Distance Matters, Except When It Doesn't: Discontinuities in Virtual Work

ABSTRACT

Virtual work has become an increasingly common phenomenon in today's organizations. Substantial and continuing changes in organizational processes and IT infrastructure have increased the pace and intensity of working across traditionally impermeable boundaries, enabling diverse forms of collaboration. However, our understanding of the consequences and implications of virtual work still lags and research results have been contradictory. We suggest that some of these inconsistencies have been because the boundaries that characterize virtual work—time, space, culture, organization, and so forth—are objective demarcations that are not uniformly problematic. It is only when those working in virtual settings perceive a boundary to be a discontinuity that it hinders work processes. We develop a model of virtual work that differentiates between boundaries and discontinuities, which helps account for contradictory findings. By examining the process of virtual work in more detail, we can uncover issues that are the underlying cause of problems, rather than deal with the more obvious symptoms that can mask underlying problem. Our model has implications both for research and for those working in virtual environments.

Keywords: Virtual work, Discontinuities/Continuities, Boundaries

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1. INTRODUCTION

Many work situations have long required workers to manage boundaries between themselves and their co-workers. For example, distributed sales teams involve individuals working from different geographic locations across a boundary of distance, and temporary organizational alliances involve individuals from different organizations working together across organizational boundaries. However, substantial and continuing changes in organizational processes and IT infrastructure have increased the pace and intensity of working across boundaries, making them an increasingly common feature of more workers' lives. Internet-enabled applications such as email, instant messaging and wikis have augmented traditional electronic media such as telephone and voice and video conferencing, enabling diverse forms of collaboration across traditionally impermeable boundaries.

For example, when distance was an insurmountable barrier to collaboration, a person would have to move to a new location to join a new work group. Today, that person can instead be expected to form a similar working relationship from a distance via information and communications technology (ICT). The worker may also be expected to form multiple relationships in multiple groups, and again this is feasible with the use of ICT. However, while some boundaries may be bridged, additional boundaries are exposed. A worker using ICT may work with people from a variety of contexts or backgrounds, exposing these boundaries, which would never have been relevant before.

Thus while some boundaries may be overcome by the extensive use of ICT, the work environment becomes more complex as additional boundaries need to be crossed.

Our understanding of the consequences and implications of virtual work still lags its ubiquity in the workplace. Consider for example one of the most basic questions about virtual teamwork: are periodic face-to-face (FTF) meetings still necessary for effective team functioning? The literature on this question is divided, with some authors (e.g., Maznevski and Chudoba (2000) and Nandakumar and Baskerville (2006)) finding that yes, FTF meetings are necessary, while others (e.g., Chudoba et al. (2005b) and McKinney and Whiteside (2006)) maintaining that no, virtual relationships can be maintained with a mix of communication media that does not have to include FTF communication. Such contradictory findings point to a need for better understanding of virtuality.

We suggest that part of the reason for the divergent findings of prior research is that these studies have often treated virtuality in isolation, examining specific work practices enabled by the use of ICT but without fully accounting for the larger ongoing context in which these practices take place. When technology enables connections between individuals that transcend boundaries of time and space, the context in which the work takes place is also changed and sometimes disrupted. Little research has examined how previous work practices may have been adapted to new situations in the virtual work environment or how understanding of virtual work may evolve over time. We therefore address the following research question:

> *What factors affect the relationship between virtual work settings and work outcomes, beyond the simple presence or absence of boundaries?*

We are particularly interested in how the relationship between virtual work settings and work outcomes might evolve over time. To address this question, we develop a process model of virtual work that differentiates between boundaries and discontinuities, which helps account for contradictory findings. By examining the process of virtual work in more detail, we can uncover issues that are the underlying cause of problems, rather than deal with the more obvious symptoms that can mask underlying problems. Our model therefore has implications both for research and for those working in virtual environments.

We begin with a review of prior research on virtuality and its assumptions about the virtual workplace. Next, we present a model of virtuality that characterizes boundaries as objective demarcations that are not necessarily always problematic. The model uses the constructs of discontinuities and continuities to explain the circumstances under which boundaries affect performance either positively or negatively in the virtual work environment. We conclude with the implications of our model for research and practice.

2. PREVIOUS RESEARCH ON VIRTUALITY

In this section, we review common assumptions about virtuality and virtual work to set the stage for our proposed model of virtuality. We do so by examining in more detail research that has investigated the nature of virtual work.

2.1 Communications perspective on work

There are many possible perspectives on virtual work, but because of our interest in ICT-supported work, and in line with a long tradition of research, we view

organizations, and in particular the virtual environment, as patterns of communication and flows of information between individuals (e.g., Galbraith, 1977; Stinchcombe, 1990; Weick, 1969, 1995). For example, Stohl (1995) conceptualized organizations as "identifiable social systems of interacting individuals pursuing multiple objectives through coordinated acts and relationships". From this vantage point, organizations are realized and sustained with and through communication. We chose this perspective because it treats as a first-order concern what ICT does, namely help support communications, thus providing a useful lens with which to examine the processes of virtual work. In so much as work practices associated with virtuality alter the nature and patterns of communication, it becomes crucial to develop a deeper understanding of this process. From this perspective, much of the research on virtual work has explicitly or implicitly defined the phenomenon of interest as "work with distant co-workers enabled through the use of ICT".

2.2 Oppositional strategy for research

The research strategy most used in research on virtual work is to compare virtual to non-virtual work (Powell *et al.*, 2004) contrasting discrete activities within groups. For example, many researchers have compared FTF groups to non-FTF or distributed groups (e.g., Mortensen & Hinds, 2002; Ocker *et al.*, 1998; Ocker *et al.*, 1995/1996). This research has most often involved experimental comparison, typically of student groups, though there is some field research as well (e.g., McDonough *et al.;* Mortensen & Hinds, 2002). The approach of this stream of research, generally speaking, is to develop deeper understanding of the 'virtual' environment by comparing with its opposite, the 'traditional' environment. This research strategy provides a convenient way to

characterize virtuality in order to compare with traditional, or FTF, interactions. For example, distributed groups using asynchronous and synchronous electronic media were compared with FTF groups (Niederman & Beise, 1999) to develop understanding of media perceptions and effects on performance.

Comparing a new work environment with the traditional one is an effective strategy in the early stages of research on an emerging phenomenon. It is natural to contrast what we know with what we do not know when grappling with new ideas. Schultze and Orlikowski (2001) point to the role of familiar metaphors in constructing meaning when faced with unfamiliar concepts. However, they also caution that a "strategy of opposition is often reductionist and may result in oversimplification" (p. 65). For example, in research on telecommuting, a new work environment enabled by the use of IT, researchers have often compared the work practices and perceptions of telecommuters to those of non-telecommuters (e.g., Hill *et al.*, 1998; Igbaria & Guimaraes, 1999). Practitioner testimonials and publications highlight the advantages and benefits of telecommuting, while empirical research found mixed results (Orlikowski & Barley, 2001). More recently though, researchers have begun to suggest that considering telecommuting in either-or terms—work at home vs. work at the office—may have in fact constrained our understanding and subsequently, missed more nuanced but fundamental changes in work practices. Orlikowski and Barley (2001) point out that telecommuting has been investigated as the opposite of work in a traditional office with a resulting lack of research into actual work practices of telecommuters. In particular, there has been failure to recognize the ways that "people integrate telecommuting into their daily lives" (Orlikowski & Barley, 2001) so that the lines between work and non-work

are blurring. Powell and her colleagues (2004), who conducted the most comprehensive review of the literature on virtual teams to date, also recognize the limitations of an oppositional strategy and call for research to move beyond the comparison of traditional and non-traditional teams to better understand virtual teams. Such a strategy is key to answering our research question, since comparing traditional and virtual teams will not illuminate the other factors affecting the relationship between virtuality and work outcomes.

More recent work on virtuality has enriched the conceptualization of virtuality by moving beyond an "either or" dichotomy. Two specific strategies that have been employed are: 1) the recognition of 'hybrid' environments instead of a strict dichotomy; and 2) the recognition that virtuality encompasses dimensions other than distance and time. We next discuss these two research approaches.

2.3 Hybrid groups

In recent work, researchers have recognized that few work environments are either totally virtual or totally FTF. Increasingly, work environments are some type of hybrid configuration with workers varying their interactions along a continuum of FTF and non-FTF (Griffith *et al.*, 2003). Hybrid groups have been characterized in different ways. First, different work settings have been characterized by different degrees of distance between co-workers. For example, Scott and Timmerman (1999) studied teleworkers and proposed that the "percentage of one's workweek spent away from the main office" (p. 245) can be used to segment workers into low, medium, and high categories of virtuality. Similarly, Wiesenfeld, Raghuram & Garud (1999) stratified workers by time spent away from the traditional office and investigated differences in

"organizational identification," between those closest to traditional and those most virtual. Another strategy has been to consider different group compositions, e.g., totally distributed (all members in different locations) vs. partially distributed (e.g., a group with some members in one location and some in another or with some distributed and others co-located). Niederman & Beise (1999) examined communication patterns within groups to propose a framework characterizing the "virtualness" of a group, team or meeting based on the amount of electronic and FTF communication the entity engaged in. In their framework, highly virtual teams are those that meet frequently through electronic media and not FTF but they recognize that "fully-supported" teams might meet frequently in both modes.

However, even this more nuanced view reduces the complex phenomenon of virtual work to a set of remote/local oppositions and misses the opportunity to conceptualize further mediating factors. In addition, this research conceptualizes virtuality primarily as spanning geographic distance. Yet, working in a virtual environment encompasses more dimensions than distance. We turn to recent research that has explicitly recognized multiple dimensions, and focus especially on research characterizing virtuality in terms of boundaries.

2.4 Multiple dimensions of virtuality

The second direction in which the dichotomy of virtuality has been extended is to consider multiple dimensions of virtuality. Many researchers have characterized the multiple dimensions of virtuality in terms of boundaries. Boundaries are "often imaginary lines that mark the edge or limit of something" (Espinosa *et al.*, 2003). Distance is the most obvious boundary that is encountered in virtual work but people in these

environments encounter numerous boundaries, such as time, organization, and nationality, which are not usually present in more conventional work settings to the same extent. Espinosa and colleagues (2003) examined five boundaries they observed in five separate research studies of field-based virtual teams: geographical, functional, temporal, organizational, and identity (team membership). Their focus was on methodological issues arising in teams working across multiple boundaries.

Orlikowski (2002) found boundaries to be particularly important in understanding how work was conducted in a geographically dispersed high tech organization. She identified seven boundaries that "members routinely traverse in their daily activities" (p. 255)—temporal, geographic, social, cultural, historical, technical, and political. Members of the *Kappa* organization adapted behavior regularly in order to deal with the multiple boundaries they encountered in their daily work activities, as the boundaries were being "reconstructed and redefined".

Watson-Manheim et al. (2002) similarly conceived virtuality, though they examined it in terms of discontinuities, defined as "a break or gap in the work context," or a "lack of continuity." They proposed the concept of discontinuities as an overarching notion to permit a more comprehensive understanding of the many ways in which virtuality was discussed in the literature. In addition to the demarcations suggested by Espinosa et al. (2003) and Orlikowski (2002), they identified discontinuities such as relationship with an organization (e.g., permanent vs. self-employed or temporary worker) and task. Their literature review, however, found that distance and time were most often investigated in research studies even though many other boundaries exist in practice.

Chudoba et al. (2005b) used the concept of discontinuities to create a virtuality index to characterize the distributed work environment at Intel and to understand what difference it made to employees' perceptions of their teams' performance. The use of discontinuities as a measure of virtuality provided a reliable way for individuals to report the different components they experienced, such as whether they work with team members at a physical distance, across organizations or national cultures, and how often this occurred. The authors identified variety of work practices as an important component of virtuality, which had a negative influence on performance, while more common boundaries, such as geography, time and language, were not perceived to have an effect on performance. They concluded that implications of practice-related discontinuities points to the importance of focusing on the process of working virtually in addition to considering the boundaries characterizing the work environment.

To summarize the research reviewed above, we conclude that a major shortcoming of the oppositional perspective has been the failure to fully account for the larger ongoing work context in which virtual work occurs. Analyzing the work setting in terms of boundaries is a step forward in understanding the complexity of the virtual work environment. There is evidence from previous research, however, that behavior is being adjusted at boundaries, yet current research strategies do not fully account for these changes in work practices. We therefore propose a refined model of virtuality that enables us to incorporate additional factors that moderate the relationship between virtuality and work outcomes.

3. A MODEL OF VIRTUALITY

To understand the factors that affect the relationship between work outcomes and virtual work settings, conceptualized as work crossing boundaries, we consider the circumstances under which boundaries are associated with problems in the virtual work environment and factors that moderate their effects. We do so by re-examining the role of discontinuities in a virtual work environment to explain why boundaries are only sometimes problematic.

3.1 Why Boundaries May Create Problems in a Virtual Setting

A key point in our analysis is to understand why virtual work is problematic, and therefore, identify the factors that might mitigate or exacerbate these difficulties and so moderate the effect of virtuality on team outcomes. As noted above, virtual work has often been analyzed in terms of boundaries, which have generally been understood as static demarcations that separate individuals and create barriers to communication that can be bridged in part through the use of ICT (Espinosa et al., 2003). Given the communications perspective we introduced above, we suggest that boundaries may be problematic because of the effect they have on communications. To conceptualize the effect, we draw on work by Nijkamp, Rietveld & Salomon (1990) on the effects of borders on physical flows of products and information across space. They defined a discontinuity as a change in the marginal cost of such flows, noting that such a change indicates the existence of a border. For example, moving products from one nation to another can increase costs due to waiting time and administrative activities at the border. The result is a discontinuity in travel costs, which rise smoothly with increased distance but jump discontinuously when the barrier (the border crossing) is reached. The cost of

transportation between a starting point A and two equidistant points B and C may differ because of the presence of a border between A & C, as shown in Figure 1. Appendix A contains a more detailed example of the way a physical border can create discontinuities in travel costs and how those costs might be mitigated.

The boundaries that must be crossed in a virtual work setting may similarly pose numerous new kinds of difficulties that increase the effort needed to get work done, thus posing discontinuities in the cost of communications. In this case, the border *per se* does not contribute to the increased effort, but rather the differences introduced at that point which must be articulated, negotiated and resolved, leading to a discontinuity in communication costs. Thus, we define a discontinuity as *the increased effort to accomplish a task through a communication interaction across a boundary*. By effort, we mean the additional difficulty an individual faces in trying to accomplish a given purpose.

A virtual work setting may pose numerous difficulties that increase the effort needed to get work done. A simple example is that when colleagues are in different time zones, it can be hard to find a mutually agreeable time to meet, so adding a distant colleague to a group results in a discontinuous increase in the cost of meeting scheduling. More substantively, it can be difficult to communicate with co-workers at a distance, especially if there are also language or cultural differences. As a result of these boundaries of language or culture, an individual might expect to have to do more work, e.g., talking more slowly when non-native speakers are participating in a meeting or using fewer colloquialisms in verbal discussions, resulting in a discontinuity in work effort at the boundary. Differences in functional background can make communication in cross-functional teams more difficult, as described by Dougherty (1992). Even within the

same functional area, work practices can differ to a problematic extent. For example, in a conversation with one of the authors, an executive with a major bank recounted difficulties combining a team of 'wealth managers' in Texas. The expectations of how information was to be given to clients, how clients were to be treated and what their needs were differed extensively between those managers with clients in Houston ('old' money and a more relationship-based connection with clients) and Dallas ('new' money and a more transaction-based connection with clients). This difference in understanding of the customer, and even the identify of the different wealth managers, created significant difficulties in the performance of this virtual team.

A further example can be drawn from Maznevski and Chudoba's (2000) study of three global virtual teams. One of them, SellTech, an alliance between a U.S-based company and one of its major customers, crossed boundaries of time, space, and culture with members in the U.S., U.K., and northern Europe. These boundaries created many problems early in the team's life because the sales manager, located in the UK, could not get the attention of the U.S.-based engineers to address issues raised by the northern-European-based customer. The boundaries led to communication problems (e.g., U.S.-based engineers would not return calls, emails, or even respond to FTF personal appeals) and threatened the viability of the corporate alliance. As a result, the boundaries between the firms created discontinuities in the effort to communicate and work together.

An important implication of our definition of discontinuities is that boundaries are only problematic to the extent that they involve increases in effort. To return to the geographic example, boundaries between US states (and many EU nations) are still boundaries, but generally speaking do not increase transportation costs, meaning that they

are not discontinuities. Similarly, there may be boundaries in virtual work that are not problematic and so do not create discontinuities. As a result, while boundaries are objective (i.e., recognizable by all parties, even those not actually involved in the communication process), discontinuities as we have defined them are subjective (i.e., relevant only as perceived by those involved in the communication process). We summarize this discussion as a first proposition:

P1: *A* discontinuity *is an increase in effort to accomplish some purpose through a communication interaction across a boundary. While a boundary can be objectively noted as being present (e.g., individuals cross a boundary of time when they work in different time zones), a boundary is perceived as a discontinuity by individuals only when they experience it as an impediment to communication.*

3.2 Role of Expectations of Work in Perception of Discontinuities

Given the definition of discontinuity developed above, a key question is how does an individual come to experience a boundary as an impediment to communication? In this section, we discuss the role of expectations in the experience of discontinuities. Expectations can be understood as part of an individual's mental model of the situation, an internal representation of reality that guides thinking and acting (Eden & Spender, 1998). The role of expectations is critical to organizational functioning as they allow individuals to assume different roles while still adopting their activities and meanings appropriately for the situation (House *et al.*, 1995). In addition, expectations enable individuals to deal with ambiguity in well-practiced ways by associating them with prior experiences, and therefore enabling them to predict what should happen next (Matlin, 1998). As people respond to the situations they encounter, they develop expectations of events and typical behaviors of others, and meaning is attached to these events and

behaviors, e.g., performance expectations and socialization practices. They draw on these expectations while performing work activities and navigating the work environment. Action choices are framed and decisions made regarding behavior based on understanding of the situation, and expectations of action outcomes.

These mental models reflect an individual's particular context as they are shaped through interactions and observations in that context. For example, when individuals first learn they will be working with virtual partners or on a virtual team, various expectations of the needed effort required are developed. Existing knowledge and skill, e.g., previous history with working virtually, or working with a virtual partner or team, or previous history of working on a collocated team inform these expectations. Expectations will also be influenced by a person's perceptions of her or his identity and the groups with which an individual identifies (Tajfel, 1978), whether functional (e.g., engineer or marketing analyst), organizational (e.g., Microsoft or General Motors), or national (e.g., French or Russian).

Based on the prior discussion, we identify two possible outcomes in a shared work situation. First, individuals may experience a boundary as problematic when action responses and flows of information are not as expected and hence are perceived as an impediment to communication, or as a discontinuity in effort. Alternatively, if flows of communication and action are as expected, the situation is perceived to be ordinary and manageable. A variety of factors may explain why crossing a boundary is non-problematic, such as previous virtual work experience, a strong institutional framework that provides common ground for work practices to develop, or commonalities in background that override differences introduced in a virtual environment. While

differences can emerge, communication partners have enough common ground to quickly negotiate differences without perceiving extraordinary effort. This ground can come from several sources, though social identities seem particularly powerful. Katzy and Crowston (2000) found a shared national culture and shared professional culture held the group together so that it could function successfully. Likewise, Kumar and his colleagues (1998) suggested that standardized supply chain management procedures and a social network substituted for what would have been in place if all production had been done in one company. In a study of global software development teams, Orlikowski (2002) described how the shared identity of Kappa employees permitted the teams to develop innovative products on time, within budget. The common understanding of Kappa goals enabled workers at different physical locations with different cultural backgrounds to successfully complete projects even though they may have had different specific understanding of precisely how to achieve their goals.

> *"The way we work in Kappa is the same across locations because we're always shooting for the one goal, and this is to have a successful project. That's the bottom line. And people strive for that. We may differ sometimes on how to get to that goal. But the common goal of a successful product and a good product so our customer doesn't holler at us, is pretty much, I think, viewed by everybody as really important. And so whether the Americans want to go, you A,B,C,D to get there, or the Germans want to go A,F,E,D-as long as they come to that common goal, that's fine. And they do. It's the Kappa way." (Orlikowski, 2000, p. 258).*

What is common across these situations is that individuals were able to make sense of their differences and form common expectations of work practices and patterns of interactions. We call these common expectations *continuities*. When one or more continuities is present, the scripts for communication activities are clear to each group and shared by the members, based on common understandings and expectations of

organizational norms, roles, and routine behaviors. While communication partners may not share the same precise meaning of events, there must be enough common understanding to allow persons to make sense of the situation and choose agreed upon actions. This does not mean that all differences must be resolved but that all parties must at least have comparable understandings in order to undertake joint action (Weick *et al.*, 2005). Our use of the term continuity is different from that of Watson-Manheim and colleagues (2002) because rather than a continuity being the antithesis of a discontinuity, it is a separate construct. In addition, discontinuities are perceived at the individual or group level of analysis, whereas continuities are a group-level phenomenon.

In sum, prior research of the virtual work environment suggests that predictable, equivalent expectations between communicating partners are important contributing factors to success. Reliable expectations simplify the work environment and allow individuals to focus energy and attention on the content of their work practices (House et al., 1995) and away from negotiation and interpretation of behavioral rules. By developing an appropriate stock of habitual work practices, i.e., continuities, an individual reduces the problems and uncertainties associated with discontinuities. Thus, as interactive work activities are performed in the virtual environment, the effort that individuals make is interpreted through their frame of expectations. A key point in this analysis is that expectations have to be shared to be effective, forming *continuity*. Thus, we argue:

P2: *A continuity exists when expectations between virtual communication partners are equivalent. When a continuity and a boundary condition exist concurrently, extra effort in communication may be required to accomplish interdependent work activities; however, the effort is not perceived as an impediment to work*

(i.e., as a discontinuity).

3.3 Routinization and Adaptation of Virtual Work Practices

Until this point we have discussed the problems created by boundaries from the point of view of a single individual. However, our focus is on communication in a complex environment where individuals (or groups of individuals) are interacting across multiple boundaries. Through communication, even when mediated by ICT, individuals attempt to construct a 'shared space' in which work occurs. The endeavor to create a shared space in the face of differences is intrinsically motivated, as humans experience the world with others, sharing and interpreting common experiences. As Schutz & Luckman (1973) put it, "The life-world is not my private world nor your private world, nor yours and mine added together, but rather the world of our common experience." (p. 68). A shared identity provides the context within which coordination and learning are formed. This shared identity lowers communication costs and determines explicit and tacit rules of behavior within an organization. It is through this shared identity that discourse, coordination, and learning are structured (Kogut & Zander, 1996).

We now turn to sensemaking as a basis for understanding the construction of shared space at boundaries in virtual work. The sensemaking perspective is useful for several reasons. It is a process-oriented view of actionable change at the individual level, which concurrently helps explain macro-level changes; sensemaking is oriented toward action and interpretation by the individual in an interdependent context. Thus, sensemaking is about constructing meaning and collective understanding in an ongoing and changing social context (Weick, 1995; Weick et al., 2005).

Weick (1995) describes *generic subjective* interactions as based on common understandings and expectations of organizational norms, roles, and scripts for action. Explicit efforts at sensemaking occur when circumstances are perceived as different than expected, especially changes in circumstances that interrupt flows of activities. When an unexpected event is encountered, or, in our language, a discontinuity, "uncertainty increases because the old scripts and generic subjectivity no longer work" (Weick, 1995, p. 71). As a result, individuals reinterpret their perceptions and patterns of behavior in the face of these disruptions. Interactions become *intersubjective*, meaning that through interaction with others, individuals revise scripts to construct meaning and adapt earlier collective understandings to the new situation. Intersubjective interactions involve negotiation and interpretation; disparate views must be reconciled. Extra effort must be focused on resolving these differences before interdependent work activities can be effectively resumed (Weick, 1995). This process becomes especially salient when people are interacting across boundaries, which may introduce significant differences in context, and they must develop a sense of common environment (Mark & Abrams, 2004). Through these interactions, individual understandings are synthesized into common understandings. Generic subjective understanding is created such that the group has a set of common expectations (Weick, 1995) or social structure (Wiley, 1988).

Ongoing work activities and organizational circumstances are continuously adjusted through movement between stable, expected routines of behavior and reinterpretation of action scripts when faced with disruption from a discontinuity. As individuals observe problems and respond, negotiate new meanings, and reconcile differences, new expectations of future action, i.e., routines of behavior, are developed.

This is important for effectiveness as reliable expectations simplify the work environment and allow individuals to focus energy and attention on the content of their work practices (House et al., 1995). By developing an appropriate stock of habitual work practices, an individual reduces the problematic, with less time needed for negotiation and planning. In fact, research indicates that successful work in the virtual environment depends on the establishment of routines of behavior, or in our framework, continuities, including routines around the use of supporting communication technologies (Powell et al., 2004).

Our emphasis so far, and in fact in most literature on routines, is on the efficiency gained from stable and expected interactions. However routines can also be seen as a source of adaptation in work practices (Feldman & Pentland, 2003). It is through the performance of routines that flexibility and change can occur, as individuals react to the specific circumstances they face at the time of executing the routine (Feldman & Pentland, 2003). In other words, changes in behavior occur under specific circumstances where the flows of information and communication are disrupted within the shared space the group has constructed. And it is through "talk" that sense is made of reactions to disruptions and expected interdependent behaviors are developed (Weick, 1995). Using Weick's terms, routines involve generic subjective interaction while disruptions to routines lead to intersubjective interactions. The interplay between generic subjective and intersubjective interactions can lead to innovative responses to the changes being encountered (Weick, 1995).

Chudoba and her colleagues (2005a) recount the story of a London-based Intel employee who regularly had evening audio-conference meetings scheduled with colleagues in the western U.S. There was no overlap in traditional work hours for the

whole team. After having to interrupt his personal schedule on multiple occasions, the London-based employee began to habitually block off the 6-8 p.m. time slot in his electronic calendar. The team honored this block so that no meetings were scheduled then to allow the employee time to travel home, eat dinner, and read his children a bedtime story, and then resume work from home. The team's routine changed—e.g., meetings no longer occurred during 6-8 p.m. London time but continued before and after. This change in meeting routines allowed the team to work together productively, and reduced the frustration the far-flung employee experienced on the team. Thus, a discontinuity of geography and time zone, i.e., no overlap in traditional work hours for all members of a team, was no longer perceived as a discontinuity as the team's meeting routines were adapted to form a continuity. The geographic and time zones boundaries still existed but the team members no longer saw them as unacceptably problematic. This change in the audio-conferencing routine allowed the team to mitigate the effects of the discontinuities of time and space.

Returning to Maznevski and Chudoba's (2000) SellTech example, we can see how practices are adapted more substantively. These changes were put in place when the success of the strategic alliance was threatened because of problems emanating from difficulty in traversing the multiple boundaries. Specifically, the sales manager in the UK was unable to obtain cooperation from other alliance members due to lack of shared expectations of how to support the work of the alliance. The problem was addressed by the formation of a new team with senior representatives of both organizations. The team initiated regular monthly telephone conference calls; because of the presence of senior management, participation in the meetings by lower level employees was expected.

Subsequent problems were resolved because key personnel were involved and gave the attention necessary to resolve them. The objective boundaries of time, place, and culture were still present, but the effort required to address problems and expectations of possible problems were understood by all. The shared expectations and hence expected action outcomes mitigated the negative effects on communication within the team. New routines were formed, e.g., monthly conference calls, and the team established continuities that supported effective operation of the strategic alliance. Thus, we expect:

P3:	*What is perceived as a discontinuity at one point in time may not be considered a discontinuity at a later time even if the underlying boundary condition continues to exist.*
P4:	*New routines of work practices and uses of ICT can emerge through shifting from discontinuity to continuity.*

3.4 ICT, Discontinuities And Continuities

A second critical aspect of expectations is the perceived affordances and capabilities offered by ICT. While most definitions of virtuality include the use of ICT, research has been divided on how, when and what features of ICT best support cooperative work in this setting. Virtual work is often implemented successfully without the introduction of special new technologies, and in fact fairly simple communication technologies are commonly used, e.g., email, IM, and telephone. However, technologies have been shown to have different socially constructed affordances and perceived possibilities for use (Pinch & Bijiker, 1987). In particular, studies have shown that an individual user's background and experience with the technology influences her perception of richness, e.g., channel expansion theory (Carlson & Zmud, 1999). In addition, users of communication media have been found to develop common perceptions

of the capabilities of a medium and expectations of usage over time (Lee, 1994; Markus, 1994).

This perspective parallels work on the social construction of technology, developed by Pinch & Bijker (1987) as described in Klein & Kleinman (2002). Three elements that they discuss are useful in our analysis. First, Pinch & Bijker (1987) argue that rather than being objective, technologies have interpretive flexibility. Second, the norms and understanding of the possibilities of the technology are the result of a process of negotiation that takes place within a social group. It is through on-going usage of the technology that meaning and understanding that meaning and understanding of the technology is developed (Orlikowski, 2000). Finally, views of a technology are embodied in shared cognitive frames (Bijker, 1995). As Bijker (1995, p. 192) puts it, "within a technological frame, not everything is possible anymore but the remaining possibilities are relatively clearly and readily available to all members of the relevant social group."

Thus, the meaning and understanding of capabilities of ICT can differ at different points in time within the same group and can differ across the same groups at the same point in time. So the perceived usefulness of ICT (either a particular medium or combination of media) at a boundary is not static and can vary across different situations. In Table 1, we use two different communication media, email and desktop video conferencing, to illustrate how the same medium may be perceived differently at example boundaries. Features of technology can trigger sensemaking and serve as the foundation for developing understanding (or disrupting previous understanding) of appropriate usage (Griffith, 1999) and usage patterns and understanding of media are also constrained or facilitated by material characteristics of the medium (Orlikowski, 2000). Therefore, we

examine the two media by separating their core features. We illustrate how these features, and thus the medium, may be perceived as a discontinuity or a continuity at different boundaries. So for example, as shown in Table 1, email is an asynchronous communication medium. This capability clearly allows work to take place across time zones; however, the same feature can create disruption in information flows under certain conditions, which can lead to a discontinuity. We therefore propose the following:

P5: *ICT may be perceived as either contributing to a continuity at a boundary, with similar expectations of its use across members of a work group, or as a discontinuity, contributing to a perception of increased effort to perform work across a boundary.*

4. IMPLICATIONS

Our process-based framework has several implications for both research and practice. Having worked through the effects of boundaries on communication and work practices in a virtual setting, we next discuss some implications of a discontinuities/ continuities approach for future research and practice.

4.1 Research Implications

Our basic proposition—that not all boundaries are problematic all of the time—highlights the importance of looking at actual detailed work practices. For researchers, a practice approach has several implications. First is the importance of longitudinal examinations of those engaged in virtual work in order to capture changes over time in perceived discontinuities and the development of continuities. In addition, while our analysis above has identified some factors influencing the connections between virtual settings and team performance, further details should be gained through study of actual work situations. The discontinuities/continuities framework also highlights the need for

cross-level research as discontinuities can be experienced at the individual or group level, while continuities are only experienced at the group level.

We expect that differences in task characteristics, especially those that have a communication component, will have an effect on the perception of discontinuities or continuities. For example, jobs that are not predictable require more communication with co-workers to gather information and solve problems than jobs that are predictable (Rice, 1992). In addition, highly interdependent jobs require extensive integration of work activities and increased communication between group members (O'Brien, 1984). The same boundary may have more problematic effects for the performance of unpredictable and highly interdependent tasks than others with different characteristics. Again, the implication is that researchers need to examine the actual content of the work in more detail.

Researchers should also consider the interaction effects between boundaries. While a single boundary may not be perceived as problematic–i.e., not perceived as a discontinuity–the interaction between multiple boundaries may result in the perception of discontinuities. Recent literature has recognized that boundaries may not exist independently and, when existing in combination, can covary in their effects (Espinosa et al., 2003). For example, performance of work activities by members of an inter-organizational team may mean that individuals who are separated in time and/or space have to interact with colleagues from a different professional, organizational or even national culture (Boudreau *et al.*, 1998; Carmel, 1999). In addition, these may be combined with differences in technology further compounding the complexity of the work environment (Orlikowski, 2002). Espinosa et al. (2003) caution researchers to take

into account the presence of multiple boundaries and the effects of possible interactions between these boundaries in studies of virtuality, and we echo this caution.

Combinatorial effects are also important because of the rising incidence of multi-teaming (Chudoba et al., 2005a; Majchrzak *et al.*, 2004). Majchrzak et al. (2004) found an increase in overall productivity due to the ability of far flung team members to concurrently participate in multiple teams. However, Chudoba et al. (2005b) found that differences in work practices across teams had a negative impact on performance of individuals on multiple teams. To the extent that different teams have different practices and different uses of technology, people who cross teams may be at a disadvantage and be more likely to experience discontinuities and resultant negative effects on performance. From an individual's perspective, discontinuities are not necessarily managed the same way across all teams. Continuities created within teams may also differ, leading to discontinuities across teams. The team itself may then become another boundary, and a potential discontinuity when individuals work on multiple teams.

In addition to examining discontinuities at the boundaries where they occur, researchers could also look at other distinctions between discontinuities. For example, working with a colleague in a different time zone requires different meeting strategies and extra effort to perform cooperative work. However, a communication partner who is one or two time zones away clearly requires less effort to work with than a partner with whom there is a larger time zone gap (say 5 or more time zones away). In the latter example, the available hours for synchronous meetings are significantly limited and may require meetings outside of normal work hours. Thus, the problematic effects of the boundary are likely to be much more significant. This suggests that future research

should investigate structural differences in discontinuities. One such distinction (following from a mathematical view[1]) may be between 'removable' discontinuities, which have little significance, and 'jump' or 'essential' discontinuities, which have substantial effects.

4.2 Managerial Implications

For practitioners, our framework indicates that focusing primarily on boundaries a team is crossing may not be informative, as the problems stemming from the boundaries will change from team to team. Instead the focus should be on building shared practices or equivalent expectations for practice (e.g. creating continuities) within a team. This could take the form of meetings at regular intervals (e.g., Maznevski & Chudoba, 2000), or setting incentives for team members to build continuities, such as expected response times for email messages (e.g., Watson-Manheim & Belanger, 2007). Also, managers should identify the area to develop continuities at boundaries over which they have control. For example, in cross-organizational teams, the priorities of people in different organizations are beyond a particular manager's control, but the team can be encouraged to create work practice continuities (such as expected response time for emails).

Our definition of continuities emphasizes the need for equivalent expectations between individuals. In focusing on the development of continuities, managers should keep this definition in mind. In other words, creation of shared expectations does not mean that individuals must have understanding of all differences introduced by boundaries. For example, equivalent understanding of how differences will be negotiated can reduce the impediments to communication even if there is not complete

[1] http://en.wikipedia.org/wiki/Classification_of_discontinuities

understanding of those differences. In an examination of a group formed to support an outsourcing agreement, a colleague[2] found that the contractual agreement was more successful than anticipated even though group members were located in the United States and Eastern Europe, crossing multiple boundaries, including distance, time, culture, and organization. Upon further examination, she discovered that a key member of the group located in the United States was an Eastern European expatriate. This person served as a bridge between the individuals in the two locations and helped reduce the effort required for communication and effective functioning. The insights of the expatriate also guided the groups as they came to develop shared work practices over time, which served as continuities and further supported the work of the group members. Thus perceived impediments to communication were reduced when members trusted that the boundary spanner would negotiate differences.

Finally, because of the constant exposure to new ways of thinking and re-definitions of action routines in discontinuous work environments, these changing relationships can enhance an individual's, and thus the organization's, innovativeness. On the other hand, since individuals working together may not share common vocabularies, assumptions, norms, mental models, and so forth, they may find it difficult to understand each other, or worse, believe that they understand each other while oblivious to the presence of misunderstandings. Practitioners should be aware of this tension and focus on identifying and managing consequences.

[2] Informal conversation between two of the authors and Natalia Levina, Assistant Professor, Stern School of Business, NYU

5. CONCLUSION

Prior research has identified many challenges to work in virtual settings, but guidance on how to achieve positive work outcomes is sometimes contradictory as researchers highlight different problematic aspects of virtuality. We suggest that this inconsistency is because the boundaries that characterize virtual work—time, space, culture, organization, and so forth—are objective demarcations that are not uniformly problematic. It is only when those working in virtual settings perceive a boundary to be a discontinuity that it hinders work processes. Further, what is perceived as a discontinuity at one point in time may not be perceived as a discontinuity at another time. Continuities, or equivalent expectations across members of a group, are a construct distinct from discontinuities and are necessary for successful work in the virtual environment. They may be present when members of a group first begin to work across boundaries. Alternatively, continuities may be created through deliberate management or group member intervention, or emerge as members work through problems arising from the presence of discontinuities.

Our proposed framework can serve as a foundation for future investigation of virtual work outcomes across a variety of settings. The framework highlights the importance of looking at not only specific work practices but the larger on-going context in which the work takes place.

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Tables and figures

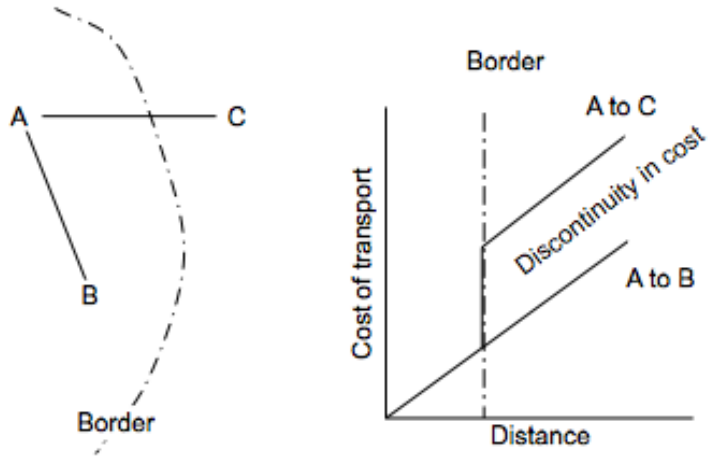

Figure 1. A border creates a discontinuity in the cost of transport.

Table 1. Illustration of Email and Desktop Video Conferencing as Continuity and Discontinuity**.**

Features of the medium - email	**Boundary**	**Continuity**	**Discontinuity**
Asynchronous communication	Time	Time zone differences become less important	Lag time between interaction goes up
Text-based	Language	Non-proficient English speakers may prefer text-based communication instead of verbal communication	Narrow medium, can exacerbate effects of language differences
Message is stored, can be saved, retrieved, forwarded to others	Nationality, Language	Can lessen effects of language differences when people have time to reflect before reacting, e.g., can re-read for better understanding	Reader may react to misunderstood or poorly worded message by forwarding to others, escalating the misunderstanding
Threads of multiple messages can be saved, retrieved, forwarded to others	Geography	Helps establish common understanding of message context	Can contribute to lack of trust when users forward messages not intended to be shared
Features of the medium - desk top video conferencing	**Boundary**	**Continuity**	**Discontinuity**
Synchronous communication	Time	Provides immediate feedback	Time zone differences matter
Higher bandwidth medium	Nationality, Language	Questions can be asked, issues clarified in real time	Effect of language differences may be heightened, flow of interaction may be disturbed
Session can be stored, saved, retrieved, forwarded to others	Language	Can be replayed for better understanding	People may hesitate to be honest when session is being recorded

Appendix A: Example of Discontinuity and Continuity in a Border Crossing

Marie lives in the Northeastern USA, near the border with Canada. She has the choice of traveling to a US city or a Canadian city for dinner and a movie. The geographic distance between US city or a Canadian city is the same, so distance alone does not play a role in her decision about where to enjoy a night on the town. (see Figure 1). However, traveling to C means that Marie must cross a national border, and this requires a significant amount of effort. There are likely to be long lines as she waits to go through a border inspection and further delays if she is questioned by border or customs agents, perhaps even including a search of her car. Thus while the geographic distance from A to C is no greater than the distance from A to B, the challenges of the border inspection mean that Marie perceives the national border to be a discontinuity—extra effort is required to cross the border. The sharp increase in effort required to traverse the discontinuity is represented by the steep vertical segment of the line, as seen in Figure 2. As a result of the perceived challenges of dealing with the discontinuity, Marie may decide to only cross the border when absolutely necessary. Most of the time, therefore, she'll decide to go to B for dinner and a movie.

Marie and others living in the border towns of A and C are frustrated that it is so difficult to cross the border between the two countries. In response, the two national governments develop a process to make crossing the border easier for local residents. Initially, the new process requires some extra effort on Marie's part. First, she completes an application and submits it to her government. Once she is notified that she has passed this initial screening, Marie travels to the border in order to be fingerprinted, photographed, and interviewed by border and customs agents of both countries to ensure that she understands the regulations for traveling from one country to the other. In return for providing personal information and assurances that she will adhere to policies of both countries, Marie receives a commuter pass that allows her to travel across the border in the commuter lane. Usually, this entails minimal interaction with border and customs agents and significantly less effort than those without commuter passes must expend in order to cross the border. The new routine enabled by the commuter pass, and shared expectations between Marie and the border agents about the guidelines for traveling between the two countries serves as a continuity for Marie. The cost and effort of crossing the border increases linearly, as shown in Figure 3, and is dependent on the distance traveled with little additional impact from having to cross a national border

The ease with which Marie can now traverse the border allows her to do things she would not have done before such as enjoy an impromptu dinner in C. Marie may even consider options that she would not have considered previously such as accepting a job in C. The national border remains, but Marie no longer perceives it as a discontinuity because of the new routine enabled by her commuter pass.