A Typology of Virtual Teams:

Implications for Effective Leadership

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Abstract

As the nature of work in today's organizations becomes more complex, dynamic, and global, there has been an increasing emphasis on far-flung, distributed, *virtual* teams as organizing units of work. Despite their growing prevalence, relatively little is known about this new form of work unit. The purpose of this paper is to present a theoretical framework to focus research toward understanding virtual teams and, in particular, to identify implications for effective leadership. Specifically, we focus on delineating the dimensions of a typology to characterize different types of virtual teams. First, we distinguish virtual teams from conventional teams to identify where current knowledge applies and new research needs to be developed. Second, we distinguish among different types of virtual teams, considering the critical role of task complexity in determining the underlying characteristics of virtual teams and leadership challenges the different types entail. Propositions addressing leadership implications for the effective management of virtual teams are proposed and discussed.

A Typology of Virtual Teams:

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The nature of work in today's organizations is changing. In recent years,

corporate activity has become increasingly more global, competition from both foreign

and domestic sources has grown dramatically, and there has been a continued shift from

production to service/knowledge-based work environments (Townsend, DeMarie, &

Hendrickson, 1998). In addition, advances in information and communication

technology have enabled a faster pace of change than in the past and have created jobs

that are increasingly more complex and dynamic. In response to these changes,

organizational systems, structures, and processes have evolved to become more flexible

and adaptive. Horizontal organizational structures and team-based work units have

become increasingly more prevalent and, with advances in technology, there has been an

increasing emphasis on far-flung, distributed, *virtual* teams as organizing units of work.

Townsend and colleagues (1998, p. 17) define virtual teams as "groups of

geographically and/or organizationally dispersed coworkers that are assembled using a

combination of telecommunications and information technologies to accomplish an

organizational task." In fact, these teams are used to accomplish a variety of critical

tasks. Price Waterhouse, which has 45,000 employees in 120 countries, uses virtual

teams to bring employees from around the globe "together" for a week or two to prepare

work for a particular client. Whirlpool Corporation used a virtual team composed of

experts from the United States, Brazil, and Italy during a two-year project aimed at

developing a chlorofluorocarbon-free refrigerator (Geber, 1995). Virtual teams offer

many benefits. They allow organizations to access the most qualified individuals for a

particular job regardless of their location, enable organizations to respond faster to increased competition, and provide greater flexibility to individuals working from home or on the road. There is little doubt that virtual teams will play a key role in the design of organizations in the next millennium.

Interestingly enough, while it is clear that virtual teams will play an important role in shaping future organizations, we know relatively little about them. Virtual teams have received a great deal of attention in the popular literature and have recently begun to receive academic attention (e.g., Byrne, Brandt, & Port, 1993; Davidow & Malone, 1992; Dess, Rasheed, McLaughlin, & Priem, 1995); however, this literature has been primarily descriptive and has focused mainly on the benefits of such teams. As a result, little attention has been directed toward understanding their potential problems and challenges, and it is difficult to determine what implications these teams will have for critical organizational processes. In particular, it is difficult to ascertain how the unique characteristics of virtual teams affect critical leadership functions, including performance management and team development. There is little current theory to guide research on the leadership and management of virtual teams.

Although virtual teams offer high flexibility and many other potential benefits, they also create several leadership challenges. The purpose of this paper is to develop a theoretical framework to improve understanding of this new form of work unit. Specifically, we focus on delineating the dimensions of a typology to characterize different types of virtual teams; the dimensions are then used to draw leadership implications.

Our typology is intended to make two conceptual contributions. First, we distinguish virtual teams from conventional teams to determine where current knowledge applies, and where new research efforts need to be focused. Second, and more important, we distinguish among different types of virtual teams. The literature has tended to treat virtual teams as a single "ideal" type, yet there are several dimensions or characteristics that vary among and distinguish different types of virtual teams. We focus on four such characteristics -- *temporal distribution, boundary spanning, lifecycle, and member roles*. Throughout this discussion, we treat task complexity as a key constraint or moderator on virtual team design. Virtual teams are created to handle a variety of tasks that range from the simple (e.g., brainstorming) to the complex (e.g., command and control). We will argue that virtual teams need to adopt different characteristics to successfully operate within the constraints that are imposed by the complexity of their collective task.

This paper is organized as follows. The first section introduces overarching conceptual issues that shape the focus of the typology, its mechanisms, and its implications. We begin with a consideration of the two major leadership functions that are critical in all teams, *performance management and team development*. We then discuss the constraining role of task complexity on the interdependence of team workflows. Task complexity is a critical constraint on the design of all teams (Goodman, 1986). In our typology, task complexity implicates different characteristics that distinguish different types of virtual teams.

We develop our typology of virtual teams in the second section. The typology is divided into two main parts. We begin by delineating the two characteristics that differentiate virtual teams from conventional teams. We then discuss four characteristics

that distinguish different types of virtual teams. Following each of these discussions, we posit the implications of these characteristics for effective leadership in virtual teams. The challenges that virtual teams present for the performance of the leadership functions are the focus of the implications drawn from our typology. Propositions are used throughout the typology to identify distinguishing features of virtual teams and to highlight key leadership challenges.

Leadership Functions, Task Complexity, and Virtual Teams

The Challenges of Virtual Teams for Leadership

Most models of group and team effectiveness recognize the critical role of team leaders, and there is certainly no shortage of leadership models in the literature. Remarkably, even as teams have increasingly become the primary building-blocks of organizations, there have been relatively few theoretical efforts to specify the *functional* requirements of team leaders (e.g., Hackman & Walton, 1986; Kozlowski, Gully, McHugh, Salas, & Cannon-Bowers, 1996a; McGrath, 1962). There is, however, a reasonable amount of consistency across these efforts in terms of the important leadership functions that need to be accomplished. Although different names have been used to describe these functions, they can be broken down into two primary categories: (a) the development and shaping of team processes (e.g., Kozlowski et al., 1996a), and (b) the monitoring and management of ongoing team performance (e.g., Fleishman, Mumford, Zaccaro, Levin, Kerotkin, & Hein, 1991; Hackman & Walton, 1986; McGrath, 1962). Note that these approaches to leadership functions generally assume that team member selection, composition, and task design fall outside the discretion of the team leader.

With respect to team development, leaders are often faced with the prospect of building a brand new team. At formation, new teams are merely a collection of individuals. The leader's functional role is to develop them into a coherent, seamless, and well-integrated work unit (Kozlowski et al., 1996a). In other instances, ongoing teams experience personnel outflows and inflows over time. As new replacement personnel are brought into the team, they need to be socialized and assimilated (Moreland & Levine, 1989). Leaders are critical to this newcomer assimilation process (Ostroff & Kozlowski, 1992). The developmental functions of team leaders focus on the enactment of *team orientation* and coaching to establish *team coherence* (Kozlowski et al., 1996a). Team orientation includes factors with motivational implications, such as promoting shared goal commitment, creating positive affect, and shaping climate perceptions. Team orientation represents the affective bonds that connect members to the team and its mission. Team coherence includes the development of linked individual goals, a repertoire of team task strategies, and a compatible network of role expectations across team members. Team coherence represents team member's collective bond to task interdependencies and dynamics, and provides the capability for teams to self-manage (Kozlowski et al., 1996a; Kozlowski, Gully, Salas, & Cannon-Bowers, 1996b).

With respect to team performance functions, the leader's roles are to monitor team members' behaviors and to take action as needed (Hackman & Walton, 1986; McGrath, 1962; Roby, 1961). A leader's first priority is to monitor the team's performance and progress toward task accomplishment. When problems are discovered, the leader must gather information to determine the nature of the problem and use this information to devise and implement effective solutions (Hackman & Walton, 1986).

Monitoring functions include vigilance, diagnosing group deficiencies, data gathering skills, forecasting impending environmental changes, and information use in problem solving. Taking action includes preventing deleterious environmental changes or their effects, enabling performance situations, providing material resources, and developing and managing personnel resources (Fleishman et al., 1991; Hackman & Walton, 1986; Komaki, Zlotnick, & Jensen, 1986; McGrath, 1962; Roby, 1961).

One important characteristic underlying these theoretical efforts to identify the key functional roles of team leaders is the assumption that the leader interacts directly with team members in the processes of team development and performance management (e.g., Fleishman et al., 1991; Hackman & Walton, 1986; Komaki et al., 1986; Kozlowski et al., 1996a, 1996b; McGrath, 1962; Roby, 1961). This underlying assumption is also characteristic of the emerging literature on self-managing work teams, which provide these functions on their own in the absence of a formal leader (e.g., Manz & Sims, 1987).

Thus, virtual teams present the potential for real challenges to effective team development and performance management. How can these key functional leader roles be duplicated, substituted, or eliminated given that the team may be widely dispersed in space and spread across time? In order to address these challenges and identify the implications for leadership, it is important to clearly distinguish the characteristics of traditional and virtual teams, and to distinguish among the different forms that virtual teams may assume.

Team Task Complexity and Workflow

Attention to the effects of task complexity on team structure and process is the major characteristic that distinguishes the emerging literature on work groups and teams

from the broader and more voluminous literature on small groups. This constraining influence of task complexity on work group structure and process has been noted by every major literature review and theory developed over the last decade or so (e.g., Bettenhausen, 1991; Goodman, 1986; Guzzo & Shea, 1992; Levine & Moreland, 1990; Kozlowski, Gully, Nason, & Smith, 1999). Thus far, task complexity has not received attention with respect to virtual teams. We believe that task complexity has critical implications for the structure and processes of virtual teams. We employ it as a key theoretical mechanism for the derivation of propositions and leadership implications drawn from the typology.

Van de Ven, Delbecq, & Koenig (1976) described four basic interdependence arrangements, based on Thompson's (1967) typology, that characterize the work flow processes inherent in different types of team structures. The least interdependent arrangement is termed *pooled/additive* because work and activities are performed separately by all team members and then combined into a finished product. In the second arrangement, *sequential*, work and activities flow unidirectionally from one member to another. The third arrangement, *reciprocal*, is characterized by work and activities which flow back-and-forth between team members, one-by-one, over time. In the final and most interdependent arrangement, *intensive*, team members must diagnose, problem solve, and/or collaborate simultaneously, as a team, in order to accomplish their task. These four types of workflow arrangements are illustrated in Figure 1.

Insert Figure 1 About Here

The team workflow interdependencies described above entail several other associated characteristics, including the *task environment, external coupling*, and *internal coupling*, that have been used to distinguish team task requirements (Cohen & Bailey, 1997; Kozlowski et al., 1999; McGrath, 1991; Sundstrom, DeMeuse, & Futrell, 1990; see Figure 1). This combined set of characteristics contributes to our conceptualization of task complexity as a continuum ranging from low to high complexity. Tasks at the less complex end of the continuum are static and loosely coupled to the external context, with minimal temporal pacing or entrainment requirements (Anacona & Chong, 1997; McGrath, 1991). Such tasks have weak, asynchronous intra-member linkages; they require minimal collaboration and information sharing among team members. Low complexity tasks are usually structured by an additive/pooled or sequential workflow arrangement.

However, as tasks become more complex they grow increasingly more dynamic and involve more tightly coupled external linkages. Such tasks are typically highly entrained temporally, with demanding pacing requirements for intra-team processes and for the team's interface with the external context. Such tasks are quite challenging, with greater levels of synchronous collaboration and information sharing among team members (Kozlowski et al., 1999). High complexity tasks are typically structured by reciprocal or intensive workflow arrangements.

The combination of characteristics that comprise task complexity set constraints on team structure and process. The nature of team tasks creates demands that are best resolved by appropriate workflow arrangements, which create corresponding demands for coordination, communication, and intra-team processes (Kozlowski et al., 1999). As a

result, we focus on the role of task complexity as a moderator of virtual team structure and process. In effect, task complexity sets constraints on the design characteristics of virtual teams and therefore influences the leadership functions that will be critical for the team's effectiveness.

A TYPOLOGY OF VIRTUAL TEAMS

Typologies have been used by several researchers to identify the characteristics that distinguish between different types of conventional work teams. Should one conceive of virtual teams as simply another category of team type to be integrated into one of these existing typologies? Certainly, existing work on virtual teams, which tends to treat them as a single category, might suggest that the answer is yes. Sundstrom et al. (1990), for example, used differentiation, integration, and work-cycles to identify four types of work groups -- advice and involvement, production and service, project and development, and action and negotiation -- that face different demands for effectiveness. Cohen and Bailey (1997) present a similar typology in their review of the team and group literature. Are virtual teams just another category? We think not.

As we will make clear, virtual teams possess characteristics that distinguish them from conventional, face-to-face teams. In particular, members of virtual teams are not physically proximal. However, the tasks, goals, or missions they are designed to accomplish are not necessarily different than those of conventional teams. It is the way they go about accomplishing those tasks, and the unique constraints they face, that are different. Thus, we do not view virtual teams as another discrete category to be fit into an existing typology. Moreover, given our goal of better understanding virtual teams, we do not see much conceptual value to extending an existing typology to add a virtual

category that could be applied to existing team types. Although potentially useful for classification purposes, such an approach would reveal little about the unique nature of virtual teams. One might conclude that they are much like conventional teams, but not face-to-face. We believe there are deeper distinctions that can be revealed through an exploration of the dimensions that distinguish different types of virtual teams.

The typology we develop draws on underlying characteristics in the conceptualization of task complexity that are similar to those used in existing team typologies (e.g., Sundstrom et al., 1990); thus, there is a conceptual linkage. Task complexity is used to represent constraints on virtual team design and, hence, implicates additional underlying dimensions that distinguish among different manifestations of virtual teams. Our point is that virtual teams have unique characteristics that make it possible to differentiate them both from traditional teams and from one another. The typology we present in this paper, therefore, is meant as a first step in identifying several of the key features that distinguish virtual teams not only from more traditional work teams, but more importantly from one another.

The role of typology in scientific development is to help organize and make sense of complex phenomena. Typology is especially useful in new areas of inquiry that are little explored and characterized by a variety of diverse, but related, phenomena. By creating a schema that establishes similarities and differences, the scientist endeavors to classify the phenomena into distinct types. Classification, however, is merely the first step. Ultimately, the scientist hopes to identify new and unexplored aspects of the phenomena that are ripe for research. Our use of typology to advance the understanding of virtual teams is predicated on this broader goal. Thus, our goal is not classification per

se. Rather, we focus on the use of typology to surface underlying characteristics that distinguish among virtual teams in order to identify research issues.

<div style="text-align:center">Virtual Teams vs. Conventional Teams</div>

The first section of our typology focuses on the characteristics that differentiate between virtual teams and conventional teams. These characteristics are present in all virtual teams, and in a sense they are what make these teams "virtual." Figure 2 displays the two characteristics that distinguish virtual and conventional teams: (1) spatial distance; and (2) information, data, and personal communication.

Insert Figure 2 About Here

<u>Spatial Distance</u>

The most critical and important feature of virtual teams is that they cross boundaries of space. Whereas the members of traditional teams work in close proximity to one another, the members of virtual teams are separated; often by many miles or even continents (Pape, 1997; Townsend, DeMarie, & Hendrickson, 1996). The specific distance that separates team members is not as important as the effect this spatial separation has on how team members interact. In contrast to conventional teams, the members of virtual teams rarely interact in traditional face-to-face fashion and instead use a number of mediating technologies, such as videoconferencing and e-mail, to maintain internal links and carry out their work. While many traditional, localized teams also communicate through computerized communication media, such technology is typically used to supplement face-to-face communication. Therefore, it is the absence of this

proximal, face-to-face interaction between members of virtual teams that makes them "virtual" and distinguishes them from more traditional teams.

Eastman Chemical Company, a subsidiary of Eastman Kodak, provides an example of an organization that utilizes both traditional and virtual teams. The company consists of between 800 and 900 interlocking teams that criss-cross the organization (Lipnack & Stamps, 1997). While many of these teams operate in the traditional face-to-face fashion, the company uses virtual teams to connect employees who are distributed geographically across various locations, such as the United States, Argentina, Wales, and Hong Kong. Eastman also uses virtual teams to connect to its numerous suppliers and customers located throughout the world, and as a result is able to conduct business around the clock.

As the example above illustrates, virtual teams allow organizations to become more flexible, adaptive, and responsive by enabling them to cross boundaries of space. Virtual teams can be designed to include the people most suited for a particular project, because there is no longer a need to worry about traditional concerns of whether or not members are located in reasonable proximity to one another or what it will cost to achieve that proximity (Townsend et al., 1996). Furthermore, virtual teams allow organizations to respond faster to increased competition because they can quickly harness the knowledge employees possess, regardless of location. While these features of virtual teams may not be extremely advantageous or even necessary when dealing with less complex tasks, they become increasingly more critical as the task a team performs becomes more complex. Complex tasks often require multiple individuals, each with an area of expertise, to coordinate their actions, and often this expertise is located outside of

an organization. Virtual teams, which cross boundaries of space, allow organizations to access this expertise regardless of where it may be located. It is important to note that these benefits associated with dispersed work groups are not guaranteed. As we discuss later in the paper, the ability of a virtual team to operate effectively depends a great deal on the match between the task demands and the communication technology used by the team. For example, if a task is very complex and requires a great deal of information exchange and group decision-making, e-mail will not provide an effective means of communication between team members and a process loss will result. However, if the communication technology used by the team meets the demands of the task, a dispersed work group can offer many advantages over a team whose members are co-located.

> Proposition 1: *We propose that the more specialized the expertise underlying the collective task a team needs to perform, the greater the likelihood that it will not be found in a proximal location. Virtual teams provide organizations with the means of accessing unique, highly specialized expertise that is distributed in space.*

Information, Data, and Personal Communication

The ability of virtual teams to be distributed across space is relevant to the second differentiating feature of virtual teams, technological mediation. In recent years, a number of advanced communication technologies have been introduced into the business world. While e-mail is probably the most common and most used example, other more complex and interactive communication technologies, such as videoconferencing, groupware, and project management software, are growing in popularity (Geber, 1995). Together with some more common modern appurtenances, such as telephones and fax

machines, these communication technologies have helped to transform the basic structure of work teams. They allow individuals to communicate and share information and data regardless of their location in time and space, and are the primary means by which the members of virtual teams interact.

Sun Microsystems, a highly decentralized organization consisting of six independent "operating companies," has been operating in cyberspace since its 1982 inception (Lipnack & Stamps, 1997). The company uses virtual teams, or as they call them "Sun Teams," for a number of different purposes. Some of these virtual teams are created to handle a particular project or problem and disband when a solution is a reached. Other Sun Teams are more permanent and are used to connect team members located in the company's different sales regions, including North America, Japan, and Europe. All of these teams operate through the company's extraordinary information infrastructure, which generates over 1.5 million e-mail messages a day (Lipnack & Stamps, 1997).

In traditional teams, such complex linking technologies are often not necessary (or are supplemental) because team members communicate primarily through face-to-face contact. However, since virtual team members are distributed across space, communication technologies provide the means to link members together and are absolutely critical. While the specific communication technologies a virtual team employs depends to some extent on an organization's resources, the choice should be dictated by the nature of the task the team is performing.

As discussed earlier, less complex tasks often require minimal communication and collaboration between team members. Team performance is either an additive

function of individual performance or the result of unidirectional interfaces between team members (Tesluk, Mathieu, Zaccaro,& Marks, 1997). In these situations, asynchronous communication media, such as e-mail or screensharing, will usually be sufficient because the need for reciprocal communication and interdependence is minimal. In recent years, a number of studies have examined the effects of computer-mediated communication and group decision support systems (e.g., Kahai, Sosik, & Avolio, 1997; Sosik, Avolio, & Kahai, 1998; Sosik, Avolio, Kahai, & Jung, 1998) on group processes and effectiveness. This research has shown that asynchronous communication is very effective with respect to less complex tasks that are essentially independent, such as idea generation (Dennis & Valacich, 1993 ; Gallupe, Biastianutti, & Cooper, 1991; McGrath, 1984; Valacich, Dennis, & Connolly, 1994). In fact, asynchronous communication is often superior to synchronous communication for less complex tasks because "production blocking" effects, which are caused by only one person being able to talk at a time, are eliminated.

As tasks become more complex, they necessitate more precise forms of coordinated effort. Team members' roles become highly interdependent and the need for well-orchestrated teamwork, reciprocal communication, and feedback is essential. Communication and collaboration demands increase dramatically, and information richness becomes critical (Hollingshead, McGrath, O'Conner, 1993). For example, Straus and McGrath (1994) compared the performance of face-to-face groups on three tasks of differing complexity to that of computer-mediated groups that utilized a fairly simple computerized bulletin board system. They found that there were no differences between face-to-face and computer-mediated groups in effectiveness on the lower complexity tasks, an idea-generation task and an intellective task. However, face-to-face groups did

perform significantly better than computer-mediated groups on a more complex judgment task. Research has shown that synchronous communication is superior to asynchronous communication for complex tasks that require a great deal of information sharing and collaborative decision making (Daly, 1993; Farmer & Hyatt, 1994; Hollingshead et al., 1993). These technologies maintain information richness and facilitate decision-making by allowing team members to communicate in a more interactive fashion. Thus, it is necessary for virtual team members to adopt synchronous communication media, such as videoconferencing or groupware, when dealing with complex tasks.

> Proposition 2: *Virtual teams performing less complex tasks are expected to be able to effectively manage their information and collaboration requirements with asynchronous communication media. As virtual teams perform more complex, dynamic, and challenging tasks, however, they are expected to be more likely to adopt synchronous, or tightly linked, communication media to facilitate collaboration, information richness, and group decision making.*

General Implications for Leadership Functions

As we have described above, the key characteristics of virtual teams that distinguish them from conventional teams are (1) the spatial distance between team members that restricts face-to-face communication; and (2) the resulting use of technological communication to connect team members. Each of these characteristics impede the two primary leadership functions, performance management and team development. The ability of leaders to monitor team member performance and to implement solutions to work problems is severely restricted by the lack of face-to-face contact within these teams. It is also difficult for virtual team leaders to perform typical

mentoring, coaching, and developmental functions. How do leaders of virtual teams monitor team member performance and progress toward task accomplishment? How do the leaders of virtual teams develop and mentor team members?

The challenge for virtual team leadership is that these functions must be accomplished by substitutes and by distributing the functions to the team itself. For example, the members of virtual teams are usually chosen for their expertise and competence, and often for their prior virtual team experience. They are expected to have the technical knowledge, skills, abilities, and other attributes to be able to contribute to team effectiveness and to operate effectively in a virtual environment. Thus, the need for virtual team leaders to monitor or develop team members may not be as crucial. In addition, it is important for virtual team leaders to distribute aspects of these functions to the team itself, in effect, making it more of a self-managing team (Manz & Sims, 1987). Leaders will need to implement a system in which team members will be able to regulate their own performance as a team (Kozlowski et al., 1996a).

To accomplish this, virtual team leaders need to provide a clear, engaging direction (Hackman & Walton, 1986) along with specific individual goals. Clear direction and goals enhance individual self-regulation and enable team members to monitor their own performance, gather their own feedback, and evaluate their own performance (Kozlowski, 1998; Smith, Ford, & Kozlowski, 1997). Although this is relevant in all teams, virtual team leaders need to be more proactive and structuring. Virtual team leaders need to develop mechanisms and processes that become reinforced by the team members themselves, to regulate team performance patterns (Zaccaro & Burke, 1998).

One way virtual team leaders can do this is by developing appropriate habitual routines early on in the team's life-cycle (Gersick & Hackman, 1990). Habitual routines operate automatically and perpetuate existing patterns of behavior, unless some extraordinary event occurs. Leaders can develop habitual routines by prespecifying desired routines (e.g., standard operating procedures), training members in the desired routines, and providing motivational incentives sufficient to ensure compliance with them (Gersick & Hackman, 1990). Team member self-regulation can also be enhanced by leaders who set explicit objectives, create a clear mission, and develop an appropriate climate or tone (Kozlowski et al., 1996a). Leaders can also set forth rules and guidelines that specify appropriate team member behavior. For example, computer-mediated communication tends to lead to more uninhibited individual behavior, such as strong and inflammatory expressions (Siegel, Dubrovsky, Kiesler, & McGuire, 1986; Strauss & McGrath, 1994; Weisband, 1992). Therefore, virtual team leaders may need develop standard operating procedures that specify appropriate and inappropriate computer-mediated communication.

Virtual team leaders also need to closely monitor any changes in environmental conditions. Because virtual team members are distributed, they are less aware of the broader situation and the dynamics of the overall team environment. So, as external conditions change, such as modified task specifications, a new deadline, or changes in the team's goals, leaders need to facilitate adaptive and appropriate changes within their team. And finally, virtual team leaders need to motivate team members to commit strongly to the overall team effort and need to facilitate team coherence, especially under high intensity conditions (Hackman & Walton, 1986; Kozlowski et al., 1996a, 1996b;

McGrath, 1962; Zaccaro & Burke, 1998). Team coherence, which is characterized by seamless group processes, is facilitated by developing linked individual goals, creating a repertoire of team task strategies, and building a compatible network of role expectations across team members (Kozlowski et al., 1996a).

> Proposition 3: *We propose that the ability of virtual team leaders to perform key leadership functions is limited by the distribution of team members across space and the consequent lack of face-to-face contact. Thus, effective virtual team leaders are expected to be more likely than leaders of traditional teams to create structures and routines to substitute for the functions and to distribute the leadership functions to the team. They are also expected to be more likely to create self-managing teams by providing direction and specific goals, monitoring environmental conditions, updating/revising goals and strategies as environmental contingencies warrant, and facilitating collaboration and cohesion among team members.*

This section of our typology focused on two characteristics that differentiate virtual teams from more traditional teams. The first, spatial distance, allows virtual teams to gather the expertise needed for a task regardless of where it is located. This is a critical feature when dealing with complex tasks, because such tasks require highly specialized expertise that is rarely found in the same location. The second characteristic, computer-mediated communication, enables virtual team members to work together closely even though they are dispersed across multiple locations. As virtual teams perform more complex tasks, they will need to adopt more synchronous communication media that provide greater information richness. Although these two features of virtual

teams offer many benefits, they also present numerous challenges for those charged with conducting performance management and developmental functions within such teams. Since the leaders of virtual teams cannot directly monitor or interact with their team members, they need to create a self-managing team by distributing leadership functions to the team and creating structures and routines that enhance team member self-regulation. In the next part of our typology, we turn our attention to four dimensions that distinguish different virtual teams. We then discuss their implications for effective leadership.

<center>Different Types of Virtual Teams</center>

The discussion above addressed the two characteristics that distinguish virtual teams from conventional teams. Now we would like to turn our attention to dimensions or characteristics that differentiate virtual teams. The focus of our typology is on the underlying conceptual dimensions that distinguish alternative types of virtual teams, not on classifying the types per se. The literature on virtual teams has tended to treat these teams as a single type; distributed in space and linked by mediating technology. However, there are several other key characteristics that vary across these distributed work groups, yielding many possible types of virtual teams. Our approach in this section is analogous to that recommended by Levine and Moreland (1998), who suggest identifying dimensions that make a set of people more or less "groupy," rather than searching for criteria that distinguish groups from non-groups (see also, Kozlowski et al., 1999). In this section we discuss several characteristics that help to characterize a team as either more or less "virtual" in order to highlight the variety of forms virtual teams can assume. As shown in Figure 3, we have identified four characteristics that are useful for

distinguishing among the different types of virtual teams: *temporal distribution,*
boundary spanning, lifecycle, and *member roles.* We present these characteristics in a
circular arrangement to show that a particular team is defined by a combination of these
characteristics. While we make no claim that these characteristics are exhaustive, we
believe they capture most of the diversity encompassing different types of virtual teams.

Because our purpose is to draw distinction, our discussion focuses largely on the
extremes. Nevertheless, it is helpful to think of each of these characteristics on a
continuum. At one end lies the "ideal type" or prototypical virtual team that is typically
discussed in the literature. It is distributed across time, spans numerous functional,
organizational, and cultural boundaries; is short-lived; and is comprised of members who
each possess multiple roles in different virtual teams. At the other end is the virtual team
which possesses many characteristics typical of conventional teams. This type of virtual
team is temporally entrained, has less permeable boundaries, has a continuous lifecycle,
and is comprised of members who have singular roles. As can be seen in Figure 3, where
a particular virtual team falls along the continuum depends on the complexity of the task
it performs. While we will discuss the extreme ends of this continuum to better
characterize virtual team distinctions, it is important to recognize that there are many
virtual team alternatives. The key, however, is to understand the dimensions of these
teams, not to focus on rigid typological classification. In the following sections we
discuss these distinguishing characteristics and examine how they are affected by the task
the team performs.

Insert Figure 3 About Here

Temporal Distribution

A great deal of literature has defined virtual teams as work groups that transcend boundaries of both space and time. This is understandable since the former often implicates the latter. The ability of virtual teams to cross boundaries of time is made possible by their use of technological communication media and is often one of their most salient and important assets. This quality allows a virtual team to operate around the clock and enables individuals to complete their portion of the work almost anytime. However, not all virtual teams distributed across space are also distributed across time. To provide a relatively simple example, consider a virtual team composed of individuals all located in a relatively confined geographical area, such as city or state. Although this team can be considered virtual because its members are distributed across various locations and don't interact in a face-to-face fashion, all members of the team are co-located in time. A more complex example is provided by ground controllers, distributed around the world, who monitor space shuttle operations in real time. While the members of these teams are not co-located, they are temporally synchronized or entrained (Ancona & Chong, 1996). That is to say that the team interactions necessary to yield effective performance require temporal bounding (see McGrath, 1991).

When determining whether a virtual team is entrained by real time or is distributed across time, it is important to consider the technology the team employs. Certain forms of synchronous communication technologies, such as videoconferencing,

allow virtual teams to interact in real time even though great distances and time zones separate team members. While other, asynchronous forms of communication technology, such as e-mail, result in greater temporal distribution, even when team members *are* co-located in time.

NCR Corporation, for example, uses a high-speed, continuously available audio/video/data link to connect its virtual team members located throughout the United States (Lipnack & Stamps, 1997). There are two to three conference rooms at each location which are equipped with a video camera, a 32-inch television for seeing people at the other end, an electronic overhead projector which projects foils onto the television screen, and a PC monitor for information sharing and distribution. Each of the locations is connected by an open lease line, which means that team members can sit down and have a meeting whenever they want. The arrangement has been very successful because it allows team members to operate in real time even though they are geographically separated and creates the feeling of one team rather than several distributed teams (Lipnack & Stamps, 1997).

Whether a virtual team operates in distributed or real time is dictated by the complexity of the tasks the team performs and the resulting workflow arrangements. As teams move from additive/pooled workflow arrangements to more reciprocal or intensive interdependencies, the need for real time communication increases. In pooled/additive or sequential workflow arrangements the task is usually one in which each member of the team can perform his or her work with relative independence from the other members of team. Each individual contributes incrementally to overall task completion. Team members still work together, but each individual team member's performance is more or

less a function of his or her efforts and does not depend as much on the performance of others. This allows the team to operate effectively across time and minimizes the need for real time communication media.

In reciprocal or intensive workflow arrangements, however, team members' roles are more interdependent. Work activities flow back-and-forth between team members who must collaborate to accomplish the team's task. Situations in which dynamic, external links are critical to team effectiveness also necessitate more complex workflow arrangements. These complex workflow arrangements facilitate the social integration that is necessary for a group to move from additive to interactive collaboration (Moreland, Levine, & Wingert, 1996). In air traffic control (ATC) teams, for example, FAA traffic controllers are tightly coupled to various external groups, such as airline pilots and dispatchers, FAA traffic managers who monitor conditions (such as severe weather), and the FAA's Air Traffic Control Systems Command Center (ATCSCC) which provides numerous services, such as approving route changes. In these situations, it is often necessary to implement real time communication technologies to facilitate decision making, collaboration, coordination, and integration among team members, and between the team and external groups.

> Proposition 4: *The need for virtual teams to operate in real time (vs. distributed time) is expected to become more critical as tasks become more complex, workflow arrangements become more reciprocal and intensive, and situations require dynamic, external links. The ability of virtual teams to operate effectively in distributed time is expected to increase as tasks become less complex, workflow*

arrangements become more additive and sequential, and situations are less

dynamic with looser external links.

<u>Boundary Spanning</u>

Virtual teams often cross many different boundaries. Two of these boundaries, space and time, were discussed above; however, virtual teams can also span functional, organizational, and cultural boundaries. While conventional teams are often defined by such boundaries, the ability of virtual teams to cross boundaries enables them to be more adaptive, flexible, and responsive. It also allows virtual teams to access the most qualified individuals for a particular project and perform their functions from around the world.

Whereas conventional teams are typically limited to the resources available within the organization, virtual teams can and often do cross organizational boundaries to access the most qualified individuals for a project. It is most often the search for the "right people," those with needed expertise or experience, that leads an organization to create a virtual team (Lipnack & Stamps, 1997). These individuals may be independent consultants or experts, members of support organizations (or even competitors), or may be members of the same organization located in different divisions or plants. Each of these individuals performs a different function which is necessary for the team's success. NCR Corporation, for example, uses virtual teams to connect to not only its many internal groups but also its many partners and customers, including Intel and Microsoft (Lipnack & Stamps, 1997). The members of these teams work together in designing, engineering, manufacturing, and marketing NCR's products.

As virtual teams expand across organizational boundaries, they are more likely to cross cultural boundaries as well. These teams are very common in multinational companies that need to overcome geographical barriers (Merrick, 1996). Hewlett Packard, for example, created its worldwide distributed product information management (PIM) system to allow its virtual teams to function across global distances and 24-hour timeframes (Lipnack & Stamps, 1997). While the ability of these teams to cross cultural boundaries has many benefits, it also offers many challenges.

As teams cross cultural boundaries, differences in language, tradition, and cultural values may make effective communication more difficult. These situations may necessitate "richer" communication media to better convey meaning between team members. However, there may also be differences across cultures concerning the communication and information technologies available and individuals' familiarity with these technologies. Using groups from the United States and Singapore, El-Shinnawy and Vinze (1997) examined whether the effects of computer mediated communication on decision-making processes and outcomes differ across cultures. Contrary to their expectations, they found that negative effects of computer mediated communication were more pronounced in the groups from the United States, resulting in fewer novel and valid comments and less persuasive arguments. The authors concluded that the effects of computer mediated communication were not as great in the Singaporean group because technology is so central in their society (El-Shinnawy & Vinze, 1997). Different cultures have also been shown to vary on a number of value dimensions, such as individualism, uncertainty avoidance, and power distance (Hofstede, 1980, 1991). Within a particular culture, these dimensions play an important role in determining how work is conducted

and how people interact, which may make effective cross-cultural work arrangements more difficult to establish.

While most virtual teams cross functional, organizational, and/or cultural boundaries, the permeability of these boundaries depends of the nature of the tasks the team performs and varies across different types of virtual teams. When tasks are on the less complex end of the continuum, the need to establish stable internal and external linkages, a common set of procedures, and fixed membership is less critical. In these situations, members of virtual teams are able to frequently cross new boundaries with few consequences for team performance. However, as tasks become more complex, the boundaries virtual teams cross become less permeable. Complex tasks require tightly coupled internal and external linkages, established operating procedures, and therefore more stable team membership. For these tasks, it is important for a virtual team, once established, to have less permeable boundaries. If these boundaries are constantly changing, the ability of the team to perform coherently may be negatively affected. This is not to say that complex tasks limit virtual teams to fixed boundaries, but rather that these boundaries, once crossed, are more likely to be relatively less permeable over time to limit disruptions to intra-team processes.

> Proposition 5: *Virtual teams often cross functional, organizational, and/or*
> *cultural boundaries. However, the degree to which these boundaries, once*
> *crossed, are permeable is expected to depend on the nature of the tasks the team*
> *performs. When tasks are more complex, requiring established operating*
> *procedures and more stable relationships, a virtual team's boundaries are*
> *expected to remain less malleable over the team's lifecycle. However, when tasks*

are on the less complex end of the continuum, personnel in- and outflows cause less disruption to team processes and established operating procedures are less critical, and a virtual team's boundaries are expected to be more permeable over the team's lifecycle.

Life-cycle

Virtual teams have variable lifecycles. The prototypical virtual team is characterized by a discrete lifecycle. Virtual teams are often created to solve a particular problem or to perform a specific task, and when the job is completed the team disbands. Such teams allow organizations to quickly deploy and redeploy their resources to accommodate constantly changing and unique customer requirements. In addition, virtual teams are often characterized by dynamic membership as people come and go as they complete their specific tasks. As a result, an individual's tenure in a virtual team is often much shorter than it would be in a more conventional team. This is especially true when a virtual team is composed of many outside experts or consultants. It is important to recognize that there are also virtual teams that possess a more continuous lifecycle. This is often the case when an organization uses virtual teams to connect to its outside partners, such as suppliers and customers.

The lifecycles of virtual teams are largely determined by the nature of tasks these teams perform. Less complex tasks can be handled using more pooled/additive and sequential workflow arrangements. When these arrangements are used, individuals can flow in and out of the team as they are needed with little or no impact on overall team performance. The need to develop cohesion and collaboration among team members is minimal and the degree of familiarity among team members is often not critical.

However, when a task is more complex and involves more reciprocal or intensive workflow arrangements, collaboration and integration among virtual team members is critical. Team members' roles are interdependent making it more difficult to introduce new team members and more detrimental when existing team members leave. For example, the virtual team that worked to develop the chlorofluorocarbon-free refrigerator for Whirlpool Corporation worked together for two-years, with relatively few changes in team membership (Geber, 1995). The need for the members of the team to think, act, and feel like a group, rather than a loose and shifting collection of individuals, was so critical to the success of this difficult project that the team met face-to-face every four months or so to discuss the project and allow team members to bond. In these instances, effective team performance depends on familiarity among team members and well-established role networks (Kozlowski et al., 1999). Such teams benefit from a more stable team membership and a more continuous lifecycle.

> Proposition 6: *When the tasks a virtual team performs are complex and challenging, the team is expected be more likely to maintain a stable team membership and develop a more continuous lifecycle. When tasks are less complex and challenging, however, a virtual team is expected to be able to function effectively with a dynamic team membership and a more discrete lifecycle.*

Member Roles

Virtual teams provide the capability for more flexible organizational responses, which means that the roles attributed to virtual team members will often be substantially more dynamic than in traditional settings (Townsend et al., 1998). Virtual teams draw

the necessary skills for a particular project from a pool of workers whose diverse skills

most appropriately fit the project and task requirements. To quickly tackle a particular

project or situation, virtual team members may be required to perform numerous tasks

and hold various roles. As a result, virtual team members will need to be adept at

adapting to a variety of team situations.

While multiple roles facilitate more flexible organizational responses, they can

also create conflicts and ambiguity (Rizzo, House, & Lirtzman, 1970). These effects

have been found in studies on matrix organizations, which attempt to increase the

capacity for information handling and decision making by establishing formal, lateral

channels of communication that supplement existing hierarchical channels (Davis &

Lawrence, 1977; Galbraith, 1973; Hrebiniak & Joyce, 1984). Studies have suggested that

these new channels complicate decisions concerning delegation by making

responsibilities unclear or ambiguous. The result is often increased role conflict and

ambiguity and negative effects on work attitudes such as job satisfaction and involvement

(Butler, 1973; Reeser, 1969). Similar effects may be found when the members of virtual

teams hold multiple roles.

Although the members of prototypic virtual teams hold multiple roles, it is

important to acknowledge situations in which virtual team members possess more

singular roles. When tasks are less complex, the roles of virtual team members are more

interchangeable. Many individuals within the pool of available workers can perform

each of the required tasks. Less complex tasks also typically involve asynchronous

workflow arrangements, which allow team members to hold multiple roles independent

of other team members. However, when tasks are more complex and challenging, they

require greater levels of training, specialization, and expertise. As a result, there are only a few select individuals who can perform the required tasks, and they are likely to have a single, fixed role. Complex tasks also involve synchronous workflow arrangements, which require clearly defined team member roles and a well-established role network.

>*Proposition 7:* Virtual team members often hold multiple roles both within and across different virtual teams. However, we propose that as the tasks a virtual team is required to perform become more complex and challenging, requiring greater levels of expertise and specialization, a higher premium is expected to be placed on synchronous workflow arrangements and the roles of individual team members will be more likely to be clearly defined, fixed, and singular. Under conditions of low task complexity, however, there is minimal interdependence among team members and more asynchronous workflow arrangements are expected to be adopted. In these situations, we expect that a virtual team's members can hold multiple roles without compromising the effectiveness of the team.*

Implications for Leadership

As we discussed above, there are four characteristics that distinguish among different types of virtual teams: (1) temporal distribution, (2) boundary spanning, (3) lifecycle, and (4) member roles. Each of these characteristics can be thought of as a continuum, with one end representing the prototypical virtual team and the other representing characteristics typical of more traditional teams but also possible in virtual teams. Below we discuss how each of these characteristics affects leadership functions in virtual teams.

Temporal distribution. When virtual teams operate in real time and are connected by synchronous communication technologies, leaders are able to better perform critical performance management functions. They can recognize and diagnose problems as they happen and are equipped to take immediate corrective action. Thus, rich, synchronous communication media and temporal entrainment allow virtual team leaders to manage team performance much like leaders of more conventional teams. However, when virtual teams are distributed across time or utilize asynchronous communication media, it is more difficult for leaders to execute performance management functions. The information leaders receive is delayed and decoupled from events, forcing them to act reactively. Because leaders of temporally distributed work groups have more difficulty monitoring and managing team performance as it happens, they need to be proactive. This will require leaders of temporally distributed work groups to devote additional resources to explicitly structuring performance management activities. They need to anticipate problems and provide clear direction and goals to help team members regulate their own performance. They should incorporate reviews and other feedback opportunities into their team management structure to ensure that team members receive regular performance updates. Because temporally distributed team members are also more likely to become detached from the overall team environment, it is important for leaders to monitor the environment and inform team members of any important changes. Leaders should design back-up plans to provide temporal buffering under changing environmental conditions. This buffering allows the leader to modify team and individual goals and enables team members to adapt their roles and behaviors to the new situation (Kozlowski et al., 1996a).

Proposition 8a: *We assume that as virtual teams become temporally distributed,*

the information leaders receive is more likely to be degraded and delayed making

it more difficult for them to perform critical performance management functions.

In these situations, effective virtual team leaders are expected to be more likely to

be proactive in the creation of explicit structures that help the team manage its

performance. They are also expected to be more likely to focus attention on

anticipating problems, providing clear direction and goals to allow team

members to regulate their own performance, and enabling team members to adapt

to changing environmental conditions.

When virtual teams are distributed across time, it is also more difficult for leaders

to perform team development functions. However, tasks that allow team members to

operate across time usually involve less intensive forms of collaboration and

interdependence. In these situations, leader developmental functions may not be as

critical. On the other hand, leader developmental functions become extremely critical as

coherence and collaboration become necessary for team success. In these instances,

virtual teams need a real time focus that enables leaders to effectively perform critical

developmental functions. Leaders need to determine how to develop team coherence

through communication technologies. They need to evaluate the degree to which

coherence is required for team success and choose communication media based on these

requirements. For example, when it is important for team members to have opportunities

to bond, it is necessary for leaders to choose real time communication media which

maintain information richness. When coherence is extremely critical to team success,

leaders may need to bring team members together for face-to-face meetings at designated project milestones (Geber, 1995; Lipnack & Stamps, 1997).

> Proposition 8b: *We assume that leader developmental functions will be more critical when virtual teams operate in real time. Effective virtual team leaders are expected to be more likely to determine how to use communication technologies to provide team members with necessary developmental experiences. This will likely involve evaluating the degree of coherence required for team success and choosing appropriate communication media based on these requirements.*

Boundary Spanning. When virtual teams cross boundaries, leaders are faced with a number of new challenges. One very salient challenge for leaders is determining how best to manage the performance of team members who span different functional areas, organizations, and/or, cultures. Leaders need to assess how individual and team self-regulation methods translate across different boundaries. It will be difficult for leaders to adopt a universal strategy. Instead, they may need to tailor their actions to coincide with a particular team member's orientation. Differences in power distance, uncertainty avoidance, and other values across cultures (Hofstede, 1980, 1991) require leaders to determine the most appropriate behaviors for a particular situation. Leaders who attempt to relate to the world-view of the different members of their virtual team will be better able to individualize their performance management actions.

> Proposition 9a: *As virtual teams span different functions, organizations, and cultures, we propose that effective leaders will need to assess how individual and team self-regulation methods translate across these different boundaries. Under*

these conditions, virtual team leaders are expected to be more likely to consider contextual factors when performing critical performance management functions. They are also expected to be more likely to identify what factors (e.g., differences in cultural dimensions or values) are relevant, and to tailor their performance management functions based on relevant individual differences across the team.

Team developmental functions are also more challenging as virtual teams are distributed across different organizations, cultures, and functions. It is more difficult for leaders to create a well-orchestrated team when individuals do not share similar values or possess a common set of work procedures. To overcome these problems and to facilitate coherence among team members, Graen and Wakabayashi (1994) suggest that leaders need to implement a leadership structure that builds a unique or "third" culture. At the core of this leadership structure is a network of working relationships based on strong bonds of mutual respect, trust, and obligation between individuals at all levels (Graen, 1996). The goal is to empower all employees and link them together so that they are "insiders" in the team. This structure ensures that individuals will put the team's interest above self interest, and should help to facilitate cohesion among individuals drawn from across multiple boundaries (Buono, Bowditch, & Lewis, 1985; Bridges, 1986). Virtual team leaders also need to engage in functions such as boundary spanning and buffering. The leader spans boundaries to link the dispersed team members to needed information and resources, and buffers the team from shocks and disturbances that can disrupt its work. These functions along with the creation of a third culture allow a virtual team leader to enact a boundary around an entity that has no tangible boundaries.

Proposition 9b: *We propose that team developmental functions will be more challenging when virtual teams are distributed across multiple boundaries. In these instances, effective virtual team leaders are expected to be more likely to build a unique team culture by developing bonds of mutual respect, trust, and obligation between team members at all levels.*

Lifecycle. The lifecycle of a virtual team has implications for the leader's performance management functions. Just as team members often work together better when they have been together longer, it is easier for virtual team leaders to lead when they have been with the group for an extended period of time. Leaders need to provide goals, structures, and norms to help team members manage their own performance. In continuous teams, leaders have the ability to establish these standards and are able to manage performance over time. Furthermore, leaders are better able to manage the team's performance because they are able to more easily recognize deviations from established operating patterns.

It is more difficult for leaders to establish structures and norms in virtual teams with more discrete lifecycles. The lack of firmly established operating patterns also makes it much more difficult for leaders to recognize problems and determine appropriate, corrective actions within these teams. When a virtual team has a discrete lifecycle, the leader's primary role is to keep the team on track so that they can finish a project or accomplish their tasks quickly and effectively. Gersick (1988) showed that teams typically exhibit long stable periods of inertia followed by midpoint transitions characterized by dramatic progress. Leaders of discrete lifecycle teams need to facilitate an early transition period by providing clear direction and team and individual goals.

Proposition 10a: *When virtual teams have more discrete lifecycles, we propose that it will be more difficult for leaders to establish operating patterns that help team members regulate their own performance. Therefore, effective leaders of these teams are expected to be more likely to provide clear direction and team and individual goals to facilitate an early transition to performance.*

When a virtual team is characterized by a short lifecycle or dynamic membership, team development functions are also difficult. Leaders have a limited amount of time during which they can perform these functions, and often have to focus on only the most critical issues. Developmental functions in these situations are more basic. Leaders need to quickly foster effective working relationships between team members, but should not be concerned about establishing long-term relationships. When a virtual team has a more continuous lifecycle, a leader's team development functions become even more critical. In these situations, the leader must establish long-term, effective working relationships among team members that can be sustained throughout the team's more lengthy tenure. In addition, virtual teams typically adopt a more continuous lifecycle when performing more complex and challenging tasks. Such tasks require more reciprocal or intensive workflow arrangements and necessitate a high degree of integration and collaboration among team members. By setting forth a clear team mission and developing role networks among team members, leaders play a critical role in establishing these more complex workflow patterns.

Proposition 10b: *When a virtual team is characterized by a more discrete lifecycle, we propose that it will be more difficult for a leader to perform critical team development functions. Effective leaders of these teams are expected to be*

more likely to focus on only the most critical issues, such as quickly establishing working relationships between team members. When a virtual team is characterized by a more continuous lifecycle, a leader's team development functions are expected to be even more critical. Under these conditions, effective leaders are expected to be more likely to establish long-term, effective working relationships among team members and to facilitate the development of complex workflow arrangements that are necessitated by the more complex tasks these teams perform.

Member roles. As team members hold multiple roles within and across different virtual teams, a leader's performance management functions become much more difficult. Team members who hold multiple roles are more likely to experience role ambiguity and role conflict (Rizzo et al., 1970). Multiple roles lead to indistinct boundaries and role ambiguity. Team members are uncertain of their role in the team, and other team members' expectations of an individual are often inappropriate. Conflicts between multiple role expectations and individuals' abilities to satisfy such expectations cause role overload and negative work attitudes (Joyce, 1986). To counteract this, leaders need to clearly specify each team member's role in the team. It is important for leaders to convey this information to all team members, so individuals are aware of their role in the team and also the roles of others. When individuals hold multiple roles across different virtual teams, role conflict is inevitable. Team members often get called away for other higher priority teams. Leaders need to design back up plans in case team members are forced to leave. For example, leaders can line up "alternatives" for critical team members. Team members with multiple roles are also more likely experience time

conflicts. Leaders need to clearly specify how much time each team member will be required to commit to the team.

Proposition 11a: *As team members hold multiple roles within and across different virtual teams, role ambiguity and role conflict are expected to make leader performance management functions more challenging. To manage virtual team performance, effective leaders are expected to be more likely to clearly specify each team member's role within the team, design back-up plans in case team members are called away to other teams, and clearly specify how much time each individual is expected to commit to the team.*

As team members hold multiple roles across different virtual teams, leaders' developmental functions also become difficult to perform. It is more challenging for leaders to create a coherent and well-orchestrated team if personnel are constantly flowing into and out of the team. It's also difficult to create integration if team members are not clear on what their job entails or what the roles of others are. Thus, it is important for leaders to clearly define team members' roles and the role networks within the team (Kozlowski et al., 1999). When the tasks a virtual team performs become more difficult and complex, it is even more critical for leaders to develop clearly defined team member roles networks. Well-established role networks help to facilitate well-coordinated interdependence, and help team members operate effectively together. Leaders establish these complex role networks by providing each team member with a singular, defined, and fixed role. By clearly establishing each team member's role, the leader facilitates the development of the reciprocal and intensive workflow arrangements that are required for more complex and challenging tasks.

Proposition 11b: *As team members hold multiple roles across different virtual teams, leaders' developmental functions are expected to be more difficult to perform. To create coherence and interdependence among team members, effective leaders are expected to be more likely to specify not only individual team member roles but also the interrelationships between the roles of team members. These functions are expected to be even more critical as teams perform more complex and challenging tasks, requiring morereciprocal and intensive workflow arrangements. Effective leaders are expected to be more likely to establish clearly defined role networks by providing each team member with a singular, fixed, and defined role within the team.*

Discussion

As the nature of work in today's organizations becomes increasingly more complex, dynamic, and global, there is a growing need for flexible and adaptive organizational systems, structures, and processes. Horizontal or flat organizational structures and team-based work units have become increasingly more prevalent, and, with advances in technology, there has been a growing emphasis on far-flung, distributed, *virtual* teams as organizing units of work. Although virtual teams will play a key role in the design of organizations in the next millennium, we know relatively little about them and their implications for effective leadership.

Theoretical Implications

The purpose of this paper was to further understanding and research about this new form of work unit. We developed a typology that focused on the characteristics of virtual teams. Although typology is often used to create a taxonomy, we see little value

in classification per se. Rather, our goal was to surface the underlying dimensions of

virtual teams in order to distinguish virtual teams from conventional teams, and to

explore different manifestations of virtual teams. The object of our typology was to

make salient differences, and our discussion was often based on extreme representations

of forms. Although these ideal types help to uncover differences, they may not map well

to "fuzzier" natural entities. Hence, we believe that our focus on identifying

distinguishing characteristics, in contrast to classification, has more theoretical and

research value for understanding this emerging form of work organization.

Virtual teams can be distinguished from conventional teams in terms of their (a)

spatial proximity and (b) communication technologies. Different manifestations of

virtual teams can be distinguished in terms of their (a) temporal distribution, (b) boundary

spanning, (c) lifecycle, and (d) roles. These dimensions were used to formulate

theoretical propositions concerning both the nature of virtual teams and implications of

virtual teams for key leadership functions of (a) performance management and (b) team

development. Where a virtual team lies on the distinguishing dimensions is largely

determined by the complexity of its task. Less complex tasks enable virtual teams to be

distributed in time, have permeable boundaries, short lifecycles, and multiple, fluid roles

for members. These characteristics are descriptive of the prototypic virtual teams. More

complex tasks are more likely to entail virtual teams that operate in real time, have less

permeable boundaries, continuous lifecycles, and singular roles; characteristics that are

descriptive of distributed action teams (Sundstrom et al., 1990) or distributed decision-

making teams (Kozlowski et al., 1999). Thus, virtual team forms, and implications for

leadership functions, are deeply entwined around the complexity of the task the team performs.

When tasks fall at the less complex end of the continuum, work is typically organized in an additive or sequential fashion and interdependence and collaboration among team members is not as critical to team success. Under these conditions, the characteristics associated with the prototypical virtual team are most likely to emerge. The additive or sequential nature of work allows team members to operate effectively across space-time and organizational, functional, and cultural boundaries. Since integration and collaboration among team members is not as critical to team success, the team can also possess a more discrete lifecycle, team membership can be more dynamic, and members can hold multiple roles with little or no disruption to team processes.

However, when tasks become more complex and challenging, work is arranged in a more reciprocal or intensive fashion and a high degree of integration and collaboration among team members is required. Under such conditions, a virtual team's characteristics are more likely to be similar to those typical of conventional action teams (Sundstrom et al., 1990) or distributed decision making teams (Kozlowski et al., 1999). Team members will need to operate in real time to facilitate the exchange of rich and detailed information. The reciprocal or intensive workflow arrangements will also require the team to have less permeable boundaries, a more continuous lifecycle, a more stable membership, and members who hold more defined, fixed, and singular roles. All these factors will play a critical role in building the role networks that facilitate the integration and collaboration between team members that is required for more complex tasks.

Just as task complexity determines the characteristics a virtual team will assume, these characteristics have implications for important leadership functions. As we described earlier, leaders perform two critical functions in teams, monitoring the team's performance and facilitating team development. Where the dimensions of a particular virtual team fall on the continuum has implications for both the nature and importance of these two leadership functions. A leader's *performance management functions* will be most critical when dealing with the more prototypical virtual team. In these situations, team members are temporally distributed and cross multiple boundaries. As a result, the information leaders receive will be temporally delayed and decoupled from events. Leaders will therefore need to devote additional resources to explicitly structuring performance management activities. In the prototypical virtual team, team leaders are also faced with managing the performance of constantly changing members, who also often hold multiple roles, and need to do so within the team's typically short lifecycle.

In contrast, a leader's *team development functions* will become critically important when a virtual team assumes characteristics more typical of action teams or distributed decision-making teams. The rich, synchronous communication and temporal entrainment in such teams should better enable such teams to self-manage and self-regulate their performance, placing less emphasis on the leader's performance management function. However, the leader will need to develop long-term, effective working relationships among team members that can be sustained throughout the team's more lengthy lifecycle. Since such virtual teams typically emerge when dealing with more complex tasks, leaders will be faced with the challenge of creating clearly defined role networks to facilitate cohesion among team members. This can be accomplished by

employing rich communication media and helping team members to enact well-defined singular roles. After a leader establishes these effective and sustainable workflow patterns, his or her performance management duties should be less important.

Research and Practice Implications

Our framework is a point of departure, not a finished product. We have established a conceptual foundation for the dimensions of the typology, and have derived propositions. The next step is to evaluate the propositions. More specifically, the propositions addressing the distinguishing characteristics for different forms of virtual teams, and the constraining, moderating influence of task complexity, are most relevant to elaborating understanding of virtual teams and have the most salient implications for virtual team leaders. Thus, these characteristics should be the primary research focus. Future theory and research efforts should also explore the operational issues surrounding leadership in virtual team environments. For example, organizations or virtual team leaders will need to create infrastructures that facilitate information sharing, work planning and assignment allocation, feedback and review, information processing, decision-making, and dispute adjudication. It is important for future research to focus attention on understanding how virtual team leaders design and implement these and other management systems.

In addition, the interaction between communication technology and task type on team processes and effectiveness is another area that we feel deserves future attention. Past research on this issue has used, almost exclusively, simple asynchronous forms of computer-mediated communication, such as bulletin board systems. Future research would benefit from studies that employ today's advanced synchronous technologies, such

as videoconferencing and groupware. It would also be beneficial to examine how groups using these advanced forms of communication technology perform on complex dynamic tasks, such as real-time group decision-making simulations. Past research in this area has found that computer-mediated groups do not perform as well as face-to-face groups on complex tasks; however, these differences may disappear when the technology utilized provides the capability for information rich communication.

Descriptive studies that examine the role of leaders in virtual teams is another valuable research approach. We have derived propositions regarding the implications of virtual teams that are theoretically consistent with our typology. However, to the best of our knowledge, there are no naturalistic studies that directly examine the problems leaders of different types of virtual teams face. The current literature on virtual teams is saturated with stories and descriptions of different types of dispersed work groups. Surprisingly, there has been little focus on the role of leaders in these teams. Descriptive studies on the role of leaders in virtual teams may help to provide a qualitative validation of the typology and can provide a foundation for additional theoretical and research development in the area.

Although we recognize it is a bit premature, we offer some practical implications of our model. First, one implication for virtual team leaders, regardless of virtual team type, is the need for delegation and facilitation skills. How the task is delegated and managed from afar is quite different at the extremes of the model, but the necessity to distribute leadership functions across team members is a common theme. It is important to select leaders capable of, and oriented toward, "distal" leadership. Second, where the propositions call for different approaches to accomplish leader functions, we can and

ought to develop training programs and structured supports to inculcate key functional

leadership skills.

Conclusion

Virtual teams are here, and they are here to stay. They offer many benefits to

organizations striving to handle a more demanding work environment, but also present

many challenges and potential pitfalls. We have uncovered and discussed many of the

challenges throughout this paper. The next step is to address these challenges with more

focused and detailed research. We hope the typology represents a small first step toward

the development of theoretically-based and application-relevant virtual team principles.

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Figure Caption

Figure 1. Characteristics of simple vs. complex team workflows.

Figure 2. Characteristics that differentiate virtual teams from conventional teams.

Figure 3. Characteristics that distinguish different virtual teams.

**Task
Environment:**   •
Static   • Dynamic
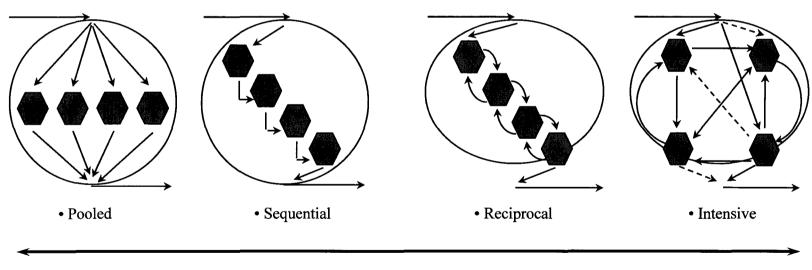
**External
Coupling:**   • Loosely
Coupled   • Tightly Coupled

**Internal
Coupling:**   • Asynchronous   • Synchronous
              • Weak Linkages   • Strong Linkages

**Workflow
Interdependence:**

• Pooled   • Sequential   • Reciprocal   • Intensive
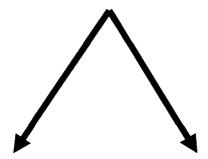
Low   **Team Task Complexity**   High

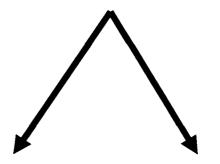# Characteristics that Differentiate Virtual Teams from Conventional Teams

Virtual Teams

Spatial Distance	Communication
Distributed	Technologically Mediated

Conventional Teams

Spatial Distance	Communication
Proximal	Face-to-Face

Characteristics that Distinguish Virtual Teams

Virtual Teams

Member Roles
Multiple

Lifecycle
Discrete

Boundaries
Multiple

Temporal Distribution
Distributed

Work-flow Patterns

Task Complexity

Member Roles
Singular

Lifecycle
Continuous

Boundaries
Singular

Temporal Distribution
Real Time