COMPUTING AND ORGANIZATIONS: WHAT WE KNOW AND WHAT WE DON'T KNOW

An examination of the literature on the effects of computing in organizations reveals that these effects are more complicated and diverse than has traditionally been assumed.

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A few issues in the evolution of computing draw equal attention from specialists and from the public at large. Nearly everyone, for example, wants to know what kind of social world is emerging from the continuing permeation of organizational life by computing. The most urgent of these questions are socioeconomic—for instance, whether new technologies will reduce employment, enhance organizational efficiency, or strengthen managers' decision-making power. However, hardly of less interest are issues relating to the changing nature of social *experience* in the face of technological change: Is work becoming more or less fulfilling, thanks to the computer? Are computerized organizations more or less humane than their conventional counterparts?

We like to think of these questions as topical, yet they echo themes that have long played a part in the history of social and economic thought. They were by no means new, for example, when Marx entertained them. He and other nineteenth-century commentators devoted much attention to what we would now call automation and technologically induced unemployment. No less was Marx attentive to what he saw as degradation in the *content* of work through technologically induced deskilling. The widespread use of computing by government and private organizations is obviously a phenomenon of the last two or three decades. Yet the same questions we are now asking about computing, others have long asked about other technologies.

What puzzles us is that people remain so willing to speak and write as though the overall effects of computing technologies were a foregone conclusion, as though they could be determined a priori. People still make broad claims that computerized work is manifestly more fulfilling than conventional work or that computerization obviously and evidently robs work of its inherent rewards. Similar a priori claims are made on the effects of computing on employment or on its role in organizational decision making. Often buttressed by studies of small sets of cases, such works give people the impression that we understand more about the repercussions of computing in organizations than we really do and that research will only confirm what we already know.

We argue the opposite: that evidence on these subjects is actually fragmentary and very mixed, and that a priori arguments are particularly inappropriate in light of the range and variety of variables at work in these situations. In this article we examine the literature on the effects of computing on the numbers and quality of jobs, on management decision making, and on organizational dealings with clients and customers. We also consider various perspectives on the causes of organizational decisions to adopt computing in the first place. We pay much more attention to the first questions, where the existing literature is larger. However, our conclusions are similar for all of these areas: Virtually none of the studies mounted so far have been capable of yielding a persuasive and comprehensive view of computer-induced social change.

QUALITY OF WORK

The research literature on the impact of new information technologies on job content and job satisfaction provides a mass of contradictory findings. The wide range of informed opinion can best be defined by describing the two extreme positions: *deskilling* and *upgrading.*

The deskilling perspective suggests that automation is used to strip relatively skilled jobs of their conceptual content [13]. Those conceptual tasks previously integrated into work are either built into computer algorithms or transferred to a numerically smaller number of high-level specialists.

Deskilling manifests itself in two ways: *intra*occupational changes, where the skill content of a particular job decreases over time, and *inter*occupational changes, where the number of people in skilled jobs shrinks and the number in less skilled jobs increases. In the second of these cases, one empirical indicator of deskilling is a shift in the occupational distribution of the white-collar work force. Thus, the deskilling position implies that new information technologies produce a more polarized pyramidal distribution of skill: a mass of unskilled clerical workers at the bottom, and a small number of "conceptual workers" at the top, alongside management. James Driscoll of MIT [25] has put this rhetorically: "The office of the future would. . . leave people in only two roles: bosses and garbage collectors."

In contrast, several researchers have argued that computerization and other new information technologies upgrade rather than deskill white-collar workers [8, 35, 81]. They maintain that automation primarily occurs in already-routinized work situations; the new technology takes the drudge work out of information processing by automating filing and information retrieval, preparing repetitious paperwork (e.g., form letters), doing simple computational tasks, moving messages, and so on. As automation absorbs many of the *manual aspects* of information processing, humans have more time to concentrate on conceptual and decision-making tasks.

The potential victims in this net upgrading of white-collar work are the lowest level clerical workers whose work consists almost entirely of manual manipulation of data (e.g., file clerks, correspondence typists, mail-room workers). These jobs can be largely replaced by the new technologies. However, proponents of the upgrading thesis argue that negative impacts need not occur even for this lowest stratum of workers. The process manifests itself in the relative growth of higher level white-collar jobs and the relative shrinkage of low-level jobs; the absolute number of low-level clerical workers need not decline in the short run. In addition, retraining schemes can modestly upgrade even lowest level clerical workers: File clerks become data-processing and entry clerks, bank tellers become officers or collections agents, typists retrain on text editors, and other workers join the computer operations staff (cf. [76, (p. 63)]).

With upgrading, then, the impact of computer technology is a net increase in skill and job satisfaction [35]. The occupational distribution of white-collar jobs shifts from a pyramid shape (few skilled, many semiskilled or unskilled) toward a diamond shape (few top managers, many professionals and middle managers, few low-skilled clericals) [124].

At the case-study level, many observers have described a loss of conceptual content, fragmentation, and deskilling of various clerical and professional white-collar jobs after computers were introduced [7, 20, 36–38, 46, 76, 116]. Groups representing clerical workers have also complained about computer-generated degradation of their work [41, 92]. On the other hand, several observers (Sometimes the same observers!) give examples of the reversal of the division of labor with the introduction of new information technologies. Tasks are consolidated rather than further fragmented [20, 72, 76 (p. 62), 102].

The most plausible explanation for these opposed viewpoints is not that either group of observers is wrong but that both processes (deskilling and upgrading) are occurring within white-collar occupations. The riddle, then, is to determine which tendency predominates. For this purpose, single-case studies are not useful.

These difficulties are partially overcome in Attewell's [5] study of the insurance industry, utilizing Bureau of Labor Statistics (BLS) surveys on a large sample of insurance firms. Using detailed job descriptions, the BLS divides each occupation into several skill levels: file clerk A, file clerk B, file clerk C, etc. Since the surveys provide the numbers of persons in each skill category and since surveys have been carried out at five-year intervals during a period of rapid computer automation, one can analyze the data to determine intraoccupational skill changes over time. Consistent with the case studies above, Attewell reported a mixed picture. Four occupations showed modest but statistically significant downgrading over the last 15 years, six showed similarly significant upgrading, and three showed no trends. Thus both upgrading and deskilling are occurring within occupations as automation affects information-processing jobs. The unanswered question is, What is the overall effect of intraoccupational shifts in skills economywide? Are the findings for the insurance industry generalizable to other sectors?

Horowitz and Herrenstadt [47] examined intraoccupational skill changes in five industries between 1949 and 1965, using occupational skill data as determined by successive editions of the Department of Labor's *Dictionary of Occupational Titles* (*DOT*), and found little overall change in skills. Spenner [107] examined change within 545 occupations using the 1965 and 1977 *DOT* skill measures and found "very little change—if any, a slight upgrading in the actual skill content of work over the last quarter century" [107, (p. 973)]. Rumberger [101] examined the *DOT* measure of educational requirements of jobs (as a proxy for skill) for the period 1960–1976. He found that intraoccupational change had led to a narrowing of skill differences: upgrading in lower occupations, downgrading in higher ones.

Although these *DOT* studies have a great advantage over the case studies in terms of correctly representing a large range of occupations and industries, they are unfortunately flawed. In an exhaustive study of the *DOT* skill-measurement system, carried out under the auspices of the National Academy of Science, Cain and Treiman [14] found that successive editions of the *DOT* do not accurately assess changes in skill content. They also echoed Howe's [48] criticism of the *DOT* as systematically biased because it undervalues the skill levels of many jobs predominantly held by women. Taken together, these objections vitiate the *DOT* as a tool for studying skill changes.

This leaves us with an unsatisfactory situation. We have a variety of case-study evidence indicating both upgrading and downgrading but no way to map this onto the economy as a whole or onto a representative sample of firms.

The evidence on interoccupational change (i.e., the relative growth of high-skill versus low-skill occupations) has similar difficulties. A series of early case studies reported that lower level clerical positions were eliminated by automation and that the proportion of higher level clerical jobs increased [18, 21, 43, 68, 94, 112, 120]. More recently, Menzies [76 (p. 63)] documented the retraining of displaced low-level clerical workers associated with "a radical upgrading of information work in Canadian industry, characterized by a diminishing demand for low-level clerical workers [and] increasing demand for technical and professional workers." Attewell [5], using BLS data on interoccupational shifts in the insurance industry from 1966 to 1980 (a period of intense automation), documents a marked growth in the proportion of insurance workers in higher level white-collar occupations (38 to 60 percent) and a corresponding decrease in the proportion of the work force in lower level jobs. These findings support the upgrading thesis.

Unfortunately, in attempting to generalize beyond these case-specific or industry-specific studies to the economy as a whole, we confront some of the problems encountered with the *DOT* data discussed above. Jaffe and Froomkin [51 (pp. 73–82)] suggested a modest aggregate upgrading of skills, most especially due to the changing industrial composition of the economy, rather than to an occupational mix within industries. Dubnoff [26] looked at the interoccupational distribution of jobs between 1900 and 1970, again using the *DOT* to measure skill levels. He found no aggregate deskilling in the nonfarm sector since 1900. Rumberger [101 (p. 578)] used *DOT* educational requirements as a proxy for skill and found that "between 1960 and 1976 changes in the distribution of employment have favored more-skilled jobs." But each of these studies stands or falls on the accuracy of *DOT* determinations of skill levels of jobs.

The third source of data for examining changes in the quality of worklife due to technological change comes from surveys of workers' own opinions. Muller [79] surveyed a representative sample of the U.S. work force (blue and white collar) about their experience of many kinds of technological change between 1962 and 1967. She found that reports of job enlargement and increased job satisfaction greatly exceeded reports of downgrading [79 (p. 14)]. More recently, Kling [59] surveyed 1200 managers, clerks, and data analysts in municipal government jobs about the impact of new information technologies on their work. He concluded that "computer use did not profoundly alter the character of their jobs." However, the new technology did have an effect on the quality of worklife. Kling found a modest upgrading of skill and job satisfaction across the occupational hierarchy from clericals to middle-level professionals to managers.

Kraemer and Danziger [62] also analyzed opinion survey data from a large sample of municipal government employees, examining several dimensions of job satisfaction and four levels of information workers (managers, staff professionals, bureaucrats who work with the public, and "desk-top bureaucrats"). Consonant with Kling's observations, they found that about half of the workers experienced an increased sense of accomplishment in computerized work, whereas only 4 percent reported a lowered sense. Most respondents did not experience computer-generated changes in supervision, nor did respondents report that computers diminished their control over others. Time pressure was experienced differentially: Forty-eight percent of the sample was unaffected, 29 percent reported decreased pressure, and 22 percent reported increased pressure. Overall, then, the effects of new technology were not dramatic, but where change was reported, computers were most often said to be enhancing job satisfaction.

Kraemer and Danziger's analysis did not support Kling's finding that the job-enhancing benefits of computerization increase as one climbs the organizational hierarchy. They found no significant differences between the occupational levels in terms of an increased sense of accomplishment. Surprisingly, they found that managers and bureaucrats directly serving the public reported higher increases in supervision than more routinized desk-top bureaucrats. Perceived changes in time pressure were also distributed across occupational strata in unexpected ways: Street-level bureaucrats experienced the highest incidence of decreased work pressure, followed by managers, desk-top bureaucrats, and professionals. The one finding that did support Kling's view of the hierarchical impact of the new technology concerned control over others. Computers allowed for an increased control over others toward the top of the occupational hierarchy.

Surveys of worker satisfaction in the private sector do not match in quality, detail, or representativeness the above research on the public sector [93, 114]. Shepard's [102] study remains the most ambitious. He compared various groups of blue- and white-collar workers on several dimensions of alienation. He found that automated workers were less alienated than both mechanized and nonmechanized groups. Unlike the surveys discussed earlier, Shepard's study did not ask workers within an occupation to compare their pre- and post-automation work, but instead contrasted quite different occupations cross-sectionally. Since pay, promotion prospects, prestige, and other factors differentiated these occupations, in addition to level of technology, Shepard's observed difference in alienation/dissatisfaction between occupational groups may have little to do with technology.

To summarize: Surveys of workers' perceptions of the new technology generally contradict the deskilling/job degradation thesis. Most workers surveyed regard the new technologies in a positive light. There are, however, three caveats concerning these findings: First, existing opinion-survey data depend mainly on studies of public bureaucracies. The application of computer technology in the public sector may be more "humane" than in private-sector profit-oriented businesses that are pressured by competition—hence, the need to study a representative sample of businesses. Second, existing studies do not distinguish among levels of information technology. Thus we do not know whether the reports of job enhancement come from those individuals who work eight hours a day on state-of-the-art computer work stations or from individuals who only indirectly or intermittently use computer data. (Kraemer and Danziger [62] suggest this as a possible after-the-fact explanation for some of their findings.) The issue needs to be tested more rigorously. Finally, there is a possibility that increased satisfaction reflects a "novelty effect," a temporary increase in interest that will fade as the technology becomes more familiar. Surveys therefore should take account of the length of time for which respondents have used the technology they are assessing.

EFFECTS ON UNEMPLOYMENT

Fears of automation-generated unemployment swept the United States and Europe in the late 1950s and early 1960s, resulting in several volumes of research and commentary [1, 42, 50, 64, 82, 89, 109]. At that time, the main focus was on blue-collar unemployment and the automation of manual tasks, although computer impacts on white-collar workers were considered. These early concerns faded as the 1960s brought both increases in productivity and a rapid expansion of the American work force, thus apparently proving that automation need not generate unemployment.

However, by the early 1970s concerns over technologically generated unemployment surfaced again. By the late 1960s the manufacturing sector of the U.S. economy was exhibiting "jobless growth"—expansion in output with no corresponding increase in employment. In the industrialized nations of Europe and Japan there were absolute declines in manufacturing employment alongside increases in output [97 (pp. 3–4, 38–39)]. The rapid growth of the service sector (18.5 million new jobs in the United States between 1970 and 1981) seemed to offset stagnation and contraction in manufacturing employment during the 1970s, although some argued that this trend was heavily dependent on the expansion of government and would not continue into the 1980s, even in private-sector services (e.g., [34]).

A spate of studies then appeared, many sponsored by European governments, assessing the unemployment consequences of new microelectronic technology [2, 6, 15, 16, 29, 31, 53, 84–86, 104, 111]. These studies were generally pessimistic, predicting substantial levels of technologically induced unemployment (10 percent and greater). However, each national study concludes that the unemployment consequences for that nation of *not* adopting the new technology would be more severe than the consequences of adopting it, since nonadoption would result in loss of international competitive standing and hence loss of export markets. The pessimistic position is well expressed by the titles of books: *The Collapse of Work* [52] and *Automatic Unemployment* [45].

Pessimists point out that microelectronics technology is simultaneously affecting all parts of industry and commerce, from product and process design to welding, forging, molding, diecasting, and painting [55] to assembly [45 (pp. 21–24), 55] and office work [30, 35, 54]. Empirically, the pessimists' case rests on a series of daunting but quite unsystematic case studies, which show employment shrinkages of 50 percent in metalworking, 25 percent in telecommunications [97 (U.K. data)], 30 percent in banking [86 (French data)], 16–35 percent in female clerical work [76 (pp. 71–73, Canadian data)], and so on.

There are two major problems with the empirical bases of the pessimists' position. First, most of the national studies utilizing sophisticated input/output analyses (e.g., [69, 85]) are grounded in percentage estimates of the degree of increased productivity due to microelectronic technology for each industrial/commercial sector. These estimates are at best informed guesses and at worst complete speculation. There have been no systematic industrywide *measurements* of productivity increases resulting from the new technology because of the near impossibility of the task, from a methodological standpoint. Different firms take incompatible approaches to productivity measurement; many do not measure it at all. Attempts to compare productivity before and after automation in a few exemplary automated corporations are frustrated by the fact that such businesses often abandon or change their productivity measurement systems when production is reorganized around new technology, thus vitiating such comparisons. Separating the effects of the new technology from other factors affecting productivity (economic contractions, good or bad management, etc.) is also quite complex.

A second and easier approach has been to directly measure changes in employment in automating firms and to extrapolate these findings to the economy at large (e.g., [97]). This approach has similar pitfalls. If, as is often the case, one looks at firms in the avant-garde of computer automation, one risks choosing totally atypical businesses. Also, automating enterprises may be more competitive, stealing market shares from less advanced firms—the employment impact may be felt not in the automating firm itself but in backward non-competitive firms in the same business. Observed employment decreases may also be due to nationwide contraction rather than new technology, and so on.

A better way to assess employment changes due to the new technology would be to draw a systematic representative sample of businesses, study each firm's level of automation, and analyze changes in employment for each firm, controlling for (1) degree of automation and (2) changes in total constant dollar sales. Such a sample would have to include the full spectrum of automated and nonautomated businesses.

Optimists argue that studies of the apparent negative employment effects of the new technology are overstated, since they ignore several countertendencies. They maintain that by cutting the costs of goods and services, new technology stimulates increased demand. The work force need not shrink if increases in production balance increases in productivity. These "economic multiplier" effects might help to create a new technological "long wave" that could revive the international economy. Other such waves were triggered by the introduction of the railroads, electric power, etc. [17, 33]. Optimists also point out that automation frequently occurs in industries experiencing a labor *shortage* and increased consumer demand. Automation in such industries only slows down the growth rate of labor; it does not shrink the labor force [30]. Again, these claims, although plausible, cannot be measured without a representative sampling of businesses and an examination of their occupational and output growth rates.

MANAGEMENT EFFECTS

Students of organizations have frequently observed that control of information is a source of power [19, 75, 91]. New technologies that alter the quality and availability of information are likely to shift balances of power between various groups of organizational actors—workers, supervisors, middle managers, executives, etc. [88]. The rerouting of information may also create new dependencies between parts of organizations and dissolve old ones, paving the way for structural changes.

One group of researchers finds evidence that such processes lead to increased centralization of power and decision making in computer-automated organizations [65]. Leavitt and Whisler [66] predicted in 1958 that the new information technologies would eliminate whole levels of middle management as improved information led to centralized decision making at the higher levels of the corporate hierarchy. Those middle-level managers who remained would have less discretion than before, since they would be supervising according to standardized procedures and decisions set from above, and since their clerical subordinates would face more routinized work [119]. Centralization would also lead to the merging of departments and a general simplification of organizational structure.

Early case-study research confirmed this prediction, especially as regards the decline of middle management [3, 49, 80, 81, 119]. Subsequent studies of computer mail systems have reinforced this view by showing the predominance of "top-down" communication [67, 70]. A further indication of centralization is the development of executive information systems that allow top executives to bypass line administrators and to monitor activity on the "factory floor" via computer tallies [12].

There is some evidence for an opposite view, however: The increase in communication resulting from new computer technologies may be *decentralizing* managerial decision making. Withington [122] reported case-study observations that management-information-system (MIS) data enhanced decision making by middle managers and strengthened their authority (cf. [58]). Pfeffer [90, 91] has argued that computerization allows for delegation of decision-making authority to lower level managers because such decisions can be easily monitored by higher level managers via MIS data. Blau et al. [10], in a comparative study of manufacturing companies, found that on-site computers do foster decentralized operational decisions, at least down to the level of plant manager. Also contra Whisler, Blau et al. and Blau and Schoenherr [11] found that, far from eliminating levels of middle management, computers are associated with an increase in the number of levels of line management and that differentiation into multiple departments increases with computerization. They contend computers lead to a more differentiated, more complex organizational structure.

Between the extremes of centralization and decentralization, we find a number of studies that suggest that power shifts resulting from computerization are complex and cannot be understood in terms of the single dimension of centralization/decentralization. Kling [60 (p. 24)] has argued that even where new information technologies provide the potential for increased managerial surveillance, this potential has often not been used by managers. He also cites instances where subordinates put false information into MIS systems in order to evade managerial control [60 (p. 84)].

Nor is it clear that upper management is always the group that benefits from improved access to information. Markus [74, (p. 55)] discusses a situation where junior officers in a U.S. military logistics group gained status vis-à-vis senior officers because of their access to on-line data. Bjorn-Anderson and Peterson [9] found that planners gained power at the expense of plant and production managers in several computerized Danish factories. Kraemer and Danziger [62] found in a sample of municipal governments that managers and staff did experience an increase in control over subordinates but that they themselves also experienced a relative increase in supervision. Meanwhile, a substantial proportion of their subordinates—"desk-top bureaucrats"—reported a lessening of supervision following computerization (see also [59, (p. 21)]). Such examples indicate that control is not a simple zero-sum relationship and that various groups may experience enhanced power and decision-making opportunities after computerization. Kling, Kraemer, and Dutton (summarized in [60 (p. 92)]) found that the pattern of power shifts following office automation in large municipalities differed from that found in smaller cities. Contextual variables thus play important mediating roles in influencing the outcome of the introduction of the new technology.

Robey [95, 96], in reviewing this literature and in presenting his own international case-study data, provided the following conclusion: "Computers do not *necessarily* affect the distribution of authority and control." In most cases either there is no change following the introduction of a MIS or an existing organizational structure is simply reinforced. Where changes are observed, centralization is a more common outcome than decentralization. Computerized information systems are clearly compatible with a wide variety of lateral and vertical power relationships in organizations [96].

Contradictory conclusions can be drawn from these case studies, if we assume that there must be a single accurate characterization of these effects. If we instead assume that a range of management effects is possible following the introduction of new information technology and that a variety of factors influences a particular outcome, our task becomes clear. We must identify those variables that can account for differential outcomes and examine them in a comparative study of a stratified sample of organizations. Variables include organizational size, industry type, degree of prior routinization or variability of work, degree of dependence upon a professional or high-skilled work force, and the patterns of information usage and information flow associated with the technologies in use.

ORGANIZATIONS AND THE PUBLIC

Social relationships within organizations are not the only ones to change in response to new bureaucratic uses of information. Relationships between organizations and their environments—particularly the general public—are also affected. It is easier to collect, disseminate, store, analyze, and use information with modern information technologies, and this is bound to make a difference in how organizations interact with the public.

This category of relationships has been the focus of much less theoretical attention and empirical investigation than those discussed earlier. To be sure, students of formal organization have long acknowledged that the flow of information between organizations and the public represents an important constraint on these relationships (see Deutsch [22] and Stinchcombe [108]). However, this recognition has not been attended by systematic attention to these issues in specific organizations. A few authors (e.g., Shils [103], Rule [98], and Rule et al. [99, 100]) have focused on the growing appetite of centralized organizations, especially governments, for information on the people with whom they deal. Other authors (e.g., Mowshowitz [77], Hiltz and Turoff [44], and Smith [106]) have speculated about new kinds of informational services that computerized organizations could provide and the concomitant changes that could be expected in modern ideas of what organizations are and do. However, none of these writings take us close to a comprehensive assessment of how informational relations between organizations and the public are changing through the rise of computing.

Any perceptive casual observer could cite additional evidence that such relationships are indeed changing. All of us find ourselves interacting more with machines, and less with live human beings, as we deal with organizations. Bank accounts, bills, responses to complaints, correspondence, and other transactions are now routinely computerized. A few authors (e.g., Turkle [110] and Weizenbaum [117]) have begun to study the effects of these interactions, but we still know little about the prevailing forms and extent of computerized processes that organizations may substitute for direct dealings with people.

We suspect that profound economic forces will lead to further automation. It is widely acknowledged that human beings are becoming more and more expensive, relative to computer time. Hiring people to deal with the general public may thus become a luxury that organizations feel they cannot afford. A major New York bank recently tried to institute rules permitting only account holders with substantial deposits the privilege of doing business with a human teller. The effort was abandoned in the face of public protest and editorial reproach, but one can hardly doubt that similar moves will be attempted elsewhere.

Still, it would be wrong to conclude that the growing reliance on computing for mediation between organizations and the public must necessarily restrict and impoverish these relations. As with job content and worker satisfaction, a variety of tendencies and possibilities seems to be present. Computerization, after all, affords the capability of providing more information to more customers or account holders in less time. The only reliable grounds for judging which tendencies will prevail would be a study of a representative sample from a large and significant population of organizations.

THE IMPETUS TO INNOVATION

For most observers, the reasons for adopting computing in organizations are moot. It is taken as self-evident that organizations computerize in order to pursue long-standing goals of efficiency and cost-effectiveness. Rationalization, or the relentless effort to adopt the most efficient means to established ends, is seen as the hallmark of modern organizations. Computerization is considered the most eminently rational of present-day technological trends.

Against this view there is a long-standing alternative, originally and most persuasively articulated by Jacques

Ellul [28]. In this view, new technologies do not arise simply as superior responses to preexisting problems. Rather, the "need" for innovation is the product of a mind-set that demands that every available technological possibility be developed as a matter of course. The evolution of technology is thus self-sustaining and autonomous—a catalyst for change in other sectors of society, rather than a response to interests generated elsewhere. Though planners may *believe* they are acting rationally in adopting new technologies, their decisions actually reflect a pervasive mystique that what can be developed, must be developed. This idea continues to have influence among modern critics of technology (e.g., Winner [121]).

In fact, this critical view is by no means unsupported in the empirical literature. True, the earliest writers on subjects like office automation considered the cost-benefit justifications of new technologies as too obvious to question [66]. However, other early studies that actually examined the effects of computer innovations in detail reported a more mixed picture [65, 118]. More recently, the URBIS study by the Irvine group has again shown how strong the tendency is, among managers in municipal governments, to perceive that the use of computers is the most rational choice (e.g., [27]). However, the participating authors themselves by no means take these perceptions at face value; indeed, they find savings through computing quite uneven among local governments and among departments within governments. They are confident that a savings is possible in the most favorable circumstances but unconvinced that any savings will necessarily be realized [57].

Downs [23] has pointed to some possible explanations. He shows, much as Laudon [65] has done, that changes in information organization may also be changes in power relations. Such findings suggest that efficiency claims for computing innovations may actually mask the political motives of the parties making the claims.

In the most penetrating empirically oriented study of these issues, King and Kraemer [57] examine why innovations in computing often seem to fail to yield expected benefits. They identify a number of hidden costs attached to new computing systems that are often ignored by planners—the interruptions of established organizational routines brought about by computing use, for instance. Even more important, they offer what strikes us as a very telling observation: New computing systems are often applied not only to existing organizational problems but to qualitatively new organizational activities. Thus, a new computing system for an accounting and finance department may be used to undertake much more thorough and far-reaching audits of the activities of other departments than anyone had previously considered necessary. In such cases it may be more reasonable to conclude that the availability of the technology incited the organizational "needs" to which it was applied, rather than the other way around.

These and other findings by members of the Irvine group provide tentative and tantalizing support for some of Ellul's seemingly incredible ideas. To be sure, their observations at this stage must be considered straws in the wind. Dutton and Kraemer base their observation on their sample of 572 larger municipal and county governments, for example. Are profit-making organizations more rigorous in their cost-benefit rationality? Can managers in most organizations even cite evidence for the cost-effectiveness of their systems? Does adoption of such systems correspond to shifts in organizational agenda?

CONCLUSIONS

The sheer variety of disparate and seemingly conflicting conclusions that can be derived from the studies noted may seem to warrant despair. Why do all these works add up to so few conclusive results? Is there really so little to show, by way of direct answers to the questions with which this review began?

For our part, we are obviously skeptical but by no means discouraged. The literature reviewed offers important lessons for future inquiry, especially by way of cautionary conclusions on relations between theories and empirical investigation on these issues. In particular, we believe that a priori reasoning proceeding from assumptions about principles that logically *must* describe the social impacts of computing in organizations is unproductive. On the contrary, we suspect that the transformations in organizational life through computing are so multifarious as to encompass the most disparate cause-effect relations in different contexts. There is no reason why computing should not result in deskilling in some settings and the enhancement of job content elsewhere, or in greater responsiveness to public needs in some organizations and diminished responsiveness in others. Indeed, one might well expect quite different effects to ensue from what appear to be the "same" causes in similar or even identical organizations, according to contextual changes in such things as the environments in which organizations act. In short, we see no reason to believe that any simple set of theoretical relationships can account for all the data that one might expect empirical inquiry to bring to light on these subjects.

The problem for research, as we see it, is twofold. First, one must determine, as far as possible, what particular cause-effect relations prevail in specific contexts. Where, for example, is computerization an authentic response to needs that are demonstrably fulfilled by the new technologies; and where, by contrast, might computerization actually *create* the needs that it is supposed to be fulfilling? Second, one must locate such cases as closely as possible within larger ranges of cases in which similar cause-effect relations can be expected to prevail. Clearly these requirements point to an ambitious program of inquiry. They suggest that large samples and extensive replication will be necessary—not so much to *isolate* the effects of computing in organizations, but to characterize such effects in their full variety.

We do not expect any of the problems considered above to be "solved" definitively, no matter how widely they are investigated. This does not dismay us. We believe that the social impacts of computing are infinitely variable but that the sources of these variations are eminently accessible to study. As long as investigators continue to study new organizations in new settings, new effects can be expected to emerge. The essential thing is that we continue confronting our theories with new data and that we not be afraid to modify theories in light of such confrontations.

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CR Categories and Subject Descriptors: K.4.2 **[Computers and Society]**: Social Issues—*employment*; K.4.3 **[Computers and Society]**: Organizational Impacts

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