Reconstructing Technologies as Social Practice

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This article provides an overview of a research program developed over the past 20 years to explore relations between everyday practices and technology design and use. The studies highlighted reflect three interrelated lines of inquiry: (a) critical analyses of technical discourses and practices, (b) ethnographies of work and technologies-in-use, and (c) design interventions. Starting from the premise that technologies can be assessed only in their relations to the sites of their production and use, the authors reconstruct technologies as social practice. A central problem for the design of artifacts then becomes their relation to the environments of their intended use. Through ethnographies of the social world, the analyses focus on just how social/material specificities are assembled together to comprise our everyday experience.

Since the late 1970s, a small cohort of anthropologists and computer scientists at Xerox Palo Alto Research Center (PARC) has been developing an interdisciplinary research program concerned with the ethnographically-based design of digital technologies. Our projects during these 20 years have joined the following three interrelated lines of research: (a) critical analyses of technical discourses and practices, (b) ethnographies of work and technologies-in-use, and (c) design interventions. Our concern throughout has been with reconstructing technologies as social practice, taking the term *reconstruction* in two senses. The first sense references the work of anthropological inquiry, particularly ethnographic studies of culturally constituted meanings and socially organized practices.[1] In this sense, the question is how to conduct ethnographies of work and technology, including both practices of design and artifacts-in-use, that are aimed at recovering the projects, identities, and interests that inform those practices.[2] These reconstructions are about making sense of what we have. The second

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sense points to a more reformist agenda, aimed on one hand at critical analyses of the professional practices and institutional arrangements of contemporary technology production, and on the other hand at possibilities for the development of alternative approaches. These reconstructions are about remaking what we have into something new. Both comprise substantial projects: Projects that we take to be intimately and necessarily interrelated.

This article is organized to follow the three lines of research previously mentioned. First, within the broader project of making sense of what we have, we need critical studies of prevailing rhetorics and practices in the production of new technologies. Here, we use as illustration the notions of *interactivity* and *reliability* as those terms have been taken up within the fields of product design and technical service work. Second, again as a contribution to making sense of what we have, we need ethnographic inquiries into specific sites of technology production and use. Here, we take as illustrative a research project on information and communication technologies-in-use in the workplace. Finally, in the interest of remaking what we have into something new, we need interventions into processes of technology design aimed at the development of alternatives to prevailing practice. We draw here on recent projects aimed at developing new forms of work-oriented, cooperative design.

CRITICAL STUDIES

As an example of what we mean by critical studies, we can begin with the notion of interactivity as it is applied to the design and use of digital technologies, particularly Suchman's (1987) investigation into the problem of human-machine communication. A central aim of Suchman's project was to suggest that the challenge of interactive interface design is actually a more subtle and interesting one than it was assumed to be by her colleagues in the field of human-computer interaction in the 1980s. Basically, their assumption was that computational artifacts just are interactive, in roughly the same that way persons are, albeit with some obvious limitations (see, e.g., Brady & Berwick, 1983; Hayes & Reddy, 1983; McCorduck, 1979; Schank, 1984; Sime & Coombs, 1983; Sleeman & Brown, 1982). However ambitious, the problem in this view was a fairly straightforward task of encoding more and more of the cognitive abilities attributed to humans into machines in order to overcome the latter's existing limitations.

Suchman's particular project began around 1981, when a delegation of Xerox customer service managers traveled to PARC to report on a problem with a recent product and enlist research advice in its solution. The product was a relatively large, feature-rich photocopier that had just been launched, mainly as a placeholder to establish the company's presence in a particular market niche that was under threat from other competitor companies. The product had been assembled very quickly, largely through the reuse of components from already existing products. In acknowledgment of this less than ideal design process, the product during its development was ironically code-named "chainsaw."

Although the machine had features of so-called "dedicated, high-volume" machines used in print and copy shops, operated by workers whose sole responsibility was to run them, the marketing goal was to position this as a "hallway" machine for the "casual, walk-up" user. However, the problem, as formulated by the delegation, was that customers were complaining that the product was "too complicated." The solution they proposed was to attach a video display terminal to the machine that would somehow enhance its existing paper and liquid crystal display-based documentation. Suchman's colleagues in research viewed this proposed solution as woefully inadequate insofar as it failed to consider the question of just what software should underlie the display. At the same time, they were responsive to her suggestion that a first step in addressing the question should be to explore further just what experiences were actually glossed by reported customer complaints that the machine was "too complicated." Following up on this suggestion entailed some visits to customer sites; that is, offices in which people were actually trying to make use of the machine in the course of their everyday work. Specifically, Suchman and her colleague Austin Henderson spent some time hanging around the machine in several organizations where it had been placed.

These preliminary observations confirmed the confusing behavior of the machine, but left Suchman and Henderson just as confused as those they observed. To explore in detail the troubles that people encountered in attempting to make sense and use of the machine, they managed to obtain a machine and install it in their workplace at PARC. Suchman then invited her coworkers, including some extremely eminent computer scientists, to try to use the machine to copy their own papers for colleagues.

From looking closely at actual encounters with this machine, Suchman began to develop the idea that its obscurity was less a function of lack of technological sophistication on the part of its users than of their lack of familiarity with this particular machine. She argued that the machine's illegibility was tied not to any esoteric technical characteristics, but to mundane difficulties of interpretation characteristic of any unfamiliar artifact. Her point was that reading a new artifact is an inherently problematic activity. She wanted to argue that however improved the machine interface or instruction set might be, this would never obviate the need for learning on the part of prospective users. This called into question, then, the very viability of marketing the machine as self-evidently easy to use.

Suchman's analysis similarly raised fundamental questions about the project of making the machine intelligent and interactive as a solution to these problems of intelligibility. Findings from ethnomethodology and conversation analysis regarding human interaction indicated that conversations among people succeed not because of the absence of troubles in understanding, but rather due to a wealth of resources available for their collaborative identification and repair (see, e.g., Atkinson & Heritage, 1984; Jordan & Fuller, 1975; Schegloff, Jefferson, & Sacks, 1977). The severe limitations on the informational resources available to the machine—basically changes in its state mapped on to a priori assumptions about a user's projected courses of action—correspondingly limit the machine's ability to engage in anything like the subtle, emergent, and highly contingent courses of collaborative sensemaking that characterize interaction among humans. In sum, Suchman's analysis reframed the problem of user interface design from creating a self-evident machine (or one able to engage in interaction with its user), to writing a user interface that is readable, with all the problematics that writing and reading imply.[3]

Subsequent studies by Blomberg (1987, 1988) took a related approach to question prevailing assumptions regarding machine reliability. Product developers and marketers had been puzzled to discover a lack of correlation between the frequency of machine service calls and customer perceptions of machine reliability. The expectation had been that as service calls increased, perceptions of reliability would decline. Correspondingly, a machine with few service calls should be seen as highly reliable. Many explanations were suggested for the lack of correlation, chief among them being the idea that machines developed reputations that persisted despite the actual behavior of the machine. Blomberg (1987) argued, however, that a closer look at the social circumstances of machine use was needed to understand relations between the frequency of service calls and perceptions of machine reliability. She maintained that,

> What is required to provide a richness of description that makes interpretable and grounds in actual behavior the relationships found between social structural categories, system design, and user acceptance and satisfaction is a research strategy that includes extensive on-site field observations and a means of documenting the behaviors observed. (Blomberg, 1987, p. 198)

Blomberg's research adopted such a strategy and revealed that patterns of interaction among users had a major impact on people's experiences of their copiers. Importantly, how information about the day-to-day operations of the machine was exchanged among occasional users, key operators (users with responsibility for the machine's operation), and technicians had a significant influence on perceptions of a machine's reliability. So, for example, the adverse effects of frequent service calls were mitigated by such things as the promptness with which requests for service were made and the availability of on-site support for working around the problem.

A third major ethnographic project was initiated by Orr (1996) in response to corporate concern over the training of service technicians. Cognitive scientists on the research staff construed the problem as one of crossing the novice/expert divide, changing the mental models of novices to match those of experts. Orr began a study of expert technicians, trying to characterize expertise in the field.

Although the corporation assumed the work of technicians to be the rote repair of identical broken machines, Orr found this to be a gross oversimplification. He argued that the work was better characterized as a continuous practice of improvisation within a triangular relationship of technician, customer, and machine. Individual machines are idiosyncratic, with different histories of use and modifications, and set in different social contexts, all of which affect their performance. Service calls are occasioned by a problem in the relationship between user and machine, and although the machine may need repair in itself, fixing the relationship is essential to the satisfactory completion of the service call.

The context of the technicians' work is marked by the fragility of available understandings and the fragility of control. Orr wrote,

> Understanding is fragile in that accurate information about the state of the machine is only sometimes available, nor is the meaning of available information always to be found. Control is fragile both in that the technicians come to work when the relationship between customer and machine is already askew and in that the technicians cannot keep the machines working and the customers satisfied; they can only restore that state after the fall. Work in such circumstances is resistant to rationalization, since the expertise vital to such contingent and extemporaneous practice cannot be easily codified. (pp. 1-2).

Moreover, during an observed diagnosis, Orr noted that the technicians were exchanging stories about earlier diagnoses and misbehaving machines from the past. When looked for, stories seemed to be everywhere in technicians' practice. In fact, Orr discovered that narrative is a primary element of their practice. More specifically, diagnosis involves the creation of a coherent account of the problematic machine, pieced together from the available unintegrated facts, which represents the state of the machine, its history, and the events that produced its present state.

These narratives are repeated to colleagues so that accounts created for diagnosis circulate in technicians' discourse, distributing the technicians' experiential knowledge throughout the community. Storytelling is the principal medium available for technicians to share their knowledge and stay informed of subtle developments in machine misbehavior. These stories are also a critical part of the social life of the community, as technicians demonstrate and share their mastery of the domain, and in doing so celebrate and create their identities as,

> masters of the black arts of dealing with machines and of the only somewhat less difficult arts of dealing with customers. Talk about machines is, perhaps, to be expected in such a job, but recognition of the instrumental nature of such talk provides a new perspective on the work. (Orr, 1996, p. 2)

In sum, ethnography produced a radically reformulated understanding of the technicians' job (Orr, 1990, 1996, 1998). In a corporate setting, further questions arose about the possible uses of Orr's analyses. The implications were demonstrated in the Denver project, an experiment in using portable radios to enhance communications between technicians (Orr, 1995; Orr & Crowfoot, 1992). Orr's analyses has subsequently influenced the development of computer-based tools for technicians as well, and by now may be said to be firmly ensconced in the corporate imaginary.

STUDIES OF TECHNOLOGIES-IN-USE

The studies previously described worked on the premise that to understand technologies ethnographically, it is required that we locate artifacts within the sites and the relations of their everyday use. We developed this agenda further through a project initiated in the late 1980s aimed at exploring in detail the constitution of a technology-intensive, multiactivity workplace. We were interested in developing new ways of theorizing both the social and material organization of everyday practice. We chose as our study site the operations room of a local airport.

Operations rooms are centers of coordination (Suchman, 1997) maintained by an airline to organize the work of ground operations, particularly in those airports that serve as a hub, or point of connection among routes within the airline's network. We were drawn to the operations room as a study site for a number of reasons. First, it presented us with a stark contrast to the vision of a technology-intensive workplace presented in the future scenarios of mainstream science fiction. For example, where on the deck of the starship Enterprise it appears that all the artifacts were created at a single moment, the operations room presented us with a kind of archaeological layering of artifacts acquired, in bits and pieces, over time (see Figure 1). Rather than being homogeneously and seamlessly integrated, these artifacts comprised a heterogeneous collection of information and communication technologies, including telephones, radios, video monitors, networked workstations, whiteboards, clocks, and a wide array of documents. The integration of these artifacts, correspondingly, seemed more a matter of string and baling wire than of design.

Along with the artifactual richness of the operations room, we were intrigued by the social organization of the work that went on there. In particular, the room was staffed by a small workgroup with a strong ongoing awareness of each others' activities. At the same time, each member of the group was assigned the responsibility of maintaining an orientation to and engagement with a different order of activity going on elsewhere (the work of passenger agents, gate agents, ramp and baggage workers, and so forth). In this sense, the work of the group was concerned less with the activities within the room than with events taking place at a range of locations outside the room, to which group members had no direct access. One way of understanding the role of information and communication technologies in a setting like the operations room, then, is to reconfigure

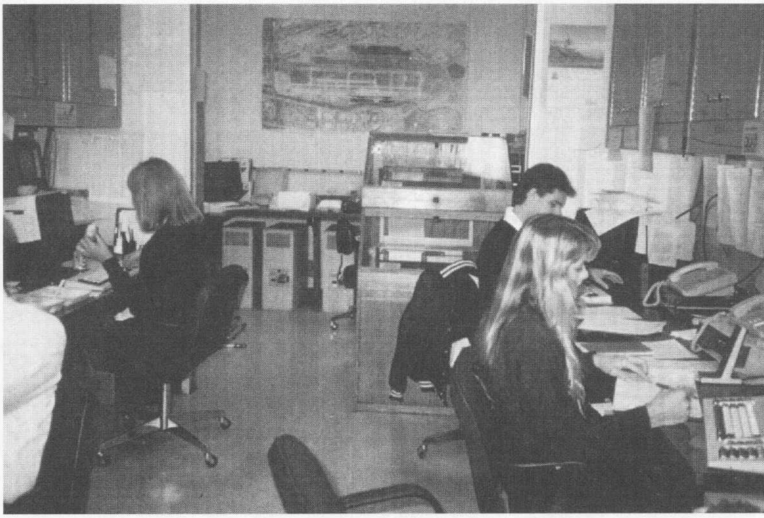


Figure 1: An Airport Operations Room

space and time in order to make available, within the site, those remote locations that are the objects of its members' work.

For approximately 2 years we visited the operations room and its associated sites within the airport facility. Our first project was to convey to workers in the room the nature of our interests. In particular, we find that it is difficult for people who have grown up in the shadow of scientific management to imagine what interest researchers could have in their work other than to evaluate it in terms of workers' competency and efficiency. We went to great pains to explain that our standing assumption was that workers in the operations room were fully competent and highly skilled practitioners of their craft, and that our goal was simply to understand how they actually did what they did.

This assumption explained our interest in recording their work as well. First, we could see that the intricacies of their work were such that we had little hope of appreciating how it was done "in real time." As an aid to our understanding, we needed the possibilities that video records provide the interactions and interrelations through which the work got done. Second, we assumed that those things that were most fundamental to the work—the glue that held it together—would be the least likely to be mentioned by them in talking to us about it: They would quite literally be unremarkable. For this reason, we needed to supplement our discussions with them about their work with observations of it. We were eventually able to bring back to them analyses of the everyday accomplishment of their work that showed, in ways that they recognized but never could have told us in so many words, just how skillfully and dynamically their world was put together.[4]

Our study of the operations room led us to a substantial reconceptualization of the construct of *information system*. Rather than a network of computer-based workstations in which information is stored, we observed an array of partial, heterogeneous devices brought together into coherent assemblages on particular occasions of work. To be made useful, these devices needed to be read in relation to each other and to an unfolding situation. Technologies, in this view, are constituted through and inseparable from the specifically situated practices of their use.

DESIGN INTERVENTIONS

Studies such as that previously described suggest that rather than discrete moments of production and consumption, technology-intensive work practices involve complex relations of appropriation and reworking across sites of professional design and design-in-use. This brings us to our final agenda, that of interventions into practices of professional technology production. In concert with our ethnographic investigations of technologies-in-use, we have been engaged in research aimed at contributing to practice-based approaches to the design of digital technologies. The approach that we have developed has its roots in an international network of colleagues in academia and industry. (For an inquiry into the motivations and theoretical underpinnings of a work-oriented approach to the design of computer systems, see Ehn, 1988. For recent overviews of the field of work-oriented or participatory design, see Trigg & Anderson, 1996, and Kensing & Blomberg, 1998.) The problems that interest us include the practicalities and politics involved in attempting to reconceptualize and restructure the ways in which work and technology design are done.

Our projects in work-oriented design are organized at the outset as a collaboration between researchers, work practitioners, and product developers. They have centered on document-related work practices on one hand, and on technologies aimed at translations across paper and electronic media on the other. A starting premise for the projects is that looking in detail at how people work, using existing and/or prototype technologies, provides a basis for innovative design and more well-integrated technologies. A second premise is that individual technologies add value only to the extent that they are assembled together into effective configurations, and that to construct an effective configuration requires developing technology prototypes within actual work sites. On these premises, our research strategy has been to establish relations with specific work settings and to use those as sites for cooperative applications design (Blomberg, Suchman, & Trigg, 1996, 1997).

A central focus of our projects is the development of "case-based" prototypes, artifacts that go beyond simple demonstrations of functionality to incorporate materials from the work site and from the workers with whom we collaborate.[5] We believe that through such collaborations and associated artifacts, participants can gain a better understanding of new technology directions. In addition, we are better able to communicate what we have learned about technologies-in-use to an extended network of coworkers in research and product development. Finally, new possibilities open up for ongoing relations between technology producers and members of a work site in support of future product development efforts.

A central premise of cooperative prototyping is that a new artifact must be designed in situ, in close relation to the sites of its intended use. Ideally, this includes the incorporation of actual work materials into the prototype system from its earliest development, combined with an iterative cycle of design, implementation, assessment, and redesign on the shop floor.[6] The site of our current project is the headquarters of a state Department of Highways (called here "the department"). More specifically, for the past 2 years we have been engaged in a collaborative research effort with engineers at the department charged with the design of a bridge scheduled for completion by the year 2004.[7] The focus of our prototyping efforts with members of the bridge project has been a collection of their documents called the "project files" (see Figure 2). Every engineering team within the department is responsible for maintaining a cumulative archive of all documents taken to be relevant to a particular project. This includes a heterogeneous collection of letters, memos, newspaper clippings, maps and the like, that together provide a documentary resource for demonstrating accountability over the project's course. Assembled collectively (each member of the team being responsible for adding relevant documents to the files), the project files act as a shared resource. So, for example, a question may arise as to whether a required permit was in fact secured for some aspect of the project, occasioning a search through the collection for correspondence documenting that and just when the permit was granted. In this respect, the value of the collection is tied less to any intrinsic characteristics of the documents, knowable in advance, than to their availability with respect to an unforeseeable horizon of possible inquiries.

This aspect of the work of engineering brings us into the presence of a persistent trouble for practitioners, and a recurring interest for the social sciences; namely, the work of classification and inquiry displayed, in this case, in the twin questions "How should this document be filed?" and "Where is that document?"[8] To explore the question further, we have embarked on a cooperative prototyping effort with the engineering team aimed at understanding whether digital media might provide new and useful ways of accessing their collection. More specifically, this involves understanding just what is required to move their project files (now kept on paper in three-ring binders) online into an electronic, computer-based repository with a rich search interface. To develop that understanding, in turn, has meant engaging in a process of mutual learning, aimed at recovering the work of the project files and its relevance to our respective work sites and work practices, and together constructing something at once recognizably familiar and new.

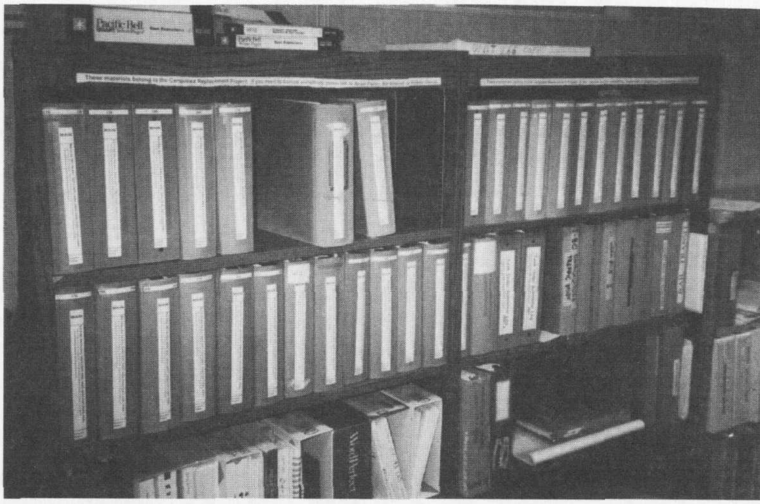


Figure 2: **Project File Binders**

From our early fieldwork we learned that the project files are currently ordered through a standardized system of categories known as the Uniform File System (UFS), used across all projects within the department. The UFS as a categorization scheme exhibits, on one hand, a normal order of work insofar as it follows a chronology of designated project phases, from environmental assessment to design to construction. On the other hand, the UFS is oriented to the kinds of objects that it orders; namely, documents that take the form of correspondence, agreements, permits, studies, public notices and the like, each of which addresses particular relevant topics. Similarly, the project files are equivocally oriented to, on one hand, constituting a working document collection to be referenced as the occasion arises within the life of the project and, on the other hand, constructing a documentary history of the project after the fact.

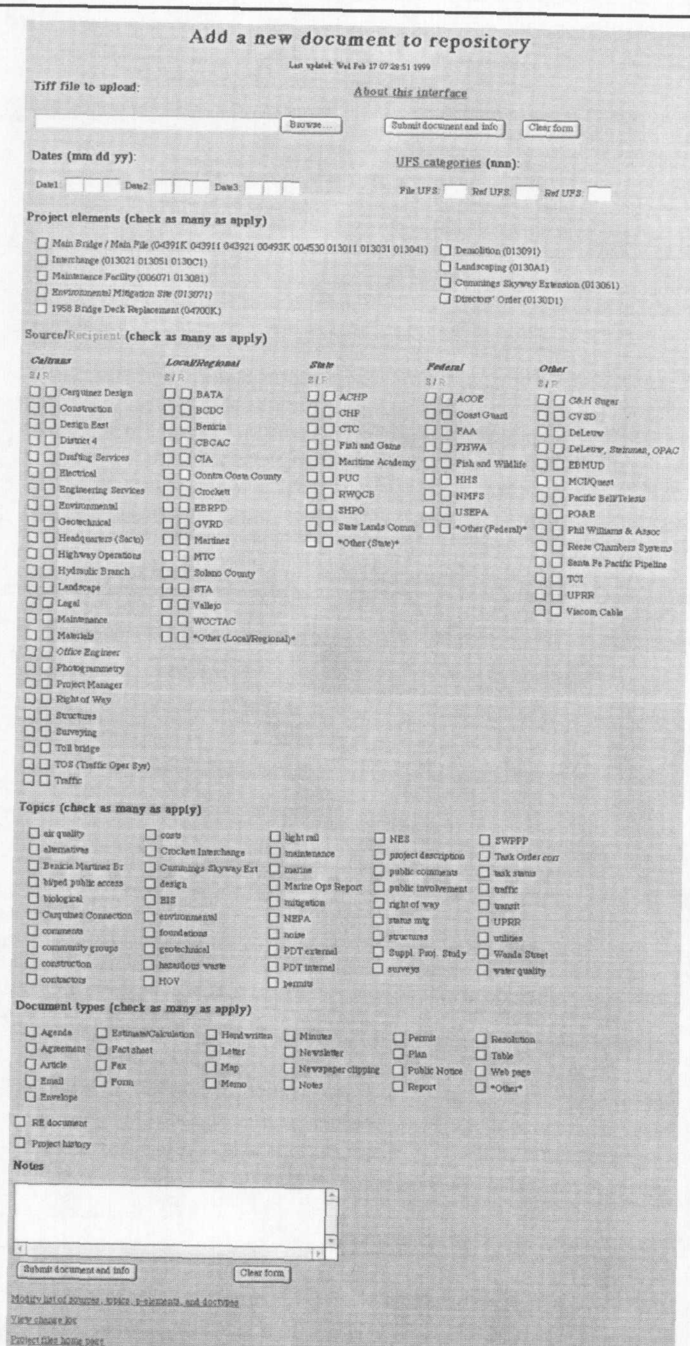
These multiple logics of the UFS present problems for the engineers in their attempt to organize their project file documents so they can be retrieved at some future time. A central trouble that we observed in engineers' use of the UFS might be described as the persistent misalignment of the work of document filing and retrieval, seen in this context as two in some ways incommensurate orders of activity. The first is the business of filing documents in accordance with the logics of the UFS. For the engineers, this takes the form of a kind of puzzle, involving the creation of an accountably rational, coherent fit between the UFS as a generic description and the characterization of a particular document in hand. The second order of activity is the business of finding documents, as an inquiry occasioned by an immediate question that arises. This latter business defies a priori logics insofar as the engineers cannot predict in advance just when and just why a particular document may become relevant, valuable, interesting, and needed.

Our design intervention has been critical to deepening our understanding of the requirements of the work of document filing and retrieval. At each step of prototype development, from early design discussions to the creation of paper "mockups" of possible interfaces to the online project files, and finally to installing a running system at the work site, we have become more aware of the work's exigencies. For example, in recognition of some of the difficulties engineers experienced with their filing system, we designed various alternative document coding strategies to augment the UFS. Through successive rounds, in which we asked engineers to code documents using mocked-up coding forms, we developed a form that allowed engineers to code documents for dates, keywords, and document types, as well as multiple UFS categories. The keyword list evolved through these experimental trials to align with topics of concern to the project team. Our first online coding interface reflected decisions we made during these mockup trials.

At about the same time, we borrowed, scanned, and coded some 200 of the engineering team's documents in order to ground the prototype that we were developing in the actual materials of their work. Again, we enlisted the engineers' help in developing our online interface for searching and viewing the scanned document collection. Through ongoing iterations, the search and browsing interfaces evolved to be more finely tuned to the requirements of the engineers' work (see Figure 3).

It was only after we had convinced ourselves that there would be some value in having documents available online that we took the next step of installing a scanner and personal computer at the work site, so that new documents could be added to the corpus by project team members themselves. Their experiences using the prototype to scan and code documents motivated further refinements and elaborations to the coding form and search interface.

The prototype that we ultimately configured with the engineering team is made up of a scanner connected to a personal computer that together are designed to take paper documents, transform them to digital images, and convert those images to "optically character recognized," and therefore searchable and editable text (see Figure 4). In addition to these components, all commercially available, the prototype necessarily incorporated various pieces of experimental software created by us and by others within the research center. We say *necessarily* here both insofar as the commercially available components require modification and extension in order to adequately address the problems of the project files, and in that to be instructive as a research artifact our system must, necessarily, incorporate emerging software components of interest and relevance within our own workplace. The aim is that a prototype should exhibit new technological possibilities in ways that, through our appreciation for working practices and through the prototype's rendering of those practices, make the technologies relevant and useful to practitioners. Here, by *practitioners* we mean both professional designers of new technologies and those who might use them. Most important, perhaps, the prototype demonstrates that the coherence



Add a new document to repository

Last updated: Wed Feb 17 07:28:51 1999

Tiff file to upload: [Browse...] | About this interface | [Submit document and info] [Clear form]

Dates (mm dd yy): Date1: Date2: Date3:

UFS categories (nnn): File UFS: Ref UFS: Ref UFS:

Project elements (check as many as apply)

- ☐ Main Bridge / Main File (04391K 043911 043921 00493K 004530 013011 013031 013041)
- ☐ Interchange (013021 013051 0130C1)
- ☐ Maintenance Facility (006071 013081)
- ☐ Environmental Mitigation Site (013071)
- ☐ 1958 Bridge Deck Replacement (04700K)
- ☐ Demolition (013091)
- ☐ Landscaping (0130A1)
- ☐ Cummings Skyway Extension (013061)
- ☐ Directors' Order (0130D1)

Source/Recipient (check as many as apply)

Caltrans (S / R): Carquinez Design; Construction; Design East; District 4; Drafting Services; Electrical; Engineering Services; Environmental; Geotechnical; Headquarters (Sacto); Highway Operations; Hydraulic Branch; Landscape; Legal; Maintenance; Materials; Office Engineer; Photogrammetry; Project Manager; Right of Way; Structures; Surveying; Toll bridge; TOS (Traffic Oper Sys); Traffic

Local/Regional (S / R): BATA; BCDC; Benicia; CBCAC; CIA; Contra Costa County; Crockett; EBRPD; GVRD; Martinez; MTC; Solano County; STA; Vallejo; WCCTAC; *Other (Local/Regional)*

State (S / R): ACHP; CHP; CTC; Fish and Game; Maritime Academy; PUC; RWQCB; SHPO; State Lands Comm; *Other (State)*

Federal (S / R): ACOE; Coast Guard; FAA; FHWA; Fish and Wildlife; HHS; NMFS; USEPA; *Other (Federal)*

Other (S / R): C&H Sugar; CVSD; DeLeuw; DeLeuw, Steinman, OPAC; EBMUD; MCI/Quest; Pacific Bell/Telesis; PO&E; Phil Williams & Assoc; Reese Chambers Systems; Santa Fe Pacific Pipeline; TCI; UPRR; Viacom Cable

Topics (check as many as apply)

☐ air quality ☐ alternatives ☐ Benicia Martinez Br ☐ biped public access ☐ biological ☐ Carquinez Connection ☐ comments ☐ community groups ☐ construction ☐ contractors ☐ costs ☐ Crockett Interchange ☐ Cummings Skyway Ext ☐ design ☐ EIS ☐ environmental ☐ foundations ☐ geotechnical ☐ hazardous waste ☐ HOV ☐ light rail ☐ maintenance ☐ marine ☐ Marine Ops Report ☐ mitigation ☐ NEPA ☐ noise ☐ PDT external ☐ PDT internal ☐ permits ☐ NES ☐ project description ☐ public comments ☐ public involvement ☐ right of way ☐ status mtg ☐ structures ☐ Suppl. Proj. Study ☐ surveys ☐ SWPPP ☐ Task Order corr ☐ task status ☐ traffic ☐ transit ☐ UPRR ☐ utilities ☐ Wanda Street ☐ water quality

Document types (check as many as apply)

☐ Agenda ☐ Agreement ☐ Article ☐ Email ☐ Envelope ☐ Estimate/Calculation ☐ Fact sheet ☐ Fax ☐ Form ☐ Hand written ☐ Letter ☐ Map ☐ Memo ☐ Minutes ☐ Newsletter ☐ Newspaper clipping ☐ Notes ☐ Permit ☐ Plan ☐ Public Notice ☐ Report ☐ Resolution ☐ Table ☐ Web page ☐ *Other*

☐ RE document

☐ Project history

Notes

[Submit document and info] [Clear form]

Modify list of sources, topics, p-elements, and doctypes

View change log

Project files home page

Figure 3: Online Coding Interface

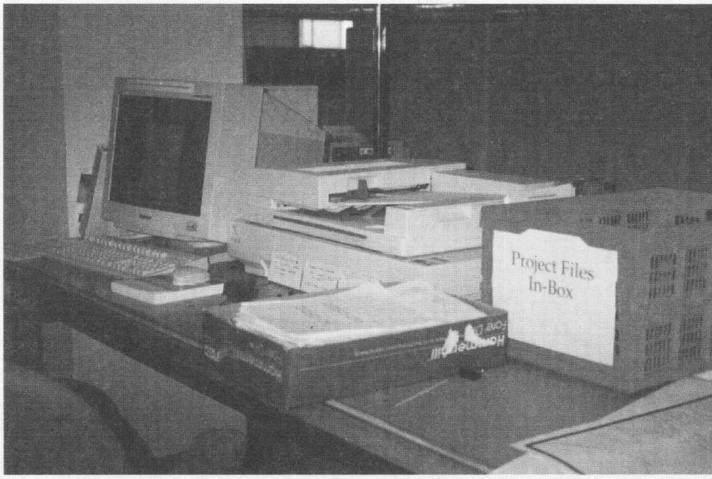


Figure 4: Prototype Scanning Station

of artifacts is a contingent and ongoing achievement of practices of design-in-use, in ways and to an extent that is missing from professional talk about finished products.

CONCLUSION

Our efforts to develop a work-oriented design practice are based in the recognition that systems development is not the creation of discrete, intrinsically meaningful objects, but the cultural production of new forms of practice. As practice, technologies can be assessed only in their relations to the sites of their production and use. Our interventionist agenda involves bringing developing artifacts out into the environments of their intended use, such that their relations to those environments become a central problematic for their design. Design success then rests on the extent and adequacy of our analyses of specific ecologies of devices and working practices, finding a place for our own artifacts within them.

A more general implication of this agenda is that, rather than the primacy of one technology over all others, powerful technical systems comprise artful integrations (see Suchman, 1994). We agree with Star (1999 [this issue]) that it is through the infrastructural details that the texture of our technology-infused society is woven. Ethnographies of the social world work across the grain of categories and distinctions—cultural and technical, real and virtual—to recover just how the social/material specificities they describe are assembled together to comprise our everyday experience. Critical studies, ethnographies of technologies-in-use, and design interventions are all forms of engagement with the production and refiguration of that experience.

NOTES

1. We include in socially organized practices the organizations and corporations themselves (cf. Bittner, 1965). The ethnographic work most directly relevant to our own focuses on sites and practices of science, technology, and medicine. Exemplary ethnographies include Berg (1997), Collins (1985/1992), Fujimura (1996), Henderson (1999), Kunda (1992), Newman (1998), and Traweek (1988). For useful collections including ethnographic as well as historical and critical technical studies, see Barley and Orr (1997), Bijker and Law (1992), Bijker, Hughes, and Pinch (1987), Bowker, Star, Turner, & Gasser (1997), Lynch and Woolgar (1990), MacKenzie and Wajcman (1985), Chaiklin and Lave (1993), and Clarke and Fujimura (1992).

2. Our use of the terms *technology* and *artifact* may require some clarification. We take technology to reference the assemblage of skilled practices and associated logics characteristic of modern industrial societies. The term *artifact* is more general, referencing any material production of skilled practice, while at the same time contemporary artifacts are increasingly embedded, for better and worse, in technological assemblages.

3. We have in mind here recent reframings of writing and reading from the transmission of authors' intent, to an inevitably indeterminate and contingent process of creating artifacts within one set of circumstances to be taken up and made sense of in another. This view implies a relationship of writers and readers that is at once more interdependent and less certain; qualities that we believe characterize relations of design and use as well. Methodologically, this view directs us to look at the respective locations of design and use to see what travels, and how, between them. Professionally, this view engenders a measure of humility and respect for the inevitable vagaries of our control over technical artifacts, and the corresponding need to remain responsibly engaged in following their trajectories.

4. We produced a 1-hour video documentary of the work under the title, "The Workplace Project: Designing for Diversity and Change," available from the authors.

5. Our notion of case-based prototypes draws on groundbreaking "cooperative prototyping" research in Scandinavia (see Bødker, Grønbæk, & Kyng, 1993; Grønbæk, 1991).

6. We sometimes video record the cooperative prototyping sessions that we conduct at the work site as our interests are also in the processes of codesign and user engagement (Trigg, Bødker, & Grønbæk, 1991), and in the interleaving of field studies and codesign (Blomberg, Giacomi, Mosher, & Swenton-Wall, 1993).

7. For more on the site and its practices see Suchman (in press-a, in press-b). A fuller account of our prototyping efforts with the engineering team is provided in Suchman, Trigg, and Blomberg (1998), and Trigg, Blomberg, and Suchman (in press). For background on the approach that we have taken to technology design see Blomberg, Suchman, and Trigg (1996).

8. Document coding and searching comprise a form of what Law and Lynch (1990) have termed *literary language games*. For further analyses of the work of coding, see Goodwin (1994, 1997), and the paper by Law and Lynch previously mentioned. For more on the problematics of classification systems see Bowker (1995), and Bowker and Star (in press).

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