The Paradox of Discontinuities and Continuities: Toward a More Comprehensive View of Virtuality

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Abstract

Understanding the fundamental dynamics in virtual work environments is a challenge for organizational researchers. We propose that virtuality is, paradoxically, generally composed of factors that simultaneously simplify and complicate the work environment. We use the metaphorical construction of continuities and discontinuities to explore this phenomenon, and show that considering boundaries as creating *discontinuities* in work environments enhances our understanding in two ways. First, the language of discontinuities allows us to employ the device of paradox to explore the underlying dynamics of virtuality. This device makes it easier to examine the more complex reality of virtual work. Second, consideration of discontinuities draws attention to possible problems encountered in virtual work environments and ways that individuals and teams may compensate for the tension and differences implicit in discontinuities; in other words, paying attention to the seemingly logical antithesis of discontinuities, or *continuities*. By taking a process perspective, one can focus on the behavioral component of work, which in turn, has a subjective component. An example from a field study of a global virtual team is examined to illustrate the usefulness of the discontinuities/continuities framework.

Keywords: virtual work, discontinuities, paradox

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1. Introduction

Virtual work is an organizational phenomenon that simultaneously simplifies and complicates workers' lives. The options presented by levels and degrees of virtuality (Griffith, Sawyer, & Neale, 2003) permit organizations the flexibility to create adaptive rather than hard-wired organizational structures. Reconfigurable structures and dynamic relationships mean that instead of a person moving to a new location to join a new work group, that person is now able to form a similar working relationship from a distance via information and communication technologies (ICT). But even as the worker's personal life is simplified by not having to move to another location to work, it is complicated as he or she may also be expected to be a contributing member of many teams concurrently (Lu, Wynn, Chudoba, & Watson-Manheim, 2003) and to work with people from different organizational, cultural, or professional backgrounds (Maznevski & Chudoba, 2000). An individual's work must then be dynamically allocated across people or subgroups depending on environmental demands, resulting in increased switching of tasks, roles, and work assignments.

We propose that virtuality is, paradoxically, generally composed of factors that simultaneously simplify and complicate the work environment. We use the metaphorical construction of continuities and discontinuities to explore this phenomenon, and draw from work on paradox, particularly Poole & Van de Ven (1989), who call for highlighting tension and opposition in the explanations of a phenomenon in an effort to develop more encompassing theories. We also explore the development of adaptive behavior by individuals working in this environment. Our objective is line with Lewis (2000): "… a more explicit exploration of the relationship between oppositional terms helps to clarify understanding and appreciation for

complexity of the work and provides a platform for creative response and innovative action." In turn, this framing can inform management practice and future research of the virtual work environment.

We begin by describing discontinuities and continuities and demonstrating how they can be an informative way to examine virtuality. Next, we explore the concept of paradox in virtuality via four methods for probing relationships between factors that are in seeming opposition. We conclude with a discussion of the implications of this framework for those engaged in this dynamic environment.

2. Theory: The Paradox of Virtual Work

Organizations most often introduce virtual work arrangements to overcome previous constraints of time and space and to gain access to distant skills and expertise. For example, Hinds and Mortensen (2004) investigated distributed R&D teams in a global organization. They state: "The organization made a decision to increase their global reach by restructuring many of their R&D teams so the teams spanned multiple sites. Their expressed objective in doing this was to increase access to expertise and to customers at distant locations" (Hinds and Mortensen 2004: 13). In another study, Chudoba et al. (2004) document virtuality at Intel where there is increasing dependence on the global distribution of design teams to facilitate 24 by 7 software engineering and production capabilities.

Unfortunately, the expected benefits of virtual work have been elusive for many organizations. While the addition of physically distant colleagues to a team is relatively easy to initiate with the use of ICT, interaction via ICT concurrently makes collaborative activities more complex. ICT-mediated communication may increase the likelihood of misattribution and make

it more difficult to maintain trust between team members (Cramton, 2001). For example, Hinds and Mortensen (2004) found that when distributed teams had coordination difficulties they experienced more conflict than collocated teams. In addition, colleagues who work in close physical proximity can initiate interactions with comparative ease, while interactions with physically distributed colleagues require more effort to initiate (Kraut et al. 2002). So, in spite of the ease with which virtual teams can be formed, coordinating and performing joint activities is more complicated and often requires changes in work practices to realize the benefits that organizations want to achieve in virtual work environments.

2.1 Continuities and Discontinuities in Virtual Work

The notion of boundaries has often been used as a conceptual anchor to help clarify the challenges and opportunities encountered in the virtual environment (most prominently by Espinosa et al. (2003), but also others, e.g., Griffith et al. (2003), Orlikowski (2002)). Boundaries are "often imaginary lines that mark the edge or limit of something" (the definition used by Espinosa et al., 2003). People in virtual work environments encounter numerous boundaries in their work lives that are may not be present in more conventional work settings to the same extent. Espinosa and colleagues (2003) examine in some depth five boundaries they observed in five separate research studies of field-based teams: geographical, functional, temporal, organizational, and identity (team membership). They determined that these boundaries were especially salient in examinations of virtual work. Likewise, 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 the organization's "members routinely traverse in their daily activities" (p. 255): temporal, geographic, social, cultural, historical, technical, and political. By focusing on these boundaries,

she describes practices that members engage in to generate and sustain collective competence in their distributed work environment (Orlikowski, 2002).

Similar to boundaries, Watson-Manheim et al. (2002) conceived of virtuality in terms of discontinuities, defined as "a break or gap in the work context," or a "lack of continuity." They proffered 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. We adopt the language of discontinuities because it broadens our perspective on the phenomenon of virtual work by encouraging one to take a process perspective and focus on the behavioral component of work. Just as a point of discontinuity in the plot of an equation encourages a mathematician to understand why the function is not continuous, so too, the presence of discontinuities within the context of virtual work draws one to explore the how and why of the phenomenon in order to understand its impacts.

Recent research has begun to examine the relationships among discontinuities, recognizing that they covary in their effects (Espinosa et al., 2003). Thus, different types of discontinuities are logically separable, but may often come in bundles (e.g., location + organizational membership + national culture). 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, Loch, Robey, & Straub, 1998; Carmel, 1999), facing several combinations of temporal and spatial discontinuities and continuities. These may be combined

with differences in technology (Orlikowski, 2002), further compounding the complexity of the virtual work environment.

There are examples of researchers studying the bundling of discontinuities in recent research on virtuality. For example, Griffith and colleagues (2003) proposed three dimensions of virtualness: technological, physical, and temporal. Using different combinations of these dimensions, they identify three categories of virtuality to differentiate teams being studied, i.e., traditional, hybrid, and pure virtual. Likewise, O'Leary & Cummings (2002), in developing a more accurate measurement of team dispersion, combined spatial, temporal, and configurational (arrangement of members across sites) aspects. Alternatively, a virtuality index consisting of three discontinuities (team distribution, workplace mobility, and diversity of work practices) was proposed as an effective way to characterize the virtual work environment, and understand the extent of virtuality and its consequences in a large global corporation (Lu et al., 2003). Espinosa et al. (2003) cautioned researchers to take into account the presence of multiple boundaries and the effects of possible interactions between these boundaries in studies of virtuality, further emphasizing the usefulness of combining multiple perspectives on the paradoxes inherent in virtual work.

2.2 The Role of Continuities.

Interestingly, the persistent focus on discontinuities (or boundaries) in virtual work frequently reveals the concurrent presence of factors that members of virtual teams have in common, or continuities. This suggests that while virtual work is defined by the presence of discontinuities, continuities may be more salient to understanding the underlying dynamics at work in the virtual environment. As Robey and Boudreau (1999) point out, paying attention to oppositional forces when investigating information technology and organizational change can

lead to a more complex understanding of resulting social and behavioral consequences. In their review, Watson-Manheim et al. (2002) found many studies were simultaneously addressing continuities as factors that are in place or that emerge to bridge negative consequences of discontinuities.

Metaphorically, continuities provide the ground against which the figure of virtual work can be perceived. While acknowledging the importance of studying this figure, it is also important to consider how the ground against which it is set shapes that figure. Studies of "virtual" work have understandably focused their attention on the changes in the work environment — the figure of the phenomenon. But viewed using a discontinuities framework, many of these studies simultaneously addressed existing or emerging continuities, i.e., factors or strategies for overcoming negative consequences of discontinuities (Watson-Manheim et al., 2002). Watson-Manheim et al.'s analysis suggests the need to be equally aware of relationships which have not changed or that develop into consistent elements (the ground). Indeed, the ground may become more critical with the introduction of discontinuities. Organizations typically strive for continuities because of their inherent efficiency and predictability (Leana & Barry, 2000). Continuities, such as shared motivation, understanding of the task, mutual expectations, and others, provide the stability necessary to deal with the introduction of discontinuities or differences. Indeed, stability seems to be a prerequisite for flexible and adaptable behavior (Leana & Barry, 2000).

Of course, the notion of discontinuities and continuities can be applied more broadly than just virtual environments. Even in work settings that primarily involve face-to-face interactions, one may find the presence of both discontinuities and continuities such as organizational culture, professional culture, and the like. We focus on the virtual work environment in this paper

because virtuality is an increasingly pervasive phenomenon and because it readily lends itself to a discussion of the dynamics of continuities and discontinuities.

2.3 The Paradox of Continuity and Discontinuity

We propose that virtuality is, paradoxically, generally composed of both continuities and discontinuities. Contrasting discontinuities and continuities to develop an understanding of virtuality is a similar strategy to that employed by many other researchers and practitioners (see Schultze & Orlikowski, 2001). When introducing an influential collection of research on virtual organizations, DeSanctis and Monge (1999) use the following definition that illustrates the role of the contrasting phenomena: "A virtual organization is a collection of geographically distributed, … diverse entities … Despite its diffuse nature, a common identity holds the organization together…" Likewise, O'Leary and Cummings (2002) and Griffith and her colleagues (2003) observed strategies of opposition in prior research on distributed teams that has focused on teams that are respectively, "either fully-dispersed or full co-located" or traditional versus virtual.[2]

It is natural to contrast what we know with what we don't 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). In particular, we believe that such a contrast implies a static division of discontinuities and continuities, rather than a dynamic perspective on virtual work. For instance, telecommuting has often been defined as the converse of traditional office work. Practitioner testimonials and publications highlight the advantages and benefits of telecommuting, yet empirical research has found little support for this

[2] It should be noted, however, that the focus of these studies was to provide mechanisms for characterizing work that involved hybrid work arrangements.

optimistic characterization (Orlikowski & Barley, 2001). More recently though, researchers have begun to suggest that considering telecommuting in either-or terms – work at home or work at the office – may have in fact constrained our understanding and subsequently, failure to recognize that the lines between work and non-work are blurring (Orlikowski & Barley, 2001).

To summarize, we argue that conceptualizations of virtual work have focused attention on the novel aspects of virtual settings (the figure), but do not provide an easy way to talk about aspects that track more conventional settings and the important role they play in helping workers cope in novel settings. Using paradox to examine the duality of simultaneous discontinuities and continuities can provide a theoretical lens that reveals both figure and ground.

3. Using Paradox to Explore the Dynamics of Virtuality

Analyzing the dynamics of continuities and discontinuities in virtual work through the lens of paradox builds on an increasing recognition that contradictions and paradox are an integral part of organizational life (Clegg, de Cunha, & de Cunha, 2002). The concept of paradox has long been used as a means to explore seeming inconsistencies in social phenomenon (Davis, Maranville, & Oblog, 1997) going back to Aristotle and his examination of the Liar's Paradox (Nielson, 1967). More recently, in a study of global virtual collaboration, Qureshi and Zigurs (2001) found that collaborative technologies implemented to support virtual work paradoxically enabled better face-to-face meetings, perhaps because of structural support offered by the ICT. Pearlson and Saunders (2001) used paradox to explore managerial strategies with telecommuting employees, focusing on the contradictory elements that arise when managing employees who work at home. By examining a paradox and the relationships between outwardly contradictory

terms that it encompasses, one is able to develop a more robust view of the complexity of work situations (Lewis, 2000; Poole & van de Ven, 1989).

"Paradox" may be conceptualized somewhat differently, depending on the discipline or context. Derived from the Greek *paradoxum*, most generally it refers to something that is contrary to expectations. Within the field of rhetoric, a paradoxical relationship is meant to capture attention and encourages one to reexamine underlying assumptions (Poole & van de Ven, 1989), whereas a logical paradox is more precise in that it describes a contradiction arising from seemingly valid reasoning and true premises (http://www.paradoxes.info/). Although there is obviously a common element running through all of these conceptualizations, our focus here is with the broader sense of paradox—"the simultaneous existence of two inconsistent states, such as between innovation and efficiency, collaboration and competition, or new and old" (Eisenhardt, 2000**:** 703). The language of discontinuities and continuities allows us to unearth and explore contradictory expectations about the virtual work environment, which contains both discontinuities and continuities.

We now review several perspectives for exploring paradoxes and discuss how these might enrich our discussion of the dynamics of continuities and discontinuities in virtual work. In the following section, we illustrate these approaches through the analysis of a case study of a virtual team.

3.1 Strategies for Exploring Paradox

The relationship between apparent contradictions is the key to understanding paradoxical phenomena (Lewis, 2000; Poole & van de Ven, 1989). Poole and van de Ven (1989) propose methods for probing relationships between opposing poles, A and B, in a paradox. We generally define as our poles discontinuity and continuity. Discontinuities are points where there may be

gaps or a lack of coherence in aspects of work environment. Continuities are aspects of the work environment that are in place or emerge to reduce this lack of coherence. Consideration of these two poles leads to new perspectives for considering the paradox of a simultaneous presence of elements of continuity and discontinuity:

- Opposition—Discontinuities and continuities are kept separate and their contrasts appreciated. Contrasting the two states of opposition inform understanding of each.
- Spatial separation—Discontinuities and continuities simultaneously exist but are situated at two different levels or locations in the organization or community (e.g., micro and macro levels). The paradox can be explored when one recognizes the cross-level interaction.
- Temporal separation—Discontinuities and continuities are separated temporally in the same location or level in the organization or community. We can investigate the paradox by recognizing changes over time, with a recursive and dynamic relationship between discontinuities and continuities.
- Synthesis—Eliminate the opposition between discontinuities and continuities. The paradox itself may not be well understood or stem from "conceptual limitations or flaws in theory and assumptions" (Poole and van de Ven 1989**:** 567), so a new paradigm may resolve the paradox by providing different assumptions and an improved understanding of the phenomena. Since our intent in this paper is to provide a perspective on current research, we do not apply this perspective in the analysis in this section. However, we return to this perspective in the discussion.

3.2 Opposition.

The first perspective for exploring paradox is *opposition*, or contrasting discontinuities and continuities to identify and examine differences. Contrasting a novel work environment in which discontinuities have been introduced to a corresponding traditional or continuous work environment is currently the most frequently used research approach (Powell, Picolli, & Ives, 2004). In our language, a discontinuity (or multiple discontinuities) such as geographic separation of the team is introduced into a work environment. By definition, the previous work environment is assumed to be continuous. For example, many researchers have compared face-to-face (FTF) groups to non-FTF or distributed, usually experimental, groups (e.g., Mortensen & Hinds, 2002; Ocker, Fjermestad, Hiltz, & Johnson, 1998; Ocker, Hiltz, Turoff, & Fjermestad, 1995/1996), or telecommuters to non-telecommuters (e.g., Hill, Miller, Weiner, & Colihan, 1998; Igbaria & Guimaraes, 1999).

Research contrasting the discontinuous and continuous work environment also provides a convenient way to characterize "virtualness," for example, by comparing the amount of electronically mediated communication and the amount of face-to-face interaction (Niederman & Beise, 1999). Different work settings may be characterized by different degrees of discontinuity. 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. Using a different unit of analysis (organizational), Kraut et al. (1999) propose that: "[O]rganizations are virtual to the extent that they outsource key components of their production processes" (p. 722);

the degree of virtuality is determined "in terms of the number and importance of cross-boundary transactions" (p. 724).

However, few work environments today are either totally virtual or totally FTF (Griffith et al., 2003). Furthermore, the divisions between continuities and discontinuities are not static, but instead are constantly evolving. As working discontinuously becomes more prevalent, it is important to understand the changing nature of this work environment. Powell and her colleagues (2004) call for research to move beyond the comparison of traditional and non-traditional teams to better understand virtual teams. In the following sections, we explore other methods of resolving a paradox as alternative research approaches for investigating virtuality.

3.3 Spatial Separation of Discontinuity and Continuity

Spatial separation suggests discontinuities and continuities simultaneously exist but are situated at two different levels or locations in the social world (e.g., micro and macro levels, or individual, group and organizational). We found very few examples of research on virtual teams using the spatial perspective. In their study of the Linux development community, Markus, Manville, and Agres (2000: 14) described the open-source software community as often consisting of "people who are neither employees nor contract workers and who receive no direct compensation for their participation." Given the lack of continuity of organizational membership, the authors anticipated the possibility of "free loading, unstable membership, and low-quality contributions" from individuals. However, they found effective governance mechanisms in the community, i.e., "membership management, rules and institutions, monitoring and sanctions, and reputation," which were built on a shared hacker culture of the participating software developers and a common financial motivation from the possibility of commercializing

the product. Therefore, while there was organizational discontinuity at the level of the individual, individuals had professional continuity that provided a shared culture at the community level.

Similarly, Ahuja and Carley (1998) investigated the organizational structure of a virtual organization whose members were engaged in the research and design of a "general purpose artificial intelligence architecture" called *Soar*. All individual members of the *Soar* community were employed by different "home" organizations (academic and commercial institutions). The researchers found that, contrary to expectations, a commonly understood organizational hierarchy of communication had developed within the group (a continuity at a different level). Similar to Markus et al. (2000), the existence of a commonly understood communication hierarchy was partially attributed to commonalities in the professional background of the members, e.g., understanding of the professor-student hierarchy in academic environments and understanding of the grant writing, submission and funding process.

More recently, Orlikowski (2002) investigated successful global product development teams. She organized her research around discontinuities that individual team members traversed in performing work activities, i.e., temporal, geographic, social, cultural, historical, technical and political boundaries. She then identified a set of practices that team members engage in to create a community-level competence in distributed organizing, e.g., sharing identity, interacting FTF, aligning effort, learning by doing and supporting participation.

3.4 Temporal Separation of Discontinuity and Continuity.

"Take time into account" (Poole & van de Ven, 1989). In this perspective, discontinuities and continuities are separated temporally in the same location or level. Changes take place over time, with a recursive relationship between the two poles. For example, discontinuities are introduced; subsequently, continuities may spontaneously emerge or may be explicitly induced

by individual or managerial action. To understand these dynamics, it is necessary to conduct longitudinal studies of the introduction of discontinuities and of coping mechanisms that address discontinuities. What are negative consequences, and what later changes mitigate consequences? Conversely, what are positive consequences, and what later changes augment these consequences?

Unfortunately, there have been few longitudinal studies of virtual teams (Powell et al., 2004). This is surprising, in light of the widely held acceptance that virtuality represents a significant change in organizations, coupled with the recent emphasis on the importance of time-orientation in change management (Pettigrew, Woodman, & Cameron, 2001). The lack of longitudinal studies may be partially attributed to the dominant use of student teams meeting an average of 4-5 weeks in current research on virtual teams (Powell et al., 2004).

Even so, research on distributed student teams meeting over a significant part of a semester has yielded important findings by stratifying teams based on performance and identifying positive factors. For example, Jarvenpaa and Leidner (1999) investigated differences between student groups distributed across different national locations, facing discontinuities of geography and nationality. This research provided insight into the importance of the development of swift trust in virtual workgroups (Jarvenpaa, Knoll, & Leidner, 1998).

Weisband (2002) found that distributed groups who actively and periodically obtained information about others outperformed those who did not. Using the discontinuities language, we see that both sets of groups had a discontinuity in location, however, groups that also developed a well-understood set of group level processes (continuities) over time were most successful.

Some authors implicitly accept the importance of a temporal perspective to develop continuities to mitigate negative consequences of discontinuities by recommending the

implementation of managerial strategies. For example, Kiesler and Cummings (2002) discussed challenges arising from collaboration in a physically distributed group (a discontinuity of space) and propose management strategies to reduce social distance and increase social cohesion. However, very little research has actually investigated the implementation of these recommendations to determine whether they achieve the desired results.

3.5 Combinational Perspective.

In this perspective, although analytically separate, paradoxical terms may be combined and related both temporally and by level (Poole & van de Ven, 1989). Both of the examples we cited above found that teams which developed community level ties, i.e., through trust (Jarvenpaa, Knoll, & Leidner (1998) and successful team practices (Weisband 2002) over time in the process of performing work activities were most successful.

4. The Paradox of Virtuality: Discontinuities/Continuities in SellTech

In this section, we illustrate the usefulness of the paradox framework in the investigation of strategies to manage a dynamic virtual work environment using previously unpublished data gathered in a 21-month field study[3] of global virtual teams (GVT). First, we briefly describe the research setting. Following this description, we apply the methods for investigating the relationships in a paradox to analyze some consequences of the discontinuities and continuities experienced by the teams. In the interests of space, we refer readers to the published study for details of the data collection approach.

[3] The authors of the study of GVTs provided us with written documentation gathered over the course of their research, which two authors of the current paper then examined, looking for instances of continuities and discontinuities. These were then considered within the framework of the four types of paradox. Additional details of the original study are described in (Maznevski & Chudoba, 2000).

4.1 Setting: SellTech GVT

The study was carried out at Manufacturing Technology, Inc. (MTI, a pseudonym), a division of an American Fortune 100 company that manufactures and sells industrial technology. In the originally published study, Maznevski and Chudoba (2000) examined three teams at MTI. They found that virtual teams required a sequence of regular FTF communication incidents interspersed with less intensive, shorter incidents using various other media for effective performance, suggesting that the continuity of predictable communication was required to manage an evolving set of discontinuities faced by team members. We have chosen one team, SellTech, to illustrate the usefulness of our framework. First, we describe the SellTech in general, and then we apply the discontinuities framework.

Maznevski and Chudoba describe SellTech as follows:

> SellTech started meeting in the early 1990's to manage an alliance between MTI and its largest customer, a global producer of industrial equipment. The agreement had two parts: a volume sales contract guaranty, and a commitment to cooperative development for future product design …
>
> SellTech's main task, servicing the volume sales agreement, required a moderate degree of interdependence and was of moderate complexity. The partner company explained its requirements, MTI engineers provided their solutions, partner engineers tested those solutions on their own equipment and went back to MTI engineers with further questions, and so on in a sequential way. The customer's requirements were fairly stable and predictable, although sometimes challenging.
> SellTech's secondary task required a greater degree of interdependence and was of greater complexity. To achieve future co-development, team members from both companies shared future plans, including highly confidential product development innovations. Each helped the other adapt the plans and move into production, while ensuring that the new products would fit with the rest of their own product lines. (Maznevski & Chudoba 2000: 482-483).

Maznevski and Chudoba considered SellTech a very successful team. They based their assessment on findings from their own analysis, as well as evaluations from the team members and MTI management. Team members felt a great deal of ownership over the team's decisions,

and were committed to making it succeed. Sales between the two companies exceeded guaranteed levels by 50 percent, and both companies initiated similar partnering relationships with other customers and suppliers (Maznevski & Chudoba 2000).

Initially, however, SellTech was not a successful venture; the team encountered many problems that members were unable to resolve. While a contract between the two firms established the team and provided goals and objectives, appropriate governance mechanisms were not in the contract. The team was unable to negotiate the inevitable conflicting priorities that arose. At first, a sales engineer from MTI who was located in the UK managed the team. Despite repeated efforts, he was unable to obtain the attention and commitment of engineers at the U.S.-based headquarters to deal with implementation problems, and the contract languished (Maznevski & Chudoba 2000).

It became clear to management of the parent companies that the contract was in danger of failing. A senior manager from MTI headquarters was assigned to lead the SellTech team, and he immediately made a number of changes. Regular meetings were scheduled, and team members were held responsible for outcomes. Process-oriented issues were openly negotiated and made explicit to the entire team, i.e., who's responsible for what, who will send what to whom using what communication medium, and who will follow up and how follow-up will take place. In addition, disagreements were openly discussed. For example, there was continual and explicit interpretation and renegotiation of the contract boundaries during monthly meetings held via audio conference calls, as well as during periodic face-to-face (FTF) meetings. The monthly audio conference meetings generally focused on status updates and problem identification, while the FTF meetings emphasized more strategic discussions. Initially, FTF meetings were held bi-monthly, but they evolved to bi-annual events two years later.

The team developed an Excel spreadsheet with assignments from each meeting, follow-up dates, and the status of different product problems. The spreadsheet, referred to by the team as the "inter-team dependency status sheet" was updated and distributed after each meeting over email or fax (at the time, not all team members had software that allowed them to receive email attachments), and was the basis for the following meeting. The status sheet also provided a record of which team members had been assigned tasks, what those tasks were, when the tasks were due, and the dependencies between tasks. A team member was given the responsibility to update the status sheet after each meeting; the date that the revised status sheet would be available was noted in minutes from the meeting.

Conference call meetings were held at the same time and on the same day, e.g., 8 am ET, the first Thursday of every month. Team members went to extraordinary lengths to avoid missing the monthly conference call. For example, once an MTI engineer participated by calling on her mobile phone as she drove her father to the hospital for an outpatient medical procedure. There were also regular face-to-face meetings. The group agreed on, and made explicit, items that were appropriate for conference calls and discussion items appropriate for face-to-face meetings. Usually, the face-to-face meetings were reserved for "general items for the whole group." For example, in one conference call, the group agreed that some issues regarding specific functional features would be put off for discussion until the upcoming FTF meeting. However, another issue that arose on the conference call, regarding European operations, was deemed inappropriate for the FTF meeting:

> "Andy and Victor should try to resolve issues before meeting. Don't expect to come to meeting to get certain issues answered. Issues must be worked on prior to meeting." (Senior SellTech team member)

The monthly conference call meetings were used to coordinate the team's current projects. When the project reached the state in the development process where tighter integration was required between team members, bi-weekly meetings were scheduled. Evidence of this pattern can be seen in the following email exchange:

> Dave, What are your thoughts on when we talk about release 3?? Jack
>
> Jack, I am still pulling together this plan and am targeting 12/13 as the goal for having the plan together and ready for use (by the team). We can start bi-weekly meetings the following week. Dave

Jack initiated this exchange by forwarding the meeting announcement for an integration meeting on product release 2 to Dave, and questioning the status of release 3 with respect to beginning to hold bi-weekly meetings. The stage of readiness of the project for bi-weekly conference calls became a milestone that all members were aware of in the project development life cycle.

4.2 Analysis: Using Paradox to Explore the Dynamics of SellTech

We now use the discontinuities/continuities framework (see Table 1) and the device of paradox to understand the dynamics of the SellTech team. Discontinuities are, in fact, the reason that the team was created since introducing discontinuities ostensibly provided financial advantages to each of the partnering organizations that could not be obtained otherwise. At the same time, the discontinuities resulted in challenges for members of the team that hindered progress towards its objective.

4.2.1 Oppositional Perspective. The first perspective for exploring paradox is opposition, or contrasting discontinuities and continuities to identify and examine differences. We found this perspective useful for our initial identification of discontinuities and continuities. While some were more obvious (e.g., language and location), others surfaced through an explicit focus on the

gaps in the work context that members of the team faced (e.g., different perceptions of time). In addition, by considering the antithesis of discontinuities, or continuities, the important role of the contract between the two organizations surfaced. We now explore these issues and their impacts in more detail.

Location is an observable discontinuity, with team members located in the east coast of the U.S. (two locations), Northern Europe (2 locations), and the U.K. The geographic discontinuity posed the most significant challenge early in the team's life. The U.K. team member, part of the U.S.-based MTI organization and the first team leader, found it difficult to get the attention from other MTI employees at company headquarters regarding support for the Northern European partner. To compensate for the location discontinuity, he traveled to the U.S. for FTF meetings, but other MTI employees continued to make work on behalf of the partnership a low priority. Relationships were difficult to develop, and collaborative activities were more difficult to coordinate because team members were in multiple locations. It was not until the team was restructured that the negative effects of the location discontinuity were mitigated by overtly establishing continuities, an issue that we will discuss in the next section.

Along with location discontinuity, members of the SellTech team were separated by up to five time zones, complicating synchronous communication. In addition to clock time discontinuity, perceptions of time differed between the Americans and the European team members (Saunders, Van Slyke, & Vogel 2004). As a U.S.-based MTI team member observed, "I get very frustrated dealing with the [the partner]. They never make a decision. The next day, they forgot they made a decision … They have no sense of urgency." Paradoxically, this perceptual difference of time exacerbated the discontinuity of clock time – rather than time zone differences contributing to a 24-7, follow-the-sun, productive work mode, time zone differences

meant 36 hours or more were lost as team members on opposite sides of the Atlantic tried to get other's attention.

Language was another obvious discontinuity in this multicultural group. Three of the team members did not speak English fluently, although English was spoken in all team meetings. Team members who were not native English speakers made a conscious effort to not engage in side conversations in their first languages because to do so was considered discourteous. At the same time, language differences meant that sometimes there was difficulty "making sure you're understood, make sure you're on the same wavelength."

MTI and its Northern European partner each had employees on the team who represented marketing, purchasing, and engineering groups in their respective firms. Whereas functional discontinuity might be expected to lead to problems and conflicts, either within or across organizations (Lau & Murnighan 1998), we found no evidence of this in the data. Instead, a common professional background, engineering, shared by all members of the team provided a continuity that superseded the functional discontinuity. The shared base of knowledge and training as engineers meant that team members approached problem-solving in a similar manner, and this facilitated discussions around different aspects of their common task.

A second important continuity that emerged from our analysis was the legal contract that established the strategic alliance between the two organizations. The contract was the first of its kind for both organizations, and provided team members a common set of objectives and goals. It outlined specific sales commitments that the Northern European partner made to MTI, and in return, MTI agreed to share development plans for future products and to incorporate functionality requested by the partner into its product line. Early in its history when it appeared that the team was faltering, in part because of problems associated with the location

discontinuity, senior management in each organization used the continuity implicit in the contractual commitments as the impetus for change. Since both organizations wanted the strategic alliance to proceed and to fulfill the contract's provisions, a senior vice president who reported directly to the head of MTI assumed responsibility for leading the team.

4.2.2 Spatial Perspective. This perspective suggests an alternative approach to comparing discontinuities and continuities that relies on cross-level analyses. We can use the discontinuity to identify points where workers may face novel problems while concurrently examining a different level for continuities that may support the work. Likewise, we use the continuities to identify points where workers appeared to be managing potentially negative effects. Is there interaction that enhances positive consequences, or prevents or reduces negative consequences? When cross-level interaction is recognized, the duality of discontinuity and continuity can be explored. We found the work practices identified by Orlikowski (2002) – sharing, interacting FTF, aligning effort, learning-by-doing, and supporting participation – particularly instructive in exploring cross-level interactions within SellTech.

Jack, a senior level manager at MTI headquarters, was made a team member and given responsibility for the team's success after it had floundered for 18 months. His higher management level in the organization and his physical location at MTI headquarters brought much needed support from the parent organization. He immediately initiated bi-monthly FTF meetings, alternating between the U.S. and Northern Europe headquarters of the respective partners. Jack also put structured group processes in place, especially the monthly conference calls and the status sheet. These meetings and structures began the process of creating a team identity and aligning effort across members in the different locations.

Functional differences at individual level did not seem to create a problem for the team members due to the continuity of a common professional background. All were trained as engineers, educational degrees and professional affiliations. Therefore, while they were members of team with backgrounds in different function areas, the commonality in professional background they shared at a community level seemed to provide cohesion (Orlikowski 2002).

The interaction of discontinuities across levels of analysis – individual, team, and organization – provides a more complete understanding of the dynamics of the strategic alliance. At the individual level, team members were from two organizations, MTI and its largest customer, and each member brought different priorities to the partnership. For example, some of the product features that the Northern European customer wanted required significant financial investments and changes to the MTI product line. MTI Development engineers had to decide how much information to reveal to their counterparts, at the same time that the customer's engineers were hesitant to commit to product orders without the assurance of features and functionality. FTF meetings were especially helpful as team members developed trust and learned how to negotiate in ways appropriate to the partnership.

The team itself was dependent on the respective parent organizations for resources and support. It was only when MTI assigned one of its senior managers as team leader that the company made clear how important the company considered the partnership. Since only high-level governance mechanisms were spelled out in contract, it was up to the team leader to command other resources (e.g., the attention of team members) so that actual work practices supporting these mechanisms could be developed.

At the organizational level, while both companies were players in a global marketplace, differences in the political and regulatory environments of their respective home countries

influenced their cooperative efforts. Dissimilar market conditions and customer acceptance expectations led to different understanding of the product, and complicated the selling process. "In Europe, standards are a big issue. Everything has to meet the particular government's environmental, electrical, etc. standards and this makes selling the product more complicated" (from interview with Jack).

4.2.3 Temporal Perspective. By examining relationships over time we can more fully grasp the dynamics in play. Again, we identified the discontinuities and continuities but with emphasis on changes over time that reduce or mitigate negative effects of the discontinuities. Regular meetings and the routine use of the inter-team dependency status sheet to track the progression of each project led to common understanding of project status and how members would be held accountable for commitments. This reduced the effort of coordinating the work activities of team members. Over time, however, this practice had a more far-reaching effect. As everyday work practices of the team members were aligned and the development process made clear, members expectations of the process routine coalesced. This routine provided stability for the team but at the same time allowed the team to identify and negotiate changes as they arose (Maznevski & Chudoba, 2000). For example, knowing that regular conference calls would take place gave team members a time and place to negotiate conflicts or differing priorities. Further, the documentation from these meetings and established expectations of accountability led to confidence in future problem resolution.

Returning to Poole and van de Ven's framework, we can more accurately classify the relationships just discussed as *combinatorial*, in that we see the relationships between discontinuities and continuities at both the temporal and spatial levels. The introduction of discontinuities in the work environment initially caused confusion and uncertainty because

individual team members had different sets of expectations. Individual expectations were aligned through the initiation of structured group-level processes by Jack, whom all members could respect due to his senior position (spatial perspective). The regular group meetings, with open and explicit interactions, allowed new scripts to coalesce over time (temporal perspective). This also led to shared member expectations that supported future problem resolution, such as what issues were appropriate for FTF meetings or the monthly conference calls (combinatorial perspective).

5. Discussion

The SellTech case provides examples of the dynamics of continuities and discontinuities, and insights gleaned from examining the paradox of these relationships. It's important to remember, however, that discontinuities may contribute to ongoing interaction and social relationships, and are not just a problem to be overcome. The opposition, spatial, and temporal strategies for exploring paradox invite us to embrace the seemingly conflicting concepts of discontinuity and continuity, rather than attempting to resolve the conflict. By not rushing to synchronize them into a single concept, we gain a more process-oriented view of these organizational dynamics. The analysis leads us to several issues that are particularly noteworthy for future research: the role of information technology in virtual teams, the dynamics of discontinuities and continuities as revealed through the temporal perspective, and possibility of synthesis to develop a new perspective on virtuality.

5.1 The Role Of Information Technology In Creating Continuities

Information technologies, especially communications technologies, are commonly recognized as one of the enablers of virtual work because they permit workers to bridge

discontinuities such as time and space. The dominant perspective in the literature assumes that technology is a given, and so researchers study the impacts of technology use under circumstances of actual or potential discontinuities. Relatively little attention has been paid to research on the design or use of specific technologies that encourage continuities, such as knowledge repositories for conversations and documents. As well, our discussion of the dynamics of discontinuities suggests consideration of the ways that the use of ICTs can enable or hinder the evolution of a virtual team. For example, a meeting support system may provide a particular kind of continuity for a team, but at the same time lock the team into that mode of interaction by making it difficult to connect discussion held face-to-face to those held through the system. Given that virtual work may alternate between these modes, systems built on the assumption of a single mode may be unhelpful.

5.2 Further consideration of Temporal Perspective

We believe that a particularly important and untapped area of research is the ways continuities are developed. For example, our analysis revealed the importance of building shared expectations through negotiating, and of negotiating differences openly. Useful as a basis for further research is Weick's (1995) characterization of interactions between individuals in the organization as either *generic subjective* or *intersubjective*, and the interplay between these types of interactions. Weick (1995) describes *generic subjective* interactions as based on common understandings and expectations of organizational norms, roles, and scripts for action. When a discontinuity is encountered, "uncertainty increases because the old scripts and generic subjectivity no longer work" (Weick, 1995). The continual movement between the generic subjective where roles and events are commonly understood and the intersubjective negotiation of new meaning allows constructive response to changes (Weick 1995). Indeed, the increased

number of discontinuities in the work environment is due to an increasing need for innovative forms of work.

In addition to changes at the community level, developing continuities requires change at the individual level. The abstract construction of expectations and beliefs that individuals have are defined as schemas. Mental models and component schemas enable an individual to meaningfully organize information from a series of events that have happened across a period of time (Matlin 1998). They are developed through experiences individuals undergo, and allow people to more easily make sense of new situations, i.e., to develop a model of expectations to apply to similar, but not necessarily identical, future events. It is possible for individuals to deal with uncertainty in well-practiced ways by associating them with prior experiences, and therefore enabling them to predict what should happen next. As the uncertainty is explored and new behaviors are attempted, individual schemas are adapted to reflect new information. In this way, individuals adapt their understanding of new situations to include new perspectives and conceptualizations. In this way, cognitive structures enable continuity but also lead to paradoxical tension between continuity and discontinuity. Once expectations and mental models of a situation are developed, however, they are resistant to change.

5.3 Synthesis perspective

Finally, the synthesis approach to resolving paradox moves beyond the limitations of the known poles of the paradox to include new concepts or perspectives (Poole & van de Ven, 1989). As an example of synthesis of paradoxical elements, Poole and van de Ven cite the development of structuration theory, which grew out of examining tensions between the paradoxical notions of structure and action. The paradox lies in conflicting assumptions, on the one hand that individuals are free actors, in control of their behavior, and on the other that

organizational and institutional structures constrain and shape behavior choices by the individual. Examining this paradox via the opposition, spatial, and temporal methods, e.g., action takes place at the micro-level, structure located at the macro-level, led to many theoretical advances. Finally, Giddens (1976) introduced the concept of structuration, which replaced the opposition in the paradox, proposing that structure and action co-exist and are mutually produced and reproduced. As Poole and van de Ven note,

> "The theory of structuration assumes structures have a dual nature: They are both the medium and outcome of action. … Structures make action, and hence the existence of social systems, possible. Nevertheless, structures only exist as they are continuously produced and reproduced in interaction. Thus structure and action mutually entail each other. … However, despite the central role individuals play in the production and reproduction of structures, the complexity of the social systems means that people do not wholly control the process. (Poole & van de Ven, 1989)."

This perspective for resolving the paradox of discontinuities and continuities would require a new conceptualization of virtuality, which eliminates or dissolves the opposition between discontinuity and continuity and recognizes what may be a recursive relationship. Indeed, the concept of virtuality is emerging and evolving, and is not clearly understood nor fully realized in organizations today. As information technology is increasingly integrated into organizational processes, we expect further changes in the nature of work and organizing. For example, just as the line between work at home and work at the office is becoming increasingly blurred (Orlikowski & Barley, 2001), it may be that work in the 21st century routinely involves activity across multiple discontinuities—time, space, organization, and so forth. The distinction between virtual and co-located work may thus become moot as a new form of work organization emerges. While we cannot yet fully describe this new conceptualization, the framework of discontinuity/ continuity gives us a language and perspective to study the changes taking place. We can envision a meta-level continuity, e.g., the ability to easily adapt to discontinuities, as new

forms of organizing take shape and individuals adapt their work practices and perceptions to their environment. For example, the authors of this paper are located in different time zones. While this discontinuity has added some complexity to our collaboration, we now are used to the multiple time zones and have developed routines to reduce potential problems e.g., although never explicitly discussed we always show meeting times in all times zones to avoid confusion. Our perception of the difficulties of working across time zones has been reduced as we have adapted our work practices.

6. Conclusion

Discontinuities offer a way to characterize and better understand virtual work environments. We employ the device of paradox to explore the underlying dynamics of virtuality. Doing so makes it easier to examine the more complex reality that we suggest is present for those who are engaged in virtual work. In addition, consideration of discontinuities draws attention to possible problems encountered in virtual work environments and ways that individuals and teams may compensate for the tension and differences implicit in discontinuities; in other words, paying attention to the seemingly logical antithesis of discontinuities and continuities.

We have described four methods suggested by Poole and van de Ven (1989) to explore paradox: opposition, temporal separation, spatial separation, and synthesis. While opposition is an either/or strategy frequently found in much of the research on virtuality, synthesis suggests that the seeming paradox is actually a recursive relationship that exemplifies discontinuity and continuity simultaneously. Likewise, temporal separation and spatial separation suggest discontinuities and continuities may exist and/or change over time or across levels of analysis,

highlighting the importance of longitudinal, multi-level research. Drawing from Lewis's work (2000), we have suggested strategies for managing paradox of confrontation, transcendence, and acceptance that enable one to "tap the potential energy, insights, and power of paradox that enable dramatic change". We also discussed the development of adaptive behavior in virtual environments and the role of sensemaking in this process.

Researchers can use the conceptual framework of discontinuities to guide their future work in several ways. For example, the presence of multiple discontinuities and continuities concurrently suggests many questions. Are there a discrete number of discontinuities that can be simultaneously combined? How do the different sources of discontinuities interact with each other in combination? Are there work contexts where some factors promote discontinuities and other factors promote continuities? Under what circumstances can the relationship between discontinuities and continuities best be described as moderating or mediating? Are there specific discontinuities or virtual work environments in which a given discontinuity is so significant that it impacts all other continuities and discontinuities? Are discontinuities and continuities experienced differently in face-to-face and distributed work environments, and if so, how are those differences manifested?

Examining the impacts of discontinuities offers another fruitful area for future research. We believe there is a difference between so-called objective, or generally agreed upon, discontinuities and the effects they have. Our conjecture is that objective discontinuities call attention to points where there may be possible problems but they don't necessarily lead us directly to the underlying problem. For example, objective discontinuities such as time, space, or nationality may be different from affective discontinuities (e.g., those that affect the work process) such as the collocated effect or subgroup effects. Affective discontinuities may track

more closely with continuities (e.g., structuring a meeting to deal with the fact that some participants are collocated and others are not). In other words, objective discontinuities may not directly relate to problems, but they may provide a useful starting point to determine whether the work process is impacted.

Practitioners should find the concept of paradox especially helpful as they manage a rapidly changing workplace that is increasingly dependent on virtual work arrangements. We suggest that it is vital for managers to recognize that a given factor may serve as a continuity in one situation and a discontinuity in another to keep from making decisions that may have negative and unintended consequences. For example, information and communication technologies (ICTs) and the attendant communication practices are commonly recognized as one of the enablers of virtuality and are relied upon in lieu of face-to-face interaction. They are deeply integrated into work processes because of their ability to help overcome barriers to collaboration and enhance flexibility required to meet the rigors presented by rapidly changing work environments (Boudreau et al., 1998). However, even as ICT enables people to span boundaries of time, space, organization, and so forth, its use presents new challenges and may introduce discontinuities. In lifting some barriers to collaboration, the technology simultaneously exposes divisions previously contained within the boundaries, suggesting less cohesion in their work environments. In short, by lowering some barriers to collaboration, use of technology simultaneously exposes previously unobserved or emergent divisions. Our objective in this paper was to give researchers and practitioners new ways to think about the complexity and current ambiguity surrounding virtuality. Using the language of discontinuities draws attention to process issues and problems that may be created by boundaries at the same time that it encourages one to examine continuities as the seemingly logical opposite of discontinuities. We

believe that a more explicit exploration of the relationship between oppositional terms helps to clarify understanding, and thus the concept of paradox allows a broader, more holistic view of the virtual work environment. As Lewis (2000: 774) puts it:

> Indeed, the rising intricacy, ambiguity, and diversity of organizations place a premium on researcher's abilities to think paradoxically: to live and even thrive within the plurality and changes of organizational life and help practitioners do likewise. Building this capacity requires confronting our own defenses—the desire to overrationalize and oversimplify the complications of organizational life—and learning to explore the natural ebb and flow of tensions.

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Table 1 – SellTech Discontinuities and Continuities

Discontinuities	
Location	Members located in East Coast U.S., Northern Europe, U.K. (total of 5 locations)
Time • Clock time • Perception	Members in 3 different time zones (5 hours maximum difference) Stronger sense of "urgency" in U.S. members than European counterparts
Functional	Cross-functional team - Engineering, Marketing, Purchasing
Organizational	• Core team members from MTI and European competitor • As a whole, team not located continuously in either organization, i.e., team level discontinuity
Language	4 members spoke English as a first language, and 5 spoke a Northern European language, although all had some fluency in English
Continuities	
Legal	Contractual agreement between the two organizations that outlined financial requirements (e.g., commitment to purchase) and IP intentions (e.g., involvement of customer to determine requirements for future products)
Professional background	All team members were trained as engineers