

CAN GOVERNMENT REGULATE TECHNOLOGY?

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Recently, while I was in Dijon, France, I happened to be listening to BBC on the radio, and heard a Yorkshire consumer affairs official complaining that the law gave him power only to require that "push-chairs" (baby carriages, or prams) be stable and have reliable brakes, but not to require that their handles not come off. Reacting to an incident of local notoriety, he seemingly felt the need for broader power under law to see to it that Yorkshire mothers be able to use prams as nearly perfect as government regulation could make them.¹

This tacit belief in the efficacy of government regulation, here expressed by an interested government regulator, is widely shared by people all over the world, especially by intellectuals who worry about the alternative risks of not controlling technology. Thus, for example, Victor Ferkiss sought in 1969 to determine the traits of the "technological man" whose skills would qualify him for the task of controlling technology. This task, according to Ferkiss, "may be the supreme test of our species' adulthood."² Nigel Calder, writing in the same year about the impact of technology on society, decided that "(m)oral and political efforts need . . . to be directed to compensating the totalitarian tendency (of technology), and to employing governments to encourage humane bonds of technology."³ Garrett Hardin, in his well-known concern about the tragedy of the commons, has even gone so far as to propose that for every problem involving a system there be an appropriate government agency to regulate it.⁴

These altogether typical expressions of liberal confidence in government do not, of course, apply to just any government, but ordinarily to whatever the writer takes to be the supreme government — in the United States, this has usually been taken to mean the federal government. Thus, for example, when the movement for auto safety got underway in our country in the 1960s, proponents thereof warned against being sidetracked by the manufacturers into "the mare's nest of state legislation" and sought instead "national uniformity through the national representatives of the people, the U. S. Congress."⁵ Daniel Moynihan supported the same movement in 1962 by claiming that autos and pipelines were "the only forms of interstate transportation . . . not regulated by the federal government for purposes

of safety," and that pipelines would soon be regulated.⁶ Even Ralph Nader, who is hardly a blind devotee of government bureaucracy, insisted in 1966 that "(o)nly the federal government can undertake the critical task of stimulating and guiding public and private initiatives for safety" and meet "the urgent need for publicly defined and enforced standards of safety."⁷

The tendency thus exemplified to count on the federal government to keep technology within bounds far antedates the Corvair crisis and, of course, is with us still. In discussing the need for regulatory reform, an attorney recently indicated his acquiescence in the basic system by noting: "Federal regulation began in 1837 with the Steamboat Inspection Service, which was formed when a rash of steamboat explosions raised early questions about free enterprise."⁸ In a report recently issued by the U. S. Office of Technology Assessment, itself a product of the federal fever under discussion, it was noted that, although both drugs and medical devices are subject to federal regulation regarding their safety and efficacy, "(s)urgical and other procedures that depend primarily on providers' techniques have not been subject to similar Federal controls."⁹ So, not surprisingly, the report anticipates "increasing scrutiny" of "the use of medical technologies."¹⁰ This increased interest is, it should be noted, justified on the grounds that the Federal Government (OTA's capitalization) is both "protector of the public" and a significant "developer and user of medical technology."¹¹

There is, in short, a considerable amount of sympathy for the idea that the federal government is without question an appropriate instrument for effecting some desired level of control over technology. Why such sympathy should exist, however, is by no means obvious. For, there are countless examples of how inappropriately and ineffectively the federal government has been dealing with technology over the years. The record of failure here in question has occurred on every level and in every branch of government. Here it is sufficient to consider only the phases of legislation and regulation. First, some examples of ineffective legislation.

Controlling water pollution has long been a concern of the federal government, but it is arguable that this concern has done more harm than good. According to a study done by the U. S. General Accounting Office and published in November 1969, government programs have concentrated on municipal treatment systems and have either bypassed industry or encouraged overloading of municipal systems with industrial waste.¹² But this misplaced emphasis is itself a product of the way relevant legislation has been written.¹³

Casual recollections of federal government support for development of the Salk vaccine may be generally favorable. But a more detailed history would

show that the Eisenhower administration very carefully avoided any program of widespread vaccination that would have taken business away from constituents of the American Medical Association. What resulted was not a public health program but privately paid fees for services with the single exception of the poor — potential carriers! — who would not otherwise have contributed to physicians' incomes.¹⁴

An even more glaring example of the inadequacy of legislation as a means of controlling technology is the fascinating process whereby the federal government came to intensify its involvement in the search for a cure for cancer through what came to be called the National Cancer Act of 1971. The federal government had long since come to be a funder of cancer research, and by 1971 some \$64.7 million of the total National Cancer Institute budget of \$78 million was spent on research.¹⁵ However, a very powerful group of lobbyists decided that this was a woefully inadequate investment in such a serious problem, and that the solution was, in part, to pull the NCI out from under the jurisdiction of the National Institutes of Health. Senator Edward Kennedy, among others, expressed the opinion that heavy spending on a cure for cancer would nicely fill the vacuum left by federal disenchantment with the supersonic transport as an expensive technological project of dubious value.¹⁶ This interest Kennedy was able to operationalize when, shortly thereafter, he became chairman of the Health Subcommittee of the Senate Committee on Labor and Public Welfare.¹⁷ It was an election year, to be sure, and the incumbent president, Richard M. Nixon, was not to be outdone in concern for cancer victims and their families by a potential opponent. Thus it came about that the Nixon Administration also supported legislation of some sort in this area and allocated \$100 million in its budget proposal for the ensuing fiscal year.¹⁸ And accordingly the two political rivals were able to arrive at a generally supportive compromise.¹⁹ Both public and private debate on the cancer legislation centered around whether and to what extent the NCI should become independent of NIH controls. The White House, hearing clearly the concerns expressed by the medical industry, generally opposed independence. Kennedy, in general agreement with the original proponents of the cancer legislation, favored a more autonomous agency. The end result, by way of a substitute bill introduced in the House by Congressman Paul G. Rogers, was essentially an agency that is operationally independent but nominally not.²⁰

The key question that arises from all of this, of course, is what advances towards a cure for cancer did all this election year legislation produce. In terms of expenditures, the cancer control program alone, which calls for

comprehensive cancer centers, had its budget increased from \$5 million in 1973 to \$34 million in 1974.²¹ And the total NCI budget between 1972 and 1981 comes to a total of some \$7-8 billion.²² In terms of power distribution, a three-member President's Cancer Panel that was conceived of as an oversight group to assist the president has in effect become the executive committee of the board of directors. Its chairman, Benno Schmidt, has been wielding the most power; and he just happens to have been the chairman of the original "Citizens Committee for the Conquest of Cancer" (1969-1970) which became the Senate's "Panel of Consultants on the Conquest of Cancer" (1970-1971).²³ And, perhaps not entirely coincidentally, other programs administered by NIH have been getting comparatively less funding.²⁴ But when all is said and done, what is perhaps most revealing in this entire affair is that the NCI continues along the traditional lines of cellular- and molecular-oriented research and, abundant evidence as to chemical carcinogenesis notwithstanding, has not concerned itself notably with any sort of regulation of the industry at issue.²⁵

This failure of relevant legislation to reach the front lines of an issue regarding technology is, at least in the judgment of theoretical pessimists, due to the inherent inequality of power arising respectively out of technology and out of government.²⁶ This thesis could be illustrated in many ways, e.g., by reviewing the history of legislation with regard to the railroads. It might also be illustrated by calling attention to an area where the limits of law are commonly recognized and worried about, namely, in international affairs. Inasmuch as the vast majority of significant technological developments impact far beyond any one nation's boundaries, laws adopted by any one nation will be of little use unless also adopted by other nations as well. This is patently true with regard to just about anything that might come under the heading of what in our country is called "interstate commerce." The vast field of telecommunications, including satellites and microwave communications, is an obvious case in point. But so is the troubled area of arms control. Recent political stances with regard to the proposed Salt II Treaty are in some respects just the tip of the iceberg. Consider also the long and still largely unsuccessful efforts of various international organizations to ban the use of all sorts of unpleasant means of warfare, notably chemical and biological agents.

Treaties, of course, are binding only on signatory nations, unless the contents of a treaty are generally held to have become "general principles of law recognized by civilized nations."²⁷ Yet the very failure of a nation to abstain from using a particular weapon itself becomes an indication that at

least that nation does not recognize such usage to be in violation of any general principles.²⁸ And as a recent analysis of this problem asked, not without a certain note of discouragement: "In time of war can it ever be expected that the law of war will actually prevail over vital national or military interests?"²⁹ This query notwithstanding, the authors thereof conclude with what is essentially an optimistic view as to the capabilities of law. For, as they see it, what is mainly lacking is enough law to do the job. In their own words:

In a world distracted and disunited beyond human experience, science has placed in the hands of governments chemical and biological weapons systems far beyond the imagination of the founders of international law. But there has been no concomitant development of the legal process which should control and direct those in positions of supreme authority with reference to such weapons.³⁰

It may be allowed, however, that just because legislation cannot resolve all problems does not mean it cannot resolve *some* problems. But not even this much can legislation accomplish without more. And the "more" that is here at issue is the manner in which the legislation is implemented — in a word, the regulatory system. Regardless of how well a legislative enactment may seem to address some problem involving technology control, the regulatory system that emanates from the legislation has a life force of its own, be it weak or strong.

For example, even when pushing for federal automobile safety standards in 1966, Ralph Nader had to acknowledge that the General Services Administration was not even exercising what powers it already had in this regard through federal procurements.³¹

The federal patent system, which obviously functions as a form of technology control, has never been entirely beyond suspicion. Acknowledging in 1939 that there were abuses, a knowledgeable writer on the subject insisted that "(t)hese abuses are not the fault of the patent law but are the fault of the Department of Justice in not enforcing the anti-trust laws."³² Writing more recently, however, Irene Till reaches a notably more fatalistic conclusion. According to her,

(T)he patent has become a potent instrument for restraint of trade. . . . Particularly in industries where the technology is subject to change, (patents) are the basic weapons in corporate strategy for eliminating, subduing, or harassing competition.³³

The same author who criticized the faults in federal water pollution laws notes in addition that even those laws that do exist have not been effectively

enforced, in large part because physicians in the federal bureaucracy have tended to side with ineffectual medical colleagues at the state and local levels rather than with enforcement-minded lawyers in the federal service.³⁴

In a recent study of the impact of FDA regulation of the pharmaceutical industry, it is asserted as "(a) consistent finding" "that regulation has had a significant negative effect on the rate of innovation."³⁵ The author goes on to claim that this negative impact gives U. S. firms "a strong incentive to develop and expand foreign production and other foreign operations."³⁶

The Nader group, among others, has tended to attribute the weaknesses in our federal regulatory system to its having been coopted by the private interests which it was supposed to be regulating. Thus in 1966 Nader was identifying the Commerce Department as "the house of business" and warning against assigning any safety-oriented tasks to such a coopted agency.³⁷ Writing in 1973, Nader sees this process of cooptation as having taken on a still more troubling characteristic: "What is new," he says, "is the institutionalized fusion of corporate desires with public bureaucracy," resulting in what he calls "the industry-to-government-to-industry shuttle, where corporate risks and losses become taxpayer obligations."³⁸ Still thinking about such then contemporary interventions as those involving Lockheed and Litton, Nader might have been speaking of current government support of Chrysler and, perhaps still to come, the steel industry and others as well:

Regulation that wastes scarce economic resources and inflates consumer prices, rewards inefficiency, and impairs service is a gross abuse. But when it assists in suppressing highly beneficial technology because the entrenched companies do not wish to displace their outdated capital, a new, worse, dimension of corporate socialism appears. In the last two decades, spectacular new technology has been developed that can throw the challenge of abundance to older technologies of scarcity — satellite communications vs. AT&T's cables, CATV vs. the traditional limited TV spectrum, mass transit systems callable on demand vs. buses and automobiles. These are a few of many developments which *the regulatory-industrial complex* has succeeded in blocking, limiting, or delaying.³⁹

A condemnation of government regulation of technology that is in some ways more sweeping will be found in Lawless's study of one hundred cases of government intervention entitled *Technology and Social Shock*. Says Lawless by way of conclusion with regard to governmental action:

One or more of the agencies or branches of the federal, state and local governments became involved in virtually all of the one hundred cases. [Fn.] In about half of the forty-five study cases [those more fully reported], one could say that a government agency took a definitive action . . . , but in fewer than ten of these cases could one describe the government action as prompt, and in two of these ten . . . the very speed

and timing of the government action added unnecessarily to the social shock. . . . In general, a delay in initiating remedial action (or in determining if it is needed) is relatively short (one to five years) when it results from a need for more technical information . . . , but much longer when it results from a conflict of powerful interests. . . .⁴⁰

These by no means atypical criticisms of the role of government, especially the federal government, in regulating technology suggest the need, quite obviously, for improvements. Some of these improvements are of a purely technical nature, i.e., better equipment for monitoring problems subject to regulation.⁴¹ Others, by way of corollary, are secondarily technical, i.e., the requirement that for any monitoring of a technology-based problem the monitoring agency be staffed with a sufficient number of appropriately trained *technical* specialists.⁴²

Such an improvement in monitoring personnel (not, of course, easily achieved given the salary differential as between the public and the private sector) would contribute greatly to alleviating the problem, stressed by Mintz in his study of federal regulation of the pharmaceutical industry, of leaving the monitor dependent on technical data provided by the entity being monitored.⁴³

Not even the upgrading of an agency's technical personnel will suffice, however, to disengage that agency from long-established subservience to the powerful interests it is supposed to monitor. This is well illustrated by the longstanding but ultimately futile effort of the Federal Communications Commission to reassess AT&T's rate structure. To no one's surprise, this effort could hardly be considered successful after over a decade of study. In the meantime, the FCC has entered some rulings which are not altogether favorable for AT&T, e.g., with regard to peripheral equipment and with regard to satellite communications, and this has been enough to cause Ma Bell to seek to induce Congress to emasculate the FCC and in effect reverse these unfavorable decisions.

The regulatory impasse thus laid bare has led one analyst to suggest an alternative approach that would include a "Natural Monopoly Contracting Agency," which would act as a kind of super-agency supposedly not subject to pressuring, at the federal level.⁴⁴ Others have sought to institutionalize impartial watchdogging in other ways, such as Nader's Public Citizen and John Gardner's Common Cause, not to mention a host of other more specialized public interest lobbyists and consultants. It is, however, precisely the plethora of watchdogs all of whom claim to represent "the public" that lends support to Lee Loevinger's onetime claim that we are wholly lacking any theory of regulation.⁴⁵ It is rather the case, I think, that we have many

theories, none of which is conducive to uniformity. But in any event we are beginning to see studies of the impact of regulation, which hopefully will one day be sufficiently accurate that they can be required as a precondition to any significant proposed regulation. For example, when a ban on DES in cattle feed was proposed a few years ago, it was possible to estimate at least within broad parameters how much said regulation would affect the price of beef.⁴⁶ Similar estimates are proffered with proposals for tax increases, e.g., the recently proposed but politically doomed duty on imported oil.

The issue of the impact of regulation on technology is, however, much broader than just a question of prices. As the very idea of standardization suggests, regulation can affect the very nature of the technology developed. This is perhaps most clearly recognized by the general public with regard to automobile fuel consumption standards and how these have affected the structure and to some extent the operative technology of cars both current and yet to come. Of even more fundamental significance is the role regulation plays in the research and development of new technologies, most noticeably (at least after the fact) in the area of military technology.

What is perhaps little understood is the kind of limits a society's accepted ways of doing things imposes on any attempt to regulate a technology in one way rather than another. To cite some obvious examples, it would be the height of foolishness, however desirable otherwise, to attempt now in any finite period of time to require the English to drive their vehicles on the right side of the road, or to require people in most European countries to settle for a half-hour "lunch break" in the name of efficiency, productivity or whatever.⁴⁷ Problems of this kind have, of course, attracted considerable interest because of socio-cultural obstacles to technology transfer in Third World countries. But there is as much need for appropriate technology in developed countries. For example, the use in various European countries of automatic shut-off switches for corridor lights could and should be applied practically everywhere in the United States. Why is there no encouragement to do so? All it would take would be an appropriate government regulation that would so require! Nor would the obstacles — even if dignified as being "constitutional" — really be any more than an instance of *our accepted way of doing things*.

The kind of attention to the socioeconomic preconditions for a given technology and for the way that technology should be regulated is illustrated by default by a recent development in Switzerland. Like other European governments, not to mention some states in the United States, the Swiss parliament recently passed a law requiring everyone on a motorcycle to wear

a helmet. However desirable such a practice might be, it was not made more desirable by federal fiat in a country whose bilingual survival has depended on recognition of many prerogatives for the individual cantons. As a result, opponents of centralization, of whom there are many in Switzerland, were able to activate provisions in the Swiss constitution to require a referendum on the helmet question in November, 1980.⁴⁸

Inversely, a very wise assessment of socioeconomic limitations, albeit after the fact, will be found throughout Jacques Ellul's masterful study of the development of political institutions in France. Consider, for example, only his observations about the impact of the revolutionary government on French industry. In spite of the altogether expected emphasis on the guiding principle of laissez-faire, he points out, a government agency was made responsible for inventions, which it encouraged by means of prizes, industrial expositions, etc. Various measures were taken to facilitate domestic trade, including imprisonment for non-payment of debts, but commerce was hindered by a shortage of money and grossly inadequate means of communication. Attempts to improve the roads were not successful. The result was commercial decline, but at the same time economic stability was restored for the benefit of a large sector of the population.⁴⁹

What Ellul's summary says, in more "in" terminology, is that post-revolutionary France was a pre-industrial economy not yet sufficiently developed for take-off. But, it should go without saying, the government at that time had to be as alert to built-in limitations as is any government in a country on the way to development or, for that matter, a country such as the United States until recently considered "developed" but in current jargon said to be in need of "reindustrialization."

The point of all this is that government policies with regard to regulation of technology cannot be any more appropriate than the limited insights of decisionmaking bureaucrats will allow. Accordingly, Ralph Nader's call for more highly specialized technicians in government agencies is helpful only to the extent that what these technicians would so efficiently regulate should in fact be so regulated or regulated at all. This is not necessarily a call for more "deregulation," so called, which is in its effects simply another form of regulation, just as a refusal to choose is itself a choice. Rather is this a recognition that any really important technological improvement (or, if you will, revolution) is almost by definition going to tax the competence of even the best trained technical experts in what Nader would presumably consider a well staffed agency. At work here, however, is not just the much criticized revolving door in the sense of crassly biased private career-conscious

regulators. Rather is this a problem inherent in the very process of technological development. Who, after all, is appropriately competent to judge how if at all a new technology ought to be utilized in our society? I submit that probably the least able to judge is any expert narrowly trained in all the meticulous niceties of the technology or technologies which the new would simply render obsolete.

From this point of view, it is difficult to accept Garcia's ethical approach to a definition of "bureaucratization." As he wrote in 1971, "through internal corruption, the bureaucracies become self-serving and increasingly ineffectual in making decisions until they are entirely corrupt and immoral."⁵⁰ His call for "feedback" to "effectively destroy bureaucracy" is useful but commonplace when stated in more neutral terms. What I disagree with most about Garcia's analysis is that he sees the problem in terms of volition rather than in terms of knowledge. And since lack of adequate knowledge is so obviously the constant problem faced by regulatory agencies, any claim as to improper motivation must surely bear the burden of proof, as in a criminal trial.

Questions of guilt aside, however, the knowledge-gap in regard to regulation of technology is analogous in many ways to the problem of tenure in a university. The standard objection to tenure is that it allows individuals with outdated information to occupy positions which should be made available to those with up-to-date information to convey. Let us not be distracted here by an obvious pedagogical equivalent of the chicken-or-egg problem nor by economic considerations as to the comparative salary requirements of new versus experienced professors. Important here is the standard response to the anti-tenure argument, namely, that education in a discipline is vacuous if the "information" conveyed is not put into a complex context that only years of study enable one to understand to some extent. Call this, if you will, the Anti-Fad Principle. What is relevant about it here is that it applies to any allegedly well-trained would-be technocrat, the nature of whose training will almost certainly involve some form of faddism.⁵¹ What society as a whole needs to appreciate even if our would-be technocrat cannot, is that there are more things in heaven and on earth than his or her slide-rule, or cost-benefit analysis, or MBO, or whatever tomorrow's trusted device will be, is able to generate for purposes of regulating technology.

An extraordinarily relevant case in point, although perhaps only indirectly concerned with control of technology, is that of a recent unsuccessful attempt on the part of federally funded technocrats to convince some people in Pennsylvania to allow the federal government to regulate the sale of land in the Brandywine watershed area. As one of the central protagonists observes,

the technocrats had "a demonstrably 'good' plan."⁵² But the demonstrably good plan did call for exercise of eminent domain, as required by the Ford Foundation and HUD.⁵³ All efforts to paint the program pretty were ultimately in vain, because "People already felt threatened by government, with the gas lines, the high tension line, the Marsh Creek project, and the proposed prison, and many saw the Brandywine Plan as another government program to force people to use their land in a certain way."⁵⁴

In retrospect the same protagonist does acknowledge what is indeed basic in all such government intervention: "We were technocrats from outside, as they charged. Our lives, our future expectations of income, and our sense of personal control were not affected by the plan. Theirs were, and we owed them more than they received."⁵⁵ With these words is verified the observation of Peter Thompson writing about the Brandywine proposal in *Science* magazine: "(P)erhaps the lesson in human relations which come out of the confrontation between 'experts' and rural Americans is the most valuable piece of base-line data to emerge from the study."⁵⁶

This matter is introduced here not in order to poison the well with regard to government regulation of technology.⁵⁷ Rather, it is meant to illustrate the proposition that there is more to regulation than putting the right words — or numbers — on paper. Nonetheless, if words and numbers are needed it is presumably better to have these generated by experts of one sort or another. To the extent that these experts are in some sense of the word "technicians" we are perhaps moving towards what Jacques Ellul calls a technological society. Whether this is good or bad is in part at least a matter of perspective. It is, however, also a matter of sorting out apples and oranges. For there are aspects of our technologies which should be regulated and are not, just as there are aspects which are regulated but were better not. And even if some form of regulation is appropriate, it is by no means obvious what form that should be. As noted by McCloy,

The critical issue today is whether [regulation by such means as licensing, rate-setting, or imposition of standards] is always the most efficient approach or whether the provision of profit incentives, recourse to taxation, or increased reliance on the free market might be more effective.⁵⁸

But even to speak of effectiveness assumes that one knows which of many possible goals the regulatory agency ought to be seeking to attain. And that is precisely where knowledge is lacking in government agencies as in the populace at large.

It is at this juncture that the increasingly common plea for some institu-

tionalized arbitrator, such as a Science Court, comes to the fore. What has been lacking in proposals of this kind, however, is provision for the kind of humanistic input that cannot be obtained merely by a debate among technical experts. Assume, for example, that the introduction and regulation of new technologies were made subject to a judicial battle of experts. Leaving the standard problems of procedural obfuscation aside, let us assume that any given case would be argued on its merits. And leaving aside also the political realities that determine who will serve in decision-making roles, let us further assume that only our wisest citizens (whoever they may be) will ever sit as judges in a Science Court. To these assumptions add others to assure fundamental fairness, adequacy of available information, and efficacy of whatever decisions might be arrived at. Given all this, consider now a few not entirely hypothetical cases.

Case No. 1 A proposal to provide individual television receivers with a retrofitted device that would make possible satellite reception of any television broadcast from anywhere in the world, without the intervention of any "network" or any governmental agency responsible for "the public interest" in regard to the communication of information.

Case No. 2 A proposal to conduct all business transactions by a new system whereby a laser would read a potential buyer's pre-assigned identity number printed invisibly on the back of his or her hand and automatically debit his or her account the amount being charged, thereby eliminating the need not only for credit cards but for money as such.

Case No. 3 A proposal to ban all vehicles from the downtown area of any major city and provide mass transportation within that area by means of two ground-level conveyor-belt systems, one primarily for people and the other primarily for goods.

Case No. 4 A proposal to expand the capability of television to transmit information so that much work presently done at a business office could be done at home, and only key personnel would be required — permitted? — to journey to the centralized workplace.

Case No. 5 A proposal to substitute genetically-engineered nutriments for food as we now know it, thereby eliminating the need for agricultural production and distribution — in other words, no more grocery stores.

My purpose in formulating these cases is not to provide an exercise in futurology but to illustrate by way of suggestion how complex is the fabric of issues that arise in connection with any significant — and often even with comparatively insignificant — technological change. With regard to the "insignificant," and with the supposed advantage of hindsight, how would you

have decided as a judge in a science court if asked shortly after World War II to approve a shift from a system of bottling products locally in glass to a system of packaging products regionally or even nationally in metal or plastic containers? Or, to return to the focus of this paper, how if at all should the federal government have responded to that proposal now seen to have entailed innumerable historically significant consequences? And how should the federal government have involved itself in the demise of the passenger train, or in the disregard of the bicycle as a convenient means of short- to medium-distance transportation? Or to the insistence that nuclear fission reactors offered the key to our future energy needs, or that women who wanted to avoid breast cancer ought to submit to mammography on a regular basis?

In a word, government as we know it is not in general able to regulate technology effectively or appropriately. Yet for the good of society technology ought to be regulated both effectively and appropriately. This can be done only imperfectly given the limited information available at any given time. But it should nonetheless be done as well as possible, and this means that it must be done on the basis of the most adequate information available. Such information will not, however, be adequate if it is only and narrowly technical. Included also must be information derived from many kinds of expertise on many levels and from many corners of reality. Along the way, of course, such a multifaceted search for appropriate choices may delay implementation of innovation. But the history of technology, including our own, is — or, perhaps, could be — filled with evidence that means do not necessarily lead to ends, and ends even if achieved may not constitute unadulterated progress.

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NOTES

- Subsequent investigation by the ever intrepid BBC produced the following information, disseminated to the public on August 14, 1980: The kind of accidents that had been occurring as a result of "buggy-handle failure" were only "of the second order," according to the Trade and Standards Office. To have qualified as failures of the first order such that the Minister would issue a warning, two conditions would have had to be met: (1) an accident must occur; (2) it must occur at a most critically inopportune time. Some 99,000 prams produced by the manufacturer (McLaren, Ltd.) from 1977 until a design change was introduced in September, 1979, were susceptible to the notorious handle failure. Some 106 accidents involving these prams had been reported, but

apparently none was "of the first order." In the meantime, the manufacturer has quietly notified retailers that the handle problem should be corrected on any of the suspect prams that are brought in for any reason whatsoever. For the August 14 broadcast BBC did a spot check of its own and discovered 6 prams with faulty handles. Pram owners seemed to know about the defect, according to BBC, but were hesitant to bring their prams in for replacement because a pram after use tends to be dirty, hence not, in their minds, deserving of replacement.

2 Ferkiss 1969, p. 217.

3 Calder 1969, p. 144.

4 Hardin 1972, p. 134. Having called for this problem-specific regulatory structure, Hardin was at least realistic enough to point out that there is something of a second-order problem in figuring out how to watch the watchers (pp. 133-140). The appropriateness of this after-thought is well borne out by the long and arduous history of efforts in other countries, notably Western Europe, to develop institutions for precisely this purpose. See in this regard Chapman 1970, pp. 181-270. In Chapman's opinion, at least, the French approach via the Conseil d'Etat is by far the most advanced and most effective government watchdog to be found in Europe (p. 229). However, the areas most in need of technology assessment, namely, the nationalized industries (e.g., Electricité de France) are immune from the jurisdiction of the Conseil d'Etat on the grounds that they are essentially in the private sector, even though they exercise powers of eminent domain (p. 223; see also p. 54).

5 O'Connell/Myers 1966, p. 208.

6 Moynihan 1962, p. 266.

7 Nader 1966, p. 249.

8 Neustadt 1980, p. 129. See also Moynihan 1962, p. 266.

9 OTA 1978, p. 90.

10 *Ibid.*, p. 4. See also pp. 104, 110.

11 *Ibid.*, p. 4.

12 Ridgeway 1970, p. 107.

13 *Ibid.*, p. 54.

14 R. Carter 1967, pp. 290-327, 332-335. See also Lawless 1977, pp. 128-138; Rettig 1977, pp. 34-39, 313-315.

15 Rettig 1977, pp. 42-46, 70. Compare pp. 30-34.

16 *Ibid.*, p. 103.

17 *Ibid.*, pp. 117-121.

18 *Ibid.*, pp. 125-126. The precise amount which the Nixon Administration actually committed is not all that easy to determine. In the first place, the announced \$100 million was in fact divided in half over two fiscal years (p. 183). And, secondly, they had actually cut some funds from cancer research just one year before (p. 210).

19 *Ibid.*, pp. 184-193.

20 *Ibid.*, p. 291: "The resolution of the legislative debate left the cancer crusade advocates with much of what they wanted, but gave the opponents the symbolic and material accomplishment of defeating the proposed separate agency recommendations."

21 *Ibid.*, p. 303.

22 *Ibid.*, p. 317.

23 *Ibid.*, pp. 79-88, 278, 295-297.

24 *Ibid.*, p. 310. It is for just this reason that proponents of heart research set about getting themselves comparable legislation providing for a categorical research program in 1972. *Ibid.*, p. 312.

25 *Ibid.*, p. 305.

26 See, for example, Ellul 1977, pp. 146-150, 292, 331.

27 Van Wynen and Thomas 1970, pp. 188-236.

28 *Ibid.*, pp. 137-187.

29 *Ibid.*, p. 207.

30 *Ibid.*, p. 249. See also preface, p. ix. A certain verbalistic legalism creeps out briefly at one point in the Thomas analysis. Commenting on the Hague Gas Declaration which signatory nations have been able to bypass rather handily, the authors suggest that use of "asphyxiating or deleterious gas" could have been avoided if instead of referring to such usage as the "sole object" the text had instead spoken of the "primary" or "main" object (p. 46; see in any event, p. 57).

31 Nader 1966, pp. 226-227, 230.

32 Toulmin 1939, p. 108.

33 Till 1973, pp. 289-316.

34 Ridgeway 1970, p. 54.

35 Grabowski 1976, p. 37.

36 *Ibid.*, p. 51.

37 Nader 1966, pp. 241-242.

38 Green 1973, p. x.

39 *Ibid.*, p. xii. Italics added.

40 Lawless 1977, pp. 508-509.

41 *Ibid.*, pp. 58-60, 64, 67, 76, 80, 294.

42 Green 1973, p. xii (Nader).

43 Mintz 1965, pp. 410-415.

44 Beverly C. Moore, Jr., in Green 1973, pp. 96-98.

45 11 Antitrust Bull. 101, 115 (1966).

46 Campbell 1974, p. 50.

47 At least one author, however, seems to feel that technology American-style will eventually bring about the demise of all of the cultural uniqueness of different peoples around the world. The end result, in his terminology, will be a race of "cybernanthropes" rather than human beings. These curious machine-men can be spotted by their liking for sleek offices and supermarkets. See Lefebvre 1971, pp. 201, 203-204, 209.

48 As it turned out, the referendum upheld the helmet law in every canton. For a detailed analysis of Switzerland's constitutional mix of federal and canton control, see Chapman 1970, pp. 219-233. It is relevant to note that Chapman puts the Swiss on a par with the French as being the most distrustful of government (pp. 308-315).

49 Ellul 1969, pp. 132-133.

50 Garcia 1971, p. 99.

51 See in this regard Stanley 1978, pp. 157-158; Lefebvre 1971, pp. 65-130.

52 Strong 1971, p. 57; see also p. 117.

53 *Ibid.*, pp. 125, 173.

54 *Ibid.*, p. 117.

55 *Ibid.*, pp. 198-199.

56 *Science* March 14, 1969, quoted by Strong 1971, p. 174.
 57 This is done, in fact, by Jacques Ellul in his recent work. See Ellul 1977, pp. 119–120, 146–156, 330–334. See also my review of the English translation of this work, *Nature and System*, 3 (Sept. 1981): 184 ff.
 58 McCloy 1980, p. 462.

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