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EDITOR: NORMAN BALABANIAN

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In This Issue

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AUTONOMOUS ENERGY SYSTEMS, BIO-GAS PLANTS

by K. K. Murthy, Systems Science, NITIE, Bombay

INTRODUCTION

Anerobic fermentation of organic matter -- a process in the absence of atmospheric air -- generates a mixture of gases: methane and carbon dioxide. The anerobic bacteria decompose the organic matter into sludge and methane, a gaseous fuel with a good calorific value. A number of organic wastes are suited to this method of methane generation: animal refuse such as cow dung, municipal and sewage wastes, vegetable wastes, human wastes and algae. Out of all these, for many a developing country with large population of cattle, cattle dung holds high promise. In this paper, I shall concentrate on the methane fuel economy based on cattle dung.

THE IMPORTANCE OF METHANE ECONOMY

In the wake of the energy crisis since 1973, the price and the supply position of fuels have greatly deteriorated in almost all non-oil-producing developing countries. The price of petroleum hydro-carbons such as cooking gas, kerosene, and gasolene have increased by a factor of 2 to 3.

Most developing countries like India depend on non-commercial forms of energy (wood, animal dung and vegetable wastes), to meet 50 to 60 per cent of their energy requirements. Firewood has become very expensive in the wake of the oil crisis. During the period 1972-1974, the price of wood went up by nearly 300%. Nearly 90% of the rural population in developing countries depend on non-commercial forms for their meager energy needs. The predominant energy requirement is for the domestic sector, mainly for cooking and heating. Commercial sources such as kerosene, natural gas or electricity cannot be made available to this vast rural sector mainly due to lack of central energy networks and the high price.

In this context, the use of cattle dung to generate methane has excellent prospects. The mixture of gases produced by cattle dung gas plants can be used for cooking and heating directly. The efficiency of combustion is far superior compared to the direct burning of dried cattle dung which is a common practice in many developing countries. Direct burning of dry dung has an efficiency of only 11%, whereas methane has a combustion efficiency of 60% (Table 1).

Table 1
Relative Efficiencies of Combustion

Fuel	Effective heat value KCal per Kg.	Efficiency %
Coal	1653	20
Soft Coke	1761	28
Charcoal	1940	28
Kerosene	4607/liter	48
Dry cattle dung	234	11
Methane (biogas)	3011/m^3	60

In addition to the better fuel efficiency, the ash residue from the direct burning of dung has an insignificant volume and low fertilizer value. On the other hand, sludge from the fermentation process in the methane gas plant, which is available as residue, amounts to 75% of the input dung and has a high fertilizer content.

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THE BIO-GAS PLANT

Figure 1 shows the constructional details of a typical gas production unit using cattle dung. The plant is simple and can be built using low level technology and locally available materials. Depending on the available supply of dung, the capacity of the plant varies. In India, by the middle of 1974, 7000 plants of different sizes were in operation. In the last two years, another 6000 plants have been built. It is proposed to build 20,000 plants by the end of 1978.

The plant consists of a digester built of masonry below the ground level. The depth varies from 3.5 to 6m and the diameter from 1.2 to 6m depending on the gas-producing capacity. The wall in the middle divides it into two semicircular compartments. The slanting pipes -- one for feeding the dung slurry and the other for collecting the output sludge are made of cement. Cattle dung is mixed with water in the ratio of 3:1 to 3:2. As the slurry mixture is filled through the inlet pipe, sludge flows out into the collection area on the surface as shown. The capacity of the digester is so designed as to hold 50 day's input dung.

The gas-holder built of milled steel dips into the slurry and rests on a ledge. The holder collects the gas which bubbles out from the slurry and the gas holder rises. Within a distance of up to 30 meters, the gas can be transported without any difficulty. The pressure of the gas collected depends on the weight of the gas holder and it is usual to arrange it so that the pressure is 7.5 to 15 cm of water. This is sufficient to run simple domestic appliances such as a stove, gas lamp, and so on.

The appliances for using the gas have to be specially designed, since the gas consists of a mixture of 35% methane and 45% carbon dioxide. The different capacities of the plants that are in operation in India are given in Table 2.

Table 2
Size of Gas Plants and Their Cost

Capacity m^3	Minimum Number of animals required	Cost of Plant in US $
2	5	230
3	8	300
6	12	420
10	30	625
15	40	875
25	72	1350
85	240	4250
140	400	6450

A typical village in India with a population of about 500 needs about 575 Kwh of energy per day for cooking and lighting at the present levels of consumption. To generate the energy equivalent of 575 Kwh, 110 m^3 of gas has to be generated daily. This can be fully met if the cattle dung typically found in the village is used. Family plants of from 2 to 6 m^3 have been most popular in India depending on the family's energy requirement and cattle holding.

ECONOMIC ASPECTS OF THE METHANE GAS PLANT

The methane economy when adopted on a sufficently widespread scale, can provide multiple benefits to the community.

In addition to the energy derived from the methane gas generated, the residual fertilizer is of high economic significance. At present, roughly 75% of the dung is burned directly and only 10% converted to manure by composting. This is a colossal waste in terms of badly needed fertilizer inputs to the land. India has a livestock population of 226 millions. The annual wet dung available is 1.2 billion tons which is equivalent to 250 million tons of dry dung. If all this dung is used for methane production, the annual production of methane will be about 77 million m^3. This is equivalent to about 24 billion liters of kerosene, or 195 million Kwh equivalent of electrical energy. This represents half the domestic sector energy demand of India. Thus, 50% of the domestic energy needs can be supplied by this source. In addition to this energy production, the residual sludge produced will be 200 million tons. This is equivalent to 3 million tons of nitrogen. The present country-wide consumption of nitrogeneous fertilizers is 1.77 million tons out of which 1.18 million tons are produced indigenously. Hence, the full methane economy has a potential of 2.5 times the present installed capacity for nitrogeneous fertilizers. The petroleum hydrocarbon, naptha, which is a raw material for fertilizer manufacture required for producing this amount of nitrogeneous fertilizer is about 1.7 million tons. This represents a saving of 200 million dollars annually for petroleum imports. [Practically, of course, not all the cattle dung can be collected; if only half of it is, the preceding benefits would be correspondingly reduced.]

To convert the whole of cattle dung to biogas, such gas plants will have to be built in every village in the country. The capital investment for each plant varies according to size (Table 2). Therefore, it is very difficult to estimate the total capital investment required. However, a cost-benefit analysis can be carried out for a typical village plant.

COST BENEFIT ANALYSIS OF A TYPICAL WHOLE VILLAGE PLANT

A methane plant to supply the fuel requirements of a typical village of population about 500 needs a daily gas output of about 140 m^3. This amount of gas can be generated if 400 animals are available in the village. The capital cost of the plant (1975 prices) in dollars will be $6450. Out of this investment, 55% is for construction, 30% for the gas holder and 15% for piping, stove and other user devices. The annual cost of operation and the return is worked out below to show whether the return on capital is adequate.

Annual Expenses:

Interest on investment @ 12%	$ 774.00
Depreciation on gas holder & frame @ 10%	193.50
Depreciation on piping, stove etc. @ 5%	48.50
Depreciation on civil works @ 3%	106.60
Annual maintenance - painting, etc. @ 2.5%	161.00
Total	$1,283.50

Annual Income:

Cost of gas @ 3.3 cents/m^3 (with 75% load factor)	$1,265.00
Cost of fertilizer obtained from sludge (differential cost after allowing for the cost of directly composted manure) 350T/annum @ $5/ton	1,750.00
Total	$3,015.00

The net annual return on the capital employed works out to be about 27%, which is excellent. These figures do not take into account the cost of labor in operating the plant because labor is required for the collection and disposal of the dung whether the gas plant is built or not. The additional labor requirement for the gas plant is marginal and hence has been neglected.

The above analysis shows that the methane economy is viable commercially. In fact, the residual fertilizer content justifies its adoption even more than the energy value of the gas. In addition, a number of social benefits such as better cleanliness, better humus content in the sludge fertilizer, etc. accrue to the community.

PROBLEMS AND FUTURE PROSPECTS

Though the above analysis shows that the methane plant is attractive for meeting the basic energy needs of the rural sector, the wide-spread adoption of this energy source has certain problems associated with it.

The process of anerobic fermentation is highly complex and not yet well understood. The methane-producing bacteria have to be isolated and made to prosper in the digester. Introduction of special bacterial cultures improves gas production. Research in these areas is required for optimum performance of the plants. Secondly, the fermentation process is temperature-sensitive and gas production is poor when the ambient temperature is low. Gas production doubles at 27° C compared to that at 15° C. External heating arrangements or solar heating to maintain the best temperature conditions will greatly improve its performance. Temperatures around 35° appear to be optimum. Thirdly, the methane production reaction is a slow one and is hampered by scum formation on the surface of this slurry. This can be broken up if arrangement for rotating the gas holder can be incorporated One novel idea is to use wind power for this agitation.

The organizational and social structure obtainable in villages are not conducive for large plants to supply the whole village. Co-operative organizations have not been much of a success in organizing the collection of raw material required. A whole-village plant also requires storage of gas under pressure and a distribution network.

These technical and socio-economic problems have to be urgently tackled before widespread use of this energy source is possible, in spite of its attractiveness.

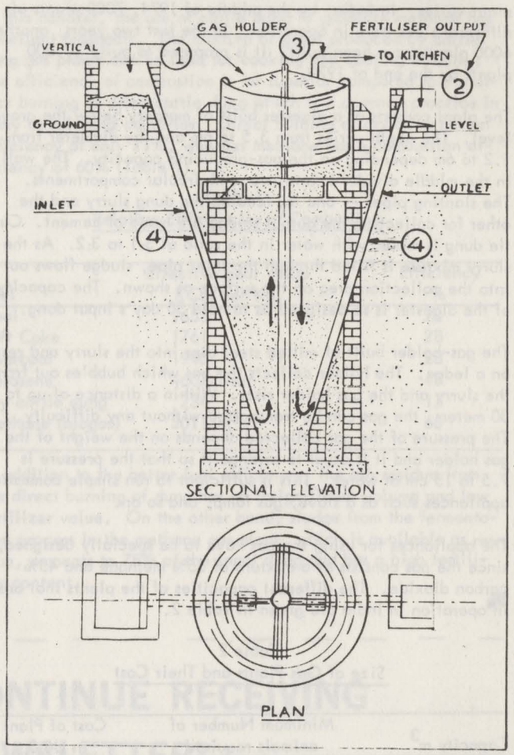

Fig. 1 Drawing of a Methane plant.

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THE IEEE AND THE ISSUE OF PERSONAL INFORMATION/PRIVACY

"What should the IEEE be saying about the currently dormant but nevertheless explosive issue of data banks and their effect on individual privacy?" Robert M. Saunders, 1976 Vice President/Regional Activities[1].

by Larry L. Stine, CSIT Working Group on Information Technology

GENERAL BACKGROUND

Public policy and legal issues about a technology arise when negative effects from that technology are perceived. If the anticipated magnitude of the negative effects is expected to approach the benefits and the technology implementation is pervasive, then the debate will be amplified.

A good example is the national debate on various aspects of nuclear power. The IEEE recently entered this debate with the formulation and public dissemination of a statement issued by the Board of Directors favoring the development of nuclear power. The statement itself and the organizational mechanics for its formulation have been the subject of intensive debate within the IEEE. We can expect future debates within the IEEE on other issues as engineers increase their personal and professional participation in policy debates and act through the IEEE to influence them.

There are other ways in which the IEEE can influence public policy debates. A less partisan way is to act as a resource to educate policy-makers and the public about the technical feasibility and operating characteristics of various systems.

We also see discussion of public policy manifested by three kinds of activities within the IEEE itself. The first is the promotion of an awareness of current public issues of technological applications. The second is the formulation of ethical guidelines that would serve the engineer as a help in making day-to-day decisions about his work. The third way is the prediction and analysis of societal implications of specific applications. Presumably the more knowledgeable the engineer is about such aspects, the better the system will be designed. If or when public debate occurs, it will be more tempered because the negative effects are lessened and opinions are more reasoned and based on greater knowledge.

The following sections discuss the status of policy problems in the area of personal data files and possible IEEE roles in current and future debates.

PRIVACY OF PERSONAL DATA FILES--A CURRENT INFORMATION TECHNOLOGY ISSUE

The last few years have seen increasing legislative activity regulating the gathering and dissemination of information about individuals on local, state, and national levels. Recent Congressional legislation includes The Fair Credit Reporting Act of 1970 and the Privacy Act of 1974.

Future regulations and laws are in the making. Government commissions include the Federal Privacy Protection Study Commission which is looking into the use of mailing lists, the social security number as a universal identifier, disclosure of federal income tax returns, credit card records, consumer credit reporting, employment records, social services, and statistical research. There is a recently formed National Commission on Electronic Funds Transfer Systems (EFTS) to explore the broad public policy issues in this area.

Two Congressional members of the Privacy Commission, Representatives Koch (D-NY) and Goldwater (R-CA) have introduced H.R. 1984, "Comprehensive Right of Privacy Act." This bill will probably undergo considerable revision before reaching any voting stages. Thus, the proposals should be considered only tentative. The bill now includes the following provisions:

Sec. 4(a) ADMINISTRATIVE REQUIREMENTS - Any organization maintaining an information system...shall.....

(9) maintain a complete and accurate record...of every access...by persons or organizations not having regular access authority;
(10) establish rules of conduct and take affirmative action to inform each person involved in the design, development, operation, or maintenance of the system,... about the requirements of this act, the rules of conduct, and the penalties for noncompliance;
(11) establish appropriate safeguards to secure the system from any reasonably foreseeable threats to its security;

Sec. 4(b) (1) Any organization maintaining an information system that disseminates statistical reports or research findings based on personal information drawn from the system, or from systems of other organizations, shall

(A) make available to any data subject without revealing trade secrets, the methodology and materials necessary to validate statistical analyses,

The bill would establish a Federal Privacy Board consisting of five members. Among other duties the Board would publish an annual Data Base Directory of the United States containing the name and characteristics of each personal information system. Individuals and organizations keeping such systems must report to the Board once a year. Other sections of the bill include

Sec. 4(d) RIGHTS OF DATA SUBJECTS - Any organization maintaining personal information shall.....

(2) request written consent of a data subject to disseminate part or all of this information to another organization or system not having regular access authority;

1. Quoted from: "VPs Cotellessa and Saunders: How IEEE Sets Policy", IEEE Spectrum, May 1976, p. 88.

Sec. 6(a) It shall be unlawful for any organization to request or require an individual to disclose or furnish his social security account number,.....unless the disclosure ... is specifically required or authorized by Federal law.

CRIMINAL PENALTY

Sec. 10. Any individual or organization or responsible officer or employee of an organization who willfully.....

(1) keeps an (personal) information system without having notified the Federal Privacy Board;

.....

(4) violates section 6 of this Act, shall be fined not more than $10,000 in each instance or imprisoned not more than five years, or both.

CIVIL REMEDIES

Sec. 11(a) INJUNCTIONS FOR COMPLIANCE - The Attorney General of the United States, on the advice of the Federal Privacy Board, or any aggrieved person, may bring an action in the appropriate United States district court against any person who has engaged, is engaged, or is about to engage in any acts or practices in violation of the provisions of this Act or rules of the Federal Privacy Board, to enjoin such acts or practices.

(b) CIVIL LIABILITY FOR UNFAIR PERSONAL INFORMATION PRACTICE - Any person who violates the provisions of the Act, or any rule, regulation, or order issued thereunder, shall be liable to any person aggrieved thereby in an amount equal to the sum of -

(1) any actual damages sustained by an individual;
(2) punitive damages where appropriate;
(3) in the case of any successful action to enforce any liability under this section, the costs of the action together with reasonable attorney's fees as determined by the court.

It is probably fair to say that the impact of existing and proposed regulations and laws such as H.R. 1984 will be administrative and budgetary in nature and will affect organizations more than design engineers. However, the design of automated systems will probably be more complex. For example, the National Bureau of Standards recently issued the publication "Index of Automated System Design Requirements as Derived from the OMB Privacy Act Implementation Guidelines"; NBSIR 75-909 accession number (PB 246-863). Also there is the mention of civil and criminal penalties in H.R. 1984.

In light of this activity, members of the IEEE could indeed consider what future actions and policies within the Institute may be warranted.

POSSIBLE IEEE POLICIES

The first section of this report listed ways in which the IEEE can enter the debate on the privacy of personal data banks. Among these are:

1. Taking an official pro or con decision on specific issues.
2. Acting as a technical education resource to policy makers and the public.
3. Promoting an awareness of public issues on the part of the membership.
4. Formulating ethical guidelines with specific focus in this area.
5. Anticipating such issues in early design phases by promoting analysis in technical activities and informing the membership.

Before addressing each of these five ways in particular, it would be useful to describe the activities of the American Federation of Information Processing Societies (AFIPS). AFIPS is an organization comprised of fifteen member societies of which the three largest are the ACM, DPMA and the IEEE. IEEE participation is via the Computer Society which has three representatives on the AFIPS board. This year the representatives are: the Computer Society President, the second vice president, and the IEEE Division V Director. One of these individuals is on the AFIPS Executive Committee. As chartered and registered under the U.S. tax code, AFIPS cannot engage in lobbying activities. This is in contrast to the IEEE which has a different charter and tax category. The IEEE can and does interact with legislative bodies to advance the standing of its members.

For the past year, AFIPS has maintained a Washington office to "keep AFIPS societies informed of significant Washington developments and to coordinate the provision of responsible technical input to the federal government..."* The AFIPS Washington Office works under the supervision of the AFIPS Washington Activities Committee. During its first year, on the subject of personal data files, the AFIPS Washington Office:

. briefed the executive director of the White House Domestic Council Committee on the Right of Privacy;
. formed a panel of experts on private sector usage of the Social Security Number, at the request of the Federal Privacy Protection Study Commission;
. briefed the National Commission on EFTS and the Office of Telecommunications Policy on the technology underlying EFTS;
. provided written comment on proposed amendments to Federal Reserve Board Regulation J, which pertains to Electronic Funds Transfer Systems which may be operated by Federal Reserve banks and automated clearinghouses.

In submitting technical comment, among the resources the AFIPS Washington Office draws on are three AFIPS Committees:

1. the EFTS Committee
2. the Special Committee on the Right of Privacy**
3. the Standing Committee on the Social Implications of Computers.

Among other activities, these committees can assist AFIPS societies' efforts to inform their membership in these areas.

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* The UPDATE column in COMPUTER, publication of the IEEE Computer Society, is drawn from the AFIPS Washington Report.

** Willis Ware, a former chairman of this Committee, is on the Federal Privacy Protection Study Committee. Other members include Representatives Koch and Goldwater, the sponsors of H.R. 1984.

Therefore, we see that the IEEE, through its participation in AFIPS, is already quite active in the personal privacy issue. In answering the question proposed by Mr. Saunders regarding unilateral IEEE statements, the following paragraphs explore the specifics as to what may be said to whom and why.

Should the IEEE take a public position favoring or opposing specific issues such as the proposed provisions of H.R. 1984? The motivation to do so could be based on the desire to serve the public interest and participate in such public debates where the IEEE has special insights to offer regardless of membership interests. Another motivation, and a more obvious one, would be to improve or protect the lot of the IEEE member.

As far as the public interest is concerned, on the one hand it is desirous to protect individual privacy as much as possible. However, in doing so it evidently may be necessary to restrict crime prevention and investigation, and to impose economic and bureaucratic burdens. In fact, the annual publication of the Data Base Directory, which collects the name and characteristics of all personal information systems, may make it easier to perform the kinds of acts the law is trying to eliminate.

As far as the membership is concerned, on the one hand, imposition of the various file protection rules, inquiry, recording, and notification procedures required by such legislation as H.R. 1984 could offer many engineering challenges. On the other hand, satisfying the rules could be annoying, delay implementation of new systems, and reduce job satisfaction.

If such safeguards are not imposed now, future abuses could reach such magnitudes that possible adverse public reaction could overly restrict the advancement of computer technology in general. On the other hand, it might be fairly stated that the civil liability provisions of H.R. 1984 are unclear and could, given certain interpretations of the law, embrace unknowing design decisions by engineers.

With the possible exception of the civil liability provisions, the above arguments are rather tenuous. In contrast to the California Nuclear Initiative where the economic displacement and public safety issues are relatively clearly stated (if not agreed upon), there seems to be no driving motivation for the IEEE to take a public position at this time, even if a consensus of the membership could be reached.

Should the IEEE act as a technical educational resource to policy makers and the public? Because of the activities of the AFIPS Washington Office, the IEEE is already reaching policy makers, albeit indirectly. Whether or not the IEEE should act unilaterally in this regard could be seriously considered although it may only confuse the picture to have more than one technical description. The IEEE could perhaps improve its ties to the AFIPS activities. As far as the general public is concerned, the IEEE would have to work out a means of reaching the public (e.g., press releases), given that the educational material was developed. At a very minimum, before embarking on unilateral actions, the IEEE should review the extent and substance of its AFIPS participation.

Should the IEEE promote membership awareness of these kinds of issues? This would certainly have to be done if the IEEE were seriously considering public statements on such matters. As previously mentioned, the UPDATE section of COMPUTER magazine performs this function to a certain extent. Perhaps this activity could be augmented with articles describing the specifics of the briefings by AFIPS and the related activities of various government bodies. SPECTRUM could carry articles on personal privacy as it has been doing in the energy area. Certainly the appearance of this article in the CSIT Newsletter is in this spirit.

Should ethical guidelines with specific focus in this area be formulated? The IEEE already has a code of ethics for its members. This code presumably embraces the design of personal information systems. If more specific guidelines are warranted, the proposed provisions of H.R. 1984 could serve as a model.

How can the IEEE anticipate these kinds of issues? The only way to anticipate future issues is to be active in trying to identify them and predict their importance. This need not be confined merely to speculation about the future. As IEEE members participate in system developments in areas that interact directly with societal institutions, possible negative effects should be of concern, as well as the positive. Recognition of possible negative effects will lead to detection which in turn will result in affirmative corrective action. The IEEE can promote this recognition through articles in SPECTRUM, encouraging authors of technical articles to include social implications of relevant applications, and sponsorship of public policy topics in conference sessions. To some extent these kinds of initiatives are already taking place. The Communications Society has a Social Implications Committee which is active in this approach as applied to such areas as health care and law enforcement. Officers of the various Groups and Societies could review their programs to see if sufficient attention is being given to the public policy aspect of pertinent applications.

This article has explored some of the aspects of possible policy initiatives by the IEEE in the area of data banks and personal privacy. The main conclusion is that there is little reason for the Institute to enter the debate as an advocate of any particular position especially if there is little impetus from the membership. Rather what is warranted in the near term is to provide more information to the membership on the details and implications of existing and future regulation. This internal activity would at least serve engineers in dealing with this aspect of their work and may serve the public interest as well. Only if some kind of specific interest of the membership becomes defined as a result of such heightened awareness should the IEEE try to formulate a public position.

LETTERS

■
DEAR EDITOR:

Since reading your interview with Dr. Enrique Kirberg I have visited Santiago, Chile and several towns in Chile. While I do not know anything of the political background of Dr. Kirberg I could think that it might have been far to the left as that of the present President of my alma mater the T.U. Berlin. That could explain his treatment by the present regime.

In talking to the people of Chile both of the middle class and the engineering profession I find that there is general relief and satisfaction. The country has turned around after an economical catastrophe and is getting back on its feet. The people are much happier than under Allende. The country had lost a very large number of its engineers and they are returning, although many seem to be permanently lost for Chile.

Now about the three engineers that Dr. Kirberg would like to see freed. I do not know why we have to call them colleagues. All three occupied important political positions under Allende, two of them being Ministers and one Director of Mines. I am sure they are being punished for their political roles rather than their engineering background.

Jack M. Noy
Salt Lake City, UT

EDITORIAL RESPONSE

The writer makes the following points:

1. It is acceptable to forcibly remove a university rector and imprison him without a trial for two years on the basis of his "political background".

2. It is similarly acceptable to "punish" other engineers, not for any violations of Chilean law, but "for their political roles", that is for their allegiance to the democratically-elected government.

3. The way to decide the popularity of a regime is not through popular elections (as Allende's government was installed) but by bloody and repressive military coups followed by a visitor's sampling of the opinion "of the middle class".

We reject all of these points. We believe that a vast majority of IEEE members will reject them also and will agree with the norm in free societies that all individuals have a right to a fair trial, whatever their politics.

The current Chilean government has denied this right to tens of thousands of imprisoned Chileans, of whom an estimated 10,000 have been executed or died from maltreatment or torture since the military coup in September 1973. These abuses have been attested to by highly responsible and respected individuals and groups, including: Chilean church groups, news correspondents, the UN High Commissioner on Refugees, a team of US Congressmen, a representative of the Federation of American Scientists, Amnesty International, the International Movement of Catholic Jurists (centered in Spain), and the International Association of Democratic Jurists (centered in France).

It should be noted that Pedro Felipe Ramirez and Fernando Flores, two of the engineers mentioned in the Kirberg interview, recently were released from prison and have left Chile. Flores is now with Stanford University's Computer Science Department. The Vatican has offered Mr. Ramirez a position at the Pontifical University of the Sacred Heart in Milan.

Parenthetically, the "economical catastrophe" alleged to Chile "under Allende" was not simply a result of its own government's actions and policies, but the consequence of the CIA's admitted "destabilization" program and the US government's documented program of financial sanctions against Chile under Allende. And, conversely, any alleged "getting back on its feet" by Chile under Pinochet (and most objective visitors do not agree with such an assessment--see Newsweek Nov. 15) is not unrelated to the US government's massive financial support of the dictatorship.

Note: Frank Kotasek has compiled an eight-page set of notes and references documenting the assertions made in this response. He will send a copy to any interested person. His address appears elsewhere in this issue.

Norman Balabanian
R. J. Bogumil
Frank Kotasek

■
DEAR EDITOR:

A. J. Fritsch's (and others') comparison of percapita consumption of energy in the US and other industrialized, high-standard-of-living countries is misleading because the US should really be considered as a confederation of regions with highly different styles of living. New York City dwellers use less than half the energy of the average American. A little thought shows why this is so.

We 8 million in the country of New York have a highly developed mass transit system, relatively few of us own cars and most of us live in energy conserving, multiple-story, dwellings. Other true urban areas in the US (such as Boston and San Francisco) also consume energy at or below the rate of Sweden. Incidentally, this implies that jokers with two or more cars living in detached homes consume much more energy than the average.

To save meaningful quantities of energy, suburbanites and country squires should change their life style to that of urban apartment dwellers. A federal tax of 45¢ per gallon of gas would help. How many of your readers are ready for such realistic conservation programs?

Cy A. Adler
New York, NY

[Ed: Cy Adler is the author of Ecological Fantasies]

■
DEAR EDITOR:

In view of recent discussions of codes and ethics, I would like to present a few general thoughts on that subject, as well as some specific thoughts relating to nuclear power and advertising.

A recent issue of a local IEEE Newsletter [1] contains the following statement: "The Executive Committee of the North Jersey Section of the IEEE accepts and approves, with the following revisions, and supports the CANNONS OF ETHICS FOR ENGINEERS [2] and the IEEE CODE OF ETHICS [3]. The revision, in all cases, changes the word 'engineers' to 'engineer/member'."

It seems to me that there are numerous conflicts between the Code and the Cannons, and that there is still room for a lot of improvement. Furthermore, if the Code and Cannons are to be packaged together, improvements in the Cannons should not be allowed to lag behind improvements in the Code. For example: the Code says that "Engineers shall ...protect the safety, health and welfare of the public and speak out against abuses in these areas ..."; while the Cannons say that "He will refrain from expressing publicly an opinion on an engineering subject unless he is informed as to the facts relating thereto." Under such guidelines, what is an engineer who has limited knowledge of atomic physics supposed to do when he gets very disturbing news about risks involved in atomic power production? Some eminent authorities hold that risks are infinitesimal, while others point out that (for example) in the case of the March 1975 fire at the Browns Ferry Nuclear Power Plant, a major radiation release was avoided by "sheer luck"! [4]. My own worries are intensified by indications of bias in the huge propaganda campaigns being conducted by corporations and other organizations already committed to nuclear development.

A recent issue of NSPE News mentions last year's success in accumulating more that 25,000 signatures of engineers and scientists on a petition supporting the development of nuclear energy, and then states that "NSPE" again this fall has asked its state societies and local chapters to gather signatures of individuals who favor nuclear energy development." Frankly, I doubt that more than a small percentage of those who signed the petition had enough first-hand knowledge of the subject to meet the Cannon requirement and, consequently, I wonder if NSPE itself hasn't violated the Cannon of Ethics.

Another example of at least partial conflict between Code and Cannons is found in the advertising provisions. According to the Code, "Engineers shall ...seek to extend public knowledge and appreciation of the engineering profession and its achievements"; while the Cannons specify that "He will not advertise in a self-laudatory manner ..."; and the New Jersey Board of Professional Engineers adds: "Telephone listings shall be limited to name, address and telephone number either under or with each branch listing in which the licensee qualifies." Does enforced "modesty" really serve an important public purpose, or does it create a kind of status symbol primarily designed to make "professionals" feel a bit superior to businessmen and other non-professionals?

Engineers are said to have won a "long, hard battle [in 1972] for procurement of engineering services by government agencies on the basis of demonstrated competence rather than price ..."[5] Since public advertising of engineers' accomplishments is not permitted, I wonder how the relative competence of competing engineers is "demonstrated" to government agencies. Do engineers demonstrate their competence by just showing their licenses, or is there some way in which engineers with superior qualifications can "sell" their services without making any self-laudatory comments? I fear there is a widespread belief that, in the absence of bidding, contracts are too often awarded through "deals made in smoke-filled rooms"; and that the system tends to protect entrenched interests more than it protects the public.

In a recent case [6], a Board of Ethical Review held that a "Local Government Open Seminar" [held at the facilities of an engineering firm] was not a violation of the Code of Ethics. However, there was a Dissenting Opinion; and even the majority felt it would have been better if the firm had omitted the "open house" portion of its program.

I can't understand why efforts should be made to keep government officials from seeing the facilities of firms with which they do, or may do, business--especially in cases where affairs are carried on in an open and above-board manner. Don't at least some government employees almost have a duty to investigate the facilities of firms they intend to employ? And provided facilities actually are exceptional, why shouldn't an engineer rise a notch or two above a mere computer and show some human pride in them?

As a matter of fact, what's wrong with making truthful and reasonably dignified statements about personal accomplishments? If someone has something unusual to offer, what does the public gain by not being told about it? Even as an engineer, I find it difficult to locate firms that are seeking work in the particular fields in which I'm interested, and I feel that some truthful advertising should be encouraged.

Theodore M. Edison
West Orange, NJ

References:

[1] IEEE Newsletter (North Jersey Section), November 1976, p. 5.
[2] Prepared by Engineers' Council for Professional Development, 1947. Reprinted from Northern New Jersey IRE Newsletter, January 1961.
[3] IEEE Code of Ethics, reprinted from IEEE SPECTRUM, February 1975.
[4] Letter of September 1976 from Union of Concerned Scientists.
[5] From item re "The Brooks Bill" in Newsletter of Essex County (NJ).
[6] Case 75-12, Professional Engineer, July 1976, pp. 38-40.

■
DEAR EDITOR:

I was very interested in the article "Drafting Consumer Standards" in the June, 1976 issue of the CSIT Newsletter, as I, also, participated in the drafting of these standards, and the bad taste still remains.

I have had appreciable experience in the lawn mower field, being chief engineer of four companies that manufactured lawn mowers from the period of 1953 to 1974. I was the Chairman of the Engineering Specifications Subcommittee of ASA B71.1 from its inception in 1955 (or 1956) until 1962. During that time ASA B71.1-1960 was published (American Standard Safety Specifications for Power Lawn Mowers). This has been revised in 1964, 1968, 1972, and 1974. The 1974 version is in effect at this time, and is ANSI B71.1-1974.

When I heard about the intention to establish mandatory safety standards for lawn mowers, by Consumer Product Safety Commission, I felt that since I did have appreciable knowledge about lawn mowers, and now was not connected with the industry in any way, that I might be able to assist as a really independent consumer, who at the same time had more technical knowledge than most consumers. I wrote to CPSC and offered to assist, for free, as is known to be their requirement.

When Consumers Union was chosen to develop the standard, as the "Offeror", I both wrote and phoned, offering to assist. I was not chosen as one of the official "Consumers" for membership on any of the several subcommittees that were established. After more phone calls and the passage of some time, I did attend meetings in New York and eventually was listed as a consumer on one of the subcommittees. By that time much work had been done, much ground had been covered, and I felt I was too late to be very helpful.

To me, one of the worst aspects of the organization of the effort was the failure to determine the effects on accidents of the major tightening of the standards that had taken place with the 1972 version. Almost all mowers are identifiable as to the year of manufacutre, if one is knowledgeable, and in addition the safety sticker has the date of the applicable specification (e.g. B71.1-1972) on the mower itself. Thus, there could have and should have been a breakdown of the little specific accident information that was given to us, to indicate how effective some of the tighter provisions of the 1972 standards had been compared to earlier years. Nothing from CPSC bore on this important matter, and in general very little solid information about accidents was furnished.

The meetings, to a large extent, consisted of speculation as to what fault in a mower, or what operator procedure, might be causing certain types of accidents, and further speculation as to the effect of proposed new requirements. This kind of pure speculation was the basis for writing the proposed new mandatory requirements, that will cost very large amounts of money to put into practice, as they probably eventually will be.

There have been appreciable over-runs of both time and money to date. The original agreement called for CPSC to contribute $91,745 to Consumer's Union for the program. It was announced in March of 1975 that an additional amount of $90,165 was being allocated.

The original time schedule called for CPSC to publish the proposed standard by February 19, 1975. This has not yet been published, and CPSC has extended the publication date several times, the latest being April 30, 1977.

Gilbert E. Buske
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NEWS, NOTES, & COMMENT

ANNOUNCING A NEW CSIT AWARD

After considerable effort to have an "Award for Outstanding Service in the Public Interest" adopted by the IEEE [1] - without success - CSIT has formally established such an award of its own:

CSIT AWARD FOR OUTSTANDING SERVICE IN THE PUBLIC INTEREST

Purpose: It is intended that the award recognize the engineer or group of engineers who acted to protect the public interest; particularly when such action was taken despite personal risk. It is to be hoped, that by focusing on such actions in this manner:

1. Engineers will become more sensitive to the need for personal action, when warranted, in the public interest.

2. The Awardee(s) will gain recognition, as public compensation for professional injury that might be incurred.

Criteria and Selection: The CSIT Awards Committee is responsible for interpreting the Award Criteria, considering candidates for the award, and selecting the Awardee(s).

Sponsors: Broad sponsorship via contributions to a CSIT Awards Committee Escrow Account currently being established.

Questions and comments about this new CSIT Award may be addressed to:

Joseph S. Kaufman
Bell Laboratories
Holmdel, NJ 07733

Details concerning contributions to the CSIT Awards Committee account will appear in the next issue of this newsletter.

[1] J.S. Kaufman, "An IEEE Award for Outstanding Service in the Public Interest," CSIT Newsletter, June 1976, Issue No.14.

HELP FOR THE ETHICAL ENGINEER IN TROUBLE

At its 9/11/76 meeting, CSIT decided to undertake the investigation of cases where engineers pursuing their professional work in accordance with the IEEE Code of Ethics have, as a result, been subjected to or threatened with unfair treatment. Where a careful study of the circumstances indicates that such a situation exists, efforts will be made to aid the engineer involved. For example, if legal action is being taken, the case might be brought to the attention of the IEEE Board of Directors with a recommendation that they instruct the Institute's attorneys to file an amicus curiae brief, as in the BART case.

It should be emphasized that only cases in which engineering ethics play a central role will be considered. CSIT is not volunteering as a shop steward for engineers dissatisfied with their last pay increases.

Readers acquainted with engineers in such predicaments are invited to inform them of this possible source of help. Initial contact should be made with the chairman of CSIT's Working Group on Ethics and Employment Practices:

Prof. Stephen H. Unger
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(212) 280-3107 (or 3104)

(Home address and phone are listed elsewhere in this issue.)

NEWS FROM SWISS SECTION

A "Working Group for Society and Technology" has been established under the auspices of the Swiss Section of the IEEE, under the inspiration of Mr. S.K. Sarkar. The working group is composed of engineers who feel that it is important that they, as technically competent persons, be concerned with the social consequences of technology. Believing that more could be achieved in working together rather than as individuals, two subgroups were formed to deal with the problems of:

1. electronic communication media
2. energy and the environment.

At the first two general meetings of the group in April and October of 1976, a number of talks were given including interim reports by various members of the two subgroups.

A highlight of the first meeting was a talk by Dr. Ernst Basler based on his book "Civilization in Transition - Maintenance and Structuring of Man's Environment".* Dr. Basler showed some of the many dimensions, through all of which man hurtles, consuming and producing at an exponentially growing rate. His conclusion, that technological developments must be made in the context of a many-faceted closed system, was thus well underscored.

A highlight of the second meeting was a brief discussion by Dr. Rolf W. Peter showing how Migros, the largest Swiss food and retailing concern, had reduced energy consumption by some 15% per production unit over a two-year period. Exciting in itself, this result was achieved with a two million dollar saving in energy even after amortization of the required equipment.

[The preceding was supplied by Harry Rudin of the Swiss Section of IEEE.]

* "Zivilisation im Umbruch - zur Erhaltung und Gestaltung des menschlichen Lebensraumes" Verlag Huber, 1974.

NUCLEAR OPPONENT WINS SWEDISH ELECTION

Nuclear power has recently become a political issue in a number of countries. In Sweden, a coalition led by Thorbjorn Falldin and his Center Party won the September 19, 1976 national Parliamentary elections, thus ending forty-four years of rule by the Social Democratic Party. Falldin has replaced Social Democrat Olof Palme as Prime Minister of Sweden.

The Center Party's opposition to nuclear power was the main plank in its platform. Falldin promised that, if elected, he would start planning to shut down the five nuclear units now in operation, would stop work on the five units under construction, and would cancel plans for the three units that have been approved by Parliament. To what extent this position contributed to his victory is unknown. Furthermore, the Center Party's coalition partners, the Liberal and Conservative Parties, favor nuclear power. The main opposition parties in the new Parliament are also split on the issue: the Social Democratic Party (pro-nuclear) and the Communist Party (anti-nuclear).

In its campaign, the Center Party raised questions regarding reactor safety, waste management, and the risk of plutonium theft. The Social Democrats responded that Sweden's nuclear safety standards were the most stringent in the world and that fossil fuels posed a greater environmental threat than nuclear power. They asserted that jobs and industrial growth would be threatened by lack of energy if the Center Party's program were implemented. Sweden's five operating nuclear power plants provide 20% of the nation's electrical energy. 50% of Sweden's electrical energy is used by industry--mainly the steel, pulp, paper, mining, and metals industries.

Sweden is a relatively efficient user of energy. Its per capita energy consumption is about half of the U.S. level, while its per capita income is roughly equal to the U.S. level. Nonetheless, all five major political parties give a high priority to stronger energy conservation measures. In addition, all five parties favor a tapering-off to zero energy growth by 1990 and a major R&D effort on alternative energy sources.

Sweden has only small deposits of coal and petroleum, and its hydroelectric capacity cannot be expanded significantly without damage to the environment, but it has large deposits of uranium. Consequently, Sweden took an early interest in nuclear power. At first, research and development concentrated on heavy water reactors, which can be fueled by unenriched natural uranium. Sweden's first commercial reactor, an underground 80-megawatt-thermal heavy water unit, provided space heating and about 10 megawatts of electrical power to the Stockholm suburb of Farsta from 1963 to 1974. It was shut down because its small size made it uneconomical to operate. A second heavy water reactor, the 140-megawatt-electrical Marviken reactor, was completed in 1969, but it was never put into operation because it failed to meet safety standards. Meanwhile, light water technology had made major commercial breakthroughs, and light water reactors were seen as more economical, efficient, and reliable than heavy water reactors; Sweden now has five LWR power plants in operation. One of the units was built by Westinghouse (USA), and four were built by ASEA-ATOM, which is owned jointly by the Swedish government and a private firm. The Marviken reactor has been converted into the world's only full-scale facility for destructive tests on reactor containment and emergency cooling systems under accident conditions.

[Note: Since the election, the Center, Liberal, and Conservative Parties have hammered out a nuclear power program and have presented it in Parliament. The program will allow the nation's five operating reactors to continue without any changes, permit a sixth reactor to start up this month, and let work continue on the four reactors now under construction and the three more that are approved but still in the blueprint stage. Prime Minister Falldin characterized the program as a "compromise."]

BOOK REVIEW

A review of The Conquest of Will: Information Processing in Human Affairs. by Abbe Mowshowitz. Addison-Wesley, 1976.

Reviewed by Jack Kurzweil, Electrical Engineering, San Jose State University.

Abbe Mowshowitz has written a profound and learned book on the social impact of computing. Drawing on the work of a range of thinkers, from specialized systems analysts to social philosophers, he has attempted to order and define, in a philosophical sense, the range of real and potential uses of computers and to explore their results and limitations.

Although Mowshowitz describes computer utilization in a large number of areas ranging from production processes to mangement decisions, to health care, education, surveillance, systems analysis, etc., a number of central ideas emerge. The book is divided into four parts:

- Historical Perspectives
- Accomplishment and Promise: Coordination of Diversity
- Challenge: Control of Disorder
- Identity and Uncertainty: The Machine as Mirror Image.

The final section is devoted to man-machine interaction and the nature of machine intelligence. The ideas that are discussed distill the philosophical essence of the practical problems of information processing whose presentation forms the bulk of the book. Does the data processing capability of computers blur the boundary between man and machine? Can computers be taught to think as human beings do?

To one degree or another all of the quoted references indicate that the answer to both questions is yes. Among those cited, some view this answer with optimism and others with pessimism but there appears to be no fundamental disagreement with this answer.

Those who support this answer base their arguments on a view of thought as a mechanical function of some formal mechanism, the brain. To reproduce human thought is simply to reproduce the formal structure of the brain, a task which is staggering in its complexity but also conceptually solvable as defined.

I do not agree with these views because I perceive them to be at variance with a real understanding of what is involved in human thought and language. On the first level, human thought and language are not simply mechanical functions of the brain; the brain is part of a complex physiological being with a myriad of subtle biochemical processes that interact with the brain, processes that are not simply a function of the body but can be induced by external stimuli. The relationship between schizophrenia and the body's chemical balance is well known. Further, human beings are not a collection of isolated individuals. We exist in a complex of social relationships, in societies organized to produce food, shelter, clothing, tools, etc. Our thought processes, our emotions and our language are a product of an extraordinarily complex interaction of our physical beings with our social relations--and these social relations are in an unending process of change and development.

To suggest that all of this can be reduced to an information-processing mechanism is so out of joint with reality as to render these points of view ideological as opposed to scientific. This should not be taken as a broadside attack on Artificial Intelligence which will undoubtedly continue to provide approaches and answers to an increasing variety of problems, but rather an uncompromising opposition to the fetishism of computers. To view human beings as no more than computers is to provide the ideological basis for replacing human control over human affairs by computer control, or, more precisely, to place the control of human affairs in the hands of those who control the computers.

Hence the title, "The Conquest of Will". Mowshowitz perceives the encroachment by computers into matters that properly should be areas of human decision making. He is distressed by this and calls for alternatives, but he is pessimistic and does not explore any of the alternatives that he calls for.

> "The analogy with the computer may not be perfect, but it is revealing nonetheless. Both the automobile and the computer answer to real social needs. Although it would appear that the existence of viable alternatives to automobile transportation has no parallel in the case of computer applications, this is true only if one insists on certain forms of social organization. So long as banks, for example, must process billions of checks, or federal agencies are responsible for administering social welfare programs involving millions of people, computers will be essential. But it should not be heretical to raise the question of whether or not this is 'the best of all possible worlds.' Just as the automobile could be utilized as a partial answer to transportation needs, the computer too could be applied not simply wherever the opportunity arises, but only where it is deemed in the best interests of society. That this might entail dismantling or modifying existing social institutions should not in itself prevent us from considering the alternative." (pp. 62-63)

The second and third parts of the book, Coordination of Diversity and Control of Disorder, represent to the author the two main general social functions of computers. These two functions of information processing are seen as corresponding to two different forms of information: information having to do with structure or complexity, and information having to do with randomness.

In the section on Coordination of Diversity, there are chapters on Computer Utilization, Corporate Decision Making, The Changing Character of Work, Education, and Health Care. The section on Control of Disorder includes chapters on Computer Utilities, Privacy and Surveillance, Information and the Political Process, Systems Analysis and Political Decision Making, and a chapter on Information, Power, and Complexity.

With regard to corporate decision-making, Mowshowitz distinguishes between processes which lend themselves relatively easily to computerization such as production processes, payroll and inventory control, and various decisions that reduce to linear programming problems, on the one hand, and on the other, those management decision problems which have not been successfully computerized because of the stochastic nature of the variables and because of the interaction of the corporation with surrounding social relations. He observes that not only is the tendency toward hierarchy and centralized

control inherent in corporate structure, but that the drive toward their continuing realization has assumed an ideological character that transcends their actual requirements. The computer and management information systems (MIS) have thus become a tool to reinforce this drive. For this reason they have been introduced and used beyond the capabilities of the systems themselves.

Similar categories of computer uses and problems associated with their use are described in the areas of health care and education. Routine administrative work such as billing, filing, and scheduling easily lends itself to automation and accompanying cost reduction. Even in this area, however, apparently neutral administrative streamlining may conceal hidden agendas that adversely affect the delivery of services. When the information processing capacity of the computer begins to have a role in the service itself, serious problems begin to appear. The automated medical laboratory and the use of computer-aided instruction to assist students in acquiring specific skills are seen, by the author, to be positive advances. But the quality of medicine is seen to suffer when the use of computers reinforces the existing trend toward depersonalized, over-specialized, hierarchically-controlled health care.

In education, Mowshowitz sees the beneficial possibilities of computers to be restricted by financial limitations on their use and, simultaneously, under the impact of the mechanical acquisition of skills and facts, a squeezing out from the educational process of the transmission of human and cultural values. But it seems that, in making this distinction, the author has overlooked what ought to be the real purpose of education: the development of critical thinking, which can only be accomplished in the course of direct human exchange. He therefore unnecessarily opens himself to attack by "pragmatic realists" who pretend to see education simply as training.

Unfortunately, the author has neglected to explore a major aspect of the social thinking that has propelled the computerization of education. There is a growing concern emanating from the Carnegie Commission on Higher Education that too much education may unrealistically raise the life expectations of students from working class and minority backgrounds and thus create a reservoir of social dynamite in the society. The notion of reordering social priorities so as to enable these strata to achieve a secure, creative, human life is, of course, not contemplated. Rather, the response is to make higher education less accessible and, so far as it is possible, reduce it to training. Hence budget cutbacks and computerization proceed together.

The use of computers in research is explored and, again two sides of the question are developed. Computers have made possible, for the first time, investigation of phenomena requiring large scale computation, real time computation, or having only numerical solutions. On the other hand:

> "Although the computer is unquestionably an asset in many areas of scholarship and research, there is some concern over the possibility of cultivating excessive dependence on its use. As computers become more and more accessible, the likelihood of inappropriate applications increases. The computer's data processing capabilities can easily be misused in ill-conceived and poorly designed research projects. This applies to all disciplines, the humanities as well as the sciences. The collection and processing of data can become an end in itself, or worse yet an excuse for publishing results which serve no other purpose than to enhance the author's status. The temptation to perform experiments or to determine word frequencies in a literary corpus, simply because a computer is available to process the data is often irresistible, especially when career advancement hinges on scholarly production. But, of course, this type of intellectual masturbation antedates the computer.
>
> Creativity is an elusive human quality, and the influence of computer technology on scholarly creativity is a matter of pure speculation. According to one often-repeated conjecture, if a computer had been available to Copernicus, he would have been content to patch up the Ptolemaic system rather than propose a new model of the cosmos. It is not always clear that declining computation costs are in the best interests of intellectual progress. Computers can be used as substitutes for thought: when in doubt, collect data and compute. Instead of trying to find an analytical solution to a problem, one may be inclined to write a computer program to explore different possibilities. This procedure is perfectly reasonable in some cases, but in others it may disguise incompetence." (pp. 117-118)

Mowshowitz observes that "the distinction between the coordination of diversity and the control of disorder is often very subtle" (p. 143). This and the question of who is to control the controllers form the running theme of the third part of the book.

After a discussion of the development of data banks and computer communication networks the author tackles the question of the future of individual rights and privacy in the face of the growing accumulation and centralization of personal data. The formidable problems that he describes for an individual to maintain privacy in these conditions are extended to the problems of democratic decision-making in the public arena when so much of the decision is based upon access to and understanding of volumes of specialized data. This problem is extended and compounded by the special knowledge required to understand and evaluate computerized models of social systems even as those models are imprecise to one or another degree.

The solutions that he poses, which are based upon the growing technical expertise of individual citizens are, in my judgment, wrongheaded because they are proposed in a framework which accepts the idea that the problems are fundamentally technical.

Mowshowitz seems to accept the inevitability and necessity of the continued collection of all kinds of personal data by the government and private enterprise. I do not. Why should private corporations be allowed to enter personal data into data banks? Why is an employer entitled to know the entire past and personal history of an employee? Are centralized medical records administratively necessary, or are they even beneficial to medical practice? Why should psychological profiles of school children be made part of the public record? It seems that law enforcement data banks have no more than a marginal effect on the ability of the police to solve or prevent crimes, although they do have a substantial influence in creating an atmosphere in which ordinary people fear becoming involved in the political process.

The highly touted "modernization" of police forces has resulted, over the vigorous objections of neighborhoods, in the virtual elimination of the cop on the beat and the local precinct stations, thereby transforming the police into heavily armed, highly mobile, paramilitary strike forces. This kind of transformation is, in the first place, a political decision

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rather than a technical necessity and it is the policy rather than the intricacies of its implementation that should be a matter of public debate.

A related set of difficulties exists with the author's discussion of Information, the Political Process, and Planning. I believe it fair to summarize Mowshowitz's appraisal of the problems involved in these areas to be:

1. a lack of sufficient data for planners,
2. inadequate models of social phenomena,
3. the difficulties, for the public, of having sufficient familiarity with the data to be able to properly influence governmental decisions.

It should be noted that the relationship of the public to corporate decision making is not even considered although earlier in the book the author had noted:

> "Concentration of decision-making in the upper echelons of management may possibly promote increased efficiency of production, but at the same time it poses a threat to democratic institutions. There is little difference between consolidation of power by a small group of political managers, and the centralization of control in large corporations which dominate our economic life ..." (p. 81).

Confining the discussion to governmental activities, the author's conclusion seems to be that the problem is with our apprehension of the phenomenon, not with the phenomenon itself.

> "... It is largely our inability to respond appropriately to a given set of conditions that precipitate a crisis. The succession of these untoward events points to the need for social planning, and the inadequacy of traditional methods. Through our failure to anticipate the consequences of excessive dependence on automobile traffic, we are now faced with a transportation crisis in urban areas ..." (p. 199).

I do not believe that social or economic planning is possible unless information apprehended in observing these phenomena can be turned to controlling them. Furthermore, in a society where economic activity is basically directed according to private rather than public interest, planning is bound to be ineffectual and oppressive to the overwhelming majority no matter how large the data base, how sophisticated the model, or how fast the computer.

To illustrate: An urban plan was drawn up for the city of San Jose which was to determine growth patterns until the year 2000. Leap-frogging development and urban sprawl, anathema to all urban planners except those who consider Los Angeles to be the model city of the future, was to be ended. A multicolored map was produced. A heavy line was drawn on the map to separate areas marked for development from those that would remain agricultural. The City Council and the Mayor were pleased. A year later, in 1975, IBM announced its desire to build a new plant employing 1500 people outside the heavy line. But there are plenty of good places to build inside the heavy line, said the Council, environmentalists, planners, labor unions, politicians, neighborhood groups, downtown business men, et al. No, said IBM, and if you don't let us build outside your heavy line, we'll build outside someone else's heavy line. The plant is now under construction. It has now been added to the database. So much for city planning and urban modeling, except for the inevitable paper probably entitled something like "Stochastic Interactive Methodologies for Positional Variations in Heavy Lines".

Early in the book, Mowshowitz explicitly states that limiting his discussion on the uses of computers to the United States would not lead to a loss in generality. This is generally unfortunate, but particularly so with regard to urban planning. In European countries, in general, and socialist countries, in particular, considerably more public control than in the United States is exercised on the development of urban and rural areas. A comparison would be instructive.

Despite the preceding criticisms, the book is a delight. In depth and breadth it is the best single presentation of the social issues involved in computing that I am aware of. It should become required reading and provoke endless discussion and debate--which is, after all, the way people generate ideas.