Title
Technostress in the Bionic Library

Permalink
https://escholarship.org/uc/item/1hc8s95x

Journal
Cheryl LaGuardia, ed., Recreating the Academic Library: Breaking Virtual Ground. (New York: Neal-Schuman), 1

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Publication Date
1998

Peer reviewed

The Bionic Library

As readers of this volume are well aware, academic libraries are offering increasingly copious and diverse information in electronic form for local and remote access. These electronic services began with online library catalogs, have come to include bibliographic, full-text, and image databases, and, through the use of Internet tools such as the World Wide Web, are rapidly evolving into networked "information spaces" where users can identify and locate both printed and electronic items, retrieve the latter, and communicate via e-mail with expert guides (e.g., the library staff).

At the same time, the physical library continues to exist and even thrive, acquiring, organizing, and serving up large quantities of material in print and other non-electronic formats to substantial numbers of students and faculty.

> *2008: "Thrive" may not be the first word that springs*
> *to mind when you read this ARL document, which shows*
> *significant declines in reference and circulation transactions*
> *between 1995 and 2006 (http://www.arl.org/bm~doc/arl-br-256-stats.pdf).*
> *But the results are mixed, with attendance at group presentations*
> *increasing. In any case, stress on staff caused by declining*
> *library usage only reinforces that caused by technology.*

Thus it seems likely that academic libraries will continue to operate in both modes for some time. In coining the term "bionic library" to describe this hybrid concept, Harold Billings also alluded to the variety of reactions among potential users:

> To some scholars, the concept of an electronic library is paradise at hand; to others, it is absolutely frightening. I suggest that libraries are evolving as bionic libraries; organic, evolutionary, and electronically enhanced. Library collections will continue, perdurable with books and journals, but for some information sources available via remote workstations, the library will soon never sleep ... The old and new library systems will become assimilated and intertwined. [1]

The library is also "bionic" in the sense that it comprises not only facilities and formats, but also the essential human elements: users and staff. The success of any library system, after all, rests not on how well the design works on paper, in the abstract, but on how readily people will accept it and how effectively they can use it. And it is the biological components of the library that embrace or reject the new technologies; fulfill or frustrate the intentions of system designers;

and, especially in these times of change, experience the kind of anxiety and disorientation known as technostress.

Stress and Technostress

It hardly need be stated here that stress plays a critical and problematic role in modern life. Most modern stress theory is based on the work of Hans Selye, who defined three stages of reaction to "stressors" in the environment: alarm, resistance, and (in extreme cases where stress is serious and prolonged) exhaustion. [2] While stressors can be pleasant or unpleasant and stress can have positive effects—energizing a person, focusing attention, and stimulating behaviors of engagement and constructive adaptation—generally speaking it is the negative aspect of "distress" that merits our attention here.

Symptoms of stress may be physical (e.g., muscle tension, rapid heartbeat, dry mouth and throat, shallow breathing, headaches, gastric problems), cognitive (mental fatigue, inability to concentrate, poor judgment), affective (irritability, anxiety, mental fatigue, depression), or behavioral (impulsiveness, avoidance, withdrawal, loss of appetite, insomnia). Other researchers have emphasized the importance of the individual's appraisal of a potential stressor (a charging rhino thus eliciting a stronger reaction than a balky hypertext link), the degree to which the individual perceives that he/she can control the situation, personality differences and social support mechanisms that affect individuals' reactions and adaptability, and the additive and cumulative effects of multiple stressors, including both negative and positive "life events." [3]

Compounding the effects of multiple stressors is the phenomenon known as the Zeigarnik effect, which confirms a common human experience: interrupted tasks tend to be remembered better than completed tasks, especially when the individual is highly involved in the task and when the interruption is unplanned. [4] This helps explain why staff and users of the bionic library, juggling a host of tasks, tend to carry around (and experience continuing stress from) their mental "to-do" lists, and why many find it difficult to derive much satisfaction from completed tasks.

Computers—or, more correctly, the ways in which people and organizations perceive, use, and relate to computers—are a potent source of stress, in the bionic library as elsewhere. Craig Brod, who introduced the term "technostress" in 1984, defined it as:

> ... a modern disease of adaptation caused by an inability to cope with the new computer technologies in a healthy manner. It manifests itself in two distinct and related ways: in the struggle to accept computer technology, and in the more specialized form of overidentification with computer technology. ... The primary symptom of those who are ambivalent, reluctant, or fearful of computers is anxiety. This anxiety is expressed in many ways: irritability, headaches, nightmares, resistance to learning about the computer, or outright rejection of the technology. Technoanxiety most commonly afflicts those who feel pressured—by employer, peers, or the general culture—to accept and use computers. [5]

As Brod suggests, technostress takes several forms. [6] Physical problems such as repetitive strain injuries, carpal tunnel syndrome, or back problems result from poor machine design or ergonomics. Computer anxiety [7] comprises several problems, ranging from temporary confusion over how to use a system, to feelings of being rushed or dehumanized by the computer, to the distinct and more pervasive fear known as computerphobia or technophobia. [8]

At the other end of the attitudinal spectrum, those who are highly positive about and involved with computers also experience technostress. This effect can be quite subtle, as when people attempt to match their thinking and behavior to that of computer systems, especially when the interface design does little to adapt the underlying functions of the machine to human perceptions and behavior. Margaret Stieg's description of technostress underscores these effects:

> To use any technology successfully, the user is forced to conform to its patterns. ... The computer has profoundly altered our sense of time, a change with many aspects. It has made possible greater efficiency, therefore greater efficiency is now required. The computer requires immediate response. Many of us find the blinking cursor tyrannical and somewhat unnerving ... . The acceleration of work the computer has brought inhibits reflection, which in turn inhibits understanding. All of these characteristics impart a greater sense of urgency to the worker, a compulsion not to waste time, a consciousness of stress. [9]

> *2008: Web interfaces have replaced the tyranny of the blinking cursor with multiple visible options waiting for a mouse click or other user action. This is a great improvement if the interface is well designed, but fast response times on high-speed networks and the growing number of computer-related tasks have combined to increase time pressure on most library users and staff.*

The same phenomenon is reflected in a recent handbook from a business consulting firm, intended to help corporate employees adjust to the fast-changing, computerized, global workplace: "... you need to operate with a strong sense of urgency. Accelerate in all aspects of your work, even if it means living with a few more ragged edges. ... Sure, high quality is crucial, but it must come quickly. You can't sacrifice speed. Learn to fail fast, fix it, and race on." [10]

Any change in a person's life, whether positive or negative, can produce stress. Technostress is especially likely to occur when new technologies are being introduced. Users of any computer system rely on their mental models to help them navigate among its various components and form assumptions about what will result from various actions. [11] When the technology changes, the old models no longer function; the more complex and less obvious the technology, the more difficult it is to form new ones. As Karl E. Weick points out in his analysis of this "sensemaking" process:

> New technologies ... create unusual problems in sensemaking for managers and operators. For example, people now face the novel problem of how to recover from incomprehensible failures in ... computer systems. To solve this problem, people must

assume the role of failure managers who are heavily dependent on their mental models of what might have happened, although they can never be sure because so much is concealed. ... Complex systems ... make limited sense because so little is visible and so much is transient, and they make many different kinds of sense because the dense interactions that occur within them can be modeled in so many different ways. [12]

These general aspects of technostress affect both staff and users of the bionic library; but because these groups are in somewhat different situations, they are treated separately in the following discussion.

Effects on Staff

By the nature of their work, librarians, like other members of the so-called "helping professions," are subject to chronic stress, from multiple sources, in situations over which they have (or perceive that they have) little control.   Several studies have documented this stress, and the related (though distinct and less common) phenomenon of burnout. [13] The effects of technostress on librarians have been described by Bartlett, Bichteler, Champion, Clark and Kalin, Dobb, Hickey et al, Hudiberg, Moreland, and Sievert et al. [14] The related problem of resistance to technological change in libraries has been addressed by Fine, Malinconico, Luguire, and Giesbrecht and McCarthy. [15]

Although technostress affects all areas of the library, staff in public services such as reference and interlibrary loan are most directly impacted by the convergence of online catalogs, electronic search and delivery systems, and remote access. The type of stress affecting reference staff in the increasingly electronic library has been characterized as having four components: [16]

- Performance anxiety: the feeling that one cannot use the systems effectively or help others to do so; particularly difficult for those whose high standards and service ethic extend to perfectionism.

- Information overload: the sensation of being overwhelmed by the volume of new systems, databases, interfaces, and service initiatives. According to one recent estimate, reference staff in a university library deal with "a minimum of 30-50 different types of software for various on-line, CD-ROM, and word processing uses." [17]

- Role conflicts: uncertainty and confusion about one's proper role—novice or expert, intermediary or teacher, reactive helper or proactive change agent.

- Organizational factors: the disparity between increasing demand (volume of work, rising expectations of users) and static or decreasing resources (insufficient staff, poor training, scarce or outdated equipment).

Common symptoms of technostress will vary among different staff members, but may include: feelings of isolation and frustration; negative attitudes toward new computer-based sources and systems; indifference to users' computer-related needs (as in "It's not my job to fix that printer");

self-deprecating thoughts or statements about one's ability to cope; an apologetic attitude toward users; and a definition of self as "not a computer person."

Those most intensively involved with developing and managing the bionic library are under particular stress. They are required to combine creative, long-range, strategic thinking with intense analytical concentration on technical details—not a novel demand in library management, but certainly a taxing one. One librarian, working on a consortium project for electronic document delivery, recently commented:

> As I observe [colleagues] losing energy, missing deadlines, forgetting assignments, and otherwise generally "melting down" from overwork and stress of all kinds, I'm beginning to wonder if we're seeing the beginning of a serious trend where significant numbers of middle- and upper-level library managers (if not those on the front lines, too) are just going to collapse from exhaustion. [18]

This description calls to mind the classic Type A behavior pattern, associated with coronary heart disease and described as "an action-emotion complex that can be observed in any person who is aggressively involved in a chronic, incessant struggle to achieve more and more in less and less time, and if required to do so, against the opposing efforts of other things or other persons." [19]

Effects on Users

Computerized library catalogs, periodical indexes, text/data systems, and Internet access are generally popular with students and faculty, especially with frequent users. [20] However, while technostress as such has not been formally studied among users of these systems as it has in other populations, there is ample evidence that users often do not understand the systems or use them well. Many searches in online catalogs produce zero results or very large results. Users are often unable to reformulate their search strategies effectively, and most do not use the systems' built-in "help" features. [21]

> ***2008:*** *Web search logs show the same patterns, plus a pervasive failure to distinguish whether a search box leads to the library catalog, a site-specific search, or a web search engine. Cognitive dissonance and stress occur when users get results that don't conform to their expectations.*

Unsuccessful searches, of course, may result from several factors: conceptual mistakes in search formulation, typographical errors, or items not being in the database; but whatever the causes, the stress contributing to and resulting from such performance problems detracts from the success of the bionic library. When considering the user's situation, we should remember that myths of the "ivory tower" notwithstanding, students and faculty tend to lead stressful lives. [22] Like the library staff, they bring a certain amount of baggage to the terminal.

However, unlike most staff, users have a convenient (if potentially self-damaging) means of stress reduction at their disposal: unless they are specifically required to use a certain system,

they can simply walk away and opt to use other sources. The often-quoted Mooers' Law is relevant here: "An information retrieval system will tend not to be used whenever it is more painful and troublesome for a customer to have information than for him not to have it." [23]

Like the traditional print-based library, which demands literacy and familiarity with various cultural cues, the bionic library presents special difficulties—and extra stress—to users who are not accustomed to computers and online retrieval or have specific needs that may not be met by standard user interfaces. [24] Any discussion of user group characteristics should bear in mind the danger of drawing erroneous conclusions from narrowly-focused studies, the problem of reinforcing negative images through stereotyping, the continuing spread and diffusion of computer knowledge, and above all the importance of individual differences. [25]

The research literature on gender and computer use discourages facile generalizations, but there is evidence that the stress and negative attitudes sometimes attributed to women as computer users may be more a matter of "computational reticence," a reaction to a traditionally male-dominated computer culture and to system designs that emphasize autonomy rather than connectedness, competition rather than communication.

In this sense, the networked nature of the bionic library appears to offer considerable promise. [26] Users from various cultures—particularly those with limited English-language skills or whose socioeconomic background has precluded contact with computers—naturally tend to respond to system cues in terms of their own preconceptions; system design and terminology should be carefully evaluated to reduce misunderstandings. Elderly users and those with disabilities may require special considerations in ergonomics and displays, but again this is an area where individual differences are paramount. One clearly disadvantaged group consists of new users, a sizable population on any campus and one that is replenished every year; relevant design strategies include providing a "novice mode" (discussed below) and choosing system terminology to match users' natural language. Those who design, manage, and teach electronic information systems should certainly be aware that users will be starting from many different points in their background knowledge and attitudes.

The individual using networked information systems from outside the library is often described in the literature as a "remote user," but for this discussion it is worth noting that from the user's point of view, he/she is central and the library is remote. Furthermore, for any individual, the "virtual library" means not only the local library's online system, but also other libraries' systems, and in fact the sum total of information resources to which he/she can connect in some meaningful way. [27]

> *2008: In my experience, participants in focus groups and usability studies often fail to make distinctions among various interconnected online systems, such as the library catalog, web pages, and vendor-provided databases. This is not a "mistake" on their part. It's a natural perception for non-experts, and designers need to address it.*

Users accessing a remote system from their office or home computers have the advantage of familiarity with their equipment, but may encounter problems if it is not compatible with the system being used. If they are new or infrequent users of the system, they may have special difficulties in understanding its structure and procedures. These users may also suffer from feelings of isolation as well as from the lack of information and feedback they could gain in a physical library through direct contact with other users or staff. [28]

Whether they are dialing in from home, connecting from a computer lab, or sitting at an OPAC terminal, people face a number of problems in using the complex of information systems that make up the bionic library. Most fundamental is the need to locate and identify the "library" itself. While it is generally easy to find the library building on a college or university campus, the corresponding electronic library may have several components (including a dial-up catalog/database system, a CD-ROM network, standalone page-image workstations, gopher and World Wide Web sites), each with a different point of contact and some not linked with the rest. In a sense, end-users in the 1990s are going through what library staff began to experience in the 1980s, adapting to one new system after another—and often to several at once.

> *2008: The mix of ingredients has changed somewhat,*
> *but the virtual library still remains fragmented. Even with*
> *most access being through the web, the library may still*
> *have multiple entry points, including alternative home pages,*
> *a presence on course pages, and perhaps an interface*
> *for mobile devices -- not to forget the tangle of networked*
> *and non-networked CD-ROMs.*

When the user does connect to one of these systems, he/she may have a hard time determining what it will do, or whether it is the best resource for the purpose, especially if the system is new or unfamiliar. Even in a well-organized multi-database system, users may not be aware of what file they are using; for example, 37% of students using a periodical index in one such system believed they were using the library catalog. [29]

The Internet offers further challenges; an academic librarian recently commented that:

> Information overload and search anxiety are two common problems here. ... The faculty feel overwhelmed by the information they have access to, and the disorganization of the Internet is a major factor for most of them not using it. They have learned to find information by browsing most of the time, but the Internet is too large to browse. [30]

A computer lab assistant in a large university library made a similar observation about student users: "The Internet just scares people to death. The Internet is so big and you get so lost." [31]

Once a user has settled on a particular information system, its interface may present further problems. Commands, error messages, and other terminology used in the system may not be understandable. Available commands and features may not be visible at a particular point.

Depending on the system design, the user may feel—and may in fact be—unable to control the system properly. [32]

Irene Sever provides a useful metaphor when she portrays the experience of new users of electronic information systems as a form of culture shock:

> Today's library, and even more that of tomorrow, has many characteristics of an exotic, alien environment: its language is unfamiliar and specialized and evokes incorrect associations. The form taken by the equipment creates difficulties which must be overcome: screen versus printed page, ... the need to press combinations of keys of baffling complexity instead of running a finger and an eye down an index page, the difficulty of mastering the order of functions necessary to run a simple "user-friendly" program ... . An electronic library cannot be "learned" through instant coaching on which keys to press or even through the diligent perusal of a manual. What is necessary is to grow into an electronic library environment gradually through socialization as well as through education. [33]

Reading this passage, librarians experienced in reference or user education will recognize similarities to the situation of first-time or infrequent users in a physical library. In fact, while the specific problems may differ, the phenomenon of "library anxiety" is not fundamentally different in this new setting. [34]

Implications for System Design

As quoted above, Craig Brod defined technostress as "a modern disease of adaptation caused by an inability to cope with the new computer technologies in a healthy manner." The disease metaphor is useful, but it can be misleading. Computer technologies are not inherently healthy or right; users who have difficulty adapting to them are not inherently diseased or wrong. We can do much to help the users adjust, but even more important is proper system design. [35]

Traditional mainframe-based information systems have generally been developed by large organizations: libraries, data processing centers, and commercial vendors. The designers have often been systems analysts who—in the best case—received feedback on user behavior from sources closer to the front lines, such as transaction logs, online user comments, customer groups, and usability labs. This "top-down" methodology has produced mixed results, the most successful systems coming from situations where user feedback was copious, frequent, and highly valued.

Recent developments in networking and client/server systems offer the potential for different kinds of products and development processes. The Gateway project at Ohio State University pioneered the concept of a library-developed front end tailored to students' research needs. [36] Moving beyond the limitations of any single interface, the Z39.50 standard permits the end-user to select from a variety of client software programs, much as he/she might choose a word processor, and use them to access a variety of information servers. The various Internet tools, particularly the graphical browsers now available for use on the World Wide Web, allow public-service librarians—and even users themselves—to design and construct front-end access systems

of various kinds. Web pages that combine instructional text and graphics with links to various information systems can offer flexible structures, helpful guidance, affective support, cultural cues, and communication mechanisms, making it easier for users to adapt to the new environment of the bionic library. [37]

> *2008: It's now clear that for all their advantages, web interfaces*
> *don't automatically produce understanding on the part of the user.*
> *Just to cite one example, the library where I work is now offering*
> *a hands-on orientation to its own web site. Like many other libraries,*
> *it's also redesigning that site with usability as a prime goal.*

On a larger scale, a consortium of federal agencies led by the National Science Foundation is currently supporting Digital Libraries Initiative projects as six universities, some of which aim to investigate usability as well as technical issues. [38]

Whatever the interface, the same essential design principles apply—clarity and consistency of presentation; visibility and predictability of functions; naturalness of commands and actions; and keeping the user in control. [39] The designer has some basic tasks to perform in order to reduce stress for the user. The first is to develop and communicate the "system image" which the user will need to internalize in order to function effectively. [40]

The more accurate and memorable the user's mental model of the system, the less stress he/she will experience in staying oriented and carrying out various tasks. The primary tools for conveying this kind of information—"welcome" screens, menus, screen headers, logos and other graphical cues—provide a consistent network of verbal and visual anchor points throughout the system, taking advantage of the user's powers of long-term memory and pattern recognition. A basic decision at this point involves whether to give the user a choice of novice vs. expert modes (the former offering a limited selection of options).

This is one way to address the needs of the inexperienced user, but forcing people to choose between the two may actually increase stress, especially if the novice mode actually cannot access certain commands or functions. A "command-driven/menu-augmented" design offers more flexibility in that a basic set of options can be displayed to all users, with advanced commands or shortcuts available to any user and explained in the system's online and printed documentation. [41]

> *2008: This was written with text-based systems in mind,*
> *but the same principle can be put to work in a graphical*
> *interface. For example, a web site may offer novice users*
> *a set of basic choices (Find Books, Find Articles, etc.)*
> *while providing other links calculated to attract the*
> *experienced user (such as the name of the library catalog).*

As suggested above, the electronic library presents users with many of the same cognitive problems as the traditional print-based library. Users must navigate through a different kind of

space—defined in this case by screens, words, links, icons, and graphics rather than walls—but the "wayfinding" process is similar. [42] The natural transfer of imagery from the physical library into the electronic library is suggested by many users' continuing fondness for the term "electronic card catalog," and by the proliferation of commercial online systems based on metaphors such as a virtual desktop, home, or town. Thus architectural concepts, such as rooms, maps, and signposts, are also appropriate tools for library system designers, whether or not the final interface is presented as a "virtual building". [43]

> *2008: An architectural mindset is still a good design tool, but web design has evolved its own set of norms that make "virtual building" metaphors less necessary. Similarly, younger users are much more likely to perceive the library catalog as a "search engine" than as an "electronic card catalog."*

An especially useful evaluation technique is to capture and study the comments of users, reflecting their awareness of and reactions to a system, much as designers will follow a naive user through a physical building, monitoring what the user is thinking and doing at various decision points.

Once the design process moves into developing specific features, the principal stress-reducing task is to control complexity without "dumbing down" the system by hiding or omitting important functions.

> *2008: The state of the art in user-centered design has advanced considerably since this was written. Web usability has become a discipline in itself, and it's standard practice to conduct usability studies as part of a major library web site project.*

The traditional admonition to "keep it simple" presents only one side of the equation; if carried too far, it leads to an impoverished result. During prototype testing of Microsoft's "Bob" operating-system interface, a novice user was shown some of the cartoon animals that serve as guides in the system. As the designer recalled, "This guy was very emotional about it—he grabbed my arm. He said, 'Save all the money on the manuals, just give me this duck to always be there and tell me what to do.'" [44] There may be a future for "social computing" interfaces in the bionic library, [45] but if a bird is in charge, perhaps it should at least be an owl.

As Donald Norman has pointed out, one of the prime features of any designed artifact is visibility: "Make things visible on the execution side of an action so that people know what is possible and how actions should be done; make things visible on the evaluation side so that people can tell the effects of their actions." [46] The designer walks a tightrope between overcomplexity and oversimplicity in developing displays of search results, hypertext links, or other information. Disorganized complexity is an obvious cause of stress, but the temptation to simplify and use low screen densities everywhere can lead to users missing important material or

having to page through multiple (though perhaps elegant-looking) screens. Edward Tufte offers some useful guidance in this area:

> Confusion and clutter are failures of design, not attributes of information. And so the point is to find design strategies that reveal detail and complexity—rather than to fault the data for an excess of complication. Or, worse, to fault viewers for a lack of understanding. [47]

> User interfaces with high information resolution are ... an appropriate match to human skills ... [and] frequently optimal. If the task is contrast, comparison, or choice—as it so often is—then the more relevant information gracefully within eyespan, the better. Low-density displays, with screens scrolling scrolling scrolling, require users to rely on visual memory—a weak skill ... . Low-information displays lead to breaking up of work into user-irritating micro-steps, with a consequent loss of coherence ... . A common question asked by users of data-thin screens is "Where am I?" [48]

Tufte's recommended solutions include layering and separation of data. In fact, the complexity of library catalogs and database systems generally requires that available commands be presented in layers, with a command available to call up a display of advanced or seldom-used functions. Likewise, search results are often presented in a series of increasingly detailed levels. Tufte also recommends arranging data in small multiples, laid out so that the user can readily see patterns. The prevailing design of World Wide Web pages shows a historical evolution from lengthy text paragraphs sprinkled with links, to greater reliance on list-type presentations, arranged either vertically, or horizontally with graphic separators.

> *2008:* *The designer's tool kit has further evolved to include*
> *pop-up, pull-down, and flyover menus, mouseover links, frames, etc.*
> *Obviously any of these tools can be used well or abused.*

The verbal elements of presentation are also worth considering. While we have come a long way from barking at the user with messages such as "Invalid command code," designers should remember that users will experience less stress if the system speaks to them in a way that is, if not friendly, at least civil, and above all comprehensible.

User errors are a prime source of stress, whether these are simple typos or the result of search strategies and assumptions that do not match those of the system's designers. Forgiveness should be a prime design goal, achieved through such means as providing multiple access points to items, offering both browse and keyword search options, trapping initial articles and other common errors, normalizing search input, accepting alternative command synonyms (including the NISO Common Command Language), and providing helpful prompts in case of zero results or large result sets. In 1994, the Research Libraries Group's Eureka system was enhanced with a package of changes collectively termed "Do what I mean;" these forgiveness features have reduced user errors by 80%. [49]

Implications for System Management

Like the bionic library's designers, its managers can do much to reduce stress for users and staff. A prime goal in this area is coherence. As mentioned above, the electronic portion of a typical academic library presently resembles a loose aggregation of disparate elements rather than a tightly knit system. Whatever the manager can do to promote both the sense and the functional reality of a unified system—through judicious selection of resources, consolidation and linking of resource menus, and carefully presented publicity and instructions—will benefit both the students and faculty who use the system, and the staff who explain and interpret it.

The greater control users feel over a system, the less stress they experience from it. This sense of control derives largely from the system design, but is also affected by how a system is managed. For example, incremental changes, announced both through advance publicity and at the point of use, are less likely to be disruptive than revolutionary changes made with no advance warning.

> *2008: My candidate for the Mt. Everest of system changes*
> *is the California Digital Library's transition to new versions*
> *of the Melvyl catalog and 34 article databases. This process,*
> *involving intricate planning, user input from all nine campuses*
> *of the UC system, and a great deal of communication, took*
> *at least three years and was completed in 2003. For details,*
> *see CDL's A&I Transition page*
> *(http://www.cdlib.org/inside/projects/a-i-trans/).*

A closely related goal is to humanize the technology as much as possible. As John Naisbitt predicted in 1982, "The more high technology around us, the more the need for human touch." [50] The "high tech/high touch" approach takes advantage of users' natural tendency to relate to computers as if they were people. To this end, any text in a system—including banners, news screens, introductions, instructions, error messages, etc.—should be written in a direct, positive, natural tone. Wherever feasible, managers should implement a "comment" or "mailto" function, offering users a chance to send feedback. Even if it is not possible to reply to every comment, posting a "frequently asked questions" file will give users a sense of a dialogue with the machine, providing benefits that go beyond the information communicated.

Training, documentation, and online help are often cited as key elements in supporting users. These devices are certainly essential and require careful design, even though they may be infrequently used. There is some evidence that human help at in-library terminal locations improves user performance and increases satisfaction. [51] This is an expensive service to offer on a full-time basis, but some libraries have assigned reference desk staff to "float" through CD-ROM and OPAC areas during high-use periods, and some public libraries have begun using volunteer docents to provide this type of help.

Managers of the bionic library can also take various actions to reduce stress for staff members. The most obvious is to equip staff not only with computers and network connections, but also with the necessary skills and competencies to function in the new environment. [52] Roy Tennant points out that "Instruction and training are the cornerstone of any effort to retool library

staff to meet the challenges and opportunities of electronic-based information." [53] Managers can further the success of training through selection of appropriate methods, sensitivity to the individual "starting points" and learning styles of staff, and provision of sheltered space and time for learning. [54]

Another important managerial task is to foster enthusiasm for the new information systems and a positive attitude toward change—something most effectively done by example.

One of the best ways to overcome technostress is to learn, and one of the best ways to learn is to teach. The experience of library staff at The University of Texas at Austin, who volunteered to teach the Internet and other computer skills to several thousand users, suggests that aggressive involvement in such teaching can reduce the effects of stress and increase self-confidence as well as technical skills. The developers of this program have also contributed to stress reduction by fostering a culture in which both trainers and students are engaged in a joint learning experience, thus reducing the trainers' fear of system glitches or difficult questions. [55]

Conclusion

Technostress is part of the price we pay for living in a time of revolutionary and dramatic change. The bionic library embodies both print and electronics, with all the social and cultural structures that surround them: the old and the new ways of learning about the world and connecting with other people. This hybrid institution, full of new devices and continually "under construction," makes many demands on its users. We can learn much from the stress that people naturally experience in this situation. The success of the bionic library will be determined not only by economics and technology, but also by the extent to which its designers and managers can shape it as a tool for human use.

Notes

[1] Harold Billings, "The Bionic Library", *Library Journal* 116 (October 15, 1991): 38-42. Reprinted in Harold Billings, *Magic & Hypersystems: Constructing the Information-Sharing Library* (Chicago: ALA Editions, 2002) (http://tinyurl.com/6452ey).

[2] Hans Selye, "The Stress Concept and Some of its Implications," in Vernon Hamilton and David M. Warburton, ed., *Human Stress and Cognition: An Information Processing Approach* (Chichester; New York: John Wiley and Sons, 1979), 11-32.

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[27] As an example, 18% of the items gathered in preparation for this chapter were obtained directly from electronic sources: WWW and gopher sites, periodical index systems with e-mail and fax delivery of articles, and e-mail messages including a survey of PACS-L listserv subscribers. Of the print items obtained from four different libraries, approximately 80% were identified and located using online catalogs and computerized indexes, the rest through browsing.

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[29] Data gathered by the author from users on library terminals at the University of Texas at Austin. Remote users, having to select databases from menus, would likely be better oriented. Screen designs were subsequently modified to provide more prominent indication of the database being used.

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[31] Quoted in Mary Lynn Rice-Lively, "Trip to Bountiful: Personal Snapshots of the Campus Computing Center," unpublished paper for graduate course at the University of Texas at Austin (June 9, 1994), 20.

[32] For a review of the extensive literature on such problems, see Martha M. Yee, "System Design and Cataloging Meet the User: User Interfaces to Online Public Access Catalogs," *Journal of the American Society for Information Science* 42 (1991): 78-98.

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[34] Constance A. Mellon, "Library Anxiety: A Grounded Theory and Its Development," *College & Research Libraries* 47 (March 1986): 160-165.

[35] Rob Kling and Margaret Elliott, "Digital Library Design for Usability," in *Digital Libraries '94: Proceedings of the First Annual Conference on the Theory and Practice of Digital Libraries* (June 19-21, 1994, College Station, TX), accessed on the World Wide Web (http://www.csdl.tamu.edu/DL94/paper/kling.html); Shneiderman, *Designing the User Interface*; Robert Waite, "Making Information Easy to Use," *ASIS Bulletin* 9 (December 1982): 34-37.

[36] Philip J. Smith and Virginia Tiefel, "The Information Gateway: Designing a Front-End Interface to Enhance Library Instruction," *Reference Services Review* 20 (Winter 1992): 37-48.

[37] As of this writing, a useful collection of pointers to "Innovative Internet Applications in Libraries" is being maintained by Ken Middleton at the Todd Library, Middle Tennessee State University (http://www.wiltonlibrary.org/innovate.html). The "Electronic Classroom" of the Science and Engineering Library, University of California, San Diego (http://web.archive.org/web/*/http://sehplib.ucsd.edu/electclass/classroom.html), offers an exemplary set of course-specific home pages, many developed through partnerships between librarians and teaching faculty.

[38] To access these projects via the World Wide Web, use:
http://dli.grainger.uiuc.edu/national.htm
http://www.dli2.nsf.gov/

[39] Anyone involved in designing a system should read Donald A. Norman, *The Psychology of Everyday Things* (New York: Basic Books, 1988) and *Things That Make Us Smart: Defending Human Attributes in the Age of the Machine* (Reading, MA: Addison-Wesley, 1993). For a useful discussion of library catalog design principles and procedures, see Walt Crawford, *The Online Catalog Book: Essays and Examples* (New York: G.K. Hall, 1992), 49-82.

[40] Norman, *The Psychology of Everyday Things*, 189-191.

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[47] Edward Tufte, *Envisioning Information* (Cheshire, CT: Graphics Press, 1990), 53.

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