Datacloud: Expanding the Roles and Locations of Information

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ABSTRACT
This presentation traces the locations and roles of computer documentation over the latter half of the twentieth-century in order to construct a model of information/knowledge space as it relates to different forms of work. The paper then provides suggestions about future forms of documentation and interface based on ethnographic research of workers in recently emerging forms of work, including nonlinear audio/video production and videogame playing. The final section of the paper provides concrete suggestions about forms of documentation and interface that will be required to support these new forms of work.

General Terms
Documentation, Performance, Design, Economics, Experimentation, Human Factors, Theory, Legal Aspects, Verification.

Keywords
Interface Design, History, Labor, Postmodernism, Research

1. INTRODUCTION
As the term "documentation" has shifted during the last several decades to include not only print-based but online formats, the role and place of computer documentation has expanded in important ways. Documentation is no longer merely a printed and bound manual set next to a computer or (too frequently) still in shrink-wrap on a user's shelf. Instead, documentation is also available in Windows help files, Web pages, and even the interface itself. Indeed, the space of documentation can now be understood as a social space, with the computer beginning to offer users methods for communicating with other people.

In analyzing these shifts, we begin to see a recursive development in which the computer absorbs social actions, fragments and flattens them only to have those actions and spaces reabsorbed into culture in various ways. Current theories of understanding computer use suggest movement toward either virtual realities or ubiquitous computing contexts (see. e.g, [1]); in actuality, though, we seem headed toward an environment in which the distinction between the two is meaningless: work and learning both happen within and across information contexts, online and face-to-face.

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In this paper, I sketch a rough history of computers as technologies for work. In each era of that history, I will focus on two aspects of how the computer is constructed and used. First, I examine the micro-context of user work and learning—that is, where, spatially, is working and learning information displayed and manipulated by users. Second, I consider the social and political implications of that spatial construction, connecting up specific shapes and processes of work to historical and developing trends in labor, economics, and politics.

2. A BRIEF HISTORY OF INTERFACES
The history of interface design will be relatively familiar to most documentation professionals, at least in broad terms. I'll spend some time here working through that history, though, in order to set up a framework for analysis.

Table 1. Historical Models of Interface

	interface	location of work and learning
50s-60s	hardwired	outside interface: education, training (few manuals)
60s-70s	punch cards	outside interface: education, training, manuals, courses
70s-80s	command-line interface	outside interface or at second-level deep in interface: education, training, manuals, courses, man pages
80s-90s	graphical interface	into interface: shifting toward **limited** interface (surface)
90s-00s	spatial online (begin datacloud)	interface expands beyond physical boundaries to allow social (online) communication
00s and beyond	spatial/hybrid, information-saturated workspaces	boundaries of interface break apart to support movement (including arrangement, eddies and flows) not only social/online but also local microcontext

2.1 Hardwired: Apprenticeship Learning and Work
Historically, an interface was the physical connection of two devices, an articulation in the strictest sense of the word—a hardware register interfacing with an output device such as a teletype. Computers, at the earliest stages, were "programmed" by actual rewiring them.

The key aspect here for our discussion is the location of knowledge about how to use the computer—in other words, the location and structuring of technical communication. In these devices, users learned to program and work with the computers

based on apprentice-type relations: you worked with an expert person, who, over time, taught you functional skills.

Importantly, that knowledge and use was also embedded in real social contexts. On one hand, there doesn't seem to be anything odd about this microcontext, apart from the retro nature of the haircuts and apparel of the workers in Figure 1. On the other hand, as we begin to move toward other models for information/work space, we'll begin to notice some very slow but profound changes in the shape of those spaces.

Figure 1: Face-to-Face Learning

I'm being nostalgic about apprenticeships here, obviously—I'm not calling for a return this situation, but instead a reflection on how this microcontext relates to other situations.

Importantly, the apprenticeship model presupposes a particular economic and industrial process, one that values in-depth, long-term investments in workers, particularly in professions that value craft. The computer at this stage is not a mass-production, mass-market device but rather a specialized, vertical tool.

2.2 Manual and Textbook Learning: Dispersing Learning and Work

Where initial computer technologies were used almost completely as discrete artifacts, two parallel developments lead to different work and learning microcontexts. The size of a computer began to shrink at the same time as processing speed and complexity increased dramatically, allowing a more mutable and powerful type of work to be done with the computer. This development spurred wider adoption and relative standardization of both hardware and software, including the development of batch and interactive processing.

Within the microcontext of work and learning, the standardization allowed the development of non-apprentice learning, first with the development of software and hardware manuals and then with technology training courses. In a sense, the adoption of print-based training materials acts as a contraction of the social context of learning and working, with new users separated from existing users.

Likewise, the economics of textbooks and manuals requires a mass market, one in which education is discrete, repeatable, and marketable, with student-customers who are (a) willing to pay (or have their employers pay) for education and (b) will be able to turn that education into profit later.

2.3 Online Help 1: Buried Information

Additional (and apparently perpetual) increases in the complexity and available storage space of computers is associated with an additional contraction of the microcontext of learning and work: information about how to use the computer becomes integrated into the computer itself. This development is a gradual one, and not apparent at first glance. Figure 2 shows a contemporary command-line interface nearly identical to the "buried information" model of this phase.

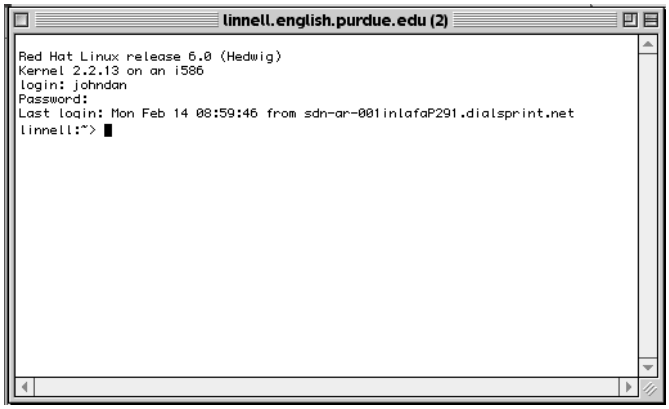

Figure 2: Command-Line Interface

When I said that some knowledge about using the computer became embedded in the computer, I didn't mean that using the computer suddenly became obvious. For example, on our linux server the command prompt gives me precious little information about how to use the system.

But if I know enough about how unix and linux operate, I'll know I can type in "man" (user's manual) page command to get help on system commands. From an expert users standpoint, this is great because if I have a general working knowledge of how the operating system works, I can bootstrap that knowledge by reading online help. But I have to know (a) what the man command is, and (2) the name of a command to connect up to—in this case, the "chmod" command, which is it's own little technological hell.

Of course, I have to have something to bootstrap with, which typically meant doing something **outside** the computer interface—taking a course, working with another expert user, buying a book, etc. For new types of microcontext do not completely erase previous ones—people continue to work in apprenticeship systems and use print manuals to this day [2]. The history I'm constructing here is an uneven one with numerous overlaps. Indeed, the deep-information model probably also requires the existence of earlier models in order to acculturate, at the very least, novices who will need assistance even getting to the point where they can use the deep information. The deep information model serves as a marker of market maturation, in a sense—the size of the market for learning how to operate this particular type of computer is robust enough to support not only apprentice-based learning, but a growing variety of learning types. In addition, it consists of a large enough group of intermediate to expert users to support the development of learning/working material for those specialists rather than a one-size-fits-all approach.

Figure 3: Online Help in Linux Man Page

At the same, the microcontext of deep help systems affords a particular type of learning for particular types of users. The structure of the man page, for example, is oriented around very concrete, functional uses: a one-line definition of the command followed by a synopsis of command syntax possibilities is at the top, allowing users to drop from the command-line (surface) to the slightly-deep definition and synopsis. In order to browse more in-depth information, users are required to stay "at depth" for a significantly longer amount of time. Furthermore, man pages do not support (or at least obviously support) long-term, complex learning situations. Obviously, such long-term, complex learning takes place somewhere—but that learning is more likely scattered around the computer, in notes and texts as well as distributed on the network, with other users.

2.4 Online Help 2: Surfaced Information

As we move toward more graphical interfaces, the location of working and learning information begins to shift; learning is buried in the interface (in online help and tutorials), but increasingly the interface itself—the surface—provides users with suggestions and hints about how to work. In other words, increasingly learning and work take place at the surface of the computer.

In the screenshot shown in Figure 3, users of the Website design program Dreamweaver are given literally thousands of cultural and technical cues that suggest to them how to work.

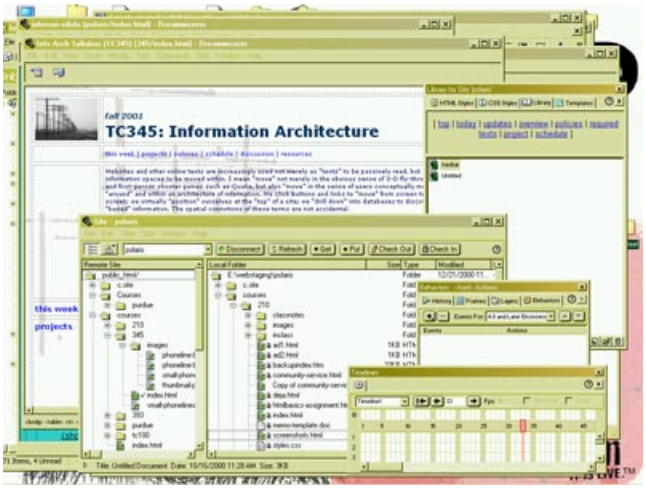

Figure 3: Surfaced Information in Dreamweaver

As information about work moves to the surface it becomes fragmented and flattened in ways that simultaneously support ease of use and discourage broad, complex forms of learning. Although traditionally such education has been dismissed as immature or "surface level" (pun intended), these types of learning are specifically demanded by some variations of just-in-time learning and project-based learning, among other areas.

In a recursive loop, the success of such interfaces in those particular work situations increases the surfacing of information in subsequent versions of interface design. Importantly, although surfaced interfaces frequently cause learning and usage problems for users in more traditional job functions, ethnographic discussed below illustrates ways that extremely information-dense interfaces are very effective at supporting emerging forms of work crucial to the rapidly growing information economy, particularly those that rely on the ability to experiment with and within complex and changing masses of information (a facility increasingly required in a range of jobs, from financial analysis to nonlinear audio/video production).

In this Dreamweaver interface in Figure 3, I'm working on the main page of my own website. Although there's a great deal of learning support available—in manuals, on the web, in users groups, etc.—most users build web pages in Dreamweaver without doing a lot of that outside work. Instead, based on their experiences of other computer programs and on experiences seeing other web pages, they muddle through the procedure based on surfaced information: palettes that offer them a range of often-used commands, menus that, by their very names suggest certain types of actions as more common than others, windows in which information that can be acted and, interacted with. In other words, the interface strongly suggests actions.

On one hand, this is a wonderful opportunity—the ease of use here provides important cues that put an immense amount of design power in the hands of people wouldn't normally have it. Although relatively speaking, HTML codes are pretty straightforward, the codes do prevent many novice users from authoring websites. So this is, in one sense A Good Thing, a democratization of technology.

On the other hand, it also worries me, because it's now much more likely people will create web pages **without** a broader context—without understanding anything about interactivity, about screen layout, about information design. What has happened is that the interface has surfaced a very small fraction of the learning support—the education—at the expense of broader thinking and learning. And we know from experience that if a user can "get by" with what's present, they're less likely to go further. In fact, trying to learn higher-level skills is frequently seen as wasting company time, as dissatisfaction with one's stage in life [14]. It's the Great Chain of Online Being: Hope No Higher.

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