

ON THE ENGINEER'S RESPONSIBILITY
IN PROTECTING PRIVACY

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There are many among us who feel no need for personal privacy. "Only the guilty need fear. I have never done anything wrong." In fully selfish terms privacy may be important both to we saints and to all others if we are to preserve the value structure and the stability of our society. Consider the following statistic.

A report of the President's Crime Commission** extrapolated that a boy born today in an urban environment has a 40 per cent chance of having a brush with the law more serious than a traffic ticket. If you are Negro, the chance is closer to 90 percent. Today a jail record is a major

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** Task Force Report, Science and Technology, A Report to the President's Commission on Law Enforcement and the Administration of Justice, The Institute for Defense Analyses, U.S. Government Printing Office, 1967, p. 53.

barrier to the better jobs. A survey of New York employment agencies revealed that 75 percent would not refer on applications of those with police records.*

Unless youth can rise above their permanent branding by an ever-present record, the hope of being able to live the rest of their lives without undue harrassment is limited. It is possible to create a class of citizens so alienated as to have little interest in the stability of a society not to their liking. The anti-social forces of the community of branded outcasts we are making poses an increasing danger to all-- even our "holier-than-thous." Mere individual self-interest then dictates that we take care in protecting the privacy of all individuals, even those who do things we don't like.

As our society becomes more highly automated and interconnected, the number of individuals required to disrupt commerce is reduced. It becomes increasingly important not to encourage alienation, and to leave the escape hatch open to those who have erred and wish to rejoin society. The issue of preserving privacy is not that of keeping alive a quaint custom. Rather, it may be a necessity in maintaining a form of society as we know it.

*The Challenge of Crime in a Free Society, A Report by the President's Commission on Law Enforcement and Administration of Justice, U.S. Government Printing Office, 1967, p. 75.

Electronic engineers, each making a myriad of independent and seemingly minor decisions, have more power in their grasp than is comfortable or that they might wish to acknowledge. Police records are but one small facet of a larger picture. We are moving into a data-rich world and the electronic engineer is constantly being called upon for decisions that will determine how this world is to unfold. And the engineer is generally far removed from a long-range view of his seemingly minor design decisions. The police record is one facet of the larger picture of too ready access to too much personal information.

EXAMPLES OF RECORDS DESTINED FOR AUTOMATION

Table 1 is a list of personal records that came to mind in a ten-minute period. Files containing this, and information similar to this, necessary to the conduct of commerce will most certainly be automated in the future; first by centralized computers, later by separate time-shared systems, and eventually by internettted computer systems with access from a large number of remote terminals. If adequate safeguards are not provided, a distorted, composite montage of an individual can be created to embarrass, to haunt, and even to make him unemployable or only partially employable.

Table 1

List of Records Containing Personal Information

AIRLINE RESERVATIONS	SCHOOL RECORDS (INCLUDING PERSONALITY, IQ, PSYCHOLOGICAL TESTS, GRADES, TRUANCY, RECOMMENDATIONS)
BANK RECORDS	SECURITY RECORD
BIRTH CERTIFICATE RECORDS	FEDERAL INCOME TAX RECORD
CENSUS BUREAU RECORDS	HOSPITAL RECORD
CORPORATE OWNERSHIP RECORDS	HOTEL REGISTRATION
COUNTY RECORDS (PROPERTY TAXES, LEGAL AGREEMENTS)	IMMIGRATION RECORD
COURT RECORDS (INVOLVEMENT IN CIVIL AND CRIMINAL COURT ACTION)	INSURANCE COMPANY RECORDS
CREDIT BUREAU HISTORY	MAGAZINE SUBSCRIPTIONS
DENTAL RECORD	MARRIAGE RECORDS
DEPARTMENT STORE RECORDS	MENTAL SANITARIUM RECORD
DEPT. OF HEALTH RECORD	MORTGAGE PAYMENT RECORDS
EMPLOYMENT RECORDS	MOVING COMPANY RECORDS
PUBLIC WELFARE RECORDS	POLICE RECORD
	VETERANS ADMINISTRATION RECORD

Let's look at this seemingly innocuous list and consider some comments that an imaginary blackmailer, unscrupulous businessman, or just a plain snoop might think if he had ready access to all records cheaply:

AIRLINE RESERVATIONS: This may be a good opportunity for blackmail. His reservations say Mr. & Mrs. His wife is home.

BANK RECORDS: So this is how much money he has. Let's offer him less. He needs cash and will have to take our offer.

BIRTH CERTIFICATE RECORDS: Hmm! An illegitimate child.

CENSUS BUREAU RECORDS: He once lived in a house without indoor plumbing!

CORPORATE OWNERSHIP RECORDS: I wonder why he is buying this stock?

COUNTY RECORDS (PROPERTY TAXES, LEGAL AGREEMENTS): So Mr. Jones is buying a new \$51,345 house and only putting \$5,000 down; he must be poorer than he lets on--what with that new Cadillac and those long cigars. He must be a phony.

COURT RECORDS (INVOLVEMENT IN CIVIL AND CRIMINAL COURT ACTION): My what interesting, juicy tidbits in this divorce file. I am sure the garden club would want to hear about this. We wouldn't want a man like that for our Senator.

CREDIT BUREAU HISTORY: Hmm! He holds two jobs and has several bills that he never fully paid.

DENTAL RECORD: I thought those teeth were his own.

DEPARTMENT STORE RECORDS: I didn't know her brassieres were padded.

DEPT. OF HEALTH RECORD: According to the files, a young man who was found to have a case of VD is said to have slept with her. It must be true; otherwise he wouldn't have given her name on the two-page list of his "possible contacts."

EMPLOYMENT RECORDS: So that is what his boss really thought of him. He was always sober when I saw him, but you can never tell about such things.

PUBLIC WELFARE RECORDS: His parents were on relief when he was a child. I wonder how this distorted his psyche?

SCHOOL RECORDS (INCLUDING PERSONALITY, IQ, PSYCHOLOGICAL TESTS, GRADES, TRUANCY, RECOMMENDATIONS): He doesn't seem to be very bright. His psychological tests coupled with his truancy record suggest that he isn't the sort of production line worker we want at Ajax Consolidated.

SECURITY RECORD: Hmm! There is some question whether or not he may have been a queer. Where there is smoke there must be fire. Let's not hire him.

FEDERAL INCOME TAX RECORD: That is an awfully small amount of money to be giving to his destitute mother, considering his high income.

HOSPITAL RECORD: I thought she was a virgin.

HOTEL REGISTRATION: The card says Mr. and Mrs., but our computer tells us that no such people can be found in the files.

IMMIGRATION RECORD: So that's where he came from.

INSURANCE COMPANY RECORDS: Don't hire this man. His medical record suggests that he is a bad risk.

MAGAZINE SUBSCRIPTIONS: Reads a lot of sexy and left-of-center stuff, doesn't he?

MARRIAGE RECORDS: So--this is her third time around, if you consider the annulment at age 16.

MENTAL SANITARIUM RECORD: Who would have suspected that she is as nutty as a fruitcake and had to be put away?

MORTGAGE PAYMENT RECORDS: Watch out for this deadbeat.

MOVING COMPANY RECORDS: So that's all the furniture those new people who moved in up the block own.

POLICE RECORD: If he was arrested he was probably guilty and released because of a good lawyer and lack of evidence. Never trust a jailbird or anyone ever arrested. Where there is smoke there is probably fire.

VETERANS ADMINISTRATION RECORD: He doesn't seem like the sort of man who would get drunk and court-martialled.

Technical Feasibility

Today it takes 30,000 reels of tape to store the simple record of the Census Bureau, but cheaper, more accessible, read-only storage media are in the offing which will make the storage of the above mentioned files feasible. For example, data storage of 645 million bits per square inch has been demonstrated.* This means that a single 4800 foot reel of 1" material can store the equivalent of 20 pages of dossier material for each of the 200 million people of the country. This is only a laboratory development today, but with necessary

*Electronic Design, December 6, 1966.

modifications, such as the use of spread coded patterns and error correction codes to defeat scratches and film flaws, we can envision inexpensive systems capable of storing all the records listed. One day in the future it will be cheaper to store bulk information indefinitely than to throw it away by purging the files.

Electronics and Privacy

Each day we move further into the increasingly transactional world of tomorrow. Last year more of the GNP was produced by processing of information than by physical motion or manufacture. And this trend is accelerating. An increasing portion of life is dependent upon the electrical transmission of information and its processing.

Maintenance of both personal and business privacy increasingly relies upon the integrity of electrical communications and electronic computer systems.

The present technology used to invade privacy is a tribute to the electronics art. Noise-free wire-tapping, miniature transmitter bugs, transistor-type recorders and the computer itself form the basic tools of those who would snoop.

The martini olive has had more impact in explaining how far the electronics industry has gone in microminiaturization than

any of the "gee whiz" descriptions of commercial electronics in the popular press. Since the new electronics is so useful to the invasion of privacy, it is appropriate that a meeting of the Institute of Electrical and Electronic Engineers Convention be a legitimate forum for expressing concern and considering new directions. The Institute's involvement could have been more timely; but wisdom, while preferably acquired early in life, is better acquired late than never at all.

Our past oblivious attitude to this issue may in a small part have contributed to the creation of an excessively tolerant attitude to the scum within our business who build up and aggressively promote the use of equipment to bug and to tap telephone lines. Electronics stores catering to hobbyists carry telephone induction coil pickups and prepackaged, tiny, wireless microphone kits and attache case recorders. Until recently, some carried a full range of sophisticated, remote tone-controlled bugs for insertion into telephones for eavesdropping across the country.

Government is often accused of being the major eavesdropper. It may have been an early entrant, but the heavy amount of eavesdropping equipment flowing into commercial and amateur channels suggests that the real problem is in the private sectors. Where this equipment is going, how it

is being used, and what long-range implications this equipment holds for our society form questions that have not been carefully considered. Laws alone cannot stem the flow of this easily built equipment. But they can raise the price and discourage the less brazen.

The big battle yet to come will be in penetrating the garbage-rich storehouses of computer information systems. This is the subject of timely concern and forms a new challenge to the information-processing community.

THE WHORES AMONGST US

There are many among us who would not hesitate to build equipment to compromise the privacy of any individual provided the price is right. These are the whores of industry. They would not hesitate building systems and devices contrary to the public interest; their only concern is the buck. Sometimes "they" are individuals; however, sometimes "they" are entire organizations. The ethics of organizations are generally better than those of individuals, but not always. As rapidly as laws are written to block undesirable activities, entrepreneurs who value only the dollar will move into another area not yet covered by precise laws. They sell equipment pretending that it will be used only for lawful purposes, knowing well that their major market is an anti-social one.

These dregs who use new technology in an anti-social manner often justify their actions with words highly reminiscent of self-rationalization voiced by apprehended criminals: "If I didn't take the money, someone else would." Or, "That money really didn't belong to the guy I took it from. He made his money by dishonest means--he charged his customers too much."

Whenever the need for bypassing constitutional safeguards appears to be the only way to cope with someone else's possibly illegal acts, the game too easily degenerates into a squirting contest between two skunks. If law enforcement is not able to function without access to strong weapons such as these, let us insure that the strongest legal safeguards be created to prevent excessive use or misuse of these extremely potent weapons. The ease with which access to personal information can corrupt makes it mandatory that caution, commensurate with the temptation, be taken.

The immediate needs of society to protect itself in the short term against the illegal acts of the criminal is a balance problem. But in reaching engineering design decisions we should also consider another tradeoff--the immediate payoff versus the long-term price to society. It is often this long-term price that frequently gets forgotten in the haste

for immediate remedies to problems that we inherit because someone in the past also chose a shortsighted solution.

THE COST OF PROTECTION

We do not set out by intent to build a system whose integrity is open to violation. It is a result of a set of seemingly piecemeal decisions by a project engineer, a design committee, and often by the designers of the detailed subsystems. We tend to leave to chance whether a computer system is built whose privacy protection is difficult to circumvent, or whether the thought of future threats is ignored. We could choose to design the computer system more carefully. But safeguards cost money. The burden of proof falls to the computer supplier to justify that the customer pays a premium for safeguards.

When the computer holds sensitive information important to the client's competitive position--such as payroll data, safeguards are regarded as economic necessities. Where data concerning third parties are to be processed, privacy protection is an expensive frill. The job of the engineer, as taught in most engineering schools, is to save money for his client. Thus, we have allowed communications systems to be built that are child's play to tamper with, because protection costs money. However, if we view the responsibility of the

engineer in a broader context (as a de facto decision maker of our future society), the new engineer has an obligation to speak out. The long-range concern for privacy in system design should not be ignored in the haste to meet the salesman's pressure for rock-bottom system price. The addition of specific privacy measures in any large system (for example, building remote terminal devices to include privacy transformations in a computer system) is often a decision made not by one person but by a group, even within a line-organization corporation.

A line organization is a highly structured establishment where people work "under" other people called "bosses." Channels around "bosses" to higher levels in the organization are generally limited and by-passing communication is discouraged. In some large, extremely structured line organizations an almost master-servant relationship exists. As most engineers work in such an organizational framework, it is understandable (but not satisfying) to observe the almost total detachment the design engineer has for the basic question of why he is doing what. Although intelligent, he has been trained to focus his attention toward carrying out the specific task assigned to him in as inexpensive a manner as possible. Yet this is the level where many design decisions are made. Without a

better scope of purpose and understanding of long-range consequences, blind men lead us into the future.

ON DECLINE OF RESPECT FOR THE ENGINEER

The relative decline in undergraduate engineering enrollment in a period of increasing salary and job opportunity has caused many to wonder if the status of the engineering profession is declining in the eye of the public. Among engineers an almost standard explanation and complaint is heard that people called "scientists" are now given all the credit for major engineering achievements, rather than the engineers who rightfully deserve the credit. I wonder if there is not a growing feeling that the public, being subjected to the more unpleasant by-products of our complex and highly mechanized society, is beginning to implicitly blame the engineers for having treated them in a shoddy manner. Some feel that the engineers have not fully met their obligation to society. They point to the pollution of our air by noxious fumes from overpowered internal combustion engines in unnecessarily unsafe automobiles, dangerous electrical appliances built to shave a few pennies from the cost of the product, a dial telephone system originally built without adequate means to trace peace-disturbing nuisance callers,

a vested interest preoccupation to build airplanes to cross the country a little bit faster and ignore waking up literally millions of infants from their sleep.

In our defense, we can point to a much better world because of major engineering achievements. But we cannot deny the grain of truth in the indictment. We are a mixed blessing to mankind. The public view of the engineer, an amoral paid employee, more responsive to his next salary check than to the best interests of society, may give rise to our decline in esteem. On the other hand, the word "scientist" connotes a white-frosted wizard, conceiver of basically good ideas far removed from implementation. He is thus less guilty of the stigma that accrues to the evolution of good ideas into shoddy products.

The fracturing of responsibility and authority is so complete under the present managerial concept of division of labor that engineers often tend to behave in an unquestioning manner. They do as they are told and assume that those around them know what they are doing; whatever one is told to do is necessarily reasonable, correct, in the best interests of the company, and automatically in the best interests of the public.

And in most instances, it is. But not always. These

are the occasions when the engineer's ethics are strained. Here he should, appropriately, question what he is told to do. But this assumes that our profession has a code of ethics.

THE ELECTRONIC ENGINEERS CODE OF ETHICS

We have no workable code of ethics. There was an old code of ethics of the American Institute of Electrical Engineers. This was a set of rules designed for one subset of the profession--the private consulting engineer. The prime concern of these canons was to protect one entrepreneurial businessman-engineer from the cut-throat competitive practices of another. True to all professional codes of ethics, this was one designed first to protect the professionals. Secondly, almost as an afterthought, the public.

As almost all members of the AIEE were employees of large companies, even this ancient ethical code was never really applicable to the real world.

We might ask why no recent meaningful code of ethics has been forthcoming from our society. The reasons are several. One unmentionable one has been the schism between the interests of the management of the engineering societies and the individual engineer. The engineer is both employer and employee.

But the employer bias of corporate management is over-represented in the roster of officers and directors of this and other professional societies. Again the reasons are several. These generally represent good leaders, interested in promoting technical development and in managing others. Who else but men in management are in a position to afford the luxury (or to be compensated) for the heavy time and travel demands that accrue to office holders in this eleemosynary endeavor.

PRACTICE OF ETHICS IN THE ABSENCE OF A CODE OF ETHICS

What shall we do? We lack an enforceable, appropriate code of ethics. Acknowledging the facts of life of the organization of the engineering professional societies, no realistic, workable code of ethics can be expected in the near future.

When one differs with the ethics of his own line management he can always quit. This is usually not very satisfying. It is too easy to find a replacement willing to go along with an unethical proposal. Even when quitting, prudence dictates finding another job and then quietly leaving. A socially acceptable corporate reason is usually given in order to prevent being blackballed by the industry. The

second, and rarer case, is when a person publicly speaks out strongly on the issue itself at his time of resignation.

This is regarded as poor form in our profession. It is even a violation of the archaic AIEE code of ethics which restricted technical arguments to the pages of the technical journals. (Have you ever seen a technical paper published where an individual disagreed with his company?)

Few individuals are so bent on career self-destruction to take on the entire public relations department of a major corporation.

The most serious message to the engineering profession in Ralph Nadar's contribution to automobile safety was that the complaint of technical engineering shortcomings was raised not by an engineer but by a lawyer. Would Nadar have taken the stance he did if he were an engineer whose skills are salable only to large companies? How much of Nadar's contribution was derived from the freedom that he is a member of an independent entrepreneurial profession (lawyer) and did not have to face the same blackball pressures as an engineer whose employer can be a large corporation?

Thus we find ourselves in a strange circumstance where the shortcomings and failures within the engineering community can be uncovered more readily by those who are outside the

profession and immune. If this is so, do we really deserve the name "profession," or are we using the word in the same sense as a prostitute refers to her occupation?

THE FUTURE ROLE OF ENGINEERS

To bemoan the past is futile. Of greater import is the future and a consideration of the changes appropriate to meeting new challenges, mindful of past mistakes and realistic constraints.

The role of the engineer is in transition, moving away from that of a designer of only small gadgets and machines to that of a major voice in the design of large social systems. We are beginning to consider, or at least to talk about, transportation as a system, waste and pollution removal as a system, and information exchange as a system. Increasingly the engineer will be called upon to make decisions whose secondary effects will be felt by large sectors of society.

This is somewhat frightening in view of the past history of non-involvement of engineers in these broader issues and of the restrictions upon his actions. A few of the more cynical observers note that problems such as air and water pollution would not be so severe today if the engineering community had exhibited greater responsibility yesterday. This new trust

is either a tribute to the forgiving nature of society, or else we are recognized as being the only ones around with the needed skills. As such, it will be an obligation thrust upon us. Sometimes these will be single person decisions. But more often in the new information processing technology decisions will be diffuse. Each of a large number of engineers will, in essence, build separate systems which to a degree may interconnect with one another in the future. Here responsibility is diffuse and the visible effects of error will be delayed for a time span longer than the mean-job-assignment-period of the engineer. Further, the number of individuals involved is so large and widespread we might say that they are distributed. For example, Alan Boyd, the Secretary of The Department of Transportation, recently remarked that when each of 100,000 people in a city reaches an independent decision to move to the suburbs to provide better schools for their children and to avoid the problems of the city, the collective results produces a socially undesirable consequence--increased racial segregation. Yet each separate decision was made without malice by well-meaning citizens in their own individual best interest.

Pursuing this line of reasoning, we face the awkward question of what should the individual employee-engineer do

when what is best for the company is not best for the country? How is the engineer to cope with the situation where he realizes that if other individuals in a similar position reach similar decisions as his own, they all would be acting in a socially undesirable manner? Yet his own best decision and immediate responsibility to his company dictate that he do the same as all the others. The obligation to point out the need for additional expenditure for safeguards is a damned-if-you-do damned-if-you-don't dilemma to the individual engineer. It would be desirable to pass these questions to the professional societies. But we have seen that professional societies have been structured in such a manner as to discourage coping with such problems.

Perhaps, lacking a suitable organizational structure, it is appropriate that a new one be created to deal with such matters. We would need a competent technical agency sufficiently protected from the political and money pressures that are certain to be created when such an agency finds fault with large organizations.

Of course, there is always the bureaucracy of last resort--the Federal Government. It would be a pity to place such a function in government. The government does poorly controlling complex activities when there are well-financed

external constituencies opposing specific individual acts.

THE ENGINEERING SCHOOLS

In the absence of an alternative, perhaps this new role can be served by our engineering schools. They come closest to having the right people and the most isolation from pressure. A restructuring of our profession could take place at the engineering school. This implies a major reform of the engineering curriculum. It must be modified to cope with "large systems," where the citizenry are an integral part of the system--not as operators, but as benefactors. The new engineering curriculum would contain substantial course material on how people and organizations of people behave (have behaved, can behave) to balance the weight given to training in quantitative methods.

RELATION TO PRIVACY

This discourse may seem removed from privacy, but it is fundamental to the issue. For, unless we can modify our profession from one whose prime concern is to "save money" for our employer, we will dramatically demonstrate that the apparently lessening public respect for our profession is not without merit.