The Myth of Spontaneous Connection:
An Ethnographic Study of the Situated Nature of Virtual Teamwork

by

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Submitted to the Sloan School of Management
in Partial Fulfillment of the Requirements for the Degree of

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Abstract

This thesis reports the findings of an exploratory 23-month multi-site participant-observation study of one multi-organizational virtual team in the automotive industry. Observing and interacting with the team members in their local work sites and in team meetings, I investigated the influence of virtual team members' situation in their respective local work contexts on the work, communication, and participation patterns observed at the team level. I found that the team members' local work worlds directly influenced both their capacity and their incentive to contribute to the team. In addition, I found that the participation patterns observed at the team level reflected, in large part, the unintended cumulative consequence of the members' respective locally-advantageous strategies for responding to local events and conditions. Using Giddens' structuration theory, I show how the members' consistent application of these local world management strategies under changing local circumstances accounts for contrasting participation patterns observed at the team level between the first and second years of the study. The thesis contributes to the virtual team literature by extending the analytic focus to include virtual team members' local work contexts, bringing to light aspects of virtual collaboration that have heretofore been largely matters of speculation and, consequently, opening new avenues for further research.
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Cleveland, August 2001
...To my mother, Helen Davis, who, through her example, instilled in me a curiosity about and respectfulness for how other people live and work and believe that is at the heart of ethnographic work.

...To my nieces, Katie Ellen and Sarah Beth Davis, with love and hope that this contributes in at least some small way to further expanding the possibilities available for your own futures.
Chapter One

INTRODUCTION

This thesis explores the significance of virtual team members’ situation in physically and socially particular work contexts for the work, communication, and participation patterns observed in a virtual team. In the excitement over “anyone, anytime, anywhere” connections (O'Hara-Devereaux & Johansen, 1994) enabled by new and ever-evolving communication and information technologies, the “ones,” “times,” and “wheres” being connected have been largely overlooked. Based on detailed observation of the members of one multi-organizational virtual team in their respective work sites as well as in team meetings, this study concludes that “where matters” and offers a taxonomy of the features of local environments influencing virtual team members’ participation in the team.

Developments in both information and communication technologies have enabled profound changes in organization and work design, allowing the geographic dispersion of formerly collocated workers; the connection of others whose geographic distribution previously made collaborative work too expensive or inconvenient; and linking across organizational boundaries to share resources or streamline processes. Organizational pundits have heralded these technology-enabled work configurations as solutions to a variety of managerial dilemmas posed by simultaneous mandates to become both “lean” and “global” as well as facilitators of new collaborative opportunities (Townsend, DeMarie, & Hendrickson, 1998).
Virtual teams represent one version of these new work forms used to link people from different functional groups, occupations, locations, nations, and even organizations, for tasks as diverse as creating new products (Armstrong & Cole, 1995; Armstrong & Cole, 2001), streamlining or implementing new processes (Barrett, 2000; Kraut, Steinfield, Chan, Butler, & Hoag, 1998; Robey, Khoo, & Powers, 2000), sharing resources (Crowston, 2000), and developing policy or standards recommendations for industry or government entities (Orlikowski, 1994).

The term "virtual team" can and has been used to encompass a variety of work group configurations including physical, temporal, and organizational dispersion of members as well as fluid collectives with amorphous membership operating under the auspices of a consistent identity. In this study, I use the term "virtual team" to refer to a group of geographically-distributed individuals working collaboratively toward a common objective and relying primarily on technology-mediated communication for their collaborative interaction.¹

A Department of Occupational Titles survey in the mid-1990’s estimated that 8.4 million U.S. workers then participated in geographically-distributed teams and projected the number of teams to proliferate to over 30 million by the year 2000 (Saunders & Ahuja, 2000). Similarly, the Gartner group estimates that "by 2004, 60 percent of the professional and management tasks

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¹ For experimental researchers, this definition may leave too many variables unspecified such as how much physical separation constitutes "geographic distribution" and whether using email between face-to-face meetings constitutes "relying primarily on computer-mediated communication." As mentioned in the previous chapter, just being located on different office corridors effectively inhibited face-to-face collaboration, and members of the same organization commonly communicate with one another via email. In addition, collaboration among geographically-distributed individuals has been taking place for centuries, and collaboration supported by communication technologies such as the radio, telephone, and fax have been taking place for decades. So what differentiates virtual teams from their precursors remains somewhat a matter of semantics and debate. The members of the team I studied did not consider any of their prior experience collaborating across organizational boundaries to be "virtual." Rather they reserved that term for the use of technologies, including audio- and video-conferencing to support multi-point synchronous collaborative interaction. However, my generic working definition for this work form includes synchronous and asynchronous collaborative interaction.
at Global 2000 companies will be done via virtual teams" (as cited in InfoWorld, Sept 25, 2000). Consistent with such projections, some firms have designated computer-conferencing applications, such as NetMeeting, as part of the "standard load" of applications installed on workers' desktop computers. Others have established new departments and positions to focus solely on the design and support of virtual work, and at least one company I am aware of has implemented provisional policies restricting travel specifically to accelerate the use of collaborative technologies by dispersed coworkers (personal communications). The currently available statistics, seemingly relentless managerial directives to decrease both development and operating costs, and trends in information and communication technology development suggest that virtual teams will become an increasingly prevalent work form involving a growing proportion of the work force (DeSanctis & Poole, 1997; Handy, 1995; O'Hara-Devereaux & Johansen, 1994; Townsend et al., 1998).

Research has been underway in several disciplines for over fifteen years to better understand the practical and social implications of this new mode of work. This study aims to contribute to that effort by investigating how virtual team members' situation in physically and socially particular work contexts influences the work, communication, and participation patterns observed at the team level. This aspect of virtual team members' experience has been largely overlooked in the research to date, which tends to focus on interaction processes and technology use among team members, exclusive of any extra-team influences. In the following several pages, I first sketch the streams of this literature and situate this study relative to it. Then I briefly describe my study and the team's experiences over the twenty-three months I followed them from the perspective of a within-team observer. This perspective serves as both context
and contrast for the detailed *in situ* descriptions of the members' activities developed in chapters four and five. Finally, I close the chapter with a roadmap of the pages ahead.

**Building on the current research**

A great deal of the 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 & Bailey, 2000), trust (1999; Jarvenpaa, Knoll, & Leidner, 1998), participation equality (Mantovani, 1994; Weisband, Schneider, & Connolly, 1993), and decision-making (Harmon, Schneer, & Hoffman, 1995; Siegel, Dubrovsky, Kiesler, & McGuire, 1986) among others. A central question in these studies, and others more explicitly concerned with "performance," is the relative effectiveness of virtual and collocated teams (Barrett, 2000; Harrom et al., 1995) and identification of "critical success factors" for effective virtual teamwork (Maznevski & Chudoba, 2000). 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 contexts within which the virtual team members work (for exceptions see Barrett, 2000; Staples, 2000).

A handful of studies *have* identified extra-team influences as important for understanding virtual team work and communication practices. For instance, in separate studies, both Gluesing (1995) and Robey (2000) found that local cultural differences affected cross-site collaboration, and Barrett (2000; Klein & Barrett, forthcoming) found that changes in local management priorities directly affected virtual team members' meeting attendance among things. Finally, in a study of virtual student project teams, Cramton (2001) noted that aspects of the students' local
contexts (generally) not revealed in the team-level interaction, which she refers to as "hidden profiles," contributed to miscommunication and team-level conflicts.

In this study, I explore how virtual team members' situation in their respective, unique work worlds influences the work, communication, and participation patterns that emerge at the team level. A number of precedents exist, including studies of organizational culture, work practices, communication patterns, and social psychological studies of proximity effects, for assuming virtual team members' actions in the team would be shaped by their proximal circumstances. In the next chapter, I elaborate more on these streams of research as background for the present study.

The Study

In this study, I set out to investigate the relationship between virtual team members' situation in their respective local contexts and the observed team-level work, participation, and communication patterns that emerged over time. Using ethnographic methods, I followed the experiences of one multi-organizational virtual team for 23 months from their kick-off through the completion of their second project, observing and interacting with the members both in their respective work sites and in both face-to-face and technology-mediated team meetings. I spent thirteen months in the field full-time, distributing my time among the seven charter sites, then continued to follow the team through participation in team meetings and phone and email contact with key informants for another ten months. The findings reported here draw upon data collected through observation, unstructured and semi-structured interviews, email exchanges with members, review of a partial archive of the email correspondence between members, monitoring of the team Web site content, and my experiences as a participant. My participant
roles varied across sites, but at various stages of the project included producing the draft version of team meeting minutes, writing and presenting a literature review of the risks of human exposure to the technology the team was developing, doing impromptu clerical tasks, providing English translation support for the international members, and generally being an "extra set of hands" as the occasion warranted. In this section, I give an overview of the team's work and communication practices from a team-level perspective as both context and contrast for the descriptions of the members' actions and experiences in their local work environments that comprise chapters four and five.

The AES Team

Fifteen electrical engineers from five organizations distributed over eight sites comprised the initial core of the 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, 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, respectively. Over the course of the study, the number of participating organizations expanded to ten distributed over seventeen sites in three countries, and average meeting attendance grew to 19

\textsuperscript{2} All organization and individual names are pseudonyms.

\textsuperscript{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.
with a range of 15-26 engineers participating in any particular meeting. Though diverse from many perspectives, the group also represented a subset of a relatively small occupational community, automotive power electronics engineering, in a well-established industry with long-tenured membership.

The regional organization of the automotive industry, so arranged to facilitate face-to-face interaction among coworkers and between automakers and suppliers, may make it seem an odd venue for studying "virtual" teams. Indeed, though automaker's production facilities are scattered around the globe to minimize transportation costs of both materials and finished goods to and from the production site, the "engineering" and "design" functions tend to be located near "Headquarters," and managers and engineers exhibit an explicit bias in favor of "local" suppliers who are more available for face-to-face meetings when needed. However, persistent and intensifying cost pressures have translated into efforts to standardize core components and subassemblies across vehicle lines, including foreign-based subsidiaries, and ferreting out lower-cost suppliers regardless of location. In addition, mergers, acquisitions, and joint ventures intended to further decrease costs through economies of scale, elimination of redundancies, and technology-sharing 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 the international acceptance of a standard for the voltage level and possibly a few design features of the "next generation automotive electrical system," or AES technology. Standardization initiatives are notoriously political, but in the case of the AES Team, all but two of the original team members
had been participating in an industry consortium on AES technology hosted by the participating academic researchers ("the Consortium") for at least several months prior to the start of this project and were themselves already in agreement about the target voltage level, the critical system feature to be standardized. Rather than working out differences among themselves, they saw their task as primarily one of persuading others in the industry to agree on the voltage level.

The catalyst for forming this particular team at this particular time came from a strategic agreement between 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." When the study began, virtual engineering was loosely interpreted as technology design and development by a group of geographically-dispersed engineers communicating via collaborative technologies rather than collocation. At that time, the expectations regarding the types of technologies to be used or how they would be used varied significantly. For instance, in the kick-off meeting, the charter members talked about (eventually) using "virtual reality" tools and collaborating in real-time on simulation models, but in an interview a couple of weeks later, an AmeriCar executive instrumental in launching the team told me that he expected the team to use fairly "low tech" communication and information technologies with which they were already familiar, such as telephone, fax, email, and file transfers. So the means and methods for actually doing "virtual engineering" were generally unspecified. In fact, one of the team's objectives involved learning how to "virtual engineer" effectively.

Year 1
After launching with grand proclamations regarding their anticipated use of collaborative technologies and the potential for ongoing collaboration after achieving their initial objectives, the team's first year was characterized by rather limited interaction at the group level. The
overall work structure consisted of joint planning in the kickoff meeting and then weeks-to-months long intervals between team meetings during which some members worked on team project tasks independently or in small groups, while others continued with their local responsibilities, mostly unaware of the others’ activities.

At the time of the kickoff meeting, the channels for group communication included a Web site with document posting and threaded discussion capability and an email distribution list. Nonetheless, most cross-site interaction occurred among previously acquainted members using private communication channels such as personal email or the telephone, and as often as not, these exchanges concerned other projects unrelated or peripheral to the AES Team’s work. For the members not engaged in these exchanges, it was possible and even common to go several weeks without interacting with another team member.

Initially, the team had anticipated using NetMeeting, a free computer-conferencing application, to hold “virtual” meetings on a more frequent basis than any of the members could have afforded to travel for face-to-face meetings. 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 of an application installed on their own computers. During the kickoff meeting, the team members had talked about using NetMeeting to do such things as jointly building and testing simulation models. However, when they encountered technical problems and organizational barriers to using NetMeeting across organizational boundaries, they relied instead on face-to-face meetings, scheduled to coincide with Consortium meetings to minimize travel costs, and videoconferences as the primary forums for group-level interaction and collaboration.
The team's first deliverable consisted of a conference paper providing an "evidence package" asserting the feasibility of AES technology to be delivered at TechExpo, an auto technology extravaganza, one year to the day from the team's kickoff meeting. The team's paper session drew a large crowd and generated a significant amount of audience interaction and media attention. At the TechExpo closing ceremonies, the team received the "Best Paper" award for the conference.

At a face-to-face team meeting in Paris as the first year came to a close, approximately a month before the TechExpo paper presentation, the team members agreed to establish new goals for their next stage of work together. Specifically, they agreed to define a collective task that would better engage all the members rather than only small subgroups, and to establish explicit goals for learning about virtual engineering. In addition, at this same meeting, the AmeriCar engineers demonstrated remote control of an experimental workstation via NetMeeting and described several solutions for the technical problems that had previously blocked their attempts to use NetMeeting. So after a year of low-tech and limited collaboration that nonetheless culminated in a prize-winning paper, the team agreed to take steps to work more collaboratively using more sophisticated collaborative tools.

Year 2
In contrast to the first year, the team's second year of work was characterized by regularly-scheduled technology-mediated meetings, collaborative work at the team level, and growth in the number of members, organizations, and sites participating in team meetings. The team agreed to meet monthly and occasionally met more often. They first met via videoconference then quickly transitioned to audio-conferencing, using photocopies, web postings, or NetMeeting to view meeting documents. Over time, the members developed a norm of posting all documents
discussed in a meeting on the team Web site. In addition to supporting those members without NetMeeting access, the Web site also served as a backup when the NetMeeting connection failed. Over the course of the year, more and more sites gained NetMeeting capability.

Though team members still worked on team tasks offline, they discussed their progress and received feedback primarily in the team meetings rather than through person-to-person exchanges. In cases where discussions did occur offline, these were often mentioned and summarized during team meetings: “Bill and I discussed...and we decided...”

Finally, the team grew over the course of the second year despite attrition of some of the charter members. When each of the semiconductor organizations spun off a division, the team members in that division continued to participate under the new organizational identity and brought in an additional member or two. Midway through the year, the team invited two battery manufacturing organizations and one connector manufacturing organization to join the team to gain needed expertise. In addition to the new members, more members from each organization were able to participate in the technology-mediated meetings than would have been able to travel to face-to-face meetings. I describe these changes in the team’s composition, work, and communication practices in more detail in chapter five.

While the team worked to develop prototypes during the second year, they also wrote another conference paper based on the analyses used to develop the prototype that they presented at a special conference on AES technology. After this presentation, Consortium membership, a proxy for industry-level interest in AES technology, more than doubled within a few months, and several organizations asked to join the AES team. Though a number of factors contributed to increased industry interest in and attention to AES technology at this particular time, the team’s work had clearly played a catalytic role, fulfilling its intended objective. Despite a few
unresolved technical and political questions, by the close of the team's second year, industry
participants had agreed on a single voltage level. By all counts, the team had been "successful"
based on the initial expectations of their work.

Overview of findings

An analysis based on an intra-team focus might attribute the team's new work and
communication practices to the numerous changes the team underwent at the conclusion of their
first year of work, and indeed, those changes did influence the members' perceptions of the team
and meetings. Nonetheless, I argue that the primary explanation for the observed shifts in the
work, communication, and participation practices lies in understanding the members' perception
of and response to the conditions and events in their respective local contexts. In addition, my
observation data from both team meetings and site visits indicates that members both
intentionally and unintentionally withheld information about their respective local contexts from
the team, suggesting that factors central to an accurate interpretation of observable team
dynamics may be invisible in a team level analysis.

This study contributes to virtual team research by extending the analytic frame beyond the
team boundary to include the members' respective local work contexts, offering a supplement to
intra-team explanations for the patterns of work, communication, and participation observed in
virtual teams. In addition, I suggest that the relationships identified are not unique to virtual
teams or necessarily the product of the team's "virtualness," but instead could inform studies of
traditional teams and other collocated work configurations as well.
Chapter overview

In the next chapter, I draw on the growing, inter-disciplinary body of literature on virtual teams to sketch out the current streams of inquiry in the field and provide a basis for my expectation that an investigation of the influence of virtual team members' embeddedness in their local work worlds on practices observed in the virtual team would be a fruitful line of inquiry. The third chapter introduces each of the participating organizations and describes the data collection and analysis methods I used in more detail. Chapters four and five describe the local conditions, events, and experiences shaping the members participation in the AES Team during the first and second years, respectively, showing the local bases for the contrasting patterns observed at the team level. In chapter six, I synthesize these local influences into a taxonomic structure of local enablers of and constraints upon participation in the virtual team and draw conclusions regarding the reasons for the differential influence of the enablers and constraints during the first and second years and the nature of virtual collaboration among bureaucratically-embedded team members more generally. In chapter seven, I reflect on the implications of these findings for virtual team research and practice.
Chapter Two

Contextualizing Virtual Teamwork

Introduction

Though it may seem an obvious proposition that an individual's participation in and contribution to a virtual team would be influenced by the conditions and events in his or her local work world, in the excitement over the possibilities of “anyone, anytime, anywhere” communication promised by technology proponents, the “ones”, “times,” and “wheres” being connected have been largely neglected in virtual team research. Early writings about technology-enabled organizational and work configurations (Davidow & Malone, 1992; Galegher, Kraut, & Egido, 1990; Hiltz & Turoff, 1993; Sproull & Kiesler, 1991) emphasized 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. More recent writings with titles like “The Currently Unique Advantages of Collocated Work” (Olson & Olson, 2001) and prefaced with statements such as “Collaboration at a distance remains substantially harder to accomplish than collaboration when members of a work group are collocated” (Kraut, Fussell, Brennan, & Siegel, 2001: 181) suggest that subsequent research and practice have yielded a more tempered view. Recent longitudinal studies of several virtual teams (Barrett, 2000; Cramton, 2001; Gluesing, 1995; Majchrzak, Rice, Malhotra, King, & Ba, 2000) suggest that investigations of the influences of virtual team members’ local contexts on their participation in and contribution to the virtual team may be a
fruitful line of inquiry for better understanding the bases for at least some of the experienced difficulties.

In this chapter I describe the theoretical and empirical underpinnings for my exploration of the influence of virtual team members’ embeddedness in their particular organizational contexts on the work, communication, and participation patterns observed in the virtual team. I begin with a brief overview of the now burgeoning literature on virtual teams to show that theoretical and methodological biases have largely obscured local contextual influences from researchers’ view. Then I draw on several extant research streams to illustrate the over-determined nature of proximal influences on individual action, arguing that virtual team members, despite their electronic connections, remain engaged in and influenced by their respective local worlds. Finally, I introduce Giddens’ (1984) structuration theory as a useful lens for conceptualizing and analyzing the relationship between context, in this case the members’ local work worlds, and social action, a lens that I will draw upon in the analytic discussion in chapter six.

Research to date

Studies of virtual teams have pursued numerous avenues. The majority of initial (and continuing) studies, both empirical and theoretical, center on the differences in group attributes, processes, and effectiveness between “virtual” teams and their co-located counterparts stemming from the two main differentiating features of “virtual” work: geographic distribution and computer-mediated communication. Topics of primary interest have included trust (Fuehrer & Ashkanasy, 1999; Jarvenpaa & Leidner, 1999; Jarvenpaa et al., 1998; Meyerson, Weick, & Kramer, 1996; Saunders & Ahuja, 2000), participation equality (Mantovani, 1994; Weisband et al., 1993), decision-making (Brashers, Adkins, & Meyers, 1994; Chidambaram & Jones, 1993;

In general, studies on these topics have concluded that virtual teams are potentially as effective as face-to-face teams but that collaborating virtually is generally more “effortful” (Kraut et al., 2001), takes longer to achieve similar results and develop relationships (Walther, 1992a; 1992b; 1996; 1997), and may involve more conflict that is more difficult to resolve (Armstrong & Cole, 1995; Armstrong & Cole, 2001; Hinds & Bailey, 2000) than that experienced in face-to-face groups. In addition, one study of mediated communication among pre-existing “decision groups” indicates that technology-mediated communication may not have the degree of status equalization in established groups anticipated by technology proponents (Harmon et al., 1995). On the other hand, in addition to its heralded convenience, virtual collaboration may offer additional advantages over face-to-face work including less asymmetric participation in discussions (Weisband et al., 1993) and “hyperpersonal” interaction (Walther, 1996), or relational communication that exceeds that possible in typical face-to-face task groups. Several authors conclude or suggest that “task-technology fit” (Chidambaram, 1996; Ocker, Fjermestad, Hiltz, & Johnson, 1998) may determine the effectiveness of technology-mediated groups, but that remains an empirical question.

These studies have provided valuable insights regarding the characteristics and challenges of technology-mediated collaborative work. Their use of ad hoc and student teams with little or no history or future along with their use of experimental methods of brief duration serve to

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4 See Walther for examples of experimental studies of longer duration.
minimize the influence of extra-team variables, making it possible to draw apparently broadly applicable conclusions regarding media and distance effects. However, the strengths of these studies also potentially limit their relevance for virtual teams composed of organizationally-situated members working together over time. Even if the members have no collective history or anticipated future, organizationally-situated virtual team members do have occupational and organizational pasts, presents, and anticipated futures (Putnam, 1988).

Another set of studies have examined either one or several virtual teams or work groups in greater depth over longer periods of time to identify those features and practices differentiating more and less effective virtual teams (Armstrong & Cole, 2001; Barrett, 2000; Gluesing, 1995; Majchrzak et al., 2000; Maznevski & Chudoba, 2000). These studies have investigated real teams doing real projects over at least several months time. Extended studies of student project teams (Cramton, 2001; Weisband, 2001) have also been fruitful for identifying unanticipated practices and problems that emerge over time and, thus, are not detectable in cross-sectional studies of ad hoc teams. Several studies have found relationships between teams’ communication patterns—including message content (Maznevski & Chudoba, 2000; Weisband, 2001), message complexity, and media mix (Maznevski & Chudoba, 2000)—and team performance. According to these studies, high performing teams communicated more frequently, shared more “awareness” information, did so earlier in the project process, and used media appropriate to both the message and task complexity. Two studies (Armstrong & Cole, 2001; Weisband, 2001) also identified team leaders’ facilitative “integrating” and “initiating,” respectively, interventions to be important for overall team effectiveness.

Nonetheless, similar to the primarily experimental studies discussed earlier (with a couple of exceptions I will discuss below), these studies are also characterized by an intra-team focus
with little or no attention to the relationship of either the team or its members to their embedding contexts. That is, the data sets typically include observation and documentation only of those actions, messages, and texts exchanged among and visible to all the members, and the conclusions drawn and theories put forth relate outcomes to either member characteristics, inter-member interactions, or other intra-team variables such as media use and meeting structure. Implicitly, the teams are depicted as autonomous entities comprised of autonomous agents, related to their individual and collective external contexts only at the point of delivering the outcome of their labor to managers who may judge it either positively or negatively, but with no detectable impact on the team.

Lack of attention to embedding contexts is a common lament of group research, both traditional and virtual. Ancona and Caldwell (1992) called attention to methodological and theoretical biases for an intra-team focus and advocated an "external perspective" in teams research based on their own novel findings that new product development team performance correlated directly with the members' level and quality of interaction with extra-team constituents. Though this paper 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:

"most [small group] research and theory pay little attention to the interaction of groups with their embedding contexts...does not construe groups as continually engaged in intricate two-way
interchanges with many facets of their embedding contexts—with other work groups and individuals within the same organization; with customers and suppliers; and with families, friends, and communities as well as with a physical environment from and to which information, stimulation, and resources may flow...” (p. 27)

Similarly, Putnam (1988) has implored group communication researchers to take into consideration the significance of organizational groups’—and their members’—embeddedness in larger organizational, typically bureaucratic, contexts in order to accurately interpret observed group communication practices. Nonetheless, the gap persists in both traditional and virtual team research. An intra-team focus risks theory development based on the misinterpretation of the overt comments, messages, and actions of group members as reflections of intra-group dynamics and motivated by intra-team circumstances rather than of the members’ responses to elements in their local environments (Barge & Keyton, 1994).

As virtual teams research has moved to the field and to more longitudinal designs, researchers have begun to recognize and document extra-team influences on intra-team activities. A handful of the studies cited earlier do address or at least acknowledge some relationship between virtual team members actions in the team and aspects of their embedding contexts. Gluesing (1995) related many of the problems experienced by the teams she studied to differences in the members’ cultural contexts, similar to the conflicts observed in traditional multi-national groups (Hambrick, Davison, Snell, & Snow, 1998) and cross-functional teams (Dougherty, 1992).

Two studies report team members’ concern for hierarchical relationships as a key factor in the observed team practices. In a study of a multi-organizational team, Majschrzak et al (2000) described how the members’ collective use of a groupware tool changed over time at least partly in response to local managers’ misinterpretation of documents posted in the public area. Although the tool was intended to facilitate sharing of document and design drafts to enable
better work coordination, the members eventually used the tool only for synchronous sharing of presentation-quality documents to obscure the draft versions from managers who found them unsettling. Barrett (2000) described members of four intra-organizational virtual teams feeling "torn" between their responsibilities to the team and the changing expectations of their respective local managers who, not insignificantly, controlled the members' performance evaluations. A management change mid-way through the project brought in managers less interested in the teams' task, translating into attendance drops at team meetings.

Finally, in a study of thirteen virtual student teams, Cramton (2001) traced team conflicts and numerous examples of miscommunication to team members' failure to elicit and share contextual information that was affecting their participation in the team or, in some cases, to register contextual information that members did share, resulting in misattributions that hindered team cohesion and learning. Though the study itself focuses primarily on the quality and effectiveness of the members' interactions, she extrapolates from her findings to suggest that "unrecognized differences in the situation, contexts, and constraints of dispersed collaborators constitute 'hidden profiles'" amplifying the likelihood of the problems she observed. In this study, I explore the nature and significance of these "hidden profiles" for virtual teamwork.

Research precedents for investigating local influences

Researchers representing a variety of traditions have shown that an individual's proximal circumstances and relationships influence his or her work practices and interaction with others outside that context. Organizational culture studies, analyses of social action in particular physical settings, social practice studies of work, communications studies, and social psychological studies of "proximity effects" all document the integral nature of social and
physical location to social action. In this section, I relate examples and key findings from each of these areas and consider the implications for virtual collaborative work, arguing that “where,” meaning the social and physical situation of work and interaction, matters.

Organizational culture studies’ bread and butter has come from the analyses of the development, content, and maintenance of unique and dynamic meaning systems among those who share common experiences—such as those associated with education, work routines, roles, and status—and their implications for collective action. “Culture” generally “refers to the knowledge members (“natives”) of a given group are thought to more or less share; knowledge of the sort that is said to inform, embed, shape, and account for the routine and not-so-routine activities of the members” of the social group (Van Maanen, 1988: 3). Though cultural researchers originally studied primarily physically- and, by default, socially-bounded groups, the identification of differentiated subcultures organized around gender, ethnicity, occupations, status, and avocations (Hannerz, 1992; Kunda, 1992; Martin, 1992; Sackmann, 1997; Van Maanen & Barley, 1984) and the identification of emergent cultures in online communities (Doheny-Farina, 1996; Kollock & Smith, 1999; Reid, 1999; Wellman & Milena, 1999) illustrates that culture is not necessarily coterminous with location. Nonetheless, as a practical matter, collocated individuals share a great deal of day-to-day experience and in the process develop the sort of knowledge Van Maanen describes.

The following examples illustrate the influence of organizational culture on practice, in these cases the uses of particular technologies, despite the influence of occupational subcultures both within and across the organizational boundary. In a study of identical technology implementation in two different hospitals, Barley (1986) found that radiological nurses, doctors, and technicians at each site, occupational orientations that transcend location, used the new
technology differently and interacted differently with one another regarding its use, but did so in ways consistent with the pre-existing and prevailing culture and social structure in each facility. Similarly, in a study of information and communication technology use by two newspaper editorial teams, again, occupationally similar groups doing similar tasks, Zack and McKenney (1995) also found that the two groups used the technologies differently but consistently with the prevailing values and practices at each organization. In a study of two organizations’ use of the Lotus Notes application, Orlikowski (1995) observed a similar phenomenon. So while it is possible and even likely that a virtual team will, over time, develop a corpus of unique knowledge-in-practice constituting a “team culture,” the virtual team members’ continued situation in their respective organizations suggests that they will also continue to be influenced by the local “knowledge…that inform[s], embed[s], shape[s], and account[s] for the routine and not-so-routine activities” of day-to-day work, including virtual teamwork.

While studies of organizational culture emphasize the influence of shared experience and affiliation on social action among collocated individuals, other studies indicate that “settings” themselves play a constitutive role in individual and collective social action regardless of the particular individuals present in the setting or their prior affiliation. Citing Barker (1968), an ecological psychologist, Kiesler and Cummings (2001) 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.” In his analysis of self-presentation and social interaction Goffman (1959) also noted the setting-specific nature of social “performance”:

A setting tends to stay put, geographically speaking, so that those who would use a particular setting as part of their performance cannot begin their act until they have brought themselves to the appropriate place and must terminate their performance when they leave it. (p.22)
As long as the person remains in the setting, however, Goffman notes that he or she experiences both internal and external pressure to maintain a particular performance. Similarly, Giddens (1984) uses the notion of "locale" to describe actors' dependence upon and use of their physical settings to contextualize their—and others'—actions and interactions. Though communicating across great distances with people outside their physical setting, virtual team members remain physically and socially situated with co-located others in the particular setting of their workspace. These empirically-grounded perspectives on the constitutive significance of place for social action suggests that the members' physical work settings—and the expectations of the co-present others there—would play an essential role in the members’ structuring of their day-to-day actions, including those related to the virtual team.

The constitutive role of setting is also integral to the concept of "situated action" employed by social practice researchers. This perspective emphasizes the contextual specificity of social action, focusing on the "complex world of objects, artifacts, and other actors, located in space and time" that "gives action its sense" (Suchman, 1987: 179). Practice researchers emphasize the adaptation of action to local resource constraints and opportunities that results in situation-specific practices not easily transferable to other situations where the resource repertoires differ (Orr, 1996) (Brown & Duguid, 1991; Lave & Wenger, 1991; Sole & Edmondson, 2001).

In studies ranging from the use of a photocopier's expert help system (Suchman, 1987) to the performance of practical mathematical operations (Lave, 1988) to the practices of a a blacksmith (Keller & Keller, 1993), the researchers show the emergent, situationally-specific nature of social action and practical knowledge. Regardless of the nature and intent of the activity, people drew upon the physical and social resources at hand, in ways congruent with prior experience and local expectations, to carry out the myriad activities of daily life. It seems reasonable to
anticipate that virtual team members will similarly use and depend upon the physical, social, and informational resources available to them in their respective local worlds to inform their actions, even those related to the virtual team.

So far I have focused on literatures that examine various aspects of individual action related to their embeddedness in larger, more enduring social contexts, but a body of social psychological laboratory studies on “proximity effects” indicates that even the mere presence of and brief interaction with others as experienced in a laboratory setting influences individual action. In a review of this literature, Kiesler and Cummings (2001) describe numerous consequences of co-presence for collaborative interaction. Though the authors’ principle focus is on the interactive losses resulting from geographic distribution and the consequent challenges for collaborating across distance, their discussion nonetheless illuminates the numerous influences of proximal others. First, they note, the mere presence of others increases attention, increases concern for their opinions, increases physiologic arousal (measured by blood pressure and pulse rates), and decreases free-riding, effects Latane (Latane, 1981; Latane, Liu, Nowak, & Bonevento, 1995) summarized in the “theory of social impact.” Furthermore, only small variations in physical separation, such as moving several feet away, across the room, or just into the next room, were required to alter the patterns of most of these phenomena. They also cited other studies showing that “mere exposure” to another human being, without conversation, stimulated feelings of familiarity (citing Zajonc, 1968) and that even brief conversation with a former stranger stimulated collaboration on competitive tasks (citing Deutsch, 1958; and Kerr & Kaufman-Gilliland, 1994). Based on these studies and multiple replications, it seems reasonable to expect that electronically-linked collaborators remain sensitive and responsive to the co-
present others in their respective local worlds and, potentially, less responsive and sensitive to their non-present virtual collaborators.

Studies of communication and collaboration patterns among engineers (Allen, 1977) and research scientists (Kraut, Egido, & Galleger, 1990; Kraut et al., 2001) illustrate at least one consequence of these proximity effects in practice. In a study of research and development engineers in aerospace, academic, chemical, and computer organizations, Allen found that the likelihood that two engineers would speak at least once per week about work-related matters dropped dramatically from about 23% at a between-desk distance of around three meters to less than 5% at a distance of ten meters and then continued to decline more gradually beyond ten meters. Controlling for membership in the same organizational group, the frequency of communication increased but the pattern remained the same. For individuals in the same group, the likelihood that engineers within three meters would speak at least once per week was about 40% and for those whose desks were ten meters apart, the likelihood was about 12%.

Kraut and his colleagues (Kraut et al., 1990; Kraut et al., 2001) found a similar pattern among the research scientists in one organization where physical proximity of workspace proved to be a much stronger predictor of collaboration patterns than either “research similarity” or “organizational proximity.” Though nearly all the joint publications by the members of this group were written by researchers with related research interests (“research similarity”), “researchers with the most similar interests were more than four times as likely to publish together if their offices were on the same corridor as they are if their offices were on different floors of the same building” (p. 182), and those in the same department (“organizational proximity”) were “two-thirds more likely to collaborate if their offices were on the same corridor than if their offices were only on the same floor” (p. 183).
Summary
The cumulative message of these diverse literatures is that local influences on individual action
are over-determined. Culturally, politically, practically, and psychologically, individual action is
evoked, informed, enabled, and constrained by proximal customs, resources, relationships, and
emergent circumstances constituting the context of action. While supporting collaboration
among physically distributed workers, virtual work configurations also effectively relegate their
participants to work in contexts shaped predominantly by conditions and events unrelated to the
specific collaborative endeavor but influential for the participant. From this perspective, I reason
that virtual team members’ situation in their respective local work environments shapes their
individual work, communication, and participation practices with respect to the virtual team and,
consequently, the work, communication, and participation patterns observed at the team level,
even when these influences are not made explicit in team meetings or do not culminate in overt
conflict.

Conceptualizing context and action
Giddens’ (1984) structuration theory offers a useful lens for conceptualizing and analyzing the
relationship between social action and the social structures comprising the context in which the
action occurs. In structuration theory, Giddens poses a reciprocal, recursive relationship between
action and structure in which social structure serves the dual roles of both "medium and
outcome" of social activity, a relationship he refers to as the “duality of structure.” He
conceptualizes "structure" as the enacted "rules and resources recursively implicated in social
reproduction" (1984: p.xxxi). From this perspective, structure enables and constrains, but does
not dictate, actor behavior.
Complementing this perspective on social structure, Giddens suggests that social actors are "knowledgeable agents" who draw upon social structure, or the enacted rules and resources of the social context, to appropriately manage the myriad day-to-day activities, events, and circumstances comprising daily life, to "go on." Arguing against both strictly rational and strictly passive views of social agents, Giddens' introduces the notion of "practical consciousness" to describe how actors performing habituated, taken-for-granted behaviors nonetheless monitor their circumstances and behave with awareness of a complex constellation of rules, resource configurations, and relationships.

It is important to note, however, that in Giddens' view the "rules and resources" comprising the "structuring properties" of an actor's context reflect the actor's individual stock of experience as well as those held in common with others in her social world. So in responding to social situations, an actor draws upon both shared and unique stocks of experience, with respect to her fellow actors, increasing the probability of diverse responses to similar circumstances. It is this potential of the actor, in each action and interaction, to either replicate or deviate from the status quo, whether by conscious choice or by habituated action, that accounts for patterns of both stability and change emerging from the same social processes.

In contrast to the tendency in the social sciences to depict structure as a source of constraint on social action, Giddens (1984) emphasizes the simultaneous enabling and constraining nature of social structures. The same rules (e.g., norms, policies, regulations, expectations, job requirements, etc.) and resources (e.g., knowledge, space, time, people, power, money, equipment, experience, relationships, reputation, etc.) that socially and practically constrain behavior also make that behavior and its intended effects possible and intelligible to others in that context.
Extrapolating from these basic conceptions of social structure, social actors, and the relationship between them, it is possible to draw a number of corollaries. First, rules and resources simultaneously constrain some actions while enabling others. In addition, the actions enabled and constrained by a given set of socially-instantiated rules may change when the circumstances, or “resources,” change. Finally, social actions have implications for contexts beyond the one in which they emerged. Individual actions enabled and constrained in one context influence the rules and resources available for individual and collective action in another context, both enabling and constraining action in the second context. So with respect to the phenomenon of interest here, a virtual team member’s actions in his local context may both enable and constrain his or others’ individual and collective action in the virtual team.

My own working conceptualization of “context” is informed by Giddens’ notion of social structure as enacted rules and resources and includes the combination of the structures informing, enabling, and constraining social actors’ day-to-day actions. These would include the physical, organizational, temporal, cultural, relational, practical, and political structures comprising the fabric of their work lives. These ideas are woven into the text and revisited in chapter six where I abstract from the detailed descriptions of the group’s work and communication practices described in chapters four and five to consider the import of the members’ situation in particular local contexts for interpreting and theorizing about virtual teamwork.
Chapter Three

Studying Virtual Teamwork

Introduction

In many ways, ethnographers are like explorers...and the significant thing about explorers, as Bateson has suggested, is that you cannot know what you are exploring until you have explored it. (Schwartzman, 1993: 72)

The study of such an underexamined phenomenon as the influence of virtual team members’ embeddedness in discrete work contexts on the team-level work, communication, and participation patterns 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). In this chapter, I describe my methods, and the rationale behind them, and then introduce the team and each of the members’ respective organizational “homes” that, in combination, provided the “setting” for my study.

Methods

Participant Observation

The decision to approach the study as a participant-observer reflects a personal bias for in situ data as well as a judgment call that participant-observation offered the best way to explore unknown territory. I went to the field guided by an assumption that the members’ situated activities would somehow influence their participation in the virtual team and the patterns of activity that emerged among the team members but uncertain about what aspects of the members’ local contexts would prove important or why. Participant-observation allows the researcher to identify factors related to the focal phenomenon that would not, and could not, have
been anticipated based on the literature or abstract conceptualizations of the situation and to revise her strategy and tactics as she gains new understanding and obtains access to unanticipated data sources. Another reason for adopting a participant-observation approach is that the aspects of the members' work practices most central to understanding both their individual practice and their impact on others may be discursively unavailable (Barley & Kunda, 2001; Giddens, 1984; Suchman, 1987). Routines (Nelson & Winter, 1982), habituated practices (Giddens, 1984) and taken-for-granted aspects of the members' work worlds (Schein, 1992) central to an actor's repertoire for "getting on" with day-to-day activities, are typically absent from his conversation and may not be discursively available except in the course of performing the action (Barley & Kunda, 2001; Giddens, 1984; Lave, 1988; Suchman, 1987). Finally, participant-observation "brings the work back in" to organizational theory (Barley & Kunda, 2001), offering a "potential check" on "an overconceptualization of the workplace" (Van Maanen & Kolb, 1985) that threatens the relevance of some contemporary organization theory. The virtual teams literature is not immune to these tendencies. Normative models dominate the literature and serve as the reference point for interpreting team members' actions and evaluating team performance without clear justification of the models' validity. Through detailed examinations of the actual work practices of organizational members in situ, participant-observation provides an empirical grounding for theorizing about virtual teams.

Defining the "Field"

Though participant-observation seemed to be the appropriate methodology for exploring my questions about this new phenomenon, applying this approach to the study of a geographically-distributed group posed several challenges (Jordan, 1996; Marcus, 1995; Ruhleder, 2000) the
first of which was simply defining the field. Participant-observation calls for the researcher to
immerse herself in the world of those being studied, and an informal standard is to spend
approximately one year in the field, the “field” being defined by Van Maanen as “wherever work
is done” (1993: 223). Assuming work would be done both within the physical confines of
individual members’ workspaces and in collective forums, whether face-to-face or technology-
mediated, I defined the field to include the combination of these.

**Site Selection**

The AES team was an opportunistic choice. The project was funded, timed to begin after my
general exams, and the organizers were asking to be studied.\(^5\) In addition, the multi-
organizational membership offered greater potential for cross-site variation that I expected to
increase the range and variety of local activities influencing the members’ participation in the
virtual team.

**Site visit schedule**

Obviously, I could not be in all of the work sites simultaneously, so I had to develop a site visit
schedule. In practice, the schedule represented an ongoingly negotiated achievement guided by
several objectives but contingent a number of factors over which I had no control. First, I
wanted to stay long enough in each site during each visit to mitigate the novelty of my presence
and for my “outsider” status to become less salient. Secondly, I wanted to visit each site more
than once during different stages of the project, both before and after the midpoint (Gersick,

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\(^5\) The organizers of the AES project team initially understood the mandate of all Alliance-supported projects to be to engage interdisciplinary research teams. My study was to provide the social perspective in a team initially expected to include members of the architecture and civil engineering faculties engaged in the study of virtual work spaces.
1988) to minimize the risk of obtaining an impression distorted by the peculiarities of the project phase. For similar reasons, I wanted to visit each organization at different times in the calendar year so that no single annual cycle—such as holidays, budget allocation processes, or performance appraisals—unduly shaped my interpretations (Ancona & Chong, 1997). And finally, without compromising the other goals, I also wanted to schedule visits to each site to coincide with times when project activities would be at the forefront there. My travel budget, while generous, was not unlimited and was also a factor in the scheduling, requiring me to visit the four European sites in sequence to minimize costs.

After establishing a provisional schedule, the dates and duration of visits to particular sites were negotiated throughout the study. My objectives served as a guide but were not fully achieved. Several additional variables I had not anticipated also came into play. Participating sites of three of the five original organizations were themselves distributed—DeutschCar, AmeriChip, and EuroChip—increasing the number of sites to be visited to eight rather than the original four I had anticipated. As it turned out, I visited SuperU, AmeriCar, both DeutschCar and both AmeriChip sites but only one EuroChip facility bringing the total number of locations visited to seven of the eight charter sites.

The sites also varied in the number of people participating in the project, and I generally did not know the number until the day I arrived except in the case of the two single-member supplier sites. The members at those sites did notify me of their “solo” status about a month before my visit when I confirmed my travel plans. So the time spent at each site also varied in proportion to the number of people there to be observed and could not have been planned a priori because the participating organizations were still assembling their respective complements of participants at the time of the project kickoff.
Finally, a factor neither I nor the members anticipated was the reorganizations that occurred in each of the companies over the course of the study. In some cases these had no effect on my visit schedule, but in two cases they inhibited my access. In one case, my first site visit, scheduled a couple of months in advance, was to begin four days after the company announced a corporate-wide reorganization significantly affecting everyone I was to observe at one site. While this would have been an interesting time sociologically to be at the site, it was not practical for the participants to have a "visitor" nor politically appropriate to be "observed" at this time, so we deferred for several months. I was also unable to successfully negotiate a visit to the U.S. EuroChip site due to a reorganization there and shift in the relevant personnel. So using the initial goals as guides, accommodating the unexpected, and coordinating around holiday and individual members' schedules, 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. During the subsequent ten months, I participated in all electronic and face-to-face team meetings but did not observe the team members at their home sites.

Entry and Access

"Entry" into the AES Team began at the project proposal phase and continued in a series of negotiated steps as I visited each new site. At a pre-kickoff organizing meeting, I made a presentation proposing my project and describing my intention to use participant-observation methods. No one openly objected to my conducting the study, but one participant, initially excited by my prior experience working with teams, expressed frustration at my intention to observe and participate to the extent possible as a team member rather than as a consultant. He
begradually accepted my explanation of the validity concerns underlying my rationale for not taking on an advising or consulting role.

Each organization's participants had acquiesced, if not formally, by default, to give me access as a condition of participation in the AES project, but all fieldworkers know that formal and practical access are not one and the same. "Access" is always a matter of degree, ongoingly negotiated in one's relationships with each member of the group under study. At each site, the logistical aspects of entry included obtaining an office key, an identification badge or visitor pass, desk space, computer network access, maps of the facility, and occasionally some information about the community in which the facility was located. My initial contact generally asked me, or I offered, to give a brief explanation of my study to the relevant work group and managers and explain what I would be doing during my stay. My standard explanation began by telling them I was studying how geographically-distributed people worked together using technology, that my hunch was that the day-to-day activities in each person's particular work world would somehow affect the way he or she participated in a virtual project, and that I wanted to better understand the relationship between these local factors and what happened in the virtual team. Then I explained that to get good data, I needed to see and participate in the daily routines and prepared them to expect me to take notes about things they would consider mundane. I described my plan to "shadow" each member, though I usually suggested a minimum of a half day and, preferably, a full work day at a time, but I left it open to the members when and for how long I would observe each of them. With the exception of one faculty member at SuperU and one manager at DeutschCar, all the participants agreed to be shadowed.

Gaining "backstage" (Goffman, 1959; Kunda, 1992) access to the day-to-day activities comprising the members' work days proved more challenging, with the challenges varying from
one site to another. In most cases, the participants initially expressed skepticism that I would find them or their work “interesting.” Over time, they seemed to relax, giving me increasing access to their activities, correspondence, off-the-record thoughts and feelings about their jobs and the project. At each site, one or two members eventually emerged as primary informants. In addition to being observed and interviewed, these members also served as organization and work group historians and were often instrumental in my being included in key meetings.

Key to this expanding access was my promise and demonstrated commitment to keep everything I saw and heard confidential, within as well as across sites. With regard to their own actions and comments, people I spoke with would occasionally tell me they intended a remark to be “off the record” to which I responded by obviously not taking notes. Periodically, someone would double-check with me that our conversation was confidential before proceeding with their remarks, and as often as seemed necessary, I reassured them that I would not share information across people or across sites. The members’ occasional innocent queries about the other sites—How many people do they have working on this? Do you know if they’ve done this yet? Do you think Bill knows about this?—offered opportunities to demonstrate commitment to my promise. To such questions, I usually responded with a humorous remark to the effect that it seemed interesting that they did not know these things about one another and suggesting that if they needed to know, they should ask the members at the other sites. Their reassurances to coworkers outside the project regarding my trustworthiness suggest they took me at my word: “It’s okay. She won’t say anything.” I also made a practice of asking before I took any written documents or made copies of any company materials, but the request was always granted though the granter would sometimes remind me that a document should not be shared with the partners or request
that some information, like project code numbers or names, be covered or removed before taking
the document out of the building.

**Data Collection**

Studying the influence of virtual team members’ embeddedness in their respective local contexts
on observed patterns in a virtual team necessarily calls for the study of both the patterns of
collaborative interaction at the team level and the members’ respective local worlds. The study
relies primarily on participant-observation data collected over thirteen months of full-time field
work, four to six days per week in the seven sites mentioned earlier, followed by ten months of
participant-observation in monthly (and sometimes more frequent) virtual and face-to-face team
meetings. This section describes my roles and data collection methods in each setting in more
detail.

**"Participant" Roles**

A key aspect of conducting “participant-observation” research is participating in the activities of
the people under study (Wolcott, 1982) to enhance the richness of interactions with group
members by embedding them in the fabric of day-to-day activities, but finding a “culturally
meaningful” role (Van Maanen & Kolb, 1985) that allows the researcher to fit into that fabric is a
strategic choice with implications for the ongoing negotiation of access to informants and events.
“Selection” creates the illusion of an *a priori*, rational plan for the role one will play and how to
play it. In practice, my roles were emergent and decided as much (or more) by the study
participants as by myself.
The decision to visit each site more than once in order to be present during different stages of the project and at different times of the calendar year meant relatively short stays\(^{6}\) at any single site with longer periods between visits while observing at the other sites. This schedule, combined with the technical nature of the participants' work for which I lacked the appropriate education, precluded the role of "apprentice" \((ibid)\) often helpful for situating the researcher in the midst of key activities, providing access to "masters," and legitimizing her endless questions. Capitalizing on what I could contribute, during my introduction at each site, I told the engineers I would like to participate in any way that would be helpful and encouraged them to assign me tasks, suggesting faxing, photocopying, errands, literature searches, or basic manual labor that required an extra set of hands as possible tasks I was able and willing to perform. Besides saving the engineers' time as a small compensation for their time spent explaining things to me, I anticipated that these activities would also help to make me aware of activities, relationships, and procedures that they might not otherwise think to mention to me. The responses at each site varied as did my roles.

The members at AmeriCar, having been sensitized to various forms of gender discrimination by company "diversity" programs, were initially uncomfortable asking me to do clerical work but, over time, accepted my offers as "tokens of my appreciation" for their time spent helping me. I was periodically allowed to fetch packages, photocopy, carry equipment, paint varnish on electrical wiring, and accompany members on errands. As hoped, these activities took me to different parts of the building and different locations on the campus than the team members would have otherwise thought to show or tell me about. Many of the tasks such as accompanying members on errands gave me opportunities to talk with them in a variety of, often

\(^{6}\) "Short" is a relative term and is used here to contrast my visit schedule with the traditional anthropological model of 1-2 years in a single site.
more private, settings and provided opportunities to see how the members interacted with others in the organization outside the focal group.

In contrast, the faculty members at SuperU readily embraced my offer and gave me an assignment originally slated for an undergraduate engineering student but deemed too boring and of too limited duration for a student project. The original task was a token review of a dozen or so papers regarding the “shock hazard” posed to humans exposed to electrical current at the voltage levels being considered in the group’s electrical system design. However, when I discovered discrepancies in the recommended safety levels in the assigned papers, the project escalated to a larger-scale literature review taking advantage of my background as a cardiac nurse and culminating in two oral presentations at Consortium meetings, a written report, and an annotated bibliography of the papers reviewed. The SuperU members noted the paper in their annual report of “accomplishments” to their funders.

Participating at DeutschCar was a bit trickier due to my less-than-elementary command of the German language. However, the DeutschCar members had none of the reservations regarding my gender that had inhibited the AmeriCar participants and were happy to let me fax, photocopy, fetch, relay messages, and other similarly instrumental activities. In addition, they also asked for my help with English composing documents or translating presentations. For instance, I wrote the original draft of a letter for one manager recommending an American university student for a job in the U.S.

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 automaker and university locations 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. The members’ geographic dispersion
also meant that they spent the majority of many days reading and responding to email and talking on the telephone, activities with which I could be of little assistance.

In each of these roles, I tried to maintain a spirit of “helpfulness” (Schein, 1999) and adopt a stance of “reciprocal vulnerability” (Segal, 2001). By this, I mean that I assumed an affirming, rather than evaluative, perspective toward all the participants. In response to their justifying explanations or seeming embarrassment regarding apparently illogical or inefficient actions, I offered reassurance that I believed they were doing what needed to be done within the context and occasionally related examples from my own prior work experience in which I had encountered similar circumstances. These were reflexive actions rooted in my prior professional training as a nurse, not intended as manipulations, but key, nonetheless, I believe, to the members’ openness with me. Consequently, in each site I carved out not only a functional role for myself but also, inadvertently, a persona adapted to the interests, concerns, and perspectives of the members at that site. One of the challenges of doing single-researcher multi-sited ethnography, I discovered, is managing these multiple personae, a challenge intensified when the team met face-to-face and my personae converged!

During the last ten months of the study, my participation in the team more closely resembled that of the members. I attended all team meetings, whether face-to-face or technology-mediated, but then worked independently from my home or office, interacting with and informally interviewing team members via telephone and email. In effect, I became my own laboratory, losing the direct access to the members’ local contexts but gaining the perspective and experience of interacting with the members via technology without the benefit of the information and perceptions available on-site that characterized much of the members’ work together.
Shadowing

I conducted two rounds of observation during the first year, corresponding to the first and second sets of site visits. In both rounds I took detailed notes on sequences of activities, patterns of interaction, and reactions to day-to-day events (among other things), but my focus and purpose in each round differed. In the first set of visits, I endeavored to develop a physical, organizational, and cultural sketch of each site, and so in my interviews and observations, I included organizational members and subgroups beyond the focal group. In the second round, I focused more narrowly on the people and activities most directly related to the AES Team project.

Shadowing, as I practiced it, involved placing myself in the engineer’s workspace so that I could see his 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 work day. 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 work 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 wrapped up 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.

7 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.
When observing, I took notes on a legal pad or in a spiral notebook, common note-taking media among the natives, but I was nonetheless conspicuous for actually writing on my pad. Though the engineers generally bring a legal pad to all project-related meetings, they often leave a one- to three-hour-long meeting with a clean page unless they personally receive a new assignment or make a promise to meet a new deadline which they document as a single-line “bullet” point, i.e., “March 5.” An engineer from a group unrelated to the AES team who chaired a meeting I frequently attended with one of the team members stopped me one day after the meeting to ask about my project saying, “I thought you must be doing something with psychology or sociology because you write when everyone else doesn’t.” This conversation served as an early reminder that the observer is always herself being observed (Barley, 1984; Schwartzman, 1993)

Though I began by shadowing individuals, I anticipated that as I became more familiar with both the content and the process of the work, I would be able to place myself strategically to observe group interactions. In fact, I did try on a few occasions to “hang out” without attaching myself to any specific person or to work at my own desk for a day while remaining alert to emerging events, ready to participate as they occurred, but the nature of the engineers’ work combined with the physical arrangement of the workspaces rendered this less-structured approach ineffective in several settings. For the most part, the engineers’ work involved parallel independent tasks, and the physical arrangement of several sites meant that independent work was also performed in relative isolation from the other team members, so it was necessary to be with each person to see the work occur. In addition, though members would occasionally agree on a meeting time to discuss some topic, most collaboration occurred spontaneously and sporadically via telephone, email, or in person if the people were collocated. Shadowing
individuals ensured that I was present to at least some of these spontaneous interactions. In addition, when I was not attached to a specific person, attempts to include myself in these chance encounters came across as intrusive. For instance, when I approached an informal conversation in progress, the engineers would stop talking or appear stiff, and then, recovering, would make a joke about my “spying.”

In a couple of cases where coworkers desks were situated in near enough proximity that I could observe an area within which two or more people worked, I would do so and ask to accompany the occupants when one of them would leave the area to talk with other coworkers. This allowed observation on the group or subgroup level during the parallel, largely independent portions of the work and offered some respite to the engineers who, no doubt, tired of the relentlessness of one-on-one attention.

Concurrent with my observation of individuals working within their respective sites, I also observed all of the team meetings and audio-taped all meetings after the kick-off with one exception when my equipment failed. In exchange for permission to tape the meetings, I agreed to write the first draft of the meeting minutes from November 1997 through January 1999 after which the Administrative Project Leader took over the task. Poor room acoustics and excessive background noise made the tapes of three meetings almost unusable. Otherwise, I reviewed the tapes of the remaining 19 meetings, ranging from one to eight hours in length, and made notes on the content and interaction patterns.

**Interviews**
In the first round, the semi-structured interviews were used to elicit demographic and work history data that were not easily worked into the flow of conversation during the observation
periods. I also queried members about their first exposure to the project, what they had been
told, with which other team members they had had contact, what they believed to be the goal(s)
of the project, and their own role in it. Discussing the focal project offered entrée into more
general discussions of the typical ways projects came about in their organization and what types
of projects members considered to be “good” and “bad” as a reference point for interpreting their
perceptions of the AES project. I also used the interview as an opportunity to clarify my
understanding of the previous days’ observations. In addition to interviewing the members of
the team, I also interviewed people at least one level up and one level down the hierarchy from
those participating in the project as well as peers of both the manager and engineers from a
different, but hierarchically equivalent, group within the same department when these individuals
were accessible.

In the second round, my goal was to develop a more complete and detailed picture of the
cross-organizational project team itself. I followed a similar schedule of shadowing and
interviewing except that I focused only on those members considered to be direct participants in
the project team with a couple of exceptions. In one site, two engineers were key to the site-
based group and had a close relationship with the participating AES team member from their
site, but they did not participate themselves. I shadowed and interviewed them to obtain an
additional perspective on that site and the organization. In another site, I interviewed and
shadowed a former AES Team member when he was in the process of leaving the team to take
another job within the company. He had been his company’s primary contact for the team for a
year and was the only person in his organization to whom I had access who knew the story of his
organization’s entry into the project.
In the second-round interviews, I used examples of activities I had observed each engineer perform as a springboard for asking him to help me develop a more complete picture of his work to gain a more accurate sense of the scope of each participant's work than was available through intermittent observation because of the periodicity of project work. In these discussions, I probed for information about the range of activities performed and the types of collaborative experiences considered "routine" as bases for comparison with the focal project. Their responses to these questions usually provided opportunities to discuss other collaborative efforts that had gone well or poorly and their beliefs about why things had worked out as they did, surfacing ideas and beliefs about collaboration, distance, communication, and technology that had not previously been discussed, again, as a backdrop for interpreting reactions to the AES project.

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.

**Technology-mediated communication**

Theoretically, my definition of the "field" included telephone and electronic mail correspondence between members and the team's use of their Web site. While I had free access to the team Web site and was included on the team email distribution list, the team used these media primarily for their more formal communication such as meeting announcements, meeting minutes, and document archiving. Outside these two channels, there was no common email system or server and no technology in place to log or archive the electronic exchanges. So I
depended on the members' good will and memory to "cc:" me on their project-related messages. No one refused to do so, and several members were very consistent, but the messages I received tended to be from members at the site I was visiting at the time. Some members kept their own private archives of messages they considered important and shared at least portions of these with me, supplementing the messages I received at the time of their original transmission. Nonetheless, my archive of the email messages exchanged between members is partial.

Telephone interactions proved even more elusive. Members were much too busy to keep records of their calls and no automatic documentation system was in place in any of the organizations. I do have notes about calls that each member either received or placed when I was observing him, and sometimes these were made on the speaker phone to give me access to the entire conversation. In addition, I asked staff-level members and one particularly agreeable manager to keep a three-day log of their interactions which most did, if grudgingly. This provided some indication of whether, when, and how often members' communication focused on the team project and with whom they were interacting. While having only partial records of members' email and phone exchanges limits my awareness of the step-by-step unfolding of every event and decision, it provides a more realistic experience of membership in this team where most communication was point-to-point and documented primarily in personal archives rather than group repositories.

**Staying connected**

As a supplement to my on-site observations, I corresponded by email with key informants at each location between site visits. In these messages, they offered substantive updates on the progress of their own contributions to the project and occasional notes about organizational and personnel changes. In addition, in these exchanges I queried them regarding their perception of
and reaction to particular aspects of a meeting or inquired about behind-the-scenes activity in automaker-supplier pairs that could not be revealed in the meeting. Though inferior to the first-order data obtained via observation, these updates helped me maintain a sense of the project and group as a whole while immersed in a single site.

In all, my data set includes 3000-plus pages of fieldnotes, a partial archive of the members’ electronic mail messages; notes on and audiorecordings of 22 team meetings; 80 semi-structured and unstructured (but scheduled) interviews; plus a variety of forms, examples of internal communication at each site, and copies of in-house communiqués gathered along the way.

Data analysis

My methods for analyzing the data draw upon the principles and spirit of grounded theory (Strauss & Corbin, 1990) but did not employ all of the techniques associated with that method nor use the techniques in the exact manner they are prescribed. While in the field, I wrote analytic notes and memos of varying length that informed my ongoing fieldwork, then after returning from full-time fieldwork, I began a comprehensive review of my observation notes and interview tapes between team meetings. The comprehensive review began with several readings of my notes, changing the order in which I read them to increase the probability of seeing patterns at different levels of analysis that might not have been as readily visible in one reading as in another. First, I read the entire corpus of notes and reviewed the team meeting audiotapes chronologically. Then I regrouped the notes by organization, separating out the team meeting notes and team-level email exchanges into a separate group, and then read each group of notes chronologically. Along the way, I stopped to write descriptive and analytic memos or to group
excerpts of my notes into thematic categories or classes of examples. This often occurred midway in a reading, so the remainder of the reading served to substantiate, refine, and refute the ideas developed in the memos or the labels assigned to the classes of examples. Included in these writings were lengthy descriptions of each site including the people, organization, activities, and orienting issues characterizing day-to-day life there, and a chronology of the team as a collective to capture my "head notes," or those images and understandings held in memory but not yet committed to the page, before my memory faded.

Along the way, as 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 reviewed another set of notes to see if I found what I expected. In several cases I had hunches that I still believe to be accurate but did not find enough additional data to make the claim with confidence.

I employed a number of other checks on the accuracy of my interpretations involving members of the team and other people in the industry I met through Consortium meetings but who were not members of the team. I took advantage of opportunities at six multi-day Consortium meetings, TechExpo, the conference where the team presented their first paper, and two professional education seminars to talk with engineers from organizations outside the team to check my interpretations of industry and occupational norms, interorganizational dynamics, and the commonality of the patterns I was observing within the team. I also asked key informants

8 The categories used in the taxonomy presented in chapter six differ substantially from the categories employed during these initial readings. Nonetheless, these initial groupings provided a new perspective for seeing commonalities and differences across sites and laying the foundation for the later analysis.

9 "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.
at three of the five charter organizations to read early drafts of chapters and give me feedback regarding the accuracy of my account and interpretations. We discussed differences of interpretation, and in cases where I had multiple pieces of data gathered at different points in time to substantiate my original interpretation, I left the text intact. Where a difference of interpretation could not be resolved, I have noted the ambiguity either in the text or footnotes or removed the example.

Despite these efforts at accuracy and completeness, the study is based on an inherently partial view of each site and the project overall. As one observer studying multiple sites,\textsuperscript{10} I gained a more comprehensive view of the project than most of the team members but a more limited perspective of each organization than its natives. Still, I believe that these methods provided a reasonable balance between the team-level and site-level perspectives to support the development of inferences about the relationship between virtual team members' situation in their respective work settings and their participation in the virtual team.

**Field Sites and Members**

The charter organizations where I conducted my fieldwork were similar in that each of them was well-known and well-regarded locally, nationally, and internationally. Each organization was a significant employer in its region and important to its local economy, and all of the participating industrial organizations had multiple manufacturing and research and development locations scattered around the world in both industrialized and emerging nations. The seven sites

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\textsuperscript{10} See Ruhleder (2000) regarding challenges, limitations, and options for studying distributed work environments and Marcus (1995) for a more abstract discussion of the epistemological and methodological concerns in doing "multi-sited ethnography."
Sites and Membership—Year 1

SuperU-AmeriCar

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University Administration
- SuperU
  - Frank
  - Don
  - Ken
  - Brad
  - Students

AmeriCar Management
- AmeriCar
  - Lloyd
  - Bill
  - Richard
  - Kevin
  - 3 PT Engr
  - 2 Tech
  - Dean

DC MGMT
- DeutschCar
  - North
    - Siegfried
    - Sebastian
    - Juergen

AmeriChip MGMT
- DeutschCar
  - South
    - Reinhart

- AmeriChip
  - U.S.—West
    - Rodney
  - U.S.—North
    - Charles

EuroChip MGMT
- EuroChip
  - U.S.
    - Jeremiah
  - Germany
    - Robert

Figure 3.1
Sites and Membership—Year 2

Figure 3.2
I visited were all located in, or in very close proximity to, urban centers in the United States and Germany. Throughout the study, participation in team meetings varied, but Figures 3.1 and 3.2 show the distribution of “core” members across the participating sites during the first and second years. My fieldwork was limited to seven of the charter sites for the reasons explained earlier, so following are descriptions of those sites and their members. The organizations that joined the team during the second year are shown in Figure 3.2 to illustrate the growth and change in the team over the course of the study, but I did not visit these sites and so will refer to them only occasionally, if at all, in subsequent chapters.

All of the team members mentioned in the descriptions below were quite computer literate, often writing their own programs in more than one computer language, and used email and the Internet routinely in their work. All of the members had previously participated in collaborative projects with other organizations. For the industry members, these typically involved a single automaker and a single supplier and relied primarily on face-to-face meetings with supplementary information and data exchange between meetings by email. The academic members had more experience participating in multi-organizational groups, but these operated similarly to the industrial collaborations and relied largely on face-to-face meetings. Though collaborators periodically used audio and video-conferencing, the members did not consider any of their prior experience to constitute “virtual engineering.” Rather the team members defined virtual engineering as conducting the interactions and activities that normally take place in face-to-face meetings via computer instead.

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11 The definition of “core” members is complicated in the face of fluid membership and variable participation. Nevertheless, I identified as core those members known to one another through repeated meeting participation and perceived by me and other team members to be someone who, if asked, would know what was going on in his organization with respect to the AES Team.
In the next few pages I introduce each of the sites and their members. Though I do not yet go
into detail regarding the aspects of the members’ local environments influencing their
participation in the AES Team, these descriptions serve as a starting point for recognizing the
team members’ embeddedness in particular work situations in particular organizations and in
relationship to others in their organizations.

AmeriCar
AmeriCar, one of the U.S. “Big Three” automotive companies, is headquartered in the “Detroit
area,” a region of 50-70 mile radius around the urban center also known as “Motor City,” or
“home” to the U.S. Big Three and key offices of many of their suppliers. The participating
members from AmeriCar worked out of SciLab, AmeriCar’s research center also known among
the other divisions of AmeriCar as the “country club.” Indeed, the facility is housed in one of the
newer buildings on a sprawling, partially wooded campus near the company headquarters and
equipped with new furnishings and top-of-the-line computers envied by other departments.
Though sheltered from layoffs in previous reorganizations, during the time of my study, pressure
was developing to work on projects with nearer-term market potential.

When the project began, the AmeriCar group consisted of nine members—a manager, a
supervisor or “Group Leader,” five staff engineers, including one member with relevant work
experience “borrowed” from another group and two technicians—listed hierarchically by name
in Figure 3.1. The group was educationally and ethnically diverse. The manager, supervisor,
and one staff engineer held PhDs in either electrical engineering or physics, one member had a
master’s degree in electrical engineering, and one member had an MBA. Five of the nine were
foreign-born and spoke English as a second language though four of these five were educated in
the U.S., and all of them had lived in the U.S. for more than five years. Dean, the member whose name is shaded in Figure 3.1, joined the group mid-way through the first year on “special assignment” as the Technical Project Leader for the AES Team and coordinator of AES technology research within AmeriCar from his former management role in an internal electronic components group. The shading indicates his later entry into the team.

Though the members ranged in tenure with the company from five to twenty-plus years, and the staff engineers, with the exception of Dean, had all worked for Bill, the supervisor, for at least five years, the group was newly organized to focus primarily on the AES project immediately following the team kickoff meeting in October 1997. Two of the members had been collecting data informally on AES technology for about two years prior to the project start, and the Lloyd, the manager, Bill, the group leader, and Richard, a staff engineer and initial team leader, had been participating in the Consortium for about the same length of time. To the other members, though, standards for AES technology represented a relatively new concept and certainly a new assignment.

DeutschCar

DeutschCar is one of four German “luxury car” manufacturers, in contrast to AmeriCar’s role in the industry as primarily a “volume producer” of large numbers of moderately-priced vehicles. However, as both companies expanded their product lines, these distinctions blurred, and they increasingly regarded one another as competitors.

The DeutschCar members participating in the project called from two physical locations and two different stages of the technology development process reporting up two different chains in
the hierarchy. DeutschCar North (DCN) was one of the several recently-acquired (1992) research facilities, formerly owned by another company, that comprised DeutschCar’s research division. DeutschCar South (DCS), located approximately two hours away by autobahn, was home of the Advanced Technology division and was situated near the company’s headquarters and oldest manufacturing facilities. DCN’s research spanned the entire transportation sector including planes, trains, and automobiles, while DCS focused only on automobiles, the company’s flagship product. These differences in group origin, industry affiliation, and location contributed to status differentials between the sites and a sense of ongoing antagonism often battled out in the budget process and other political maneuvers rather than in words.

At the beginning of the study, the DCS group was housed in temporary quarters on the edge of a residential area in a historic suburb of a major urban center, but during the second year, the group moved to permanent facilities closer to a large production facility but farther from DCN. The DCS members participating in the AES Team spanned three levels of hierarchy and involved Siegfried, the Electrical Systems Director in the Advanced Technology group; Sebastian, the Team Leader who held a PhD in electrical engineering; and Juergen, a senior staff engineer, formerly the Team Leader. All of the members were natives of Germany but conversant, with differing degrees of fluency, in English.

Though these members’ organizational tenure averaged around twenty years and work on advanced electrical systems for cars had been going on in the company for several years, the

12 There is no set or consistent threshold for declaring things “old” versus “new,” or “recent” versus in the long ago past, and the use of these terms certainly varies with respect to the phenomenon being described. Nonetheless, in the automotive world with inter-organizational relationships dating back several decades and members boasting 40+ year tenures either with a single company or with the industry, serially employed by several firms, organizational events within the previous ten years are often referred to as “recent.”
13 DCS’s move to their permanent facilities occurred after the completion of my site visits, so all of my observations are based on their situation in the temporary quarters, where they had been for several years, two hours from DCN.
particular work group to which these members belonged was only in the process of forming when the AES Team project began. The members had known one another but had not worked together in this particular configuration.

The DeutschCar North (DCN) facility was one of a handful of “post-war” style white and gray “modern” (as opposed to traditional) two-story buildings on a wire-fenced campus in a suburb called a *Burostadt*, or “office town,” where the street signs offer directions to corporate offices. At DCN, the relevant work group developing AES technologies internally consisted of four members spanning three levels of hierarchy—a lab manager and two staff engineers with project management responsibilities, all of whom held PhDs, and a staff engineer. Of this group, only the lab manager, Reinhart, considered himself a member of the AES Team. A native German educated primarily in Germany, he had spent almost two years in the U.S. acquiring his masters’ degree and spoke fluent English. Though his participation in the AES Team and Consortium represented somewhat “extracurricular” activities he took on at the invitation of one of the SuperU faculty, he had been involved in AES technology development behind the scenes for several years.

**SuperU**

Located in the heart of an American city, SuperU ranks consistently in the top ten for engineering schools overall and for electrical engineering in particular. Among the project members, the SuperU participants were seen as “neutral” parties who could be trusted to guard sensitive organizational information and not to carry a competitive bias for any particular technology configuration.
The SuperU members participating in the AES Team worked out of the Electrical Systems Laboratory (ESL), a conglomerate of faculty-led groups who share lab space and are supported by a combination of industrial and governmental sources. At the beginning of the project, five people representing five levels of hierarchy either directly or indirectly participated in the AES Team. These included two faculty members, Frank, the lab (and Consortium) director, and Don, the Consortium co-director, a former SuperU graduate on sabbatical from his industry position; Brad, a post-doc (also a SuperU graduate); a doctoral student, and a new masters’ program student. The faculty members, post-doc, and one of the students had been involved in the Consortium since its informal inception almost three years prior to the AES Team kickoff. All the participants except the doctoral student were Americans, and the doctoral student had been in the U.S. since he was a small child, so all were fluent in English but not in German.

In addition to these primary players, there was an ever-changing complement of students who contributed to the physical completion of the work: undergraduate students looking for work experience, masters-level students looking for a thesis topic, others looking for funding, and high school students during the summer months. While the primary members’ participation in the project presented a consistent face to their partners, their own work context was characterized by almost continuous flux.

AmeriChip

AmeriChip, an American semiconductor ("chip") manufacturer, was consistently perceived by the industry members I spoke with as "one of the top three" producers in most of their product markets. They produce a range of products from "raw" semiconductors, or silicon chips not yet customized to perform a specific function, to "modules," or combinations of customized
semiconductors designed for particular consumer and manufacturing applications. After a several year cycle of growth in electronics technologies, the semiconductor business was in the midst of a "slump," or deceleration of growth, when the project began that worsened over the course of the first year. In addition, AmeriChip itself was in the midst of a series of reorganizations and executive transitions, some related to the industry turbulence and some simply coincidental.

Accordingly, the AES Team participants representing AmeriChip changed significantly over the course of the study, often from one meeting to the next. As indicated in Figures 3.1 and 3.2, the AmeriChip participants were distributed over several locations, but I only visited two sites, one in the U.S. and one in Germany. The U.S. location represented the original headquarters of the participating division where Rodney, the engineer who functioned as the AES Team's primary contact for AmeriChip, worked. Recently unseated from its long-time position as division headquarters, the U.S. AmeriChip location I visited is still a major development and production center for the company. Sprawling brick buildings linked by internal walkways house research, design, development, and testing facilities in addition to marketing, communications, and other administrative functions.

At the outset, Rodney was the only known AmeriChip member. Though an engineer by training, he was a marketer by choice and had not himself been involved in AES technology development prior to this project. He saw himself acting as a coordinator and information dispatcher between the project team and some undefined cadre of people inside his division for whom he thought the information would be relevant, such as the engineer I observed in Germany who worked more directly with customers developing AES systems.
The German site I visited consisted of one four-story building, similar in construction to the post-war DCN facility, located on the outskirts of an urban center. Pierre, the single participant here was a “systems engineer,” a liaison between customers and the “development engineers” scattered around the globe working on a variety of technologies for several industries. He was informally recognized as a key contact in this division regarding AES technology and regularly received messages related to AES technology development forwarded by people throughout the company from around the globe. He became known to several AES Team members through his presentations at the Consortium, and he was in frequent contact with the U.S. AmeriChip member, but he did not participate in an AES Team meeting until the eleventh month. Though native to Germany, he was also fluent in English and French.

The member from the U.S. North site joined the team at the January 1998 meeting, but it was not clear that he was or would be a regular team member until after my site visit schedule had been filled and my travel budget exhausted, so I did not visit his location.

EuroChip
EuroChip and AmeriChip are direct competitors in many markets, yet they are also one another’s customers and suppliers for other products. In the same markets where AmeriChip is considered number one, two, or three, EuroChip generally fills one of the other slots. Facing similar market challenges as AmeriChip, EuroChip members described their organization as “lean” to the point of being understaffed.

EuroChip’s participation in the project during the first year was similar to AmeriChip’s in that Jeremiah, the team’s primary contact person for the organization was originally the only known participant and served as an information conduit for his unidentified coworkers. Due to a
combination of scheduling conflicts and, eventually, Jeremiah’s reassignment, I did not visit his facility. Based in the U.S., Jeremiah forwarded electronic project correspondence to Robert, the company’s European-based AES Coordinator, whom I did visit.

Robert was an engineer responsible for managing the interdependent development efforts of approximately a dozen subgroups. He was the designated center of AES activity for the company’s automotive division, a group that made pre-assembled modules customized for automobiles. He had only been in that role and at his site in a new building for three months at the time of my first visit. Though collocated with his boss and two coworkers, he worked primarily with at least a dozen geographically-dispersed subgroups plus some unnumbered assortment of customers and suppliers by telephone, videoconference, email and fax, so he was quite familiar with the technologies of distributed collaboration. A native Frenchman, he was also fluent in English and learning German to work more effectively with key customers.

Table 3.1 summarizes these attributes of the AES Team charter members at the seven sites I visited.
Table 3.1 Summary Team Member Profiles

<table>
<thead>
<tr>
<th>Attribute</th>
<th>AmeriCar North</th>
<th>DCar South</th>
<th>SuperU</th>
<th>AmeriChip U.S.</th>
<th>AmeriChip Europe</th>
<th>EuroChip Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td># of members</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Organizational roles</td>
<td>Manager Group Ldr Team Ldr Staff Engr. Technician</td>
<td>Manager Team Ldr Staff Engr.</td>
<td>Faculty Post-doc Students</td>
<td>Manager/ writer</td>
<td>Systems engr/ customer liaison</td>
<td>AES Dev coordinator</td>
</tr>
<tr>
<td>Education</td>
<td>PhD phys. PhD EE MS EE BS EE</td>
<td>PhD EE BS EE* PhD EE PhD EE BS EE*</td>
<td>PhD EE PhD EE PhD Cand</td>
<td>BS EE</td>
<td>BS EE*</td>
<td>BS EE*</td>
</tr>
<tr>
<td>Experience with AES</td>
<td>Years to none</td>
<td>Several years</td>
<td>Several years</td>
<td>Several years*</td>
<td>Awareness</td>
<td>- One year</td>
</tr>
</tbody>
</table>

* A baccalaureate engineering degree from a European university was generally considered to be the equivalent of a bachelor's plus a master's degree in the U.S.

** With the exception of the newest student.

Despite the variations in organizational location, configuration, and product portfolio, the charter organizations were similar in that each was bureaucratically organized with a clearly defined, and easily identifiable, hierarchy. Despite trials with a variety of structural and relational arrangements, such as “matrix management” or “liaison” roles, to overcome the limitations of this organizational form for inter-unit collaboration, actions and relationships within the organizations were consistently informed by one’s and others’ respective positions in the hierarchy.

Figures 3.1 and 3.2 hint at the implications of this aspect of the members’ situation for virtual teamwork. In addition to their physical and cultural distribution, the members’ situation in separate work sites, each with its own management structure, also entailed a political distribution in that each member was responsible, first and foremost, to his own manager and for his own organization’s output. In addition, the AmeriCar and SuperU members were separately and
collectively accountable to the Alliance administration. The orientation of the AES Team members' toward their respective local hierarchies emerged as a central theme in the study. The data and descriptions in the following two chapters illustrate the implications of this orientation for interpreting the patterns observed in the AES Team.

Summary

These brief portraits of the participating sites and members offer glimpses of some of the organizational and member similarities and differences across and within the participating organizations shaping the members' respective work contexts. To understand how these and other aspects of the members' contexts influenced their participation in the AES Team, however, we must see the members in action, interacting with local others and drawing upon the rules and resources available to them to enact their daily work lives. In the next chapter, I venture into the members' work worlds and describe how the members' actions in and interactions with the people and circumstances in their local worlds shaped their participation in the AES Team during the team's first year of work.
Chapter Four

Year 1: Local Contexts as Barriers, Limits, and Distractions

Introduction

The members’ situation in their respective local work contexts influenced nearly every facet of their participation in the AES team, from their original agreement to participate, to their access to project-related information, prioritization of project-related tasks, and execution of those tasks. In this chapter and the next, I use examples from each of the charter organizations to illustrate the ways I observed the members’ work contexts enabling and constraining their participation in the AES Team. The examples provided here offer some insight into the nature of Cramton’s “hidden profiles,” or “unrecognized differences in the situations, contexts, and constraints of dispersed collaborators” and how they influence virtual teamwork.

As I mentioned in the first chapter, the members’ work, communication, and participation patterns differed significantly between the first and second years of their work together. In this chapter, I describe the aspects of the members’ local work worlds influencing, and predominantly constraining, their participation during the first year. To organize the data, I have adapted and elaborated upon Buchanan et al.’s (1988) playful descriptors of the stages of the ethnographic research process—“Getting In, Getting On, Getting Out, And Getting Back”—using labels that correspond both to chronological stages of the members’ participation in the project and with key aspects of the work to show how the members’ local contexts influenced every aspect of their participation in the AES Team.

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In Getting In, I describe the local considerations informing the members’ decisions to participate in the team. Then in Getting On and Getting the Word Around, I show how the members integrated AES Team project-related tasks and communication into their local work and communication routines, respectively, and the implications of this intermingling for the accomplishment of the virtual team’s work. Getting the Work Out describes examples of the members’ work on specific team tasks to illustrate the team members’ use of and dependence upon local resources to accomplish team-related work and the implications of this dependence for the virtual collective. In Getting Attention, I show how events and conditions in the members’ respective local work worlds compete for and shape the members’ allocation of time and attention, and in Getting Together, I describe the extra-team and intra-team influences that facilitated the team’s work, acting as a counterbalance to the predominantly constraining local influences experienced during this first year. Finally, in Getting Out, I describe the local bases for several members’ exit from the team buttressing my argument throughout that the team, a contradiction of the normative model of members entering and leaving the team in response to team task and knowledge needs.

Getting In: Joining the AES Team

The AES Team members’ heuristics for deciding to participate in the project team reveal their primary concern for local, as opposed to team, matters from the project’s outset. Though all the project participants agreed that the establishment of an international standard for the new AES technology was a worthy goal and key to the cost-effective implementation of the new system, the opportunity to contribute to the development of AES standards did not motivate the participants (or their managers) to join the team. Instead, the formation of the team and
individual members' agreements to participate hinged primarily on the potential latent benefits of participation for achieving local aims, and only secondarily, if at all, on concern for an international standard. In some cases, the members acted as good soldiers, complying with organizational requests or directives, while other members joined the team as opportunists, seeing the AES team as a means to other ends.

The formation of the team reflects both the enabling and constraining effects of local contextual influences on the AES Team. On the one hand, local considerations prompted the members to join the team, and on the other, perceptions of the project and commitments to prior projects moderated member investment in the team.

**Background**

The original impetus for the AES project team came from Bob Krannert, an AmeriCar vice-president responsible both for hosting TechExpo, a biannual automotive technology exposition, the following year and for operationalizing an agreement between AmeriCar and SuperU executives to establish a multi-year strategic alliance (the "Alliance"). According to several sources, Bob learned about the work of the Automotive Industry Consortium for AES Technology ("the Consortium") at an organizational meeting for the Alliance involving both AmeriCar executives and SuperU faculty. Because both AmeriCar and SuperU were already involved in the Consortium, Bob told me that he saw this project as an opportunity to catalyze the Alliance as well as to contribute to the TechExpo program:

…and since Frank Geertz [SuperU, Consortium Co-Director] was there, you know, we were talking about different things, and then we said, 'Gee, there's already a lot of trust between AmeriCar and SuperU on the AES technology with Geertz's people. We're looking for a [charter project]'…So we said, 'Well, gee, AmeriCar and DeutschCar are getting along pretty good, …and then, well, AmeriChip is in the Consortium, and we get along real good with AmeriChip
and so does DeutschCar. So...what if we took the AES technology as a goal—and I knew I was
going to be chairman of TechExpo, and we were thinking of standards already as being an
element of that conference—and 'hey, let’s use the TechExpo date as an endpoint to maybe
accelerate faster than we’re going...

At AmeriCar, he committed a group of his own engineers to work nearly full time on the AES
team.

**AmeriCar**

Though the AmeriCar managers and a few staff members had been involved to varying degrees
in AES technology development and in the Consortium prior to this project, establishing an
international standard had not been a local priority. In fact, this project represented a significant
departure from the group’s work plan. In an interview, Lloyd Yeats, the group’s manager,
lamented having to redirect Bill Pelham and his group:

I’m having to pull Bill Pelham away from other things I’d envisioned for him. He’s played a
really big role in the hybrid vehicle program, but this takes a lot of time...We’re tied into a high-
visibility project [the AES Team] that decreases our flexibility and with fixed resources, we have
less autonomy [about what we work on]...

Explaining his unquestioning compliance with a directive that seemed to him to be at odds with
prior plans, he told me

You wonder sometimes why they want you to do things and if this really makes sense, but
usually, if you go along and do what they ask you, you find out that there is a reason and things
work out. You just sort of have to trust that they [superiors] can see a bigger picture and see how
this fits in with things you don’t know about.

Trying to make the best of a tough situation, though, Lloyd reflected that the “negatives are also
positives”:

With greater visibility comes an opportunity to showcase what you’ve done. That’s always a
problem in the technology area because the customer generally doesn’t see what we provide.
“Showcasing” here refers to gaining recognition within the company regarding the importance of
his group’s contribution to the product, a marketable vehicle. Attention and status generally
accrue to those groups which develop features and components visible and of interest to the customer, such as the engine and interior and exterior designs.

Lloyd and Bill had not chosen to participate in the project. They told me they had agreed to attend a pre-team organizational meeting several months prior to the kick off on behalf of a coworker who had fielded the initial queries about the project but was then leaving AmeriCar:

   We just thought we were going to take some notes and stand in until they hired Mark’s replacement.”

Instead, while they were at that meeting, Bob Krannert phoned a SuperU administrator also attending the meeting with a message that Bill and Lloyd would be participating in the project. I was sitting next to them when the administrator announced his receipt of the message and saw them both silently gulp.

So the AmeriCar managers’ initial participation reflected compliance with a local directive.

Similar to the SuperU members, Lloyd and Bill subsequently found a way to positively frame the project for themselves, but the new frame, Lloyd Yeats’ “bright side” perspective, was rooted in local interests, exhibiting a relative indifference to the collective goal.

SuperU

At SuperU, Frank and Don, faculty members in the Electrical Systems Lab (ESL) and co-directors of the AES Consortium, became the “obvious” people to draft the research proposal, required by the Alliance administration, for a team focused on AES technology standardization. Once on the proposal as the investigators, they became the default project coordinators.

Their descriptions of their initial reactions to Bob Krannert’s idea indicated that they initially experienced this new “initiative” as a potential threat to their legitimacy with the members of the
Consortium and as a frustrating distraction from their "real work" of building that organization. As hosts of the Consortium, they had been under increasing pressure from Consortium members to be more "professional" and to provide more services that justified the annual participation fee. Both their comments to me and their conversations with one another about how to present the project to the Consortium members indicated concern that Consortium members might perceive this project either as competing for faculty time or as showing favoritism to the organizations participating in the AES team—or both.

On the other hand, they felt pressure from the university administration to acquiesce to the invitation—an invitation to participate in such an Alliance offered financial and physical resources, including organizational access, needed to grow nascent research programs—and their own relationship with AmeriCar stood to benefit by maintaining a positive relationship with Bob Krannert. Don remembered their decision process this way:

Well, this whole initiative was coming down from the very highest levels of SuperU and AmeriCar. SuperU had been...courting the AmeriCar management...people in pretty high places were trying to get this ironed out...We were aware of the overarching significance for SuperU and knew that we couldn’t be too cavalier—we were sensitive to SuperU’s institutional objectives. At the same time, it didn’t make sense for us to be involved unless it would be of some benefit to the Consortium overall...I know Frank was concerned, and rightfully so, that we might be getting dragged into something with no redeeming social value from the perspective of the Consortium...Bob Krannert became very enthusiastic about it. For whatever reason, the stars aligned, and he thought this was a good arena to pursue...So eventually we convinced ourselves that this was a good thing, too. We thought it would satisfy some needs of the Consortium as well as SuperU’s institutional objectives.

Frank and Don somehow resolved their internal dilemmas and agreed to participate in the project. Then they announced their participation to the Consortium members in a way that put forth an active, results-oriented image:

[The AES Project]...will provide us with an opportunity to get some concrete results...will not take away from the Consortium in any way...if anything, it will add to what we’re already doing here...and, of course, whatever findings we have from this initiative will be shared with the Consortium members...
While Frank and Don eventually crafted explanations that rationalized their participation to themselves and their constituents, their motivation to participate grew primarily out of a sense of both obligation and opportunism, a chance to maintain face both locally and with their AmeriCar contacts. Though Frank later told me that they were interested in the project as a way to learn about “virtual engineering” which they saw as a new way to work with Consortium partners, in a meeting of the faculty members about a year after the project began, he referred to SuperU’s entry into the project as having been “dragged kicking and screaming into this thing” and the others nodded, laughed, and exchanged other anecdotes about having had similar initial reactions.

**DeutschCar**

Of all the participants, the members of the DeutschCar group were the most interested and invested in the establishment of an international standard. Because they were further along in their development of AES-based technologies, they participated in the team, at least in part, to guide the standards development process to prevent the invalidation of their work to date, a common agenda among standards development participants. In addition, the two managers participating in the project were interested in learning about virtual engineering:

> Our interest for the AES Project Team is we want to deal with the method. Virtual engineering is not a thing we want to do but a method we want to train in, but we must have a subject [as a focus], right?...So we have three tasks—virtual engineering; AES architecture; and the TechExpo paper, ja? (*Siegfried, DeutschCar South*)

Reinhart, the DCNorth Research Manager located two hours away by autobahn from Siegfried’s Advanced Technology (AT) group, told me that he saw the ability to collaborate virtually as a way to level the playing field with the DCSouth research group with whom he competed for
funding. As he saw it, the DCS group’s propinquity to the advanced technology managers gave it an unfair advantage for choice projects. In addition, he hoped his group’s ability to collaborate remotely would also make them more attractive to other groups in the company distributed throughout Europe and increasingly in the U.S.

In contrast to the tangential nature of the project to the original work of the groups described so far, the DeutschCar group’s local goals aligned well with the espoused project goals. Nonetheless, because they were so much further along in their work on AES technologies, the technical activities of the AES Team held little interest for the DeutschCar group members, representing instead an obligatory distraction with little relevance to their day-to-day work activities as illustrated in the following quotes from DeutschCar engineers:

We don’t expect any “breakthrough,” even from the research with SuperU. We just need everyone to agree [on the standard]. [Supplier X] is already building prototypes for us to test…

We need the Consortium and Project Team to move ahead with AES technology, but other than that…as far as what we do, our day-to-day work, it is not really a part of what we do…We have done this work. Some companies have not yet done this work and need to do it now, but it is not very interesting to us to do the same thing over and over. But it must be done (shrugs).

Mathias and Thomas, central figures in the internal AES technology development efforts at DCNorth, expressed similar sentiments explaining to me why they had not wanted to be directly involved with the project team, further illustrating the engineers’ locally-oriented decision heuristics:

There is nothing for us. We have already answered those questions for ourselves. We do not think we can learn from these others anything that will help us with our projects. (DCN engineer)

So even in an apparent “best case” scenario of aligned local and project goals, the team members’ initial investments in the project were hindered by their evaluation that participation offered little to their accomplishment of their own day-to-day local project responsibilities.
Semiconductor Suppliers: AmeriChip and EuroChip

When invited to participate, the semiconductor supplier members at AmeriChip and EuroChip faced similar dilemmas. Supplier organizations, in general, stood to benefit the most from standardization, but more importantly, individual supplier organizations working directly with the automakers developing the standards had reason to believe they would have a strategic advantage over competitors when the time came to sign contracts for new components. They told me that participating on the team provided an opportunity to create an image of being on the forefront of technology, the obvious “go to” choice when it came time to select “preferred suppliers” to build the new components:

If we work with them on this now, when it comes time to name a supplier or they need prototypes built, we’re going to be the ones they come to because they’ll know that we know what they want and that we can build it.

On the other hand, the supplier members also told me they were under extreme pressure from their own management to justify all time and money expenditures in terms of a set return on investment (ROI). This explanation from an AmeriChip engineer is typical:

When a customer calls me and asks if we can build something, the first question I ask is how many do they want to build [per year], and the second question is when do they expect to sell it. If they want to build less than a million dollars’ worth or if it’s going to be more than two years until we see a return, I just hang up.

The proposed technology promised millions in eventual revenue but was likely a minimum of three-to-five years from being realized, outside the two-year ROI criterion for evaluating new projects and would be costly to develop. Here a bit of industry history also came in to play. Members of both supplier and OEM firms told me very similar stories about the development and implementation of a technology called “multiplexing” in the 1970s and ‘80s, a collaborative undertaking of the U.S. “Big Three” automotive companies. According to the stories, the automakers had convinced the suppliers to participate in and partially fund the development by
promising high volumes, commensurate revenues, and rapid implementation into a significant proportion of their respective “fleets.” However, the development proved more costly and complicated than anticipated—both technically and politically—thus delaying production and, consequently, revenues. When the supplier members first approached their managers regarding participation in the AES team, then just less than ten years since the unsatisfactory resolution of the multiplexing gambit, they told me they met with brow-raised queries, “Is this going to be another ‘multiplexing’ debacle?”

So the individuals invited to participate saw an opportunity to be perceived as being at the cutting edge of technology development by their automotive clients but at the same time felt pressure to be perceived as savvy—i.e., conservative and compliant—business people by their managers at home. Standardization was, at best, a remote concern.

**Getting In: Summary**

In summary, the participating organizational subgroups each entered into the collaboration for different reasons, all rooted in their respective local concerns, with varying expectations regarding the likely benefits of the project, “benefits” defined by the members in terms of the project's potential contributions to local day-to-day affairs. For the AmeriCar members, participation initially represented compliance with a supervisor’s directive but a frustrating departure from their “real work.” For SuperU, participation offered both risk and opportunity with respect to their relationships with industry members. For the DeutschCar members, the project represented both a necessary evil to achieve their own local goals and an opportunity to learn about “virtual engineering,” though their expectations were quite modest concerning the immediate benefits for their own local work. For the supplier members, participation offered a
strategic opportunity with their customers but risked rebuke by their managers, a dilemma
resolved through a participation strategy of maintaining a presence in the team to stay abreast of
developments but with minimal time and energy investment to avoid managerial scrutiny. So
while "standardization" goals, questions, and concerns received ceremonial attention in team
meetings, most of the AES team members apparently gave standardization little thought outside
the meetings until well into the team's second year of work.

The formation of the team illustrates both the locally-particular nature of the site-based
influences on the members' participation in the AES team and the simultaneous enabling and
constraining nature of these influences. In the preceding several pages, I described how the
members' compliance with superiors' directives, desire to protect local technical development,
and attempts to gain advantage in the future competition for component contracts led to the
formation of the AES Team at the same time that myriad disincentives to participate
foreshadowed limited member investment in the team.

From a normative perspective, this absence of consensus around and commitment to a shared
goal could be viewed as a recipe for team disaster. From an industry perspective, however, the
formation of the team could be viewed as fortuitous regardless of the degree of initial
investment. All the organizations in the industry would benefit from an a priori agreement on an
international industry standard for AES technology, but doing the work to establish a standard
had not previously been on any of the individual organizations' priority lists. So while the
members' joining the team primarily reflected the members' pragmatic responses to local
circumstances, their local orientation also resulted in the formation of a team performing work
useful to all the organizations, which may not have occurred otherwise.
Getting On: AES Team Members’ Day-to-day Work

The AES Team represented only one of each team members’ several work responsibilities and projects of differential significance to the members both within and across sites. In this section I present a sample of members’ activity logs for “typical” work days showing the variety of members responsibilities, the variation in time allocated to the project both within and across members, and the way the members integrated AES Team tasks into their work routines.

Figure 4.1 shows a record of several members’ work activities on a sample of “typical” days I observed. The AES Team project was one of several responsibilities for each member, so on any given day, the team members’ daily activities included some combination of local administrative and planning tasks; attention to other projects; educational seminars; research, communication, and analysis for the AES project team; trading favors with collocated coworkers; and local social occasions. Consequently, the members interspersed their work on the AES Team project among these other activities, integrating this project into their pre-existing work patterns rather than establishing new routines organized around the AES Team task, just as they would do for any locally-based project (Reder, 1993).

These records provide a glimpse of the variation in time allocated to the project both across and within sites as well as the day-to-day variation for any particular member. Work on AES team project activities could account for anything from zero to 100% of a members’ work day, depending upon the organization, the day, the stage of the team project, and most importantly, emerging events within the organization.
# Figure 4.1 Member Activity Logs

## AmeriCar

<table>
<thead>
<tr>
<th>Bill (Group Leader)</th>
<th>July '98</th>
<th>Richard (Team Leader)</th>
<th>Dean (Team Leader)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nov '98</strong></td>
<td></td>
<td><strong>Nov '97</strong></td>
<td><strong>July '98</strong></td>
</tr>
<tr>
<td>8:00-10:00 Elect. Syst. Review Meeting</td>
<td>(cancellation of an interview and a meeting have provided a time windfall!!)</td>
<td>7:00-8:00 Checking and responding to email, mostly regarding internal AES work</td>
<td>8:00-9:30 Meeting off-site with internal component group</td>
</tr>
<tr>
<td>10:00-10:30 Travel, hallway chats after meeting and coming into office</td>
<td>8:00-10:00 Working at desk—Email: AES Team announcement, seminars, IEEE committee meetings, employee trip reports and summaries of mtg with suppliers, spreadsheets from a supplier for AES Team paper, note from boss, response from co-author for non-AES paper</td>
<td>8:00-9:00 Preparation for meeting w/ new user of systems analysis tool</td>
<td>9:30-10:00 Travel</td>
</tr>
<tr>
<td>10:30-11:00 Mtg w/ IT about AES Team</td>
<td>10:00-10:30 Met with an employee at his cubicle about test data on an experimental component</td>
<td>9:00-12:00 Demo for new user of systems analysis tool in preparation for user group meeting next day</td>
<td>10:00-11:30 Email, electronic calendar, filing hard copies of some administrative messages</td>
</tr>
<tr>
<td>11:00-12:00 Conf call w/ SuperU; Fax documents to them</td>
<td>10:30-12:00 Phone calls and email from desk; Dean dropped by with a purchasing dept problem; working on non-AES paper formatting and revisions between conversations</td>
<td>11:30-12:00 Discussion of design issues at another member's cubicle (both AES Team and internal AES project work)</td>
<td>11:30-12:00 Discussion of design issues at another member's cubicle (both AES Team and internal AES project work)</td>
</tr>
<tr>
<td>12:00-12:30 Series of hallway chats en route to lunch</td>
<td>12:00-1:00 Weekly lunch with an informal group of peers and subordinates at a local restaurant</td>
<td>12:00-2:00 Preparation for local team meeting later in week regarding AES Team project while eating lunch at this desk</td>
<td>12:00-12:30 Lunch at his desk</td>
</tr>
<tr>
<td>12:30-1:00 Lunch w/ mgmt peers</td>
<td>1:30-2:00 IT help; Time reports</td>
<td>2:00-3:00 Composed detailed email messages to advanced technology engineers regarding internal AES project and to IT manager regarding &quot;virtual engineering&quot; lab (AES Team Project)</td>
<td>12:30-1:30 Email correspondence with a co-author for another paper; review of new paper draft and addition of own revisions</td>
</tr>
<tr>
<td>1:00-2:00 Employee interview</td>
<td>2:00-3:00 AES Work group mtg.</td>
<td>3:00-4:30 Data collection and analysis for load list involving Web browsing, phone calls, email, Excel spreadsheet tabulations (AES Team project)</td>
<td>1:30-2:00 Preparation and travel to meeting with engineers at another internal component division</td>
</tr>
<tr>
<td>2:00-3:00 Phone calls, email, queue of employees outside door coming in between calls with questions</td>
<td></td>
<td>2:00-3:30 Meeting and travel back</td>
<td>2:00-3:30 Meeting and travel back</td>
</tr>
<tr>
<td>3:00-3:15 Trial audioconference with SuperU using an internal AmeriCar system</td>
<td></td>
<td>3:30-4:30 Email; message that AES Team meeting minutes are posted—sends a message to another team member re: action item in the minutes. Email returned so spent several minutes tracking down correct address.</td>
<td>3:30-4:30 Email; message that AES Team meeting minutes are posted—sends a message to another team member re: action item in the minutes. Email returned so spent several minutes tracking down correct address.</td>
</tr>
<tr>
<td>3:15-5:15 Phone calls, email, and employee drop-ins continue.</td>
<td></td>
<td>4:30-5:00 Review of a team member's mini-experiment in the lab.</td>
<td>4:30-5:00 Review of a team member’s mini-experiment in the lab.</td>
</tr>
</tbody>
</table>

*Note: Rec'd email from Reinhart (Deuchler)—first communication with a partner other than SuperU since kickoff 10/21.*
<table>
<thead>
<tr>
<th><strong>SuperU</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Don (Faculty member and AES Team facilitator)</strong></td>
</tr>
<tr>
<td><strong>Jan '98</strong></td>
</tr>
<tr>
<td>8:15-8:30 Calendar updating</td>
</tr>
<tr>
<td>8:30-9:30 Spontaneous meeting with Frank re: hiring</td>
</tr>
<tr>
<td>9:30-10:30 Email—20 new messages; Coordination of new student arrivals and assignments; Organizing meetings with job candidate</td>
</tr>
<tr>
<td>10:30-11:45 Administrative work for Consortium → Spontaneous meeting of all faculty to define resp. for mentoring students</td>
</tr>
<tr>
<td>11:45-12:00 Face-to-face follow-up with students at their desks to pass along assignment information and set up meetings</td>
</tr>
<tr>
<td>12:00-1:30 Consortium Research Unit audioconference with industry advisors</td>
</tr>
<tr>
<td>1:30-2:00 Conversation with Ken</td>
</tr>
<tr>
<td>2:00-2:15 Preparation for afternoon meeting</td>
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<tr>
<td>2:15-3:15 Interview job candidate</td>
</tr>
<tr>
<td>3:15-5:00 Group meeting with students—Consortium overview</td>
</tr>
<tr>
<td>5:00-5:30 Mtg re: job candidate</td>
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<tr>
<td><strong>Aug '98</strong></td>
</tr>
<tr>
<td>7:30-8:00 Phone call w/ Bill (Acar)</td>
</tr>
<tr>
<td>8:00-9:00 Email and proposal notes</td>
</tr>
<tr>
<td>9:00-10:00 Mtg with Ken regarding Consortium budget</td>
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<tr>
<td>10:00-11:00 Additional spontaneous meeting regarding Consortium budget after finding new information; Phone call with Frank regarding AES funding</td>
</tr>
<tr>
<td>11:00-11:20 Conversation w/ myself providing context for AES Team funding discussions</td>
</tr>
<tr>
<td>11:20-11:45 Phone conversation with Dean (AmeriCar) regarding his meeting with Alliance administrator about AES Team funding</td>
</tr>
<tr>
<td>11:45-12:00 Gathering notes and prior documents for AES Team funding discussions</td>
</tr>
<tr>
<td>12:00-5:00 Worked at desk through lunch focused on AES Team funding—faxed documents to Dean; email to Dean explaining documents sent; phone calls and email to computer scientists regarding next steps for funding process; developed draft documents for next day’s meetings</td>
</tr>
<tr>
<td><strong>Brad (Post-doc)</strong></td>
</tr>
<tr>
<td><strong>Early Jan '98</strong></td>
</tr>
<tr>
<td>8:30-12:00 Meeting with Don and Frank re: Load list (AES Team)</td>
</tr>
<tr>
<td>12:00-12:30 Lunch at desk and email</td>
</tr>
<tr>
<td>12:30-1:30 Location of a needed reference regarding technology needed to build the dc/dc convertor; trip to library; copy of paper and distribution to other team members (AES Team and Local projects)</td>
</tr>
<tr>
<td>1:30-3:00 Worked in office reading, reviewing own and students calculations</td>
</tr>
<tr>
<td>3:00-5:00 Meeting with Don and Frank regarding project and faculty assignments for incoming students.</td>
</tr>
<tr>
<td><strong>Late Jan '98</strong></td>
</tr>
<tr>
<td>10:00-12:00 Solo work doing calculations to determine size of an element in the convertor (AES system component)</td>
</tr>
<tr>
<td>12:00-1:30 Helping a friend from another project group in the lab set up an experiment</td>
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<tr>
<td>1:30-2:00 Check-in with students regarding progress on their calculations and simulation developments</td>
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<tr>
<td>2:00-3:30 Typing draft minutes from last Consortium meeting</td>
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<tr>
<td>3:30-5:00 Discussion of personnel issues with Don and Frank</td>
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<tr>
<td>5:00-6:30 Solo work doing calculations on convertor (AES Team and local project)</td>
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<tr>
<td>Date</td>
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<tr>
<td>Mar '98</td>
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*Sebustian (DCS; Team Leader)*

*Reinhart (DCN Res. Manager)*

*Juergen (DCS Staff engineer)*
<table>
<thead>
<tr>
<th>Pierre (AmeriChip Systems engineer)</th>
<th>Robert (EuroChip AES Technology Coordinator)</th>
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<tbody>
<tr>
<td><em>May '98</em></td>
<td><em>May '98</em></td>
</tr>
<tr>
<td>9:00-12:00 Email: quotes to customers; project status reports to internal groups; several ongoing electronic conversations regarding development of particular technologies—technical details, cost information, competitor information, Web links for more information, etc.</td>
<td>7:30- 9:00 Responses to phone and email queries; check electronic calendar for day’s “agenda”</td>
</tr>
<tr>
<td>12:00-12:45 Lunch with coworkers</td>
<td>9:00-12:00 Doing analysis to develop a proposal for a customer—using Excel, schematic diagrams, emails from colleagues, hand-drawn sketches, notes in a bound journal from previous meetings, and phone queries to obtain needed information.</td>
</tr>
<tr>
<td>1:00-2:00 Coworkers drop in with information that a customer may be interested in their products rather than those of another AmeriChip division—conversation strategizing how to proceed both with customer and with internal division</td>
<td>12:00- 1:00 Lunch w/ coworkers</td>
</tr>
<tr>
<td>2:00- 5:00 Email letter: to U.S. colleague for technical feasibility information regarding a product modification; to an internal new product development engineer on same topic; to NPD manager on same topic but decided to not send until after a political announcement next week.</td>
<td>1:00- 4:00 Continues to work on proposal while monitoring email, taking all phone calls</td>
</tr>
<tr>
<td>5:00-6:00 Reminder emails on pending projects.</td>
<td>4:00- 5:00 Reviews draft proposal with boss; makes revisions</td>
</tr>
<tr>
<td><em>Sept '98</em></td>
<td><em>Sept '98</em></td>
</tr>
<tr>
<td>8:30-10:00 Offsite customer visit</td>
<td>7:30- 8:30 Responses to phone and email queries; check electronic calendar for day’s “agenda”</td>
</tr>
<tr>
<td>10:00-10:30 Travel</td>
<td>8:30-12:00 Off-site meeting with nearby coworkers to accommodate a teleworking group member</td>
</tr>
<tr>
<td>10:30-11:30 Email: meeting minutes; arranging telephone meetings; ongoing electronic project conversations; queries about internal AES work; travel arrangements; 11:30-12:00 Spontaneous meeting with boss to develop strategy for responding to an earlier email</td>
<td>12:00- 1:00 Lunch</td>
</tr>
<tr>
<td>12:00-12:45 Lunch</td>
<td>1:00- 2:00 Phone and email msgs.</td>
</tr>
<tr>
<td>1:00- 2:30 Evaluation of and response to specs faxed to him from a customer. 2:30-3:30 Responding to another customer about AES technology capabilities; phones sender to be sure his response is accurately interpreted</td>
<td>2:00- 3:30 Two extended phone conversations with customers regarding various AES components</td>
</tr>
<tr>
<td>3:30- 4:45 Continues work on eval of specifications</td>
<td>3:30- 4:00 Break</td>
</tr>
<tr>
<td>4:45- 5:15 Work on a patent disclosure</td>
<td>4:00-5:00 Videoconference meeting with a customer group</td>
</tr>
<tr>
<td>5:15- 5:45 Discussion with colleague regarding a new business opportunity</td>
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In general, local projects took precedence except when concerted effort was required to meet an AES project deadline. This example from a conversation with a EuroChip team member illustrates the members’ prioritizing heuristics, demonstrating the primacy of (often emergent) local demands. At EuroChip, Robert coordinated all of the AES technology development for the automotive division, which involved extensive communication via telephone, electronic mail, and videoconference with geographically-dispersed coworkers. When I met Robert, he had only been in his position coordinating this new, globally-distributed group for four months and was still taking German lessons to be able to better communicate with key customers. His boss had just returned from a multi-year expatriate assignment himself, and the automotive division was a relatively young one in the company—good conditions for innovation perhaps, but administratively time-intensive because relationships and coordinating routines were still developing. During one of my observation days, he received an email about the AES project team, giving me an opportunity to see how he dealt with team information. He explained to me that he had good intentions for attending to team activities but that his local responsibilities for AES technology development always came first and rarely afforded him time for anything else. He sheepishly showed me his system for organizing team information among his other tasks:

> When I get a message from Jeremiah (U.S. EuroChip representative), I print it out and put it here [a stacking letter box on the edge of his desk]. Then when I get time, I go through them—I don’t very often get time.

He looked through the stack and noticed from the dates on the messages that some were more than two months old. Grinning, he told me, “I guess it’s been a long time since I have had time.”

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14 At each semiconductor firm, more than one division and sometimes more than one department in a division develop semiconductor devices for automotive applications. "Semiconductor" groups develop individual semiconductors to be installed in other components by either the automakers or another supplier. "Automotive" groups build "modules" that use several semiconductors and perhaps even include the motors or other devices the semiconductors were intended to control, built as "pre-assembled" units ready for installation by the automaker.
Occasionally a member’s local responsibilities changed, prompting an adjustment in his project participation. At AmeriCar, about two months after he had been told that the AES project was to be his team’s number one priority, Bill Pelham was given responsibility for another program and told that that project was to be his primary focus. In a meeting with a prototype supplier, Bill related the shift in priorities as an alert to the supplier regarding likely future requests:

Right now, XYZ is our most important project. It’s the top priority. We’re going to be pushing XYZ.

About a month later in a telephone conversation with SuperU, Bill also alerted Frank and Don:

We’re going to do anything and everything we can to be an Alliance partner but within the constraints of the XYZ program.

Three months after the phone conversation with SuperU, Bill missed several deadlines for distributing drafts of the team’s TechExpo conference paper, at least in part, because he was occupied meeting government-stipulated deadlines for the XYZ project.

All of the examples provided so far show the members, unsurprisingly, privileging revenue-producing projects with relatively near-term direct effects on their respective organizations’ — and their own — performance appraisals, over the AES project, one with indirect and still unrealized implications for their own and their organizations’ futures. However, profit concerns and performance appraisals were not the only local factors influencing the members’ organization of their work. A vignette taken from my observation notes for one day at SuperU illustrates the more mundane and insidious ways the people and circumstances of the members’ local contexts shaped their day-to-day work, directing their attention, further contributing to their privileging of local priorities over the AES project. Though taken from my observations at the university, this scenario is typical for all the organizations participating in the AES team:
On this particular day, Don has just returned to the office from a week away for an out of town Consortium meeting. It’s just a week before the beginning of a new semester and, concomitantly, the arrival of a new set of student research assistants (RA), Don’s primary concern of the day. While he unloaded his briefcase—a couple of stacks of file folders and several spiral bound notebooks, one for each of his several projects—Frank came to the door and asked him to meet about a personnel matter. An hour later and only 10 minutes into reviewing his email, he heard another colleague talking with the secretary outside his door and went out to confirm his availability for a meeting later in the day to discuss student and faculty assignments for new Consortium projects. Back in his office a few more minutes, the graduate student in charge of student desk assignments came in to confirm that he has all the new students assigned and that their assignments are appropriate to their projects. After only 30 minutes at his desk, he attended a lunch meeting where the student presenting his work reminded Don that he needs feedback on his dissertation proposal and asks to meet the following day. After the lunch meeting, Don had an impromptu meeting with another student he found waiting just outside his office door regarding that student’s thesis, which is nearing completion. That conversation ends when Frank tells Don it’s time to interview a job candidate. Eventually returning to his desk in order to continue the “recovery” from being gone an entire week, he reflects on the day’s activities and tells me, “Unfortunately, I really get into a crisis management mode, and it boils down to whoever is standing at my door saying, ‘Can you…?’; ‘Did you…?’; ‘Will you…?’”

This scenario, repeated daily at each of the organizations, shows how a member’s physical proximity to (Allen, 1977; Kiesler & Cummings, 2001) and social embeddedness in (Granovetter, 1985) a network of local relationships, stemming, in large part, from his formal organizational role (Blau, 1963; Kanter, 1977) profoundly impacted his day-to-day activities and the focus of his attention. In the case of the organizations studied here, the relationships and circumstances in which the team members were embedded reflected their situation in bureaucratic organizations, but a similar scenario can be imagined occurring in any work setting with collocated, interdependent coworkers regardless of whether the organization is bureaucratic, cooperative, or voluntaristic. Proximal others more readily attract attention (Kiesler and Cummings, 2001).

The variations in time spent on the project and the range of demands competing for member attention are not surprising for anyone doing “knowledge work” in contemporary organizations. Nonetheless, this aspect of virtual teamwork is rarely acknowledged in the virtual teams literature which, often implicitly, assumes that the virtual team is the members’ primary, if not
singular, focus and relates member participation and team performance almost exclusively to intra-team, or inter-member, processes and interactions rather than accounting for the members' other responsibilities and relationships in their respective work settings (Arrow et al., 2000; McGrath & Hollingshead, 1994; Schulman, 1997).

**Getting the Word Around: Internal Communication Routines**

As to the AES team members intermingled AES Team-related work with their multiple local responsibilities, they also conducted communication about the AES project in the course of pre-existing communication routines and practices within each organization. The team members' choices of communication media, both for team meetings and for between-meeting communication increased their collective dependence on their respective local communication practices for disseminating project information. However, differences in local practices regarding the who, what, where, and when of project-related information exchange made for significant variance in the timing, rate, and scope of project information dissemination within sites and organizations.

During the first year, the team relied upon face-to-face meetings and videoconferences for project planning and progress reporting and upon person-to-person email and telephone calls for information exchange between meetings. Because the team chose not to use multi-site videoconferencing and organizational policies limited travel for non-revenue producing projects, the full complement of team members was never assembled simultaneously in real time

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16 One of the SuperU members had had bad experiences with multi-site videoconferencing, so he suggested only having two sites. The chosen sites were AmeriCar and DeutschCar, so they offered no challenge, and AmeriChip and EuroChip, the supplier members, who would either be most inconvenienced or left out by such an arrangement also offered no protest.
during the first year. Consequently, many members relied upon their coworkers or manager who
did participate in the meetings as their source of project information.

Then between meetings, rather than using the group email distribution list or the “discussion”
feature of the AES Team Web site, team members typically exchanged information about the
project across sites via personal email or telephone, relying upon the inclination of the message
or call recipient(s), using routine local communication channels and practices, to relay the
information to the other team members within their site or organizations. Several authors have
documented problems of asymmetric information distribution within sites as a contributing factor
to problems in cross-site collaboration (Barrett, 2000; Cramton, 2001; Gluesing, 1995; Jarvenpaa
& Leidner, 1999). Investigating the sources of specific team conflicts, these researchers
discovered several instances in which local work and communication routines had inhibited the
dissemination of information among the members of collocated subgroups of virtual teams.
Though the AES team experienced few overt conflicts, information asymmetries were the norm
despite equal ease of access to electronic mail and the team Web site.

AmeriCar

At AmeriCar, the AES team member’s individual cubicles were distributed across three
cavernous, nearly windowless suites and two laboratory areas. Though the members did
encounter one another in the hallways that both dissected and connected the cubicle caverns,
they generally communicated with one another by email in order, they claimed, to both avoid
wasting time looking for one another and to provide a “paper trail” of communication in the
event of litigation over a future component failure or, more likely, an “irate manager looking for
someone to blame” for an error or project delay.
When a team member received an email about the AES Team project, he generally responded directly to the sender, including other team members on the address list only if he had consulted them before sending the response. When I queried group members regarding their receipt of project-related emails and their perceptions of periods of "silence" with respect to project status information, they told me, "If it's important, someone will tell me," reflecting a, perhaps pragmatic, passivity that characterized much of AmeriCar communication.

Group meeting frequency at AmeriCar depended upon the inclinations of both the local Group Leader, Bill, and the Team Leader, initially Richard and then later Dean, and reflected strict, though voluntary and informal, adherence to the local pecking order. After the project kickoff, Bill Pelham, initially the primary point of contact for the other organizations, initiated weekly project group meetings, asking Richard to facilitate any meetings or portions of meetings he could not attend due to scheduling conflicts. After a holiday and another local conflict preempted a couple of meetings in a row, the routine was effectively dismantled, and the group did not meet for another two weeks. Eventually, the technicians told me, "We really need to have a meeting." When I asked why they did not mention to Richard, then the Team Leader, that they wanted to meet, they explained, "It's his place to schedule meetings. If he wants to meet, he'll call a meeting. It's not my place to tell him he needs to schedule a meeting." Then in a later conversation with Richard about whether or not the group would meet that week, he told me, "I don't know. Bill hasn't asked me to schedule one. I don't know if he wants us to meet or not."

The engineers' and technicians' passivity with respect to declaring a "need" and initiating a meeting could be interpreted as either "typical" technologists' loathing of meetings or as veiled slacking, i.e., "If we don't meet, I won't get another assignment." However, my observations of these patterns in the context of other recurring practices in the organization indicate that the
engineers' and the technicians' hesitancy to initiate meetings of groups for which they were not the designated "leader" stemmed from fear of violating the pecking order, or acting "out of place."

Status differentials also influenced the list of meeting invitees, another source of information asymmetry among the members at this site. Though included in the initial internal project-related meetings, technicians were excluded from cross-organizational meetings, even video and computer conferences unless their services were needed to run an experiment. Their managers told me that they had not been invited because they had "too much to do" to spend three hours in a videoconference (and later computer conference), but the technicians did not believe their workload precluded their inclusion. The technicians were responsible for much of the construction of the "yellowboard," an experimental set up being constructed to test AES components, and they anticipated that their exclusion would actually create more work pressure and complications for them later:

"The problem is, none of those guys [engineers] have built anything. They've simulated, but they've never built the hardware. They don't know what it's going to take. You don't just hook up all the parts and it works. There's always something that doesn't work, something breaks. There's something that has to be done that you couldn't anticipate beforehand. But none of them have ever built anything, so they don't know about that kind of stuff, and they don't invite us to the meetings, so we can't tell them. Just watch. They're going to make all these decisions, then they'll come to us at the last minute and tell us 'we need this by tomorrow,' and they'll be mad when we tell them it can't be done."

Excluded from the meetings, the technicians were dependent upon those in attendance to relay the relevant information. Here, managerial practices varied. After one meeting, a technician found a copy of a meeting summary written by the Team Leader on top of his own document in the output tray of the community printer. Typical of the practice at AmeriCar of communicating "up," he noted that they had been distributed to the Team Leader's manager and his manager's
manager but not to the other participants at the meeting or those excluded from the meeting (himself) who he believed most needed the document as a reference for their daily work.\textsuperscript{17}

So in the hierarchical world of the AmeriCar participants, the people needing the information, the technicians and staff level engineers, depended upon their superiors' idiosyncratic definitions of "need" to initiate meetings, or to distribute information more generally, but felt too inhibited by their relative status to communicate their need to their superiors.

\textbf{SuperU}

The physical arrangement of the SuperU group ironically mirrored, and reinforced, the group's two-strata communication system. The faculty office suite upstairs ("the Board Room") and the maze of student desks in the basement ("the Roach Hotel") were worlds apart, two insular communication networks connected by a staircase most often traversed by Brad, the post-doc, who functioned as both messenger and intermediary. Brad's office was in the basement across the hall from the student area, but he had "key access" to the faculty suite. Both networks, the faculty and the students, depended primarily on face-to-face communication. Because of the physical organization of the workspace, the members within each network usually had a fair idea of one another's whereabouts and work status but little awareness of the goings on in the other system.

\textsuperscript{17} During the team's second year, Dean functioned as the local Team Leader as well as the Technical Project Leader, and he did make it routine practice to hold scheduled meetings to relay both verbal and written summaries of meetings he attended that excluded any portion of the group.
The double wooden doors into the carpeted faculty office suite stood out in a building otherwise appointed in gun-metal gray steel and tile. Don and Frank's adjacent offices both opened off the reception area which remained locked until the secretaries arrived around 9:00 a.m. Before the secretaries arrived, Don and Frank often communicated by calling out to one another or stepping only to the door of their own office before calling out questions or bits of coordinating information: "Is that call at 3:00?"; "Are you going to be in town on the 6th?"; "Can you meet about the ABC program this afternoon?" During the day, they could often hear the secretary's comments when she stood at one of their doors to announce a call or visitor or make a query about travel plans and so peripherally monitored one another's activities. The students, on the other hand, were neither within eyesight or earshot of these activities and were generally unaware of all project activity except their own assignment.

Spontaneous meetings were the primary vehicle for AES project-related communication. As a general rule, spontaneous meetings quickly followed a faculty member's receipt of a message from another site and lasted only as long as necessary to deal with the new information. A typical sequence of events where all the necessary players were available began with either Frank or Don receiving a phone call or email that contained new project information, then going to the other's office to relay the information and discuss the implications for their own participation. Realizing they needed more information, they would call Brad, the post-doc both working on the project and supervising the participating students, and ask him to come upstairs to their offices, or Don would go personally to retrieve Brad from his basement office. These meetings often concerned the students' work, but the students were rarely invited. Instead, after the meeting, if necessary, Brad would then initiate a conversation with the appropriate student to either gather or disseminate information. When I periodically queried the students at SuperU to
discern their awareness of project activity beyond their individual scopes of responsibility, they would respond, "I don’t know. We’re not invited to those meetings." Nor did they expect to be.\footnote{The students' role in the lab group resembled the "traditional" role of children in a family, that is, both they and the faculty expected faculty to “take care of them” and act as the authority figures, making the rules and assigning them tasks.}

The unique situation of a student workforce made it possible, in most cases, to complete this sequential communication process in a matter of minutes or hours. By design, each student was assigned to a single project supported by either the Consortium or the Alliance, so students not in class were generally not tied up in other meetings. In addition, Frank, "the big guy," periodically admonished them, "When you’re not sleeping, make this your second home." Though the intention of this directive, he told me, was to facilitate peer learning among students in the lab, the students’ compliance with the directive also resulted in their being easily accessible during the hours faculty were present. So anytime a faculty member wanted to go to the student offices or call a spontaneous meeting, they could generally count on the student being there.

The students were included in and were actually the focal point of a weekly forum to give progress reports and make presentations on the research projects supported by the Consortium, and when a student was assigned to an AES Team task, he or she would also be given an opportunity to give a verbal report to the group. However, the day-to-day progress of the AES Team, the issues under discussion, or the information exchanged between sites were not routinely shared in this meeting. Because of the similarity in the technical content of the AES Team project and the research projects supported by the Consortium, compounded by the absence of any differentiation in the reporting process, the students did not themselves know whether or not they were considered part of the AES team. For instance, the student that Don
told me he considered to be the “main student” associated with the AES Team told me he did not know if he was part of the AES Team but thought “probably not.”

The SuperU group’s reliance on spontaneous meetings as the primary information dissemination vehicle contributed to information asymmetries within the group because their occurrence hinged upon both a faculty member first identifying an information deficit and then the appropriate others being available for the meeting. If either of these conditions were not met, the information often did not get relayed unless a chance encounter or question reintroduced the issue. For instance, in a conversation between Frank, Don, and Brad, they realized they needed information from Sergio, a doctoral student, about a data set. Sergio was not in the lab at the time, so the matter was put on hold. Later in the day, Brad saw Sergio several times in the lab and even spoke with him briefly, but Brad was then engaged in other tasks and did not broach the earlier “urgent” question. The question remained unanswered for several days.

**DeutschCar**

Shared office space and the perception of all workspace as public facilitated face-to-face communication and shared awareness among the DeutschCar members. Not all the members of the AES research group at DeutschCar North (DCN) or the AES advanced technology group at DeutschCar South (DCS) were members of the virtual AES Team, but those who did not participate were aware of the project and their coworkers’ involvement. Though the DCS and DCN office buildings differed in basic design, the sites were similar in their use of office space and the proximal location of team members. Staff engineers shared an office with at least one coworker from the same workgroup, their desks forming a continuous work surface. Because only managers and a few engineers had answering machines, they were also in the habit of
answering one another’s telephones. Because the shared workspace allowed them to see and hear one another going about their work, they were often able to answer a caller’s queries regarding the coworker’s project schedules, budgets, status and pending technical questions. Normal communication practices with coworkers in other offices included walking to one another’s offices to talk face-to-face, entering one another’s offices without knocking, and looking through papers on one another’s desks and open files on one another’s computers to find sought-after information if the occupant was out of the office.

A weekly cascade of standing meetings provided the mechanism for distributing company, division, departmental, and group information across levels of hierarchy. Beginning Monday morning, the highest-level executives met, followed by meetings that afternoon of each executive and his direct reports, and so on until the four-member work group at DeutschCar South, including the AES project participants, met on Tuesday afternoons. In these meetings, the supervisor went through a stack of papers that served as both his agenda and notes, passing along corporate announcements, reminding the members to take care of administrative tasks, asking for updates on particular aspects of their local work such as the status of ordered equipment or the outcomes of contacts with suppliers or university collaborators. The two members of this work group participating directly in the AES project team also occasionally exchanged project-related information in this forum, in the course of the group’s routine information exchange and project updating. Consequently, the contents of an email or telephone call received by the manager on Thursday might not be trickled down to the rest of the group until the following Tuesday.

The DeutschCar North group’s interaction was less structured. Reinhart and the engineers in his group were each out of the office at least two days a week—and often more—attending meetings at DCS, another DC research center, or one of the handful of universities with whom
they collaborated to compensate for lean staffing policies. The meetings at DCS were the most frequent. While the meeting attended may have lasted only an hour, they believed it was still more efficient to make the trip—two hours one way by car—because while there, they maintained their network through chance encounters with prior collaborators and were more likely to learn of future project opportunities. Reinhart also used his time at DCS to exchange AES Team information with Siegfried, the advanced technology manager.

The DeutschCar members participating in the AES Team also came together specifically to discuss team information in separate, face-to-face meetings, sans the non-participating members of each site’s work groups. Just prior to scheduled AES Team meetings, Reinhart (DCN) and Seigfried, Sebastian, and Juergen (DCS) would meet for an hour or two to review the meeting agenda and any accompanying documents to agree on a collective position, a common pre-meeting practice at DeutschCar when dealing with external collaborators. On the one hand, project-related information received by any one of the participants might be held for more than a week in anticipation of these meetings, but on the other, all the participating members eventually had access to the same information before a team meeting. These meetings also provided a forum for identifying and sometimes clarifying points of ambiguity.

**Suppliers**

The two supplier organizations, AmeriChip and EuroChip, were similarly organized with similar communication practices, at least with respect to AES project information. The AES Team members within each supplier organization did not formally meet face-to-face with one another about project activities because they themselves were distributed. Instead, they communicated by email. Typical work days of both Pierre at AmeriChip and Robert at EuroChip consisted of
some combination of out-of-office face-to-face meetings at customer offices and several
consecutive hours at their computer terminals and telephones communicating with distant
coworkers, customers, and suppliers, often in three different languages. For instance, after Pierre
(AmeriChip) had been out of the office for two days, he spent seven hours one day reading and
responding to work-related emails and phone messages from coworkers and at least four hours
each of the remaining days of that week.

AES Team information propagated along the same electronic pathways. During the first
year, one member from each supplier firm attended the face-to-face meetings and served both as
the AES Team’s point of contact and as an information conduit for the participants from that
organization. These other participants’ awareness of project activities depended entirely upon
the proclivities of the contact person. Though I did not have access to all the members’ personal
email messages, my observations of the supplier members’ communication indicated that the
contact person forwarded all emails sent to the Team distribution list but was less consistent in
forwarding messages from remote team members addressed only to himself. He also did not, as
a general rule, send any information to his coworkers documenting telephone conversations
between himself and team members from other sites, nor any commentary on team meetings
other than forwarding the email announcement that meeting minutes had been posted on the Web
site. Consequently, most of the supplier members were rarely aware of any project information
not documented in the meeting minutes or sent to the Team distribution list, and depending upon
the individual practices of their contact person, might not even be aware of the contents of those
documents.

Despite equal access to the technical elements of a group communication infrastructure—a
Web site and an email distribution list—members’ communication of project-related information
still depended heavily on local communication practices. Shaped by the members’ physical organization, local customs, status observances, and personal idiosyncrasies, these local practices both enabled and constrained project information dissemination across and within sites. In many cases, the combination of team and local practices facilitated project awareness among higher status members while further amplifying information asymmetries across and within sites. Researchers have documented the challenges of achieving information symmetry among distributed collaborators and the consequences of the more common situation of information asymmetries, dubbed the “mutual knowledge problem” (Cramton, 2001; Krauss & Fussell, 1990), but the local factors contributing to the irregular distribution of information across and within sites have been largely a matter of speculation.

Getting the Work Out: Local Influences on Team Task Work

The members’ respective work sites influenced their performance of AES Team activities in very apparent ways that affected their capacity to contribute, but also in more subtle ways that shaped their conceptualization of the tasks and task objectives, affecting the members’ incentive to participate. Each member’s capacity to contribute was shaped by the formal rules, normative practices, and resource configurations in his local work world, particularly those circumscribing his own position in that social system. Completion of an assigned task often required persistent navigation of local information systems, formal policies, and informal networks as well as deft negotiation of local power relations. These influences were identifiable and potentially quantifiable in terms of lost time or compromised quality. Less problematic for the individuals doing the tasks but with potentially farther-reaching impact on the collective effort, the members’ situation in their respective work contexts also informed their conceptualization of the
AES Team project as either an opportunity or liability in terms of its contribution to local—and personal—objectives.

In this section, I describe influenced members’ efforts on several tasks to illustrate the variety of ways their local contexts constrained their individual capacities to contribute. After several short examples highlighting local factors influencing one or more individuals in a single organization, I then use the more complex example of the team’s efforts to establish a computer-conferencing infrastructure to show how the combination local constraints at different organizations complicated the conduct of a collective task. Finally, I provide two examples to show how the members’ local situations contributed to their conceptualizing team tasks in local terms, subsequently informing their approach to the task. Because the team had chosen an AmeriCar as the test model for their new technology designs, the members reasoned in the kick-off meeting that “it made sense for AmeriCar to take the lead” on the initial conceptual and analytic tasks with the other organizations playing an advisory role. SuperU, having initiated the formal proposal for the project and having been informally appointed to facilitate the group by Bob Krannert, played the role of overseer. Consequently, the examination of the team’s work practices during this first year center on these two organizations.

**Capacity to contribute**

**Developing the Load List: Local Information Infrastructure**

The first step in conducting the analysis that was to become the core of the team’s TechExpo conference paper (the team’s first formal “deliverable”) involved creating the “load list.” Actually a multi-page spreadsheet, the load list inventoried all the existing and potential electrical components on a “typical” luxury car along with the details of each component’s
electrical power consumption under various driving conditions and in different seasons. Because
the team had agreed to use an AmeriCar luxury sedan as the base model for making “current v.
future [AES]” system comparisons, responsibility for compiling the list fell to the AmeriCar
group and then to Richard, individually. The team members had assumed that while obtaining
reasonable data for the new, still experimental components might be challenging, obtaining the
needed information for existing components on the current, or “baseline,” model would require
little more than a few mouse clicks in a central AmeriCar database. To start, Richard would
have a template developed by a SuperU doctoral student aggregating information from several
automakers, and his task would be to adjust the list to reflect the electrical system of the test car
model. However, the data proved to be elusive and the acquisition process complicated. Richard
explained to me that rather than being in a single, up-to-date database, most of the needed
information was housed in individual repositories to which the original owners, having moved on
to other assignments or left the company, no longer had access:

Everyone is trying to be helpful, but either we cannot find them [the people who worked on a
particular component] or we find out that they’ve move on to other things and no longer have the
files.

A series of phone calls searching for the right engineer sometimes turned up the name of one or
more suppliers for a particular component, making it possible to then search the appropriate
supplier’s online catalog for product specifications (“specs”), but this still left a number of cells
in the load list spreadsheet blank.

Richard’s final version of the list, later modified by SuperU, consisted of a hard-won
combination of archived data, calculated estimates, and supplier-estimated parameters.

Independent of Richard’s relative technical competence and diligence, his ability to “complete”
the assignment depended upon the organization and accessibility of AmeriCar's information repositories.

Revealing his difficulties to the SuperU members and his boss, Bill Pelham, over the course of two AmeriCar-SuperU meetings a couple of weeks apart only prompted negative attributions of his competence despite the fact that the SuperU members encountered similar difficulties when they tried to develop their own version of the list. The following excerpt from my field notes shows the SuperU members encountering many of the same difficulties Richard did.

This new design consists of a "dual-voltage" system. One step in the development of the load list involves dividing the list of loads [electrical components] into two groups, those that will operate on the new "high voltage" portion of the electrical system, and those that will remain on the current, "low voltage," subsystem. Without consulting Richard or Bill at AmeriCar, Frank, Don, and Brad commenced "segregating" the list of electrical components into "high-voltage" and "low-voltage" loads. In the process, they encountered the same sources of ambiguity that had perplexed Richard. For instance, Brad explained to Frank and Don that the rationale for "load placement," whether to put a component on the "high-" or "low-voltage" circuit in a dual-voltage system, was less clear-cut than they had assumed and, instead, depended upon the choice of "architecture," or overall system design, another decision that had not been made:

Which bus [system or circuit] you put the loads [electrical components] on depends to some degree on which architecture you're going to use. If we choose the dc/dc converter, it's going to be hard to argue for putting any high-powered loads on the low-voltage bus, but if we use the dual-wound stator architecture...

Later they realized they did not understand the meaning of several of the column labels in the load list. Frank first noted that "max" and "nominal power" were the same value for a new component and assumed Richard had made an error. Then they all noticed that the numbers for the two values were the same for some components on the list but different for others. Don, Brad, and Frank each made suggestions as to possible definitions of "nominal power," then looked through the list for either support or refutation of their proposed definition, inevitably surfacing refutation of each idea. Eventually they realized that none of them knew what the terms meant, nor could they determine the definition from the data, and Don laughed, "Shows how little we really know about this."

Finally, they did not recognize several components on the list and were, therefore, uncertain where to place them, opting more than once to resolve the ambiguity by removing the component from the list:

Don: What is "parking heater"?
Frank: Heat your parking space? (laughing)
Don: I have no idea what...
Brad: Let's kill it then.
Frank: All weather night vision? What is that? I don't know about Richard...

Don: I don't think it's Richard. It's also on Jorge's original list (comparing documents)

Frank: Let's take it out. What about this trans-shift solenoid? There are two of them, but the second one is blank. Maybe only one of them is on at a time?...What do we want to do about this one?

Brad: Since I don't know what it does, it's kind of hard to say where it should go...

Several attempts to segregate the loads or even to identify all the loads to be tabulated for a specific condition—idle, cruise, summer, winter, etc.—only surfaced additional complexity and were abandoned when they realized the determination depended upon unavailable information. After several aborted attempts to segregate the loads themselves, Frank and Don agreed to assign the task to a soon-to-arrive visiting faculty member and a yet-to-be determined undergraduate research assistant.

Though they themselves invoked a number of different and occasionally conflicting rules for sorting the components into high- and low-voltage groups, differences between their own judgments and Richard's led to the assumption Richard had operated without any heuristic:

I don't feel comfortable with Richard's process for segregating the loads...He seems to just be going through the components one-by-one without any system perspective or consistent rationale for putting the loads into a vehicle.

While the speed and quality of Richard's work on the load list were affected by his organization's information management practices, the other members made a negative dispositional attribution regarding his competence. So in addition to a compromised contribution to the team task, the influence of one member's local context on his performance also contributed to an erosion of (or inhibited the development of) trust and cohesion among the members. Several studies of distributed groups (Armstrong & Cole, 2001; Barrett, 2000; Cramton, 2001; Gluesing, 1995) have documented similar negative misattributions among members ignorant of one another's local work worlds, noting that negative attributions tend to "stick" even after impression-correcting information had been acquired (Cramton, 2001).
Co-Authoring the TechExpo Paper: Relationships, Policies, and Schedules
The development of the TechExpo conference paper offers another example of a seemingly straightforward task becoming complicated by the internal workings of the members’ local contexts. In this case, procedures, politics, and schedules hindered the members’ ability to make their respective contributions, and differences in schedules across sites multiplied the within-site challenges. Nonetheless, the team did complete the paper in the nick of time and eventually won the “Best Paper” prize at TechExpo.

Bill Pelham distributed an abstract and a skeletal draft of the paper in hard copy at the January '98 AES Team meeting. Don encouraged him to post the paper on the Team Web site, and Bill agreed with the caveat that he needed to obtain additional input from a coworker and local approval to make the paper public. Nonetheless, he thought he could post it in February. February came and went. When the team met by videoconference in March, he evaded the other members’ queries about the paper with noncommittal humorous responses. Finally he circulated a full draft in late May with a cursory apology for the delay but no detailed explanation.

Through personal communication, Reinhart at DCNorth and the SuperU faculty were aware that government-mandated deadlines for another project at least partly accounted for the hold up. However, when I spoke with Bill in July, he told me that internal political processes and legal requirements had been an additional and significant source of delay.

In order to augment the paper’s legitimacy to an industry-wide audience, the team had agreed to include, as “authors,” representatives from both the “research” and the “advanced technology” (AT) groups from both AmeriCar and DeutschCar in addition to someone from SuperU. Participation by “advanced technology” managers was intended to signal to the industry that the
automakers were "serious" about AES and fully expected it to be implemented in the foreseeable future. For DeutschCar, this simply meant including two AES team members. For AmeriCar, however, whose team members all came from the research group, this meant soliciting participation from an AT manager. Bill had anticipated this being little more than a formality, adding the manager's name to the author list and keeping him in the loop as the team refined the draft. He was unprepared for the sequence of events that followed. The AT manager in charge of electrical system development demanded significant changes to the paper and circulated it to others who also requested changes. In addition, organizational policy required that the paper go through legal review after each major revision before being released outside the organization, i.e., to the other AES Team members. After making one set of changes and thinking the paper ready to release, Bill submitted it to the legal department only to receive additional revisions from the manager requiring yet another legal review. He recalled at least six repetitions of this process, speculating that he may have forgotten one or two. His work to meet the government-mandated deadlines certainly complicated the process, but it was not the only limiting factor. In dealing with another manager, Bill might have been less tolerant of such onerous demands, but in addition to the AES Team needing the AT manager's endorsement of the paper for its objectives, Bill's own internal work depended heavily on good relationships with this manager and the members of his department. The AT manager controlled the project review forums that determined which research projects from the electrical group would receive AT funding and be considered for implementation into a car, an automotive research engineer's ultimate coup. Bill was both formally and practically subordinate to the AT manager and, therefore, saw few options except to comply.
Having cleared the AmeriCar hurdles, the paper arrived on Don’s desk at SuperU during the peak of end-of-semester activities—exams, thesis completions, graduation—and just before an AES Consortium meeting, a recurring source of frenzy in the SuperU offices. In addition, unbeknownst to everyone except the AmeriCar and SuperU members, Don was negotiating new job offers from SuperU and other universities, limiting the time he had available to devote to the paper. He finally completed a thorough review of the paper, suggesting significant structural changes, a couple of days before Bill was to leave on vacation and the paper was due to be delivered to the conference proceedings publisher. Bill was almost beside himself when he saw that the changes were of sufficient magnitude that the paper would require yet another legal review, a process typically taking up to a month. With some persistence and pleading, he managed to “walk” the paper through the process in one day in time to submit it to the conference and leave for vacation. Talking to me after having completed the process, he admitted that the changes had significantly improved the paper, but he lamented the process.

Despite the various barriers and complicating factors impeding the paper completion, it did get written, indicating that enabling influences were also at work. For one, the automotive members wanted to see AES technology introduced into a vehicle because it would enable the introduction of additional electrical components and features into the car, increasing the electrical engineers’ importance (and hopefully status) relative to the mechanical engineers (Thomas, 1995) in the ongoing negotiation of resource allocations and project priorities. Industry agreement on the standard was key to AES being introduced into a vehicle in the foreseeable future. Also, a significant amount of individual face was at stake for at least Don and Bill. Don and Bill’s bosses, Frank and Lloyd, respectively, were the co-chairs for the TechExpo session in which the paper was to be presented, and Bob Krannert, Lloyd’s boss, was
the chair and “host” of the entire TechExpo event. Consequently, Frank and Lloyd kept the paper on the forefront of the team’s meeting agendas. Finally, the fact that the paper was destined for TechExpo undoubtedly played a role in the legal department’s flexibility in response to the last minute review request. Though I did not interview or observe anyone in the legal department, it was clear from my observations at AmeriCar that no one wanted to be responsible for AmeriCar presenting a less-than-stellar organizational face.

This example illustrates several of the numerous, and previously unaccounted for, influences of the members’ local worlds on the execution of team tasks. Local dependencies, policies, and competing demands all influenced Bill’s capacity to post a draft of the paper and to reissue subsequent drafts after revising. Then differences in the timing of local demands at SuperU and AmeriCar created additional coordination problems. However, locally-oriented concerns also motivated the members (and others in their organizations) to overcome these barriers and cross-site coordination problems to produce a high-quality paper on time.

In the case of the TechExpo paper, the need to coordinate between sites made the local factors, or at least their impacts, more visible. However, it is important to note that various aspects of the members’ local contexts informed, enabled, and constrained all of their activities related to the AES Team, even when those influences did not culminate in overt communication or coordination breakdowns.

Building the Computer-conferencing Infrastructure: Rules, Policies, and Politics
During the team’s first year, they relied primarily on face-to-face meetings supplemented by two team videoconferences and an occasional audioconference between AmeriCar and SuperU for team-level communication. They employed this particular combination of media at least partly
because of the difficulties encountered in establishing the technology infrastructure to support computer-conferencing. Frank (SuperU) told me that when he agreed to participate in the project, he thought many of the "tools" for distributed collaboration already existed and that researchers from other fields would be developing additional tools as they were needed: "I thought we were just supposed to be the guinea pigs." While many of the "tools" did exist, they were not yet in place for use, and ill-timed funding, role ambiguity, and local technology policies all contributed to delays in establishing the computer conferencing infrastructure.

Funding
The impact of local environments began even before the team kick-off. The original Alliance 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 organizations. However, differences in budgeting and resource allocation rhythms between AmeriCar and SuperU delayed work to put the technologies in place. 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 faculty had also already committed themselves to other projects that involved a great deal of international travel. Eventually a student near the completion of his degree agreed to help part-time, but ambiguity among the engineers and technologists at the companies regarding their relative responsibilities for
establishing the communication infrastructure wasted much of the student’s already limited time trying to discern who to contact and waiting for responses to his email and telephone queries.

Roles and Responsibilities

Considering the various motivations for joining the project, most unrelated to the espoused objectives for AES standards and virtual engineering, it is not surprising that the information technologists, except for those at the university, were not involved in the decision to participate in the project and did not consider it to be among their work priorities. Organizational decoupling of the engineering and information technology groups in most organizations further inhibited collaboration and perpetuated the ambiguity regarding relative responsibility for getting the needed technologies in place. First, the absence of clear lines of authority between these two groups meant that any collaborative activity other than a corporate-wide top-down directive represented a negotiated outcome. In addition, the departments were so organizationally distant in some sites that the engineers did not know whom to contact for help. In AmeriCar and DeutschCar where decentralized IT specialists were more clearly linked to specific engineering groups, somewhat 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, while the IT organization rankled at their second-class citizen status despite their “obvious” centrality to the organization’s effectiveness. The following examples are illustrative of the interpersonal and interdepartmental negotiations required to bring about change, with varying degrees of success.
At AmeriCar, Richard sent an email to the technology manager in his building, located in the office immediately below his (approximately a 60-second walk away) with a list of questions and requests. When I went to see the 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. To my knowledge, he never responded to the message. Several weeks after the original message, Richard's questions were addressed through meetings when the SuperU faculty came to AmeriCar and asked the IT manager to meet with themselves and the AmeriCar subgroup. Also, the IT manager's performance objectives for the following year eventually came to include some support of the AES project.

At DeutschCar North, where there was a similar organizational structure, a different scenario unfolded. Due to server and network problems at DeutschCar North, the AES Team Web site operated so slowly as to be practically inaccessible for the first month or so of the project. In this case, Reinhart 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 potentially, in Reinhart's view, help everyone at the DCN site. In response, the technology manager became 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 technologist spent several hours on successive days finding and fixing the problem, Reinhart gave him a small thank you gift for his help. Unfortunately, obtaining the information technologists' participation proved to be only one of several local hurdles to the establishment of the communication infrastructure.
Local technology infrastructures and policies

Technologists at SuperU had suggested that the team use NetMeeting, a free Microsoft application for computer-to-computer conferencing over the Internet already in use by several organizations and at least a few thousand home computer users. NetMeeting supported communication and group application sharing by linking individual computers together with the equivalent of a telephone call. Once linked by NetMeeting, participants could view and manipulate documents and applications displayed on any one of their personal computers, such as an Excel spreadsheet, even if the viewing computer did not have Excel installed.

The first implementation challenge involved the traversing of "firewalls," a technology designed to protect the integrity of company's information system by preventing the company's computers from being directly linked to other computers outside the organization, the basic operating principle of NetMeeting. Working collaboratively, the SuperU and AmeriCar technologists eventually identified a handful of solutions to the technical problems, but these solution proposals only served to foreground organizational barriers to getting connected.

The use of firewall technology reflected a fundamental electronic security practice also codified in organizational policies prohibiting the linking of internal computers to either computers at other organizations or to "insecure" computers at the university, key elements 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 university computers via a dedicated ISDN line. I only saw and heard the final stages of this process but based on my observations and members' retrospective accounts, obtaining this permission had 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 the technologists, learning along the way exactly how to phrase their request to get the go-ahead.

Other organizations were unwilling to pay for an ISDN line for a temporary project. So after establishing connections between SuperU and AmeriCar, work on the computer-conferencing infrastructure stalled again. This overview of the team's efforts to establish a computer-conferencing infrastructure illustrates the variety and inescapability of local influences on team-related action and the added degree of complexity when resulting from the members' situation in multiple local environments. In the next chapter, I pick up on the development of the computer-conferencing infrastructure story as it progressed during the second year.

**Conceptualization of tasks**

Because all the team members also participated in AES technology development work within their own organizations, information needs and analyses for the AES Team project often overlapped with those for their local projects despite their perception of the AES Team as a divergence from their "real" work. The intermingling of the AES Team project work with the members' other local tasks only further amplified their conceptualization of the team tasks through locally-particular frameworks. When working on such a coincidental task, the team members did not (usually) differentiate between the Team's objectives and their own local objectives. Rather they engaged in the project from the perspective of meeting internal criteria, satisfying internal constituents, and furthering internal programs. The team task assignment provided an external motivator for doing the particular task at a particular time, but also provided an occasion for review, reflection, and action to move their own internal initiatives forward.
The "Load List"

Once again, the team's work on the "load list" offers a useful illustration. In this exchange during an AmeriCar-SuperU meeting, the participants were politely arguing over whether the electrical components (i.e., electronic engine control, heated catalytic converter) included in the load list needed to represent an "accurate" prediction of what would be in the "future" car (circa 2005), AmeriCar's position, or a "plausible" one, SuperU's position. The members from each organization advocated a resolution of their disagreement that would satisfy local criteria and local constituents:

Richard: It's not clear there is a consensus which is the right way to take in the future. I mean...it's hard to say if camless [electronic engine valves to improve fuel efficiency] is going to show up or some heated catalyst [for emissions reduction] is going to show up. What is going to show up in 2005?

Frank: I'm not convinced that what we have to do is come up with an accurate answer of what's going to be in the 2005 vehicle, but what we have to come up with is a plausible response to the question, "What are the electrical loads going to be in 2005?"

Richard: ...I don't want to pick an application and then go and try to sell that to our vehicle program people and they say, "This is never going to happen." I mean we have to look at a reasonable application we think is very likely to come on board.

After the meeting, another AmeriCar engineer, reflecting on the meeting, commented to me:

We're in industry, so we are more practical...SuperU doesn't have to worry about convincing a program manager or developing things that could work in a specific car. They only have to show that something is possible and so approximations are okay, but that will never fly in the VCs [vehicle centers].

Though the team's espoused objective only called for presenting a persuasive case for the new system in their TechExpo paper, catalyzing industry consensus around the new system as the standard electrical system for future cars, the AmeriCar engineers interacted with the SuperU

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20 Vehicle centers are the divisions of the organization responsible for the design, development, and testing of specific cars and trucks scheduled for production, as opposed to "research" and "advanced technology" which tend to work on technologies for future vehicle programs not yet scheduled for production.
members from the perspective of a local initiative, developing technology to “sell” to an
AmeriCar vehicle program manager for installation into an AmeriCar automobile.

In this case, the typical SuperU approach paralleled the objective for the Team paper, to
make a conceptual case for a future technology, so the local basis of their position is less
apparent in this exchange. However, the AmeriCar engineer’s post-meeting comment regarding
the SuperU members’ priorities resonated with my own observations regarding SuperU’s
orientation to their work and their perceived constituents. As academic faculty, the SuperU
members gain prestige for “new” ideas, new analytic techniques, or new criticism of extant
theories and technologies. As an engineering research facility, they have a reputation for being
on the “cutting edge” and believe both industry and other universities look to them for hints of
the future. So their tendency is to “push the envelope” as far as possible without, as in the case
of TechExpo, completely losing their practical engineering audience. Their audience only
expects them to prove conceptual feasibility—i.e., “it works”—and takes for granted that a
model proposed by SuperU would require some significant “tweaking” to work in any particular
application. In contrast, at AmeriCar, technologies proposed to a Vehicle Center (VC) manager
are expected to be “proven out,” meaning not only that the technology exists and works, but it
works in an AmeriCar at a measured level of reliability in “under-the-hood” conditions (extreme
hot and cold) within AmeriCar performance specifications. So while each group’s advocacy of
the particular level of required accuracy did reflect, in part, semantic differences between groups
as might be seen between any two independent work groups, in this case it also illustrates how
each group framed the task as an element of their local portfolio, subject to the requirements of
local constituents and the consequences of failing to meet those requirements.
The “Yellowboard”
This same concern for local legitimacy motivated additional action at AmeriCar that became the focus of another (polite) disagreement between AmeriCar and SuperU members. At the conclusion of the kick-off meeting, some members had mentioned the possibility of doing physical experiments. Don had closed that discussion by saying that doing comparative physical experiments would be “ideal” but that the group did not have time and so would need to rely instead on a “paper study,” or theoretical analysis. No one seemed to object at the time, so he believed the other members had agreed. Then two weeks later when I arrived at AmeriCar, I discovered the entire group there engaged in the process of building an experimental setup. A crane had been hired to lift the steel mesh platform that would form the base for the experimental equipment, the “yellowboard,” through a window because it would not fit through any of the doors or into the elevators, new electrical circuits had been installed in the lab, and the engineers were busy ordering components from various AmeriCar and supplier factories.

These examples give testimony to the differences in viewpoint that result from localized practices and meaning systems developing among collocated collaborators, complicating collaboration between physically, socially, or functionally disparate groups (Boland & Tenkasi, 1995; Dougherty, 1992; Fleck, 1979; Lawrence & Lorsch, 1967), what Carlile (2001) would call a “semantic,” or interpretive, boundary condition. In addition, this might also be interpreted as what Carlile (ibid) calls a “pragmatic” boundary condition, or one where members’ commitments to particular positions stem from vested interests within their respective groups, such as the need to appear competent to their collocated workers, to achieve their local

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21 More generically, the steel mesh platform outfitted with a mock-up of the electrical system of a car is called a “breadboard,” but the one used for this set up (and for several others in AmeriCar) had been painted bright yellow-gold, hence the name “yellowboard.”
performance objectives, or to retain local status, limiting their flexibility in the collaborative process.

My interpretation of the members’ concern for the perceptions of local constituents and the local relevance of team tasks as indicators of a primarily *local*, rather than *team*, orientation represents a gestalt understanding of these events within the context of members’ other actions and comments with respect to both this project and others. Examples in the next chapter illustrating how locally-oriented behavior during the team’s second year *facilitated* collaboration in the AES Team further illustrates this perspective.

**Getting Attention: Riveted by Local Events**

In Blau’s (1963) study of two government agencies, he noted that contrary to the then popular view of bureaucracies as static institutions, they were instead quite “dynamic,” undergoing continual change and reconstitution through members’ adjustments in their daily activities in response to internal and external stimuli such as economic, regulatory, personnel, and facility changes. Similarly, the AES Team members’ respective work worlds were continually in flux and, consequently, even more demanding of their attention than would be expected to stem from proximity alone. Organizational changes directly influencing the members usually meant individual role or responsibility changes and the incumbent personal “overhead” of developing new routines and learning new skills that accompanies such change. Whether up, down, or lateral, changes with individual career implications also involved new relationships, increasing uncertainty, and new sources of ambiguity. The members’ work groups at each organization underwent a myriad of changes, varying in scope and frequency, throughout the time of my study. If for no other reason, the simple progression of their local projects from conception
through development to completion involved ongoing adaptation. Here I relate just a few of the more salient events at each of the organizations during the team’s first year of work that directly impacted AES team members, amplifying their preoccupation with local events and conditions.

**EuroChip**

“Reorganization” was the catch-phrase at several of the organizations during the first year. As already mentioned, Robert, on an expatriate assignment for EuroChip, led a group that had formed in January 1998, about two-and-a-half months after the AES Team kick-off meeting. Besides the anticipated upheaval of establishing new routines and developing new networks following any reorganization, his group’s situation was complicated by the fact that they were a new group in a relatively new division established to manage the development of a new technology, AES components. In addition to technology development, they were responsible for their own business development as well, which meant marketing themselves to customers unaware of their existence. For instance, during one of my visits to AmeriCar, I saw Robert on such a videoconference explaining his group’s capabilities to a cross-functional AmeriCar group. During this same time period, Jeremiah, the primary EuroChip contact for the team based in a U.S. office, was being groomed for a new assignment and was officially in transition first to Europe and then to South America during the summer of 1998. The AES Team occurred during a period of significant flux—organizational and personal—for the EuroChip members.
AmeriCar

January '98 was apparently the month for new beginnings. In addition to the formation of the new EuroChip group, both the AmeriCar and DeutschCar groups went through reorganizations at the same time. I have already mentioned the AmeriCar reorganization that directly affected Bill Pelhams' role responsibilities. His group doubled in size, the additional team he acquired was responsible for a large, government-funded project with imminent deadlines, and he says he was told that this new project was to become his new "number one priority." He subsequently informed Frank and Don that he would be less active in the team but made no such statement to the team as a group. The AES Team goal had not changed, nor the implications of an international standard for the industry or for AmeriCar, but local managerial priorities had changed.²²

DeutschCar

At DeutschCar, the loudest reverberations of reorganization were political. Rather than multiplying the members' formal responsibilities as occurred at AmeriCar, the changes at DeutschCar altered long-standing relationships. Siegfried had replaced a well-liked director whose style differed significantly from his own, prompting more than a little concern, speculation, and backstage discussion regarding his effectiveness, the appropriateness of his decisions and their implications for the department, and what he "really meant" by certain jokes. At the same time, Juergen, formerly a team leader and a charter member of the AES Consortium, was demoted to staff engineer in the same group. During the time of my study, his role remained

²² See Barrett, 2000 for another example of a similar phenomenon
a nagging source of ambiguity for the department and a source of tension between him and Siegfried in particular. He was a senior member of the company and one of the first members of the relatively new AT department, and he often worked autonomously. For these reasons and out of deference to his prior status, he was allowed to attend the “Team Leiter” (Team Leader) meetings, but the mismatch of formal status and inclusion created ambiguity about his outspokenness in those meetings.

Pre-existing competition and tension between the DeutschCar North research group, represented in the AES team by Reinhart, and the DeutschCar South research group that did not participate in the team, were addressed structurally in the reorganization by putting both groups under the same director. This solution mitigated some of the gamesmanship that had characterized the prior relationship between the group leaders but also heightened tensions for some time because it brought the two group leaders into more frequent contact, required more frequent communication, and called for more coordination of their AES-related projects. Reinhart was continually strategizing regarding his relationship with the DCS research group leader—whether and how to approach him about collaborating, respond to his backhanded public comments, and protect himself from being maligned or his group from being excluded from a project.

The other source of debate and consternation at DeutschCar South concerned the relocation of the entire AT unit to be nearer a major production facility. In addition to their regular assignments, the engineers and managers were involved in organizing the new facility and in the political maneuvering for space. Engineers told me they were thinking seriously about whether or not to remain with the company because the new location would lengthen their commute and most were unwilling to move their families. These decisions were further complicated by the
fact that for several months, they did not know if all the groups would move, and if the research
group also moved, whether it would move with the AT group (an hour further south by car) or
move to the DCNorth facility (two hours north by car). In addition, members speculated about
how the move would affect their day-to-day routine, the future of current projects, and the
relationships between departments. In short, the certain move, coupled with the uncertainty of
who would be affected and how, promoted a great deal of local focus.

**AmeriChip**

The AmeriChip members had undergone a similar disruption just prior to the AES project kick-
off when the company relocated its headquarters and the center of operations for the
semiconductor division to another city a few hours away by plane. The primary AmeriChip
contact told me that during the first several months after the AES Team kick-off that he had
spent most of each week out of town at the new headquarters.

Then several months into the project, semiconductor sales started tapering off. As one
AmeriChip engineer explained to me, “We’re still growing, but instead of growing at [a certain
percentage] a year, now it’s only [a lower percentage]. But we’ve been set up for [the higher
percentage] growth, so what is really a slow down feels like a crash.” In response, the company
layed off more than 10,000 workers and eventually “spun off” the “commodities” portion of their
semiconductor operations. Rodney, the primary AmeriChip contact, took a demotion and decided
to remain with the commodities group, he says, to avoid relocating his home to another city even
though that meant leaving AmeriChip. Others occupying “liaison” positions between groups in
the pre-crash organization chart or working on projects slated for termination scrambled for
“safe” positions. During my visit to the U.S. site, people were colluding to find one another
positions. Engineers, staff members, and managers who had known and worked with one another for most of their careers informed one another of openings, spoke with contacts in other departments and divisions on one another’s behalf, and kept one another apprised of their progress. This exchange in the parking lot on the way to our cars was typical:

Engr #1: “I think I’ve got a spot for Bob, but I’m still working on Jim. Dan was supposed to get back to me, but I haven’t heard from him yet.”

Engr #2: I think I might have something for Jim. I’m going to talk to Alan again tomorrow, but when I talked to him today, he thought he might have something.

Engr #1: So if that works, that only leaves us with Sheila still to do, right?

Another engineer explained to me the symbolic and emotional significance of the downsizing:

“To understand how upsetting this is, you’ve got to realized that we’ve been like family. This was a family company, and when you came to work here, you weren’t just joining a company, you were joining a family. This is like a big divorce.”

Several other people made similar illusions to “family” and “divorce” throughout my stay.

Though this shift in the nature of the unwritten employment contract was not new in U.S. industry, it was new—and a shock—to many members of AmeriChip and preoccupied most of the people I met there.

**SuperU**

At SuperU, many of the changes I observed were cyclical and generally seen as positive, such as new students entering the program or graduating and Consortium meetings, but they were disruptive all the same. When I arrived, I found it strange that in a large room housing most of the students assigned to the lab (the “Roach Hotel”) with two clearly visible entrances and public computer terminals that the students could not tell me whether or not a particular desk was occupied or whether the previous applicant was still associated with the lab. After periodic visits over the course of a year, I understood.
New students arrived three times a year, at the beginning of each semester and the summer, from several different sources, for varying lengths of time. At different times of year, the new student complement included varying proportions of high school students (summers only), undergraduates seeking research experience at all levels from freshmen to seniors, and graduates beginning their masters or doctoral programs. Typically this might have involved only a few students each semester, but at the time of my study, industry interest in AES technology and the Consortium had blossomed. As a consequence, the number of research initiatives, or student projects, grew from four to twelve with additional short-term subprojects from time-to-time. Recruiting, screening, selecting, assigning, orienting, and mentoring occurred in an unending cycle, consuming significant portions of Frank’s, Don’s, and Brad’s time and attention for several weeks at the beginning of each term and then again at the end as undergraduate semester-long projects came to a close and graduate students polished their theses.

In summary, each of the organizations experienced significant organizational events during the first year, drawing the attention of the AES members. From my data it is not possible to say that these events occupied some measured percent of the members’ time that would otherwise have been devoted to the AES Team project. It was clear, however, that the discontinuities and uncertainties stirred up by these events occupied a significant portion of the members’ attention not already devoted to local projects, relationships, performance reviews, stock prices, budget meetings, computer problems, personnel concerns, and the like. In short, they further amplified the members’ focus on local circumstances.
Getting Together

Though my focus here is how the AES Team members’ situation in their local worlds influenced their participation in the virtual team, it is also useful to recognize that team-level and extra-team factors also influenced the patterns observed at the team level. While the constraining influences of the members’ local contexts predominated in their first year of work together, team practices and extra-team events facilitated the team’s work, primarily by temporally structuring their activities. For instance, the Consortium meetings provided both occasions for the team to meet face-to-face and a temporal structure for doing so. At the time of the study, the Consortium met three times per year, scheduled at times to accommodate the academic calendar and to coordinate with significant industry conferences and technology expositions such as the Paris Auto Show. Some members from each organization attended each Consortium meeting, so it was rather easy to schedule a team meeting for the day immediately preceding or following the multi-day Consortium event. Only on rare occasions were members who attended the Consortium unable to also attend the team meeting, so this practice simplified what could have been an onerous—and near impossible—coordination task, maximizing the attendance of those able to travel to face-to-face meetings.

While the Consortium meeting schedule influenced when the team met, the TechExpo paper submission process imposed a series of interim deadlines—i.e., title and authors identified, paper abstract, and draft paper—before the final version was due, shaping the content of meetings and prompting individual action, cross-site communication, and collective decisions that might not have occurred or taken longer without the deadlines. Frank (SuperU) and Lloyd (AmeriCar) were both accountable, as session co-chairs, to the TechExpo program committee for getting the
papers in on time, including the one from the AES Team, so they took responsibility for keeping the paper deadlines in the foreground of team meeting conversations.

Finally, at the team level, the team's own meetings also served as interim deadlines, increasing the priority level of the AES Team project in the members' day-to-day time allocation lottery. In the absence of daily activity reports for all the members, document postings on the team Web site serve as one proxy for gauging relative collective attention to the team project. Maznevski and Chudoba (2000) noted an increased volume and frequency of cross-site communication around the time of team meetings, and I observed a similar pattern in the AES Team. Though the team's use of the Web site for document exchange declined over the year, the local peaks in the graph in Figure 4.2 correspond with scheduled meetings.

![Graph](image-url)

*Figure 4.2 Documents posted on Web site per month--Year 1*
So while in the balance, the members’ experiences of and responses to their local contexts largely constrained their participation in the AES Team during the first year, these imposed temporal structures provided a facilitative counterbalance. Nonetheless, the members’ actions toward the team were still informed primarily by local concerns and interests. Several team members’ exits from the team described in the next section are illustrative.

**Getting Out: The Bureaucracy Beckons**

Just as local considerations informed members’ decisions to join the team, local circumstances also cued their exits. While the team made decisions as a group regarding inviting new members into the team, individuals opted out at will, usually without warning or farewell, in response to local directives, career opportunities, or reorganization, as opposed to the model propagated in the literature of fluid membership, based on collective task demands.

At AmeriCar, after Dean joined the AES Team as the team’s Technical Project Leader, Bill Pelham also gave him responsibility for AmeriCar’s participation in the team. After the June 1998 meeting to finalize the TechExpo paper, Bill stopped attending meetings with the exception of one face-to-face meeting when he was already in town for a Consortium meeting. Similarly, as Dean took over local responsibility for the AES Team project, Richard became more involved with AmeriCar’s internal initiative and moved from research into a liaison position in the advanced technology group and only attended AES Team meetings intermittently when the content seemed relevant to his new assignment. Neither Bill nor Richard informed the team formally that their involvement would change though Bill did indicate in a phone conversation with Don and Frank (SuperU) that his priorities had changed.
At SuperU, Don, the team facilitator and coordinator for the first year, left the team to accept a position at another university. His role as co-director of the Consortium had been a temporary one, a sabbatical from his industry job, so his eventual departure was likely. Nonetheless, the timing and announcement of his departure were determined by a combination of the demands of his new position and the Consortium meeting schedule rather than AES Team priorities. Though he had accepted his new position in the spring of 1998, he and Frank had delayed announcing his departure because they did not want to inform the Consortium that he would be leaving until they could also announce his successor to avoid an impression of “things being in limbo.” Because all the team members were also Consortium members, they were unaware of his plans until his last meeting in September 1998 where he passed the torch to Alan, his successor.

Finally, the reorganization at AmeriChip also manifested in participation changes in the AES Team. When Rodney changed roles, he could no longer justify his participation, so he left the team as the first year came to a close. Similar to Don, he did so by introducing his successors, two friends of his, as they told me later, “looking for a safe perch until the dust settles.” So although Rodney managed his exit from the team to assure continued AmeriChip membership, both his exit from and his friends’ entrance into the team were in response to local circumstances. This transition occurred on the cusp of the team’s second year of work and is explained in more detail in the next chapter.

Congruent with their respective decisions to join the team, these examples illustrate that members’ exit from the team stemmed from local directives, opportunities, role changes, and shifts in focus rather than changes in the skills and knowledge called for by the team project, underscoring the primacy of the members’ situation in their bureaucratic work contexts for accurately interpreting their participation in the AES Team.
Summary

As these examples show, the members’ situation in their respective physical and social contexts influenced their entry into and exit from the AES Team, their access to project information while participating, their ability to contribute to the team utilizing the resources available to them in their respective roles, and the time and attention they allocated to the project relative to local demands. Though these influences were rarely mentioned in team meetings, they were central to the work, communication, and participation practices observed at the team level. Though the members’ experience of their local contexts both enabled and constrained their participation in the AES Team, the team’s first year was predominantly a story of local constraints on collaboration. In the next chapter, I describe how the members’ local contexts primarily facilitated their participation during the second year, contributing to the changes observed at the team level between the first and second years.
Chapter Five

Year 2: Local Events as Prompts, Prods, and Motivators

Introduction

Anyone observing the AES Team meetings over the course of the two years of this study would have noticed several changes between the first and second years. In the previous chapter, I showed how the members’ social and physical situation in bureaucratic organizations, while enabling them to be part of the AES Team, largely constrained their participation in it. In contrast, in this chapter, I show that despite the persistence of many of the organizational characteristics and practices that hindered members’ participation during the first year, changes in the members’ local circumstances at three organizations toward the end of the first year enabled, even encouraged, increased and increasingly productive team participation.

During the second year, the team met more frequently (more often via audio and computer conferencing than face-to-face), grew in size, made more active use of the Web site for document archiving and sharing, and collaborated more across organizational boundaries. These changes observed at the team level correlate in time with both the changes in several members’ local circumstances and with personnel and practice changes within the team as well. A within-team analysis would likely attribute the observed increases in team participation and activity to changes in the team leadership, goals, or use of meeting media, and indeed, these changes in the team’s practices were beneficial.

Through descriptions of the behind-the-scenes experiences of the members at the affected organizations, I show instead that the intra-team personnel and practice changes stemmed first from changes in the members’ local organizations. While advantageous for the team, the
members' actions represented, for the most part, tactical, locally-advantageous responses to exigencies in their respective work worlds with unintended consequences for the AES Team. Further, even those actions intended to promote team participation were motivated largely by the members' strategies for satisfying local requirements.

I begin the chapter by juxtaposing the meeting, participation, and work practices observed at the team level during the first and second years to illustrate the changes over time. Then I describe significant events at three organizations and their implications for those members' participation in the AES Team, showing the connection between these local events and the observed changes. Finally, I show that despite significant changes in the members' work contexts at these three organizations, many of the local constraints described in the previous chapter persisted throughout the second year. The presence and persistence of simultaneously enabling and constraining local influences with differing consequences over time raises the question of the bases for the relative bearing of local enablers and constraints on virtual team participation, which I address in the following chapter.

AES Team Changes

As the first year came to a close, a convergence of significant changes at three organizations altered several members' circumstances, facilitating participation and collaboration on the team project. In this section, I describe the changes in meeting participation, communication and information technology use, and collaborative work practices observable at the team level.
Meetings

During the team’s first year, the “full”\(^{23}\) team met six times—four face-to-face meetings (including the kick-off) and two videoconferences. In addition, the SuperU and AmeriCar members met four additional times that I observed: twice by audioconference, once by videoconference, and once face-to-face following one of the two team videoconferences. In contrast, after the team’s September 1998 meeting, the team began to meet at least monthly via computer and audioconference and, occasionally, more than once a month during those months when the team also met face-to-face, for a total of 14 team meetings during the second year. In addition, I am aware of at least two additional times that cross-organizational subgroups met between full team meetings. Figure 5.1 shows the meeting frequency\(^{24}\) by quarter over the course of the 23 months of the study.

For the team’s first meeting of the second year, in October 1998, they used multi-site videoconferencing technology for the first time. When the team members agreed to monthly meetings, they also agreed to use video rather than audioconferencing at the request of the non-native English speakers who said the visual cues helped them follow the conversation. However, the camera’s switching delay and occasional switching errors when the “voice activated” camera responded to random room noise mooted the benefits of video, so subsequent “virtual meetings” were held via a combination of audioconferencing, NetMeeting, and the team Web site.

\(^{23}\) I use the term “full” here to indicate a meeting intended to include representation from all the participating organizations. In practice, all of the charter organizations were not represented at all the meetings, and the full complement of engineers working on the AES standards project were never assembled for either a face-to-face or technology-mediated meeting.

\(^{24}\) Figure 5.1 does not include the additional subgroup meetings.
The use of meeting technologies facilitated information distribution and collaboration. First, it made meetings accessible to members who would not have been allowed by their organizations to travel to a face-to-face gathering. Consequently, these members gained first-hand access to the information exchanges and discussions that took place in team meetings, decreasing their reliance on local information distribution practices for project information. Technology-mediation also enabled more frequent meetings. In the engineers’ “deadline driven” worlds, scheduled meetings created interim deadlines commanding at least momentary attention to the team project even if it went largely ignored between meetings. More frequent meetings translated into more frequent attention to the project.

**Growth**

The team also grew during the second year. The number of meeting attendees and participating organizations increased over the course of the year, and the number of participating
sites represented in each team meeting was higher, on average, during the second year than during the first. Figures 5.2, 5.3, and 5.4 show this growth.

![Graph showing team meeting attendance over time](image)

**Figure 5.2 Team Meeting Attendance**

While the initial increase in the number of participants and participating sites in October of the second year as shown in Figures 5.2 and 5.3, respectively, coincided with the team’s increased use of meeting technologies, the numbers only partly represent an expansion of access to members previously excluded by travel restrictions. I explain other reasons for this growth in meeting participation in a subsequent section where I describe the members’ experiences of changes in their organizations. The growth later in the second year reflects primarily the entry of new organizations.
The addition of new organizations beginning in February 1999 as shown in Figure 5.4 reflected the team’s acquisition of needed expertise—i.e., battery and connector specialists—to address emergent questions as the project progressed while the later, rapid growth as my study came to a close reflected escalating industry interest in AES technology and turbulence in the semiconductor industry. Each of the participating semiconductor firms “spun off” their “commodity” semiconductor groups, and those members continued to participate in the team under a new organizational identity. As my study concluded, Ken, the Administrative Project Leader at SuperU, told me that following the team’s presentation at the September 1999 Consortium meeting, organizations were asking him for an invitation into the team.
Web site usage

Another observable change in the way the team worked involved their use of the team Web site that included functionality for both document storage and threaded discussion. During the team’s first year, members posted a total of 36 “documents,” in a pattern of declining use over the course of the year with a maximum of 9 documents in any single month. During the second year, the team used the document repository to post all materials discussed or presented in team meetings, including drafts of the second conference paper posted to generate feedback. They posted four-to-eighteen documents per month for a total of 129 documents. Figure 5.5 on the following page shows the members’ increased use of this portion of the Web site during the second year in contrast to the declining use during the first year.
Several factors contributed to the increased volume of posted documents. First, the team's task during the second year involved multiple iterations on the same documents—technical drawings, a set of Excel spreadsheets, and a second conference paper—so many of the posted documents represented multiple versions of the same thing. Persistent problems with opening email attachments also made document sharing via the Web easier than email and certainly less labor intensive than fax. Finally, another significant impetus for increased document sharing via the Web was to make that sharing publicly visible to Alliance administrators, reflecting one group's local legitimacy concerns, which I discuss in more detail later in the chapter.

In contrast, the team's use of the threaded discussion ceased after only meager use during the first year. During the first year, the team members posted six "discussion" messages. Of those, one member responded to his own message two months after posting it, and only one of the other
messages elicited any response. During the second year, no one on the team posted any
discussion messages. One member told me that he thought the team was just using the
“documents” section for everything and did not differentiate between documents and discussion
messages, but a review of the documents showed that other than draft versions of the team’s
second conference paper, none of the other posted documents posed questions or comments for
discussion or feedback, and none of the posted documents contained feedback on or a response
to any other posted document. Any needed “discussion” apparently occurred via other channels
such as the team meetings or email. The non-use of the “discussion” feature is an interesting
consistency across the two years considering the other shifts in the team’s work and
communication practices, particularly their technology use practices. Perhaps the increased
meeting frequency eliminated the need for between-meeting discussion at the group level, but I
think this pattern is better interpreted as a persistence of industry communication norms and a
consistency in the team members’ low prioritization of the AES project between meetings.

Cross-organizational collaboration

The team also organized some parts of their work differently during the second year. During the
first year, the team segmented the project into discrete tasks assigned to one organization or
another, using a central coordinator, such as the “lead” author on the TechExpo paper, to do any
necessary integration as described in the previous chapter. In contrast, during the second year,
the members worked collaboratively across organizational boundaries on several tasks.

FMEA

The first task was the FMEA, the failure modes and effects analysis process for identifying and
evaluating the risk and costs of all the system failure scenarios the team members could imagine,
a common procedure in the industry. The team used the AmeriCar forms and process, and the AmeriCar group worked together “offline” on a draft version of the analysis, but the team discussed each failure mode and collectively revised each iteration of the analysis during online team meetings. In addition, members reviewed the document between meetings and either sent suggestions via email to Dean, then the team facilitator coordinating the process, or contributed their suggestions in the next meeting. If Dean received the suggestion via email, rather than just responding to the contributor, he would report the contribution to the team in the next meeting and tell them how he and the AmeriCar group had integrated the suggestion. In part, this change in practice reflects a difference in leadership style, but it also indicates a conscious attempt by Dean to better “engage” members from all the partner organizations stemming from the organizational changes explained in the last section of this chapter.

DeutschCar’s willingness to contribute to the FMEA work, including design suggestions for preventing some of the failure modes, contrasted sharply with their apparent reluctance to share technical information regarding the load list during the first year. In that case, during a team videoconference, Bill (AmeriCar) and Frank and Don (SuperU) had each queried the DeutschCar South members about components to include and omit from the list, but the DeutschCar members had evaded their questions. In working on the FMEA, however, the DeutschCar members participated actively in the meetings and even reviewed some iterations of the analysis “offline” between meetings. For example, both Juergen and Reinhart revised a couple of the technical drawings, the basis for the analysis, and suggested alternative designs that would eliminate one or more of the failure modes.
“AES Congress” Paper

During the team’s second year, the members also produced another conference paper, this one for a special “congress” on AES technology. Similar to the approach taken to the first paper, Dean (AmeriCar) took the lead on this paper and did most of the writing. Nonetheless, he and the team adopted a more collaborative and inclusive process than that used for the first paper. First, the author list for the second paper included a representative from each of the charter organizations rather than just the automakers and SuperU. Dean also involved the other authors in the entire process. He first proposed an outline for the team to review before drafting the paper. Then he posted each new draft on the Web site for all the members to review and comment on. The paper went through approximately thirteen revisions within the team before legal review and submission. Similar to the team’s work on the FMEA, if members sent feedback to Dean via email, he did not simply communicate one-on-one with each of the other authors. Rather, in the team meeting, he related the feedback he had received and either how he had incorporated it into the draft or why he had not. Then the group either expressed agreement with his decision or offered reasons for a different course of action that he might not have considered. He also facilitated two additional computer and audioconferences I am aware of for the author subgroup (not reflected in Figure 5.1). Even though all of the authors did not attend both the meetings, the authoring process was inclusive, interactive, and collaborative (Yates, Orlikowski, & Rennecker, 1997).

Simulation Modeling

Finally, Kevin, an AmeriCar staff engineer, and Michael, a new DeutschCar member who joined the team during the second year, worked together to develop a simulation model for testing and evaluating the team’s prototype designs. In this case, Michael, in Detroit for other business at
the U.S. office of the recently acquired EuroCar, came to AmeriCar a couple of days a week to work with Kevin, then the two of them presented their model in team meetings over NetMeeting. This was the only example of physical relocation across sites during the time I followed the team, though members did occasionally visit one another’s sites in the capacity of “customer” or “supplier” regarding other projects.

Summary

In summary, comparing the team’s work and communication practices between the first and second years, the team exhibited more interaction, more collaboration, and a greater degree of inclusiveness during the second year than during the first. In addition, the team made greater use of information and communication technologies to support team meetings and share information, all despite the persistence of many aspects of the members’ local environments previously described as constraints. In the next section, I describe the local changes in the members’ work worlds that provided the incentive to transcend local constraints, contributing to the changes in the patterns observed at the team level.

Local Changes

The series of organizational changes altering the members’ local circumstances began in the late spring and early summer of 1998 with DeutschCar acquiring a portion of another automaker, EuroCar, followed by downsizing at AmeriChip, and finally a threat to SuperU’s funding in the
late summer. Two of these three events were quite public and announced in national and
international publications, but their implications for the participating AES team members were
not discussed openly in the team, and their subsequent impacts on the AES Team members’
participation were not evident until the fall of the team’s second year. Here I describe how each
of these events influenced the members’ participation in the AES Team.

SuperU—Threatened Funding
For the breadth of its impact on the team, the most important of the organizational changes that
occurred during the 1998 summer happened during my third site visit to SuperU. In August,
Don informed me that future funding for the AES team was uncertain and that “sensitive
meetings” would be held soon to determine if the project satisfied the Alliance criteria for
research on “virtual teams.” This news came as a surprise to both Don and Frank, but also to
Bill Pelham at AmeriCar, the organization funding the Alliance, when he learned during an
audioconference with SuperU that the AES Team was competing for funding with other projects:

I’m confused. I thought the initial plan was to fund this project, not initiate new projects.

Frank, who had been in communication with the SuperU Alliance administrator, and Dean, who
had met with the AmeriCar counterpart, told Bill their understanding of the Alliance
administration’s then-current stance:

Frank: “Virtual engineering” is still supported, but specific projects are not necessarily
supported for the duration [of the Alliance].

25 EuroChip also underwent a significant and publicly reported reorganization, but the primary contact there had just
taken a new position in another country, so I was unable to gain access to a EuroChip site during this time.
Dean: Apparently, when the project began, they had $1M and weren’t sure what to spend it on, but now they [Alliance administration] have received proposals for $1.6M and have to make some choices.

Don: I’m not surprised by that...a bunch of hungry academics.

Dean: He [administrator] did say that the emphasis of the virtual engineering initiative/umbrella is on dispersed teams, though they were thinking more internally.

When Don, in an off-the-cuff comment, attributed the disparity between their expectations of ongoing funding and the new reality to “misinformation or bad memories” on the part of the Alliance administration, the SuperU meeting participants all nodded agreement.

Privately, the SuperU members speculated that the appointment of a new faculty administrator for the “Virtual Engineering Initiative” explained what they perceived to be a shift in strategy and focus. Though I did not have access to any internal written definitions of “virtual engineering” or to the meetings where the new definition might have been announced, the SuperU members’ believed that the definition of virtual engineering had changed to reflect this new faculty supervisor’s own research interests and represented the cost of recruiting faculty participation in such an initiative. This comment from an internal meeting is representative:

I think they realized it’s hard to get anyone to serve in any of these supervisory roles unless they have something at stake even though that runs the risk of losing objectivity or being too invested. Nonetheless, they also acknowledged that during the first year, the AES Team had failed to meet their own criteria for working virtually.

**Taking stock: Retrospective sensemaking**

The threat of losing their funding prompted a series of meetings I observed both within SuperU and between SuperU and AmeriCar via audioconference. In these meetings, the members discussed the future of the project and a strategy for writing a new proposal, but also how to account for their performance during the past year. In a SuperU meeting in preparation for an
audioconference with the AmeriCar subgroup, Don and Frank, the electrical engineering faculty, and Ben and Ed, the SuperU computer engineering faculty, inventoried their explanations for the team’s less-than-expected performance. Frank followed a cursory summary of the team’s “accomplishments” with an acknowledgment that SuperU had not effectively engaged the non-Alliance organizational subgroups:

...We’ve organized the TechExpo session and written a paper, and we’ve done a lot of experimenting with different ways of communicating, but we’ve not really engaged AmeriChip, EuroChip, or DeutschCar...

Don posited that unclear objectives had left the members directionless:

I think the reason we’ve had a tough time galvanizing this team...the objectives have been stated in terms that are too vague so that the members of this erstwhile team don’t know what they need to be doing.

Frank echoed this same sentiment later:

The problem is, there aren’t any project goals.

In fact, however, the original project proposal submitted in May 1997 included seven “objectives” and in the following February ('98), Bill Pelham had posted a “work breakdown statement” on the team’s Web site delineating roles the participants had agreed to at the January 1998 meeting. So goal and role statements did not really seem to be missing during the first year, but the claim of insufficient goal statements offered a concrete and legitimate explanation for the team’s problems—and one they knew how to remedy—in contrast to the numerous but ambiguous and potentially sensitive factors I described in the previous chapter that actually impeded the team members’ participation in and contributions to the team.

They attributed their questionable status as a virtual engineering project to their limited use of technology and speculated about other reasons, besides the technical obstacles and insufficient goals, for their failure to get a workable infrastructure in place. Ed, one of the computer
engineering faculty, inquired about the members’ level of interest in virtual engineering, as opposed to AES standards, but also considered that he and Ben had perhaps been pursuing the wrong tools or had not been insistent enough when confronted with objections by the partner organizations, such as DeutschCar’s refusal to install a dedicated ISDN line for a temporary project. But Frank argued that the information technologists were not to be faulted, suggesting instead that the team, the engineers, had not been clear enough about their own objectives to make explicit requests of the technology specialists, returning the focus to goals:

We haven’t decided what we want to do. We haven’t given you and Ben and whoever the guy is at DeutschCar, we haven’t told you what we want to do so you can give us the tools we need to do it.

Similarly, Don and Ben also saw the other team members’ seeming lack of interest in implementing and using the communication technologies as just another indication of less-than-compelling goals:

Don: It’s all part and parcel. You’ve got to have a vision and goals [that compel participation] and apply pressure to the powers that be...the incentives haven’t been there. We haven’t used the tools because we didn’t need to.

Ben: (nodding) When the only way to do the job is to use these tools, then they’ll use them.

Frank: The trick is finding that task.

Don: That’s the difficult part--deciding what’s the nature of this objective.

So, in concluding, they acknowledged collectively that the team had been less-than-engaged and attributed that state of affairs primarily to the absence of compelling goals that involved representatives from all the partner organizations. Their objective in writing the proposal, as they saw it, was to articulate an engaging goal. Though this series of meetings was prompted by
the risk of losing their funding, Frank expressed confidence that with a clear action plan, their funding would be renewed:

...If we commit to a course of action and get commitment from our colleagues at AmeriCar, we'll get the funding.

They did not anticipate that Dean, the AES Team Technical Project Leader (and AmeriCar employee) would be less enthusiastic.

An unexpected dilemma

In the following extended excerpt from an audioconference with Dean, the SuperU members discovered that Dean also saw the project coming to a close by the end of the calendar year, fourteen months after the kickoff in contrast to the three-to-five years the SuperU members had expected the project to last:

Dean: As a backdrop, I have to go talk with [the Alliance administrator] at his request, and they don't sound like they're in a very supportive mood for '99.

Frank: What does that mean?

Dean: Well, he basically asked me what we were planning to do and how much it would cost and said he would see if they could fit it in somewhere and that most of it could be paid for by the Consortium.

Frank: Well, you can disabuse him of the idea that the Consortium will pay.

Dean: By the end of the year, we hope we will have demonstrated everything we hope to demonstrate on the yellowboard except smart post and a few other things [that haven't been developed yet].

Frank: What about NetMeeting and WebCast?

Dean: Everything with WebCasting and NetMeeting can be demonstrated by the end of the year, too.

Don: (laughs)

Dean: We can start involving AmeriChip and DeutschCar this year, and we've got 3-4 months to wrap it up. We've already done a demo between AmeriCar and SuperU. Future sites are just a matter of plugging in.

Frank: One of the goals was to explore collaboration, and we haven't been able to do that because we haven't had the technology in place. We just now have the yellowboard almost ready and are getting NetMeeting in place
Dean: The problem I see with that is that I'm not sure our partners can get much benefit because it's an AmeriCar platform. AmeriChip is under duress from downsizing and they are not interested because this program is too far away [in time] for them. EuroChip is interested in motor control—we may be doing something with them internally—but they're not very interested in this project...DeutschCar has demonstrated interest but for whatever reason, they haven't done much with this.

Frank: That was DeutschCar's original interest—you probably weren't on board yet, but the early communication from DeutschCar indicated they were very interested in virtual engineering, not just AES.

Dean: From my perspective, all of the objectives have been or will be met before the end of the year. The yellowboard results won't be available in time for TechExpo paper, but they will be available for AmeriCar.

Frank: Dean, I agree that the AES objectives may have all been accomplished, but the remote team collaboration objectives have not been accomplished. Granted, the nature of the Alliance has changed and the goals of this project also could possibly have changed. Could you help us by telling us where AmeriCar is on virtual teams? Maybe this isn't important to AmeriCar anymore.

Dean: [launched into technical detail about what they have and haven't done in the way of tests on the yellowboard but did not address question of where virtual engineering fit in the organizational priority list]

Frank: The dilemma we're facing, if AmeriCar is seeing this project coming to a close, we need to plan similarly...We don't want to be pushing on something here if you don't see any value there...For this thing to continue, we've got to present a united front.

Dean: I guess I don't see any long-term value in continuing unless others want to send us their parts for testing in the system.

After this conversation, the SuperU members almost resigned themselves to an inevitable termination of the AES Team as illustrated in this excerpt from their post-meeting comments:

Frank: I can't believe it! We can check this one off if Dean's our advocate.

Ed: Death by injection, or maybe I'll just drink myself to death.

Frank: I'd rather truncate this thing. These are things we can do with you [Ben and Ed] through the Consortium.

Don: This is a huge contrast to a call we had a couple of weeks ago...

Frank: I would certainly like to get a reading from Bill Pelham on this before we cut loose [call it quits].

Ed: It's a lost opportunity, but everyone here has other research.

Don: Yes, I guess we'll just have to wait and see if in the conversation with Bill, if he isn't enthusiastic, then we'll write this off.

Frank: (after several minutes of side conversations, Frank interrupted Don and Ben) Don, I've asked Ken to draw up a budget without AmeriCar. It might actually be nice to not have the Alliance to deal with. It's been cumbersome and complicated.
According to Don, a discrete call to Bill Pelham, Dean's AmeriCar supervisor, the next morning before Dean was scheduled to meet with the Alliance administrator revealed "a bit of a disconnect there." A later email from Bill to Don indicated that he and Dean had spoken and that the AmeriCar group would "argue forcibly" for the continuation of the project and would participate in the new proposal development.

Strategizing

The SuperU and AmeriCar members met two more times via audioconference before submitting their proposal. These meetings focused on identifying tasks and objectives to "engage" the other team members and, more importantly, deciding how to present these objectives to "make the project appealing to the Alliance administrators." The day before one of these meetings, I was shadowing Don when Dean called with "encouraging" news from his meeting with the administrator plus some tips about how to frame the proposal. This is an excerpt\(^\text{26}\) from that conversation:

Dean: At this point, he's agreed to let us proceed forward but wants us to spin these [several task ideas] off separate from AES—close AES as having accelerated industry acceptance and have new proposals for the data tagging [one of the new task ideas] and "soft" stuff...

Don: There seems to be interest in ongoing social research, but that, this research requires a platform...

Dean: ...He's not saying they won't do it, just don't call it AES. Call it "soft skills for teaming" and say we're going to use the AES test bed to do it.

Don: I'm not above a little creative wordsmithing.

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\(^{26}\) Don asked Dean for permission to put the call on speaker so I could hear.
Dean: Obviously, I don’t know everything that’s going on in AmeriCar...[The administrator] said the focus has changed, but it sounds like what we’re doing is more in line with what they’re up to than it was at the beginning.

Don: ...we’ve never been comfortable with how this standardization issue played out, playing down the AES aspect and giving top billing to virtual engineering is not a problem. In fact, it’s consistent with the proposals we’ve submitted but not consistent with what we’ve done this past year.

As a result, my own study, initially a thorn in the SuperU members’ side, now became a bargaining chip:

Dean: I’m going to prepare a progress report for Bob Krannert and copy [all the Alliance administrators], and Julie—well, maybe since your project is separate—

Don: It’s a little political, but I’m not opposed to including information to make it clear that the AES project is necessary for Julie’s work to continue. The fates [of the two projects] are tied.

The SuperU members exhibited a similar change in heart regarding the yellowboard, the experimental set-up at AmeriCar that had been the focus of a disagreement between AmeriCar and SuperU during the early part of the first year. At that time, SuperU had seen the labor involved in assembling the yellowboard as an inappropriate squandering of limited human resources that would provide little new information for the TechExpo paper. Now, as the first year came to a close, Frank saw that it could appeal to the members’ technical interests:

...Let’s think about how the yellowboard can be catalyzed because the yellowboard has captured AmeriCar’s attention, and DeutschCar doesn’t have anything like that as far as I know...The yellowboard can be used to bring in AmeriChip and EuroChip...If we can come up with a set of critical experiments and if each experiment involves every member in an active way, not just as passive observers...We could have an experimental set up at each organization focusing on different technologies.

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27 As a student studying a university setting, my status was problematic. In order to observe those most closely involved in the AES Team, I needed to observe faculty meetings, which were usually off limits to students. My inclusion was initially felt, by both faculty and students, to be inappropriate. After completing the shock hazard literature review mentioned in chapter 3 and developing my own contacts with other professionals in the industry, the faculty were more accepting.
So as with the revised view of my own project, the concern for funding prompted a new perspective on—and new interest in—activities and pursuits that during the first year had seemed uninteresting, wasteful, or bothersome.

Whatever the focal activity, however, Don and Frank were clear that the proposal needed to present virtual engineering as the focal interest, as evidence by this comment from Don regarding a possible format for the proposal:

I'm having a vision of two columns, one for AES technical tasks and a second column for the virtual engineering tasks, not a one-to-one correlation necessarily but we need to have clear links between the AES tasks and the remote collaboration goals...to the extent that AES tasks get top billing, they have no stomach for that...The AES provides an important, almost irreplaceable environment for achieving these (using hands to indicate the virtual engineering tasks column and to show the relationship between the two aspects of the project). If we don't make that clear, we're dead.

As the series of discussions came to a close, they agreed that the proposal needed to include some accounting for the previous year's meager use of collaborative technologies, a task definition that would engage all the members, and "virtual engineering" clearly identified as the team's focus.

As the proposal strategy sessions came to a close, the SuperU members spoke with Lloyd, Bill and Dean's boss, who they expected might be called upon by the Alliance administrators to give an account of the project and reassured him that they would do "whatever it takes" to ensure the implementation of the computer-conferencing infrastructure:

Lloyd, Don here. I've talked with Frank, and we've agreed that we will do whatever it takes, even if it means sending someone to each site to stay until it's done...

This promise in combination with giving virtual engineering "top billing" foreshadowed the SuperU members' role in the AES team during the second year.
Enacting the promise
The primary impact on the AES Team from this threat to the SuperU members’ funding was that the SuperU and, to a lesser extent, the AmeriCar members became patient but persistent advocates of technology-mediated collaboration, particularly computer conferencing. The entreaties began subtly then became increasingly frank as illustrated by a few examples from the team’s next meeting, a face-to-face gathering in Paris a few weeks after the discussions just described. Don opened the meeting by saying “today’s meeting is an important one.” He described the plan for the meeting as a “review of what has been accomplished and a discussion of where we’d like to go.” He acknowledged that the year “has been marked by successes” but added that there were “also some areas where there’s a lot more that I hoped we would accomplish, particularly in the area of one of the key themes of the project, virtual engineering.”

Kevin, an AmeriCar engineer attending his first face-to-face AES Team meeting, followed with a presentation on and demonstration of the “virtual workbench,” the yellowboard experimental assembly at AmeriCar controlled remotely via NetMeeting. He concluded with diagrams and explanations of multiple ways for the organizations to link electronically and an appeal to the other members to recognize the value of remote collaboration. Kevin’s delivery of the technology demonstration was a statement in and of itself. In previous meetings, discussions and demonstrations of collaborative technologies had always been handled by information technologists while the engineers looked on with glazed expressions.

When DeutschCar members responded with skepticism regarding the value of the workbench for their own data gathering and component testing because the yellowboard used an AmeriCar electrical system, Dean appealed to them with sketches and lists written on a flip chart suggesting a number of technical features and pre-competitive technologies that would be
beneficial for both automakers to test and generic enough that the particular car model used as
the experimental base would be negligible.

Finally, Don took a direct approach:

Frankly, if we don’t frame this more as a virtual engineering project, we are going to lose our
funding.

The DeutschCar members remained uncertain whether they would benefit technically from the
yellowboard experiments, but they did express interest in learning more about virtual
engineering. So they suggested generating separate “aims,” or goals, for virtual engineering in
addition to new goals for the AES development work, and the group agreed.

In subsequent meetings, the SuperU members took up the advocacy torch. They humored the
members through the awkward learning stages with the technology and applied increasing social
pressure to the late-adopters to take whatever steps were necessary to establish computer-
conferencing links. For example, in the first computer conference using NetMeeting, the SuperU
members experienced some difficulty viewing a spreadsheet projected by AmeriCar because the
computers at each location had different screen resolution settings. When Ken interrupted the
technical discussion for several minutes to adjust the view size, an AmeriChip member not yet
using NetMeeting made a remark that he thought the people not using NetMeeting were the
“lucky ones” and a couple additional remarks about the technology being “more trouble than it
was worth.” Alan, Don’s replacement at SuperU, responded by reminding the group that they
would be taking time to sort out technology problems as they arose because “one of the main
goals of the project was to learn more about virtual engineering” and that that included “learning
how to use the technology.” He did, however, assure them that if the technology became too
much of a hindrance, they would abandon the technology for another, but he encouraged them to
“give NetMeeting a chance” and said they should expect to experience a “learning curve” anytime they used a new technology.

The application of social pressure to late adopters took several forms and intensified over time. Though an increasing number of sites and individuals were joining the team meetings via audioconference, several sites still lacked computer conferencing capability for all the reasons described in the previous chapter—incompatible technologies, organizational policies, frozen funds, etc.—well into the fall of the team’s second year. The first level of social pressure consisted of a query in each meeting announcement asking the members to R.S.V.P. as to 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 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, Ken asked again out of administrative curiosity, 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. Finally, he, too, reminded the members that virtual engineering was the team’s *raison d’etre* and that using NetMeeting was an expectation of all members.

As mentioned earlier, the group’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. In response to the Alliance administration’s threat, they began to foreground virtual engineering in the team meetings and took on 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. At the team level, the SuperU members’ actions may have appeared simply to be follow-through on the virtual engineering goals agreed to at the Paris meeting—and the team did follow through—but at the local level it became apparent that the motivation to do so was rooted in local events.

**AmeriChip—Downsizing**

I visited the U.S. AmeriChip site five months after the corporation announced a global downsizing. Though downturns were a familiar occurrence in the semiconductor industry, this one had come as a surprise:

> These are crazy times. We’re in the midst of our reorganization and three years of semiconductor recession. It happens every ten years, around the middle of the decade—1975, the mid-'80s—but it seemed around mid-'95 we wouldn’t have one this decade. We were wrong.

Besides the reorganization already in progress, industry events suggested even more lay-offs ahead. EuroChip had spun off its semiconductor division, or the group that manufactured single-chip “commodity” devices, around the close of the team’s first year, and the AmeriChip members I spoke with assumed if the EuroChip deal proved successful, their group would be next: “If EuroChip can make a go of it. We’re definitely at risk.”

Local austerity measures and internal communications also served to reinforce to the members that both the company’s well-being and their own employment were tenuous at best. Unlighted expanses of empty cubicles stood in memorial to their previous occupants while also reminding those in the “offices with walls” around the perimeter of each dark room to cut
spending in every way possible, including turning off unnecessary lights. In addition, “inspirational” email messages from the CEO always included reminders to conserve and of the consequences of failing to do so:

Watch internal spending carefully…We have a pattern of overspending at the end of the year. We cannot afford to let that happen this year. Ensure that you and your associates accept responsibility for our fiscal health.

As mentioned in the previous chapter, such local disruptions tended to rivet organizational members’ attention, leaving little time, energy, or interest for focusing on the AES Team project. In the case of the AmeriChip members, however, daily reminders of their precarious employment were both a consuming distraction and an incentive to associate themselves with promising, future-focused projects. The AES Team offered the possibility of such a project.

According to Rodney, AES technology had become an “official task in the organization” when AmeriChip joined the Consortium and agreed to participate in the AES Team in May 1997, but not without managerial misgivings as described in the previous chapter. However, as the team’s first year came to a close, several of the most-watched trade journals covering TechExpo, where the team presented their first paper, put AES technology in the headlines. Rodney told me that this had helped to boost the team’s legitimacy with relevant managers. Another AmeriChip member who joined the team during the second year echoed the importance of the industry press coverage for managers’ perceptions of emerging technologies generally, and that the press had certainly played a role in his manager’s perceptions of AES. In addition, he believed that other market events such as DeutschCar’s acquisition of EuroCar also had contributed to the AmeriChip managers’ interest:
DeutschCar's anticipated volume was too small to get management support to proceed with
design and testing, but they're more interested now that DeutschCar acquired EuroCar—and
after Standard and Poor's AES study!

So, according to the AmeriChip members I spoke with, by the fall of 1998, their managers were
looking more favorably upon AES technology as a legitimate development direction.

Besides the shift in their managers' perception, to accurately interpret the AmeriChip members'
participation in the AES Team during this time, it is also necessary to understand their
orientation toward the organization and their jobs. Based on conversations with several
AmeriChip engineers in the semiconductor group in both the U.S. and Europe around this time,
many job roles and their occupation by a particular person were seen as temporary. When
exchanging information about the status of coworkers' employment and current location, the
description often ended with the phrase, "that job is just a perch until things perk up," or
something similar. In choosing their respective "perches," AmeriChip engineers looked both to
associate themselves with projects expected to continue and to appear to be filling a traditional
function and a technically essential role for that project. Designations as a "design," "systems,
"product," "test," or "applications" engineer were preferred over support-type roles such as
"market liaison" or "portfolio manager." Projects associated with AES technology development
offered an opportunity to be linked to a technology with high market potential and an improving
time horizon, and, therefore, one unlikely to be terminated. The AES Team provided a tangible
connection to AES.

Not surprisingly, these internal shifts in job stability and the perception of management's
growing interest in AES technology influenced the AmeriChip members' participation in the

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28 I did not have site access during this time and did not have the type of access to managers I needed to verify this
claim, but it is consistent with my other experience with supplier firms that willingness to invest often hinges on
assurance of a threshold production/sales volume.
AES Team. During the team’s first year, Rodney and either an engineer or a manager from the “automotive group” were AmeriChip’s only representation at each of the face-to-face meetings with the exception of the January 1998 meeting held in the home city of an AmeriChip facility and attended by six AmeriChip engineers. Attendance during the second year contrasted significantly with the first. Beginning with the first of the monthly meetings held during the second year, four to ten AmeriChip members from up to five different sites attended each meeting, with an average of six AmeriChip members participating in each one. The team’s use of multi-site video, audio, and computer-conferencing certainly facilitated participation by people who would not have been able to attend a face-to-face meeting, but information about local events and how new members came into the team indicate that the new attendees had not simply been working in the background awaiting a technological breakthrough to participate.

According to the accounts of the people I spoke with, AmeriChip had been in a “wait and see” mode regarding AES technology during the first year of the team’s work, with Rodney participating in the AES Team as the group’s “scout.” During conversations both with me and with one another about a variety of projects, several members made reference to “watching the horizon,” an apparently typical, but perhaps somewhat recent, AmeriChip strategy with respect to emergent technologies. Judging from several AmeriChip engineers’ comments, there was a great deal of retrospective sensemaking going on in the organization about how not only “premature investment” but also “missed opportunities” and “boondoggles” had contributed to the company’s financial straits. So the person or group “watching the [market] horizon” was responsible for cuing the organization to invest at the right time. One engineer explained to me the importance of timing and staying aware but not investing too much too soon:
I think this [AES technology] will take longer than expected, but then it will happen within a short period of time... You can expect some setbacks, and when those happen, AmeriChip will be there with some bridging technologies... We’ll be there when they need us... If we invest too early, we’re not going to invest in the most time-sensitive technology.

Another engineer described this as Rodney’s role with respect to AES technology, offering more insight into AmeriChip’s limited investment in the AES Team during the first year:

Rodney was the person perceived as the person watching the horizon for AES but also, probably to save money [we only sent one person]—one riot, one ranger.

So rather than participating in the team’s meetings as a representative of an actively engaged subgroup, Rodney’s attendance at team meetings was more of a reconnaissance mission on behalf of, at best, peripherally-interested colleagues. Apparently, lack of meeting access was not the reason for AmeriChip’s limited meeting attendance during the first year.

At the time of my visit early in the team’s second year, Mark, Rodney’s friend, was still in a “liaison”-type role and uncertain whether or not he would be terminated while Rodney himself had just moved into a new job with a different group doing work unrelated to AES. In the prevailing friends-helping-friends spirit of the times, Rodney was trying to help Mark find another position and thought having Mark take his place on the AES Team would serve the dual purposes of maintaining both Mark’s employment and the AmeriChip semiconductor group’s representation on the team:

I’ll be shifting this thing [AES Team] to Mark. It will help him having a focus for a job, and he’s a good person to pick it up.

For Mark’s part, he was quite circumspect when talking with me about the possibility of termination, but he was also actively looking for and weighing options:

I haven’t been told yet [whether or not my job will be terminated]. They [managers] say, ‘Keep doing what you’re doing,’ but as a safety net, I’ll probably move into something more traditional. This AES thing, I might become the focal point for that.
When I queried him about his knowledge of the team’s work prior to attending any meetings and about how the project related to his previous experience, he admitted that he knew very little before attending his first virtual team meeting in October 1998:29

Not much… I attended one meeting when it was here in town, and Rodney invited people from all over the organization [Jan ‘98], but the project, in terms of knowing what’s going on, I didn’t have any idea.

Mark’s lack of knowledge regarding the team project at the time of his entry into the team did not present a detectable constraint on the team’s ability to move ahead with their work at that time but does reinforce the local nature of the rationale informing his and other AmeriChip members’ participation in the team, at least during this time.

Rodney also brought Luke, another of his and Mark’s friends, into the team at the same time. During the time of my visit, I observed Mark and Luke working together on several projects, but Rodney never gave me a clear explanation for including Luke. Luke himself described his and Mark’s entry into the team as a bit of a surprise, partly attributable to expertise, but largely a matter of default:

Rodney was the person perceived as watching the horizon… He stayed tuned in and sent us messages once in a while, but he was the primary contact. When he got the news that his job was going away, he started cc:-ing us and telling Ken [AES Administrative Project Leader at SuperU] he should include us in his list, then he sent out an email to Ken that “Mark and Luke are your contacts,” but he hadn’t told Mark or me beforehand… The majority of the [AES] technologies involved are non-microelectronic, and that’s us, but it’s more of a case of “the only two guys left standing.

In combination, Rodney’s, Mark’s, and Luke’s comments cited here illustrate two of the local bases for membership changes within the AES Team—local role changes and concern for job security—and the absence of any direct link between these membership decisions and the AES Team objectives.

29 At the time of these conversations, Mark had attended the two previous consecutive virtual meetings.
DeutschCar—New remote partners

What DeutschCar’s acquisition of EuroCar meant for DeutschCar’s AES Team members was not initially clear. The DeutschCar members I spoke with saw DeutschCar’s acquisition of the EuroCar division as a “good fit” that would offer several benefits to both brands: expanded markets and—the fantasy of all mergers and acquisitions—improved financial performance through the elimination of redundancies, pooling of technical expertise, and discounted prices for larger volume purchases. Congruent with such expectations, Reinhart and Siegfried told me they began, within a few months of the acquisition, to participate in exchange visits with their new partners to learn about one another’s work practices and to look for ways to gain efficiencies. According to Siegfried and official managerial commentary at company gatherings, DeutschCar expected their association with EuroCar to help them to expand their product line across a broader range of the socioeconomic spectrum and expected their own research division to improve EuroCar’s quality and performance.

In this envisioned exchange, Reinhart [DeutschCar North research manager] saw an opportunity to expand his group’s internal customer base, and he perceived virtual engineering as a potential key to his group’s competitive advantage over other internal research groups in the internal competition for funding:

If we can show expertise in virtual engineering, then when they need research done, they are more likely to choose us because it will be less expensive to work with us because we will be able to work with them remotely.

Reinhart reiterated this perspective in slightly different terms when the local union steward became suspicious of my project and of me. He expressed concern because I was asking people questions about their work, and Reinhart reassured him by explaining that I was only trying to
learn about "virtual engineering" and that the results of my study might actually help everyone at DeutschCar North maintain their employability.

Finally, during my last visit with Reinhart in September 1999, he talked about how advanced the AES Team had become in their use of collaborative technologies and the possibilities for using even more sophisticated tools. I remarked that Michael’s trips to AmeriCar to work with Kevin on the simulation model seemed like another indication that the team was making progress, and Reinhart responded,

It is okay that Michael goes to AmeriCar, but that is not so important. What matters to me is that he is making connections with our new partners [U.S. office], and when they need research, they will call us [instead of another research group in the company], and we will be ready because we have experience with virtual engineering.

So while the other AES Team members regarded Reinhart as a real "team player"—and rightfully so—this brief behind-the-scenes look at his participation suggests that a key factor motivating his involvement in the AES Team was an interest in improving his local group’s strategic position in the company by learning about a new way to work that would give them an edge over internal competitors.

Despite his personal and consistent enthusiasm for virtual engineering, managerial interest at DeutschCar varied influencing Reinhart’s ability to invest in the AES Team. Just prior to the acquisition, Reinhart told me after a meeting with his boss that he might have to drop out of the AES team and even possibly the Consortium because his boss did not believe these to be his group’s highest priorities. He anticipated that the TechExpo presentation 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...
Within a few months after the acquisition, though, local interest in virtual engineering increased. Beginning in the summer of 1998, Reinhart participated in demonstrations of the "virtual workbench" with AmeriCar and SuperU for the members of the Alliance administration and gave me the impression through descriptions of his interactions with coworkers that he was becoming regarded as somewhat of a local expert in "virtual engineering." 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 he was asked to demonstrate the technology locally. Coincidentally, a high-ranking manager 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.

Whether this executive's interest in virtual work tools and practices resulted from the merger, I cannot know, but his interest facilitated Reinhart's continued investment in the AES Team.

Reinhart was one of the most proactive AES Team members with respect to establishing the computer-conferencing infrastructure, but his interest was clearly locally-motivated, and his ability to pursue that interest, shaped by his managers' priorities.

**Persistence of the status quo**

In the previous section, I have shown how changes in the members' local work worlds at three organizations facilitated increased participation in the AES Team and contributed to changes in the communication and work practices observed at the team level. At the same time, however, many aspects of the members' local work worlds described in the previous chapter as
predominantly constraining with respect to the members' participation represented institutionalized practices and conditions that persisted, relatively unchanged, throughout the second year, though apparently with less influence than during the first year. Several examples illustrate this point and serve as a reminder that the members' "hidden profiles" always simultaneously enable and constrain participation in and contribution to the virtual team, though at any given time the enabling or constraining influences may be more or less apparent.

Building the Computer-Conferencing Infrastructure

This brief description of some of the challenges met in the members' ongoing efforts to implement a computer-conferencing infrastructure highlights several aspects of the members' work worlds that continued to influence their capacity to participate in and contribute to the AES Team.

After getting around one portion of the firewall problem that had stalled efforts to establish the computer-conferencing links during the first year by obtaining permission to link designated AmeriCar and SuperU computers via a dedicated ISDN line, the subsequent availability of a commercial computer-conferencing service made it possible for the other organizations to connect by means of a secure server. Surmounting the firewall challenge, however, only surfaced other barriers to connecting.

While attention had been focused on the access issues at some organizations, hardware problems at AmeriChip had gone unnoticed. The NetMeeting application was designed to run only on the Windows operating system, but AmeriChip used only Macintosh computers. The problem did not surface until the early part of the second year. When queried during the meeting regarding their progress establishing a NetMeeting connection, the primary AmeriChip contact
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 he lacked the fiscal authority to requisition new computer equipment or the installation of new telephone lines (to circumvent the firewall) without the approval of his supervisor. Eventually he did obtain permission for the phone line installation, and he and several colleagues told me that they brought in personal computers from home and participated in the meetings via a dial-up connection through their personal Internet service provider accounts.

Delays in obtaining NetMeeting access resulted in members having differential access to meeting documents. Those with access to NetMeeting were able to view documents in that medium and work with them interactively. Those without access relied on one of three non-interactive versions of the documents. For several months, Ken, the Administrative Project Leader situated at SuperU sent an electronic version of all prepared documents as an email attachment prior to the meeting. However, electronic “file size” limits, a common security measure, and application version differences occasionally prevented the documents from being either received or usable, so some members relied on a faxed version of the documents instead. Others used the Web for the documents available there. Eventually the team members (with some coaching from Ken) developed the practice of posting all meeting documents either prior to or at the start of a team meeting, but when the team began meeting via technology-mediated channels, documents were often not available until after the meeting. Though all the members eventually gained some access to the documents discussed in the team meetings, those with interactive access via NetMeeting had an edge in directing meeting discussions.

Similar to the first year, a variety of local factors, including the local technology infrastructure and policies, budgets, and member status in the organization continued to influence
the establishment and use of an infrastructure for computer conferencing and document sharing that impacted the AES Team members’ relative access to project-related information. Though the collective use of conferencing technologies increased information access and mitigated local deterents to information dissemination, local factors influenced individuals’ access to these conferencing technologies.

Building a prototype: Bargaining in Local Relationships

Increased engagement in and interaction with others about the remote project did not alter the members’ immersion in and dependence upon their local situation to accomplish their work, including AES Team tasks. This example comes from an AmeriChip member’s efforts to develop a prototype component for the battery subsystem. The subsystem required semiconductor devices to control the electric current flowing into and out of the battery and between the battery and another component to prevent damage to either the system or the car owner.

After several electronic team meetings devoted to the design specifications for this “switching” device, the AmeriChip members began work on a prototype. At a face-to-face meeting where they presented the first schematic diagrams and a not-yet-functional mockup of the device, Jeff, the AmeriChip engineer heading up the effort, explained that in order to go ahead with the project, he had had to “bribe” a manager by offering to use an existing device from that manager’s group that was less than optimal for the AES Team’s purposes. Nonetheless, the prototype could not have been built without the device, and the manager would not have been willing to develop the needed component. So by offering to use the existing one, Jeff reported that he had managed to enlist the manager’s assistance and willingness to
contribute, keeping the prototype development almost on schedule. Though not as apparent in
the examples used in the previous chapter, this type of bargaining is an integral part of these
engineers' daily work worlds not apparent on the organizational chart, but nonetheless essential
to getting work done. However, they almost inevitably involve some degree of compromise.
Virtual team tasks were not immune to these local rules of play.

Persistence of Local Distractions

The AES Team members' involvement in multiple projects competing for their time and
attention continued throughout the second year. This example comes from a conversation with
Dean (AmeriCar), the AES Team's Technical Project Leader. Between electronic team
meetings, I called Dean to ask for his perception of the project status and progress:

Right now, I've got a starter-alternator program that's behind schedule that I'm more concerned
about than the AES team.

Then he went on to talk with me about the series of events that had gotten the starter-alternator
program behind schedule before it had become his responsibility and told me the next steps in his
plan for getting it back on track that would be occupying most of his time for the next several
days. The AES Team project would be getting little of his attention until just before the next
meeting. The heuristics for organizing and prioritizing work seemed to have changed little
between the first and second years.

Conclusion

In the previous chapter, I showed how the members' experience of and orientation toward their
local worlds largely constrained their participation in the AES Team, then in this chapter, I
showed how this consistent local orientation in the context of changing local circumstances served to facilitate team participation. For the most part, the enablers and constraints identified during the first year—i.e., habituated practices, established relationships, roles—represented institutionalized aspects of the members' local work worlds. Though I had less data on the members' day-to-day activities for the second year than for the first, several examples suggest that these aspects of the members' work contexts persisted throughout the second year, shaping the members' day-to-day work experiences and constraining their participation in the AES Team. Nonetheless, these constraining influences were much less apparent at the team level during the second year than during the first. This differential influence of and changes in the enabling and constraining influences of the members local work contexts over time is the focus of the next chapter.
INTRODUCTION

In chapters four and five, I have shown how the physical and social situation of one multi-organizational virtual team's members in their respective work sites shaped every aspect of their participation in and contribution to the virtual team project. Based on the evidence presented, I have argued that the observed work and communication practices at the team level reflected, primarily, the unintended cumulative effect of team members' practical and strategic responses to local events and circumstances rather than to the objectives and needs of the team or the dynamics among team members. In this chapter, abstracting from and synthesizing the evidence provided in the previous two chapters, I explore this relationship between the members' situation in their respective local contexts and the patterns observed at the team level more analytically.

I begin by presenting a typology of the members' team participation strategies to show the pattern of the members' participation over the duration of my study. Then I develop a typology of the local contextual elements that influenced the members' participation in the AES Team grouped by the type of influence these elements had on the members' participation, organized broadly as constraints and enablers. Finally, I discuss the link between these local contextual factors and the shifts in participation strategies observed over the course of the study, arguing that the explanation for the differential influence of the constraining and enabling influences between the first and second years lies in understanding the team members' embeddedness in bureaucratic organizational contexts. I close by presenting three conclusions of my analysis as
foundational elements for theorizing about virtual teamwork among bureaucratically-situated collaborators.

Team Participation Strategies

In this section, I define several team participation strategies employed by the AES Team members in general terms regarding members’ actions in team meetings and toward the team project, and show the pattern of members’ participation strategies over time. I use “strategy” here in the sense that it is used by Lofland (1976: 49):

“any act or more complex activity...enacted to deal with a situation. To the degree, too, that any act has some determinate impact on a defined situation of interest, intended or not, it may be considered, for analytic purposes, to be a strategy.”

The members’ team participation strategies were both intended and happenstance, but in all cases reflected the members’ knowledgeable responses (Giddens, 1984) to both emergent and chronic conditions in their respective local work worlds.

I identified four different participation strategies exhibited by the members over the course of the study: initiating, guiding, contributing, and observing. Several members changed strategies over time, and the strategies employed varied among the members of organizational subgroups. Figure 6.1 shows the distribution of the members by strategy. A few members’ used more than one strategy within one of the time periods, so for those members the figure is an (even greater) simplification of their participation, but I believe it accurately represents their overall participation for that time period. For some members, I differentiate between their strategy with respect to AES standards work (AES) and virtual engineering (VE). Where I make no
<table>
<thead>
<tr>
<th>Participation Strategy</th>
<th>Fall '97/Winter '98 Kickoff</th>
<th>Spring/Summer '98 Local Changes Began</th>
<th>Fall '98/Winter '99 Paris; TechExpo</th>
<th>Spring/Summer '99</th>
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<td><strong>Initiating</strong></td>
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<td>Ken (VE)</td>
<td>SuperU</td>
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<td>Don</td>
<td>Alan (VE)</td>
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<td>Dean (AES, VE)</td>
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<td>Siegfried</td>
<td>Kevin (VE)</td>
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<td>Reinhart (AES, VE)</td>
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<td><strong>Guiding</strong></td>
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<td>AmeriChip Automotive</td>
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<td>EuroChip Automotive</td>
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<td>DeutschCar</td>
<td>Reinhart</td>
<td>AmeriChip Commodity</td>
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<td>Robert</td>
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distinction, it is implied that the member’s strategy was with respect to the team’s work on AES standards.

The *initiating* strategy involved introducing agenda items, suggesting and lobbying for specific plans of action, and making facilitative interventions in team meetings; in short, taking a directive approach. The members exhibiting the *guiding* strategy attended nearly all the team meetings, making suggestions and raising objections about technical matters including system design, the content of the conference papers, and how the team presented their work publicly. Members employing the guiding strategy made sure the team’s work stayed within certain implicit bounds, technically and politically, but, for the most part, they did not do any initiating or coordinating of others’ participation. The *contributing* strategy was similar to the guiding strategy in that team members attended team meetings, made suggestions, and raised concerns about technical matters. *Contributing* members did not, however, attempt to direct the team’s work. Rather they provided technical expertise, advising the team about the technical limits of available technologies and the technical and financial implications of design options. Members employing an *observing* strategy did not generally introduce new questions or ideas and did not attempt to direct the team’s work. *Observing* members varied in their level of team meeting attendance from “frequently” to “rarely” but were similar in their relative indifference to the team’s direction or process. Instead, they were primarily interested in staying abreast of progress and decisions regarding the direction of AES technology development.
**SuperU**

Frank and Don, the SuperU faculty members, exhibited the *initiating* strategy throughout the first year of the study with respect, primarily, to the AES work, but Frank also advocated locally and in the team for the development and use of collaborative technologies, or doing “virtual engineering.” Then, during the second year, after changes in the composition of the SuperU subgroup and the changes in local circumstances described in chapter six, Alan, Don’s replacement, and Ken, the team’s Administrative Project Leader, maintained an initiating strategy with respect to virtual engineering. Alan adopted a *guiding* strategy with respect to AES technology standards, making sure the team’s efforts stayed coordinated with activities in the Consortium, and Frank adopted an *observing* strategy. Brad, the post-doc, maintained a *contributing* strategy throughout the project with respect to AES technology development.

**AmeriCar**

Bill, the AmeriCar Group Leader, adopted an *initiating* strategy at the project’s outset, while Lloyd, his boss, took on a *guiding* role. After a reorganization in AmeriCar’s research department shortly after the AES Team kickoff, Lloyd changed to an *observing* strategy in his capacity as Bill’s supervisor and stopped actively participating in the project team. Bill retained an *initiating* strategy with respect to AES technology through the completion of the TechExpo paper in the summer of 1998, then transferred responsibility for team participation to Dean, purportedly due to a significant increase in his local responsibilities, and adopted an *observing* strategy instead. Dean, the team’s Technical Project Leader, joined the team in Spring 1998 and adopted an *initiating* strategy with respect to both the AES standards work and virtual engineering, though at the outset, many of his activities were through personal communications...
with individual team members and not apparent to members at all the sites. Richard, initially the local Team Leader, took a contributing approach through the completion of the team’s first year. During the second year, his participation in the team switched to an observing strategy when his job responsibilities changed with respect to AmeriCar’s internal AES initiative. Kevin, a staff engineer, began attending team meetings in September 1998 and, with Dean’s support, adopted an initiating strategy with respect to establishing the computer conferencing infrastructure for “virtual engineering.” With respect to AES technology development, however, he employed a contributing strategy, providing technical information and support as needed but deferring to Dean and other managers for direction.

DeutschCar

During the kick-off meeting, Siegfried, the DeutschCar South Advanced Technology Manager, initially adopted an initiating strategy. Then when his idea for a project focus was not adopted by the team, he saw the project as offering little value for DeutschCar’s local work on AES technology and assumed a guiding strategy to be sure the team did not take a direction that would jeopardize DeutschCar’s work-to-date. Sebastian’s strategy was informed by a similar philosophy. Concerned primarily with the progress of his own AES project within DeutschCar, he adopted a contributing strategy in the team. In contrast, after the first couple of meetings, Reinhart adopted an initiating strategy, regularly introducing new technical information with suggestions regarding its implications for the team’s work in addition to his efforts to facilitate virtual engineering. Michael, who joined the team during the second year, adopted a contributing strategy similar to Kevin at AmeriCar with whom he collaborated.
AmeriChip
Throughout the first year and into the second, the AmeriChip members demonstrated an *observing* strategy. Members’ comments to me regarding their participation in team meetings indicated a relative indifference to the team’s direction or process. Instead, based on their “backstage” comments during and after meetings, they were primarily interested in staying abreast of the automaker’s decisions regarding technical direction. During the latter half of the second year, however, the members in the automotive group—Wilson, Charles, and Jeff—adopted a *contributing* strategy as they became more central for the team’s prototype development process. While they contributed technical information and suggested technical and financial limits for the team’s design work, they did not attempt to shape the team’s overall direction or work processes. Instead, they maintained a deferential stance with respect to the automakers, the latter providing the final approval or rejection of any technical suggestions.

EuroChip
The EuroChip members maintained an *observing* strategy throughout the team’s first year. Then Robert, EuroChip’s AES Technology Development Coordinator became more involved and adopted a *contributing* strategy after agreeing to be a co-author on the team’s second paper. Other EuroChip members—Paul, Tim, and Uwe—continued to employ an *observing* strategy throughout the second year. Though they attended more meetings during the second year following multiple solicitations from Dean, their attendance remained scanty, and they rarely made substantive comments during team meetings. They did not, however, withdraw from the team or ask for any diminished contact.
Status Effects

What these descriptions do not reveal is that the relative status of a members’ organization in the industry, or of a member in his local work world, also played a part in determining the strategy employed. For instance, it is unlikely that a member of a supplier firm would ever play an initiating role in this team, or any other group of similar composition. The automakers and suppliers in the industry collaborated according to an unwritten division of labor: The automakers wrote the performance specifications, set cost parameters, and often placed other restrictions on the design (initiating and guiding actions), and the suppliers built the technology to suit the automakers’ requirements—and whims (contributing actions). In short, suppliers rarely “initiate” or “guide” (at least not explicitly!). The stability in the strategies of organizational subgroups over the course of the study shown in Figure 6.1 reflects these relationships—i.e., at least some SuperU and automaker members consistently adopt the more directive initiating and guiding strategies, and the suppliers, the more passive contributing and observing strategies. Similar divisions of labor and relationships existed across levels of hierarchy within the organizations as well. So it is the pattern of a member’s participation over time that is most meaningful for accurately interpreting the influence of local conditions on his participation in the virtual team rather than the specific strategy employed.

Summary

These descriptions of the members’ participation strategies and the rationales for their change over time highlight the influence of the members’ local contexts on their team participation. While Figure 6.1 shows significant stability at the subgroup level, it also shows greater variability at the individual level with changes in a subgroup’s participants and those
participants' strategies corresponding to changes in the members' local contexts described in the preceding chapters. While the increasing engagement of many members' participation strategies did contribute to more fruitful team outcomes, the observed strategies were rooted in locally specific rationale. The overall pattern of increasing engagement represented, primarily, an unintended cumulative outcome (Giddens, 1984; Merton, 1963) of individuals' and local subgroups' strategies for managing local interests and conditions.

**Local Influences on Team Participation**

Based on my observation of the AES Team members in their respective work sites and in team meetings, I developed a typology of the local contextual factors influencing members' participation in and contribution to the virtual team (see Figure 6.2) grouped by the type of influence exhibited in the members' actions. The influence types are first organized into the broad categories of *constraints* and *enablers*, from the perspective of their affect on members' contributions to the AES team. Then the *constraints* and *enablers* are further subdivided into types of constraints and enablers, specifically *disincentives, barriers, limits, distractions, complications, motivators*, and *accelerators*. These constraint types represent variations both in affect on member participation and relative malleability by individual action. The *types of influences* are analytically distinct, but the local contextual factors affecting team members' participation have more than one type of influence on member action and, therefore, are sometimes included in more than one influence type category. For instance, in some cases, a particular aspect of the members' local worlds enabled participation at one point in time or in one organization and constrained participation at another point in time or in another organization.
In the next several pages, I define and elaborate upon each of the identified influence types. Then I reflect on the similarities and differences in the constraint and enabler profiles between the first and second years, and the relationship between these profiles and the members’ participation patterns. I argue that the explanation for the differential effects of the local constraints and enablers on the members’ participation observed over the course of the study lies in understanding the members’ philosophies, or strategies, for managing their local worlds.

**Constraints**

The types of constraining influences included *disincentives, barriers, distractions, limits,* and *complications.* Here I define and give examples of each of these types. Figure 6.2 provides a visual depiction of their organization and indicates their presence or absence during the first and second years.

**Disincentives**

*Disincentives* consisted of aspects of the local contexts that decreased members’ motivation to participate and included *locally-oriented performance appraisal processes* and *negative project perceptions* stemming largely from the performance appraisal criteria. Though the details of the procedures varied across organizations, the performance appraisal processes at each of the organizations consisted of some process for the members to be evaluated by their immediate superior, with implications for both their financial compensation and their career opportunities within the firm. According to the members’ descriptions of the processes, supervisors based their evaluations on one or more of the following criteria: peer regard; internal customer satisfaction; numbers of papers, patents, and technical innovations; and group or division financial performance. In one organization, the individual’s final “ranking” depended upon his
supervisor’s endorsement in a rankings competition meeting of all the managers in his
department. Though the processes and criteria varied across the organizations, each
organization’s process evaluated the individual on local activities and achievement of local
objectives as perceived by local colleagues, an unsurprising finding in bureaucratic organizations
of the 20th and early 21st centuries, but an important one for understanding virtual team
members’ privileging of local matters over team activities.

Figure 6.2 Typology of Local Influences on Virtual Team Participation

<table>
<thead>
<tr>
<th>Local Influence</th>
<th>Year 1</th>
<th>Year 2</th>
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<tbody>
<tr>
<td><strong>CONSTRAINTS</strong></td>
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<td><strong>Disincentives</strong></td>
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<td>* Local performance metrics, e.g.,</td>
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<tr>
<td>- numbers of papers, patents, technical innovations</td>
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<td>- internal customer satisfaction</td>
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<td>- well-regarded by peers</td>
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<td>- supervisor endorsement in department-level ranking</td>
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<td><strong>Barriers</strong></td>
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<td>* Internal communication practices</td>
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<td>* Information distribution practices</td>
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<td>- meeting exclusion</td>
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<td>- reporting “up”</td>
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<td>- “need to know” lateral communication</td>
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<tr>
<td>* Information withholding practices</td>
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<td>* Physical arrangement of members (proximity effects)</td>
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<td>* Information management practices, e.g.,</td>
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<td>- personal archives</td>
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<td>- restricted access to shared repositories</td>
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<td>* Technology infrastructure</td>
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<td>* Technical features/specifications</td>
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<td>* Reliability</td>
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<td>* Security features</td>
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<td><strong>Limits</strong></td>
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<td>* Organizational policies</td>
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<td>* Travel</td>
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<td>- Career dynamics</td>
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<td>Distractions</td>
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<tr>
<td>Internal projects</td>
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</table>
| Organizational changes, e.g., | (began end of Y1) | \[ \text{AmeriChip} \]
| - reorganization | \[ \text{DeutschCar North} \]
| - relocation | \[ \text{DeutschCar} \]
| - mergers and acquisitions | \[ \text{SuperU, Americar} \]
| - change in funding | | |
| Complications | | |
| Relationships | X | † |
| - Between peers | | |
| - Between superiors and subordinates | X | † |
| - Between departments | X | † |
| - Competitive | X | † |
| - Antagonistic | X | † |
| - Formal | X | † |
| - Subordinate | X | † |
| - Between organizations | X | † |
| - Competitive | X | † |
| - Customer-supplier | X | † |
| - Antagonistic | X | † |
| Rhythms | X | X |
| - Holiday/"Production" schedules | X | X |
| - Budget cycles | X | X |

**ENABLERS**

**Motivators**

| Managerial mandates | X | X |
| (to participate) | (to be "virtual") |
| Incentives | AmeriCar, SuperU | X |
| - Managerial interest | AmeriCar | X |
| - Positive project perceptions, e.g., | DeutschCar | X |
| - visibility | AmeriChip, DCar | X |
| - internal competitive advantage | AmeriChip | X |
| - job security | | X |
| - future revenues | | X |
| Face maintenance interests | X | X |
| - Internal | X | X |
| - External | X | X |

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<th>Accelerators</th>
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<td>* <strong>Internal communication practices, e.g.,</strong></td>
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<td>* <strong>Information management practices</strong></td>
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<td>· Between organizations</td>
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<td>* <strong>Deadlines</strong></td>
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X – Observed
† – Assumed based on earlier observation and organizational member comments and descriptions of ongoing work life after my site visits.
(†) – A workable solution found but still had to be taken into account

Understandably, the team members perceived the project from the perspective of its potential contribution to their local endeavors. *Negative project perceptions* included seeing the project as a threat to internal initiatives; as not contributing to internal initiatives; as “temporary” and, therefore, not warranting substantial investment; and as leading to uncertain and too distant revenues. The SuperU faculty initially saw the project as consuming resources, primarily faculty time, that they would have preferred to invest in cultivating the Consortium, a top priority, while some DeutschCar members initially feared collaborating with AmeriCar might risk their technological lead. Other members at several organizations saw no reason to invest in the team because it did not directly contribute to their accomplishment of local projects. The temporary nature of the project primarily affected the members’ managers’ willingness to invest in the technologies needed to establish the computer-conferencing infrastructure rather than the members’ individual levels of involvement. However, being technologically limited effectively
restricted members' participation. Finally, the supplier members, participating in the team primarily as a means to develop closer relationships with two key customers, DeutschCar and AmeriCar, gauged their participation on the likelihood, scale, and timing of the potential return on their investment in the form of future technology sales.

**Barriers**

Barriers are those aspects of the local context that blocked members' efforts to contribute and interact. These included *group communication practices, physical arrangement of members, organizational information management practices, and technology features*.

*Group communication practices* included norms for both *information distribution* and *information withholding* that blocked the flow of project information among members within sites. The *information distribution norms* constraining project information flow included excluding lower-status members from both internal and cross-site meetings; reporting “up” but not out or down about interactions with other team members; and a “need to know” approach to distributing information to peers. Members engaged in these practices under the guise of “efficiency” through the elimination of “unnecessary” communication but these practices actually reflected the inherent status-orientation of the members’ day-to-day actions.

Examples of deliberate *information withholding* within a site included a supplier subgroup not passing technical AES information along to a competing internal subgroup peripherally associated with the team in order to gain advantage with common customers, and an automotive engineer withholding a technical concern and insight that would affect the basic technology design until after he had filed pre-patent documentation—a performance appraisal metric. Each
of these examples illustrates many members’ locally and personally, as opposed to team, oriented strategies for managing project-related information.

The physical organization of the members at several sites hindered information flow among individuals or between subgroups. At those sites where the members’ desks were located in separate areas or on different floors, the members often failed to share project information with their coworkers or did so only after significant delay. Further, the members did not see or hear cues from one another to prompt queries for information. For instance, at SuperU, the faculty members were located in close proximity to one another on one floor and the students in close proximity to one another on the floor below. Information flowed rather easily within each group, but very little information about the AES Team flowed between the students and faculty.

As illustrated by the story of Richard’s blocked efforts to complete the “load list,” an organization’s information management practices could be a significant barrier to an individual’s capacity to contribute to the AES Team. Though all of the participating companies employed some combination of “shared drives,” Web sites, and groupware applications intended to support collaborative efforts, access to these repositories was restricted for security reasons and their accuracy and currency was always considered inferior to the contributors’ private files. For instance, in the case of Richard developing the “load list,” he found that most of the technical information he needed lied in workers’ personal archives to which most of those workers no longer had access because they had moved on to other assignments or had left the company. All of the members spent considerable time searching for information, and a variety of individual, local, and organizational practices often made that information elusive.

Though several aspects of the members’ local contexts constrained active engagement in the team, when the members did attempt to collaborate across organizational boundaries by sharing
electronic files or meeting "virtually" the technology infrastructure often proved to be as much barrier as aide. Application and platform incompatibilities rendered some shared files unusable and made NetMeeting off-limits for some members. Security "features" such as email attachment size limits, default encryption languages, and firewall technologies resulted in truncated or unreadable files and an inability to connect to the NetMeeting computer conference. The members eventually found work-around solutions for each of these problems, such as reliance on fax for file exchange and accessing independent internet service providers (ISP) outside the firewall to participate in meetings, but each one presented a barrier requiring a tangential problem-solving effort before continuing with the AES work. The ironically predictable unreliability of the conferencing technologies also proved daunting. Each video and computer conference involved at least one loss of connection and time spent troubleshooting and reconnecting.

Limits
Less constraining but more enduring were limits to members' participation. Limits are those aspects of the members' local context that circumscribed, but did not prevent, their participation but over which they had no control and little recourse. These included organizational policies, resource availability, and a member's role status. Organizational policies limiting member participation included travel policies, purchasing policies, and IT security policies. Formal travel policies, intended (ostensibly) as cost containment measures, effectively limited the number of team members from any one organization that could attend face-to-face meetings. In addition, most organizations also employed an informal policy of giving preference to rank, so managers were disproportionately represented in face-to-face meetings. Local purchasing
policies were most relevant for AES Team members with respect to the purchase and installation of computer hardware and software. These policies determined who controlled computer purchases, when and what type of new computer equipment could be purchased, and the version of software to be used in order to make internal systems compatible. IT security policies, understandably, restricted access between company computers "inside" the firewall and those "outside" the electronic perimeter. Even when technical alternatives made linking possible, these policies still circumscribed the number and affiliation of linked computers. For instance, the companies could link to a SuperU computer or a commercial computer-conferencing service provider, but not to one another.

The degree to which organizational policies restricted a member's participation in the team related in part to the member's role status. A team member's formal role in his local work context circumscribed the member's formal authority and autonomy. Besides limits to purchasing authority, other actions were both formally and informally proscribed. Role status determined both the local and team meetings to which a member was invited, the process "required" to communicate with someone of a higher rank or to obtain assistance from another department or group. Staff-level organizational members generally possessed the technical expertise needed by the virtual team but lacked the organizational authority to access and utilize many of his organization's resources.

Finally, resource availability directly impacted a team member's capacity to contribute. These included the availability of financial, human, and expertise resources. Restricted financial resources limited the availability of other types of resources as well. In the auto companies, the word is "lean" as American and European manufacturers try to mimic Asian automotive companies' practices of shaving costs off every component and every step of the manufacturing
process. According to the people I spoke with both within the team and from other firms in the industry, cost-cutting mandates have resulted in continual workforce reductions and stricter financial controls making all resources less accessible—at least to staff engineers and first and second tier supervisors.

*Personnel practices* within the firms reflected this emphasis on cost reduction and further decreased the availability of *human resources*. “Hiring freezes” meant that hiring a new person involved letting someone else go, and attractive financial offers encouraged early retirement of workers who were generally not replaced. These practices effectively reduced not only the number of people available to participate in a virtual team, but eroded the local knowledge resources available to virtual team members as well.

The *career dynamics* within some firms also limited both the personnel and knowledge resources available to the virtual team. The practices of frequent lateral transfers to develop workers (the “fast track”) and personnel transfers to facilitate internal project continuity translated into discontinuities both for team members seeking expertise or information within their own organizations and for the virtual team membership. In general, members left the AES Team to pursue other activities in their organization, not because their expertise was no longer required.

Though limited local resource availability is an oft-mentioned rationale in the popular literature for forming a virtual team, limited resource availability within at least some of the AES Team member’s home organizations constrained the speed and quality of the members’ contributions to the team. The inability to acquire—or delays in acquiring—equipment, information technology, information, and even physical assistance to carry out an assigned task,
limited the rate, scope, and quality of a virtual team member's contribution to the team.

"Virtual" teamwork still requires and consumes "real" resources.

**Distractions**

*Distractions* are those aspects of the team members' local contexts that consumed their time and demanded their attention, decreasing the time and attention available for participation in the virtual team endeavor. These included *internal projects* and *organizational change* (local or corporate-wide). *Internal projects* distracted members with day-to-day demands—calls, meetings, paperwork, messages to be sent, information to be found, schedules to be made and revised, and problems to be resolved. In addition, the members of the team studied here commonly deferred their virtual team tasks and communication until after the achievement of local project deadlines. Sources of *organizational change* riveting members' attention on local affairs included *reorganization, relocation, corporate merger, and a funding policy change.* These, too, involved additional calls, meetings, paperwork, schedules, and problems to be resolved.

*Reorganizations* threatened members' job security, disrupted routines and relationships for getting work done, and generally increased uncertainty. A *relocation* involved logistical planning and evoked political maneuvering in an internal competition for premium space while speculation, seeking connections, exchanging information, and protracted negotiations typified the aftermath of the *corporate merger.* Finally, a *funding policy change* at one organization took precedence over most other local activity and immersed those members in an intensive process of evaluation and redefinition of their project. In each of these cases except the relocation, the disruption also facilitated the team's work, which I address later in the discussion of enablers.
Complications

*Complications*, the final category of local contextual constraints, includes those aspects of the members' local contexts that required ongoing negotiation and management but did not consistently limit or preclude either participation in or contribution to the virtual team. In the case of the team studied here, these included *relationships* and *rhythms*.

*Relationships* affecting the members' contribution to the virtual team included those among peers, between superiors and subordinates, between departments, and between organizations both within and outside the team. Antagonistic relationships among peers inhibited initiative, information flow, and cooperation among team members within an organization. Collaborative work among members in these situations required extra doses of diplomacy and was marked by hesitancy to initiate out of concern for being seen as acting out of place. Tense superior-subordinate relationships similarly inhibited individual initiative and collaborative interaction and also required careful handling.

*Competitive, antagonistic, formal, and subordinate* relationships between the team members' work groups and other departments or groups within their respective organizations constrained members' capacity to contribute to the AES Team by limiting their ability or willingness to access those groups' expertise. *Competitive* inter-departmental relationships stemmed from organization design and performance appraisal systems that put internal groups in the position of competing for internal resources, particularly project funding and performance bonuses. *Antagonistic* inter-departmental relationships usually reflected contests for control over a proprietary technology. Government regulations, performance criteria based on technology performance, technology trade-offs, and organizational reporting relationships were all bases for
inter-group antagonism. Examples of team members’ technical efforts being stopped short or compromised by antagonistic inter-departmental relationships included a desire to alter the electrical power supplied to the car’s lights, requiring an encounter with the “Safety Office”; a technology design that took more space in the already-at-a-premium “under-the-hood real estate,” calling for negotiations with the “packaging group”; and a design direction that involved collaboration with “powertrain.” In two of these three cases, the members redirected their efforts toward finding options “we can do ourselves.” While none of these were specific AES Team assignments, they were all AES-related and could have yielded information helpful to the team both as a collective and to individuals working on team tasks.

Lack of familiarity due to organizational distance seemed to account for formal inter-departmental relationships, which could slow a member’s work. For the sake of both protocol and practicality, if a team member did not already know someone in another department from whom he needed information or assistance, he usually went through the formal channels of asking his boss to initiate the query. Team members explained to me that they often did not know who to ask in the other department, that even if they found a name via some internal directory, they assumed their request would be ignored if it did not come through the person’s boss, and that the boss might be angry if not consulted first. All else being equal, communication through “channels” was generally slower than a direct exchange between a requester and respondent.

Finally, the team members’ local work groups were both formally and practically subordinate to some other groups in their organizations. In both automaker organizations, the research groups were subordinate to the advanced technology groups on whom the research groups depended for internal project funding. In two instances that I am aware of, technologies
developed for the team prototype were compromised by that member’s group’s subordinate position relative to another group on whom they depended for approval.

Interorganizational relationships complicating the team members’ efforts included competitive relationships within the team, customer-supplier relationships both within and outside the team, and antagonistic relationships outside the team. Both competitive and customer-supplier relationships within the team inhibited information-sharing to protect proprietary information. Members from each organization shared contextual information with the SuperU members that they did not share with others in the open forum of the team. Similarly, the automaker members each disclosed technical information in meetings with members from each supplier firm that they could not disclose to the whole team. History further complicated these relationships and their impact on the team. The negative experience between the automakers and the suppliers in the development of “multi-plexing” technology in the 1970-1990’s left skepticism in its wake and made the suppliers hesitant to invest too much too soon.

I have also included antagonistic inter-organizational relationships outside the team in the list because two members’ independent reports to me indicated that such a relationship had temporarily stalled one supplier’s contribution to the team. According to the reports, one partner organization balked at contributing to the prototype development when they learned that AmeriCar had also collaborated independently with another supplier firm with whom the supplier had a dispute. This report is consistent with other inter-organizational dilemmas I heard about in the industry and observed the team members dealing with directly in their day-to-day work. A quality problem or broken deal between a group in one firm and a group in another firm can lead to an organization-wide ban of further dealings with the “problem” company. These
issues were usually resolved but, again, required diplomacy, compromise, and time. In the interim, they curtail the resources available to a member and, by extension, to the virtual team.

The virtual team members’ local worlds involved relationships at multiple levels—with peers, with superiors and subordinates, with other departments, and with other organizations. In the case of this multi-organizational team, the competitive or proprietary nature of many of these relationships often constrained members’ motivation and freedom to contribute openly to the virtual team task. However, relationships could also be enabling, which I discuss in the next section.

*Rhythms* consist of the various temporal structures pacing the members’ local work. While these rhythms provided coordinating devices for local activities, because of differences in the temporal structures across sites, they often inhibited AES Team work by making team members, or other organizational resources, unavailable to one another when needed. For the AES Team, the problematic rhythms included *budget cycles* and *holiday and production schedules*, with recurring conflicts between the academic and industry calendars. At the project’s outset, differences in the academic and industry budgeting cycles presented the first barrier to the development of the computer-conferencing infrastructure. By the time monies were released to fund someone at the university to work on the technology, all the students had accepted other assignments. Eventually a less-than-optimal arrangement allowed some work on the infrastructure to occur but not at the level or pace originally intended. Differences in the academic and industry “production” schedules also limited the members’ availability to one another. During December and the summer months when the industry members were taking vacations, the academic faculty were finally free of teaching and many ceremonial responsibilities and available for focused collaboration. The completion of the TechExpo paper
is an example of this type of complication. Differences in individual and organizational holiday schedules were also problematic at times with the biggest delays caused by differences in the American and German schedules at very macro levels because these rendered entire groups unavailable rather than just individuals. For instance, the Germans’ four-week summer holiday is scheduled at the national level, and many of the American engineers schedule their vacations to coincide with the two weeks in the summer when many American automotive firms close their factories for retooling—Scheduling conflicts did not prevent the team from working but did complicate the process.

This cursory review of the types of constraining influences shaping the AES Team members’ capacity and motivation to contribute to the team show that the organizational conditions and practices, the local contextual factors, that shaped the members’ local practices also affected every aspect of their work on the virtual team project. The sheer number of constraints may make it seem surprising that any work gets done at all, but the members’ local worlds also enabled their participation in the AES Team. In the next section, I discuss the local conditions and practices enabling the team members’ participation. It is noteworthy that several of them also appear on the list of constraints.

ENABLERS

The types of enabling influences included motivators and accelerators. Again, Figure 6.2 offers a visual presentation of the typology.

Motivators

Motivators, which consisted of mandates, incentives, and face maintenance interests, included those aspects of the members’ local work worlds that encouraged participation in the virtual
team. Directives from the members’ local superiors or, in the case of the university members, funders, constituted mandates that motivated member participation by virtue of the members’ subordinance to and dependence upon the person or group issuing the mandate. The examples of members’ participation being motivated by mandates included AmeriCar’s entry into the team and SuperU redefining the project focus to satisfy funding requirements.

Incentives included those aspects of the members’ context that made participation seem likely to be organizationally and personally advantageous. Incentives included managerial interest and positive project perceptions. Shows of managerial interest in the form of queries or public mention of either AES technology or virtual engineering motivated member participation by signaling that investment in these initiatives would be supported by management and looked upon favorably. Member participation motivated by managerial interest was evident in the AmeriChip members’ increased involvement in the team based on their interpretation that their managers looked more favorably on investments in AES technology after positive press reports and forecasts of larger production volumes. Managerial interest differed from mandates in that a manager’s show of interest involved no explicit directives, only implicit legitimating signals.

Members’ positive project perceptions, based on locally-framed interpretations of the AES Team’s relevance and value, motivated team participation with anticipation of locally-significant personal gain. These included perceptions that the project offered opportunities for local visibility, internal competitive advantage, job security, leverage for an internal project, and future revenues, all of which, in turn, translate into more positive performance appraisals and larger bonuses. These project perceptions and their implication for the members’ participation in the AES Team were discussed in chapter five.
Face maintenance interests included members’ concerns for the impressions “given off” (Goffman, 1959) to both internal and external constituents. Each member’s local superior constituted the internal constituent of primary concern, but other constituencies included one’s peers or other groups in the organization with whom one desired to gain or maintain favor. Externally, members sought to maintain impressions of being “on the cutting edge” and to be positively regarded in ongoing relationships with representatives from other organizations on whom they depended. For instance, the suppliers strove to make a positive impression on the automakers and saw participation in the AES Team as a way to promulgate an image of being technologically up-to-date.

Accelerators

Accelerators included those aspects of the members’ local contexts that made participation easier, made work or communication faster, and augmented members’ efforts by focusing attention and resources. Accelerators included internal communication practices, information management practices, technology infrastructure, internal projects, relationships, and deadlines.

Internal communication practices that facilitated information distribution included meeting practices and the physical arrangement of members. Meeting practices that enabled members’ participation included regularly-scheduled work group meetings to disseminate project information, inclusiveness in meetings, and pre-team-meeting meetings. DeutschCar and, later, AmeriCar each held (usually) weekly work group meetings that provided a forum for disseminating project information that members may not have received through other channels and to address questions and exchange ideas stemming from that information. Similarly, the pre-team-meeting meetings at DeutschCar attended only by those members participating in the AES
Team offered another forum for information-sharing and for those members to discuss their interpretations as well as their positions. When they came to the team meeting, the DeutschCar members had already thought through many of the issues and intervened constructively in team discussions.

Of the various *physical arrangements of members* I observed in the different sites and organizations, the “cohabiting” arrangements in DeutschCar and among the students and faculty at SuperU accelerated information distribution among those members. In these arrangements, the participants shared office space and so were able to see one another, hear one another’s conversations with others, and spontaneously exchange ideas and information as they emerged (Olson & Olson, 2001).

While an organization’s *information management practices* often proved constraining for certain individuals seeking certain information at particular times, these same practices also gave members access to information they did not create or that they created and stored far enough in the past that they could not have remembered it or recreated it without great cost. I have no particular example of an organization’s information management practices launching the team to new levels of productivity, but rather the storage, organization, availability, and access to information that are taken-for-granted aspects of organizational life made it possible for the members to contribute effectively to the team. Examples include individual and group archives of presentations, meeting notes, supplier price quotes, experimental output and analyses and similar archives at the organizational level.

Similarly the local information and communication *technology infrastructure*, though occasionally a source of aggravation, also provided the means for managing information and for communicating with coworkers and external collaborators, including the AES Team members.
For the AES Team members, these aspects of organization are taken for granted and go unnoticed as work enablers, but occasionally an encounter with an industry member who did not yet have Internet access or, consequently, was not accessible by email foregrounded the enabling dimension of their own technology resources.

Team members' responsibilities for other internal projects competed for—and usually won!—the members' time and attention, but these projects also produced information that the members were sometimes willing to share. For instance, Reinhart's research group at DeutschCar, as part of their own internal work on AES technology development, had conducted experiments involving the recharging of a battery by the car's own system rather than an external source, and he brought these results to the team providing evidence for a technology design that the other members had only speculated about.

While relationships often proved to complicate the members' work efforts, whether for an internal project or when working on an AES Team task, they were also essential to the members' conduct of their work and made possible things the members could not have accomplished independently, whether for an internal project or when working on an AES Team task. These included relationships among peers, between departments, and between organizations. Among peers, cooperative collegial relationships within work groups and between work groups within a department were often sources of information and help. Many of the members' day-to-day tasks would have been extremely difficult without "connections" with former coworkers and other acquaintances in other departments. Finally, each organization's interorganizational relationships represented a resource of potential benefit to the team. In one case, AmeriCar's agreement to act as a beta-test site for a telecommunications company's computer-conferencing service made this service readily and cheaply available to the team. In another case,
DeutschCar’s relationship with a semiconductor firm outside the team made it possible for him to obtain and share with the team cost information other suppliers were not yet willing or able to release. So relationships on many levels also facilitated the AES Team members’ work.

Finally, *deadlines* provided a temporal structure that focused resources and attention, facilitating work on the team project. These engineers’ work worlds were organized chiefly around deadlines with resources being focused on the task with the most proximal due date. In such a world, deadlines related to the AES Team, even local team meeting times, provided the impetus for gathering information and completing tasks that would otherwise have been deferred. Deadlines imposed by the Alliance administration added an additional level of “burden” for the SuperU and AmeriCar members but facilitated the team’s work by giving those members a target for accomplishing specific tasks.

**Summary**
The constraints and enablers included in this typology represent those aspects of the AES Team members’ local worlds that I observed influencing the members’ participation in and contribution to the AES Team. Several aspects of the members’ contexts both enabled and constrained the participants’ work on the team, and many, but not all, of these influences remained stable over the course of the study, yet the work, communication, and participation practices observed at the team level differed significantly between the first and second years. Constraints appear to “outnumber” enablers, yet the team did accomplish their objectives with respect to AES technology standards and many of their objectives with respect to virtual engineering. In the next section, I discuss the bases for the relative influences of the constraints and enablers and the link between these local influences and the team-level practices.
Discussion

Locally-embedded action

Two things stand out in a review of the typology of local influences. First, members' participation in the AES team was inextricably linked to their situation in particular locales. Both the members' capacity to contribute and their motivation to participate depended, in large part, upon local practices, policies, systems, resources, relationships, and events which both enabled and constrained participation in the team. Second, many of the local contextual aspects affecting the members' capacity to contribute represent stable, institutionalized practices and conditions, while those aspects influencing their motivation to participate are more changeable.

The AES Team members were embedded in their local work contexts, and their capacity to contribute, that is, the speed, quality, and scope of the contribution an individual was able to make depended, in part, on his individual expertise but also, and in large part, on his particular situation in his organizational context. For example, local practices influenced his access to project information; organizational policies limited his participation in both face-to-face and virtual meetings; local systems both sped and slowed work; and the resources needed to do work were variously more and less available. This is true for all workers in all organizations, of course. Each of us, even the so-called "free agent," is socially embedded in structures for accomplishing work—communication structures, political structures, relational structures, information structures, etc.—that shape our work practices (Granovetter, 1985; Orlikowski, 2000; Suchman, 1987). In short, a virtual team member's actions with respect to the virtual collective are not practically separable from his physical and social situation in his local work context.
An “obvious” feature of virtual teams, but one not foregrounded in the list of constraints and enablers, is that virtual team members are embedded in socially and physically distinct work contexts, each its own distinct social system, comprised of many social structures, effectively multiplying the number of people, groups, and practices impinging on the team. For instance, rather than one information management system helping or hindering a collocated group’s efforts, the AES Team, with eight, or, eventually, seventeen sites, was enabled and constrained by the features and norms for use of the system at each site. As a practical matter, the tools, knowledge, and resources required to work on the team task were woven into the fabric of the members’ local worlds (Sole & Edmondson, 2001), and the number and separateness of these worlds multiplies the number of rules, relationships, systems, resource considerations, and events bearing upon the collective, an appreciable increase in the practical complexity of accomplishing collaborative work. This complexity is depicted conceptually in Figure 6.3.
Figure 6.3: The physical and social embeddedness of virtual team members
In addition, those aspects of the members' local contexts most directly affecting their capacity to contribute to the AES Team, that is the barriers, limits, complications, accelerators, and many of the distractions listed in Figure 6.2 and represented pictorially in Figure 6.3 represent, for the most part, relatively stable, institutionalized aspects of the members' organizations—i.e., information systems, communication practices, the heuristics guiding physical organization, etc. Though minor alterations in these aspects of the members' environments no doubt occur continually, major changes in any of these features of the organization would be costly, would generally be undertaken as a significant change initiative, and would most likely be intended to facilitate some "core" internal function rather than a single, temporary virtual team. So the AES Team depended, in a very practical sense, upon its members working with and within numerous, different, and relatively stable social structures and work systems designed to facilitate local work, the extent to which any of these facilitated virtual teamwork being largely a matter of serendipity.

Not all aspects of the members' local environments persisted unchanged, however. Aspects of the members' local worlds more subject to change, and which did change in several of the charter organizations over the course of the study, were the mix of factors influencing the members' motivation to participate and contribute, namely the motivators and disincentives. In the remainder of this section, I discuss why the changes in the AES Team members' local contexts and the resulting shifts in their experience of the enablers and constraints stemming from those changes led to increased team participation despite the persistence of numerous institutional constraints.
Local motivators

Changes in the members’ organizational contexts created new enabling conditions, specifically, new incentives for participating in the team. Reviewing the list of local constraints and enablers, the primary differences between the first and second years were the net shift from negative to positive project perceptions and new displays of managerial interest stemming from organizational-level changes in three of the five organizations. Whereas in the first year, members perceived the project as offering little to and even detracting from their local work, following the changes in their respective local worlds, they perceived the project as a source of local advantage. To better understand the link between the members’ perceptions of the project in terms of its local value and their level of engagement in the team requires a closer look at the members’ strategies for managing their local worlds.

Local world management strategies

Though the members’ actions and in-the-moment micro-strategies for managing particular people and the various recurring and emergent aspects of their local worlds were quite contingent and varied in detail at the encounter-level (Lave, 1988; Suchman, 1987), they were consistent in principle, guided by a philosophy for “surviving,” even succeeding, in their respective worlds. An occasional idiosyncratic variance notwithstanding, the following several statements comprised the unwritten code of conduct informing the engineers’ negotiation of day-to-day activities and interactions, including participation in the AES team:

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30 Whyte (1955) talks about the necessity for “organization man” to develop a pragmatic philosophy regarding his place in the bureaucracy in order to preserve his ego and identity. Recognizing that few will make it to the top and needing to reconcile his chronic subordinate condition, he constructs a philosophy that minimizes the importance of these things and rationalizes his subjugation of dignity by focusing on security.
· "Keep the "big guy" happy."
· "Don't act out of place."—e.g., defer to authority, whether formal or technical.
· "If you don't stick your neck out, you can't get your head cut off."

Accurately interpreted as impression-management strategies, these "rules" reflect the members' pragmatic responses to their lived reality of work and membership in bureaucratic industrial organizations.

All of the members were situated in bureaucratic worlds.31 Unsurprising formal features of these contexts included (a) hierarchical arrangements of roles correlating with circumscribed arenas of authority and resource control—so the "big guy" and one's "place" relative to him were clearly identified; (b) organizational policies delineating allowable and forbidden actions—adding new dimensions to the definition of "place"; and (c) individualistic performance appraisal processes, administered by each member's immediate superior, as the basis for distributing organizational rewards.

Informally, the organizational members understood that performance appraisals were not objective measures and financial rewards not their only outcome. Regardless of the format and procedure, the performance appraisal process at each organization, as the members explained them to me, were subject to interpretation and, therefore, dependent upon the manager's perceptions of the worker and the nature of the relationship between the manager and the

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31 By "bureaucratic" I mean organizations structured, at least in principle, according to the tenets of Weber's (1978) ideal type characterized by hierarchical organization of members, policies governing activities, and meritocratic compensation strategies intended to optimize efficiency and minimize personal influence. Multiple studies have exposed the pretenses of these espoused characteristics in many organizations, revealing instead the prevalence and centrality of relational networks and political processes for accomplishing work and distributing rewards. Nonetheless, organizations retain many of the features of the ideal, and organizational members' work lives are often characterized by a dual-existence of sorts, doing work via informal channels while maintaining the appearance of following formal procedures and satisfying formal performance requirements.
subordinate. The members believed—and, based on my conversations with managers, *with good reason*—that the perceptions informing their performance appraisal also influenced their project assignments and promotion opportunities. The same principles applied in the academic world, simply with different currencies. Resource availability, including money, lab space, faculty attention, and inclusion in decision-making processes, correlated directly with one’s reputation for being “cooperative,” doing “interesting” research, and having fruitful “connections” with funders. Failure to “keep the big guy happy,” acting “out of place,” or “sticking one’s neck out,” all risked a negative perception. The performance appraisal itself simply provided a legitimate means by which superiors could express disapproval.³²

“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 and/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

³² Subordinates, too, sometimes took advantage of the performance appraisal’s legitimacy to justify their actions—or refusals to act: “It’s not on my performance appraisal. I’m not responsible for that.”
dissension moved backstage, and public behavior gave every impression of being on board with the boss’ position.

Concern for knowing and behaving appropriately to one’s “place” permeated all of the AES Team members’ interactions. 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” offered perhaps the most apparent display to the outsider of the existence of and reverence for differential status levels among group members and most often occurred during scheduled meetings. 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 beside or behind the table. In the case of a small meeting attended by similarly-stated and fairly high-ranking managers, those sitting at the table would pull up an extra chair to include the new arrival at the table. 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. I did not observe new members receiving instruction on this behavior, but I also did not see the same member make the gaffe twice.

Observance of the technical hierarchy, based on expertise rather than formal role, involved shifts in attention more than physical location. It often differed a bit from the administrative
hierarchy, but, again, the order was clear and the "deferee" understood his authority to be confined to a particular area of expertise, such as batteries, wiring, or relations with a particular supplier.

Relative status was less clear-cut in the semiconductor supplier companies. In addition to formal status and expertise hierarchies, supplier members also located themselves with respect to the closeness of their association with customers. Frequent reorganizations of structure and personnel classification that also altered customer contact responsibilities in the semiconductor [commodity] divisions left a certain amount of ambiguity in their wake, making room for anarchy among peers. Nonetheless, members always knew their immediate superior and were careful to "not overstep their bounds" as they interpreted them to be defined by their boss du jour.

Given the tenets of the code described so far and their implications for member behavior, the risk-aversion expressed in the sentiment, "If you don't stick your neck out, you can't get your head cut off," is not surprising. In reality, except for the rare, dramatic, corporate-wide downsizing, the members of the groups I studied enjoyed a great deal of job security and were unlikely to get fired for suggesting an unconventional idea or championing an investigation that failed. However, according to stories circulating in the industry, those in the organization closer to the design and production of the commercial version of products were subject to immediate termination in the event of a product failure. When product recalls or liability law suits became public, jokes abounded regarding the likely career trajectory of the responsible manager, such as "I guess he's probably flipping burgers at McDonald's by now." For instance, during the early months of the project, DeutschCar released a new vehicle model that failed the "moose test" (a rapid-evasion maneuver around a metaphorical moose in the road) in the final round of safety
tests after the vehicle had already gone into production. At the next Consortium meeting, everyone’s question for the DeutschCar members was whether the vehicle program manager had been fired right away or if he had been allowed to stay until the problem had been corrected.

Though the AES Team members rarely faced the risk of job termination, the threat of job loss by vehicle managers, the source of the final word on what research projects do and do not get developed for installation into a vehicle, created a general climate of risk aversion that propagated back along the technology-development chain. The members of each stage of technology-development—research, advanced technology, development, and finally, production—faced a skeptical, demanding, reluctant audience when pitching a new technology for further investment to the managers of the next development stage.

For the members of the AES Team, the more immediate consequence of taking a risk and failing was public embarrassment, usually in the form of interrogation, questioning of one’s competence, and an itemization of one’s failings in a public forum, followed in some cases by social avoidance. For example, at DeutschCar, Sebastian championed an AES design that differed from one that was being marketed by a supplier as superior, cheaper, and the approach expected to be taken by all other European luxury car producers. He and Juergen did not believe the supplier’s design lived up to its promises but believed his own design could. When he made a presentation to a group of managers, both he and Juergen told me that he was interrogated and criticized for not having answers to all their questions even though the design was still in development—it had not even had an opportunity to fail! The next week was spent first defending himself to his own manager, then to his manager’s manager, and finally, developing a defense that his boss’ boss delivered at a high-level meeting to justify the group’s investment in
this alternative design. Sebastian felt “beaten down” and questioned whether or not it had been “worth it” to champion a new idea.

In another example, after making a presentation, a supplier member told me that he knew he had succeeded “because they were quiet when I finished. That means they couldn’t find anything to criticize.” Then he told me about the aftermath of having made a similar presentation to the same group six months previously. In the earlier presentation, he had made a couple of erroneous claims and had been pummeled with questions. He told me that afterwards, the meeting facilitator would not speak to or look at him even though they encountered one another several different times. After making the second presentation, he told me, and I observed, that the facilitator took the initiative to talk with him when the meeting adjourned.33

So the engineers’ code of conduct reflected a pragmatic, informed response to their lived experience, particularly the power and status relations governing that experience. In the next section I discuss how and why this same code informed the members’ participation in the virtual team and is at the core of the explanation of the shifts in participation observed over time.

“Enforced Localism”

Allen (1977), in a study of communication among collocated engineers,’ notes that unlike scientists, whose communication practices had been studied a great deal at the time Allen wrote—and “free agents,” if Allen were writing today—“engineers are employed by bureaucratic

33 This resonated with a similar experience of my own. Several months after I left the field, I made a presentation at a team meeting summarizing my preliminary findings, but my computer containing the presentation had been stolen the day before the meeting. I made an effort to reconstruct the slides, but my presentation was unpolished and technical problems during the presentation only further eroded my organization/polish. After the meeting, when I passed a team member in the hallway with whom I usually exchanged warm greetings, he turned his head and walked past me without comment.
organizations" (p. 99). One requirement of organizational membership Allen calls "enforced localism" includes an obligation to "work only on problems that are of interest to his [or her] employer" (p. 40). Allen also draws on engineering career studies to note that the effects of this organizational obligation are compounded by engineers' own career orientation. Citing studies indicating that engineers value "certainty of the [tangible] rewards" and "job status" over autonomy and innovation (Krulke & Nadler, 1960; Ritti, 1971; Schein & Bailyn, 1975) and that advancement for the engineer "is tied to activities within the company" (Ritti, 1971). Allen notes that "the engineer sees the organization as controller of the only reward system of any real importance to him and patterns his behavior accordingly...The organization in which he is employed controls his pay, his promotions...He therefore behaves in ways that he feels the organization desires." (ibid, p.99). While cultural studies, work practice studies, and theories of social proximity and its effects on communication, identity, and attention predict the primacy of the local over the remote (see chapter two), it is appreciating the implications of the members' embeddedness in bureaucratic organizations that provides an interpretive foundation for understanding their particular choices and behaviors at particular times.

In the AES Team, the members remained full-time employees of their respective home organizations, so the organizations retained control over the members' time, compensation, and career opportunities within the organization. Consistent with Allen's observations, the team members' actions reflected their organizational dependence: The AES team members were first and foremost organizational members. Consequently, their actions in and toward the team were governed by the same code of conduct informing their actions in their own organizations. They interpreted the time- and energy-worthiness of projects, including the AES Team, through the locally-oriented and locally-particular lens of their superiors' (and other locally-relevant
constituents’) priorities, allocating their time and energy (or at least creating the appearance of allocating their time and energy) to the projects these constituents considered legitimate. From the perspective of the bureaucratic “ideal,” efficiency is maximized by subordinates’ compliance with superiors’ priorities, supposedly based on a broader view of organizational obligations and opportunities. However, my observations suggest that the members’ compliance was motivated by the impression given off and the personal consequences of that impression rather than dedication to efficiency. Even in cases where a team member’s contribution reflected concern for the impression given off to another AES Team member, as in cases of “customer-supplier” or “academic researcher-industry funder” relationships, the basis for the concern was the local implications of the impression received. A variation on this theme was Reinhart’s concern with the impression received by his potential future customers more so than his immediate supervisor.

I am aware of two enduring exceptions to this exclusively local orientation to action and interaction among the team members. In both cases, the members had long-term relationships pre-dating the formation of the team. In one case, Don (SuperU) and Bill (AmeriCar) had known one another since completing their doctoral degrees, twenty-five years earlier, and were both active in IEEE, the electrical engineering professional organization composed primarily of engineering researchers. In this case, the amount of time and energy put into writing the TechExpo paper and the debates between them regarding the practice considerations for building the argument presented in that paper transcended their local pragmatic practice and impression-management concerns and appealed instead to a professional standard to which they both ascribed.

Blau (1963) described a similar scenario in his study of two groups in a state employment agency. When statistical performance measures were implemented, one group’s work practices
changed to improve their "performance" as reflected in the metrics, but the new system did not have the same effect on the other, similar group. Further investigation revealed that the second group was composed of a mixture of degreeed professionals and pre-professional students who measured of their own performance and their own "success" in terms of their profession's standards rather than the organization's metrics.

In the second case, Bill and Reinhart saw themselves in similar positions in the research departments of similar organizations. In this case, the two men's relationship resembled that of the "invisible college" (Price & DeSolla, 1965), a pattern more typical among scientists than engineers (Allen, 1977). Though they were still prohibited by law and propriety from sharing some types of information, they did query one another and exchange information about matters of common interest and experience, though with no particular degree of regularity. There were other cases of long-term acquaintances among the AES Team members, but to my knowledge, those members' interactions about AES technology did not transcend their local orientation and local obligation.

In the absence of a separate, independent governance or financial structure, as would likely be established in a contractual joint venture, or a common professional orientation such as IEEE transcending the members' organizational associations, the AES Team members' participation in the team was informed by their code of locally-rational strategies for managing local relationships. Their participation in the team occurred as part of the *duree*, or "ongoing flow of conduct" (Giddens, 1984), in their local lives. Their heuristics, or enacted "rules" (ibid), for allocating their time and attention and responding to emergent events were the same for the AES Team and their local projects and did not change from the first year to the second. What
changed were the local circumstances, or "resources," relevant to the enactment of those rules, specifically funders' priorities, managerial interests, and an internal customer base.

Concurrent change

It is necessary to acknowledge that the changes in the members' work contexts and in their team participation patterns observed during their second year of work coincided in time with changes within the team and in industry-wide attitudes toward AES technology. I have no comparative data from another team in the same industry working on a similar task and technology to assess the relative influences of these three arenas of change on the members' participation in the AES Team. However, based on the data available to me and presented in chapter six, I understand these three streams of change to be related to one another as follows: industry-level changes (e.g., increased interest in AES technology; DeutschCar acquisition of EuroCar) translated into local changes (e.g., increased managerial interest in AES technology at AmeriChip and in "virtual engineering" at DeutschCar), which then combined with additional changes at three organizations (e.g., downsizing at AmeriChip; DeutschCar's acquisition of EuroCar; funding rule changes and personnel turnover at SuperU) to create incentives for changes in the team's organization and work practices, e.g., a shift in meeting facilitation responsibility, goals written explicitly to engage all the partner organizations, and increased meeting frequency utilizing meeting technologies.

These intra-team changes did further facilitate communication and collaboration among the members, but it is important to recognize that the local changes preceded and encouraged the member actions culminating in team organization and work practice changes. Prior to the changes in the members' local contexts, other members had suggested agreements regarding the
process and frequency for using the email distribution list and Web site and for using both media more frequently for group communication. Yet use of both media declined over the course of the first year.

Summary: The Relationship Between Local Situation and Virtual Participation

In the previous sections, I noted the AES Team members’ practical dependence on local practices, policies, systems resources, and relationships for accomplishing the work constitute both enablers and constraints for the members’ contribution to and participation in the virtual team. I differentiated between those aspects influencing the members’ capacity to contribute to and those influencing their motivation to participate in the virtual team. Those aspects of their organizations most directly influencing their capacity to contribute, I described as “institutionalized,” and not given to sudden or frequent change. In contrast, I noted that those aspects most directly influencing the members’ motivation to participate, those related to the impressions given off to customers and organizational superiors, were given to relatively frequent and rapid change in response to market conditions, personnel changes, and industry trends. Though the power dynamics in these relationships were institutionalized, the perceptions, preferences, and priorities of the participants in the relationship were not. Changes in three of the charter organizations resulted in shifts in these very aspects of the members’ contexts, transforming “barriers,” “limits,” “distractions,” and “complications” into navigable nuisances, accounting in large part for the changes in work practices, technology use, and meeting participation observed during the team’s second year of work.

I do not intend to paint the AES Team members either as mercenaries or as dupes, puppeted about by tugs on the financial and career strings. Rather, I intend to emphasize the significance
of their situation as integral members of separate and complex social systems, bureaucratic social systems specifically, in which status and its implications figured large, for interpreting their participation in a virtual project team.

Drawing on my observations of the AES Team’s experiences, I have drawn three primary conclusions regarding the relationship between the AES team members’ situation in particular and distinct work worlds and their participation in the virtual team. I anticipate that these conclusions will generalize to other virtual teams comprised of bureaucratically-situated members and will provide the bases for additional studies of virtual teams.

First, the members’ situation in their respective local contexts both enabled and constrained member participation in the virtual team, influencing both their capacity to contribute and their motivation to participate in the virtual team. Second, virtual teamwork occurs in the duee of its members’ organizational lives, prioritized along with their other projects, interspersed among their other activities. Consequently, virtual teamwork is subject to the same structures shaping each members’ conduct of his daily work. In the case of the bureaucratically-situated team members, a key element of this work context is the members’ hierarchical relationship to others, leading to my third conclusion. In the absence of a transcendent incentive structure—i.e., professional reputation, separate project governance or financial structure—virtual team members’ motivation to participate was shaped by their position in and the perceptions, preferences, and priorities of their local constituents, primarily their immediate supervisors and customers. Finally, participation patterns at the team level reflected the unintended, cumulative outcome of the members’ strategies for managing their local worlds (Giddens, 1984; Merton, 1963).
Conclusion

A theory of how local work contexts influence participation in virtual teams needs to account for differences in the relative influence of the enabling and constraining aspects of the local contexts and to explain both stability and change. By elaborating the local factors influencing the members' contributions to and participation in the AES Team, I have shown that both stability and change stemmed from the team members' attention to activities considered important by their organizational superiors or others in the organization on whom they depended for a variety of resources, creating an incentive to invest in those activities. Managers, customers, and their interests changed over time, but the rule to invest in those activities valued or looked upon favorably by one's manager or customers remained consistent over the course of the study. The means for collaborative work may have shifted—i.e., electronic mail, videoconferencing, computer conferencing, Web-based document repositories—but the game, at least for these virtual collaborators, situated in bureaucratic organizations, remains essentially unchanged. In the next chapter, I discuss the implications of these findings for virtual team research and practice.
Chapter Seven

Conclusions and Implications:
Expanding the Focus of Virtual Teams Research

Introduction

In this thesis, I have explored the question of how virtual team members’ situation in socially, organizationally, and physically separate and distinct work contexts influences the observed team-level work, communication, and participation patterns. Several precedents, both theoretical and empirical, exist in social psychology, organization theory, cultural studies, and work practice studies for expecting virtual team members’ local worlds to impinge on their participation in the team, but the role played by virtual team members’ proximate circumstances and relationships in team-level practices has gone largely overlooked. Coining the term “hidden profile,” Cramton (2001) has suggested that additional aspects of the members’ local contexts may impinge on the members’ participation in the virtual team besides those made apparent by conflict, but the nature of these factors has been largely a matter of speculation.

As a participant-observer, I immersed myself serially and repeatedly in the work worlds of the participants in the seven charter sites of one multi-organizational virtual team in the automotive industry. I observed the team members working alone, in cooperation with collocated coworkers, and via telephone and email with people at other sites and companies on activities both related and unrelated to the task of the virtual project team. In addition, I
observed the members’ participation in both face-to-face and technology-mediated team meetings. My analysis has focused on understanding the multiple influences of the members’ local worlds on their contribution to and participation in the virtual team, the patterns of participation observed in the virtual team, and the relationship between the local influences and the observed patterns.

In the previous chapter, I drew four conclusions about how the team members’ situation in their respective local worlds had shaped their contribution to and participation in the virtual team. In this chapter, I consider these findings from the broader and more abstract perspective of virtual teams generally, and the particular case of virtual teams in bureaucratic worlds more specifically, to suggest several implications for virtual team research and practice with relevance also for information technology designers. Then I consider the applicability of these findings beyond the team studied here, closing with suggested directions for future research.

**Local Worlds as Enabler and Constraint**

The most basic finding and one with broad applicability is that the local contexts proved to both enable and constrain members’ participation in the virtual team. No single element of an organization can be *a priori* identified as an enabler or constraint—policies, technology, relationships, resources, systems, etc. can prove to either enable or constrain collaboration at any point in time, can enable at one time and constrain at another, or can enable some aspect of the collaboration and constrain another. From a research perspective, this suggests that the work of a virtual collective does not progress independently of its members’ situations in their respective
work worlds suggesting caution regarding prescriptive conclusions that do not take into account or control for local influences.

The finding that the same local context may be predominantly constraining or predominantly enabling at different points in time over the course of the life of a virtual team suggests the need for a longitudinal approach to the analysis of local influences with a series of “snapshots” being preferable to a one-time cross-sectional check. 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 from an “objective” standpoint but varied in the degree of constraint imposed on members’ participation in accord with shifts in managerial interest and other local conditions making member participation more or less personally advantageous. This finding suggests concurrent monitoring of both the members’ interactions with aspects of the organizational infrastructure and their perceptions of the personal significance of managerial initiatives.

For both research and practice, the typologies provided in chapter seven are not intended to be prescriptive but rather offer a framework and starting point for considering what aspects of the members’ local worlds might be impinging upon their participation in the virtual team and what types of influence they might be having on various aspects of the members’ participation. The organizational features influencing the members’ participation in the AES Team are common to most organizations and the types of influences observed are not unique to either the organizations studied or the automotive industry.
Virtual Teamwork in the Local Duree

In my analysis of the AES Team, I noted that team members do much of the work of the virtual team in their respective work sites, using their regular desk, computer, telephone, and fax machines, interspersed among the myriad other activities comprising a typical workday. Technology exponents emphasize this as one of the many advantages of virtual teamwork, and, in fact, advances in information and communication technologies aim to make virtual collaboration a "seamless" element of the worker's world, "as commonplace and uncomplicated as making a phone call or calling over the cubicle wall" (field notes). This view of virtual collaboration focuses on the benefits/opportunities of connectivity—i.e., decreasing disruption to an individual's workflow by minimizing time "wasted on travel" while maximizing participation by enabling access to people who would otherwise not be accessible to those needing their expertise or access to the project by people who would otherwise not be able to contribute. While I do not dispute these claims' legitimacy, they do not consider the reciprocal aspects of the arrangement, that is, how other aspects of the participants' respective local environments influence his or her ability to contribute to these new arenas to which he or she now has access.

Perhaps the most apparent conclusion from this study, and one, I believe, with broad applicability to any type of virtual collaborative work arrangement is that, as a practical matter, an individual's capacity to contribute to a virtual collective is influenced by the same routine practices, policies, systems, resources, relationships, rhythms, and events in his or her proximate work context that he or she uses and navigates on local projects. "Virtual" work is not independent of the physical and social context within which an individual works.

An additional theoretical nuance implied by the integration of virtual teamwork into the team members' daily organizational lives is that the members treat the activities related to the virtual
team according to the same heuristics applied to the other demands for their time, local or otherwise, that is the local costs and benefits of investing in the activity. My emphasis here is not so much on whether the perspectives are similar or different or even that members’ points of view about the project reflect the interpretive skew peculiar to their organization. Rather, I mean to emphasize that the virtual team members’ engagement with the project occurs within the flow of the activities and interactions that ongoingly reproduce their locally-specific work worlds. These structuring processes are not only locally-based, but locally-oriented, rooted in local history and directed toward local, particularly personal, futures. Members of the team studied did not exhibit a separate set of heuristics regarding what would be best for the AES team independent of their local considerations for careers, projects, and relationships.

This understanding of virtual teamwork occurring in the context of the local duree has several implications for the study and management of virtual teams. Theoretically, the ongoing shaping of members’ participation in a virtual collective by the local social structures suggests an alternative interpretive frame for explaining activity patterns—communication, participation, collaboration—observed at the team level. As an adjunct to intra-team theories, in cases where an internally-focused team analysis leads to conflicting explanations or inconclusive findings, broadening the analytic lens to include the influence of the members’ local situation may resolve the dilemma.

In addition, it suggests that theoretical leverage may be gained by viewing virtual teams (or other virtual work arrangements) as constellations of contexts rather than simply interlinked individuals, or “talent,” as envisioned in the infinitely fluid view of virtual work promulgated by technology enthusiasts. From this 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 his or her competence. Without understanding the context from which an individual contributes (or doesn’t), his or her actions in the team are difficult to interpret. Such a view also suggests that those designing virtual teams, evaluating their progress, and troubleshooting their breakdowns look beyond team structure, individual competence, and inter-member dynamics for member selection criteria and troubleshooting problems as they arise.

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, daily or weekly 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 help to ensure accurate interpretation.

At a minimum, this finding suggests the practical implication of simply appreciating the practical complexity of virtual, or more descriptively, multi-contextual, teamwork or the “polycontextuality” (Engestrom, Engestrom, & Karkkainen, 1995) of virtual teamwork. Virtual arrangements may decrease time and money spent on travel but may also involve significantly more administrative and managerial overhead navigating and coordinating across multiple systems.

**Local Power Relations**

A corollary of the previously described finding that virtual teamwork occurs in the duree of the members’ local organizational lives is that it is subject to the same power dynamics that shape
local work. I extrapolate from that finding to assert that in the absence of a transcendent incentive structure, or suprastructure, with short and long-term career and financial implications, members’ motivation to participate in a virtual team will be informed by their perceptions of and position in the local power structure. In the case of the AES Team, the members worked in bureaucratic organizations with very hierarchically-organized power relations, both within and between departments.

In a virtual team composed of members from organizations with differently organized power relationships, the members may be less concerned with the perceptions and preferences of their immediate local superior than with those of other individuals or groups. However, as long as the team members remain full-time employees of a particular work group in a particular organization, the proximate power dynamics will remain relevant. Even in the case of a free agent member, the agent is likely to perceive some customers to be more powerful than others, some other participants in the virtual collective to have greater bearing on his or her future than others, and certain affiliations and activities to be perceived more favorably than others by those in the industry who represent potential future clients, to name just a few of the possible considerations informing his or her participation in the team. Whatever the configuration and whatever the virtual team members’ organizational affiliations, I anticipate that their perceptions of the dynamics of the power structure and its bearing on their work will be relevant, even central, for interpreting their participation in a virtual collaboration.

The methodological implications discussed in the previous section regarding the need for methods that allow the researcher to observe local dynamics also applies here. This finding simply reinforces the notion that the actions—individual, cumulative, and collaborative—observed in a virtual team may in fact reflect the nature of local conditions and relationships
rather than dynamics among the virtual team members or a virtual team member's particular orientation to the project.

**Virtual Teamwork in Bureaucratic Worlds**

In this study I have focused on the particular case of virtual team members situated in bureaucratic organizational worlds, contexts with hierarchically-organized relationships. The bureaucracy is so ubiquitous as to be taken for granted as the definition of organization and is, consequently, often invisible in the academic literature—its tenets, varieties, aberrancies, individual, group, and societal level effects long ago explicated. Except in investigations of alternative organizational designs or strategic design interventions intended to counteract its shortcomings, the influence of the bureaucratic form on the phenomena of interest often escapes critical evaluation.

The fundamental features of the bureaucratic context—assigned status; formally circumscribed authority and autonomy; hierarchically-organized power structure; and relative stability of all these features—run counter to the most-often touted opportunities of the ideal-type depiction of virtual work arrangements—market-derived, competence-based status; autonomy constrained primarily by the limits of one's aspiration and skill; free-flowing communication (uninhibited by requirements to go through channels); and general fluidity on all dimensions. Consequently, though the AES Team members had access to email and a Web site, their interactions within and across organizations still exhibited compliance with the bureaucratic rules. This is not to say that the members never deviated outside the bounds of formally-defined...
“acceptable” nor that the members’ exhibited blind compliance\textsuperscript{34} with the hierarchy at all times, but as described in chapter seven, the general principles guiding members day-to-day activities reflected a continual awareness of and attendance to the hierarchy.

Though both researchers and practitioners now write about the “networked organization,” “post-bureaucratic organization,” and “virtual corporations,” this team’s experiences serve as a reminder that while circumstances may have changed—people sit in different places and collaborate more frequently with people in different time zones speaking different languages, etc.—the rules bounding and lending meaning to their actions are largely unchanged for people living and working in bureaucratic organizations.

For virtual team researchers, this finding serves as a reminder in the zeal for the “new” not to overlook the import of the “old.” In fact, though the data in this study are insufficient to explore the question, there is reason to believe that increased use of “virtual” organizational forms may actually promote a “re-bureaucratization” of work. In a practitioner workshop I attended, virtual team participants, managers, consultants, and a handful of researchers from diverse backgrounds promoted defined procedures, clear goals, strict communication protocols, and inflexible deadlines as key elements for coordinating distributed work projects. Brown and Duguid (2000) in their exploration of the “6-D vision” perspective on the future of technology-enabled organization forms—demassification, decentralization, denationalization, despacialization, disintermediation, disaggregation—note that, in fact, the implementation of new information technology systems has often led to a resurgence, rather than a disassembly, of the centralization of authority and bureaucratized organizational relations

\textsuperscript{34} Though to someone with a much more autonomous professional socialization, the degree of complacency with the limits was startling.
“Teamwork” as an By-product of Locally-Significant Action

Finally, I noted in my analysis of the AES Team’s participation and work practices that the patterns observed at the team level represented, in large part, the unintended cumulative consequence of multiple, locally-motivated member actions. Though team leader style, goal clarity, and increased utilization of computer-conferencing as the primary meeting media facilitated the interactions that did occur among team members, meeting attendance, web site and computer-conferencing usage did not represent direct reactions to team leader charisma or goal clarity. This finding suggests more generally that participation, interaction, and work patterns observed among virtual team members, at the team level of analysis, reflects extra-team influences, sounding a note of caution regarding intra-team explanations of team-level phenomena without controlling, or at least accounting, for extra-team influences, particularly those wielding personal consequences for the members.

Contributions to the literature

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 approach advocated by Ancona in a series of studies (1987; Ancona & Caldwell, 1992; 1999) identifying
and describing the relationship between a team’s members’ interactions with external constituents and the team’s effectiveness. The focus and findings of this study differ from Ancona’s, however, in that the proximate audiences with which the AES Team members were concerned represented their respective individual constituencies rather than those most interested in and affected by the team’s process or final product. 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.

This study brings to light a level of interconnections more uniquely problematic, and complex, for virtual teams than for traditional ones. Because the team members inhabit physically and socially separate work worlds, each faces a unique constellation of constituents—boss, peers, cross-functional contacts, support staff—as shown in Figure 6.3 in addition to the team’s constituencies as a collective. This portrait of a virtual team opens up new lines of inquiry for future research.

Using ethnographic detail to illustrate the multiple influences of virtual team members’ local work contexts on participation in virtual teams, the study shows how members’ proximate circumstances influenced their participation in the virtual team even when these influences were not apparent at the local-team interface in the form of coordination or communication conflicts, the emphasis of the current literature. Further, by exposing the multiple aspects of the members’ contexts impinging on their team participation, the study also highlights a central feature of virtual team members’ experience—the frustration of navigating locally-particular systems to accomplish “virtual” work—often obscured in team-level studies and so missing from much of the literature on managing workers engaged simultaneously in both virtual and collocated projects.
By differentiating between the influences of the members' local contexts on their capacity versus their motivation to participate in the team, the analysis of these influences suggests additional dimensions for developing finer-grained theories of virtual teams. In many studies of virtual teams to date, and teams more generally, researchers implicitly assume team members are motivated by the team goal and place their investigative emphasis on other barriers to collaboration. This study suggests first, that the source and focus of team member motivation remains an empirical question, and subsequently that distinguishing among factors influencing capacity, motivation, or both offers a basis for more sound prescriptions for designing, diagnosing, and facilitating virtual collaboration. Again, data gathered in situ at the individual level offered a perspective not readily available with team-level measures due to the tendency to not reveal local influences on performance and motivation in team meetings or other public interaction forums.

Highlighting motivation brings power to the fore. Whether or not technology-mediation democratizes interaction and team decision-making processes has been a topic of interest for some researchers (Mantovani, 1994; Siegel et al., 1986) but the implications of a virtual team member's situation in his or her proximate power structure has previously escaped researcher attention. In this study, I have explored the specific case of members' situation in bureaucratic organizations and shown how the hierarchically-ordered information distribution practices, communication practices, and performance appraisal processes typical of this organizational form pose particular challenges for effective virtual collaboration. This finding contributes to the literature both by reinforcing the importance of the members' local situation for understanding their participation in a virtual team and by suggesting organizational form as an important analytic dimension for further studies of local influences on virtual teamwork.
Applicability of findings

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 predicted configurations. Nonetheless, I suggest a conservative approach in the extension of the findings to other virtual teams until further studies have corroborated or refined my conclusions. The team’s multi-organizational composition suggests the first boundary condition. Though observation of the team members participating in internal projects and anecdotal reports from others in the industry suggest that the study findings also hold for intra-organizational virtual teams, that remains an empirical question.

The second boundary condition concerns the nature of the team’s task, a non-revenue-generating, inherently political activity. Understandably, in each of the organizations studied, the official “line” is that priority is always given to revenue-producing projects, and it is not possible with my data to determine what aspects or proportion of the activity I observed is attributable to the nature of the task and what to the more enduring aspects of the members’ organizations. Other tasks for which I am aware of virtual teams or virtual collaborative initiatives being convened include new product development (Sole & Edmondson, 2001), new process implementation (Barrett, 2000; Klein & Barrett, forthcoming) 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.

**Future Research**

I anticipate that a follow-on study would first explore the relevance of these patterns for intra-
organizational teams. Anecdotally, I believe the same enabling and constraining influences
would be observed, with the particular aspects of any single member's context proving to be a
*barrier, limit, accelerator*, etc. varying from one context to another. Nevertheless, I would
expect the general patterns of the work being shaped by the local contexts, integrated into the
local duree, prioritized congruent with the preferences of the local hierarchy, and, consequently,
contributing to unintended communication and participation patterns at the team level would
hold.

Other directions for future research stemming from these findings would include similar
investigations but with the team members situated in organizations with different—i.e., non-
hierarchical—power structures, different industries, and performing different tasks with different
financial implications for the firm(s). I anticipate that clear links would still be identified
between the members' local situation and the observed team-level practices but that these
differences in team situation and task focus would foreground influential aspects of the
members' local worlds not apparent in the current study.

Another area of particular interest to myself is the invisibility of these influences across sites.
The members were generally unaware of the local conditions influencing one another's
participation in the team, partly because they did not ask but largely because they did not tell the
others about their local circumstances, a bases for conflict and significant misunderstandings in
some teams that have been studied (Armstrong & Cole, 2001; Cramton, 2001). Assuming a similar pattern is found, a comparative study of intra- and inter-organizational teams would be helpful for differentiating among reasons members do not share local contextual information in the virtual team open forums.

Reflection

In his 1956 now classic *Organization Man*, Whyte noted the growing bureaucratization of our society, made increasingly invisible through its ubiquity, and the pervasive influence of this trend on the thinking and behavior of organizational members, both inside and outside the corporate walls. In this age of technology-enabled “de-institutionalization” and the era of the “free agent” and “contingent worker,” the persistence of the bureaucracy receives little press. Yet, the most potent feature of the AES Team members’ work worlds, affecting every aspect of their participation on the AES team, was their simultaneous membership in their respective bureaucracies. Despite the members’ proud claims to the contrary, citing recent efforts to flatten the organization including “empowering” the workforce, expanding availability of managerial perquisites to the lower ranks, and an increased emphasis on “teamwork,” all the AES team members—including the SuperU members—worked in bureaucratic organizations with significant consequences for their participation in the virtual team.

No doubt technology is enabling more instantaneous contact across distance, more interactions across more boundaries simultaneously, and, consequently, opportunities for partnering previously considered impractical or impossible. Nonetheless, the social institutions many of these electronic networkers inhabit have changed more slowly than the technologies their members are using—despite the press to the contrary.
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