Technology Mediation: An Organizational
Mechanism for Contextualizing
Technologies in Use

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ABSTRACT

We suggest that a mechanism for facilitating the context-specificity of technologies in use already exists in organizations, but is under-appreciated, under-utilized, and under-managed. We studied the use of a conferencing technology and found that its effectiveness was significantly shaped by a set of actors--*technology mediators*--who actively guided and manipulated the technology and its use over time. These technology mediators contextualized the technology in use, while also adapting it over time to keep it current with changing circumstances. We argue that well-managed technology mediation is a useful mechanism for facilitating the context-specificity of technologies in use, and that it complements the existing approaches of involving users in design and empowering users to continue design in use.

KEYWORDS: Context-specificity, electronic conferencing system, technology mediation.

INTRODUCTION

It has long been understood that the effectiveness of technology depends considerably on how well a technology relates to the work practices and contexts within which it will be used. After a history of technology implementation difficulties [10, 13, 14], a number of researchers and practitioners have proposed alternative design approaches that explicitly address the problem of designing for use. Two such approaches have emerged to date.

The first approach is known generally as "participatory design" and it was recently featured in a CACM special issue [7]. It tries to incorporate use experiences into design, either through techniques of cooperation and collaboration that require greater user participation in the initial design process [1, 3, 12], or a process of "ethnographically-informed design" that uses ethnography and interaction analysis to capture the situated practices of users [6, 16]. The second approach shifts the focus away from the initial design process, and attempts to enable users to continue designing the technology in their contexts of use. This approach advocates developing technologies that incorporate mechanisms and tools for allowing users to tailor, adapt, and reconfigure the technologies in use [5, 8, 9].

These two approaches have already begun to have a significant impact on the nature and usability of the technology artifacts developed and used in organizations. In this paper, we suggest that there may yet be a third, complementary approach for facilitating the development of context-specific technologies. This third approach recognizes the critical role of a set of actors that have typically been overlooked in studies and practices focused on the center stage action of designers inventing technologies and users using technologies. These actors--whom we label *technology mediators*--include trainers who prepare instructional materials and teach classes on technology use [15], technical support personnel who configure the technology, experts who resolve thorny technical problems, administrators who issue policy and practice guidelines for use [4], sales people who persuade users to adopt specific technical innovations, and even lead users who have acquired adequate technical proficiency that they can advise or improve other users' technology interactions [8]. We argue that these actors all play a role in customizing the technology to its context of use, in shaping users' understanding of the technology, and in establishing users' work habits around the technology. Such actions directly influence users' interactions with their

technology, and can have a profound effect on how usable, appropriate, and relevant the technology is (and remains) in particular contexts of use.

Our argument is based on research we conducted into the use of conferencing technology by a large project group in one organization. While examining how this group had made use of its new communication technology, we realized that a small set of users had actively shaped other users' adoption and utilization of the conferencing technology. Detailed analysis revealed that they had not only manipulated the conferencing technology over time, but also guided and promoted users' understandings and uses of the conferencing technology.

We argue, thus, that another mechanism for addressing the context-specificity of technologies in use routinely operates in organizations, but has gone largely unnoticed, unappreciated, and unmanaged. We suggest that paying attention to this mechanism may be a particularly useful third approach for increasing the effectiveness with which technologies are adopted, used, and changed over time. While typically seen as more peripheral to the central action of design and use, our findings suggest that technology mediation can be particularly effective when it is:

- **Appropriately Constituted:** The nature and efficacy of technology mediation depends considerably on the type of individuals involved. Where technology mediators are technically skilled, have intimate knowledge of the context of use, and are credible to the users, their actions will be more appropriate (technically and socially) and more likely to be accepted by the users.

- **Organizationally Authorized:** The extent and effect technology mediation also depends on the authority granted and resources made available to technology mediation. Technology mediation occurs, with or without careful deliberation and management. Where the role and influence of technology mediators is recognized, sanctioned, and supported, technology mediators can be empowered to advance particular kinds of innovative and locally customized uses of technology, and to allow the evolution of such use over time.

- **Proactively Managed:** Successful technology mediation requires sensitivity to the capabilities of the technology as well as the evolution over time of contexts of use. Adjusting to changing contexts may be facilitated by:
  - regular solicitation of user feedback to stay in touch with user concerns and use issues;
  - ongoing monitoring of usage patterns to detect errors, inefficiencies, misunderstandings, and areas of improvement;
  - routine minor modification of technology and usage guidelines to maintain and promote current use;

- periodic reassessments and major modifications to the technology and context of use to reflect changed organizational and technological circumstances.

Below, we describe the research study that led us to identify and explore the central role and influence of technology mediators in technology use. We conclude with some implications of technology mediation for the research and practice of technologies in use.

RESEARCH SETTING

The research study we conducted examined the introduction and use of a conferencing system in the R&D division of a large Japanese manufacturing firm. The system had been installed to support communication among the members of a project group developing a new computer product, Alpha (a pseudonym). Because Alpha was expected to be an innovative product that would improve the company's competitive position, a new organizational and technical infrastructure was set up specifically to support the Alpha development effort. At the launching of the Alpha project, 127 members joined the project from other parts of the R&D division, while another 50 new employees and external temporary engineers joined during the 17 month life of Alpha. The project group was divided into six teams: an administration team, a hardware development team, and four software development teams. All Alpha project members had experience with computers and computer-based communication tools such as electronic mail (e-mail). However, not all had used computer conferencing before.

The computer conferencing system used in the Alpha project was a slightly modified version of the network news software widely used to run Usenet (and was known as the "news-system"). Like all computer conferencing systems, the news-system was organized hierarchically into topics, known here as newsgroups, where users could post and read messages. The news-system was in operation for the full 17 months of the Alpha project, and accessible by all members at all times. The number and type of newsgroups present in the new-system changed over time during the project; that is, some newsgroups were created and some newsgroups changed in name, definition, and usage. Figure 1 shows all the newsgroups that were created on the news-system over the 17 month period.

The usage of the newsgroups varied considerably, from official newsgroups containing important announcements to the whole project group, to *chat* newsgroups that were meant for recreational purposes. Each of the six Alpha teams also had its own newsgroup for the more specific and local communication its members engaged in.
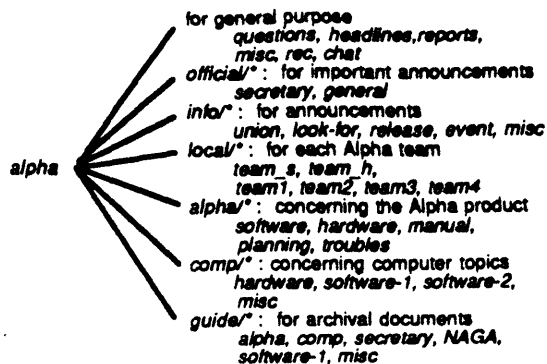
for general purpose
    questions, headlines, reports,
    misc, rec, chat
official/* : for important announcements
    secretary, general
info/* : for announcements
    union, look-for, release, event, misc
local/* : for each Alpha team
    team_s, team_h,
    team1, team2, team3, team4
alpha/* : concerning the Alpha product
    software, hardware, manual,
    planning, troubles
comp/* : concerning computer topics
    hardware, software-1, software-2,
    misc
guide/* : for archival documents
    alpha, comp, secretary, NAGA,
    software-1, misc

Figure 1: The newsgroups in the Alpha news-system.

Because Alpha was the biggest project group the company had ever had, and sharing information was especially important for establishing collaboration, some of project members felt the project needed a well-managed network to facilitate intra-group communication. They thus volunteered to serve in this technical and administrative capacity. They had to negotiate with their managers why this role was necessary because the need for infrastructure support was not yet well recognized. In their motivation, these members stressed the importance of having ongoing support for both the project's technical infrastructure as well as the specific communication tools installed on that infrastructure (e.g., e-mail and the news-system). Once managers accepted this rationale, they initiated a group named NAGA, the Network Administration Group of the Alpha project (a pseudonym). NAGA members communicated their role and responsibility to the rest of the project in a message they posted on the news-system:[1]

Subject: NAGA
Date: 30 Nov 89 10:05:48 GMT
Newsgroups: *misc*

....
Most of NAGA's activities are, by their nature, miscellaneous. ... All members share the view that no user-friendly computers can be created without being used by ourselves. Our goal is not only to achieve trouble-free use of the network, but also to increase the productivity of the project by improving communication among members. We hope that our project will take the lead in using the company-wide network.

At this point, NAGA was authorized and recognized as the committee responsible for administering Alpha project's news-system as a part of the members' regular job duties. NAGA was composed of nine members who were drawn from each of the six Alpha teams. Decision making was done by consensus, and involved discussions of all the members in face-to-face meetings. Regular meetings were held on average twice a month, the minutes of which were distributed to NAGA members via e-mail. E-mail messages were also frequently exchanged among NAGA members to supplement their meeting discussions.

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[1] Electronic messages cited here were translated from Japanese.

RESEARCH METHODS

Our study was designed to examine the policies and process through which the news-system was managed by NAGA, over time. Two types of data were collected, interview and textual data The interview data came from extensive and in-depth discussions with one NAGA member over a number of weeks. The textual data consisted of computerized records containing all the e-mail messages exchanged among NAGA members, and all the newsgroup messages that were posted on the news-system by Alpha participants over the 17 months of the project.

Qualitative data analysis was employed by carefully examining the e-mail messages, many newsgroup messages, and interview transcripts, and coding these for common topics and actions [2, 11]. This analysis yielded information related to the rules and policies enacted by NAGA over 17 months.

Over the period of the Alpha project, 438 e-mail messages were exchanged by the NAGA members. We selected 223 of them that dealt with administrative issues concerning the news-system. The selected messages were then categorized into common issues, thus yielding 97 topics that the NAGA members had discussed during their meetings or in electronic dialogue. These topics were then categorized by type of NAGA action taken as a result of the discussion.

Over the 17 months of the Alpha project, 9302 messages were posted on the news-system. Two types of news-system messages were examined in our analysis: messages that were posted by NAGA members in the execution of their administrative activities, and messages that were posted by users around the time of NAGA's actions.

RESULTS

Four types of action emerged as characteristic of NAGA's role and influence over time:
- Defining the role of the news-system;
- Promoting understanding and usage of the news-system;
- Modifying the definition and/or usage of a newsgroup;
- Creating new newsgroups.

In mapping these actions over time, we found that they fell into two phases: establishment of the news-system and its evolution over time (depicted in Figure 2). In Phase I, NAGA's actions were concentrated on defining the role of the news-system and promoting its usage, while in Phase II, NAGA's actions focused on modifying the definition or usage of specific news-groups and on the overall nature and configuration of the news-system.

PHASE I: ESTABLISHMENT OF NEWS-SYSTEM

NAGA began its activities in December 1989, at which time it installed the news-system on the Alpha project's network. From this time until the first system reconfiguration at the end of January 1990, NAGA

members devoted their efforts to defining the role of the news-system and promoting its usage. First, we will discuss their approach to policy-making for the system, and second, their differentiation of the news-system from other media already in use by project members.

Policy making process

NAGA started by developing a basic understanding of the role of the news-system in Alpha, considering whether it should be used for official communication. While NAGA members began discussing this in their meetings, they also solicited the participation of all project members. The following message triggered responses from project members who were already using the news-system:

Subject: New newsgroups
Date: 6 Dec 89 10:05:48 GMT
Newsgroups: misc
We need to discuss the following issues.
(1) The officiality of this news-system is unclear. Must everyone read the general newsgroup?

...

(2) The relationship of this news-system to bulletin boards that are organized within each team, and any e-mail mailing lists is unclear. As long as we use only these closed media, we cannot share useful information among all project members.
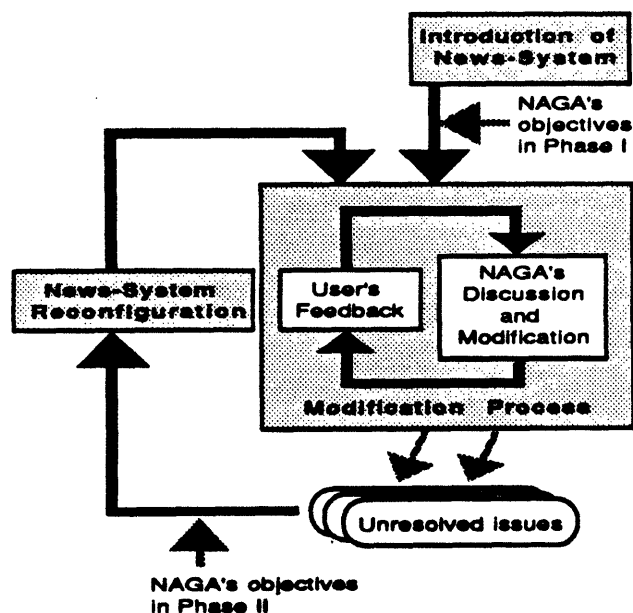=> Should we not gain the advantage of many members working together?

Figure 2: Establishment and Evolution of the News-System

Most users who responded endorsed the introduction of the news-system as the project group's official communication medium. The fact that the users were developing new technology motivated them to try the new communication technology. Without such motivation, project members might not have been willing to incur the costs of learning a new technology. Because many project members were not

yet using the news-system and thus did not reply, NAGA members also talked with team members not using the news-system. In addition, NAGA members consulted with project managers because their consent was critical if the committee was to implement its administrative objectives.

This policy making process demonstrates NAGA's administrative objectives and their implications. The messages sent by NAGA members indicate their interest in making the news-system an official communication medium. For example, the second question: "Should we not gain the advantage of many members working together?" suggests that they believed using the news-system would benefit the group's work. At the same time, NAGA members solicited other project members' ideas instead of directing them to use the news-system as an official communication medium. NAGA's approach enabled it to build general support among all project members to accept the news-system as an official communication medium.

Differentiation from other media

Establishing the news-system as an official communication medium thus became NAGA's first goal. To achieve this, NAGA felt it must position the new medium in relation to the other communication media commonly used in the firm. It started to investigate and discuss how daily lunch-time meetings,[2] routing-slips, bulletin boards, and e-mail were used and understood in the project group. NAGA members discussed what types of information should be allocated to each medium when the news-system was added to the configuration. Their decision was documented in the following meeting minutes:

To: NAGA@xxx
Subject: Meeting report from December 26, 1989

...

Communication media within the project

...

<daily lunch-time meetings>
The purpose of daily lunch-time meeting should be restricted to confirmation of information that has been announced in the news-system beforehand. This meeting should not be an official announcement tool.
<routing-slips>
The routing-slip will be terminated. Printed information should be posted on bulletin boards and we should direct project members to use the news-system as much as possible.
<bulletin boards>
Bulletin boards can be used only for printed information. However, all information should be provided through the news-system and at least summaries have to be posted on the news-system.
<e-mail>
Precise e-mail use guidelines should be set. E-mail must be used only for urgent or confidential information.

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[2] By company policy, each division or group had a daily lunch-time meeting, in which formal and official information was usually announced.

The definition of 'urgent' information: information that should be shared within a day.

Clearly, NAGA's objective was to encourage news-system use by allocating most of the information exchanged within the Alpha project to the news-system. NAGA's differentiation of existing media and the definition of the news-system's role among them established the news-system's officiality and promoted its usage by assigning to it specific functions previously handled by other media. NAGA created definitions and usage rules for each newsgroup. A definition included the appropriate message content and purpose of a newsgroup, while usage rules were use norms such the requirement that users read mandatory newsgroups at least once a day.

PHASE II: EVOLUTION OF NEWS-SYSTEM

Once the news-system was established, NAGA continued to play a central role in its on-going evolution in response to participant feedback and its own evolving objectives. As Figure 2 shows, this evolution involved two levels of change: modifications and reconfigurations. First, NAGA members responded to specific problems by modifying definition and usage rules, and occasionally by adding a new news-group. In some cases, the problems were not resolved by such modifications, or NAGA members saw their actions as merely temporary measures. In this case, they accumulated the unresolved issues and addressed them through periodic reconfigurations in which they created sets of new newsgroups or restructured the schema of the news-system. Figure 3 depicts the change in news-system configuration over time. In both types of mediation, user feedback was a critical trigger.
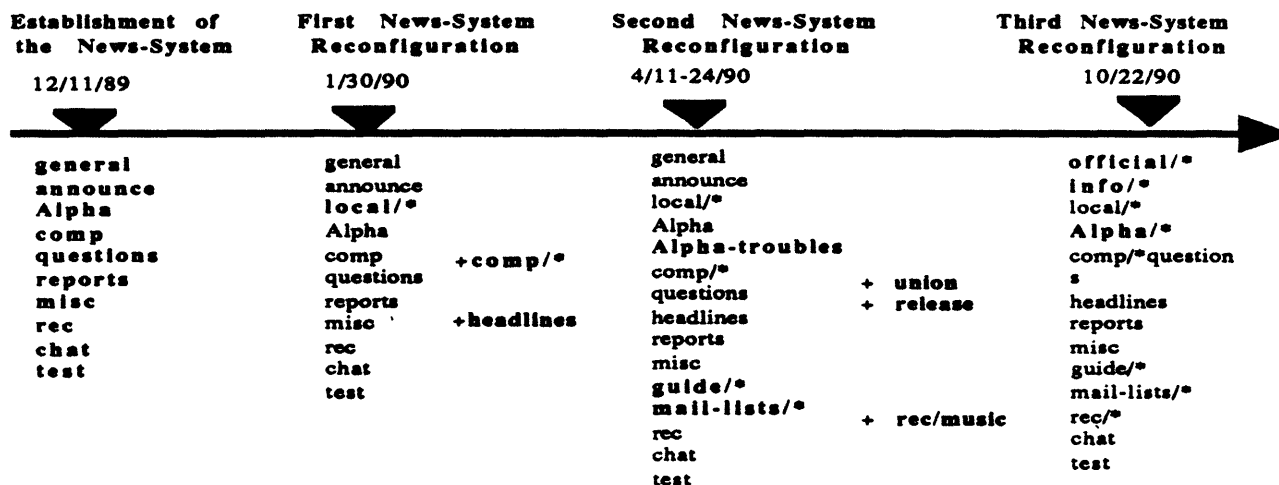
messages were observed by NAGA members largely because they carefully checked newsgroups. Second, users included their questions or confusions about the news-system in their messages. Third, users sent more direct feedback in the form of questions and suggestions to NAGA members, either through face to face interaction or e-mail. NAGA members did not hesitate to talk with users directly and they gathered users' feedback through general conversation. Fourth, NAGA gathered information from users about the news-system by posting soliciting messages on the news-system.

Through these various modes of feedback, project members interacted with NAGA members and hence influenced -- deliberately and inadvertently -- the technology mediation of their conferencing technology. In response, NAGA changed the news-system in two ways via minor modifications and major reconfigurations.

News-System Modifications

Between the periodic reconfigurations of the technology, NAGA responded to users' questions and problems by enacting minor adjustments and enhancements. These modifications may be categorized into three groups. First, NAGA established definitions and promoted proper usage of news-groups, especially after creating new ones. To prevent improper use of newsgroups by users, NAGA members often advertised the newsgroups in internal magazines and daily lunch-time meetings. They also promoted proper usage through education. For example, because external newsgroups such as Usenet and fj[3] were accessible, users needed to be trained to avoid revealing proprietary information to outside of the project. Second, NAGA

Establishment of the News-System 12/11/89	First News-System Reconfiguration 1/30/90		Second News-System Reconfiguration 4/11-24/90		Third News-System Reconfiguration 10/22/90
general	general		general		official/*
announce	announce		announce		info/*
Alpha	local/*		local/*		local/*
comp	Alpha		Alpha		Alpha/*
questions	comp	+comp/*	Alpha-troubles		comp/*question
reports	questions		comp/*	+ union	s
misc	reports		questions	+ release	headlines
rec	misc	+headlines	headlines		reports
chat	rec		reports		misc
test	chat		misc		guide/*
	test		guide/*		mail-lists/*
			mail-lists/*	+ rec/music	rec/*
			rec		chat
			chat		test
			test		

Figure 3: Evolution of the News-System in the Alpha Project

User Feedback

Four types of feedback from users were observable. First, users provided indirect feedback when they violated usage rules and posted messages improperly. For example, some people violated a usage rule by accessing the *rec* newsgroup during office hours, an activity prohibited by NAGA. These

modified the definitions of newsgroups. For example, the early definitions of the *general* and *announce* newsgroups were vague and many users were consequently confused about which newsgroup was appropriate for their messages. NAGA modified the definition of these two newsgroups

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[3] fj is a major Japanese news-system on Internet.

several times. Third, NAGA modified usage rules for newsgroups. For example, the use of moderators for certain newsgroups was introduced. NAGA members discussed the potential for improper use and confusion when discussing the creation of a new newsgroup. However, sometimes the necessity for new usage rules appeared only after a certain period of use by users.

News-System Reconfigurations

Three news-system reconfigurations were made to the set of available newsgroups during the project. At each reconfiguration, NAGA members carefully announced how the news-system structure was being changed and why new newsgroups were being introduced. The first news-system reconfiguration was executed in January 1990, before the system was well established and was thus motivated primarily by NAGA's own objectives. NAGA created the *local* newsgroups, one for each of the six project teams, to convey information previously exchanged via e-mail mailing lists. The difference between mailing-lists and the *local* newsgroups was that users from all teams could read and contribute to every *local* newsgroup (a feature not available on mailing lists). This was a deliberate attempt by NAGA to increase communication across the six project teams, and the strategy appears to have been effectively, as 33% of the messages posted in local newsgroups were contributed by members of other teams.

During the first system reconfiguration, NAGA also introduced all members of the project group to the definition and usage of the news-system. They persuaded the Alpha project managers to require project members to use the news-system; this support from the managers was very influential in making the news-system an official communication medium. As the final element of the first news-system reconfiguration, NAGA improved the news-system software to allow Japanese subject lines. This improvement made the news-system a more convenient tool for users and thus encouraged use. Since the first news-system reconfiguration made it easier for project members to post messages, the number of messages increased dramatically in its wake (see Figure 4), from approximately 20 messages per week to approximately 200 messages per week. It remained at this level (excluding vacations periods) until the termination of the Alpha project was announced in late January, 1991. At that point, usage fell off dramatically for the last month of the project.

As the news-system became a widely recognized communication tool, users requested the creation of new newsgroups and NAGA members also observed new uses of the news-system. This led to the news-system being reconfigured for a second time in April 1990. This news-system reconfiguration was motivated primarily by NAGA's responses to users' requests, including requests to extend the functionality of the news-system. For example, the *guide* newsgroups functioned as data-bases for archival copies of messages (documenting procedures, directions, and

guidelines) rather than as interactive news-groups from which older messages were regularly purged. This new type of news-group allowed members to reuse or refer to useful information such as maps, addresses lists, and administrative procedures.
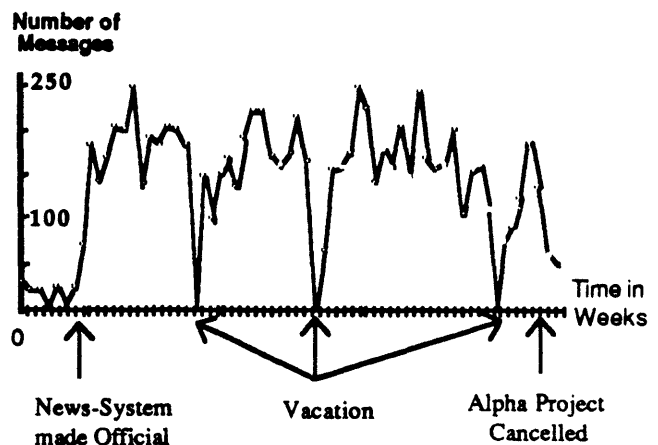

Figure 4: Use of the News-System during the Alpha Project

Finally, in the third news-system reconfiguration, NAGA re-organized the entire architecture of the news-system, changing the allocation of information among the newsgroups as well as creating new newsgroups. Because some newsgroups were not being used effectively and the number of newsgroups had increased, reducing access time and promoting proper use by users became an urgent issue. Some newsgroups were terminated or replaced by new newsgroups and all newsgroups were better classified and had their usage more clearly defined.

CONCLUSION

NAGA's actions in modifying and reconfiguring the news-system responded to users' feedback; at the same time, these actions were not simply reactive, but were carefully aligned with NAGA's objectives at each stage of the news-system's evolution. Moreover, while NAGA's overall goal of creating an effective communication system for the project group did not change, their specific objectives changed from Phase I to Phase II, in response to changing organizational circumstances and user feedback.

We believe that the influence and action of technology mediators we have examined in this one setting may be generalized to other settings and technologies in general. On reflection, it is apparent that individuals who act as technology trainers, consultants, system administrators, technical support staff, application customizers, and even lead users can all play a similar mediating role, that is, their actions--whether deliberate or inadvertent, whether informal or sanctioned--all mediate users' interactions with their technology, and hence can be an important source of the context-specificity needed to increase the effectiveness of technologies in use.

While this study only examined a single site, the in-depth analysis has facilitated the development of a rich and detailed understanding of how, on the one hand, policies and actions of technology mediation influenced users' use of a computer conferencing system, and how, on the other hand, users' feedback, experiences, and patterns of use influenced the policies enacted and the technology mediation actions taken. This understanding of the role of technology mediation should benefit both the research and practice of technology use in organizations.

For researchers, the study has highlighted the role of a set of organizational actors that have been largely overlooked in the research of technology design and use. In particular, our work suggests that the ongoing process of technology mediation plays a critical role in shaping the effective and context-specific use of technologies in certain contexts of use. Technology mediation is an activity that is too often discounted because of its relatively intermediary status and behind-the-scenes nature. Yet, our study reveals that the mediation actions taken around a new electronic communication technology significantly influenced its adoption, use, and effectiveness.

Our study confirms the view that design extends beyond the designers' workshop and into the setting of organizational use. However, our findings suggest that rather than focusing solely on empowering users to do design, designers could also empower technology mediators in their task of contextualizing the technology to increase its effectiveness in use. The tools supplied to technology mediators might be similar to those given to users, but could also allow for more sophisticated manipulation and reconfiguration which the technically-skilled mediators are more likely to be willing, able, and authorized to perform.

For practitioners, our findings suggest that a new technology was effectively introduced and used because a group of technology mediators managed not only the technical issues, but also issues of context and use with carefully planned objectives and constructive reactions to users' feedback. These findings and our mapping of NAGA's role suggest some of the actions (listed in the opening of this paper) that technology mediators can take that will contribute to facilitating the ongoing contextualizing of technologies in use.

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