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Reflections on a Work-Oriented Design Project

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1. INTRODUCTION

For some years, we have been engaged in research aimed at developing new ways to conceptualize and structure relations between work and technology design. We take our project to be understanding relations of work and technology in ways that draw from and contribute to current theory and practice within anthropology and computer science. To that end, we conduct theoretically informed, empirical investigations of everyday work practices and technologies in use, in relation to work and technology (re)design. Our approach differs from conventional business process and marketing analyses in its focus not only on the detail of how activities are organized and interrelated, but also in its concern with practical problems and solutions as they appear to organization members in the course of doing their work. We are interested in exploring how such analyses can contribute to more effective change initiatives and to better adapted and therefore more useful technologies.

Our goals for the project reported in this article were to deepen our understanding of document work practices, to gain experience in cooperative design, and to explore the opportunities and obstacles for doing cooperative work-oriented design within our company. At the time of this writing, there is little in the way of work-oriented design practice

within our company's product divisions.¹ For the most part, intended users of new technologies are involved in design and development only through participation in focus groups, as respondents to questionnaires, and through usability testing. As others have pointed out, concerns with usability, although necessary, are not sufficient to the development of genuinely *useful* systems (Beyer & Holtzblatt, 1995; Nardi, 1993; Wixon & Comstock, 1994). Whereas *usability* refers to the general intelligibility of systems, particularly at the interface, *usefulness* means that a system's functionality actually makes sense and adds value in relation to a particular work setting.²

In what follows, we first sketch our approach to work-oriented design, with a focus on cooperative development of prototype applications. We then briefly describe the work site in which our project was located, and the rationale for taking up two design efforts within that site. The remainder of the article discusses those two efforts, highlighting distinctive issues that arose for us in each. In raising these issues we hope to make explicit an experience that we believe is quite common to design efforts based in actual work settings: the simultaneous pursuit of a design agenda and negotiation of complex, often contested organizational ground. The different and sometimes disconnected forms of engagement that are called for in response to these two aspects of cooperative design are reflected in the two cases that we present here. Our hope is that the diverse issues raised by the two cases will be recognizably consistent with the experience of others who have engaged in work-oriented, Participatory Design projects.³

2. A COLLABORATIVE RESEARCH APPROACH

Our early research focused on the application of interaction analysis and ethnography to questions of information systems design and use (Blomberg, 1987, 1988; Suchman, 1983, 1987, forthcoming; Suchman & Trigg, 1991). More recently, we have been exploring possibilities for incorporating work-oriented design practices into product development within our organization. The starting premises for our current work are the following:

¹Notable exceptions include, for example, Anderson and Crocca (1992). More recently others in Xerox—for example, Bowers, Button, and Sharrock (1995) and Brun-Cottan and Wall (1995)—have been developing work-oriented design agendas in relation to product divisions.

²Both concerns are important, and each is potentially complementary to the other. However, they are not equivalent; making a system usable does not ensure its usefulness, and useful systems (e.g., DOS) may not be particularly usable.

³For overviews of PD, see Muller and Kuhn (1993) and Schuler and Namioka (1993).

- Detailed analysis of how people work using existing and prototype technologies provides a basis for innovative design and better-integrated technologies.
- Individual technologies "add value" only to the extent that they work together in effective configurations.
- Delineating the space of effective technology configurations requires applications development within actual use environments and with the active participation of end users.

Based 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. Our approach involves cycling among studies of work, codesign, and user experience with mock-ups and prototypes of new technologies (Kyng, 1995; Tang, 1991). Through this approach, work practice studies are embedded in design activities, whereas design efforts contribute to work analyses.

A challenge for us in attempting to create a work-oriented design practice is to develop innovative ways of making insights that we gain from our research projects available to product development.⁴ Because not all developers are able to accompany us to worksites, we use various means of bringing what we learn from the site to relevant development efforts. As part of our own work in the site, we record interviews with members of the organization, instances of their everyday work, and meetings that we convene or to which we are invited. The materials that we accumulate (e.g., documents, field notes, and video records) are a resource in our ongoing communications about the project. For example, customized video collections are sometimes used in short presentations to our research colleagues and as a resource in meetings with developers.

We also use case-based prototypes as a way to support the imagination of future work practices, augmented with new technologies. As with all prototypes, *case-based prototypes* constitute partial implementations of envisioned technologies and their interfaces. Prototypes have long been used as stand-ins for designs in progress, where they are often employed in structured meetings in which users perform tasks designed to test particular parts of the system (Gould, 1988). In our work, prototypes are employed in a way more akin to what Bødker and Grønbaek (1991) call *cooperative prototyping*.⁵ As with all rapid prototyping approaches (see,

⁴For further discussion of the relations between ethnographic studies of work practice and design see, for example, Blomberg (1995), Blomberg, Giacomini, Mosher, and Swenton-Wall (1993), Forsythe (1992), Hughes, Randall, and Shapiro (1993), Jordan (1996), Shapiro (1994), and Simonsen and Kensing (1994).

⁵See Bødker and Grønbaek (1991) and Grønbaek (1991) for descriptions of the cooperative prototyping approach.

e.g. Miller-Jacobs, 1991), cooperative prototyping includes the notion of iterative development as a means of gaining user input throughout the development cycle. Changes to the prototypes can be made in direct response to feedback that users provide during prototyping sessions. In addition, cooperative prototyping views prototypes not just as proxies for future products or as means to gain user feedback, but as triggers for discussion and mutual learning.⁶ In this way, our prototypes are co-constructed artifacts that depend on participation from work practitioners. Finally, our prototypes incorporate a significant body of materials (e.g., documents and categorization schemes) actually in use at the worksite. We use the term *case-based* to underscore the ways in which our prototypes address the work of particular practitioners, reflect our shared understandings of their work, and incorporate their work materials.

In our projects, we attempt to work in close collaboration with individuals from particular worksites. We choose to focus on a single worksite and, within that site, to look closely at specific work activities. These choices are motivated by two considerations: our desire to obtain detailed, in-depth views of specific work practices as opposed to more superficial accounts of a wider range of activities, and our commitment to work closely with worksite participants. Although generalizing beyond our specific cases is constrained by these objectives, we believe that many of our findings do apply to other activities and settings. Where warranted, therefore, we point to the more general implications of our work.

Finally, to enable the investigation of work practices and the development of case-based prototypes in actual work settings, our projects are structured as research collaborations among ourselves as researchers, technology designers, and developers within our own organization, and prospective users of new technology in an interested outside organization. Structuring the relationship as a research collaboration means, on one hand, that our funding comes from our own organization; the prospective user organizations with which we are cooperating do not provide us with any direct payment, but only with their time. On the other hand, this arrangement also means that we do not promise to deliver a working system at the project's end. Instead, what we aim to provide as compensation for the engagement of organization members is (a) a clearer appreciation for their own work practices and associated technology requirements and (b) new insights into the state of the art and foreseeable future directions of emerging technologies. This type of relationship is one way to create the space for exploration and learning that seems to be required for the detailed envisionment of new work and technological possibilities.

⁶For accounts of how prototypes can trigger or "provoke" discussions in work settings, see Mogensen (1992), Mogensen and Trigg (1992), and Trigg, Bødker, and Grønbaek (1991).

3. THE WORKSITE: A SILICON VALLEY LAW FIRM

The site selected for this project was a large law firm. The choice was motivated partly by the forms of work that we expected to find there and partly by the apparent likelihood of a fit between the work and the technologies that we were interested in developing.⁷ The business division with which we set up our initial collaboration was involved in developing products that bridged paper and electronic documents, incorporating new approaches to search over electronic documents as well as machine analysis of marks on paper. Legal practice involves extremely document-intensive forms of work, in environments in the midst of transition from paper-based to increasingly electronic media. Both of these characteristics seemed relevant to our interests.

Our initial discussions concerning the scope of our project and our early interviews and observations were with members of the firm's technology advisory committee. Through them we learned that the firm provides its clients with two forms of legal services: corporate law and litigation. These two forms comprise distinct organizations within the firm and involve significantly different document-related work practices. Put simply, the work of corporate law centers on the creation of documents, based in large part on the reuse of existing documents, many of which were generated in house. Litigation, in contrast, involves locating and accessing crucial documents from a very large corpus generated outside of the firm, within the client's organization, and available almost entirely in paper form.

Our initial interest in exploring advanced applications for a suite of image processing technologies led us first to focus on the litigation side of the firm's practice, specifically on the work of creating electronic indices to the paper documents used in litigating large cases. Later, we turned our attention to the practices of document reuse on the corporate side of the firm, in response to a decision by the developers within our company to include text database retrieval technologies in their next product. Our aim was to investigate how those technologies might support the identification and retrieval of relevant documents from electronic files. In the end, we focused our work practice studies on both the practice of document retrieval and reuse in corporate law and the database production

⁷Note that this differs from some early participatory design projects where the system developers/consultants had fewer a priori commitments to specific technologies, and could be more freely responsive to the needs of workers. A well-known example was the Utopia project (Kyg, 1991), which developed computer systems in cooperation with graphic workers at a Swedish newspaper. For a description of the relations between the project and technology vendors, see Bødker, Ehn, Romberger, and Sjøgren (1985).

activity in litigation, exploring the possible applications of text database retrieval and image processing technologies respectively.

4. DEVELOPING A CASE-BASED PROTOTYPE: AN ATTORNEY'S "FORM FILE"

Attorneys at the law firm expressed to us a central tenet of their practice that effectively states, "If at all possible, avoid drafting anything from scratch." That is, if a "model" or boilerplate document (often referred to as a *form document*) can be located—for example, a buy-sell agreement or a venture capital loan agreement—it should be used as a starting point for the creation of the new document. At times the form document requires only minor modification; perhaps only the date or names are changed. In other cases, the form document provides "language" for a new document that is otherwise unlike the form document. A third possibility is that the form document provides information to help guide composition of a new document.

In response to the challenge of locating relevant form or model documents, attorneys at the firm employ a variety of strategies. These often include retaining documents from previous transactions that might prove useful in the future and "walking the halls," asking other attorneys if they have ever drafted a particular type of document or one with specific provisions. Attorneys differ in how systematic and diligent they are in keeping and organizing their form documents. Some attorneys are known to others for their dedication to maintaining their form file. They and their form files become resources to others in the firm who do not keep such extensive sets of files themselves. We worked closely with one attorney, M, who keeps a lateral file cabinet containing several thousand documents organized by topic in alphabetically arranged file folders (see Fig. 8.1). Another attorney with whom we worked keeps a more ad hoc, distributed "form file" (throughout his office, on the floor, on the desk, and in file cabinets), that, although useful for his own work, is less of a resource for others.

At the outset of the project, we were interested simply in understanding M's current use of his paper form file. We asked him to describe the organization of the documents in his form file and observed a few occasions on which he referred to the file, either to assist in document composition or in response to requests from colleagues. However, because M's use of the form file was occasional and unpredictable, we asked him to let us leave a video camera in his office so that he could record his use

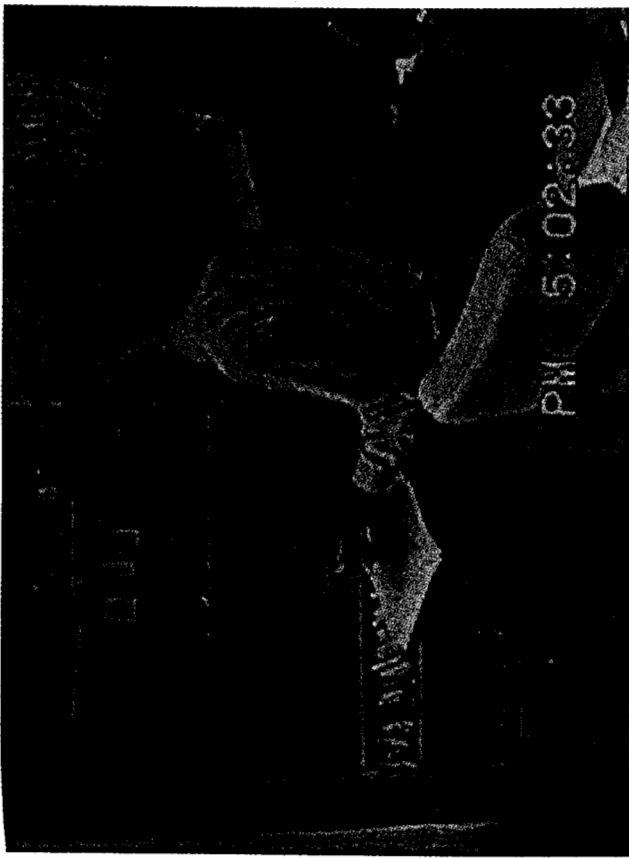


FIG. 8.1. Attorney M at the form file.

of the file for us. We requested that he record himself when using the file either for his own purposes or in response to colleagues' requests.

The utility of M's file for other attorneys depends on his knowledge of its contents and organization, derived in turn from his creation, maintenance, and regular use of the file. Other attorneys rely on M to help determine whether the form file contains documents relevant to the transaction on which they are working, to point them to likely places in the file where relevant documents might be found, and to justify the choice of particular documents (e.g., "This agreement is good for the protection it affords the lender"). During discussions with M about the document for which they are looking, junior attorneys can also learn about other issues relevant to the transaction. M views the effort he expends in maintaining the form file as worthwhile because it provides him with a suitable collection of model documents to work from (reducing the number of times he needs to compose a new document from scratch), it helps him keep informed about the status of projects around the firm, and his overall value to the firm is enhanced by maintaining the form file for use by other attorneys.

Informed by observations of the use of paper document collections like M's form file, we began to explore with M the potential for technological

support, in particular an electronic document collection that could offer advanced search capabilities and (eventually) shared access. In what follows, we discuss our prototyping work in collaboration with M and our subsequent attempts to engage product developers in discussions around these ideas.

4.1. Defining and Developing a Prototype

Our application-development effort on the corporate side of the firm was informed by our general understanding of the centrality of document reuse in the practice of corporate law. We focused specifically on supporting the maintenance and use of M's form file, because of his highly developed organization and use of the file, his willingness to allow us access to a subset of the documents (for scanning), and his interest in working with us. Other attorneys also contributed to our application design effort by reflecting on the overall value of making form documents available electronically and by evaluating the usefulness of particular design features.

We decided to build a prototype that would give M electronic access to a sizable fraction of the documents in his form file. Our prototype was developed in two major iterations. The pilot version was based on 36 documents taken from several of M's most frequently accessed folders that we scanned, using optical character recognition (OCR) whenever possible. Using this version, we conducted a cooperative prototyping session with M and another attorney. Our goal was to obtain feedback on the prototype and assess whether we should proceed to incorporate a larger number of the documents from the form file. The session raised important technological and work practice issues relating to the requirements for image-based browsing and text-based retrieval. Given M's clear interest in continuing to develop the prototype, we borrowed, copied, and quickly returned approximately a quarter of the documents (862) in his file cabinet. By scanning and OCRing these documents ourselves, we allowed our design effort to focus on issues of searching and browsing the corpus rather than the problems of inputting new documents.

In building our prototype, we made use of a platform being developed in our research organization to support "retrieval-centric" applications (Rao, Card, Johnson, Klotz, & Trigg, 1994). Although our original plan was to build the prototype on a product platform (making later integration with the product easier), this was not possible due to organizational and technical problems in the development organization (Blomberg, Suchman, & Trigg, in press). The research platform did provide us, however, with an interface to text database technologies as well as browsing of document

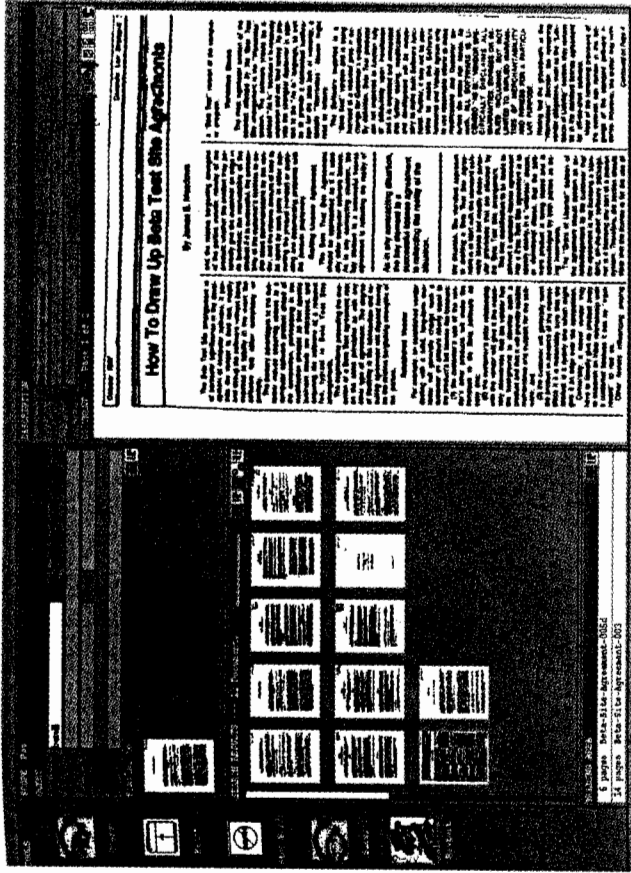


FIG. 8.2. Electronic file cabinet prototype. The left side of the window contains reduced "thumbnail" images of the documents returned from a search. The right side shows a "full size" image of one of a chosen document's pages. Other options include displaying the OCR'd text for a document and laying out intermediate-size images of its pages. See Rao et al. (1994) for a full description of the prototype.

page images. The case-based prototype we created reflected particular aspects of M's work practice, and included the images and text from his document corpus (Fig. 8.2).⁸ Viewed as an electronic document collection, our prototype was an exploration of the possibilities for combined use of text and images in the work of searching and browsing. More specifically, our prototype supported search with a full-text information retrieval program (Cutting, Pedersen, & Halvorsen, 1991). Because only minimal labeling information (e.g., folder name) was associated with the docu-

⁸The development of the prototype involved a three-way collaboration among M, the authors of this article, and Ramana Rao, a research colleague at Xerox PARC. Although Rao's platform provided the basis for the implementation, he also participated in design discussions at the law firm regarding both the pilot and later versions of the prototype. He played a key support role during the weeks when the prototype was left running in M's office, and was primarily responsible for several rounds of customization of the platform necessary to meet the evolving needs of M's application (cf. Footnote 16).



FIG. 8.3. M using/demoing the prototype with a visitor.

ments,⁹ the prototype also provided small scale "thumbnail" reductions of the documents' first pages as a way to present the results of searches. Browsing through a scrollable display of these first page thumbnails, M could select one document, step through individual images, lay out reduced images of all the pages, or scroll through the OCR'd text.¹⁰

Once the prototype was relatively stable, we left it in M's office for over 2 weeks. Again we requested that he record himself using the prototype or discussing and demonstrating it for visitors (Fig. 8.3). In addition to providing us with a record of his attempts to use the prototype as occasions arose, we found that the camera became a communication channel from M to us during the time that the prototype was in his office. M's comments to the camera included requests for new features, complaints about the speed of the system, general observations as to its utility, and a few humorous asides. For some of M's requests and complaints, we were able to respond with patches to the prototype and new documentation intended to clear up possible confusion.

⁹The lawyers reported having no time to assign keywords or titles to documents.

¹⁰We have recently built a World Wide Web-based version of the prototype, which is shareable and integrates images into search as well as browsing.

4.2. Bringing the Case to Developers

Given the limits on product developers' ability to engage directly with the project, we used a variety of project materials (including video recordings of work at the firm) to engage developers in discussing the implications of our observations and experiences. For example, we met with programmers and quality assurance engineers charged with developing a product aimed at supporting document management. The meeting consisted of a series of topical discussions, each triggered by a short video segment from our collection. Our initial suggestions of technical questions raised by each segment were followed by free-ranging discussions of relevant implementation issues. During the discussions, we answered questions and volunteered information about the setting and our understanding of the attorneys' work practices (see also Blomberg & Trigg, in preparation). As a result of these discussions, several features were added or modified on the developers' "to do" list for the current product plan.

A video clip of an attorney critiquing the words used to classify search clusters, for example, led the developers to rethink their design of the stopword list. *Stopword lists* are used to eliminate certain common words from the text before building indices over which retrieval algorithms search. Normally the stopword list is taken to be standard across applications (assuming only that the text is in English). During a cooperative prototyping session with M and another attorney, however, we found that additional stopwords were required; words like *corporation* and *agreement* are as nondistinguishing at the law firm as *and* and *the*. It was apparent to the developers on seeing this video clip that the attorneys would need the ability to edit their own stopword lists. In discussing the problem of reindexing the corpus when stopwords change, a developer made the proposal that their document management product should allow stopword lists to be assigned on a per-corpus basis. This requirement came from seeing the need for customizability and from recognizing that stopword lists might not be identical for all attorneys in the firm.

Another design topic that came up during this same meeting with developers involved the role of on-screen page images in search and browsing. The software platform on which our prototype was built combines document page images with OCR'd text. Support for corpus-wide searches is based on the text, whereas browsing through smaller collections of documents and document pages is facilitated using reduced page images arrayed on the screen. Our discussions of this topic with the developers revolved around several video clips showing M searching for documents, browsing using the "thumbnail" reductions of the documents' first pages, and browsing within the document using intermediate-sized

page images laid out in rows and columns. We noted the attorneys' ability to identify quickly the "genre" or style of a document (e.g., memo, letter, financial statement, etc.) from a vastly reduced image of its first page. We also pointed out that attorneys found intermediate image sizes useful for quickly browsing through the pages of single documents and for jumping to larger images of particular pages.¹¹ In viewing these video clips, the developers were interested in the degree to which the attorneys relied on cues about the form and structure of the document. These cues could be gleaned from reduced page images, but were lost in ASCII text renderings. Also of particular interest to the developers was the precise point at which M shifted from refining a search by, say, adding new keywords, to using what one of the developers called "pictorial browsing": browsing using scaled page images. This observation underscored the potential value of support for combined image and text-based search strategies.

5. ENCOUNTERING ORGANIZATIONAL POLITICS: THE WORK OF LITIGATION SUPPORT

As we noted earlier, the law firm conducted litigation as well as corporate law. Along with an opportunity for a second prototyping project, our engagement with the litigation side of the firm revealed an ongoing contest within the organization over the status and future of one aspect of the work of litigation. In what follows, we focus less centrally on our cooperative prototyping efforts with workers in litigation and more on our navigation of the political complexities that we met in the course of those activities.

Litigation work within the firm comprises defense of corporate clients against suits brought by other corporations or by shareholders. The material grounds for these disputes take the form of documents, in some cases numbering in the hundreds of thousands, gathered from the client's files. Every case includes a legally binding process known as *document production*, in which documents taken by the firm from the client's files are turned over to the opposing side. This same corpus provides the basis for the firm's preparation of its own case.

No generalized account of the process of document production can adequately represent the overwhelming logistical requirements of actually managing a large document corpus, in relation to the multiplicity of actors

¹¹In the last version of our prototype, four page image reduction sizes were supported, all of which M used and appreciated. For more on changes made to the prototype based on M's use of an early version, see Rao et al. (1994).

involved and the unfolding interests of the case at hand. How documents are taken from client files, photocopied and returned, searched and indexed, in what order, and by whom is only partly rationalizable, due to these practical exigencies. Ideally, however, document production begins with the assignment of a unique identification number to each page of every document, followed by a rapid sort of the entire document corpus into those documents that are "responsive" to the case—that is, that must be turned over to the opposing side—and those that are not. This sorting is done by junior attorneys, relatively new both to the practice and to the firm. The set of responsive documents is then "computerized." This does not mean that all documents are transformed into electronic media, but rather that an online index is created to the paper documents. Creation of this database, done by workers in "litigation support," involves coding each document by representing its type and aspects of its content in a standardized format. That information is entered into a database, which can then be queried according to various criteria of interest to attorneys. The results of queries, typically submitted by paralegals, are presented in a report that is used as a pointer for retrieval of the paper documents.

Having developed an initial sense for the document-related work practices of paralegals and attorneys, we decided to look directly at the work of coding documents and creating the database index. From what we had heard, we had reason to believe that the relations of paper and electronically based media involved in this practice were particularly well suited to our design agenda. Through inquiries, we located the firm's litigation support operation. There we found a former paralegal, with extensive experience in the maintenance and use of computerized databases, supervising an office of temporary workers, many with bachelor's degrees. These "document analysts," as their supervisor called them, were engaged in carefully examining and representing the thousands of documents for a given case with the goal, vigorously instilled by their supervisor, of creating a valid and useful database.

At the time we began to look at the work of litigation support, coders were recording information about each document on a form, which was then handed to coworkers who entered the information into the database (Fig. 8.4). It became clear to us that representing the documents involved coders in an interweaving of tedious activity and mindful judgment. What interested us was the possibility of embedding bits of automation into the coding practice in a way that would relieve the tedium, while maintaining interactive control required for the exercise of necessary judgments. The image processing technologies that we were interested in exploring supported machine "interpretation" of certain classes of marks on paper (e.g., constrained handprinted characters, checked boxes, and circled text). We decided to work with the supervisor of litigation support

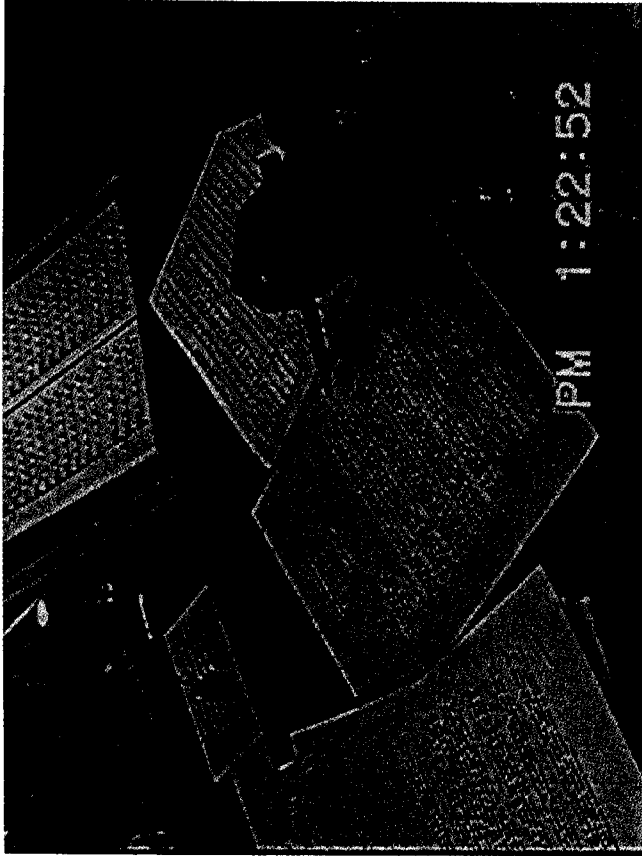


FIG. 8.4. A document coder at work.

and her staff to mock up a redesigned document-coding practice, incorporating some of our technologies.

Maintaining alignment between our design efforts and the work practices of litigation support during this time was a significant challenge for us. The litigation support staff were continuously experimenting with alternative strategies for coding documents. One lesson we (re)learned was the degree to which workers themselves are engaged in reflecting on and redesigning their own practice.¹² Our design proposals had to stay attuned to these ongoing changes in work practices.

5.1. The Politics of Invisible Work

The place of the "routine/knowledge work" distinction in divisions of labor and its implications for technology development came to life for us in our work with the law firm. A powerful construct in the representation of divisions of labor within organizations is the distinction between so-called routine and knowledge work. The standard organizational icon of the pyramid, for example, is stratified according to the attribution of

¹² Andrew Clement (1994), among others, has argued eloquently for the place of workers' active and *independent* involvement in work and technology design.

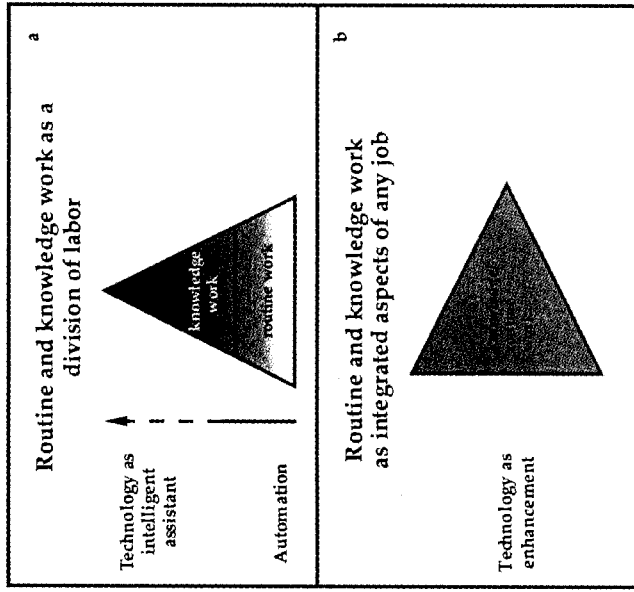


FIG. 8.5. Two views of the distribution of routine and knowledge work.

progressively more knowledge work as one moves from bottom to top (Fig. 8.5). The bottom layers in this view are made up of relatively large numbers of workers with relatively few skills, engaged in appropriately routine tasks. The top layers comprise smaller numbers of workers with greater knowledge and skills, engaged in correspondingly more knowledge-intensive forms of work. With respect to technology development, this image argues that efforts to replace labor by capital investment should begin with displacement of routine work by automation or outsourcing. As this logic is brought to bear on increasingly more powerful organizational actors, technology is reconstructed from a replacement for one's labor to one's "intelligent assistant."

In the case of the work of litigation support, we were presented with two very different views of the work. On one hand, our initial contact with the firm was through a senior attorney who described the process of document coding as made up of two types; what he termed *subjective*, or issues coding done by attorneys, and *objective* coding which he described as follows:

You have, you know, 300 cartons of documents and you tear through them and say, I'm going to put Post-Its on the ones we have to turn over to the other side. And then, ideally, you hire chimpanzees to type in *From, To,*

Date. And then, ideally, you then have lawyers go through it again and read each document, with their brain turned on.

This characterization was repeated on several occasions in which the attorney recapitulated for us how the document production process is organized. At the same time, at no point during the period in which we talked with and recorded the work of attorneys did we encounter the work of objective coding directly. Literally as well as figuratively, that work was invisible from the attorneys' point of view. In contrast, once we began to observe and engage with the work of litigation support, the supervisor of that operation expressed to us her belief that, given the coders' familiarity with the document corpus, they could be responsible for certain other aspects of the document production process now handled by junior attorneys (e.g., the assignment of subjective codes). She also expressed her view that the attorneys underutilized the database, due to their ignorance of its capabilities and how to exploit them.

We found ourselves, in other words, in the midst of a contest over conflicting characterizations of the work of subjective and objective document coding and its requirements. Our observations of the work of the attorneys revealed no small measure of mundane or tedious activities, which when brought into the attorneys' awareness were accepted by them, albeit ruefully, as inevitable accompaniments of their practice. At the same time, the more we looked into the work of document coding and data entry, the more we saw the judgmental and interpretive work that the document coders were required to bring to it. Given our knowledge of previous studies, these observations came as no surprise.¹³ Nonetheless, in contrast with the simple characterization provided by the senior attorney, the interpretive demands of something as basic as, for example, finding the "documents" in a box of papers, were remarkable. That is to say, document coders were presented with boxes containing hundreds of pieces of paper and asked to establish document boundaries within them.¹⁴ Although some pages might be attached together with a paper clip, the coders knew that they could not rely on those physical markers alone; they needed to make sufficient sense of each page so as to assess

¹³We are thinking here of previous studies that have revealed, on one hand, the mundane activity required for the accomplishment of what has come to be called knowledge work, in particular in recent studies of science and technology (e.g., Bijker, Hughes, & Pinch, 1987; Collins, 1985; Fujimura, 1987; Knorr-Cetina & Mulcahy, 1983; Lynch, 1993; Lynch & Woolgar, 1990) and on the other hand, the judgment and reasoning required for the accomplishment of so-called routine work (e.g., Garfinkel, 1967; Goodwin & Goodwin, in press; Orr, 1990; Suchman, 1983; Whalen, 1993; Zimmerman, 1969).

¹⁴This because "documents," not pages, needed to be entered into the database. A document is entered as a range of page ID numbers; for example, a given memo might be coded as XYZ000134 to XYZ000138.

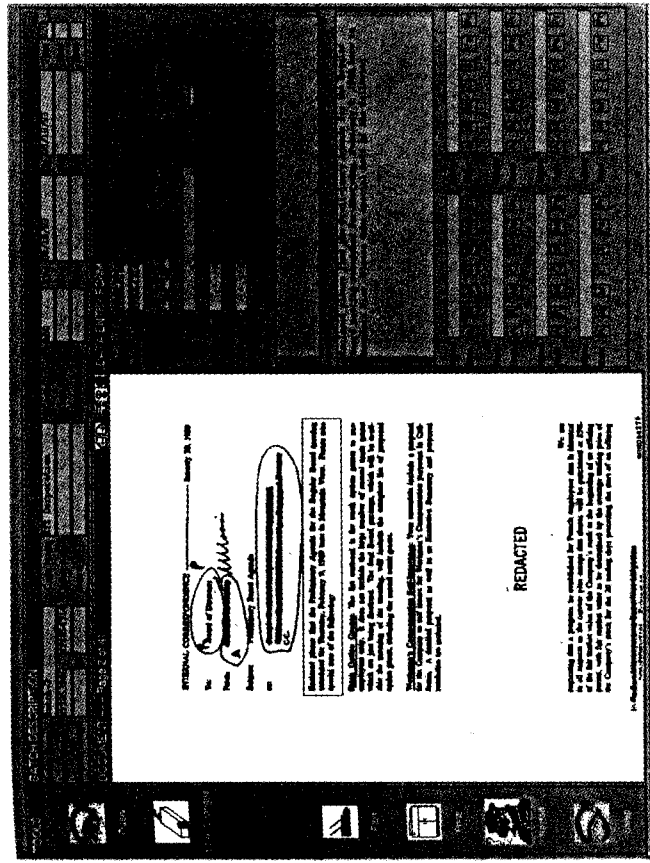


FIG. 8.6. Prototype for document coding and data entry. The left side of the window shows a document page image. The document analyst has circled and labeled various names of interest on the original hardcopy. The right side shows an electronic data entry "form," the fields of which some have automatically been filled in. A region containing text has been specified in the page image, automatically OCR'd, and pasted into the Description field in the data entry form.

its association with or independence from those that came before and after. Similarly, deciding on the date of a particular document—given, for example, an agreement that was written on one day, signed on another, and faxed on a third—might involve choosing which of several dates would be most useful to an attorney engaged in a search for documents relevant to a particular issue in the case. And so forth.

5.2. Supporting Document Coders' Knowledge Work

Our aim of relieving some of the tedium of the document coding process, while at the same time allowing flexible control over the work, led to a prototype design that supported automatic recognition of document codings where possible, while also providing image views of documents and editable text fields (Fig. 8.6).¹⁵ Our design allowed coders to use paper

¹⁵For more on the work of document coding and our design proposal, see Suchman (1996).

coding forms that later could be scanned and automatically recognized, or to code directly on the documents by circling and labeling relevant regions of text. Coding forms, document page images, and previously circled text regions could then be displayed on the screen, giving coders the ability to edit the coding forms, correct OCR'd text, or "lift" text regions directly from the document images for on-the-fly OCR into the database. This design supported the coders' review, correction, and enhancement of entries into the database, allowing them to bring their experience and accumulated knowledge to bear on the task at hand.¹⁶

After working for some time on this design for litigation support, we learned from the firm's director of technology that, in the interest of cost cutting, the senior management of the firm was seriously considering closing down the in-house coding operation altogether and shipping the documents for coding to the Philippines. Because we had reason to believe that this decision was being made without full knowledge of what was actually involved in the work of document coding, we arranged to provide the director of technology and whomever else he felt was appropriate with an update on our work, including our observations and proposals regarding document coding. We hoped that this presentation would have some influence on the firm's deliberations.

In the meantime, the supervisor of litigation support and her staff had been moving proactively to respond to what they recognized as potential challenges to their continued operation, by increasing their productivity and lowering the cost of their services. This was in part accomplished by coding documents directly into the database rather than in two separate passes for document coding (on forms) and data entry (from forms into the database), as they had been doing. As a result of their efforts, at the time our project ended their place within the firm seemed relatively secure.

Our representations of the work of litigation at the firm and our design of a prototype application involved reconceptualizing the work from activities divided clearly into two types—knowledge and routine—to different orders of practical reasoning and action. The implications of the invisibility of practical reasoning and action are different for differently positioned organization members. For those whose work has been mythologized, making the actual work visible implies a process of demysti-

¹⁶As with our prototype on the corporate side (Footnote 8), the development involved the law firm's litigation support staff; the authors of this article, and Ramana Rao. Again, the prototype was based on Rao's platform, augmented by text editing and image mapping functionality he added per our request. This time, we took responsibility for the user interface customizations necessary for the document coding application and for design discussions with litigation support staff.

fication. For those whose work has been trivialized, in contrast, making the work visible is about recognizing and acknowledging the skills that are actually involved in doing it. Rather than premising our design proposals on a distinction between mindless labor and knowledge work, we attempted to show that routine activities and the exercise of judgment coexist at all levels of the organizational hierarchy (Fig. 8.5). Although the conditions of our own working practice meant that our design efforts ended with a research prototype, we hope to have contributed to the standing of litigation support at least by seeing their work and acknowledging what we saw, both in our representations of it and our designing for it.

6. GENERAL FINDINGS AND RECOMMENDATIONS

The project reported here has contributed to our knowledge, both specific and general, of how documents are actually created and used within working practices, to our understanding of what it means to do work-oriented design, and to our appreciation of the problems and possibilities for more work-oriented design practices within our company. In concluding we offer some general observations and recommendations from our experience.

6.1. Working Document Collections

Our work in the law firm provided us with a rich view of document work practices not only as they occur within the specific practice of law but, we believe, in ways generalizable to other settings as well. In particular, M's form file is an example of what we are calling a working document collection. Such repositories comprise documents that are selectively saved for future reference and reuse by their creators as well as others. Though working document collections are created for long-term and possibly infrequent use, the documents they contain must nonetheless be readily available for the task at hand. In the law firm, their location in attorneys' offices, in file cabinets, on bookshelves, or in stacks on the floor provided this accessibility. Working collections seem to occupy a niche between archives (often stored remotely) and active documents (kept, e.g., in stacks on the desktop). Although documents requested from a remote archive are frequently returned within days or weeks, a document from a working collection needs to be retrievable within the shorter time frames dictated by an immediate task. In the law firm, for example, if a form file document cannot be found quickly, it may not be worth retrieving at all.

To continue working on the task, attorneys might, for example, resort to drafting from scratch the language they had hoped to reuse.¹⁷

At the same time, the scope of working collections extends beyond just those documents currently in use. Moreover, a collection may become quite large in size, and any specific document in a collection may be used only rarely.

Work with a document collection involves adding new documents to the corpus, transforming them as necessary (e.g., printing or copying the document, or labeling it with filing instructions to an assistant). In addition, ongoing maintenance of the collection includes activities of cleaning up and reorganizing, throwing away outdated and duplicate documents, shuffling documents between folders, and consolidating and removing folders. Finally, the reuse of documents in the collection involves searching and browsing as well as transforming and integrating found documents into current work. Transformations include copying a borrowed document from the collection so that modifications can be indicated by marking up the document, or reading aloud from a document into a dictation machine while making changes to the language for a new version.

Our observations of M's work with his collection indicate several other characteristics of the dynamics of these practices:

1. Activities are ordered and interleaved in complex and opportunistic ways. For example, before adding a document to the form file, M might search to see if something like it is already there. Similarly, maintenance of the collection may happen as part of the activities of storing and searching. For example, M might rearrange folders in the midst of responding to colleagues' query for a document.
2. Access to the collection involves tightly linked consideration of both a document's visual characteristics and its content. We saw, time and again, the ease with which attorneys could identify document genre as well as other document characteristics (e.g., the source of the document) simply by leafing through a folder.

¹⁷Reporting on two studies of the practices of organizing online information, Barreau and Nardi (1995) proposed three information types: ephemeral, working, and archived. Their sense of *archived* matches most closely our term *working document collections* in terms of the longer "shelf life" and less frequent access. Barreau and Nardi claimed, moreover, that this category of information has been overemphasized in the literature, perhaps reflecting the "researchers' own needs for archival support" (p. 42). We suspect, however, that their impressions may be a result of studying patterns of information organization by individuals. Though only a minority of the members of an organization may spend the time to manage "archived" information, the entire organization may benefit from their librarian-like work. Indeed, the law firm we studied pronounced the attorneys' working document collection "corporate assets" and began investigating how to centralize them.

3. The collection's creator and primary maintainer plays a crucial role in facilitating shared access to the documents because of their knowledge of the collection's organization and contents. Moreover, a request for a document provides an opportunity for discussion about points of law, the status of projects, and so on. Those posing requests may be querying not only the files but the creator's expertise as well.

Our cooperative prototyping with M centered on the second observation. That is, our prototype did not support either the scanning of new documents into the corpus or the easy rearrangement of documents between folders. Furthermore, the standalone status of the prototype limited our ability to explore issues of shared access. We were, however, able to develop new insights regarding the value of combined image and text-based document search, and to convey those insights and their implications to our collaborators at the worksite, to other researchers, and to product developers.

6.2. Case-Based Prototypes

Although at the time of this writing our work at the law firm has drawn to a close, we continue an extended process of communicating what we have learned in the project to other researchers and to product developers. Rather than "delivering" the results of our studies and prototypes to these relevant others, we are committed to finding ways to engage them directly in exploring with us the implications of our work for their ongoing projects. Given the realities of occupational specialization, we believe there will always be a need for persons and artifacts that mediate between work practice and design. At the same time, we agree that "participatory design is a collaborative approach to design, not a rigid set of design methods" (Good, 1992, p. 441). To us this means that mediating artifacts and activities must be flexibly adapted to the demands of the situation. We recognize that to be accessible to the work of design, the details of working practices need to be explicated, interpreted, and contextualized. But this is a different and, we believe, more challenging process than developing abstract representations of those practices. A basic tenet of our approach is that the details of practice are an essential part of what must be addressed in system design.

Perhaps the single most important lesson that we take from this project with respect to these issues is the power of case-based prototypes. Such prototypes are working artifacts that demonstrate the potential of one or more technological innovations. They incorporate a significant body of material from an actual worksite, and are informed by the practices and needs of those who work with the material. Such prototypes thus embody real-world cases as well as new technological possibilities.

Case-based prototypes and their contents can be made available in an ongoing and iterative way to the work of research and development. They offer design input that is different from and complementary to other techniques for bringing experience of work practice to bear on product design.¹⁸ Moreover, we believe, perhaps paradoxically, that prototypes that are "specific" in the sense described here are more likely to be generally useful. This is because the richness of their contents and the observable details of their use connect in varied and evocative ways to a wide range of other settings and practices.

At the same time, the work of case-based prototyping does require investments of time and resources. Building a case-based prototype requires not just a knowledge of the relevant technology, but also understanding and incorporation of materials and practices from a particular work site. Case-based prototyping also requires maintaining an ongoing relationship with workers with whom the prototype is iteratively defined. Moreover, the prototype does not simply speak for itself, but must continually be "read" for its significance and lessons in ways that connect with the particular concerns of researchers, developers, and intended users. Communication through and around a case-based prototype in this respect remains a labor-intensive undertaking.

7. CONCLUSION: TOWARD MORE WORK-ORIENTED PRODUCT DEVELOPMENT

The project we report here was organized at the outset as a collaboration between researchers, product developers, and work practitioners. We set out to work with particular partners in the product divisions of our company to incorporate more work-oriented design practices into the product development process. However, conditions within the product development organizations made it difficult to sustain the kind of collaboration that we had hoped for. Briefly, shifting technology directions and inadequate allocations of resources for use-oriented design activities made it difficult for developers to maintain real engagement with our project. Given these conditions and the constraints they placed on the direct involvement of developers in any form of work-oriented design, we found ourselves as researchers in the position of trying to maintain some kind of alignment between the work site and product development activities.¹⁹

Nonetheless, our continued belief is that ongoing relations between technology developers and strategically selected work sites can deepen

developers' understanding of the problems that workers face and expand workers' understanding of the technological possibilities. At the same time, we recognize that system development is a highly specialized, somewhat fragmented enterprise, with tremendous differentiation among the participants even within a given job category. Individuals have different objectives tied to their particular backgrounds and interests, and even in the best of circumstances there are different levels of involvement with prospective technology users on the part of developers. Moreover, the increase in outsourcing, third-party development, partnerships among companies, and the like means that there is greater ambiguity as to who actually makes up the product development team. As a consequence there will always be a need for people who can bridge between groups variously positioned with respect to a product development effort (Fromherz, 1996).

Our goal in this project was not to define a new bridging role in system development, but rather to propose new kinds of activities that might occur in a variety of places internal and external to system development organizations. From our efforts to develop our own practice of work analysis and case-based prototyping, we can offer some recommendations that might productively inform any project that combines work practice studies and design interventions. These recommendations are based in the approaches of anthropology and action research, two of the traditions underlying Participatory Design. One tells us how to study people and their practices respectfully, and the other how to turn our interventions into cooperative, mutually enriching and reflective engagements.

Look for "invisible" work. In the case of the law firm, this led us to see not only the taken-for-granted aspects of an attorney's work with his form file, but ways in which the work of litigation support was obscured systematically from the view of firm management in their plans for change. Our view onto the work's actual requirements suggested new directions for both work and technology redesign.

Find the knowledge work in what is characterized as routine, and the routines in what is characterized as knowledge work. Again, this orientation led us to see knowledgeable aspects of the work of litigation support that were missing in its being stereotyped as routine, and to articulate routine aspects of attorneys' work with documents. Both are relevant to the design of new supporting technologies, within a design ethic of relieving tedium while enhancing judgment-based activities.

Expect and encourage joint project design and definition with worksite participants. Our strategy of collaborative research begins with an interest in finding productive relations between a particular form of work

¹⁸For example, Carroll and Rosson (1992), Karat and Bennett (1991), and Nardi (1992) suggest that scenarios can be productively employed in connecting design to work activities.

¹⁹For a more extended discussion of these difficulties, see Blomberg et al. (in press).

and a range of emerging technologies. From there, our projects are shaped in interaction with organization members.

Assume that change is already and always in progress. Understand the politics of change and where you stand within them. In our experience, all organizations are engaged in some ongoing forms of self-assessment and redesign. These initiatives often reproduce or make more visible existing contests over divisions of labor and associated distributions of material and symbolic reward as well as implying changes to them. Navigating responsibly within such settings requires an awareness of one's own values and commitments with respect to those contests.

Understand how extended contexts (e.g., institutional and global) constrain the scope of what can be accomplished in a given setting, and attempt to question or take advantage of those contexts as appropriate. In this project, the constrained conditions of product development, and the movement toward increased outsourcing of litigation support in the law firm, brought us into contact with intensification and shifting configurations of work within and among organizations locally, regionally, and worldwide (Greenbaum, 1994). To some extent we were required to incorporate these conditions, as given but also problematic, in the direction of our own research.

It is our hope that the project reported here and others like it will help bring traditions of anthropology and action research a step closer to the world of product design. In the end, however, developing a work-oriented design practice requires time and space for exploration and learning. As researchers we may be in a better position at present to develop cooperative, work-oriented design practices than our coworkers in product development or, for that matter, than prospective technology users. Making work-oriented design an integral part of system development and use ultimately will require resources to be committed to alternative forms of design practice, within both product development organizations and the sites in which technologies are intended to become useful.

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