7-15-2008

The Situated Nature of Virtual Teamwork: Understanding the Constitutive Role of â€œPlaceâ€ In the Enactment of Virtual Work Configurations

Julie Rennecker
Case Western Reserve University, jar27@po.cwru.edu

芽|Sprouts Working Papers on Information Systems ISSN 1535-6078

The Situated Nature of Virtual Teamwork: Understanding the Constitutive Role of â Placeâ In the Enactment of Virtual Work Configurations

Julie Rennecker
Case Western Reserve University, USA

Abstract
The time-space configurations of place and space are used to ground an analysis and discussion of the constitutive role of place, or virtual team membersâ respective local contexts, in the conduct of virtual teamwork. In contrast to the majority of current virtual teams research, which emphasizes the â spatial,â or virtual aspect of virtual teamwork, this study uses an extended example, the establishment of a computer-conferencing infrastructure, to show the constitutive role played by local institutionalized rhythms, relationships, rules, politics, and resources in the enactment of virtual team tasks. Implications for studying, designing, and managing virtual teams are discussed.

Keywords: Virtual Teams, Ethnography, Situated Action, Embeddedness

Permanent URL: http://sprouts.aisnet.org/2-14

Reference: Rennecker, J. (2002). "The Situated Nature of Virtual Teamwork: Understanding the Constitutive Role of â Placeâ In the Enactment of Virtual Work Configurations," Case Western Reserve University, USA . *Sprouts: Working Papers on Information Systems*, 2(14). http://sprouts.aisnet.org/2-14

The Situated Nature of Virtual Teamwork: Understanding the Constitutive Role of "Place" In the Enactment of Virtual Work Configurations

Introduction

Ongoing advances in information and communication technologies have enabled a variety of new organizational configurations characterized by geographic distribution, transient membership, and mobile participants. Dubbed "T-form" (Lucas 1996), "post-bureaucratic" (Heckscher and Donellon 1994), "networked" (DeSanctis and Poole 1997), or "virtual" (Davidow and Malone 1992), contemporary organizational forms as depicted in the ideal are characterized by actions and relationships that, enabled by technology, transcend place. Drawing on the writings of social theorists of post-modern society and organizations (see (Casey 1993; Casey 1997; Giddens 1990; Harvey 1989; Tuan 1977), Schultze and Boland (2000) note that these emerging organizational forms represent a shift in the time-space orientation of organizational activity from *place* to "*space* as the guiding image of organizational design" (p.187). *Place* is associated with a "sense of boundedness, localness, and particularity" and, in contrast, *space* with a "sense of the universal, the generalizable, and the abstract." Modernity represents a shift in orientation from place to space:

> "Space as a guiding image brings the hope of making an organization more flexible by freeing it from the constraints of place." (p.187)

Virtual teams reflect one such organization design intended to capitalize on the affordances of ever-emerging information and communication technologies. I use the term "virtual team" to mean a group of geographically-distributed workers relying primarily on technology-mediated communication for their collaborative interaction. By enabling participants to remain in their respective work environments while participating in a project team via technology-mediated interaction, virtual teams promise the simultaneous benefits of place and space. The Gartner group estimates that "by 2004, 60 percent of the professional and management tasks at Global 2000 companies will be done via virtual teams" (as cited in *InfoWorld*, Sept 25, 2000).

Because much of our extant theories of social behavior are rooted in and bounded by assumptions of placed, co-present interaction, a great deal of virtual teams research has investigated the implications of the *absence* of a shared physical and social context, or the placelessness of space, for typical group processes and effectiveness. Often overlooked, however, is how the team members' continued membership and participation in their local, *place-based*, work context influences their participation in and contribution to the virtual team.

In their analysis of the work practices of outsourced computer system administrators, Schultze and Boland (2000) show how place and space operate simultaneously in a dialectic that organizational members manage in their day-to-day actions. While increasingly true for all workers in contemporary organizations whose affiliations include trade, identity, and interest, as well as task, groups that transcend locational boundaries, the place-space dialectic is particularly

salient in virtual teams where the members' day-to-day tasks require concurrent participation in and accountability to both placially- and spatially-configured work groups.

Though there have been few systematic investigations of virtual workers' local contexts (see Jordan 1996; Star and Ruhleder 1996), researchers have been interested in the implications of virtual workers' concurrent memberships in both a "home" organization and a virtual work group. One arena of research grows out of a curiosity regarding the relationship between virtual work configurations and organizational identity and the subsequent implications for organizational loyalty (Wiesenfeld, Raghuram, and Garud 1998;), anticipating that workers might privilege spatial relations over placial ones. Other studies, echoing prior work on cross-functional teams, foreground the cultural (Gluesing 1995) and practical (Star and Ruhleder 1996) differences across sites that impede collaboration, suggesting a privileging of place over space.

This paper reports a field study intended to investigate the role of *place* in virtual teamwork and the interplay between *place,* virtual team members' situation in their respective work locales, and *space*, their participation in the virtual team. In a multi-site study of a multi-organizational virtual team in the automotive industry, team-level accomplishments reflected often unanticipated, cumulative consequences of the members' locally-based and locally-oriented activities. The paper is organized as follows. I begin by developing the concepts of *place* and *space* and their application to virtual teams. Then I reflect on the placial-spatial framing of virtual teams in the literature to date. I use the extended example of the members' efforts to establish a computer-conferencing infrastructure to illustrate the constitutive influence of local rhythms, rules, relationships, politics, and resources on the accomplishment of team tasks. The paper concludes with a reflection on the implication of these findings for studying, interpreting, and managing virtual teamwork.

Place & Space

I adopt Schultze and Boland's (2000) depiction of the time-space configurations of *place* and *space* and explore the significance of each configuration for virtual teams. They define *place* as "the experience of being in a bounded locality with unique qualities in which traditions are important determinants of behavior" (p.189) and where time is marked in terms of cyclical events and recurring rituals. Place-oriented social action is locally-based and locally-directed. Actors take their cues from local circumstances and consider local norms and rhythms in order to influence local conditions. Whether they intend to alter or maintain those conditions, the basis for and focus of the action is the local world. While members may derive a sense of belonging from their home locale, place is also associated with constraint (Schultze and Boland, 2000).

In contrast, the time-space configuration of *space* is associated with freedom from placial constraints and a decoupling of time and location experienced as "boundless, universal, and infinite" (p. 189). Space-oriented social action occurs in response to and with intention to influence conditions beyond those of the local world, unencumbered by either the physical or social limits of place. Spatially-oriented actors identify ideas, patterns, and opportunities that transcend locale to create generalizable knowledge with universal applicability, interacting and collaborating with dispersed others without regard for location or locally-imposed constraints. Furthermore, spatially-oriented action is paced by schedules, whether arrived at by negotiation, regulation, or fiat, presumably decoupled from local rhythms. Table 1 summarizes the typifying dimensions of place and space.

Dimensions	Place	Space
Bounding of action arena: the actor's conceptualization of the scope and purpose of his actions	locally-particular and locally-consequential	Universally applicable and consequential
Logic for acting: the rules and norms defining a preferred course of action	Locally-particular	Universal (or at least widely held by some spatial community)
Temporal structuring: the bases for the pace and timing of social action	Entrained to local cycles	Established by agreement among participating parties

Table 1: Typifying dimensions of place and space

Duality of Place and Space

The depictions of *place* and *space* offered here reflect pure states typically unrealized in contemporary social activity. Though analytically distinct, Schultze and Boland note that contemporary social life is characterized by a blurring and intertwining of place and space. Typified by a simultaneity of presence and absence, individuals make themselves present to distant others via information and communication technologies and codified versions of their positions, knowledge, and ideas (i.e., documents, diagrams, spreadsheets) and, at the same time, are influenced by the knowledge, requirements, and expectations of distant others. Placial activities are imbued with spatially-based influences, and spatially-directed activities are grounded in place-based experience. Rather than a hybrid combination of placial and spatial orientations, however, Schultze and Boland note that this post-modern orientation represents a dialectic tension, one that is best understood as a "duality" (see (Giddens 1984) in which place and space are mutually constitutive, each defined by and meaningful only in juxtaposition to the other. (Figure 1)

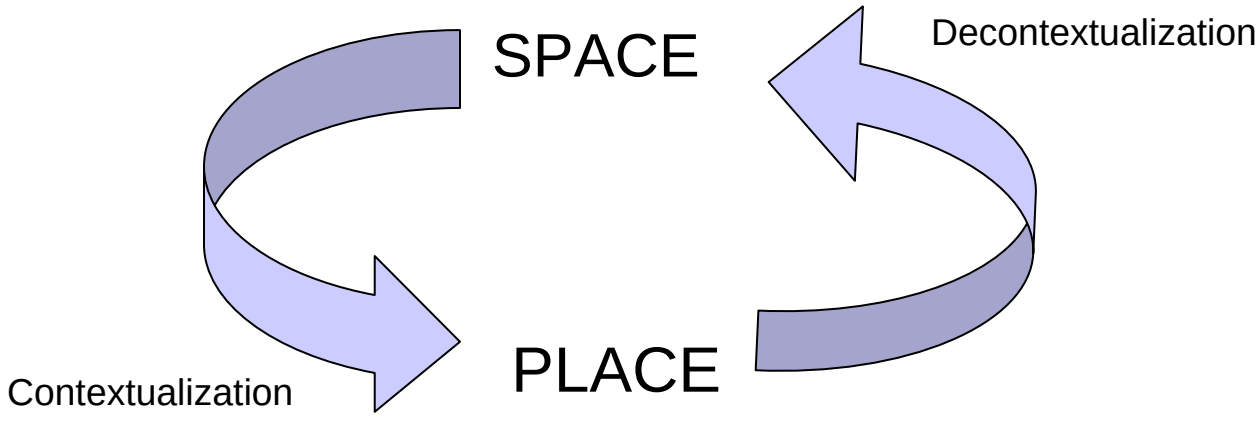

Figure 1: Contemporary Organization Forms: The Place-Space Dialectic

Place & Space & Virtual Teams

For virtual team members, *place* corresponds to their participation in their respective "home" work contexts, physically and socially-bounded locales with particular configurations of people, relationships, rules, routines, equipment, and resources. Prior research showing that physical and social context play a constitutive role in co-present social, as well as individual, activity (Barker 1968; Garfinkel 1967/1984; Goffman 1959; Lave 1988; Suchman 1987) suggests that virtual team members' actions would be informed by local norms of social appropriateness and paced by local routines—daily, weekly, monthly, quarterly, and annual—for communicating, meeting, working, reporting, and planning (Ancona and Chong 1997).

While communication and information technology enables the "stretching" of social relations beyond the constraints of the here-and-now (Giddens, 1984; 1990), making virtual work configurations possible, virtual team members continue to relate on a here-and-now basis with co-located associates who influence the members' actions and assess their appropriateness for the member's position in that organization at a particular point in time. In fact, participating in the virtual team actually requires that team members be emplaced somewhere in order to access the technology.[1] Citing Barker (1968), an ecological psychologist, Kiesler and Cummings (2002) note that "social settings, such as offices, meeting rooms, cars, restaurants, stores…are associated with behavioral norms, mental schemas, and even scripts that sharply affect the way people act and the expectations they have of others [even if the co-present others are unknown to the actor]." In the sociological literature, Goffman's (1959) detailed studies of people in social settings show how social actors subtly modify their actions in response to both the setting and the actions and reactions of the co-present others in order to put forth an acceptable "performance" regarded by the others as appropriate to the situation. In addition, Suchman's (1987) and Lave's (1988) detailed accounts of "situated action" illustrate that social actors adapt their activities to the available resources, acting in ways that deviate from both their plan for and their report of the activity (Suchman, 1987) and from their performance of the same activity in different contexts (Lave, 1988). It seems reasonable, therefore, to expect that virtual team members' actions would be shaped by their situation and participation in their local environments.

Some virtual team members may be mobile workers, such as salespeople or consultants whose physical context may vary significantly over the course of a day or from one day to the next, or teleworkers who work primarily out of a private residence, a local coffee shop, or a leased "business center" space. Nonetheless, the majority of participants in virtual teams, as they are currently described in both the popular and academic literature, are affiliated with a particular organization that provides contextual cues regarding the content, pace, priority, and consequences for worker's activities. Despite "belonging" to one or more task groups that span locales, most virtual team members identify themselves as a member of an organizational group with which they have a history and an anticipated future and, thus, to which they feel accountable.

However, the virtual team is premised on the promises of *space*, or freedom from placial constraints, specifically location, tradition, and the timing of social action. Virtual work configurations emerge from expectations of workers interacting without regard for physical location or local tradition, independent of local rhythms and rituals, paced instead by negotiated schedules based on project requirements, perceived market demands, contractual agreements or

[1] At least until wireless communications become ubiquitous and seamless to use. It will be interesting to re-evaluate the role of place in spatially-configured work groups using wireless technologies.

other such jointly-constructed abstractions. The spatially-based normative view of effective virtual teaming (for example Lipnack and Stamps 1997) calls (often implicitly) for team members to be oriented toward common interests, universal practices, and generalizable knowledge, informed by the universal rather than the particular.

Temporally, the team represents a placeless collective held together by transient interests and objectives, reflecting a particular confluence of events at a particular point in time, unlikely to recur in exactly the same way or with any predictable frequency. Any shared social context is likely to also be a virtual one, such as an "invisible college" (Price and DeSolla 1965), the industry, or an occupational community. The legitimacy of team members' activities in the spatial context derives from the universal norms of these placeless collectives. For instance, among a group of scientists, though local enactments of a commonly used practice may vary, participants often agree on a professional standard by which a virtual team member's contributions should be judged.

While the normative orientation implied in the virtual teams literature is a spatial, or team, one, it seems reasonable to expect that virtual team members would exhibit both placial and spatial orientations, rather than just spatial, and that their spatially-directed actions would not be independent of but rather constituted by placially-based experience, consistent with Schultze and Boland's (2000) assertion that modern social organization is typified by a place-space duality. In practice, this duality is instantiated in the virtual team members' day-to-day interactions with both collocated and remote associates. As described above, the members' task responsibilities in a virtual collective will likely require utilization of local resources and consultation with collocated peers, exposing the peers to extra-local perspectives and utilizing local resources in non-traditional ways, but also subjecting the team's "universal" ideas and knowledge to local scrutiny. At the same time, it seems reasonable to assume that a team member's participation in and contribution to the virtual team will represent locally-informed, locally-enabled, and locally-constrained action. With the exception of a handful of studies, the literature to date has not considered or accounted for these local influences on virtual team members' actions, but has focused, instead, on the enabling influences of technology and the resulting opportunities and challenges encountered in the spatial context.

The Treatment of Place and Space in the Virtual Teams Literature

The literature has been relatively silent regarding the interplay between the members' placial and spatial worlds. Perhaps due to their novelty, studies of virtual work configurations have emphasized and investigated their "virtuality," or spatial characteristics. Early writings about technology-enabled organizational and work configurations (Davidow and Malone 1992; Galegher, Kraut, and Egido 1990; Hiltz and Turoff 1993; Sproull and Kiesler 1991) emphasized the benefits of space, focusing on the potential of new communication and information technologies to enable new work practices and organizational forms based on travel-free collaboration, uninhibited—even facilitated—by time and location differences.

A great deal of the more recent current research on virtual teams investigates how geographic dispersion and reliance on technology-mediated communication affect intra-group processes and attributes. Studies to date have focused on intra-group conflict (Hinds and Bailey 2000), trust (Jarvenpaa, Knoll, and Leidner 1998; 1999), participation equality (Mantovani 1994; Weisband, Schneider, and Connolly 1993), and decision-making (Harmon, Schneer, and

Hoffman 1995; Siegel, Dubrovsky, Kiesler, and McGuire 1986) among others. Despite differences in the phenomenon investigated, these studies are similar in their focus on intra-team attributes and processes and their scant attention to the extra-team, whether placial or spatial, contexts within which the virtual team members work.

Lack of attention to embedding contexts is a common lament of group research, both traditional and virtual. Though Ancona and Caldwell's (1992) call for an "external perspective" in teams research based on their own novel findings is often cited, few studies I am aware of have heeded the authors' call (for an exception, see Cummings 2001). In a review of the first generation of technology-mediated groups research, McGrath and Hollingshead (1994) noted a similar intra-team bias and outlined a framework for future studies of "computer-assisted groups" that included a call for increased attention to the "organizational context," among other things. Later, Arrow, McGrath, and Berdahl (2000) observed that, with the exception of the sociotechnical tradition and Ancona and Caldwell's work, most small group research continues to neglect groups' ties to their embedding contexts.

Though not explicitly defining virtual teams as time-space configurations nor systematically studying the members' situation in their respective local organizational context, a handful of field studies *have* identified extra-team influences as important for understanding numerous aspects of virtual team work. For instance, in separate studies, both Gluesing (1995) and Robey *et al* (2000) both found that local cultural differences affected cross-site collaboration similar to the challenges experienced in cross-functional teams (Dougherty 1992). Cramton (2001) adopted the term "hidden profile" to indicate the unique aspects of the students' local contexts contributing to intra-team conflicts because they were (generally) not revealed in the team-level interaction. Barrett (2000; Klein & Barrett, 2001) discovered that one aspect of this "hidden profile," changes in local management priorities led to changes in virtual team members' meeting attendance and left the members feeling "torn" regarding their participation in the virtual team versus their responsibilities to their local managers. Finally, Sole and Edmundson (2001) found that team members did not effectively identify and apply knowledge if the source of that knowledge or needed expertise were in a site remote from the identified problem. The recurring call for studies of teams to venture beyond the team boundary and this handful of empirical studies indicating a direct relationship between virtual team members' situation in their respective local work contexts and the nature and effectiveness of the team's work suggests the need for focused studies of the interplay between the spatial and placial dimensions of virtual teamwork.

This study set out to investigate the inter-relationship between virtual team members' situation in their respective work environments and their contribution to the virtual team. Specifically, two questions guided the inquiry: (1) How does the ongoing situation of virtual team members in their respective local work worlds influence their contribution to a virtual team? (2) How does a person's participation in a virtual team influence her activities in her local work world?

Research Context: The AES Team

My selection of the AES Team was an opportunistic one. The catalyst for forming the team came from a strategic agreement—"the Alliance"—between two of the participating organizations, AmeriCar and SuperU, to fund several multi-year research initiatives to study

topics believed to be important for the future of engineering, including "virtual engineering." Part of the funding agreement required the involvement of a multi-disciplinary cadre of researchers. My study partially fulfilled that requirement, and the Alliance provided the initial funding. Fortuitously, the multi-organizational membership offered to maximize cross-site variation in local conditions.

Fifteen electrical engineers from five organizations distributed over eight sites comprised the initial core of the AES team whose mission was to catalyze the development of international standards for the "next generation," or "advanced," automotive electrical system (AES). Spanning two countries, five native languages, and eight time zones, the original membership included competitors, customers and suppliers, and representatives from both academia and industry. The charter organizations included SuperU[2], an American technical university; AmeriCar and DeutschCar, automakers from the U.S. and Germany, respectively; and AmeriChip and EuroChip, semiconductor ("chip") manufacturers based in the U.S. and Europe. Participants from three of the five charter organizations were themselves geographically-distributed bringing the number of original sites to eight. Over the course of the study, the number of participating organizations expanded to ten[3] distributed over seventeen sites in three countries, and average meeting attendance grew to 19 with a range of 15-26 engineers participating in any particular meeting. Communicative technologies available to the team throughout the study included a Web site with capability for document posting and threaded discussion, an email distribution list, and audio and video-conferencing capability. During the second year, the team also established computer-conferencing capability.

Though newly formed at the beginning of my study, the team represented a subset of a relatively small occupational community, automotive power electronics engineering, that transcended organizational boundaries. Most of the members belonged to either one of two professional organizations, Society of Automotive Engineers (SAE) or International Society for Electrical and Electronics Engineering (IEEE), and had been participating in the industry consortium ("the Consortium") hosted by the SuperU members for over a year prior to this team's kick-off. In addition, each of the participating site subgroups had had prior business dealings with the other organizations represented in the team, either as customer/supplier or as collaborators. Consequently, many of the members knew or knew of one another before the project began and, at a minimum, shared an occupational identity. However, none of the members considered any of their previous experiences collaborating across organizational boundaries to constitute "virtual engineering."

Historically, the automotive industry has been very place-based. Though each automaker had scattered their production facilities around the globe to minimize production and distribution costs, the "engineering" and "design" functions tend to be located near "Headquarters," surrounded by satellite offices of numerous suppliers. The managers and engineers I studied exhibited an explicit bias in favor of these "local" suppliers because they were more available for face-to-face meetings when needed. However, persistent and intensifying cost pressures have translated into increasingly space-based practices, such as efforts to standardize core components and subassemblies across vehicle lines, including foreign-based subsidiaries, and to work with lowest-cost suppliers regardless of location. In addition, strategic mergers, acquisitions, and

[2] All organization and individual names are pseudonyms.

[3] Representatives from three additional organizations joined the team at the final meeting included in this study, and immediately subsequent to that meeting, one of the project leaders informed me that additional organizations had requested invitations to join.

joint ventures undertaken to decrease costs have, in practice, also called for greater collaboration with geographically, organizationally, culturally, and temporally-dispersed partners.

The AES Team represented one of a growing number of inter-organizational initiatives within the automotive industry to develop new technologies and the standards to enable their cost-effective production. In this case, the team was expected to catalyze industry-wide acceptance of a new standard voltage level for the "next generation automotive electrical system," or AES technology, for passenger vehicles. Standardization initiatives are notoriously political (cites), but in the case of the AES Team, all but two of the original team members had been participating in the Consortium, and everyone on the team had already agreed on the target voltage level, the critical element of the standard. Rather than working out differences among themselves, they saw their task primarily as one of persuading *others* in the industry to agree on the voltage level.

Based on its initial objectives, the team was a success. They produced two conference papers, one at the end of each year of the study, each with significant industry impact. The first paper, reporting a feasibility study of the proposed technology, won the "Best Paper" award at a major U.S. conference and generated a great deal of media attention. Following the presentation of the second paper in Europe outlining design requirements based on the team's work on a prototype, Consortium membership, a proxy for industry-level interest in AES technology, more than doubled within a couple of months, and several organizations asked to join the AES team in particular. Though several factors contributed to increased industry interest in and attention to AES technology at that particular time, the team's work had played a catalytic role. Despite a few unresolved technical and operational questions, by the close of the team's second year, industry participants had settled on a single voltage level.

The team structured their work on the AES project according to the prevailing industry model for inter-organizational collaboration—typically automaker-supplier pairings. After defining the work to be accomplished, they divvied up tasks among organizational subgroups, then worked in parallel until their next meeting with occasional communication between sites on an "as-needed" basis between meetings. When confronted with a challenge or a point of ambiguity, members typically consulted collocated coworkers rather than contacting another AES Team member.

Methods

The study of such an under-examined phenomenon as the interplay between virtual team members' embeddedness in distinct work contexts and their participation in the virtual team is, almost by definition, exploratory. That label suits this study well, and the study design and methods employed reflect the early state of knowledge in this area (Bailyn 1977; Jordan 1996).

Based on Cramton's (2001) conceptualizations of members' local work contexts as "hidden profiles" that influenced virtual collaboration in insidious, unpredictable ways, and a personal bias for first-order data, my primary strategy for studying the AES Team was participant-observation, an approach which took many forms over the course of the study. I spent the first thirteen months in the field full-time as an overt participant-observer, four to six days per week, serially visiting seven of the eight charter sites. After two rounds of site visits, I continued the study for another ten months as a participant-observer in the monthly (and sometimes more frequent) virtual and face-to-face team meetings, maintaining personal contact

with key informants via email and telephone conversations between meetings, a mode more closely resembling the members' experience of the team.

I supplemented the observation data with semi-structured interviews of the team members and a theoretical sampling of their coworkers to fill in gaps resulting from my intermittent presence at each site and allow me to triangulate my interpretations of the observation data. Early interviews were audiotaped but security policies prevented audiotaping at several sites and increased familiarity with the material made it possible to take near-verbatim handwritten notes instead. In all, I conducted 80 interviews, 27 of them audiotaped. In addition, email correspondence with team members, monitoring of the team Web site, and reading members' correspondence with one another as those messages were forwarded to me[4] served to keep me informed of team activities I could not observe but also provided a tertiary data source for reinforcing or challenging my interpretations.

My participant roles emerged over time, decided as much (or more) by the study participants as by myself, and varied significantly across sites. At various stages of the project I produced the draft version of team meeting minutes, wrote and presented a literature review of the risks of human exposure to AES technology, did impromptu clerical tasks, provided English translation support for the international members, and generally acted as an "extra set of hands" as the occasion warranted. In both supplier organizations, my role was purely that of researcher-observer (Wolcott 1982). My visits to these sites were brief relative to my visits to the auto manufacturing companies and the university because only one or two team members worked at each location, so I was not at the location long enough to do many activities independently.

My methods for analyzing the data draw upon the principles and spirit of grounded theory (Strauss and Corbin 1990) but did not employ all of the techniques associated with that method. To check my interpretations, I took advantage of several industry gatherings to talk with engineers outside the team and several team members read the resulting document and confirmed my impressions, making suggestions regarding the nuances of automaker-supplier relationships. A more detailed description of my data collection and analysis procedures, is included in an appendix.

Constructing the Computer-Conferencing Infrastructure

The development of the computer-conferencing infrastructure offers a rich and comprehensive illustration of how the members' local worlds influenced their accomplishment of team tasks. During the AES Team's first year of work, team-level communication consisted primarily of three face-to-face meetings, two videoconferences, and a group email address used primarily for distributing meeting announcements and notices of new postings in the document archive on the Web site. During their second year, the team met at least monthly via NetMeeting, a Microsoft computer-to-computer conferencing application, supplemented by an audio link. NetMeeting allows members to view and manipulate one another's documents and applications in real time even if all the members do not have the application (or the same version) installed on their own computers. This particular use of media resulted in large part from difficulties experienced in establishing the technology infrastructure to support computer-

[4] The technologies used did not support a log of all intra-team and inter-member email correspondence, so my access to the members' email depended upon their willingness and remembering to forward messages.

conferencing. Local rhythms, relationships, rules, and resources each complicated the process at various stages of the implementation.

Local Rhythms

The impact of the members' local environments on the accomplishment of this particular team task began even before the team kick-off. The original budget projections in May 1997 included monies earmarked for a second group of SuperU faculty and students to establish and support a computer-conferencing infrastructure among the participating organizations. However, differences in budgeting and resource allocation rhythms between AmeriCar and SuperU delayed work to put the technologies in place. Annual budget discussions at AmeriCar occurred during the fall, delaying the release of the funds to SuperU until after student assignments had been made in the late summer. Unlike a firm that could reallocate personnel or hire short-term contract workers to fill such a role, student assignments implied a long-term commitment by both the student and the department to a project expected to culminate in either a masters' or doctoral degree thesis. At the same time, the computer engineering faculty, believing the project to have been cut from the funding, committed themselves to other projects that involved a great deal of international travel making them relatively unavailable when the funds were released for use.

This example illustrates how entrenched rhythms, or temporal structures, complicated collaboration across locales. I describe this as a conflict in temporal structures rather than as a coordination breakdown because the term "coordination" suggests a scheduling dilemma, resolvable through communication and negotiation. In this example (and others not reported here), the members' actions depended upon and were subject to institutional cycles and processes not easily modified to accommodate single project groups, particularly transient ones such as a virtual team. Managers' "discretionary accounts" could sometimes be tapped in an emergency, but for the most part, organizational-level cycles such as those for resource allocation, production, and performance reviews and promotions, were intractable to team-level requests for exceptions. It is possible that the local rhythms could have facilitated teamwork, but for the AES Team, they were mostly problematic.

Eventually, a student nearing the completion of his degree agreed to help the team on a part-time basis, but his task was complicated by the relationships (or lack thereof) between the engineers and information technologists in the companies.

Local Relationships: Engineers and IT Specialists

In addition to funding and technical expertise, the establishment of a computer-conferencing infrastructure that met the AES Team members' needs required collaboration between the engineers and the IT staff. Relationships between these departments in each of the organizations reflected the organizational structure, entrenched patterns of interacting, and individual adroitness at managing interpersonal relationships. Organizational decoupling of the engineering and information technology groups in most of the organizations inhibited collaboration and created ambiguity regarding the locus of responsibility for getting the needed technologies in place, complicating the SuperU student's work. The departments were so organizationally distant in some sites that the engineers did not know whom to call for help with collaborative technologies or whether their organization even supported such applications. In addition, the absence of clear lines of authority between these two groups—in very bureaucratic organizations—meant that any collaborative activity other than a corporate-wide top-down

directive represented a negotiated outcome between the involved members, contingent on the quality of their relationship.

In AmeriCar and DeutschCar where decentralized IT specialists were more clearly linked to specific engineering groups, tenuous relationships between the departments often required deft interpersonal maneuvering to bring about action. In these organizations, engineers were typically granted higher status and viewed members of the IT organization as "service providers," or "staff" while the IT specialists rankled at their second-class citizen status despite their "obvious" centrality to the organization's effectiveness. The following examples illustrate the consequences of these relationships for the AES Team's accomplishment of this task.

At AmeriCar, the team leader sent an email in the first week or two after the project launch to the information systems manager in his building with a list of questions and requests. When I went to see the technology manager three weeks later, he showed me the message saying he did not really understand what was needed, that he did not think it to be among his responsibilities, and that he had not responded. Richard complained to me about having not received a response, but said he felt that he had no recourse because he had no formal authority over that manager and had not developed any personal rapport with him before this request. Several weeks more after my meeting with the IS manager, the questions were finally addressed in a meeting between department managers.

At DeutschCar, a different scenario unfolded. Due to server and network problems at DeutschCar, the AES Team Web site operated so slowly as to be practically inaccessible to those members for the first month or so of the project. In this case, Reinhart, the primary DeutschCar contact, approached his technology manager somewhat deferentially, acknowledging his own limitations with respect to the needed technology and his dependence on the technologist, both to be able to present a technologically-competent face to the project team (a reflection on the organization, not just himself), and to be able to learn about virtual engineering which could, in Reinhart's view, help everyone at the DeutschCar site. The technology manager responded by becoming a valued ally in the purchase and installation of needed equipment and the presentation of the organization as technologically up-to-date. Some time later, Reinhart had new problems with his email, and after the technology manager spent several hours on successive days finding and fixing the problem, Reinhart gave him a small thank you gift for his help.

These two examples show how the quality of interdepartmental relationships significantly and deferentially influenced the speed and quality of the AES Team members' project contributions. Here I used the example of engineering and IT groups in the establishment of the computer conferencing infrastructure, but the same was true of relationships with other departments on which the team members depended for information, technical expertise, or political support. Typically, the nature of these relationships was so integral to the fabric of the members' respective organizational lives that they rarely warranted mention in team meetings—as might an unexpected affront or show of support—but they routinely involved team members' choices between courses of action. For instance, one design option the team investigated during the second year involved changing the electrical power supplied to the car's lighting system. However, when the team members learned that pursing that path would involve an encounter with the "Safety Office," they decided to choose a different path. In another case, realizing a design would call for collaboration with the "powertrain group," the members at one site decided instead, amidst much eye-rolling, head-shaking, and sighing, to "find something we can do ourselves."

In the case of establishing the computer conferencing system, the SuperU, AmeriCar, and DeutschCar members did eventually gain the support of their respective technology specialists. Unfortunately, this was only one of several local hurdles to achieving their goal.

Local rules

Once funding was in place and the IT specialists were "on board" with the project, the team encountered a series of organizational barriers—both technical and social—to implementation. The first challenge involved the traversing of "firewalls," a technology designed to protect the integrity of a company's information system by preventing the company's computers from being directly linked to other computers outside the organization, the fundamental operating principle of NetMeeting. Working collaboratively, the SuperU and AmeriCar technologists eventually identified a handful of solutions to this technical challenge—a "tunnel" through the firewall enabling the connection of designated internal and extern computers; routing all interactions through a secure server at SuperU that would be equipped to interface with each of the firewalls; etc.—but these merely served to uncover previously unidentified organizational barriers to connecting.

Each of the organizations also had a *policy* in place prohibiting the linking of internal computers to external ones, including "insecure" computers at the university, a key element in one of the proposed solutions. Eventually permission was obtained to create a "tunnel" through the firewall at AmeriCar to allow connections between a few designated AmeriCar and SuperU computers via a dedicated ISDN line. Based on my observations and members' retrospective accounts, the process of obtaining this permission involved a series of meetings and presentations to managers beyond those in the group I studied and a significant amount of "off-line" lobbying by both the engineers and information technologists, learning along the way exactly how to phrase their request to get the go-ahead. One senior information technologist in another group responsible for developing virtual work practices for AmeriCar's product development engineers proved particularly helpful as a liaison with the managers responsible for "blessing" both the original policy and any exceptions. He would tell the engineers what to write, then shuttle the documents back and forth between the engineers and the managers, interpreting, advocating, and supervising revisions.

In this case, an organizational policy proved tractable but only with considerable investment of time and energy that could have been spent meeting and working on the AES technology itself. In addition, the victory gained the team little. Managers at DeutschCar, AmeriChip, and EuroChip did not approve the installation of the needed ISDN line, and the AES Team members lacked the authority within their organizations to authorize the installation themselves. However, unforeseen shifts in the political tide at two organizations provided the momentum to overcome or circumvent this and other myriad resource constraints.

Local Politics

Unanticipated turns in the political climates of two organizations—SuperU and DeutschCar—ultimately provided the impetus for overcoming many of the barriers already described. In the case of SuperU, the climate turned threatening; in the case of DeutschCar, supportive. Nonetheless, both shifts resulted in a redoubling of those members' efforts to establish the infrastructure.

SuperU. Ironically, a threat to the SuperU members' project funding proved to be the primary catalyst for a surge in the implementation and use of computer conferencing observed during the team's second year of work. A few weeks before the final meeting of year one, the SuperU members learned that the SuperU-Alliance administration planned to discontinue the AES Project funding because they did not believe the team's activities-to-date satisfied their current definition of "virtual engineering." The team members never obtained an explicit statement of this definition, but it was their sense that a change in the Alliance management personnel had contributed to a shift in the definition that favored the new administrator's research agenda. Without being certain of the criteria, the SuperU Team members decided that the needed remedy was to increase their use of collaborative technologies. So they submitted a new proposal foregrounding the role of collaborative technologies in their work and discussed tactics for getting the other members on board.

The primary impact on the AES Team was that the SuperU and AmeriCar members became patient but persistent advocates within the team for the use of computer conferencing. The entreaties began subtly, then became increasingly frank. Though an increasing number of sites and individuals were joining the team meetings via audioconference, several sites still lacked computer-conferencing capability. The first level of social pressure consisted of a query in each meeting announcement asking the members to *R.S.V.P.* whether they would be participating in the meeting and whether or not they would be using NetMeeting. The query was presented as an administrative matter, just part of the procedure for making the reservation with the conference service provider, but, nonetheless, required each site to explicitly communicate whether or not they would be using computer conferencing. Then as each member or group of members signed onto the call, the primary SuperU contact asked in the open forum of the call whether or not they would be using NetMeeting that day. After a couple of months, if the answer was "No," he would ask them if they were making progress on the implementation and whether or not they needed help. If they agreed to accept help, he would then arrange an off-line conversation to schedule a meeting with either himself or one of the computer science faculty or students to answer their questions and help them troubleshoot any problems. He even offered to send the student to each site to stay as long as it took to complete the setup. Finally, he reminded the members that everyone was expected to use NetMeeting. When the team experienced difficulties on their first few attempts at using NetMeeting and some members suggested abandoning it and just doing an audioconference, he would humor them by reminding them that there would be a learning curve and encouraging them to "give NetMeeting a chance." Little by little, members at each site gained NetMeeting access.

The AES Team's increased reliance on computer-conferencing positively influenced communication and collaboration across sites, but as this account illustrates, the impetus for pushing ahead to put the needed technologies in place came primarily from the SuperU members' response to a very local concern for their funding. To fend off the Alliance administration's threat and to court its favor, they began to foreground "virtual engineering" in the team meetings and took an advocacy role regarding the establishment of the technology infrastructure. Had it not been for the funding threat, several of the NetMeeting "late adopters" might not have adopted at all—an ironic example of a local constraint facilitating virtual work.

DeutschCar. About the same time that SuperU was dealing with the funding threat, the DeutschCar members were enjoying a day in the sun for their virtual engineering efforts and a swell of managerial support to do more. Not long before, however, the situation was very

different. In May 1998, Reinhart, the primary DeutschCar contact told me, after a meeting with his boss, that he might have to drop out of the AES team because his boss did not believe this to be his group's highest priorities. He anticipated that the TechExpo presentation on the team's one-year anniversary might mark the end of his participation:

> After the TechExpo paper, I don't know if I will be coming to AES meetings…If there isn't any money coming from the AT group to support this, I don't think I can justify this expense…It's not my job as a researcher to do standardization work…I need to stop spending so much of my time on this AES Team. It's not really a very big part of my job…I need to be focusing on what is the work of my group…

So despite his own interest in the AES Team's objectives, Reinhart expected to leave the team to comply with his manager's priorities.

Within a month of this conversation, however, DeutschCar acquired a portion of another more distributed car company, EuroCar, and managerial interest in virtual engineering increased. Beginning in the summer of 1998, Reinhart participated, with his management's support, in demonstrations of the "virtual workbench" with AmeriCar and SuperU for the members of the Alliance administration. He told me that at least a few DeutschCar managers were becoming interested in virtual engineering work arrangements as a cost-effective way to collaborate with their new counterparts at EuroCar and that he had been asked to repeat the demonstrations for his own managers. Coincidentally, a high-ranking executive visited his facility twice in one month, and according to Reinhart, seemed to be becoming a virtual engineering advocate after seeing one of the demonstrations:

> We are really making progress on virtual engineering. Dr. Sackmann visited two times in one month—this is very unusual—and we did demonstrations with SuperU and AmeriCar, and he was really impressed and made comments that this is something we should learn about more.

So at DeutschCar, a change in organizational composition, increased the perceived relevance of virtual engineering, enabling Reinhart's continued participation in the AES Team and legitimating his requests for technology and technical assistance. Reinhart was one of the most proactive AES Team members with respect to establishing the computer-conferencing infrastructure and experimenting with other collaborative technologies, but his ability to pursue that interest was shaped by his managers' priorities.

These two examples serve as reminders that the members of the types of virtual teams most commonly reported in the current literature are rarely independent agents but subject to both constraints on their own autonomy and the (often fickle) exercise of authority by their managers. The significance of hierarchical authority relationships in the AES Team members' day-to-day lives is illustrated in two "rules for surviving" that routinely informed the members' chosen course of action: "Keep the big guy happy," and "Don't act out of place." Technically, these rules represent a *spatial* logic in that they were widely-held among members of the automotive industry and not unique to a single locale. However, they were placial in their consequences: the "big guys" and "places" were defined by members' situation in the pecking order of their respective local worlds.

"Keeping the 'big guy' happy" involved any combination of keeping the boss informed about projects, taking pains to demonstrate that his pet project was receiving top priority,

offering unsolicited problem solutions supported with research or calculations, formatting documents in the way he preferred, using his preferred communication medium, and even mimicking his interactive style, i.e., brusque or warm; brief or verbose; directive or solicitous etc. Some of the European members prided themselves on being more forthright with their bosses than the Americans they had met, saying that they found Americans unwilling to say anything negative about their bosses while they themselves claimed to openly disagree with their superiors in public meetings. In the meetings I observed in Europe, I did see subordinates more openly confront their superiors in discussions about both technology development directions and budget allocation priorities, but once the discussion was over, the end result was the same: the boss delivered the final decision in a declarative statement—"This is what we will do…"—then dissension moved backstage, and public behavior gave every impression of being on board with the boss' position.

With respect to the virtual team, this philosophy meant that AES Team members' participation hinged on both formal managerial approval and his or her day-to-day perceptions of the value and priority of the team's work *relative to other competing local demands and their potential local payoffs*, because bosses, too, wanted to "keep the big man happy." With both bosses and market conditions changing, the managerial preferences circumscribing member participation could vary widely within a year, as shown in the preceding examples.

The members' concern for knowing and behaving appropriately to one's "place" is less vividly illustrated in these examples but was integral to the perpetuation of the extant power structures, permeating all of the AES Team members' interactions—both local and across-sites. In the automotive companies and the university where the rank titles remained stable despite reorganizations of personnel, members' relative places in the hierarchy were stark. The practice I call "musical chairs" that occurred in scheduled meetings provided one of the most apparent displays to the outsider of the existence of and reverence for differential status levels among group members. The first people to arrive at the meeting usually sat at the meeting table unless the attendance routinely exceeded the table's seating capacity in which case the lowest status members, often the first arrivals, seated themselves in extra chairs along the walls. As others arrived, both before and during the meeting, those seated at the table monitored the new arrivals. In the event that a higher-ranking member than those at the table arrived after all the seats at the table had been taken, the lowest status members offered their seats to the entrant. Even if the new arrival demurred, at least one table occupant would ignore the gesture and move to a chair along the wall behind the table, and the new entrant would take the chair. In the occasional case when the lowest status member(s), if new to the community, missed the cue to give up his or her seat, a slightly higher status member would recover the blunder by hastily doing so.

This same regard for the local pecking order also applied to technical expertise and spilled over into virtual team meetings. Numerous times over the course of the study, an engineer would tell myself or another coworker why a solution proposed in a meeting would not work. When queried as to why he did not introduce the comment in the meeting, he would reply, "If Bill [manager] didn't say anything, I wasn't going to." At DeutschCar, two participants held equal rank in their organizations but one, Reinhart, was, in practice, subordinate to the other because he depended upon the other to finance his research. He explained to me one day, "You've probably noticed that in our [team] meetings, I let Siegfried take the lead and decide what we will do."

In one case, a DeutschCar subordinate, taking a spatial approach, violated the local pecking order by coming to an AES Team meeting prepared with his own overhead

transparencies, eager to contribute to the discussion. He was later reprimanded by his boss and was not allowed to attend any subsequent face-to-face meetings though he did continue to sit in on technology-mediated ones. So for the AES Team, this deference to local pecking orders meant suboptimal utilization of the available expertise or, at a minimum, information delays in those cases where a member found an opportunity in an offline conversation to contribute his idea indirectly.

These examples explicitly illustrate the political tensions woven into these organizations' cultures and integral to the members' day-to-day experiences, but dilemmas stemming from an organization's political dynamics often masqueraded as resource constraints.

Local Resources

After obtaining political momentum at SuperU, DeutschCar, and AmeriCar for the establishment of the computer conferencing infrastructure, resource constraints were more easily overcome and the team did eventually accomplish their task. Nonetheless, the local resource issues do warrant mention both because they are often either barriers or facilitators of virtual teamwork in their own right and also because they are frequently symptomatic of and intertwined with political constraints requiring targeted intervention. The resource constraints described in the following example were unanticipated, then overlooked and hidden for several months once identified.

While attention had been focused on the access issues at some organizations, hardware limitations at AmeriChip had gone unnoticed. The NetMeeting application was designed to run only on the Windows operating system, but AmeriChip, as a matter of policy, used only Macintosh computers. This problem did not surface until the early part of the second year when the SuperU members became insistent that all team members participate in team meetings via NetMeeting. When queried during the meeting regarding their progress establishing a NetMeeting connection, the primary AmeriChip contact finally, and sheepishly, acknowledged their dilemma. He told the team that "a few PCs" had been purchased but during the time of this study, AmeriChip was under increasing financial pressure and that he lacked the fiscal authority to requisition new computer equipment or the installation of new telephone lines (to circumvent the firewall). He and several colleagues told me that they eventually obtained permission from their supervisors for the telephone line installation then brought in personal computers from home and participated in the meetings via a dial-up connection through their personal Internet service provider (ISP) accounts.

Again, the team eventually accomplished their goal, but the constraints on technological and fiscal resources delayed progress and diverted members' time and attention away from the focal task, AES technology. In other aspects of their work not described here, local limits on human and knowledge resources also played a role in the team members' capacity to contribute to the team, or to do so in a timely manner.

Summary

In the above series of examples, I have shown how institutionalized *rhythms*, *rules*, *relationships*, *politics*, and *resources*, particular to each AES Team member's local work situation, influenced the team members' capacity to contribute to the accomplishment of one team task, establishing the computer-conferencing infrastructure, central to the team's ability to work as a "virtual" team. In some cases these local factors facilitated the team's work, and in others, inhibited it. In many instances, the same factor, for instance *relationships*, played an

enabling role in one site and a constraining role in another, or an enabling role at one point in time and a constraining role at another. In the next section, I relate these findings to extant research and discuss the implications for virtual team research and practice.

Discussion

While effective virtual teaming calls for the members to be *spatially* oriented, abstracting up from the particularities of their immediate experience to ideas and avenues of activity universally accessible to their teammates and broadly applicable across situations, accomplishment of the work of the virtual team—even participating in the team via collaborative technologies—requires the members to be *in place*, physically and socially, in order to access the technology and to accomplish the work. This study has shown that the members' *emplacement* requires them to use place-based *resources* and manage place-based *relationships* according to place-based *rules*, *politics*, and *rhythms* in order to accomplish team-related tasks. Even the establishment of the communication infrastructure, as shown in this study, depends upon and reflects the members' situation in particular physical and social contexts. This finding has numerous implications for research.

Recognition of placial influences on virtual team participation, work practices, and effectiveness in prior research has been largely restricted to those instances where local practices have culminated in team conflict (Armstrong and Cole 1995; Armstrong and Cole 2001; Cramton 2001), overlooking the potency of the members' local contexts in the day-to-day accomplishment of virtual team tasks. From a research perspective, taking local influences into account in the interpretation of observed patterns in virtual teamwork calls for an extension of the analytic lens to include the members' interactions with extra-team others, artifacts, and events, offering either an adjunct or alternative to an intra-team perspective for virtual team research.

In addition, theoretical leverage may be gained by viewing virtual teams (or other virtual work arrangements) as constellations of *interlinked contexts* or a network of *embedded* individuals rather than as interconnected, disembedded sources of expertise, as is often implicitly conveyed in the literature. From a contextual perspective, an individual's contributions to and participation in a virtual collective would be understood as reflections, at least in part, of the conditions and events of his or her embedding context, not just of his or her competence. Without understanding the context from which an individual contributes (or does not), his or her actions in the team are difficult to interpret, or likely to be misinterpreted (Cramton, 2001; Weisband, 2002).

Such a theoretical perspective implies the need for alternative methods that make visible and comprehensible the local contextual influences shaping a members' participation. My choice of the participant-observation methodology for this study allowed close observation of these contextual factors, but a number of other methods including serial interviews, diaries or activity logs, or straight observation by one or multiple researchers could all be used to gather contextual data. In the absence of extended physical presence, an ongoing dialogue, via telephone or email, with the member(s) at each site could also provide contextual information not revealed in team meetings.

In addition, recognition of the potency of local influences suggest a degree of caution when interpreting observed patterns of intra-team activity in order to avoid misattributing an

artifact of local conditions to intra-team dynamics. For instance, the status of the AES Team's computer-conferencing infrastructure at any point in time could have been interpreted as a reflection of leader potency, member commitment to the team goal, or members' resistance to the adoption of a new technology when, in fact, a more accurate interpretation would have been to view it as the cumulative consequence of multiple, situated actions, decisions, and accommodations to local circumstances.

Another finding with theoretical and methodological implications was the variability in the enabling and constraining nature of the members' local contexts over time. This suggests that processual and contingency models may be preferable to factor models for describing and predicting virtual team performance and that longitudinal research designs would be preferable over cross-sectional approaches. In the case of the team studied here, the more institutionalized aspects of the charter organizations—information systems, personnel policies, fiscal calendar, etc.—changed little over time but shifts in managerial interest and other determinants of local priorities made member participation more or less difficult and more or less advantageous over the course of the project. Depending upon the phenomenon of interest, an explanation developed from a one-time cross-sectional design documenting the nature of the organization's infrastructure would have likely been misleading.

Conclusion

This ethnographic study of one multi-organizational virtual team explored a poorly understood aspect of virtual teamwork, the influence of virtual team members' local worlds on their participation in and contribution to the virtual team. Using the example of the members' efforts to establish a computer-conferencing infrastructure, I showed how members' navigation of institutionalized local rhythms, relationships, rules, politics, and resources each figured into the speed and quality of the team's outcome. The identification of the potency of local influences on virtual team members' accomplishment of team tasks and their variability over time opens up new avenues of inquiry for virtual team research and an alternative perspective from which to view extant theory.

In addition to its particular findings, this study contributes to the literature on virtual teams in several additional ways. First, by using participant-observation, the study provides detailed information about an aspect of virtual collaboration that has heretofore been largely the subject of speculation: the influence of members' local work contexts on their activities in a virtual collective and the resulting team-level practices. The "external" perspective taken here represents an extension and adaptation of the perspective advocated by Ancona in a series of studies (1987; Ancona and Caldwell 1992; 1999) identifying and describing the relationship between team members' interactions with external constituents and a team's effectiveness. Whereas Ancona's studies focused on the team members' interactions with their collective constituencies, the groups to whom they would be "selling" their ideas—sales and marketing, manufacturing, etc., in a virtual team, the team members each face a unique constellation of constituents—boss, peers, cross-functional contacts, support staff—in addition to the team's constituencies as a collective. This is not completely unlike the situation experienced by cross-functional team members (Dougherty, 1992). However, in the case of the virtual team, there is little or no social or locational "overlap" among the members' separate constituencies so that team members cannot benefit from the relational redundancies characteristic of collocated

contexts that facilitate information flow and persuasive tactics. Nonetheless, both Ancona's study and the findings reported here send a common message: teams do not exist in isolation but within a complex web of interconnections.

Several characteristics of this particular team should be taken into consideration prior to extending these findings to other virtual teams. As a multi-organizational team composed of competitors, customers and suppliers, and both academia and industry, the AES Team may represent a somewhat unusual virtual team, though useful for the phenomenon of interest here and not outside the bounds of configurations predicted and described in the literature. Nonetheless, three characteristics of the team may have particularly influenced these team members' management of team tasks within the context of their local circumstances, limiting the applicability of the findings reported here to other types of virtual teams. First the AES Team's multi-organizational composition and the participation of competitors may have contributed to the members being more conservative and reserved in their contributions and more subordinate to management directives to avoid making strategic errors.

It is also important to consider the nature of the team's task, a non-revenue producing activity and one less glamorous (according to the members) than developing a particular component to be installed in next year's model. The members' personal interest and perceptions of the value oif the task may have influenced the degree of initiative exhibited in navigating the myriad challenges of their local environments. However, while the nature of the task may affect the members' degree of diligence in confronting local challenges and, consequently, the degree to which local circumstances retard team progress, changes in task would not obviate the constitutive role of these local circumstances on team member actions.

Other tasks for which I am aware of virtual teams or virtual collaborative initiatives being convened include new product development (Sole and Edmondson 2001), new process implementation [Barrett, 2000 #3; Klein, forthcoming #125] and resource-sharing (Crowston 2000) which vary along both the political and revenue-generating continuums. None of these studies were designed specifically to investigate local influences on the collective (or the relationship between the local settings and the collective), but they represent a sample of the types of virtual work groups that might be included in follow-on studies to locate the limits of the findings reported here.

The team's modular structuring of their tasks as subtasks addressed in parallel by collocated subgroups rather than cross-organizational subteams likely also influenced their felt need for collaborative technologies. Future studies using a sample of teams differentiated by task structure could clarify the significance of this fact for the nature and degree of local influence son the conduct of virtual teamwork and the use of collaborative technologies.

Finally, it would be naïve—even hypocritical—to ignore the larger context within which the team worked—the automotive industry. The automotive world's physical organization reflects its deep entrenchment in placial relations. A comparative study using a sample of teams from different industry sectors would be a valuable contribution to the virtual teams literature and would help to refine our understanding of the nature and bounds of the constitutive role of *place* in the enactment of virtual teamwork.

References

Ancona, Deborah G. 1987. "Groups in Organizations: Extending Laboratory Models." Pp. 207-230 in *Group Processes and Intergroup Relations*, vol. 9, *Review of Personality and Social Psychology*, edited by C. Hendrick. Newbury Park, California: Sage Publications.

Ancona, Deborah G. and David F. Caldwell. 1992. "Bridging the Boundary: External Activities and Performance in Organizational Teams." *Administrative Science Quarterly* 37:634-665.

—. 1999. "Compose Teams to Assure Successful Boundary Activity." *MIT Sloan School of Management* Working Paper #4097.

Ancona, Deborah G. and Chee-Leong Chong. 1997. "Entrainment: Pace, Cycle, and Rhythm in Organizational Behavior." in *Research in Organizational Behavior*, vol. 19, edited by B. M. Staw and L. Cummings. Greenwich, Connecticut: JAI Press.

Armstrong, David J. and Paul Cole. 1995. "Managing Distances and Differences in Geographically-Distributed Work Groups." Pp. 187-216 in *Diversity in Work Teams: Research Paradigms for a Changing Workplace*, edited by S. E. J. a. M. N. Ruderman. Washington, D.C.: American Psychological Association.

Armstrong, David J. and Paul Cole. 2001. "Managing Distances and Differences in Geographically Distributed Work Groups." Pp. 216-241 in *Distributed Work: New Research on Working Across Distance Using Technology*, edited by S. Kiesler and P. J. Hinds. Cambridge: MIT Press.

Arrow, Holly, Joseph E. McGrath, and Jennifer L. Berdahl. 2000. *Small Groups as Complex Systems: Formation, Coordination, Development, and Adaptation*. Thousand Oaks, California: Sage Publications, Inc.

Bailyn, Lotte. 1977. "Research as a Cognitive Process: Implications for Data Analysis." *Quality and Quantity* 11:97-117.

Barker, Roger G. 1968. *Ecological Psychology: Concepts and Methods for Studying the Environment of Human Behavior*. Stanford, California: Stanford University Press.

Barrett, B. J. (2000). *Factors Influencing the Performance Effectiveness of Globally-Dispersed Teams.* Unpublished Doctoral dissertation, Michigan State University, Lansing, Michigan.

Casey, E.S. 1993. *Getting back into place: Toward a renewed understanding of the place-world*. Bloomington, IN: Indiana University Press.

—. 1997. *The fate of place: A philosophical history*. Berkeley, CA: University of California Press.

Cramton, Catherine Durnell. 2001. "The Mutual Knowledge Problem and Its Consequences for Dispersed Collaboration." *Organization Science*.

Crowston, Kevin. 2000. "Discontinuities: The Key to Understanding Virtual Work." in *Academy of Management Meeting*. Toronto.

Cummings, Jonathon N. 2001. "Work Groups and Knowledge Sharing.", Unpublished doctoral dissertation, Carnegie Mellon University.

Davidow, William H. and Michael S. Malone. 1992. *The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21st Century*. New York: Harper Collins Publishers, Inc.

DeSanctis, Gerardine and M. Scott Poole. 1997. "Transitions in Teamwork in New Organizational Forms." Pp. 157-176 in *Advances in Group Process*, vol. 14. Greenwich, CT: JAI Press.

Dougherty, Deborah. 1992. "Interpretive Barriers to Successful Product Innovation in Large Firms." *Organization Science* 3:179-202.

Galegher, Jolene, Robert Kraut, and Carmen Egido. 1990. "Intellectual Teamwork: Social and Technological Foundations of Cooperative Work.". Hillsdale, NJ: Lawrence Erlbaum and Associates.

Garfinkel, Harold. 1967/1984. *Studies in Ethnomethodology*. Cambridge, UK: Polity Press.

Gersick, Connie J. 1988. "Time and Transition in Work Teams: Toward a New Model of Group Development." *Academy of Management Journal* 31:9-41.

Giddens, Anthony. 1984. *The Constitution of Society*. Berkeley, CA: University of California Press.

—. 1990. *The consequences of modernity*. Stanford, CA: Stanford University Press.

Gluesing, Julia C. 1995. "Fragile Alliances--Negotiating Global Teaming in a Turbulent Environment." Doctoral Thesis, Anthropology, Wayne State University, Detroit, Michigan.

Goffman, Erving. 1959. *The Presentation of Self in Everyday Life*. Garden City, NY: Doubleday & Company, Anchor Books.

Harmon, Joel, Joy A. Schneer, and L. Richard Hoffman. 1995. "Electronic Meetings and Established Decision Groups: Audioconferencing Effects on Performance and Structural Stability." *Organizational Behavior and Human Decision Processes* 61:138-147.

Harvey, D. 1989. *The condition of postmodernity: An enquiry into the origins of cultural change*. Oxford, UK: Blackwell.

Heckscher, Charles and Anne Donellon. 1994. *The Post-Bureaucratic Organization: New perspectives on organizational change*. Thousand Oaks, CA: Sage Publications.

Hiltz, Starr Roxanne and Murray Turoff. 1993. *The Network Nation: Human Communication Via Computer*. Cambridge, MA: MIT Press.

Hinds, Pamela J. and Diane E. Bailey. 2000. "Virtual Team Performance: Modeling the Impact of Geographic and Temporal Virtuality." Pp. 47 in *Academy of Management Meeting*, edited by S. J. Havlovic. Toronto.

Hochschild, Arlie Russell. 1983. *The managed heart: Commercialization of human feeling*. Berkeley, CA: University of California Press.

Jarvenpaa, Sirkka L., Kathleen Knoll, and Dorothy Leidner. 1998. "Is Anybody Out There? Antecedents of Trust in Global Virtual Teams." *Journal of Management Information Systems* 14:29-64.

Jarvenpaa, Sirkka and Dorothy Leidner. 1999. "Communication and Trust in Global Virtual Teams." *Organization Science* 10:791-815.

Jordan, Brigitte. 1996. "Ethnographic Workplace Studies and CSCW." Pp. 17-42 in *The Design of Computer Supported Cooperative Work and Groupware Systems, Human Factors in Information Technology*, edited by D. Shapiro, M. Tauber, and R. Traunmuller. Amsterdam: Elsevier Science B.V.

Lave, Jean. 1988. *Cognition in Practice*. Cambridge, UK: Cambridge Univiersity Press.

Lipnack, J. and J. Stamps. 1997. *Virtual Teams: Reaching Across Space, Time, and Organizations with Technology*. New York: John Wiley & Sons, Inc.

Lucas, Henry, Jr. 1996. *The T-form Organization: Using technology to design organizations for the 21st century*. San Francisco: Jossey-Bass.

Mantovani, Giuseppei. 1994. "Is Computer-Mediated Communication Intrinsically Apt to Enhance Democracy in Organizations?" *Human Relations* 47:45-62.

McGrath, Joseph E. and Andrea B. Hollingshead. 1994. *Groups Interacting With Technology*, vol. 194. Thousand Oaks, CA: Sage Publications.

Perlow, Leslie A. 1997. *Finding Time: How corporations, individuals, and families can benefit from new work practices*. Ithaca, NY: ILR Press.

Price, D. and J. DeSolla. 1965. "Networks of Scientific Papers." *Science* 149:510-515.

Robey, Daniel, Huoy Min Khoo, and Carolyn Powers. 2000. "Situated Learning in Cross-functional Virtual Teams." *Technical Communication* 47:51-79.

Schultze, Ulrike and Richard J. Jr Boland. 2000. "Place, space, and knowledge work: A study of outsourced computer systems administrators." *Accounting, Management, and Information Technologies* 10:187-219.

Siegel, Joel, V. Dubrovsky, Sara. Kiesler, and T. McGuire. 1986. "Group Processes in Computer-Mediated Communication." *Organizational Behavior and Human Decision Processes* 37:157-187.

Sole, Deborah and Amy Edmondson. 2001. "Situated Knowledge and Learning in Dispersed Teams." *(under review at the British Journal of Management)*.

Sproull, Lee and Sara Kiesler. 1991. *Connections: New Ways of Working in the Networked Organization*. Cambridge, MA: MIT Press.

Star, Susan Leigh and Karen Ruhleder. 1996. "Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces." *Information Systems Research* 7:111-135.

Strauss, Anselm and Juliet Corbin. 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, California: Sage Publications.

Suchman, Lucy. 1987. *Plans and Situated Action: The Problem of Human-Machine Communication*, Edited by R. Pea and J. S. Brown. Cambridge: Cambridge University Press.

Tuan, Y.-F. 1977. *Space and place: The perspective of experience*. Minneapolis: University of Minnesota.

Weisband, S. (2002). Maintaining Awareness in Distributed Team Collaboration. In S. Kiesler & P. J. Hinds (Eds.), *Distributed Work: New Research on Working Across Distance Using Technology*. Cambridge, MAq: MIT Press.

Weisband, Suzanne, Sherry Schneider, and Terry Connolly. 1993. "Participation Equality and Influence: Cues and Status in Computer-Supported Cooperative Work Groups." Pp. 15p. in *Third European Conference on Computer-Supported Cooperative Work*, edited by G. De Michelis, C. Simone, and K. Schmidt. Milan, Italy.

Wiesenfeld, Batia M., Sumita Raghuram, and Raghu Garud. 1998. "Communication Patters as Determinants of Organizational Identification in a Virtual Organization." *Journal of Computer-Mediated Communication* 3:23.

Wolcott, Harry F. 1982. "Differing styles of on-site research, or "If it isn't ethnography, what is it?"." *Review Journal of Philosophy and Social Science* 7:154-169.

Appendix A: Methods in greater detail

Participant-Observation

During each site visit, I "shadowed" each team member multiple times, typically for a full day each time, making handwritten notes on a legal pad or spiral notebook, common note-taking media among the natives. Shadowing, as I practiced it, involved placing myself in the engineer's workspace so that I could see his[5] computer screen and any documents he worked on well enough to discern the type of information—text, numeric printouts, schematic drawings, handwritten calculations and sketches, etc.—he used for various tasks as well as when he changed tasks. I accompanied him on errands, to meetings, to lunch and coffee breaks, and the myriad miscellaneous tasks that comprise an automotive electrical engineer's workday. I began by shadowing each member of the relevant work group, whether they were actively involved in the cross-organizational project or not, for one entire day. Then, depending on the size of the group, the time available, and various other scheduling contingencies, I shadowed each member a second day before doing a semi-structured interview (described below). Depending on the site and particular team member shadowed, days began between 7:00 and 9:00 a.m. and ended between 5:00 and 7:00 p.m., except for conference and workshop meeting days, which often lasted from early morning until midnight for two to four consecutive days.

Several objectives guided the timing and duration of my site visits including staying in each site long enough to at least partially mitigate the novelty of my presence, visiting each site during different stages of the project—both before and after the midpoint of their first assignment (Gersick 1988)—and different times in the calendar year to minimize distortion from periodic events (Ancona and Chong 1997). However, variations in the number of people at each site, budget limitations for travel, holiday and vacation schedules, and unanticipated reorganizations at three of the five charter organizations also figured in the plan. In the end, the site visit schedule represented an ongoingly negotiated achievement. I spent between one and seven weeks at each site per visit and visited six sites at least twice and one site once during the thirteen-month period October 1997-November 1998.

The geographic dispersion of these members' coworkers also meant that they spent the majority of many days reading and responding to email and talking on the telephone, so I could be of little assistance.

The role of meeting minute drafter resulted in exchange for permission to audiotape the team meetings. I wrote the first draft of the meeting minutes for the first 15 months of the study after which the Administrative Project Leader took over. Poor room acoustics and excessive background noise made the tapes of three meetings almost unusable except as prompts for writing the minutes, but the tapes for 19 meetings were transcribed.

Interviews. In the first round of site visits, I used the semi-structured interviews to elicit demographic and work history data that were not easily worked into the flow of conversation during the observation periods and to develop a cultural portrait of each participating site. I also queried members about their experience of the project to date from their first exposure, which I often did not witness. I also used the interview as an opportunity to clarify my understanding of the previous days' observations.

[5] All of the charter members were men. During the second year, one woman joined the team, so I use male pronouns throughout both to reflect the team's actual membership and to protect the one female member's anonymity.

Having gained a sense of the industry and organizational contexts, my goal in the second round of site visits was to develop a more complete and detailed picture of the how the AES Team and its task requirements fit in the overall scope of the project team members' work. I followed a similar schedule of shadowing and interviewing except that I focused only on those members considered direct participants in the project team.

Initially, I audiotaped all of the interviews because the vocabulary and rhythm of the language were new to me and the people I interviewed were amenable to taping. As I moved through the sites, however, some companies prohibited the use of recording equipment, and as I became familiar with the technical terminology, I no longer needed the tapes and relied entirely on near-verbatim handwritten notes. In all, I conducted 80 interviews, 27 of them audiotaped, and the remainder documented by hand.

Data analysis. After returning from the field, I did several close readings of my fieldnotes, changing the order—chronologically, then by site, then by task—to increase the relative salience of different themes. Following the examples of Hochschild (1983) and Perlow (1997), I drafted a narrative description of each site including the people, how each site and the participating individuals came to be involved in the project, and the activities and orienting issues characterizing day-to-day life there. I wrote a similar account of the team's work and experiences as a collective. These writings served to capture my "head notes"[6] before my memory faded but also to illuminate gaps in my knowledge of each site to surface similarities and differences across organizations that often subtly influenced members' participation in or contribution to the AES Team and to link these with the team-level activities.

As I reviewed the notes, when I developed impressions about various relationships or patterns based on notes from one site or one team meeting, I made either mental or written notes regarding what I would expect to find in the notes from another site—or from the same site at a different time—if the relationship held. Then I reviewed another set of notes to see if I found what I expected. Several examples of team members taking either an implicitly or explicitly local approach to team tasks stimulated the inquiry reported here. I reviewed my fieldnotes for every example of team-related activity, exploring the patterns and bases for team members' relative placial and spatial orientations toward team activities. After experimenting with several different organizing schemes, the dimensions of *place* and *space* as depicted by Schultze and Boland (2000) best captured the multi-dimensionality of the data.

[6] "Head notes" is a term used by both John Van Maanen and Martha Feldman in informal discussions of their work, if not in their writings, to indicate the rich detail and understandings of relationships among things and people in a particular world that for a variety of reasons do not make it to the page when writing one's fieldnotes but that nonetheless inform the researcher's analysis of the "data" that are recorded.

芽|Sprouts

Working Papers on Information Systems | ISSN 1535-6078

Office:
Sprouts
University of Amsterdam
Roetersstraat 11, Room E 2.74
1018 WB Amsterdam, Netherlands
Email: admin@sprouts.aisnet.org

芽|Sprouts