Stanley L. Jaki

The Three Faces of Technology: Idol, Nemesis, Marvel

COINED BY THE Greeks almost two and a half thousand years ago, the word technology stood, until the beginning of the seventeenth century, for the skill known as grammar, the skill of making correct sentences. As late as 1683 an English author trying to modernize the teaching of English grammar could compain that "there were not any further Essays made in Technology for above fourscore years but all men acquiesced in the Common Grammar." A century later, Immanuel Kant used the word technology in the sense of any formal training, such as pedagogy or education, but in doing so he was already old-fashioned.

The shift in the meaning of technology from grammar to engineering was almost complete by the late eighteenth century. Chiefly responsible for this was Johann Beckmann, professor at the University of Göttingen, with his five-volume history of inventions, which even in its English translation went through six editions during the nineteenth century.

During the same period schools called "polytechnique" came into existence. Their prototype, the Ecole Polytechnique in Paris, found quick imitations in Germany and also in the United States. On seeing that new schools of technology are no longer called polytechniques but institutes, grammarians and other students of language could remind us of two things. They would first note that in the present-day fashionable expression, Institute of Technology, it is not the word technology that carries the main appeal but the word institute. Then they would remind us of certain words that suddenly become the rage of the day and then go no less quickly out of fashion.

As to the word technology, its attractiveness for our times rests, unfortunately, not so much with its second part *logos* (mind, reason, science) as with *techne* (crafts, if not plain craftiness). A proof of this is the increasingly frequent use of the adjective technological in connection with nouns such as man, age, society, that until recently stood in contrast to machine or anything technical. There is also the increasingly frequent appearance of *techne* in new words construed to characterize our modern predicament, such as technotronic, technocratic, technocrats, technostructure, technopolitan, and the like. That all these words have been coined by outsiders to the profession of the technologists (engineering) is a point worth noticing.

Outside observers of any profession may easily detect in its physiognomy features that often remain hidden to its practitioners. The same is true about the role played by any profession. The cutting edge of that role may be felt more keenly by those who are cut by it to the quick than by those who do the cutting. Outsiders were the first to speak of technology as the independent variable in the great social equation. On the face of it nothing should seem more innocuous or insignificant than the word independent in the technical context of variables. After all, it is a

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In 1987, **Stanley L. Jaki** received the prestigious Templeton Prize for Progress in Religion. A physicist and theologian, Fr. Jaki has also delivered the Gifford Lectures *(The Road of Science and the Ways to God)*. In the summer of 1988, the Intercollegiate Studies Institute will publish a second volume of Fr. Jaki's essays, to be entitled *The Absolute Beneath the Relative and Other Essays.*

daily tactic of any engineer to make now one variable independent, now another, depending on what is required from an effective handling of a technical problem. But when technology is spoken of as the independent variable in the broad human context, the term is anything but insignificant.

What is implied is a centrality in which technology is no longer an art or a science but an overlord or, if you wish, an idol. The story is not new. Already two hundred years ago, when the word technology came into its own, Joseph Priestley spoke of the reinstatement of man into his erstwhile "paradisaical" state through the inventiveness of science and technology. To others the same future appeared a rather mixed blessing. Diderot was certainly most influential in turning man's vision toward a heaven brought about by technology, a point of which we have now a good reminder in the cut-rate price at which a five-volume reprint of the illustrations (all on mechanical arts) for the *Encyclopedie* of Diderot and d'Alembert are being offered by remainder booksellers. Yet the same Diderot perceived the agony in store in a mechanical heaven as he exclaimed in reference to the all-consuming love between him and his mistress, Sophie Volland: "I am furious at being entangled in a confounded philosophy which my mind cannot refrain from approving and my heart from denying."

Still others, no less brilliant than Diderot, saw no saving grace whatever in the new technological heaven. One of them was Edmund Burke, who held up for well-deserved contempt that memorable piece of technological innovation, the guillotine, which barred, presumably with the least possible torment, tens of thousands from entering the new heaven, though not the hell of the Terror. Learned cliches notwithstanding, the real mainstay of the Terror was not Robespierre, the humanist manqué, but Carnot, soon to become a chief glory of the famed Polytechnique, already in the planning stage.

Burke may not have been entirely right in claiming that the new "mechanic philosophy" was a "barbarous philosophy" and that on its basis a woman was "but an animal and an animal not of the highest order." Burke may have also struck the wrong chord as he bemoaned the demise of the age of chivalry. Little genuine knighthood was left behind knightly coats of arms overlain with lace, velvet, silk, and thick layers of face powder. The vantage point offered by the 1980s may, however, help one discern a prophetic ring in Burke's apparent hyperbole: "The glory of Europe is extinguished forever." For if those words are a prophecy, it is because of the runaway technological race known as nuclear weapons development. Amidst the ups and downs of superpower relations, tied in part to questionable achievements in nuclear disarmament, Europe cannot shake off a nagging suspicion: Is she going to be the sacrificial lamb if and when a nuclear holocaust is frantically extinguished after a wrong start?

On the academic level of more or less pure science, the future is not necessarily freer of disturbing omens. Suffice it to recall the inaugural lecture (1980) of Prof. Hawking, the famed crippled occupant of the Lucasian chair once held by Newton. As he surrendered, rather glibly, the future of theoretical physics to computers, a prophetic fulfillment could be seen in Burke's words: "The age of sophisters, economists, and calculators has succeeded."

The French Revolution, especially as implemented by Napoleon, was indeed a feat of calculators, the technocrats produced by the Ecole Polytechnique. Not all of them were up to the task of an engineering which was expected to deliver not only chemicals, better guns, and systems of communications, but a newly mature society as well. Amidst such expectations only scorn could meet Aristotle's age-old observation, frightfully relevant also in this age of brash young wizards with computers: "while young men become geometricians and mathematicians and wise in matters like these, . . . a young man of practical wisdom cannot be found." Wizardry with quantities was not enough to spot the most promising technological feat of the times. It was a little steamboat, the Charlotte Dundas, that began in 1801 to pull barges along the Forth and the Clyde Canal in Scotland. A fleet of steamboats, however

primitive, would have been the only means for landing French troops on the shores of England, when on any windless day the proud British sails could do only one thing: hang powerless.

As a Minister of the Interior, Laplace, the mathematical genius, was through in three short months. In Napoleon's often quoted complaint, he brought only the spirit of infinitesimals into the administration, or infinitesimally little in any tangible way. Applied mathematicians, or technocrats, were at best a mixed bag in which the political genius could not necessarily find the very best. Napoleon's defeat at Waterloo was in large part due to an error in communication. Less known is that after Waterloo only one French general could hold out: Carnot, the famed mathematician, father of Sadi Carnot, the founder of thermodynamics. It was the engineering genius of the older Carnot that made the port of Antwerp impregnable to forces attacking it either from the land or from the sea. "I have come too late to appreciate your talents, Monsieur Carnot," was the parting message to him from the exiled Napoleon.

Burke's ultimate perspective on the shift from chilvalry to calculators, human or electronic, was a religious perspective. Burke may not have noted the gentle irony in the name of Priestley, who conjured up the age of calculators as a "paradisaical" age. In scientific circles Priestley is remembered for his role in the discovery of oxygen and perhaps as the author of a very readable history of electricity. The irony lurking behind Priestley's name is that he belonged to the priestly profession not only in name but also in fact. He was perhaps the first of those nowadays very fashionable Christian clergymen who stand for the program of exchanging the old heaven of revelation for the new heaven of technology. A century after Priestley, Ernest Renan was studying for the Catholic priesthood before he switched to a secular career under the influence of a very intelligent though very bitter woman, his own sister. The career was not to be of ordinary ambitions. What Renan aimed at was concisely and fully expressed in his phrase: *"La science organisera Dieu,"* a truly technocratic manhandling of God.

That the old Renan found no salvation in science is hardly ever recalled in our times when the examples of the idolization of technology are a dime a dozen. Once more clergymen are among those in the lead. Harvey Cox certainly provided an illustration to the background of Marshall McLuhan's memorable dictum, the medium is the message, by hailing man's new condition as technopolitan. McLuhan in turn argued that not until man builds a contrast to what he has been doing will he perceive the true physiognomy of his actual course or predicament. Thus the technopolitan man, or the occupant of the city of technology, would only be understood in contrast to the occupant of that city which St. Augustine epitomized as the City of God, a contrast certainly valid at least historically. Indeed Harvey Cox was eager to point out that the technopolis is a place from which God has withdrawn. He should have rather spoken of the invariably futile efforts to send God into exile, a futility which he has recently recognized, but perhaps only for the desire to ride again the crest of the wave which now washes religion over the secular city.

The Metaphysical Vacuum

A vacuum, either in physics or in theology, cannot exist too long. Idols quickly move in where God is no longer tolerated. The technological man is no exception to Burke's dictum that man is a religious animal. In technopolis technology is the idol, or rather the technological man worships himself. Like any other form of worship, this too involves the offering of sacrifices. Teilhard de Chardin gave away the true trend of his thought, so much in conflict with his childlike faith, that in the "noosphere," where evolution is driven forward by science and technology, we are required "to sacrifice our individuality."

Technology as an idol can, of course, be found in the writings and utterances of some engineers. Not being trained in theology and often very unfamiliar with theological lan-

guage, they idolize technology in non-theological terms which are revealing enough. Those mindful of the meaning of the name Yahweh, or HE WHO IS—that is, the very foundation of existence—will easily notice a theological undertone in the declaration according to which technology enables man to reshape his very existence. Those mindful of that omnipotence that has been traditionally ascribed to God, will not fail to think of theology on hearing some engineers declare that man, by virtue of technology, can do almost anything.

To be sure, most engineers have little taste for such extravagant statements. It has indeed been noted (and deplored, in some circles) that engineers by and large are conservative in outlook. They have little use for the obvious nonsense which is the idolization of technology and are shocked when it is presented to them, however innocently. An illustration of this is the consternation of that professor of engineering at a prominent university in the East who discussed space travel with his two sons, 9 and 11 years old. In the euphoria following man's landing on the moon nothing was more popular than to talk of journeys to the planets and even beyond. Travel to the stars, even to the nearest ones, is impossible, said the father. He was probably mindful of the remark of a Nobel-laureate who, in speaking on the subject at Brookhaven in the early 1960s, said that such travels would remain always where they have been mostly outlined, on the side of the boxes of raisin bran mixed with crunchy nuts. "Impossible?" retorted the two boys. "Dad," they sang in chorus, "nothing is impossible!" The children spoke, if not the truth as such, at least truthfully. They did not invent the phrase, "nothing is impossible." They simply picked it up from the intellectual climate, the idolization of technology. In creating that pseudotechnological climate, misguided men of the cloth seem to have a greater share than do engineers.

The situation is not exactly the same with regard to the functioning of technology as a nemesis. Today it is enough to mention the words ecology and nukes for a layman to consider himself an expert on the dangers of technology. Of course, toolmaking as weaponmaking is as old as man himself. Even if man the killer was a successor of man the foodsharer, the succession was quick and lasting. Long before poison gas, germ bombs, yellow rain (trichothecene), and nuclear warheads became daily topics, the nemesis of technology had prompted agonizing comments. The outcry "for the injury of man, how many kinds of poison, how many weapons and machines of destructions have been invented!" came not from a twentieth-century mouth but from the mouth of St. Augustine, some 1500 years ago. Again, it is not at all modern to notice the incredibly quick proliferation of weapons. Once the first cannon had been made, cannons were everywhere. Or as Petrarch put it around 1340: "instruments which discharge balls of metal with most tremendous noise and flashes of fire . . . were a few years ago very rare . . . but now they are as common and familiar as any other kind of arms. So quick and ingenious are the minds of men in learning the most pernicious arts."

Few things can tell more about the sinister labyrinths of mind than the story of Hiram Maxim, the inventor of the machine gun. A technological genius he certainly was in the sense that he invariably came up with an answer once the idea of a gadget caught his fancy. A perverse touch was not, however, absent even in his earliest and fairly innocent mechanical creations. The mousetrap invented by him worked by setting the stage for the next victim. Decades later, he took nemesis by hand when he was told in Vienna that a new machine, which "will enable these Europeans to cut each other's throats with greater facility," would be a sure money maker. The result was the machine gun of which automatic rifles, whose number is now estimated at 100 million all over the world, are the grandchildren. In this age oppressed by the memory of Nagasaki and Hiroshima few if any think of the comparable, and cumulatively much greater, havoc wrought by machine guns week after week during World War I. The mowing down by German machine guns of 21,000 British Tommies on the Somme in a single day (July

1, 1915) was neither an isolated carnage nor a dubious distinction limited to one side.

Such data were possibly in Oswald Spengler's memory as he wrote in the wake of World War I his *Decline of the West.* There he prophesied that "Faustian man will be dragged to death by his machines." Yet Spengler spoke of machines, not of war machines. Indeed, nemesis may be hiding even in the simplest machines such as cans of aerosol spray, operating with fluorocarbons. Their ultimate threat is not in kitchens and garages where they are mostly used, but 25 kilometers above us, in that vital ozone layer which they may destroy, and all of us with it.

Technology as a nemesis is a very real thing and the reason for this is a counterpart to the idolization of technology and therefore theological in nature. Of course, theological symptoms are given nowadays nontheological labels, with no consideration for the fact that pharmacies may not be the only place where labels can be disastrously misplaced. The reason in question found its best description in Melville's *Moby Dick,* in his portrayal of Captain Ahab's being wrapped up more and more irresistibly in a self-destructive pursuit. Irresistibly yet not unknowingly. The high point comes much earlier, in that meditation where Captain Ahab admits: "All my means are sane. My motive and my object mad." A masterful observation in a masterpiece which starts with a sermon, a paraphrase of the story of Jonah who does the wrong thing though fully aware of the right thing he was supposed to do.

Quite a few who write about science and technology as something which is getting out of hand, slip, time and again, into a style which on the one hand evokes theology, but on the other falls far short of Melville's outspokenness. Take, for instance, the graphic description of science by A. Lapp, a physicist turned lobbyist, according to whom science is a train racing down the track "on which there are an unknown number of switches leading to unknown destinations. No single scientist is in the cab and there may be demons at the switch. Most of society is in the caboose looking backward." Whatever the possible misplacement of scientists and society, demons have never been more misplaced. Are they not just so many red herrings? Would it not have been far more honest to admit that in all too many occasions man deliberately throws the switch which shifts the train of science to tracks where nemesis looms large? It would have been far more honest to recall not demons but those two men who, according to St. Paul, struggle within each of us: one urging us to do good, the other luring us to do evil.

Once this theological label is declined, the result is not merely the placing of a wrong label (an always potentially disastrous procedure), but the impossibility of recognizing the very real situation. For if man is by definition an aggressive animal, how can one make him accountable for his wrongdoing, indeed how can one argue that there is wrongdoing at all? Is it not the worst nemesis to be caught in a course of increasingly sophisticated murders and to write off the whole matter under the disguise of that sophisticated blindfold which is genetic determinism? Are we not in that case condemned to be conscious cogwheels in that inexorable machine, a true nemesis, which invariably turns the possible into an imperative?

Examples, crude and refined, would not be amiss. On the crude side, there is the admission by Albert Speer, by training an architect and an organizer by genius, a superman of a technology taken in the sense of systems-engineering. It is generally admitted that without Speer the Nazi war machine would have come to a grinding halt long before May 1945, perhaps two full years earlier, with the saving of millions of lives and thousands of towns. Albert Speer kept saying that if Hitler had any friend he, Speer, was the one. Yet Speer was the friend of nobody except himself, of his own aggrandizement as a technologist. This proved to be his nemesis and the nemesis of our century. Speer first saw Hitler in 1931 and was overawed. As was the future Führer by the brilliant architect. In the following years the two spent many an evening together poring over blueprints of

Germania, the planned capital city of the New Reich and of the new Europe for the next thousand years. In his memoirs Speer wrote: "For the commission to do a great building, I would have sold my soul, like Faust.... Now I have found my Mephistopheles."

On the refined though no less telling side, there is that tragically sensitive Oppenheimer who gave as one justification for the making of the bomb that when you have a "technically sweet" project, you do it. Those who at Los Alamos were at times apprehensive, were brushed aside by Fermi with the words, "the bomb is superb physics." It is well to recall that once the bomb exploded, Fermi was anything but superb. He was in fact so shaken that for the first time in his life he was unable to drive his own car. He had to be driven back to Los Alamos. Mark Oliphant, the Australian physicist and member of the British atom bomb project, was prompted to words which sear with their plainness: "We could not have done anything else, but we have killed a beautiful subject." The nemesis of technology could not have been evoked any better. The search for magnetic monopoles is certainly a beautiful subject, but is it not potentially killed when long before the discovery of those monopoles they are being spoken of as the ultimate binary weapon?

Oliphant in all likelihood spoke of political and military necessity, but the nemesis which is coupled with technology is not merely exterior to it. There is a nemesis which is almost inborn to technology, such as the production of more for the sake of more, the production of greater speed for speed's sake, or the commitment to production as such along a very large number of parameters. The depth of that nemesis is the idolization of the quantitative method itself. It is a boomerang that may kill or at least paralyze not only this or that scientific subject but science itself.

The Death of Wonder

How this can come about is unwittingly set forth in the book, *The Mature Society*, by Dennis Gabor, who received the Nobel Prize for the invention of the holograph. Taking the view (perhaps only plausible but certainly popular) that technological innovations are approaching the saturation point, he urged a redirecting of scientific energies and inventiveness. Instead of cultivating the physical sciences, scientifically talented men and women should address themselves to the problems of systems-analysis. Why? Because, according to Gabor, that field is yet largely unexplored and also because the findings would be directly applicable to human society. Those applications, Gabor insists, are absolutely necessary because man is in the grip of a guilt complex, a nemesis, and either he will be cured by a wholesale genetic mutation (a most unlikely event), or he will have to be re-educated through systems-analysis.

A page or two from Gabor's book on a mathematical model of freedom provides clear evidence of the true nature of his hopes of curing man of his technological nemesis through more technology or science. But what kind of science is left for Gabor and like-minded technologists? It is essentially the science of systems-analysis and not the science of an open-ended exploration of nature, as an ongoing penetration into nature's secrets. Indeed, Gabor emphatically states that the craving for new discoveries must be channeled in a different direction. But can scientific work remain a source of novelty and marvel if channelled along the lines of systems-analysis and social engineering?

Scientific work is a combination of both theory and practice, a combination of pure science and technology. Even three hundred years ago, when the expression "men of Scyence," was first used, it stood for those who not only speculated about nature as a mechanism but also tried to come up with useful machines. The myth created by Alexandre Koyré about Galileo as a "pure thinker" went up in a smoke when in 1961 T. B. Settle, still a graduate student in the history of science, reconstructed Galileo's inclined plane (which Koyré took for a fiction) and showed its effectiveness in demonstrating the law of free fall.

The poet, Wordsworth, did more justice to another great scientist, Newton, as he spoke not only of Newton's mind "forever voyaging through strange seas of thought alone," but also of his prism. Instead of the prism, not of Newton's construction, Wordsworth could have referred to that reflecting telescope, a brainchild of Newton and also a product of his own hands, a product which ultimately made Herschel's discoveries possible and all those breakthroughs in cosmology that are connected with Mount Wilson and Palomar and have kept mankind marveling ever since. Today, more than ever, science and technology are two sides of the same coin and of the same marvel.

It is, of course, possible to marvel in a trivial sense. A good example is provided by Johann Beckmann in his *Anleitung zur Technologie* (1771), possibly the first book to carry the word technology in its title. There Beckmann quoted d'Alembert who waxed rhetorical over machines that could produce intricate needlework or embroideries. Yet, as most products of technology, those needlework machines were sheer extensions of well-known gadgets and techniques and came about inevitably. Most marvels of technology are of this type. This is why a short time after their first production (it is enough to think of electronic calculators), they become part of a daily routine which dulls the sense of marvel.

A better kind of marvel is the one about which it is impossible to assume that it had to obtain at all. Some such marvels happen by sheer luck though with a touch of necessity. Oersted was bound to make the lucky move of inadvertently setting the magnet at right angle to circuit. Without incurring the crime of outright sacrilege, the same may also be said about Faraday's discovery of electromagnetic induction. The many marvelous applications and appliances to which Oersted's and Faraday's discoveries gave rise were almost inevitable consequences, but this was certainly not true of Maxwell's formulation of the idea of displacement current. It was a stroke of genius, a true marvel, about which no historian of science would as much as hint that it had to come inevitably. It was a marvel of opening the door to the unsuspected world of wireless electricity.

It was another matter with the manifold applications of that marvel, such as radio, radar, radio-telescope, television and so forth. If not always quickly, they came inevitably. The same is true of almost all the wonders of semiconductor technology. It was the *very* beginning of that technology, Bohr's theory of the hydrogen atom, that was a true wonder. I said *very* beginning and did so on purpose. When Einstein heard from Hevesy that the Fowler spectrum of hydrogen agreed with Bohr's theory "the big eyes of Einstein looked even bigger" and he said to Hevesy: "Then it is one of the greatest discoveries."

Einstein was a most qualified judge, not so much because he himself had toyed with the idea which made Bohr famous, but because he knew the difference between the respective measures of marvel due to his two theories of relativity. About special relativity he admitted that it was in the air, that somebody would have stated it sooner or later. He looked at general relativity as the mark of his genius in the belief that no one else would have thought of it for a long while at least. Einstein also said memorable things about scientific knowledge as something that cannot be taken for granted, as something which is the source of utmost wonder. By stressing the fact that this kind of wonder was not at all a necessary outcome, he saw even philosophically farther than Aristotle who started his metaphysics with a reference to man's ability to wonder. Unfortunately, Aristotle, whose pantheism left no room for human freedom, failed to see that man's marveling made no sense if he was not a truly free being.

The mere mention of the words metaphysics and philosophy, unless made in a disparaging tone, may sound distasteful to worshipers of technology. Yet leading Institutes of Technology now have chairs for philosophy. They even have full-fledged departments in such fields as psychology, history, and sociology, fields usually subsumed under the label of humanities. What a contrast to old-fashioned universities domi-

nated by even more old-fashioned humanities departments, where teachers of Greek, Latin, English, History, and so forth had one thing in common: an abysmal ignorance of pure and applied science! So went a part of Snow's famous thesis in *The Two Cultures.* The other part was that scientists, especially engineers or technologists, had not only a respectable measure of information about the humanities but also the future in their bones. About those bones, it would be advisable to "make bones," that is, to be suspicious. The claim that technology gives man a sound basis to be future-oriented is part of that disastrous procedure which turned technology into a substitute god, or idol. The so-called science of futurology may or may not be sheer blasphemy, but it is certainly a chain of predictions almost all of which turn out to be wrong within a decade and certainly within a generation.

The amount of information which scientists, pure and applied, have about the humanities is less relevant than what is being taught in the name of humanities either in old universities or some new Institutes of Technology. The humanities are not being taught at all. In the name of philosophy a set of courses, so many variations on logical analysis, is being invariably offered. Literature courses are usually the victims of psychoanalysis, Freudian or even worse. In history courses the politicization is almost complete. The teaching of sociology is largely dominated by statistics, that is, quantitative patterns. Anthropology, when blissfully "structuralized," tells the same story. This exclusive or almost exclusive concentration on "patterns" produces in the long run that boredom which is the very opposite of marvel. Worse, it erodes that sense of purpose and values without which society becomes its own nemesis, as do all of society's preoccupations, including theological concerns.

Instead of conjuring up a global apocalyptic picture, however appropriate in these times, a more practical effort may be a look at our own backyard, called Boswash, or the huge metropolitan area (megapolis) that stretches from Boston to Washington. The nicknames of two similar areas in the USA, Chicpitt (Chicago-Pittsburgh) and Sansan (San Francisco-San Diego) are no less evocative. A common feature of all three, and also their principal problem, is their being pockmarked by areas of urban decay and by futile urban renewal projects. These projects are mostly futile because they are predicated exclusively on the philosophy or rather pseudophilosophy of the technological fix. The basic dogma of that pseudophilosophy is that technology can fix all social problems, even the issue of global war and peace, to say nothing of the somewhat smaller issue of social war and peace. A corollary of that dogma is that technology can at least postpone problems coming to a head. The dogma and its corollary are a very poor technology. Every builder and plumber knows that beyond a certain point a house and its plumbing can no longer be fixed. Any further patch, any further beam, may become that very straw that breaks the camel's back.

Fortunately, there have been managers of urban renewal projects who, on seeing the plumbing of new apartments being torn out after only a month of occupancy, refused to resort to the remedy of technological fix which also implies further borrowing from the city, the state or federal government under some new entitlement program. Rather, they decided on an old-fashioned surgery. New occupants had to make a deposit, a future coverage against improper use of any and all fixtures. What was ultimately implied in that surgery is not a capitalist attempt at one's pocketbook, but a fiscal enforcement of one's sense of responsibility.

The Imperative of Responsibility

Responsibility is not a pattern. It is not something calculable, it is rather a most incalculable and awesome wonder in human existence, a counterpart of the marvel of knowledge, scientific or other. It is this kind of wonder which is no longer being taught either in the humanities departments of old universities or in the humanities sections of new Institutes of Technology. Of course, Institutes of Technology need to cultivate awareness of responsibility. Technological

specialization has its own atrophying effects and potentially catastrophic results. A rather old story, it is best told in *The German Catastrophe,* published in 1946 by F. Meinecke, then 84, a great German historian and a life-long champion of disciplined liberalism. He described the early enthusiasm of university graduates with their professional specialties, mostly technological. Then he noted the sudden rise of their suppressed metaphysical urges as they reached their late thirties. Not having any guideposts to true metaphysics, they would seize on anything fashionable at the moment as a salvation for mankind, be it

> anti-alcoholism, agricultural reform, eugenics, or the occult sciences. The former first-rate specialist changes into a kind of prophet, into an enthusiast, perhaps even into a fanatic and monomaniac. Thus arises the type of man who wants to reform the world. Here one sees how a one-sided training of the intellect in technical work may lead to a new one-sidedness that clutches about wildly and intemperately.

The passage is part of a chapter in which Meinecke contrasts *homo sapiens,* or man of wisdom, with *homo faber,* the man of technical skill, and recalls the stunningly high percentage of technically trained people in the Nazi leadership. All those engineers, turned Nazi leaders, had in their years in the Gymnasium a humanistic education which was at least as good if not better than what is offered today in most American colleges. But familiarity with Greek, Latin, history, and the arts was not in itself equivalent to that kind of humanistic education which, because of its attention to metaphysics, is imbued with a sense of values.

For leaving out metaphysics or philosophy, the usual excuse is the proverbial disagreement among philosophers. Galileo already contrasted with glee the consensus of scientists, who advance from truth to truth, with the prevalence of mere opinions among the humanists. But the advantage of scientists is also their disadvantage. The truths they establish are merely quantitative correlations. In most cases it is easy for them to agree, although not all the time, and certainly such is the case when the problems under discussion somehow go beyond the realm of pure quantities. A good illustration is the story reported a dozen years ago in Anne H. Cahn's *Eggheads and Warheads* about the conflict of scientific advisors concerning the technical feasibility of ABMs. Opinions were sharply divided, though ultimately not on purely technical grounds. As it turned out, all those who concluded against that technical feasibility were also known as doves, and all those arguing in favor were well known hawks. The same could today be verified with respect to SDI (Strategic Defense Initiative), commonly abused as Star Wars.

Clearly, if even purely scientific reasoning is not a mere logic machine, scientists should be wary of gloating over the disagreements of philosophers who are in the grip of problems, existential and valuational problems, that cannot be expressed in terms of quantities which are the easiest parameters to handle. And beyond the problems and their solution, there is the problem of assenting to the truth. It is a subject which has its own structure, own method, as does any subject matter, be it science, technology, and even grammar. The very teaching of all these subjects obeys certain rules, a certain grammar, as memorably argued in Newman's most philosophical book, *An Essay in Aid of a Grammar of Assent,* the most probing search so far offered on the question of assenting to truth.

Newman deals, of course, with assent given to religious truth. Somewhat easier should be the problem of assent to philosophical truth, let alone to mere scientific truth. But is there a purely scientific truth, the kind of truth which until recently was taken for the only and certain truth? To hear those interpreters of science who ride high today, there are no scientific truths at all, no objectivity whatsoever. All scientific theories and conclusions are so many Gestalts, paradigms, images, themata, research programmes and the like. One may be more successful than the other, but like all successes they are merely relative. They are no more than opinions, none of which call for

our assent to them, but only for familiarity with them. But as opinions, scientific theories too are like fashions that come and go, clothes that one can put on or take off at convenience if not at will.

Such is the voice of pseudohumanists for whom man does not live for truth but only for success, an always relative matter. Very few of them are willing to imitate the honesty of a professor of the history of science, L. Pierce Williams of Cornell, who said a mouthful in his letter to the *New York Times* (December 21, 1983). The reason he wrote was an attack on a colleague of his, Donald Kagan, who argued that civil disobedience as a tool of the civil rights movement was not a moral stance but a purely legal question:

> What Kagan, I think, was arguing was that there is no "moral" universe to which citizens can now appeal that provides an adequate basis for disobedience to the law. I find it strange that liberals, who insist upon the ultimate relativism of all moral values, suddenly appeal to a "higher" morality (which they are careful not to define) when it suits them. All that went out with the Victorians, and we now inhabit a society in which all moral opinions seem equally valid.... The point, of course, is, as Kagan clearly stated, that we live in a consensual society in which we often have to do things we don't want to do, or even think are wrong, because we have agreed to abide by majority rule. Destroy that argument, and the result is not freedom but anarchy—a condition which the United States seems rapidly approaching.

To rely on that consensus is to do the work of parasites that by sapping to the last drop its life-giving juices hasten their own demise as well. This is exactly what is being done by pseudohumanists who have turned technology into the very idol which gives rise to its nemesis. The blocking of the vision of technology as a marvel is also their deplorable work. To install pseudohumanists under the roofs of Institutes of Technology is the worst disservice men of technology can do to themselves. In the chronic shortage of genuine humanists, plain old common sense may be the best safeguard for men of technology.

Armed with common sense, they will have the ability, forfeited by some famous engineers who in their old age assume the role of elder statesmen, to raise the most important question about technology. It should seem significant that Juvenal, the best satirist of Antiquity, had not technology in mind but a sort of political science when he asked, in reference to marital faithfulness: *quis custodiet ipsos custodes* (who will guard the guards themselves)? No other question is more timely and important in these days when a small society of technologists claims to have the arcane science and know-how to engineer the rest of society and is given all the benefit of doubt by those who should know better.