Virtually all students of the information age suggest that the nature of work, and work arrangements, will be dramatically impacted by what Daniel Bell has defined as "intellectual technology." That is, the emergence of a "computer-assisted 'theoretical knowledge' universalized by telecommunications" (Archer 1990, p. 107) has the potential to revolutionize the nature of work in the post-industrial era. As H. V. Savitch (1988, p. 5) recently noted: "Boiled down, post-industrialism is a broad phenomenon that can be gauged along multiple dimensions. It encompasses change in what we do to earn a livelihood (processing or services rather than manufacturing) as well as how we do it (brains rather than hands) and where we do it (offices rather than factories)."

Ironically, while Bell (1980) argues that the post-industrial era may well have a "decisive" impact on "the character of the occupations and work in which men engage" (p. 501), he offers very little serious analysis of how he feels the technology will impact on the workplace. Numerous scholars have noted this blindspot in Bell's scenario, and have gone further to suggest that his brief remarks on the question are hopelessly utopian and too often contradictory. Margaret Archer (1990) notes that the result is an unconvincing and casual attempt to rewrite Emile Durkheim's (1984) classic Division of Labor in Society "with a happy ending" (p. 101).

A careful student of Bell's work will find it full of provocative and often contradictory comments on the nature of work in the post-industrial era, but little can be found in the way of thorough

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Editors Note: The above article and the two that follow were presented as papers at the Association of College and Research Libraries' 7th Conference in Pittsburgh, PA, on March 31, 1995.
projections. Perhaps the most forceful and suggestive remark Bell (1989) has made on this fundamental question is the following:

If character is defined by work, then we shall see a society where "nature" is largely excluded and "things" are largely excluded within the experience of persons. If more and more individuals are in work situations that involve a "game between persons", clearly more and more questions of equity and "comparable worth" will arise. The nature of hierarchy in work may be increasingly questioned, and new modes of participation may be called for. All of these portend huge changes in the structures of organization from those we have seen in older models (p. 171).

The implication seems to be that the post-industrial era will mandate an end to the rigidly hierarchical organization structure so characteristic of contemporary life, and will rather naturally lead to the undermining of the long-standing and institutionalized exclusionary and discriminatory practices so commonly reflected in gender and racial labor market segmentation in 20th century America. Even more clear is the fact that the post-industrial era will dictate a change in "the places where people work" and "the kind of work they do" (Bell 1973, p. 134).

Judith Perrole (1991) has noted that Bell's adherents "argue that computers will enhance the quality and working conditions of intellectual labor, freeing humans from the drudgery of routine mental activity and freeing them for creative thought" (p. 222). They do not fear the computer, for they endorse Bell's belief in "growing egalitarianism" in the post-industrial workplace, and insist that "knowledge engineering applications should not reduce the wages, autonomy, or skill of employees in the professional, managerial, and higher level technical categories" (p. 223).

While many students of the post-industrial workplace have found Bell's suggestion that the information age will mandate new organizational structures of use in analyzing our future, others are troubled by his adamant opposition to affirmative action and quota programs designed to reduce deliberately the extent of racial and gender discrimination in the workplace. While all hope that his optimistic conclusion that the end of smokestack America and the emergence of the information and service economy will herald the creation of a safer, more rewarding, and more meritocratic working environment, many still fear that long-standing discriminatory and exploitative workplace relationships will remain in place unless deliberate and forceful action is taken to eliminate these practices. It should come as no surprise to find that women and people of color are less sanguine about the post-industrial workplace than are well educated white males.

Contra-Bell: Harry Braverman and the Degradation and Deskilling of Work in Post-Industrial America

One year after the publication of Bell's The Coming of Post-Industrial Society sociologists of work encountered another book which was to stimulate a firestorm of debate and a tidal wave of research. Harry Braverman's Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century (1974) appeared at the very moment when workers and sociologists of work alike were awakening to the problems and potential of the post-industrial workplace. The stage was set for a major confrontation between Braverman and Bell, for Braverman's work directly contradicted Bell's scenario in almost every particular. That is, where Bell forecast a significant reorganization of the workplace in the new "game between persons," Braverman saw only further centralization and management authoritarianism. Where Bell projected a workforce that would be considerably "upskilled," Braverman insisted that the
workers would be further "deskilled." Where Bell glimpsed only more rewarding and fulfilling work, Braverman noticed intensifying worker alienation and the steady "degradation" of work. What became all too clear to serious students of the sociology of work in American society was that one of them had it wrong. But which one?

The empirical work stimulated by the obvious contradictions in the theories put forward by Bell and Braverman has grown into a significant corpus of scholarship which is increasingly hard to concisely categorize (for a variety of maps see Kai Erikson and Steven Vallas, 1990). One should not be surprised to learn in advance that the results of empirical work designed to test the theses put forward by Bell and Braverman have tended to run at some highly eccentric angles.

In trying to sort out this huge, and rapidly growing, body of research we might best begin with the observation that Braverman's ideas initially met with a surprisingly positive reception given their dark and foreboding predictions about work in post-industrial America. Within a decade the "Braverman thesis" had generated a large body of research along a wide ranging front all gathered, by students of the subject, under the rubric of "the labor process school" of the sociology of work. Braverman had insisted that what was most striking about the post-industrial workplace was its similarities and continuities with the industrial workplace. Building on Marxist scholarship, he reminded his readers that the essential dynamic of the capitalist system was the profit motive. He carefully documented the extent to which capitalists tended to maximize profits by exploiting workers. Braverman suggested that this was most commonly done by "Taylorizing" work. By this he meant that employers were always tempted to simplify work tasks, utilizing a variety of systems analysis techniques, and once this process was complete management would rob the workers of their skills and replace skilled workers with a more pliant and less expensive workforce. Braverman viewed the emergence of information technology as "an integral part of the struggle between labor and capital" which lead to "proletarianizing" of the workforce (Webster and Robbins, 1986, p. 129). The outcome, virtually inevitable, was that workers would be steadily and consistently deskilled and the quality of work in American society would be continuously degraded. He implied that professionals were not immune to this deskilling and degrading of their work, and he suggested that it was only a matter of time before professionals would encounter the fate of craft workers in the capitalist workplace.

Immediately upon publication of Braverman's work a large number of scholars, skeptical of Bell's upbeat scenario for the post-industrial workforce, set out to test the "Braverman thesis" in every corner of the post-industrial workplace. Judith Perrole (1991, p. 225) summarized the research agenda in this way:

If information itself is seen as a commodity produced for profit by the rational organization and mechanization of intellectual labor, then information can be produced by the computer in the same way that products were made by the factory machinery of the first industrial revolution through the alienation of laborers from the production process.

Other studies seemed to confirm much of the Braverman thesis. For instance, Philip Kraft (1979) studied the impact of IT on computer programming and concluded that:

It is clear . . . that programming has experienced a steady process of fragmentation and routinization while programmers as a group have experienced a rapid deskilling. These trends call into question the major claim of technology advocates,
that increasingly sophisticated technology in the workplace creates jobs that are better than those it displaces (p. 17).

Kraft's conclusions were supported by Aronowitz and DiFazio (1994, p. 21), who noted that the development of computer-aided software now threatens "the most glamorous of the technical professionals associated with computer technology programming . . . ." Although there will remain a need for "superprogrammers" to create new and innovative software, the majority of computer programmers are likely to be replaced by intelligent software that is already capable of automatically writing most of the low-level, routine programming turned out by today's programmers (Aronowitz and DiFazio, 1994, p. 21). They gloomily concluded that computer technology is now so sophisticated that an increasing number of white collar jobs are at risk (Aronowitz and DiFazio, 1994):

> each generation of technological change makes some work more complex and interesting and raises the level of training or qualification required by a (diminishing) fraction of intellectual and manual labor, for the overwhelming majority of workers, this process simplifies tasks or eliminates them, and thus eliminates the worker (p. 20).

The logical result of Aronowitz and DiFazio's dark vision of a world headed inevitably towards massive underemployment - the ultimate end of deskilling - is summarized by the following apocryphal story that captures our most basic fears of information technology. In this story the factory of the future's entire staff consists of one employee and a dog. The employee's sole responsibility is to feed the dog. The dog is there to make sure that the employee does not touch any of the machines.

It must be quickly noted that the picture has become less clear with time. As more and more studies have accumulated testing the Bell and Braverman theories, we have been able to develop a more detailed and complex picture of the emerging post-industrial workplace which confirms (and undermines) aspects of both theories. Paul Attewell (1987) summarizes the evidence as follows by pointing out that Braverman's "notion that deskilling is the dominant tendency across the whole economy" is not borne out by the evidence (p. 325). He notes that while "few scholars believe that deskilling never occurs" it is apparent that deskilling is not the "secular trend" identified by Braverman, and that it has not been the fate of the working-class in the post-industrial era (p. 341). William Form (1987) agrees and notes that while deskilling does, indeed, occur, it does not seem to be the dominant theme in the post-industrial workplace. ³

Thus, we find that the research is as contradictory in 1995 as it was in 1974. As Magali Larson (1980) noted early in the debate, "we may now be facing either the proletarianization of new social categories . . . or the ascension of a new class [of information professionals] or both things" (p. 171). Judith Perrole (1991) noticed the same ambiguity in the current workplace environment when she wrote:

> In both an economic and cultural sense, and regardless of the outcome of the deskilling debate, the spread of knowledge engineering will devalue some kinds of mental labor. In the economic sense, professional, technical and managerial employees who do the kind of thinking that machines do (or that inexpensive labor does with machines) will see a relative reduction in their wages and salaries unless they can acquire new tasks to protect their existing areas of expertise from automation (p. 231).

Part of our uncertainty about the effect that information technology has had on the nature of work can be traced back to the considerable uncertainty about the definition of our key dependent variable:
skill. Braverman, as Attewell (1987) notes, developed his argument by contrasting two ideal types of worker - the craft worker and the detail worker. As Scarbrough and Corbett (1992, p. 103) have correctly pointed out, this formulation is ambiguous because neither specialization nor routinization necessarily imply a deskillling of work. About all we can say is that the introduction of information technology changes the nature and type of skill used in the workplace, but without a shared, operational definition of skill, we have no means of judging if the net effect of computerization has been, in fact, to deskill the workforce. In the next section we will change our focus and look at individual cases in which information technology has been used to change the nature of work. By focusing on the way in which the workforce is involved in information technology projects, we will, hopefully, be able to arrive at a more realistic and balanced view of information technology's effect on the workplace.

She was troubled by the extent to which Bell's views on these questions were limited to "sociological abstractions," and she launched an ambitious series of empirical studies of the changing American workplace in order to:

understand the practical problems that would have to be confronted in order to manage the new computerized workplace in ways that would fulfill the lofty promise of a knowledge-based society and to generate knowledge that would be instructive to those charged with that managerial responsibility (p. xiv).

The result, after ten years of work, was the publication of her extremely influential book entitled In the Age of the Smart Machine: The Future of Work and Power (1988). In this work Zuboff concludes that information technology promises to transform the American workplace fundamentally. She readily admits that Braverman's insistence that the dynamic of organizational management tempts managers to extend their "exclusive control of the organization's knowledge base" is clearly in evidence, but that the "informated" workplace promises to undermine such rigid and hierarchical control as it becomes increasingly clear to managers that the old emphasis on certainty and control is becoming decidedly unproductive. That is, while she acknowledges the validity of Braverman's insistence that managers attempt to generate profit by exploiting labor, she also insists that Daniel Bell is correct in arguing that the new "computer-mediated" workplace demands a new approach to organizational structure.

Based on her careful empirical work she concludes that while management may well resist change in the organization and control of the production process, the post-industrial era mandates "innovative methods of information sharing and social exchange" that will eventually lead to "a deepened sense of collective responsibility and

Shoshana Zuboff on the Informed Workplace of the Information Era

In 1978, Harvard Business School Professor Shoshana Zuboff set out to attempt to resolve the contradictions inherent in the theories of Daniel Bell and Harry Braverman. Convinced that the American workplace was on the "edge of a historical transformation of immense proportions" as the result of the emergence of "information technology" in the workplace, Zuboff (1988) wanted to understand the way in which worker's lives would be transformed in the post-industrial era:

assumptions about knowledge and power, their beliefs about work and the meaning they derived from it, the content and rhythm of their social exchanges, and the ordinary mental and physical disciplines to which they accommodated in their daily lives (p. xiii).
joint ownership, as access to ever-broader domains of information lend new objectivity to data and preempt the dictates of hierarchical authority" (p. 7). She argues that the informed organizations of the post-industrial era will transcend the "stale reproduction of the past" and will, instead, take advantage of this "historic opportunity to more fully develop the economic and human potential of our work organizations" (p. 7).

The key insight in Zuboff's work seems to be the notion that while the bottom line will continue to control organizational structure and management style that same attention to the profit motive will mandate the more affirmative and participatory workplace organization hinted at by Daniel Bell. In short, the old hierarchical and rigidly centralized management structures that so characterized American capitalism in the industrial era will prove inefficient in the post-industrial era, and the profit motive will drive managers to adopt more participatory styles.

Evidence for Zuboff's Informed Organizations

For the last century the traditional, hierarchical, "command and control" organization has been unrivaled as the dominant organizational model for both profit and nonprofit enterprises. The hierarchical organizational provided a means of dealing with large and complex organizations; it provided elaborate mechanisms for monitoring and supervising employees so that they did not shirk their duties or take advantage of their employer, plus it provided coordination across independent tasks and functions (Pfeffer, 1994, p. 43). Within the last decade, however, advances in information technology and research on worker performance have caused most management experts to question the effectiveness and efficiency of the venerable bureaucratic model.

Gifford and Elizabeth Pinchot summarized the main strictures of the traditional organization as follows (1993):

In today's complex and intelligence-intensive world economy, it is becoming obvious that, in organizations as in nations, totalitarian governance and bureaucratic management are incompatible with high performance. Bureaucracy is dying because it produces organizations that lack the systems for assembling a collective intelligence to think both globally and in local detail, both near-term and long-term, and in terms of both freedom and community (p. xvi).

Although the details of the new organizational model remains unclear, there is little doubt that our nineteenth-century organizations are no longer capable of coping with twenty-first century challenges (Tomasko, 1993, p. 1). After losing more than $32 billion in 1992 alone, even the former masters of hierarchical coordination such as IBM, Sears, and General Motors are now struggling to replace their bureaucratic and hierarchical organizational structures with decentralized, participative, and team-oriented models (Loomis, 1993, p. 37).

What Tapscott and Caston (1993, p. 13) refer to as the "new organizational paradigm," aims at nothing less than a complete rethinking of worker-management relationships. The reasons underlying Tapscott and Caston's rather startling assertion can best be understood by looking at one of the most famous case studies in management history.

In the 1980s General Motors spent $40 billion to automate its factories. In fact, GM spent enough money on capital equipment to have purchased both Honda and Nissan (Pfeffer, 1994, p. 8). An analysis of the results of this massive investment revealed that (McKersie and Walton, 1991):
First, the performance of the GM plant with high technology but no work reform was not significantly better than that of the low-tech plant that continued traditional organizational practices. Advanced technology by itself clearly made little difference. Second, the NUMMI and Honda plants, with their moderate investments in technology but fundamentally reformed work organizations, dramatically outperformed GM's high-tech/traditional plant. Both required approximately 45 percent less time to assemble a car and produced 45 percent fewer quality defects than the GM plant. Third, compared with the NUMMI and Honda plants, Nissan's slightly more automated and slightly less advanced organizational design achieved comparable quality but significantly lower productivity. Again, the technology advantage appeared to be more than neutralized by a lag in organizational upgrading. The upshot is that advanced technology by itself fails to achieve performance gains. Only when innovation in work organization accompanies technological innovation do we see significant performance advantages (pp. 249-250).

The NUMMI plant is particularly noteworthy. Originally the plant was run in the same authoritarian and bureaucratic fashion that auto assembly plants have used since Henry Ford started assembling Model Ts. When a new system of management - based on teams, worker participation, extensive training, and the elimination of special parking and cafeterias for management - replaced the traditional command and control structures, productivity almost doubled. The importance of the NUMMI case is that the dramatic gains in productivity, worker satisfaction, and reduced absenteeism, were achieved with the same physical plant, the same employees, and virtually the same technology (Pfeffer 1994, p. 69-71). Because so many of the usual external variables remained unchanged, an MIT study was able to conclude that the organizational features of the NUMMI plant accounted for up to half the performance differences (Katz, Kochan, and Gobeille 1985, pp. 98-99).

Although the results of the NUMMI study remain the most startling, the failures of the traditional bureaucratic organizational structure have been well-documented in many other studies (Scarborough and Corbett, 1992, p. 122; Heller, 1989; and Piore and Sabel, 1984). There is clearly enough evidence to concur with Peter Keen's observation that (1991):

IT is most effective when it redeploy human capital -- when it cuts out unnecessary bureaucracy, leverages skills, and transforms the quality of work in an organization. If jobs stay the same or are tinkered with at the margin, innovation will be damaged. If jobs change but people either will not or cannot, stress, alienation, and incompetence will result. If jobs and people change, but not managers, expect a loss of trust and respect (pp. 29-30).

As Jeffrey Pfeffer (1994, p. 113) observed, "It seems almost axiomatic that the work force is unlikely to be used efficiently and effectively in an atmosphere of distrust or adversarial relations."

Organizational Inertia: Power, Technology and Organization Structure

Despite the mounting evidence that the principles of scientific management are flawed, systems designers, in all too many cases, persist in designing systems that use information technology to reduce work to drudgery - an almost certain recipe, in the opinion of Scarbrough and Corbett, for failure in knowledge organizations (1992, p. 132). While few would question that "the logic of computers and networking makes obsolete many of our cherished notions of the past," research on the utilization of information technology in corporations has repeatedly found that "the main impact of computing has been to reinforce existing structures of communication, authority and power in organizations" (Kraemer, 1991, pp. xi, 172). Kraemer continues, "although information technology has long
been viewed as capable of bringing about organizational change, it has never been shown to play this role in reality." (1991, p. 167)

While we may, on an intellectual level understand that the "emphasis on authority and control is antithetical" to building the kind of organization that can thrive in today's environment, the realization that most organizations, including libraries, continue to retain their hierarchical and bureaucratic structures, clearly indicates that the changeover is both complex and difficult. First of all, any change away from the command and control approach used in traditional organizations would overturn the social relations and power in organizations. Because of this political dimension, those groups whose power base is threatened have a vested interest in maintaining the status quo - and with it, their authority. As a result, the transformation of organizations into decentralized, team-based, participative organizations remains more popular in management literature than in practice (Scarborough and Corbett, 1992, p. 89).

In addition to the political dimension, the task of converting a traditional organization into a flexible organization more attuned to the needs of the Post-Industrial economy is further complicated because we cannot change just one aspect of an organization. If we want the new organizational structure to work, we must simultaneously change the social, technical, and cultural systems as well (Weisbord, 1987, p. 66).

Some Tentative Conclusions

We can now see the outlines of an emerging consensus. While Braverman's thesis explains the industrial workplace, it is Daniel Bell who appears to have glimpsed the changes mandated by the post-industrial era. Management scholars agree with Zuboff when she insists that the very dynamic of a capitalist system will mandate this change as managers seek to increase productivity and profit margins. While we are clearly in a transitional stage where both management styles are in evidence, it seems clear that computer-mediated work in the informated workplace will require a "major restructuring of work-roles" (Strassmann, 1985, p. 245). Larry Hirschhorn (1984) saw the same trend when he demonstrated that "postindustrial skill" will demand that workers be constantly involved in "the process of active learning, direct intervention in the machine system, and progressive widening of their knowledge" (p. 163). Lee Sproull and Sara Kiesler (1991), after an intense study of the networked workplace, concluded that while we are clearly in a transitional phase, the wave of the future appears to mandate:

a flexible, internally motivated, continuously learning work force; a strong internal culture to support information sharing and participation in problem solving; delegation or shared responsibility in recognition that dispersed activity requires local action and flexibility...and creation of dynamic procedures, structures, and groupings to amplify expertise and technology (p. 175).

Both the technological optimists and the technological pessimists posit extreme assumptions about technology and human behavior. While the "simplicity of these storylines gives them great clarity and makes them easy to grasp," they both err in their assumption that technology is the dominant force in shaping organizations (Dunlop and Kling, 1991, p. 28). The available evidence indicates that technology is only one of the many factors that influences an organization. By polarizing the debate over the organizational implications of computerization, both sides have ignored what research studies have repeatedly discovered: that the way the technology is implemented is as important as the technology itself.

Because organizational goals, organizational culture, social mores, and technology are all interconnected, organizations cannot simply
implement, without any planning, a particular piece of technology. "Research has shown," Venkatraman (1991) points out, that organizations "must do so in context, that it must consciously align its business strategy and its organization with its technology" (p. 122). The importance of this point is underlined by numerous research studies that provide clear evidence that advanced technology, by itself, will not lead to performance gains. According to Richard E. Walton (1989), "it is foolhardy to follow a design process which assumes that the technology will automatically elicit the appropriate organizational response" (p. 149). In his review of research that examined the links between productivity and technology, Paul Osterman (1991) concluded that "high-technology strategies, in the absence of significant changes in human resource practices...produce no significant productivity or quality improvements" (p. 225). The organizations that will truly excel in the future will be the organizations that discover how to tap people's commitment and capacity to learn at all levels in an organization.

Thus, once again we must conclude that the picture is not nearly as clear as some would have us believe. Information technology does, indeed, appear to be a fundamental reality in the future of library and information services in the United States and many other nations throughout the world. However, we have little foundation for claiming that we know much about the direction or extent of the impact of information technology in libraries. We have only begun to glimpse the promise and the pitfalls, and it remains to be seen whether the library profession can bring the technology, a clear sense of mission, and the competent personnel together in a successful attempt to bring library and information service into the post-industrial era.

Despite the need for caution, it does appear clear that organizational structures and management styles will have to change. Hierarchical and centralized management structures will be steadily undermined by the constant demand for speed and flexibility. Shoshana Zuboff's (1988) claim that organizations will, by necessity, become more participatory and open seems supported by research in both the sociology of work and information technology. And, Hirschorn's (1984) insistence that such change will offer more rewarding and challenging opportunities for information professionals is also persuasive. With enhanced opportunity will also come new responsibilities. Library and information professionals will find that they must be constantly involved in both "the learning organization" and the decision making process. Information technology is no panacea. But properly deployed, it offers the potential to enhance both the professional opportunities of librarians and the quality of service offered to the clients who depend upon their services.

NOTES

1) Early pages of this essay are adapted from Chapter Five of Michael H. Harris and Stan A. Hannah, Into the Future: the Foundations of Library and Information Services in the Post-Industrial Era, (Ablex, 1993).

2) A very useful and thorough treatment of the "labor process" school will be found in Paul Thompson's The Nature of Work: An Introduction to Debates on the Labor Process (1983). Thompson traces the history of Braverman's work, relates it to other theories, and provides a balanced assessment of its progress. The most aggressive empirical defense of Braverman can be found in Zimbalt (1979), and more recent assessments of the explanatory power of the "Braverman thesis" can be found in Attewell (1987), Form (1987), and Perrolle (1991). For an imaginative, but generally ignored, application of Braverman to librarianship see Estabrook (1981). Finally, for a current comparison of the various "sociologies" of work see Grint (1991), and for a troubling reaffirmation of Braverman see Stanley Aronowitz and William DiFazio (1994).

3) See also M. Baethge and H. Oberbeck (1989); and P. B. Doeringer et al. (1991).
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When examining the history of anything some fundamental questions spring to mind: What drives history? How is the human element perceived in relation to the world? Does an optimism or a pessimism appear to govern the course of human development? These questions are certainly foremost in any inquiry into the role technology has played in human action. If attention is focused on the history of libraries and information, these questions are central, and they are joined by another, equally essential one: is this history convergent with or divergent from the path taken by history generally? In other words, do thought and action in the profession of library and information science reflect the same influences, embody the same prejudices and hopes, embrace the same foundations, as the history of the societies of which we are part? Or does the profession follow uncritically the ideas and ways of thinking that are dominant at any point in time?

In order to attempt answers to some of these later questions, what technology is must be clarified. The next step is to look, at least cursorily, at some moments from our past to see if the profession's notion of technology has been in concert with society's. Then, and only then, can the philosophy of technology be examined in order to glean what library and information science can learn from the serious thought that has been given to the place technology has in today's world.