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What is This?

A Humanistic Technology*

by Hyman G. Rickover

"Humanistically viewed, technology is not an end in itself but a means to an end, the end being determined by man." So says Admiral Rickover in this speech which he gave at Georgetown University's Symposium on Cybernetics and Society, November, 1964.
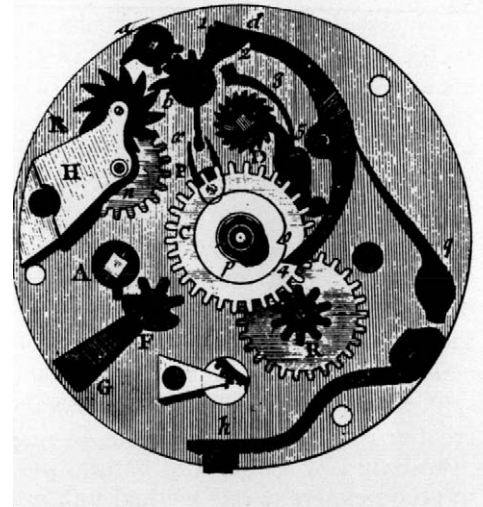
BY BORING into the secrets of nature scientists have discovered keys that will unlock powerful forces which are then put to practical use by technology. The apparatus we have set up to utilize these forces is now so huge, so complex, so difficult for laymen to understand that by its very magnitude it threatens to dwarf man himself. The threat does not inhere in the apparatus itself—technology is neutral. It lies in ourselves, in the way we look at technology, for this determines what we do with it.

My plea is for a humanistic attitude toward technology. By this I mean that we recognize it as a product of human effort, a product serving no other purpose than to benefit man—man in general, not merely some men; man in the totality of his humanity, encompassing all his manifold interests and needs, not merely some one particular concern of his. Humanistically viewed, technology is not an end in itself but a means to an end, the end being determined by man.

Technology is nothing but tools, techniques, procedures; the artifacts fashioned by modern industrial man to increase his powers of mind and body. Marvelous as they are, we must not let ourselves be overawed by these artifacts. They certainly do not dictate how we should use them; nor by their mere existence do they authorize actions that were not anteriorly lawful. We alone must decide how technology is to be used and we alone are responsible for the consequences. In this as in all our actions we are bound by the principles that

govern human behavior and human relations in our society.

This needs stressing for there is a widespread notion that, since technology has wrought vast changes in our lives, traditional concepts of ethics and morals are now obsolete. Why should the fact that technology makes it possible to relieve mankind of much brutal, exhausting physical labor and boring routine work affect precepts that have guided Western man for centuries? This may brand me as old-fashioned but I have not yet found occasion to discard a single principle that was accepted in the America of my youth. Why should anyone feel in need of a new ethical code because he has become richer or healthier or has more leisure? Does it make sense to abandon rules one has lived by because one has acquired more efficient tools? Tools are for utilizing the *external* resources at our disposal; principles are for marshaling our *inner*, our human resources. With tools we can alter our physical environment; principles serve to order our personal life and our relations with others. The two have nothing to do with each other.

It disturbs me to be told that technology "demands" some action the speaker favors, or that "you can't stop progress." It troubles me that we are so easily pressured by purveyors of technology into permitting so-called "progress" to alter our lives, without attempting to control this development—as if technology were an irrepres-

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sible force of nature to which we must meekly submit. If we reflected we might discover that much that is hailed as progress contributes little or nothing to human happiness. Not everything new is *eo ipso* good, nor everything old out-of-date.

Perhaps what makes us receptive to these arguments is our tendency to confuse technology with science. Not only in popular thinking but even among well-informed persons the two are not always clearly distinguished. Characteristics pertaining to science are often attributed to technology. The etymology of the word may have some bearing on this confusion. Its suffix lends to technology a false aura—as if it signified a body of accumulated, systematized knowledge—when in fact the term refers to the apparatus through which knowledge is put to practical use. The difference is important.

Science, as I hardly need tell this audience, has to do with discovering the true facts and relationships of observable phenomena in nature, and with establishing theories that serve to organize masses of verified data concerning these facts and relationships. Julian Huxley said that scientific laws and concepts are "organized creations of the human mind, by means of which the disorderly raw material of natural phenomena presented to crude experience is worked into orderly and manageable forms."

Because of the extraordinary care with which scientists verify the facts supporting their theories, and the readiness with which they alter theories when new facts prove an old established theory to be imperfect, science has immense authority. What the scientific community accepts as proven is not debatable; it must be accepted. No one argues that the earth *ought* to attract the moon, or that atomic fission *ought not* to produce energy.

Technology cannot claim the authority of science. It is properly a subject of debate, not only by experts in the field but by the public as well. In every field of knowledge, application to human use of scientific theories and axioms has proved anything but infallibly beneficial; in fact much harm has been done. We have yet to devise methods for testing the safety and usefulness of a given technology that would in any way be comparable to the methods by which science tests its hypotheses.

The forces put to work by technology should be handled with greater care than is presently the case. We have been remiss in failing to insist that no one be allowed to manage a technology who does not have the requisite competence. Further, anyone making a faulty decision which causes damage to others should be held responsible. As it is, many are now making technological decisions who are not capable—even if they would—of assessing the consequences of their decisions. Too often these are made on the basis of short-range, private interests with no regard for the interests of others or the possibilities of harmful long-range side effects. A certain ruthlessness is encouraged by the mistaken belief that to disregard human considerations is as necessary in technology as it is in science. The analogy is false.

The methods of science require rigorous exclusion of the human factor. They were developed to serve the needs of scientists whose sole interest is to comprehend the universe; to know the truth; to know it accurately and with certainty. The searcher for truth cannot pay attention to his own or other people's likes and dislikes, or to popular ideas of the fitness of things. This is why science is the very antithesis of "humanistic," despite the fact that historically modern science developed out of and parallel to the humanism of the Renaissance.

What scientists discover may shock or anger people— as did Galileo's discovery that the earth circles the sun, or Darwin's theory of evolution. But even an unpleasant truth is worth having; besides one can always choose not to believe it! It is otherwise with technology. Science, being pure thought, harms no one; it need not therefore be humanistic. But technology is action, and thus potentially dangerous. Unless it adapts itself to human interests, needs, values, and principles, i.e., unless it is humanistic, technology will do more harm than good. For by enlarging man's power of mind and body, it enhances his ability to do harm even as it enhances his ability to do good. Never in all his long life on earth has man possessed such enormous power to injure fellow human beings and society. Neither public opinion nor the law have caught up with his new destructive potential, which is why perpetrators of technological damage often as not escape with impunity.

That a humanistic technology is within the bounds of the attainable is proved by medicine. The practicing physician's technology is permeated by the humanistic spirit; it is centered on man. No one is allowed to practice medicine who has not given proof of his technical competence. The profession operates under a code of ethics which requires physicians to place the human needs of patients above all other considerations. On graduation from medical school they swear an oath incorporating this ethical code—an oath formulated two and a half millennia ago by the Greek physician Hippocrates.

Tension Within the Altruistic Ideal

We owe to Greece the noble idea that knowledge ought to be used humanistically, instead of for personal aggrandizement or power, or as a means of extracting maximum gain from people who are in need of the services of men possessing special knowledge. It was a novel idea at the time, and remains unknown to this day in many regions of the world—witness the fear in which medicine men are commonly held because of their notorious abuses of power. Even among the people of Western civilization, the precept is rarely followed outside medicine and a few other professions. Most human affairs are conducted on the old Roman maxim of *caveat emptor*.

Pursuant to the Greek ideal, the tradition in Europe has been to restrict the practice of medicine to persons who not only are competent in their specialty but who are also broadly or humanistically educated. Hence the requirement that before they begin their medical studies future physicians must obtain the baccalaureate that comes at the end of the exacting course of a classical or semiclassical gymnasium or lycée—a course deemed to nurture better than any other those qualities of breadth of mind and depth of character that are prerequisites of a humanistic attitude.

This, of course, prolongs the time it takes to become a physician and increases the cost. During the past century it was widely felt in our country that this was "undemocratic." So young men were allowed to enter medical school directly from high school. But eventually we followed the example of Europe, realizing that if medicine is to be of greatest service to mankind it must be practiced as a humanistic profession. Since we have nothing in our public school system comparable to the humanistic gymnasium or lycée, we require that before being admitted to medical school students obtain a bachelor's degree from a liberal arts college—the nearest American equivalent to the European baccalaureate.

I should like to see a similar requirement set up by engineering schools. They are now, in most cases, mere trade schools—though often excellent in their narrow field. Even schools that find room in their crowded curriculum for humanities courses cannot make up for the deficiencies in the American high school. We have no alternative but to demand completion of a liberal arts college course if we want future professionals to be broadly and liberally educated before they specialize for their particular career.

I have long believed that engineering should be practiced as a humanistic profession, that engineers should be humanistically or liberally educated persons. This would bring us appreciably closer to a humanistic technology, not only because it would broaden the engineer's vision but because it would raise his professional status. This is particularly important today when most engineers work in large bureaucratic organizations—private and public—where professional judgment has difficulty making itself felt against the autocratic fiat of higher administrative officials. If the technical advice of engineers is to count, they must attain a professional status comparable to that of physicians.

I speak of this with feeling. As you know, my work is in one of the new technologies—one that is dangerous unless properly handled. I am frequently faced with the difficulty of convincing administrative superiors that it is not safe for them to overrule their technical experts. Here is a case in point:

A superior once asked me to reduce radiation shielding in our nuclear submarines. He said the advantage of getting a lighter-weight reactor plant was worth risking the health of personnel. It was not possible to make him see that such a concept could not be accepted; that, moreover, where radiation is involved, we are dealing not just with the lives of present day individuals but with the genetic future of all mankind. His attitude was that we did not know much about evolution and if we raised radiation exposures we might find the resulting mutations to be beneficial—that mankind might "learn to live with radiation."

In a humanistic technology the desire to obtain maximum benefits is subordinated to the obligation not to injure human beings or society at large. Technological decisions must be made by competent and responsible persons who know that nature will strike back if her categorical imperatives are disregarded. We need, for technology as a whole, a system comparable to the one in medicine which guards against practices that, while doubtless profitable to the practitioner, would be harmful to those who suffer the consequences; in other words, we need professionalization of the decision-making process.

Increasing Organization

Most technological decisions are made by large organizations. Their custom of exalting the "pure" administrator above the technical expert, even in technical matters, needs to be changed. For in our country we do not make it mandatory that administrators have technical competence; their métier is to rule organizations. Living in hierarchies, they are accustomed to giving and obeying orders; they expect, and they give, unquestioned obedience to superiors. This offers little room for personal judgment based on knowledge and expertise. Professional persons, on the other hand, are trained to act in professional matters on their own judgment, no matter what their position in the organization. They also place the ethical code of their profession above the interests of their employer. We would be well advised to ponder whether we ought not insist on professionals participating on an equal basis in the decision making process whenever a technology is potentially dangerous.

This brings me to a final and important question: Can we handle technology in such a way that it will not distort our free society? Does our political system provide means to control the new power complexes that have arisen as a consequence of technology? Can we make certain that these do not diminish the autonomous individual on whom our system pivots; that they do not by reason of their overwhelming power pervert the democratic process?

This is so large a subject that I can only touch upon a few aspects that seem to me important. Let me say at once that if ours is to remain a society of free men, technology must be made humanistic. Men will not retain

their liberty unless their society is totally committed to the belief that "man is the measure of all things" (Protagoras) and to the maxim that "man is an end in himself" and must not be used "as a mere means for some external purpose" (Kant).

In essence, what we face is a modern version of an age-old problem that keeps reappearing: *how to reconcile liberty and civilization.* We shall understand the present-day version better if we know something about the 18th century version which occupied the thoughts of the Founding Fathers. This is how they saw it and ultimately solved it brilliantly—for *their* time:

They were men of the Enlightenment—that last phase of the Renaissance when men turned once more for inspiration to the classical world as they mounted an attack on every custom and institution that shackles the mind of man or arbitrarily restrains his action—from superstition to class privilege, from tyranny by an established church to tyranny by an absolute monarch. The central problem agitating the thinkers of the Age of Reason was how to limit power so that men may be free. They saw more clearly than anyone before or since that it was civilization—life in civilized society—which created the problem. Savages knew how to remain free, but when men lived in civilized society their social needs generated power which in the end suppressed their liberties.

Though separated by the Atlantic from the center of all this intellectual ferment, the founders of our nation were a part of it. Unlike the European philosophers, who were merely theorizing about a possible resolution of the antithesis between individual liberty and organized society, the Founding Fathers were looking for a practical solution; they were first-rate thinkers, but also experienced politicians. Their great achievement was to have recognized that on this rich, empty, newly colonized American continent a new type of self-reliant man, a new type of basically egalitarian society had come into being, and that a unique opportunity thus offered itself to establish here the Utopia the philosophers were dreaming about: a country where all men would be free to manage their personal lives, where the law recognized no special privilege or handicap, where government would be the servant, not the master of the people. With consummate skill they devised a political system combining maximum protection of individual liberty with adequate provision for the proper governance of a civilized society. Hamilton called the Constitution a happy mean between "the energy of government and the security of private rights."

Private Rights and Public Duty

The founders achieved their purpose by making consent of the people indispensable to the functioning of government—in other words, by associating the citizen with the business of governing. In an oversimplified way,

one could say that the individual in our society is a person with private rights and public duties; he safeguards his private liberties by conscientiously attending to his public responsibilities.

The fundamental tenets of our political system are to be found in the Declaration of Independence, the machinery putting them into effect in the Constitution. Familiarity with these great documents, and with the *Federalist* which elucidates their meaning, is as essential to a strong democratic faith as is the Bible to religious
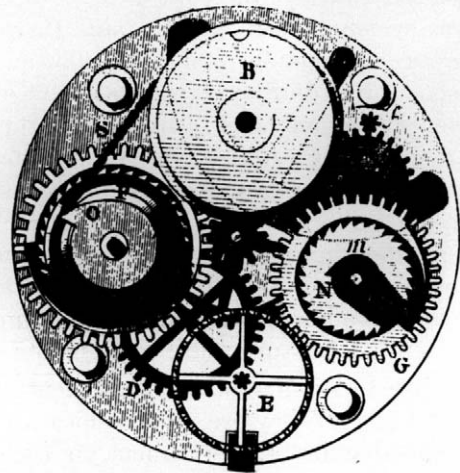
faith. We must know them well enough to be able to distinguish clearly between tenet and technique, between principle and procedure. For in order to preserve our free society we have to adjust techniques and procedures to changes in the conditions of life in order that they may be kept effective, while holding on to the basic tenets or principles that make ours a free, democratic society.

The Declaration of Independence enumerates three fundamental principles in the following order of precedence: *first,* men are born equally endowed with certain rights that are "inalienable"; *second,* governments are established to "secure" these rights; and *third,* government derives its "just powers" from the consent of the governed. Clearly the intent of the founders was that Americans were to be forever secure in the rights that make men free and, being free, capable of exercising control over their government; that never would they be ruled by anyone who had not received a public mandate and was not accountable to the people for his actions.

The founders were well aware that democracy is the most difficult form of government. They knew that to make a success of it, a people must have political sagacity as well as what the ancients called "public virtues"—a combination of independence, self-reliance

and readiness to assume civic responsibilities. But they felt that Americans possessed these qualities; that, indeed, the conditions of life in America developed just the type of man who would know how to make democracy work.

Among the advantages favoring a workable democracy, the founders counted the fact that Americans were for the most part independent farmers, artisans and merchants. Being used to managing their own business, such men would, they felt, know how to manage the nation. A scarce population and the immense wealth of the country in land and other resources would prevent formation of a propertyless class dependent on others for employment. The political equality basic to our system of government would thus be firmly supported by real equality among our people. The founders were convinced there would be free land for generations and generations to come; they could not have envisioned a hundredfold population increase in but two centuries. That seventy per cent of our people now live in urban conglomerations would have horrified them; they judged Europe's propertyless urban masses unfit to govern themselves! To them America's unique advantages were a guarantee of success for their political experiment. They felt that the land, the people and the political system were made for each other.

These special advantages are nearly all gone now. They began to disappear with the coming to our shores of the Industrial Revolution roughly a century ago; we are losing them at an accelerated rate since the full impact of the Scientific Revolution hit us about two decades ago. Directly or indirectly it has been the new technology these revolutions brought into being that altered the pattern of national life in ways that are detrimental to the democratic process. The many benefits we gain through technology come at a cost.

Let me briefly run over some of the advantages we have lost. Free land is gone and we now have an excess, not a scarcity, of people as measured by available jobs. The self-employed have dwindled to ten per cent of the working population and grow fewer each year; the solid and real property, which once gave Americans what Socrates called a "private station" from which to exercise their rights as citizens, has been replaced by masses of possessions being paid for on the installment plan. It was Kenneth Galbraith, I believe, who noted that the average family is three weeks from bankruptcy, should the breadwinner lose his job.

Early visitors to America were amazed that we had neither paupers nor very rich men; we now have both. The richest one per cent of our population owns twenty-eight per cent of the national wealth; the poorest ten per cent owns but one per cent. The gap is greater here than in many democracies abroad. We have some of the worst slums; one fourth to one fifth of our people live in want; and a substantial percentage are so poorly educated that we can find no jobs they are able to fill.

With the closing of the frontier a way of life came to an end which was simple and uncomplicated and therefore comprehensible to everyone. To make the wilderness habitable took a vast amount of rough work, so there was always demand for the kind of labor most people are able to perform. One needed little book learning to be successful in life. Men were scarce so they felt needed and therefore important. Public issues could be understood by ordinary men; de Tocqueville was astounded by the lively interest in politics he found here. "If an American were condemned to confine his activity to his own affairs, he would be robbed of one half of his existence," he wrote in the 1830's.

What changed all this was technology. The technical level of a society always determines the range of occupational skills that are in demand. In pre-industrial America, this range corresponded closely to the actual capabilities of our people. Today it is at odds with what one might call the natural range of competences. While men worked much harder in the past to earn a living, they needed much less formal schooling. Many people find it difficult or impossible to meet educational requirements that are indispensable at the present level of technology. The minimum now is a high school diploma. Though this is a modest level of education, nearly half our youth fail to achieve it. Yet it is not too much to ask; it is no more than is asked of workingmen in other advanced industrial countries.

To function properly in his environment a worker now needs to be a human being with a good basic education; he must certainly be wholly literate and what the English call numerate. Uneducated workers are a positive menace in complex industrial installations. Time and again I have seen production schedules delayed, countless hours of labor by highly skilled scientists and engineers brought to nothing, thousands of dollars' damage done by a single careless act of an uneducated worker.

Conclusion

Though we save ourselves much unpleasant labor by means of technology, we have to exert ourselves more than in the past to reach the competencies required of all who are involved with technology. If, as I said before, decision makers now should have a liberal education as well as professional competence, so must workers have a basic education in addition to their specific vocational skill. This is the price we have to pay for the many good things technology can provide.

But the raising of educational levels is not limited to job requirements. It is also essential to the discharge of our responsibilities as democratic citizens. Where in the past, life itself developed in most Americans the wisdom

and experience they needed to reach intelligent opinions on public issues and to choose wisely among candidates for public office, we must today acquire this competence largely through studies that many people do not find particularly congenial. Yet unless one understands the world he lives in, including issues requiring political solutions, he is not a productive, contributing member of society. Uneducated citizens are potentially as dangerous to the proper functioning of our democratic institutions as are uneducated workers when they handle complicated machinery.

Paradoxically, liberal education which at one time we tended to regard as "aristocratic" is the very kind of education we now need most to preserve our "democratic" way of life. Since it seeks to develop all the potentialities of the individual, not merely those he needs to earn a living, liberal or humanistic education shapes or forms him into a more capable, a more observant, a more discriminating human being. This he needs to be if he is to cope with the huge public and private power conglomerates that now dominate our society and interpose themselves between the American people and the men elected to public office, making it increasingly difficult for the popular will to assert itself whenever it goes counter to the interests of large organizations.

This is particularly serious when the people find they *must* call on their government to protect them against misuse of technology by one or another of these large organizations. So great is the power of these organizations that normally the interest of the sovereign people in getting protective laws enacted *and enforced* does not carry as much weight as the interest of organizations in continuing their harmful practices. Often something in the nature of a catastrophe which causes a public outcry will alone get action. The tragic case of the Thalidomide babies comes to mind. One could cite numerous examples of delayed or emasculated legislation and of inadequate enforcement of existing laws—for instance, against sale of foods and drugs containing ingredients not properly tested for side effects; against dangerous pesticides and weed killers which poison fish, plants and wildlife, and upset the ecological balance of nature; against air and water pollution, etc.

The problem of how to limit power so men may be free is perennial and cumulative. No sooner is society organized to control one kind of power, than new ones appear, ranging themselves alongside the old power. The founders of our nation solved the problem as it then existed, i.e., they limited the power wielded by government. Our problem is additionally to prevent the power of *bureaucratic organizations* from being used in ways that diminish individual liberty and undermine the democratic process. If we succeed in this we shall benefit from technology without having to sacrifice our precious heritage—freedom.
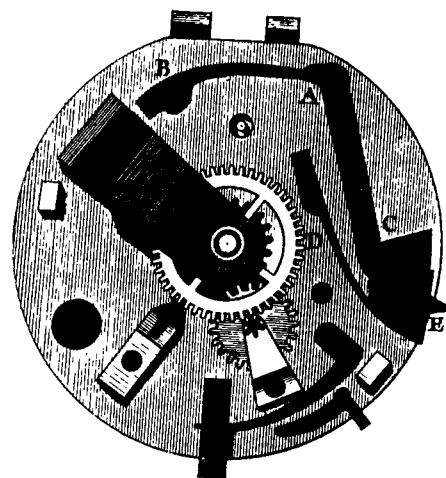
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Alfred de Grazia, PUBLISHER & EDITOR