

Eric Trist

Pava's Extension of

Socio-Technical Theory to

Advanced Information Technologies¹

Like many people, I have been waiting for a book that would guide me through the maze of multidimensional issues to which the advent of advanced office technology gives rise. Calvin Pava has written such a book, the first, in my knowledge, to combine in one account the technical and social aspects of office organization; the complete range of activities undertaken from very routine to entirely nonroutine; and the macro-implications for the wider society as well as the micro-implications for the office itself. As the title, *Managing New Office Technology*, suggests, he is concerned with the management of these interacting aspects and processes, which are not as likely to produce beneficial outcomes simply of their own accord as the apostles of automation would lead us to expect; rather will they require an expansion of management concern to factors in the environment usually regarded as beyond its purview, while extending internally the role of informed choice.

This is a far cry from the prevailing perspective, which concentrates attention on the technological aspect so that what the equipment makers propose is solemnly installed with

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the eager support of data-processing and internal "systems" staffs. Absent is any informed scrutiny of organizational and social aspects. This absence has untoward consequences: the creation at the lower levels of large numbers of poorly designed jobs that lower performance and increase alienation; failure to appreciate the subtle yet profound changes required in managerial and professional roles; the export to the labor market of those made redundant without serious thought to their retraining or future place in society.

What is happening in the office is presented as part of a wider revolution centered on the microprocessor which, during the present and subsequent decades, will establish an information society in the midst of the older industrial society. This revolution is proceeding at an accelerating rate, but there is scant recognition of the depth and scope of the changes entailed. While some general concern has been expressed over the likelihood of unabsorbable unemployment and scenarios have been offered of both extreme centralization and extreme decentralization, little has so far been said concerning new modes of organization which more advanced technologies make possible in the office itself. Unless the potentiality of these alternative organizational modes is realized, the negative effects of following the technological imperative will spill over into the wider society in a way that no external correctives can remedy. Only an internal revolution in the structure and cultural fabric (to use Pava's term) of the office itself can supply the necessary conditions for the realization of beneficial outcomes. Yet internal revolution alone will not be sufficient. For the necessary and sufficient conditions to be realized, wider changes in social values and legislative provision must also take place.

In Pava's book, both these issues are addressed and the interconnections between them unraveled. He shows how changes in the office can enable the enterprise to reach out

proactively into the surrounding society and how changes in the latter can then more easily link back to internal changes. Virtuous as opposed to vicious circles can thence be created, though how much of the former will depend in a far-reaching way on the choices made and the initiatives taken (over the next 10 to 15 years) by those in leadership positions--the managers, in both the private and public sectors.

Fortunately, there have arisen in organizational studies a theory and practice that have disestablished the technological imperative from the long reign of unchallenged rule, which has created the technocratic bureaucracies that still remain the predominant organizational form in advanced industrial societies but which are becoming increasingly dysfunctional in view of the higher levels of complexity, interdependence and uncertainty present in the contemporary environment. I refer to the socio-technical approach that is concerned with discovering the best match between the social and technical systems in any organization in which people must use technology to accomplish their objectives. A full-dress exposition of this approach is given in Pava's book, one of the very few comprehensive accounts to be offered. Not unnaturally, socio-technical studies originated in productive organizations, but more recently a large amount of empirical work has been undertaken in administrative establishments. Little, however, has been done to extend either theory or methods of analysis to the particular needs of the latter. Unless this is done, the chances are small of avoiding the bad consequences of introducing advanced technology into these settings. Yet in an appropriate extension lies the best hope of developing an office of the future that at one and the same time will be human and high performing.

The present book makes very substantial advances on what has so far been accomplished toward this end. In order to do this its author has had first to enlarge the notion of

technology--to break it free of hardware constraints. The introduction of more advanced devices and procedures has had the paradoxical effect of etherealizing them in the form of what he has called "deliberations." Next, he has had to clarify types of organizational form hitherto only dimly perceived--to break socio-technical theory free from the monopolizing idea of the autonomous work group. Third, he has had to extend the methods of work analysis from those suitable for single linear conversion processes to those that can meet the demands of concurrent multiple nonlinear conversion processes. These additions occasion the introduction of a new conceptual language. Terms such as deliberations, discretionary coalitions, saturated interdependence, artificial rationality, micromyopia and stakeholder comanagement are not jargon but names for new referents essential for the field's advance.

These innovations stem from Pava's having chosen to deal with the full range of activities that take place in office settings and therefore to include managerial and professional work rather than to restrict himself to the more routinized aspects of information processing. These latter are the type of activity commonly thought of as being carried out by most office workers, but conceptually they are no different from the type of routine work carried out by most factory workers, for both belong to the same major technological family which Thompson (1967) called the long-linked technology. In this technology the various steps of a conversion process follow each other in a linear sequence which has one outcome; there may be several such processes each with its own outcome going on in parallel, or in succession, where the output of (a) is the input of (b); but the underlying logic is the same. This being so, it is not surprising that routine factory work and routine office work can be treated within the same socio-technical paradigm, so that work redesign for both can follow the pattern of the self-managing work group.

As the level of entirely nonroutine activities is approached, this pattern becomes infeasible. Conversion processes are multiple, concurrent and nonlinear; skills are too complex to permit cross training; the work culture is that of the individual professional or manager who yet must collaborate with colleagues. By saying that the technological system for such work consists of deliberations, Pava has pinpointed the fact that the technology involved has become cognitive. The conversion processes entail the transformation of equivocal, ill-defined, ambiguous, conflicting issues into problems that can be dealt with. Since the topics to be deliberated vary immensely, so do the requisite resources, which tend to be assembled in temporary systems. These are the characteristics of Thompson's (1967) intensive technology but, valuable as his distinction has been between this technological family and those of the mediating and long-linked technologies, Thompson did not identify its core content. This is what Pava has done.

In introducing his idea of deliberation, a generic concept that covers a whole miscellany of unprogrammed activities, he has identified a dimension of professional and managerial work that has so far gone unrecognized. This dimension has been obscured by a too exclusive concentration on decision making. Deliberations are not in themselves decisions but their hinterland, which constitutes the world of cognitive technique. Deliberations provide a new unit of analysis, the equivalent for the intensive technology of unit operations for the long-linked technology. They involve determining the full range of pertinent topics, analyzing their components and ensuring their examination through a series of forums (structured, semi-structured or unstructured), in which all the relevant parties present their various perspectives so that optimum trade-offs can be achieved. This technology comprises a methodology for what

McWhinney (1980) has called the resolution of complex issues.

The combination of advanced computer and communications technology, referred to by the French as *telematique*, creates conditions that potentially increase very substantially the capacity for deliberation. Far higher levels of complexity can be comprehended; prodigious amounts of information rapidly summarized and retrieved; many alternatives compared without incurring intolerable fatigue; and all these data and analyses checked and shared with an immediacy hitherto impossible. When the generations now being brought up on the computer begin to engage in managerial and professional activities, this capacity for deliberation should be strengthened beyond its present range. Any such strengthening will be fully utilized in coping with the complexities and uncertainties emanating from an increasingly turbulent environment (Emery and Trist, 1965). Automating the routine advanced technology will accomplish a figure/ground reversal of attention and effort from instruments to operations. The bulk of a manager's time and energy can now be spent on addressing the issues rather than in laborious preparation to get to the point. The possibility is therefore imminent of being able to deliberate more topics at a higher level of competence and of doing more of the work that at present tends to be left undone because it is either too difficult or too time-consuming. One may even hope that the urgent will less often drive out the important.

Deliberation is a social as well as a cognitive process that proceeds in terms of what Pava has called discretionary coalitions, the temporary groups or network nodes formed by whatever parties are necessary to conduct particular deliberations. The salience of discretionary coalitions constitutes a figure/ground reversal in the organizational sphere parallel to that in the technical sphere, which pushes physical instruments into the background and gives the

foreground to cognitive techniques. Unless the organizational changes take place, the technical possibilities will remain unrealized.

In conventional technocratic and bureaucratic organizations the structural foreground is occupied by static positions that delineate the responsibilities of the officeholders and their authority to discharge them. These positions carry ownership of expertise and access to privileged knowledge in ways that falsely politicize the resolution of complex issues, which depend on pooled knowledge and interpositional collaboration. Complex issues are the rule rather than the exception in nonroutine office work. The discretionary coalitions brought into existence by deliberations yield a novel organizing principle in relation to which the static positions of the organization chart become scaffolding and retreat into the background.

These coalitions form and reform themselves according to the needs of particular deliberations. Their purpose is to obtain the best outcomes from the inputs of multiple perspectives. The issues are not owned by any one position but by the coalition. This minimizes false politics and maximizes true negotiation among parties carrying divergent but relevant values. The goal is optimum trade-offs leading to the best informed choices.

In reading Pava's account of this process I was forcibly reminded of my experience as a staff officer in World War II. During wartime the environment is changing so rapidly and in so many unexpected ways that military organization has constantly to redeploy itself to ensure that the relevant resources are brought to bear on the issues arising. One therefore found oneself moving from setting to setting and conferring with a wide range of people of varying rank about different matters even during the course of a single day. Given the rapid change and high uncertainty now prevailing, the business environment is becoming more like a

wartime environment. The need is greater therefore in nonroutine work to bring discretionary coalitions into the foreground. For this to happen, easily and reliably, the alternative organizing principle which presupposes openness and trust rather than possessiveness and suspicion needs to be explicitly recognized. This explicit recognition is demanded by Pava's analysis. The logic is difficult to avoid--if difficult to implement--given the inheritance of older and opposite ways.

That there might be other forms of nonhierarchical organization than autonomous work groups was first recognized in the socio-technical literature by Herbst (1976/Vol. II, "Alternatives to Hierarchy") whose discussion of alternatives to hierarchy identified the additional forms of matrices and networks. In the former, the skills and competences were only partially interchangeable. Matrices were neither autonomous work groups nor bureaucratic hierarchies; rather were they what Schwartz and Ogilvie (1980) have called "heterarchies." They compose project groups that form the basis of Pava's product line-market-segment organizations prominent in the hybrid form of office work. Herbst treats certain distinctive properties of networks such as the lack of need among their members to be copresent in space and time and their ability to foster and maintain fields of directive correlations over long periods. Lacking a concept of deliberations, however, he was unable to identify discretionary coalitions as the type of network formation that is brought into existence by the unprogrammed but interactive character of a great deal of day-to-day managerial and professional work.

Concerned with the lower levels of organizations employing long-linked technologies, early socio-technical studies concentrated on self-managing work groups. Though the concept of self-regulation was extended to every organizational level so that the organization as a whole was seen as a series of mutually articulated self-regulating systems, which made it

both flatter and leaner, this model did not spell out the nature of the self-regulation required at the high levels. The implicit assumption that it proceeded throughout on the basis of self-managing work-groups with interchangeable skills and pooled identity was obviously untenable; but no alternatives were offered. Emery's (1976) concept of senior functional managers maximizing their contributions to the whole rather than their own domains, though seminal, is still a work group analogue. The concept of discretionary coalitions in relation to deliberations offers for the first time an operational approach to the analysis of managerial and professional work in a nonhierarchical perspective. However much the hierarchical scaffolding may still be in the background, it is the unprogrammable sequences of coalitional formations that must become salient at the higher levels of any organization if it is to succeed in coping with substantial degrees of complexity, interdependence and uncertainty. This is consistent with project organization of the matrix type at the middle levels and with self-managing primary work groups at the lower levels. Taken together, these three forms provide a complete organizational alternative to the traditional technocratic bureaucracy. Furthermore, it would seem that deliberational coalitions are likely to become increasingly pervasive further down in the organization.

Pava's analysis offers a more general organizational theory than that pertaining to office work, though a great deal of an organization's nonroutine unprogrammable work goes on in office settings. The concepts of deliberations and discretionary coalitions provide the tools for a socio-technical analysis of managerial work modeled on Emery's (1967/Vol. II, "The Second Design Principle: Participation and the Democratization of Work") alternative design principle (the redundancy of function rather than the redundancy of parts). How to use these tools is

illustrated in an analysis of the activities of a design team in a software engineering group, which are traced through step-by-step. Emphasis is given to obtaining a revised perspective on "the bigger picture" in which the unit is embedded, through environmental scanning and redefinition of mission, taking into account the production of programs rather than codes. The thoroughgoing search process entailed is undertaken before the step-by-step analyses of the technical and social systems themselves are made on lines which differ considerably from the procedures used for long-linked technologies, though the theory is the same. Attention is paid to the difficulty of obtaining enough time from senior executives, which puts an extra load on the consultant, but care is taken to involve all parties so that organizational learning can become as complete as possible. Any organization that experiences such a process will undergo deep change in its cultural fabric and structural form.

The offices of many organizations cover the entire range of activities from very routine to completely nonroutine, with a good deal of their work taking place at the hybrid level. The organizational changes outlined in Pava's models are all in the same direction so that the outcome is a self-consistent alternative to the technocratic bureaucracy. If the top or middle levels remain in the old paradigm while the bottom level changes to self-managing work groups, or if badly designed jobs are left at the bottom while at the top and in the middle discretionary coalitions and project groups become salient, dysfunctional dissonance may be expected, giving rise sooner or later to unmanageable conflict or irreversible estrangement.

In addition to a change in salience from physical to cognitive technology and from staff-line hierarchies to discretionary coalitions, Pava suggests that advanced office technology is tending to produce a third figure/ground reversal--from a preoccupation with efficiency to a

greater concentration on effectiveness. Efficiency is concerned with the best use of resources inside the organization. The more automatic its attainment, the less need efficiency consume human attention, which is then freed to grapple with the complexities and uncertainties of the environment that are rendering organizational survival ever more problematic under conditions of turbulence. Effectiveness therefore needs to become a prominent concern in the work of those at every organizational level, even those concerned with the highly routinized activities of Pava's order-taking and customer-service examples.

Though Chester Barnard (1938) introduced the distinction between efficiency and effectiveness early on in organizational theory, most of the effort since then has been devoted to perfecting internal controls whose elaboration has proceeded in terms of scientific management. That this has been overdone is now widely recognized, and self-managing work groups have gone far to redress the balance and produce higher efficiency, while simultaneously increasing job satisfaction. Advanced technology can vastly increase the efficiency of office work but this should not be the main goal, which is rather making use of efficiency gains to improve effectiveness.

To a far greater extent than previously recognized, this will entail managing the organization proactively in collaboration with its stakeholders, external as well as internal. The list of stakeholders, actual and potential, is lengthening as society changes. Pava gives an account of how stakeholder groups gain in both self-awareness and public recognition as they progress in status from unorganized interests to interest groups, to claimants and to stakeholders proper who have power as well as voice. The point is forcibly made that the enterprise can no longer wait until such groups are pounding on its door. Early detection of those likely to become

important is required. Early two-way engagement with them needs to be undertaken so that goals can be harmonized where possible and unnecessary conflicts avoided. The idea of stakeholder comanagement is a relatively recent one, but it is likely to gain hold as environmental interdependencies increase. Advanced technology in the office can greatly assist this aspect of the management of effectiveness.

The process, however, needs to be two-way. Other organizations, particularly government (at all levels) but also unions and professional and educational organizations, must reach out toward the enterprise from their own bases. For example, all the responsibility for the unemployment likely to follow in the wake of the microprocessor revolution cannot be taken on by the enterprise alone. Legislative provision will have to be made for retraining and reallocation on a scale not so far contemplated and with an imagination not so far shown, even though the enterprise itself must do very much more.

The three figure/ground reversals which have been discussed are parts of the same fundamental change process which society and the enterprise are undergoing in relation to each other. The advent of advanced office technology makes these reversals obtrude massively into the managerial and institutional levels of organizational life as distinct from the technical levels, to use Parsons's (1960) terminology. So long as these reversals could be kept within the technical core they did not radically change the character of the organization as a whole. Now that advanced office technology has brought them into the levels where multiple trade-offs have to be negotiated and value changes fashioned in relation to the wider stakeholder environment, a paradigm shift is heralded.

The office revolution is the final stage of the organizational revolution. In place

of the technocratic bureaucracy that matched a less complex, less interdependent but more stable environment, there is arising a reticulist form of organization adapted to more turbulent conditions. To attain and maintain a level of effectiveness that will make the difference regarding survival, this emergent form must strengthen its capacity to conduct deliberations, assemble discretionary coalitions and deploy project teams and primary work groups supported, but not dominated, by its more static form of organization or its array of procedures and devices, however sophisticated. The paradox is that greater technological sophistication will throw more rather than less weight on how the human side performs, albeit that there will be fewer human beings around. The recent survey of corporate excellence by Peters and Waterman (1982) suggests that this trend is already apparent in many of the best run American companies, where the organizational complexities inherent in multiple interfacing and flexible deployment are rendered endurable by the relatively simple structures of a more static kind on which they rest. By the end of the decade it will be evident that the ascent of the S curve of systemic organizational change has been undertaken in earnest.

The office revolution, though radical, will not take place abruptly or across the board. It will occur incrementally and unevenly, though the rate will accelerate. This is in keeping with Pava's (1980) more general theory of planned change as a nonsynoptic process which he has called "normative incrementalism"--normative because value change is at the heart of substantial as distinct from marginal innovation (Burns and Chevalier, 1978). The great advantage of normative incrementalism is that it gives full scope for learning to take place over the extended time period required for a paradigm shift to establish itself. Many improvements will be made in diverse settings and pioneers and early adapters will learn from each others', as

well as their own, experience--against the moving ground of a changing environment.

Nevertheless, the learning process can be hastened by the provision of good maps and step-by-step guidelines. These are provided in chapters 4, 5 and 6 of Pava's book in the examples of projects that the author has personally conducted with routine, nonroutine and mixed types of office work. Attention is drawn to the need to set any proposed change in its larger context, both environmental and organizational, and to be case-specific regarding how far linear work analysis is appropriate or how far modified procedures more suitable for nonroutine components should be introduced--or a mixture of both. A distinction is drawn between analysis and design. The latter does not issue automatically from the former, though it is founded on it. Design has its own perspective and involves sensitive negotiation with all stakeholders. The importance of their inclusion is critical when it comes to implementation, for unless user ownership has been established, resistance is to be expected. The opportunity for organizational learning will not have been given. Involvement is a factor on which both democracy and enlightenment are conditional. Moreover, design does not finish when operations begin; in one sense it is never finished and depends for its elaboration on operational experience. User contributions become the basis of further discovery and engender the excitement that renews commitment. Design proceeds best by "minimum critical specifications" (Herbst, 1974/Vol. II, "Designing with Minimal Critical Specifications"), which provide the most valid criteria for decision making under conditions of uncertainty.

The book, therefore, is a "practicum" as well as a "theoreticum." Without the theoretical framework the cogency of the practical steps would not be appreciated but, unless these steps had been set out, the practitioner would be left without a "how to" tool kit. Of special

importance is the identification of a limit, beyond which the conventional nine-step model of socio-technical analysis becomes infeasible, and the development of an alternative, which can take over as the level of routineness associated with single conversion processes diminishes. The nine-step model has become something of a fetish with a number of practitioners, but it was not intended as a universally applicable methodology. It grew out of the experiment at the Hunsfoss Paper Mill in the Norwegian Industrial Democracy Project (Emery and Thorsrud, 1976/Vol. II, "The Norskhydro Fertilizer Plant") and was then offered as a training tool for departmental managers in the Shell Philosophy Project (Hill, 1971; Hill and Emery, Vol. II, "Toward a New Philosophy of Management"). It arose, therefore, in relation to continuous process technology. In experiments with office units in the same project, another method was tried that was more suited to these settings, but it was no more than an embryonic sketch. The nine-step model has proved far more widely applicable than its original use with continuous process technology suggested, but its range seems best restricted to the long-linked technological family. Pava's work has given us a modification appropriate to intensive technology. A lot of socio-technical work being done in banks, insurance companies and retail establishments, much of it related to the introduction of computers, is concerned with secondary technologies rather than the primary technology which affects the quality of the exchanges themselves (their effectiveness). A satisfactory socio-technical solution would entail the involvement of those on both sides of the reciprocal relationships in question--joint client/provider and buyer/seller design teams that would, among other things, look at the service consequences of distant rather than face-to-face transactions and of computer identification of individual customer information.

Several lines of future development are already in their early stages. Some of

these are noted in chapter 7 of Pava's book, such as the dedifferentiation of the factory and office as both become increasingly characterized by computerized tool stocks. This will tend to phase out the distinction between blue- and white-collar work. Even more far-reaching in its consequences will be the diminishing need for workers in related activities to be colocated. Under some circumstances they may work at home, under others in widely separated parts of the enterprise. There will be increased scope for work to be contracted out to small entrepreneurial groups and for customer self-service. These opportunities seem so great that a very substantial process of decentralization is likely to set in. Fears of greater centralization, warranted while computers remained large and expensive, are likely to prove less warranted now that the microprocessor has begun to take over. Foreshadowed is a spatial distribution of work very different from that at present obtaining, with far-reaching consequences for society as a whole.

As regards the scale of unemployment to be expected when the new technologies are fully established--unless new industries are capable of absorbing it--the ensuing crisis will be met only by a redefinition of work that dissociates the concept of work from the fact of employment and recognizes the value of alternative forms of social contribution. Though there are signs of some movement in this direction, the full crisis is still some distance off, so that we have a few years in hand to prepare for the radical changes involved in moving toward "a partially employed but fully engaged society" (Trist, 1981).

Meanwhile, there is one short-term certainty: that, if the technological imperative continues to be blindly followed, the worst consequence will supervene not only in the creation of badly designed jobs at the more routine levels, but in managerial failure to seize opportunities that will remain unseen unless processes of deliberation and forms of discretionary coalition are

introduced that are far more effective than those operating in most contemporary organizations. The question is whether we let the present condition continue and so lose the advantages of advanced office technology or, by countervailing it, gain them. The choice is ours. In Pava's words:

This choice may be exercised by design or default. Design represents attempts to move beyond past errors. Default is the unknowing ratification of unacknowledged history. Socio-technical analysis represents one way to design instead of default.

These brief sentences sum up the message of his book.

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