertise and assistance from the other team members. For example:

From: Paul  
To: Team 7  
Date: Day 23

1. Anybody have homeownership zone suggestions?
2. Rosemary—Any possibility of public housing for sale? I noticed in CT 0009.1 (Walnut Towers), 150 unit PH complex had only 42 units occupied in 1990. Possibility of HOPE 6 application?
3. Edy—Any thoughts on possibility of condo or co-ops in the area. Does HUD have any mortgage programs that could be used? I don't have any experience with them if [they] do so feel free to amplify.

In this e-mail, Paul was looking for specific pieces of information and suggestions from specific members of the team. Furthermore, he always asked other members to call him on the telephone to provide requested information and suggestions provoking follow-up from the other team members.

## 6. Discussion

The purpose of this study was to examine systematic differences between emergent leaders and other members of distributed teams in terms of their behavior and roles as manifested in their electronic messages. To this end, we analyzed 306 e-mail messages sent to the groups via Listserv by group members in terms of the

message type, length, and content. Our analyses provide several interesting observations regarding emergent leadership in virtual teams.

As for the emergent leaders' distinctive behaviors, our results suggest that they sent more electronic messages than others in the team. Furthermore, their messages tended to be longer and more task-related than those of the other team members. These findings are consistent with the research findings on the emergence of leadership in face-to-face environments (Hollander, 1960, 1961a, 1961b; Regula & Julian, 1973; Sorrentino & Boutillier, 1975). A tentative conclusion is that the emergent leader behaviors identified in prior research into face-to-face environments are transferable into virtual settings.

In addition, we found that none of the demographic variables such as age, previous job experience, and experience at the current position seem to affect emergent leadership. This finding suggests that in virtual teams where knowledge of these peripheral cues is suppressed (Kiesler, Siegel, & McGuire, 1984), these demographic variables do not play a role in emergence of leadership.

Perhaps the most interesting finding is the specific task-related behaviors that we discovered through qualitative analysis of emergent leaders' messages. In particular, one area that has received little attention in virtual team research involves efforts to control the temporal rhythm of the team activities. Our results indicate that emergent leaders influenced the temporal rhythm of the team by initiating the communication at the beginning of the project and also by coordinating synchronous communications (in this case conference calls). These synchronous communication events served as the "heartbeat" of the project—a flurry of activities were organized around these synchronous communication events through which the teams were able to coordinate and accomplish their tasks. Teams enacted different temporal structures through these conference calls. For example, one team participated in conference calls every day; some teams participated in conference calls once a week; and still others participated in conference calls every other week.

There is a growing body of literature which shows the importance of understanding temporal aspect of team dynamics (Ancona, Goodman, Lawrence, & Tushman, 2001; Ancona, Okhuysen, & Perlow, 2001; Gersick, 1988, 1989; Gersick & Hackman, 1990; McGrath, 1990, 1991; Walther, 2002). In virtual team research, the importance of temporal pacing has also been recognized. For example, Maznevski and Chudoba (2000) found that effective virtual teams establish a deep temporal rhythm that governs the way they interact with each other. In a recent ethnographic study of a global virtual team that developed e-commerce software, Boland and Citurs (2002) found that task performance in virtual environments involves the shaping of space and time. However, these studies did not examine the behaviors of leaders in establishing such temporal rhythms. Our findings build on their insights by noting that by patterning temporal structures, individuals can influence the other team members. As noted by Cramton (2001), one of the challenges in virtual teams is the absence of "common ground" (Clark, 1996), which can be broadly defined as the knowledge that communicating parties share and know that they share. Such common ground is considered to be integral to the coordination of actions (Clark, 1996). It is believed that physical co-location and

shared physical context play important roles in establishing common ground. Thus, in virtual teams where such shared physical space does not exist, establishing common ground can become a major challenge for team performance. In the absence of physical common space, it seems that emergent leaders in our study used common temporal pacing in order to establish common ground among team members.

Finally, most of the emergent leaders also controlled the final outcome of the project by playing the role of an integrator. What is interesting, however, is that although in most cases emergent leaders initiated the task processes, they did not complete the task structure for the team. The task structures (the approach for the problem, assignment of sub-tasks, outline of the final report, etc.) were developed through collaboration and consensus-building processes. In that regard, these emergent leaders did not show traditional structuring behaviors (Fiedler, 1967; House & Mitchell, 1974). This may be attributed to the ill-structured nature of the teams' task and the fact that the emergent leaders did not have all the required expertise; thus they had to rely on the other group members' expertise for task completion.

While it is important to note the distinct behaviors exhibited by emergent leaders, it is also important to note the behaviors that did not differentiate the leaders from other team members, particularly if those behaviors are predicted in the traditional leadership literature. One example was relationship-oriented or socio-emotional behavior (House, 1971; Stogdill, 1974). Past studies of leadership, in particular those based on the contingent leadership perspective, found that a leader's socio-emotional support was important in those task environments that were not emotionally supportive (Fiedler, 1967; House, 1971; Katz, 1977). One would expect that socio-emotional support of leaders would be particularly important in these virtual teams due to the lack of face-to-face interactions and the ad hoc and temporary nature of the teams; a recent study by Kayworth and Leidner (2001–2002) showed that effective virtual team leaders showed a high degree of empathy toward other team members.

Unlike this and other earlier studies (Zigrus, 2003), our results show that socio-emotional behaviors did not distinguish emergent leaders from the rest. It is important to note that this does not mean that these emergent leaders did not show socio-emotional behaviors. It also does not mean that socio-emotional behaviors were not important in virtual team environments. Rather, it means that socio-emotional behaviors were somewhat more uniformly distributed among the team members. Both quantitative and qualitative analyses suggested that both emergent leaders and non-leaders performed the role of “cheerleaders” and “motivators.” This suggests that in our data set, it was not a single individual (the emergent leader) who primarily provided socio-emotional support to sustain the team dynamics. Rather, the necessary socio-emotional support for the group was collectively provided by the team members. Another explanation of this finding is consistent with the findings of a field study by Hart and McLeod (2003): socio-emotional relationships in virtual teams are built through intense and frequent task-related messages, rather than messages with “personal contents.”

Technology-management behaviors were also uniformly distributed among team members. These teams used several new technologies that they were not familiar with, including Listserv, a Geographic Information System (GIS), and various office productivity tools. For example, the emergent leader of Team 1 became an expert on the GIS software, while the leader of Team 5 helped others to solve communication problems with Listserv. However, in other teams, technology-management was often a collective team effort. Team members often shared their technology experiences, frustrations, and tips with each other via e-mail messages. Given that most participants never worked in such computer-mediated environments, technology-related uncertainty was quite evident. As noted earlier, many messages concerned team members' efforts to make sense of technology and how to use it effectively as a team. However, it was not the emergent team leaders who primarily addressed the technology-related uncertainties: in most cases, it was the collective behavior of all team members.

Finally, emergent leaders did not play the dominant role in terms of providing the necessary domain expertise. Although many of the leaders played the role of integrator, putting together the team's final report, their substantive content contributions were limited to their own areas of expertise. For example, in Team 1, two individuals provided the "intellectual" leadership for the task. However, these two individuals were supportive of the leadership role played by the emergent leader. The following two messages illustrate this point:

From: Jane  
To: Team 1  
Date: Day 16

[...] I urge each of you to pull down the exec. Summary of the consolidate plan of [the town]. It is critical that you become familiar with the data. Dan[the emergent leader] cannot do it alone. You need to understand the community too.  
[...]

From: Mary  
To: Team 1  
Date: Day 17

Team-Jane and I are also reviewing the [town's] newspapers and will catch articles appropriate to the task.

As for my particular strengths, I have fairly good analytical skills and can prepare decent reports gathering info from a variety of sources. I've also participated in the development of the VA Homeownership Plan as part of the National Homeownership Strategy. Regarding computer

skills (graphics, presentation, etc) I have good ideas, but am not very procient and need assistance.

Finally, please let Dan know what your schedule is between now and September 11 so that he can prepare a calendar. Not everyone responded to that previous question.

Thanks, Mary

Throughout the project, these two individuals continually provided content knowledge to other members, including the emergent leader. Similarly, Team 3 had a member who provided significant content knowledge for the task solution, while the emergent leader primarily coordinated the group process. Overall, emergent team leaders did not dominate the content of the team's final report. This finding again contradicts the earlier findings of Kayworth and Leidner (2001–2002) who found that effective virtual leaders in their study acted as task mentors. The differences in the results may be attributed to the differences in the teams' composition. In our study, there were minimum hierarchical and status differences among team members. Furthermore, all of the team members were experienced professionals within their own area. On the other hand, Kayworth and Leider's virtual teams were composed of both MBA and undergraduate students. It is quite possible that the age/degree differences between MBA and undergraduate students might have caused implicit status differentials and subsequent different expectations regarding the expertise and knowledge of the team members. Thus, while their findings might be more applicable to virtual teams with explicit hierarchical structure within the teams, our findings are more applicable to self-managing virtual teams composed of peers with diverse domain knowledge.

What does our study mean for the various theories of leadership? Our results clearly reject the trait theory or the simple behavioral perspective that calls for a simple leadership behavior. Instead, our results, particularly qualitative ones, offer support for the behavioral complexity theory (Denison et al., 1995; Hooijberg, 1996; Hooijberg et al., 1997). For example, while the initiating and scheduling behaviors are internally focused, the integrator role has both internal and external focus. The emergent leaders' behaviors we saw in our data set are also somewhat paradoxical in that while they initiate and coordinate tasks and integrate the final outcomes, they seldom elevate themselves as domain leader of the contents. The various behaviors of emergent leaders demonstrate the complex nature of task interactions in virtual teams. This is consistent with the recent findings by Druskat and Wheeler (2003), who found that the effective external leaders of self-managing teams acted as an interface between the team and its organizational environments. The integrator role performed by the emergent leader bears similarity with the behaviors of external leaders observed by Druskat and Wheeler. This seems to



indicate that while teams in our study did not have external leaders, they at least had needs that were similar to those of self-managing teams with external leaders.

Our study also provides evidence for leadership substitute (Avolio & Kahai, 2003; Ziguers, 2003) for socio-emotional support, task-expertise support, and technology-management in the virtual teams involved in this study. In most cases, the activities in these three areas seemed to be either distributed among team members or carried out by one or two team members without critically undermining the emergent leader's status.

### 6.1. *Limitations*

Our study has several limitations. First, it is important to note that our correlational analysis does not offer any conclusive causal links between certain behaviors and leadership emergence. Instead, what we observed in this study was a clear and strong association between the level of overall communication and task coordination behaviors and leadership emergence. Thus, distinctive e-mail communication behaviors among emergent leaders observed in this study should not be considered as predictors of leadership emergence.

Second, since we examined emergent leaders' behaviors as manifested in e-mail messages only, the outcomes of our study provide only a partial picture of leadership emergence in virtual team settings. That is, we were not able to gather and analyze participants' exchanges via other communication media (telephone conferences and fax). Future research needs to examine behavioral differences between emergent leaders and other group members as manifested in all modes of team communication and interactions.

Third, three roles of the emergent leaders that we identified in this study do not constitute an exhaustive list by any means. These are behaviors that the emergent leaders exhibited through only their e-mail messages. We do not have data to show whether the emergent leaders played other roles through other communication media, such as conference calls or individual e-mail sent directly to group members.

Fourth, the electronic communication technologies used in this study to support virtual teams permitted only textual communication, which limits the generalization of the findings to richer forms of communication media such as video-conferencing. One might discover different behavioral patterns of emergent leadership with these richer multimedia communication technologies which allow synchronous interactions among the virtual team members.

Finally, teams in our study exchanged a fairly small number of messages. Thus, it may not be surprising that any one person who communicated more would emerge as the leader; nor is it surprising that task-related communications were more prominent. The emergence of leaders, and the communications produced by those leaders, might be quite different in teams where there are higher average levels of communication.

## 6.2. Implications for future research

Given the strong relationship between team performance and leadership effectiveness established in traditional work team settings (Burpitt & Bigoness, 1996; Hoffman, 1990; House & Baetz, 1979; Smith, Carson, & Alexander, 1984; Stogdill, 1974), it is imperative that scholars investigate leadership in relation to virtual team performance. The findings of this study provide several implications for future research in emergent leadership and leadership in general in virtual settings.

First, future research needs to examine the relationship between leadership and temporal structure of virtual teams. In particular, research should explore various mechanisms for enacting different temporal structures. For example, it would be interesting to determine what mechanisms leaders use to accelerate or slow the temporal rhythm of the team, as well as to examine the relationship between task-related structuring and temporal structuring behaviors and their impact on virtual team performance.

Second, future virtual team leadership research needs to examine various sources of leadership substitutes. According to Podsakoff et al. (1993), leadership can be also amplified or neutralized by other sources. Our study suggests that future research can conceptualize the virtual team leadership as a *distributed leadership system*. That is, the role of leadership in virtual teams is distributed among several members and perhaps technology artifacts. This is somewhat consistent with the past research on self-managing teams (Manz & Sims, 1987; Wageman, 2001). Given the low level of structures in virtual team environments and difficulty of asserting leadership influence on others (Piccoli, Powell, & Ives, in press), the notion of leadership substitute needs to be further developed and carefully examined in virtual settings. Examples of some pertinent research questions include: What are the sources of leadership substitute in virtual settings? What is the potential interplay among those substitutes and their impact on emergent leadership?

Third, future research can study emergent leadership in teams communicating via richer media such as desktop videoconferencing systems. These multimedia-based communication tools would enhance the social presence of communicators (Short, Williams, & Christie, 1976), which may in turn influence emergent leadership. Would people be less task-focused in evaluating potential leaders when they communicate via desktop videoconferencing systems? Would other leadership styles, such as charismatic leadership, become more salient and effective in such environments than they are in text-based communication environments (cf., Sosik, 1997)? What would be the preferred communication media of emergent leaders when both text-based and multimedia-based systems are available? All of these are important and interesting questions that have both significant theoretical and practical values.

Finally, in this study we used a simple message-coding strategy in an attempt to gain an initial understanding from this exploratory study. Future research can employ more elaborate coding strategies, which can more directly measure various leadership behaviors, influence attempts, and interaction patterns in distributed team environments.

### 6.3. *Implications for practice*

This study also has several implications for managers. First, to emerge and to be accepted as a leader in a virtual team, an individual needs to know how to communicate effectively with others via electronic media. As shown in our findings, demographic variables such as age, education level, job experiences, and gender did not seem to be related to emergent leadership in virtual teams. Instead, it was one's use of e-mail that was strongly correlated with the emergent leadership. Potential leaders need to communicate early in the project lifecycle. They need to establish the temporal dynamics of the team through electronic media. They also need to know how to play the “initiator” role in the virtual team settings.

Another important role that the emergent leaders played was “integrator”. While leaders do not need to be the domain expert for every aspect of the task, they should develop a global perspective of the task so that they can effectively integrate the contributions by individual team members.

Traditionally, leaders have heavily relied on face-to-face communication and hence leadership development programs have emphasized traditional communication skills. Our study demonstrates that communication through electronic media can augment and possibly contribute to leadership emergence. This in turn suggests that leadership development programs should include computer and electronic communication training so that prospective leaders can be effective and accepted as leaders in virtual settings.

Furthermore, organizations and the designers of systems supporting virtual teams need to carefully consider various potential sources of leadership substitute. This will maximize the aggregate leadership effect in the team, instead of relying solely on an emergent or designated leader, either assigned or emergent. Thus, a “leadership system” (Avolio & Kahai, 2003) that would produce desirable outcomes in virtual teams should be appreciated as an effective design.

## **Appendix A. Examples of electronic mail messages in each category**

### *A.1. Task-oriented message*

#### *A.1.1. Example 1*

From: abc@xxx.gov

To: ‘‘Group 1 Cohort 1’’ <radish@xxx.yyy.edu>

Date: Mon, 26 Aug 96 08:18:58 EST

Team, [deleted] and I are also reviewing Hagerstown's news papers and will catch articles appropriate to the task.

As for my particular strengths, I have fairly good analytic skills and can prepare decent report gathering info from a variety of sources. I've also participated in the development of the VA Homeownership Plan as part of the National Homeownership Strategy. Regarding computer skills (graphics, presentation, etc.) I have good ideas, but am not very procient and need assistance.

Finally, please let [deleted] know what your schedule is between now and September 11 so that he can prepare a calendar. Not everyone responded to that previous question.

Thanks, [deleted]

#### *A.1.2. Example 2*

From: efg@xxx.gov

To: 'Group 2 Cohort 2' <salmon@xxx.yyy.edu>

Date: Mon, 04 Nov 96 16:01:52 EST

Message of 11/4:

This will conrm our conference call for Wed, 11/6, 23 p.m.

#: (700) xxx-xxxx

Access code: #####

If calling non-FTS: (xxx) xxxxxxxx

Hopefully, all 3 parts will be complete and in each others' hands no later than 1st thing Wed a.m. so we can do critiques and final planning during the call.

Talk to you then.

[deleted]

## *A.2. Relationship-oriented message*

### *A.2.1. Example 3*

From: gmb@xxx.gov

To: ‘‘Group 5 Cohort 1’’ <spud@xxx.yyy.edu>

Date: Sat, 24 Aug 96 20:58:40 EST

Hi gang,

I guess someone has to be the rst to use our shiny new listserve machine maybe that will be this message :)

Hopefully y’all (a sourther pronoun) got your stu\_ earlier than I did. Between some mail faux pas, a resent package, and travel schedule, I’m just getting into my package. I printed out everything from the H.C. website, as you must have. It’s a formidable tome we are all digesting. So, does anyone want to suggest how we should begin?

As a starting point, there are seven key questions listed on the main page of the WWW home page for the H.C.

Bye for now...gotta go read this tome I just printed out! :)

[deleted]

## *A.3. Technology-oriented message*

### *A.3.1. Example 4*

From: jac@xxx.gov

To: ‘‘Group 4 Cohort 1’’ <rutabaga@xxx.yyy.edu>

Date: Wed, 11 Sep 96 11:11:49 EST

Just testing to determine who is listening!

[Deleted]

### *A.3.2. Example 5*

From: abc@xxx.gov

To: ‘‘Group 1 Cohort 2’’ <scrod@xxx.yyy.edu>

Date: Thu, 05 Sep 96 16:58:55 EST

[Deleted],

Is it working? I sent a message to the listserv on Saturday (this being the following Monday) and these were the results:

At home, from where I sent the message ([deleted e-mail address]), I received back that evening an error report that the message to [deleted] was undeliverable.

At work, by Monday morning, I've received the message in which the header shows it as from me (rather than from the listserv) and is addressed to me as a bcc (blind copy).

Do these results reflect correct operation of the system?

[Deleted]

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