Technology-Use Mediation:

Making Sense of Electronic Communication in an Organizational Context

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Abstract. Implementation of new computer-mediated communication (CMC) systems in organizations is a complex socio-technical endeavour, involving the mutual adaptation of technology and organization over time. Drawing on the analytic concept of *sensemaking*, this paper provides a theoretical perspective that deepens our understanding of how organizations appropriate new electronic communication media. The paper analyzes how a group of mediators in a large, multinational company adapted a new web-based CMC technology (a virtual workspace) to the local organizational context (and vice versa) by modifying features of the technology, providing ongoing support for users, and promoting appropriate conventions of use. We found that these mediators exerted considerable influence on how the technology was established and used in the organization. The mediators were not neutral facilitators of a well-defined technology that presented itself to them as given and fixed. On the contrary, the new technology was from the onset highly equivocal and open-ended, and the mediators were actively involved in *creating* the technology-in-practice—by making sense of it, defining it, and regulating its use. Implications for further research and for practice are considered.

Key words: Computer-mediated communication, technology adaptation, technology structuring, adoption, implementation, sensemaking, interpretation, enactment.

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1 Introduction

Many organizations are investing in new computer-mediated communication (CMC) technologies such as intranets, desktop conferencing, and groupware. Such technologies are expected to enable organizational members to share information and knowledge across organizational and geographical boundaries, so as to collaborate more effectively.

The potential of greater information sharing and improved collaboration is not always reached, however. CMC technologies have proved to be much more difficult to implement and use effectively than expected. These technologies are general-purpose media that may facilitate a wide range of possible communication patterns and collaborative interactions. They must be adapted to the organizational context and appropriate conventions for use must be established. Otherwise the technology will not reflect local conditions, work practices or communication norms and it is, therefore, likely to be underutilized, misused or outright rejected (Bowers 1994; Ciborra 1996; Kraut et al. 1998; Mark 2002; Orlikowski et al. 1995).

CMC technologies appear to be particularly fragile, for two reasons. First, they are often threatened by competing media (Ciborra 1996). No communication medium exists in the workplace in isolation and users are not passive consumers of media. They use the medium that suits their purpose at a particular point. When users experience problems using a new communication technology or get the impression that it is unreliable or malfunctioning, they will switch to other media in order to continue their work. The alternative can be telephone, fax, email, ftp, etc. Users may prefer these alternatives, even if they are inadequate in certain respects, because they are more familiar and better known (Ciborra 1996). This is true, particularly, in situations where people are pressed for time. Second, conventions are essential for governing communication and cooperation, as Mark (2002) has recently pointed out. Users cannot simply be given a new CMC technology (e.g. a groupware system) and "be expected to use it optimally without some common agreements on the means of operation" (p. 351). Conventions provide a *modus vivendi* for making interactions proceed smoothly – and if such conventions fail to develop, so will the technology.

Research by Orlikowski et al. (1995) suggests that the implementation and use of CMC technologies can be facilitated by their explicit and ongoing adaptation to the organizational context and vice versa. This adaptation process, which they refer to as *technology-use mediation,* involves both ongoing adjustments of the technology and initiatives aimed at influencing the organi-

zational context, for instance, training users, changing existing procedures, and promoting the establishment of appropriate conventions for use.

Despite its potential importance, the process of technology-use mediation is not yet well understood. Little is known about how mediators, in practice, cope with the challenge of bringing new technology and existing work practices together into a complementary whole. How do they make sense of the technology and discover what it can do? How do they learn about users' needs and requirements? How do they find out how to adjust or modify the technology, and how do they influence users' behaviour and thoughts? These are the questions that motivate and guide our inquiry. To address these questions, we adopt a sensemaking perspective (Weick 1995), which focuses on how people in organizations construe the situations in which they find themselves and examines how those interpretations or constructions are enacted through their everyday activities.

We report on a longitudinal field study of the implementation and use of a web-based CMC technology (a virtual workspace) in a large, multinational company. Our findings confirm that mediators may exert "a significant influence on the nature and effectiveness" of electronic, organizational communication (Orlikowski et al.1995, p. 441). At the same time, they show that technology-use mediation is a much more emergent, complicated and unpredictable process than prior research suggests. We argue that it is in essence a sensemaking process and that it, therefore, is complex and open-ended.

2 Prior Research

While early research on IT diffusion and implementation in organizations focused on social inertia and users' resistance to change to explain implementation failures, more recent IS research draws attention to the importance of the mutual adaptation between technology and organization. One influential stream of literature, based on research conducted from a structuration theory perspective, describes the implementation and use of new technology as a process of structuring through which users appropriate and adapt their technologies, drawing on the particular organizational context within which they work. For example, in a study of how a virtual team appropriated and used a collaborative technology over time, Majchrzak et al. (2000) found that users experienced a need for recurring adjustments of the technology and their use of it. They suggest that effective IT implementation requires numerous, ongoing adaptations of technology, work group structures and the organizational environment (see also DeSanctis and Poole 1994, Tyre

and Orlikowski 1994). In addition, a growing body of IS literature investigates the diffusion and implementation of IT from the perspective of actor-network theory, e.g., (Hanseth et al. 2004; Monteiro 2000). In this perspective, the adoption and use of a new technology in an organization is described as a process of translation in which the technology is transformed and re-defined as different actors strive to shape the innovation to their own ends. Aanestad (2003), for instance, found that the implementation of multimedia communication technology (cameras, microphones, and loudspeakers) in a surgical operating theatre was achieved through "a continuous process of design, test and redesign of different configurations of people, practices, and artefacts" (p. 1). She argues that implementation of new technology requires the establishment of a well-working mix of people, practices and artefacts.

In spite of the increasing awareness about the prominence of technology adaptation, research on technology-use mediation—as a particular kind of adaptation practice—is still relatively undeveloped. Knowledge about the phenomenon is fragmentary, and empirical studies continue to be scarce. Of particular relevance to the current study is empirical research that explores how different types of mediators or local developers may intervene in and shape (other) users' use of technology. For example, in a study of users working with customizable software, Mackay (1990) identified a small group of people (called translators) who helped their colleagues customize their software environment by interpreting their needs and creating customization files tailored to those needs. Translators enjoyed talking to their colleagues and helping to make their lives easier. Managers were generally unaware that customization files were being exchanged and the role of translator was not officially recognized. Nardi and Miller (1991), in a similar study of spreadsheet use, found that some users had acquired more advanced knowledge of computing and served as resources for other users, training them and developing code for them. Based on a study of CAD users, Gantt and Nardi (1992) also highlight the importance of local experts (called gardeners) who provide support for other users. They found that in some CAD environments the support role had been formalized and argue that organizations will be well served by recognizing the activities of local developers and formalizing their role, see also (Nardi & O'Day 1999).

Trigg and Bødker (1994) studied the work of a group of officially recognized "local developers" in a government agency. They were responsible for exploring, tailoring, integrating, and otherwise adapting the technology to the local work context. Their tailoring work was approved by management and part of their job description. Trigg and Bødker stress that tailoring is a cooperative work process and that the local developers "work on the borders between

technology development and everyday work" (p. 47) at the agency. It is their embeddedness in the local community of practice that enables local developers to develop solutions that actually work.

Finally, in a study of the use of a computer conferencing system in a Japanese R&D project group Orlikowski et al. (1995) found that the system's use was significantly influenced by the activities of a small group of people, referred to as mediators, who adapted the technology to the local work context. In addition to maintaining and customizing the technology, they trained and helped users, promoted the use of the technology, and engaged in efforts to reinforce and institutionalize particular use patterns over time. Orlikowski et al. (1995) characterize technology-use mediation as "a process of structuring resembling that engaged in by users when they structure their technologies" (p. 437). They refer to it as metastructuring because it is a form of second-order structuring of technologies in use.

In sum, technology-use mediation is a key organizational practice and empirical research has demonstrated that local developers and mediators can play a very valuable role in organizations. However, prior research leaves unanswered questions about the processes through which mediators, in practice, intervene in and shape technology use in organizations. We are, in particular, concerned with how mediators make sense of the technology, how they enact or "real-ize"(Weick 2001c) their interpretations through their actions, and how they define their own role as mediators. Underlying this interest is the premise that understanding how people make sense of a technology is critical to understanding how they interact with it.

To explore these issues, we draw on insights and concepts from organizational studies and use these to analyze the data from our field study.

3 A Sensemaking Perspective

Organizational researchers have for some time been interested in understanding processes of sensemaking, i.e. how people, individually and collectively, produce meanings and how their beliefs and understandings affect their behaviour and performance, e.g., (Barley 1986; Porac et al. 1989; Ring & Ven 1989; Weick 1995; Winograd & Flores 1986). Our approach is broadly inspired by this body of work, but draws primarily on the theoretical framework of Karl Weick who is one of its most influential exponents.

In the words of Weick (1995, p. 4), "the concept of sensemaking is well named because, literally, it means the making of sense." Sensemaking is about such things as placing stimuli into frameworks, comprehending evolving situ-

ations, and constructing meaning. To sharpen the concept, Weick (1995, pp. 6-8) contrasts sensemaking with interpretation (which is often used as a synonym for sensemaking). Interpretation focuses on understanding or "reading" some kind of "text." What sensemaking does is address how the text is constructed as well as how it is read. The key distinction, in other words, is that sensemaking is about "authoring" as well as "reading:"

> To talk about sensemaking is to talk about reality as an ongoing accomplishment that takes form when people make retrospective sense of the situations in which they find themselves and their creations. There is a strong reflexive quality to this process. People make sense of things by seeing a world on which they already imposed what they believe. People discover their own inventions, which is why sensemaking understood as invention, and interpretation understood as discovery, can be complementary ideas. (Weick 1995, p. 15)

Sensemaking emphasizes that people try to make things rationally accountable to themselves (and others) and that action is crucial for understanding. People act, and in doing so create the environment they face and this environment then constrains (and enables) their actions. In this way, people are very much part of their own environment (Weick 1995).

Now, let us consider again the work of the mediator. The mediator's job is to adapt the technology to the local context of use by modifying features of the technology, promoting use, establishing appropriate communication norms, etc. To accomplish this, the mediator has to make sense of the technology *in relation to* a specific, local context. Having a general or abstract understanding of the technology is not sufficient. It is essential that the mediator's understanding of the technology is connected to the specific needs and circumstances generated by the local use situation. This, however, is certainly no simple or straightforward task. As already mentioned, advanced CMC technologies are generic, general-purpose media, which may be configured and used in a number of different ways depending on the situation. The problem of adaptation, thus, does not have a single, obvious solution, but rather a number of possible solutions, all of which may be feasible.

Weick (2001a) has referred to such flexible and customizable technologies as "equivoques" to indicate that they "admit[s] of several possible or plausible interpretations" (p. 148). That CMC technologies are equivocal and open to many different interpretations does not, however, mean that they are a *tabula rasa* on which actors can freely inscribe their own meanings and values (Hutchby 2001). On the contrary, despite their interpretive flexibility, technological artefacts have a constraining as well as enabling materiality - in other words, different tecnologies do not lend themselves to the same set of interpretations.

The reason is that different technologies possess different affordances (Hutchby 2001), i.e. they offer different possibilities for action, and these affordances constrain both the possible meanings and the possible uses of the technologies:

> … affordances are functional and relational aspects which frame, while not determining, the possibilities for agentic action in relation to an object. In this way technologies can be understood as artefacts which may be both shaped by and shaping of the practices of human use in interaction with, around and through them. (Hutchby 2001, p. 444)

As Hutchby (2001, p. 448) has pointed out, "affordances are not just functional but also relational aspects of an artefact's material presence in the world." They are *functional* in the sense that they are enabling, as well as constraining, factors in a person's attempt to engage in some activity: for instance calculating a number or communicating across distance. The *relational* aspect, by contrast, accentuates that the affordances of an artefact may differ from person to person and from context to context. A PC with a compiler has the affordance of programmability, but only if you are a skilled programmer and know the appropriate programming language. Likewise, an advanced, digital camera has different affordances for a novice and a professional photographer.

The full range of affordances of any artefact is generally not available to immediate perception (Hutchby 2001). When people interact with (and sometimes through) technologies, it is necessary for them to learn about the affordances that the technologies offer to them, in their specific context of use. The affordances, of course, exist whether or not people exploit them, but they only become manifest when people act in terms of those affordances. Sometimes, people invent entirely new ways of using a specific technology once they begin to grasp its affordances—often to the surprise of the designers of the technology.

In other words, it is the job of the mediator to convert an abstract, generic technology into an intelligible "technology-in-practice" (Orlikowski 2000) by exploring its affordances and figuring out how to exploit them in his or her own, specific context. An important point is that the mediator seldom has the luxury of being able to step back and think carefully about what to do. On the contrary, there is an imperative to act. The mediator is responsible for setting up and maintaining operation, providing ongoing user support, responding to user requests and breakdowns, etc. S/he is literally thrown into a situation where s/he is forced to act without the benefit of a clear, stable understanding of what is happening (Winograd & Flores 1986). S/he invariably finds her/himself in the middle of things, sizing up the situation, trying to figure out

what is going on, while s/he simultaneously intervenes to improve the situation in some way. The mediator's experience is, in other words, not an occasion for passive diagnosis or detached reflection. Instead, it is "an attempt to grasp a developing situation in which [s]/he, as an observer, affects the trajectory of that development" (Weick 2001c, p. 460). After presenting the findings of our empirical research, we will develop this point further.

4 Research Setting

BioCorp (a pseudonym) is a multinational biotech company, which manufactures a range of pharmaceutical products and services. BioCorp's headquarters are situated in Northern Europe, but the corporation has production facilities, research centres, and sales offices in 68 countries around the world. In 2001, BioCorp employed more than 16,000 people and the net turnover was US$2.8 billion.

The CMC-system, *ProjectWeb*, which we studied, is a web-based application of the virtual workspace type, offering facilities for sharing documents, exchanging files, publishing information, event notifications, group management etc. ProjectWeb is developed in-house, as a collaborative effort between people in BioCorp's R&D division and the corporate IT department, but it has close resemblance to commercial systems like Lotus Team Workplace from IBM (www.lotus.com) and BSCW from GMD in Germany (bscw.gmd.de). ProjectWeb is considered a highly successful system within BioCorp and the corporate IT department regularly produces updates and new versions of the system.

ProjectWeb is a generic system and must be set up and configured before it can be used (Henriksen et al. 2002). This includes designing a home page for the virtual workspace, creating a folder hierarchy (to store documents and files), registering users, allocating access rights to different user groups (administrators, authors with uploading rights, and readers), etc.

The purpose of the system is to support communication and collaboration among participants in the company's drug development projects. These projects are complex, large-scale, long-term endeavours. A typical project lasts 9-10 years and involves up to 500 people from many different functional areas within the company (e.g., clinical research, engineering, marketing, and regulatory affairs). Most of the activities are carried out at sites in Northern Europe, but clinical trials are conducted in the US, Singapore, Japan and a number of other countries worldwide. The fact that a growing number of BioCorp's new drugs are developed in close collaboration with external partners

in Japan, the US and Europe further adds to the distributed and complex nature of these projects.

Projects are organized in the following way: Work is carried out by a number of interdependent teams responsible for different aspects of the development process such as clinical testing and registration. Together, the managers of these teams form the so-called "core group" of the project. A full-time project director, responsible for meeting pre-established goals of cost, schedule and functionality imposed by senior management, heads the core group. Each project director has a project assistant who acts as his or her right hand. While the project director (and his or her assistant) usually follow a project from beginning to end, most other participants only work on the project for shorter periods of time and, in most cases, they work on several projects simultaneously. All project directors and project assistants are located at company headquarters, in the Project Management Unit (PMU).

Although formal as well as informal face-to-face meetings are central to communication within the projects, the dispersed nature of the organization means that project members must also rely heavily on a variety of communication technologies to facilitate various modes of work. At the time of our study, these included familiar technologies like mail, telephone and fax, but also more advanced technologies like ftp, shared LAN drives, e-mail, video conferencing, and electronic calendars.

In addition, the project assistants are responsible for setting up, designing and maintaining a common project web site (a virtual workspace) for each project. They use the ProjectWeb application to create and maintain these web sites. A so-called IT-supporter, a technology-savvy person, also located in PMU, aids the project assistants with all kinds of IT-related tasks, including the use of ProjectWeb. In other words, the projects assistants and the IT-supporter together function as mediators responsible for the contextualization of ProjectWeb.

5 Data Collection and Analysis

Consistent with our research focus, we followed an interpretive case study approach (Myers 1997). Interpretive field research is particularly appropriate for understanding human thought and action in natural organizational settings (Klein & Myers 1999). This approach allowed us to gain insights into the processes related to the adaptation and use of the CMC system and, in particular, to examine how different mediators made sense of and enacted the technology. Moreover, this approach is also useful for discovering new

insights when little is known about a phenomenon. It allows for casting a new light on complex processes whose structure, dimensions, and character are yet to be completely understood (Myers 1997).

Our field data collection lasted for more than three years and we used several data sources and modes of inquiry (for triangulation). The two primary data collection methods used were interviews and examination of archival data, but we also participated in a number of formal and informal meetings with developers and users. Finally, we examined different versions of the software.

Interviews. We began interviewing managers and employees of BioCorp in August 1998 and concluded the last interview three years later, in September 2001. During this period, we conducted 34 semi-structured interviews of 60-120 minutes in length. All interviews were recorded and transcribed. Participants represented a diverse array of occupations and organizational positions, and included project directors and project assistants from PMU as well as members of several development projects. The goal of these ongoing interviews was to gather information about important events as they unfolded and to track changes in the way people experienced the technology and perceived the new communicative affordances provided by it. We also wished to avoid such problems as poor recall, hindsight bias and rationalizations.

Archival data. We reviewed public materials such as annual reports and company brochures as well as internal documents such as the company newsletter, organization charts, the project manual concerning the discovery and development of new medicinal drugs, the guidelines for organization and management of development projects, and the set of user manuals for the CMC system. This provided general information on company history, structure, core competencies, and culture as well as more specific data on the organization and management of the medicinal drug development projects (including formal planning and project management models), and the CMC system itself.

Meetings and informal conversations. We held two meetings with the director of PMU and several meetings with the manager in the IT-department responsible for ProjectWeb. We also participated in a one-day workshop with users and developers in spring 2001. The purpose of the workshop was to discuss user requirements to the next version of the system. In addition to the formal meetings, we had many informal conversations with project assistants and users on the phone and during our visits to the company in connection with meetings or interviews.

Examination of the application. We had the opportunity to inspect the different versions of the CMC system on several occasions. In addition, when

interviewing users we often asked them to demonstrate how they used the system and show us the content of the document base. In this way, we gained first-hand knowledge about the system and its salient features.

We used qualitative techniques to analyze the data, informed by the overall focus on mediation and sensemaking. We analyzed all data sources in a process of recursive scrutiny to get as complete a picture as possible of the design, implementation and use of the system. This process was "not unlike putting the pieces of a puzzle together, except that the pieces are not all given but have to be partially fashioned and adjusted to each other" (Klein & Myers 1999, p. 79). We endeavoured to place our findings in the context of relevant literature and in interpreting our data we constantly referred to relevant bodies of research on technology adaptation, sensemaking, and CSCW. Thus, the processes of reporting the findings and conducting the analysis were highly connected and interwoven.

We shared our preliminary findings with key informants in PMU and the IT department, and they provided helpful comments that confirmed and elaborated the identified issues and conclusions drawn. By discussing our findings with the key informants, we explicitly recognize that the participants in the study—just as much as the researchers – are interpreters and analysts and that the story we tell is a result of our interaction with the participants (Klein & Myers 1999).

6 Case Study Findings

The project assistants and the IT-supporter have, individually and collectively, played an essential role in making the introduction of ProjectWeb a "success story." This does not mean that ProjectWeb is used in the same fashion in all projects. On the contrary, the use of ProjectWeb varies significantly from one project to another. From our point of view, however, the important point is that the extent of use in each project is closely connected with the project assistant's effort (or lack thereof) to adapt the technology to the local situation and to motivate project members to use the system. Some project assistants have been wholehearted supporters of the new technology from the very beginning and enjoyed playing around and experimenting with it. Others have been more indifferent, and a small minority has been a bit scared by the technology and quite reluctant to use it. As the IT-supporter told us, "two thirds [of the project assistants] have been enthusiastic about it, but the last third did not 'see the light' at once." She emphasized that the commitment of the project assistants is crucial to the adoption and use of ProjectWeb by

project members: “How much it is used depends on how enthusiastic the project assistant is. If she is devoted to it, its use will be more widespread.”

6.1 Working as a Mediator

We can begin to understand the role of the mediators by examining the everyday practices of the project assistants and the IT-supporter as they deal with the challenge of adapting the technology and the local context to each other. We begin by analyzing the work of the project assistants.

The project assistants. Through the data analysis we identified a repertoire of practices, which the project assistants engage in as mediators. The practices can be divided in two main groups.

The first group includes practices aimed at promoting use and offering ongoing assistance, encouragement and support to the users. As Ciborra (1996) noted, new electronic communication media are an extremely fragile type of technology because of the threat posed by substitute media. Project-Web, for instance, has to compete with the already widespread use of email in the company. Thus, a consistent challenge, which the project assistants face, is to motivate people to use ProjectWeb. As one of the project assistants put it, “we have to go out and sell the system.” People are not waiting to “throw themselves into it.” The project assistants address this challenge in several ways:

1. They *help users* integrate the new technology into their work practices by providing advice, technical assistance, support and hand holding.
2. They actively *promote usage* of the system. For instance, when a new project is started, they introduce the core group members to the system at the first project meeting and explain how it can improve communication within the project. They also regularly send out emails prompting people to visit the project web site, when important documents or interesting news have been posted.
3. Sometimes they also have to “*discipline*” *users* (as they put it themselves) in order to foster appropriate usage and discourage ineffective or inappropriate behaviour. For instance, they try to establish as a norm that project members themselves are responsible for seeking the information they need by regularly visiting the project web site. One way to reinforce this norm is by refusing to distribute minutes from meetings and other important documents as email attachments (as they used to do before ProjectWeb).

The second group of practices is aimed at adapting the technology to ensure that it reflects local needs and conditions as well as possible. As one of the project assistants said, "It is an important part of my work to ensure that it [the project web site] is always 'fit for fight' and up to date." The adaptation of the technology involves at least three types of activities:

1. The project assistants strive to make their project web sites *attractive, interesting and dynamic* so as to entice people to visit them. They do so by playing with colours, graphics, and pictures and by frequently posting news of interest to members of the project.
2. The project assistants continually adjust and enhance the structure and layout of the project web sites to make them *easier to navigate and use*. They pay close attention to user feedback and try to identify and remedy problems as quickly as possible. For example, they constantly adjust the hierarchy of document folders on the web site to support the easy storing and retrieval of the project's documents.
3. Because user demands change over time, the project assistants maintain an *ongoing dialogue with users* about how well the system fulfils their needs. They actively collect proposals for changes and modifications to the software and pass them on to the IT department, either by contacting the responsible programmer directly or by talking to the IT-supporter (more about that later).

Finally, a few of the most enthusiastic project assistants attempt to influence the design of new versions of the software by lobbying for their proposals when they have the opportunity, e.g. at meetings and workshops or in more informal ways.

The IT-supporter. The IT-supporter does not have any direct contact with the users of the system. Her role is to support the project assistants in their technology-related activities and to act as a link or a translator between the project assistants and the IT department. Her repertoire of practices (related to ProjectWeb) can also be split into two groups.

The first group of practices focuses on helping and supporting the project assistants. The project assistants do not have any formal technical training and their knowledge of information and communication technologies is quite limited. As a consequence, they depend to some degree on the IT-supporter in carrying out their mediation work. The assistance of the IT-supporter involves the following practices:

1. She *teaches the project assistants* about the technology and helps them set up and configure it. The offices of the IT-supporter and the project

assistants are situated next to each other on the same floor, which gives the project assistants easy access to the IT-supporter.
2. She *promotes knowledge sharing* among the project assistants. She does so by arranging a monthly meeting to discuss the use of ProjectWeb (as well as other IT-related issues), and by encouraging the project assistants to communicate and share tips and ideas with each other.
3. She tries to *influence the behaviour* of the project assistants (just like they try to "discipline" the users). For instance, she has formulated a set of guidelines for the "appropriate" way of administering access rights to the project web sites. She also monitors how the project assistants design their web sites and tries to promote good design principles.

The second group of practices focuses on adapting and developing the technology:

1. As mentioned in the previous section, the project assistants, together with the users, generate a constant stream of ideas on how to improve ProjectWeb. The IT-supporter *systematically collects* these proposals, rates them, and passes them on to the IT department.
2. In addition, she *participates in the design* of new versions of ProjectWeb, acting as a sparring partner to the programmers and analysts. (In this way, she has a privileged position compared to the project assistants, who are excluded from the design process.)

As Trigg and Bødker (1994) have argued, mediators are inevitably "border persons" and the reason for the IT-supporter's critical role is her ability to act as a boundary spanner between the group of project assistants in PMU and the programmers and analysts in the IT department. She has, so to speak, a foot in both camps. Her office is situated in PMU, she is familiar with the work of the project assistants, and she knows their needs and wishes, their frustrations and their technical abilities; but at the same time, she is able to understand and interact with the programmers and analysts, owing to her formal training and long experience with IT. Thus, we believe that without the help of the IT-supporter, the project assistants would not have succeeded as well in adapting the technology.

6.2 Making Sense of ProjectWeb

So far our account, by and large, is in agreement with the existing, but limited, literature on technology-use mediation and supports the claim that "mediators

add value by keeping technology usage aligned with user conditions and organizational circumstances" (Orlikowski et al. 1995, p. 442). This is, however, not the whole story. By characterizing the mediators' job as *facilitating* use, Orlikowski and others overlook the fact that mediators are not passive or neutral facilitators, but, on the contrary, actively involved in defining what the technology is, how it should be used, for what purposes, and by whom. We believe the essence of the mediator's job is to make sense of the technology—and this sensemaking is an active process where the mediator simultaneously enacts the technology and an environment in which it fits.

Our case shows that even when the "same" technology is implemented in similar projects in the same organization, it may be interpreted and used very differently by different people. The project assistants have developed very different conceptions of ProjectWeb and how it should be used. This is clearly reflected in the way they talk about it, the layout and content of their web sites, the way they choose to allocate access- and uploading rights, etc. And all this, of course, has important consequences for the usage of the system in the different projects.

In the following, we present two contrasting examples as a way of illustration. The first project assistant, Jean, basically views ProjectWeb as a *broadcast* medium and this notion pervades her thinking about how to design, manage and use the project web sites, which she is responsible for. For Maria, the other project assistant, ProjectWeb is rather a kind of *groupware* system, which may support cooperation and interaction in her projects.

ProjectWeb as a broadcast medium. Jean's notion of ProjectWeb as a broadcast medium is bound up with her understanding of project management in BioCorp and her own role as project assistant. According to Jean, the biggest challenge to project management is to motivate people and create a common sense of identity among project members, who belong to different organizational units and are distributed over five continents:

> It is a question of people management rather than project management, because once you get people on board, you can motivate them, and get them to all pull in the same direction, well, ya, then work becomes the least of it.

She believes that the best way to motivate people is by keeping them well informed about what happens in the project. "Because information equals motivation, as we say." As a result, she attaches great importance to disseminating information about important results, events and decisions within her projects. She sees herself as the person responsible for project communication and she loves to be the center of attention:

> So, they [the project members] are used to that information comes from me. They always contact me and ask about almost anything. I'm the only one who

> can answer or otherwise I know who can answer. This is the part of the job that is most fun.

Given Jean's self-conception and her notion of project management, it is not surprising that she conceptualizes ProjectWeb as a broadcast medium, which can be used to facilitate a steady stream of information from the core group in corporate headquarters to all project members, irrespective of their geographical location or position in the organizational hierarchy. To Jean, ProjectWeb is simply "the ultimate project communication tool:"

> It has simply got something to do with the underlying philosophy about project communication. And ProjectWeb has clearly demonstrated that it is an ideal communication tool, because you have the possibility of using graphics to make things a bit more lively – and this can include, what shall I say, the hard facts such as decisions made by top management, or it can be a picture from a seminar that we've just had. So, it is very mixed, but the information goes out to everyone.

Jean thinks of herself as a "webmaster." She provides virtually all the content on her project web sites, she decides how to edit and present it, and she even writes significant portions of it herself. She strives to make her web sites dynamic, lively and interesting places to visit, for instance by regularly publishing news about the project:

> We really want it to be a living forum, so people know that we regularly update the site and that it's worthwhile visiting it. They should have it as a "favourite" [bookmark], which they check every day to see if "there is something new." (…) News, it could be case stories. They're very good. A case is when a doctor contacts BioCorp and says, "we've used this product and it really helped." We send it out in the organization, and everyone cheers.

In short, Jean's interest in ProjectWeb lies in its affordances as a broadcast medium, which may facilitate communication from the center (project management) to the periphery (project members). In practice, this means that Jean positions herself as the central gatekeeper who controls the access to publishing information on the project web sites.

Consistently, Jean firmly dismisses the idea that ProjectWeb could function as a platform for the exchange of documents and working papers among members of the many work teams, which make up a project. Asked directly, Jean answers:

> It goes out by mail. It goes out by mail. It goes out by mail. You shouldn't use the web for this. There is no reason to put drafts or working papers on the web. People have to go out there and download it, instead of just opening their mail. (…) I know, I've heard it before all that about the flow of documents. But I

> think – I won't use the word foolish – but I think it is extremely cumbersome. Really, I can't see why it [the web] should be used for this, but it's probably only me who hasn't seen the light. [Laughter]

With this answer, Jean clearly confirms that she defines ProjectWeb as a broadcast medium—and nothing else.

ProjectWeb as a groupware system. The second project assistant, Maria, is more tentative and explorative in her approach to ProjectWeb and it is more difficult for her to describe exactly what ProjectWeb means to her. Although she recognizes the advantages of using ProjectWeb to broadcast information, she is more interested in exploring how ProjectWeb can be used to support collaboration within distributed workgroups, for instance by facilitating document sharing and co-authoring:

> It's mostly documents we use it for—for exchanging information in the form of documents that go back and forth [between the project participants].

She further explained that she regards the project web sites as a "common place" and that it is a shared responsibility to ensure that the content is correct and up to date:

> But at the same time it [ProjectWeb] gives us a place where we can share information—something that wouldn't have been possible, if we didn't have it. When something is put there, then it is no longer theirs but everyone's. So, we all have responsibility for making sure that the right things are there.

Undoubtedly, the reason for Maria's interest in using ProjectWeb to support document sharing and co-authoring has (at least partly) to do with the fact that all her projects are joint ventures involving close collaboration with partners in the U.S. as well as in several European countries. BioCorp demands that all emails, which are sent outside the company's intranet, must be encrypted if they contain confidential information. This rule makes it very cumbersome to exchange documents by means of mail attachments (which is otherwise a common practice in BioCorp). Therefore, Maria sees ProjectWeb as a good alternative to email:

> But it is also because we at BioCorp have had it beaten into our brains how dangerous it is to send documents by mail. It [the project web site] is a much safer place to exchange documents than by throwing them in a fax or sending them around by mail. And we don't fill our mailboxes either, or get the nasty messages about taking up too much space, because we've put it on the web instead. We're very happy with it. I think it is really well suited. And we don't have to cryptograph and pack it and send passwords all over the place, so it works really well.

The result is that ProjectWeb is widely used to share information and documents within the projects' work teams (which in most cases encompass people from several organizations). One of the team managers explained, for instance, how they use it to share drafts of documents they are working on:

> We have just, in connection with the pulmonary project, gotten a new web site, which means we have a common web site with the US company we are collaborating with. And we use it to go in and put documents, as draft versions, and for review where everyone can see the same document. (…) We use it so we can download documents and say 'now, we'll all look at the same thing,' instead of sending it as an attachment that you have to cryptograph, and then you also have to remember the code, and whatever. So, we've simply developed a web site, where key people have access.

This practice is, of course, only possible, because Maria (unlike Jean) has chosen to distribute uploading rights to project members with the need to share documents.

The problem for Maria and her co-workers is that ProjectWeb is not really designed to support collaboration. There are, for instance, no facilities for version control or for locking documents (to prevent the "lost update problem," which occurs when two people collaborating on a single document overwrite each other's work (Fielding et al. 1998)). Such issues must be solved via agreements and rules regulating the use of the system. For instance, Maria told us that she and her counterpart in one of the partner companies had negotiated a set of rules for updating the project plan (a very important document used to coordinate activities across the entire project):

> But then we agreed that it was only me and my counterpart in the American company that could do it [correct the project plan]. Also, because it would not be practical if more downloaded a document and worked on it at the same time. So the way that we do it is that when you download a document you also delete it from the web site. You make your corrections and upload it again. (…) Then we know, if it is gone, then someone is in the process of updating it.

Even though ProjectWeb does not have well-developed mechanisms for supporting coordination, thus, making it difficult to use the technology for collaborative purposes, Maria and her co-workers are, nevertheless, satisfied with it and find it very useful.

In summary, Maria has a strikingly different conception of ProjectWeb than Jean. According to Maria, ProjectWeb is a kind of "groupware system" and its prime importance lies in its ability to support collaboration among project members, across distance and organizational boundaries. This also means that Maria and Jean focus on different affordances of ProjectWeb.

While Jean primarily pays attention to the facilities, which enable her to create visually attractive web content and disseminate it on a broad scale, Maria focuses more on the facilities, which make it possible for project members to share information and documents in a secure and relatively easy way.

7 Discussion

This study supports earlier research findings regarding technology-use mediation (Gantt & Nardi 1992; Orlikowski et al. 1995; Trigg & Bødker 1994). In line with this previous research we find that (section 6.1): First, mediators play a significant role in organizations by facilitating the ongoing, mutual adaptation between particular technologies and the specific organizational context. Second, to facilitate this adaptation process, mediators employ a broad repertoire of different practices, some of which aim at modifying the technology, while others aim at transforming the organizational environment (e.g. people's opinions and beliefs, working procedures, and communication norms). Third, mediation is usually a collective process, involving people with different backgrounds and skills. Fourth, mediators (as a group) act as boundary spanners, connecting the communities of users and IT people. They work on the borders between technology development and use and it is their proximity to the context of use that enables them to develop solutions that actually work.

More importantly, however, the study also provides new insights into technology-use mediation (section 6.2). First, our findings highlight the fact that mediators are not neutral facilitators or detached observers of a well-defined technology that presents itself to them as given and fixed. On the contrary, mediators are actively involved in *creating* the technology by defining what it means and how it should be used. They are explorers and inventors as much as facilitators and interpreters. For instance Jean defines ProjectWeb as a broadcast medium while Maria considers it to be a groupware system. In both cases they simultaneously construct and interpret their own technology-in-practice. Weick refers to this interplay of construction and interpretation as *enactment* to stress "the fact that, in organizational life, people often produce part of the environment they face" (Weick 1995, p. 30). They act out and "real-ize" their ideas, and in doing so create the materials and situations that become the constraints and opportunities they face (Weick 2001c, p. 195). For instance, Jean, by enacting ProjectWeb as a broadcast medium, prevents herself from exploring other possible uses of the technology (e.g. to support collaborative work).

Second, because advanced CMC technologies are equivocal and open-ended—i.e., they allow for several plausible interpretations and they can be put to many different uses—they require ongoing sensemaking if they are to be managed, contextualized and adapted to changing contexts of use. This means, that to carry out their work mediators must construct meaningful and credible visions of how the technology should be used in their local circumstances. This involves two distinct, but highly interconnected tasks. First, they must explore the affordances of the technology to determine its potential uses and limitations. Next, they must clarify the values, priorities, preferences and needs of the local use context. This is no simple or straightforward task. It is not just a matter of discovery or interpretation (of the technological artefact), but also a matter of invention and social construction (of the technology-in-practice). For instance, one of the problems Jean and Maria had to resolve was how to understand ProjectWeb in relation to the existing communication media in the company, including telephones, email, LAN drives, ftp and video conferencing. Was ProjectWeb essentially a one-way, broadcast technology or should it rather be seen as an interactive medium, supporting two-way communication? As we know, Jean and Maria reached very different conclusions with regard to this and other questions as a result of their interactions with the technology.

Third, the case study demonstrates that technology-use mediation is a sensemaking process, which unfolds gradually over time as mediators learn how to match the affordances of the technology with the users' needs. In the beginning neither Jean nor Maria had a clear idea about the nature of ProjectWeb, what affordances the technology had, or how to adapt and use it in their projects. It was only by using and experimenting with the technology that they gradually came to make sense of it and figured out how to contextualize it. Jean stated this quite succinctly:

> We've learned over time what it can be used for, both seen from the users' perspective and ours. So, it is a question of how things influence each other so that requirements, needs and wishes all mesh—and it develops along the way in the course of things, and so there are a lot of things going on all the time.

Fourth, technology-use mediation is a process in which action and thought continually interact and condition each other. On many occasions, Jean and Maria acted their way into understanding. Instead of analyzing user needs and creating elaborate plans for the implementation and use of the technology, they simply embarked on a program of trial and error. In the beginning their actions were informed more by hunches and intuition than knowledge or clear visions, and it was not until they looked more closely at what they had created and how people reacted to it that they began to form more specific and

sophisticated ideas about the technology's potential use. As Jean, for instance, noted:

> It is therefore important to get some user feedback. What is it that they really need? Because the longer you use it [ProjectWeb], and luckily we've used it from the beginning, you find out just what it is that people need. And of course, there are different needs and different uses, but one thing for sure is that the better we are at accommodating those, who use it [ProjectWeb], the more [people] will end up using it.

Technology-use mediation must necessarily have a strong core of experimentation and trial and error, because the full range of a technology's affordances does not become manifest until people exploit them (Hutchby 2001), and because it is never clear what the local needs and requirements are—or how they will evolve once the new technology is in place. In these circumstances, experimentation is an obvious means to gain some sense of what one is up against, as when "the action of saying makes it possible for people to then see what they think" (Weick 1995, p. 30). Action and experimentation "generates clearer outcomes in a puzzling world, and these outcomes make it easier to grasp what might be going on." Experimentation "is about making things happen, so that you can then pounce on those created things and try to explain them as a way to get a better sense of what is happening" (Weick 1995, p. 168). The implication is that the best (and often the only) way for mediators to learn about a new technology and discover its affordances is by trying it out in practice.

Fifth, sensemaking is grounded in identity construction. The sensemaker's sense of who he or she is, what threatens this sense of self, and what is available to enhance and confirm that sense of who one is all "provide a center from which judgments of relevance and sense fan out" (Weick 2001d, p. 461). For instance, Jean's enactment of ProjectWeb as a broadcast medium is clearly linked to her identity as the person responsible for communication in the projects. She was very satisfied with being that person and when she became responsible for managing ProjectWeb, she created a new role for herself as "webmaster," which maintained and confirmed her sense of identity. At the same time, it should be stressed that sensemaking is a social process. Identity is constituted out of the process of interaction and sensemaking is always influenced by the actual or imagined presence of others (Weick 1995). In other words, "Sensible meanings tend to be those for which there is social support, consensual validation and shared relevance" (Weick 2001d, p .461).

One last point, which we would like to make, is that in their endeavour to enact the technology-in-practice, mediators, unlike professional system designers, have to make do with whatever resources (in terms of technological

artefacts, people, existing norms of communication, organizational procedures and rules, etc.) are at hand. Maria, for example, in her efforts to use ProjectWeb as a groupware system must accept that important facilities to coordinate collaboration (e.g., locking and versioning of documents) are missing and try to compensate by establishing appropriate conventions of use. In this respect, technology-use mediation resembles bricolage and the mediator acts like a bricoleur. The French word bricolage means, "to use whatever resources and repertoire one has to perform whatever task one faces" (Weick 2001b, p. 62). Invariably the resources are heterogeneous and less well suited to the exact project than one would prefer, but they are all there is. The materials "are not project-specific, but, instead, they represent the contingent result of all of the previous uses to which those items have been put" (Weick 2001b, p.62). The key to understand the nature of bricolage as an innovative activity is Levi-Strauss's statement that materials "are not known as a result of their usefulness; they are deemed to be useful or interesting because they are first of all known" (Levi-Strauss, cited from Weick 2001b). To be a skilled bricoleur one must have intimate knowledge of the available resources, be ingenious, and have the ability to improvise—that is, to think "on the fly" and act in an extemporaneous and spontaneous way to changing needs and conditions (Lanzara 1999).

8 Conclusion and Implications

In this paper we have examined technology-use mediation from a sensemaking perspective. We have argued that because people's interpretations influence their actions (and vice versa), understanding technology-use mediation – and technology adaptation in general—requires understanding how mediators make sense of the technology and how they attempt to enact or "real-ize" their visions of how it should be used. The objective of our research was to explore how mediators, in practice, cope with the challenge of understanding and adapting a new CMC technology to a specific context of use.

Our findings confirm prior research into technology-use mediation, which suggests that mediators can exert considerable influence over how a particular communication technology will be appropriated and used in an organization, e.g., (Nardi & O'Day 1999; Orlikowski et al. 1995). While previous studies of technology-use mediation have tended to highlight the positive side of mediation—as adding value by promoting effective electronic communication and

collaboration—an important implication of this study is that technology-use mediation does not automatically lead to optimal or best possible outcomes.

Our analysis reveals that the practice of technology-use mediation is a much more complex, open-ended and precarious process than earlier research suggests, and that the outcome, therefore, is quite unpredictable. The reason being, we believe, that technology-use mediation essentially is a sensemaking process (Weick 1995), i.e., a process where people try to make things and events rationally accountable to themselves and attempt to produce some kind of stability and order in their world. For example, this study shows that different mediators may develop different interpretations of the "same" technology (dependent on their identity, previous experience, local conditions, etc.) and, in effect, enact very different technologies-in-practice. The notion of sensemaking draws attention to the fact that the process of technology-use mediation is highly dependent, not only on the technology and the organizational context, but also on the knowledge, experience, skills, and identity of the mediators and that it is a process of learning and experimentation, which is essentially open-ended and indeterminate. An important managerial implication is that it is necessary to recognize that although technology-use mediation may be a "powerful organizational mechanism" for promoting effective electronic communication as suggested by Orlikowski et al. (1995), success is not guaranteed—it depends on how well the process is carried out and managed.

This research also highlights the value of sensemaking as a theoretical lens to study technology adaptation in practice. By adopting a sensemaking perspective on technology-use mediation, we were able to investigate how thought and action continually interact and condition each other in the process and how the construction of meaning is an intrinsic part of technology adaptation. We encourage researchers to complement more traditional IT implementation studies with analyses of how the sensemaking processes of organizational members influence the adoption and use of technology in organizations.

Further research is clearly needed to examine how best to support, organize and manage the work of technology-use mediation under different circumstances to make it as effective as possible. A logical next step would be to conduct empirical studies of technology-use mediation in different organizational contexts. How best to organize and manage technology-use mediation probably varies with the organizational setting and with the type of technology involved. For instance, technologies that are more specialized and rigid may need less contextualizing than more generic and flexible technologies (Orlikowski et al. 1995). How many resources—in terms of training, time, organizational and technical support, etc.—should be allocated to the media-

tion process probably also depends on the situation. For instance, technology-use mediation in organizational settings characterized by continual and rapid change may require substantially more resources than in relatively stable environments.

In conclusion, a deliberate and well-organized process of technology-use mediation holds significant promise for organizations that want to successfully introduce and use new electronic media to improve communication, collaboration and knowledge sharing. At the same time, however, we must emphasize that it is not a panacea, that the process needs to be managed carefully, and that it does not automatically lead to optimal outcomes.

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