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Author(s): J. BRONOWSKI

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Technology and Culture in Evolution

J. BRONOWSKI

THERE IS NO BLUEPRINT of the future: there is not even a modern bible of the future, of the kind that Karl Marx wrote—a compound of history and exhortation that might be read as a map to the promised land. Since the heyday of H. G. Wells, almost no one has written seriously about the future except the prophets of gloom, such as Aldous Huxley and George Orwell. Their books were made popular by their moralizing tone, but in fact they lack moral as well as scientific imagination: the tragic air about them derives from a complacent assurance that literary England in the first half of the century was the arbiter and expression of ethical wisdom forever. Meanwhile, the writers with a more inventive turn of mind have backed away into science fiction, where their timid and trivial adventures in whimsy do not aspire to genuine imagination and humanity, and so do not rank even as minor prophecy.

Perhaps it has become too painful to think about the future, whose melancholy course just ahead of us is constantly predictable, and yet which we constantly fail to steer away from patently disastrous policies. Whatever the reason, we are intellectually in the middle of a grand withdrawal from history, of which the withdrawal from the future is the less visible but the more ominous half. It is as if we were trying to close our eyes to all that has made us human, by way of biological and cultural evolution, and want instead to play at being happy foundlings in a hole in time.

The truth is, however, that the special gifts of man and his achievements are inseparable from his evolutionary history as the only substantially self-made animal. A multitude of animal species

© JACOB BRONOWSKI is director of the Council for Biology in Human Affairs at the Salk Institute in La Jolla, California.

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run, fly, swim, and burrow around us, shaped by and locked into their environment; and among all the species, only man has achieved enough command to have largely influenced his own biological evolution. In the past, man has molded himself for the most part unconsciously, by changing the environment so that its selective pressure on him changed. Now we are able to command at least our immediate future with a much larger understanding of the implications of what we do; and it would be ironic if we chose this new moment to bring history to a standstill.

The contemporary crisis of withdrawal from past and future together has been brought home to me by reading again Desmond Bernal's small classic of prophecy *The World, the Flesh & the Devil*, which has been reprinted after a biblical lapse of forty years. My first reading of the book in 1929 is still bright in my mind, not because it was memorable, but because in a heightened form it was natural and native to Cambridge then: an active, uninhibited, bubbling society of young men who were forever speculating about everything. I was a fairly inquisitive undergraduate, but Desmond Bernal as a junior research don in crystallography outdid us all in curiosity, argument, and irritating candor. His great range of interests makes Bernal's first book an epitome of the intellectual tone of Cambridge then, and (by the way) is expressed in its arch title: *the World* is man's physical environment, *the Flesh* is his biological frame, and *the Devil* is his psychological makeup.

Bernal was thinking on an evolutionary scale of time, and trying to guess the future toward which man is heading, in part by the elaboration of his species-specific talents, and in part by the short-term choices that he makes, half consciously, to direct his long-term fate. Naturally he foresaw that man would more and more crowd and despoil the earth: in the long run, therefore, he would have to make new earths and put them into solar orbit. Since a man-made earth would necessarily be small, say ten miles across, it would have no gravity to speak of and would therefore best be made hollow, with the population moving and working freely inside as a three-dimensional, self-contained city culture. Chemical and energy exchanges would have to take place through the shell,

which would thus have to serve both as mother quarry and as cell wall; and the inhabitants would occasionally send off from the shell new copies of their earth, like the twinning of living cells. In time the solar system would presumably be whirling with little earths by the hundred thousand, each isolated from the others and set on its own evolutionary path.

If this seems a fantastic way to reshape the world, Bernal's way with the flesh is even more unorthodox. His thought here begins from the observation that Boswell quotes from Benjamin Franklin, that man is a tool-making animal. We now know that this is indeed how man has extended the reach of his organs into his unique ability to shape the environment to himself. Sooner or later, therefore, Bernal holds, the more sophisticated tools will be made into normal extensions of the body, and built into us for life. (Evidently this is already happening to our eyes, as we first eke them out with spectacles and then replace those by contact lenses.) The result would be a human being as an integrated tool kit, part flesh and part apparatus, all run directly by the central nervous system.

Oddly, Bernal is both most original and least specific in casting out the devil, that is, the psychological limitations of people in their everyday behavior. What is original is that he tackles the subject at all; for this is a field of prophecy that the professional forecasters always shirk—as can be seen in the otherwise sturdy work of two recent panels to assess new technology, one run by the National Academy of Sciences and the other by the Institute for the Future. What the panels guess about changes in physical and even in biological habits is as always bold and stimulating; but what they say about the effect of such changes on personal and social psychology is as always meager, old-womanish, and painfully vague. Bernal marches up to the devil boldly, though he comes away fairly vague himself. His main hope is to liberate the originality that is hidden in every human mind, and his recipe for that is to cast out fear, particularly the fear of startling innovations. There is also a nice plea for a union of the cultures, by race, geography, and disciplines, which was indeed prophetic in 1929 but, by a special irony, sounds almost nostalgic at this moment, when

the literary Jeremiahs are in full wail again, and the two cultures are farther apart than ever.

I am deliberately thrusting these speculations at the reader because it seems to me timely to remind ourselves that man is an evolved being whose evolution is still going on. We are creatures like others in course of change, and we are unlike the others mainly in our rate and range of change. Very recent studies of the protein chemistry of primates suggest that we and the chimpanzee were one stock no longer than ten or twenty million years ago, so that our evolution has gone prodigiously fast (particularly in the growth of our brain in the last half million years). By contrast, such social insects as the ants have remained quite unchanged for at least fifty million years, locked in their rigid hierarchies of function by structure. We have to face the logic of life, which is that species reach a steady state, and stop evolving, only when the individuals fall into uniform and indeed identical types. By contrast, evolution goes on if there is a pool of viable mutations, which can express themselves in structures and in behavior different from the normal: so that it is reasonable to prophesy that the more variable the members of a species are, the more freely and unexpectedly will it evolve. If we value variety in human beings, we cannot be squeamish in admitting that, as a consequence, man will go on evolving quite strangely.

Therefore when we say aloud (and rightly) that we need to *safeguard* the environment of life, we must beware of secretly thinking that we must *stabilize* the environment—with the hidden assumption that the fullness of human life is to be equated with man as he is now. Of course, it is unwelcome and unsettling to be told that we are not the peak of nature, a museum piece for eternity; but no doubt Neanderthal man (whose line has become extinct) felt the same way before us. The quality of life is not god-given; on the contrary, since the evolutionary rise of man it has been man-made, and it must not be fixed to mean what happens to be agreeable to the kind of men that we are now—conservatives who like to pose as conservationists. It does not make sense to talk of the quality of life unless we have in mind a choice

among the possible satisfactions that human life can provide, and particularly a choice among different modes of intellectual satisfaction.

Again I am deliberately invoking a long perspective in order to make the reader look hard at the Wordsworthian catchwords that are traded in the health food stores. If the basis for our disgust with the commuter city and the power state is the belief that they are unnatural to man (as surely they are) then we need to say what is natural—and we need a better ground for saying it than the authority of gut and guru. Moreover, what is natural to man must be specific to him, which is why the general accounts of animal behavior that derive from Konrad Lorenz will not do. Of course man is a poor creature if he blinds himself to the power and the satisfactions of his animal heritage; but he is even poorer, poorer than any animal, if he does not explore those satisfactions that are unique to his species. Hence the scientific search by ethologists for universals in animal behavior is distorted from its purpose, and becomes a silly piece of journalistic sensation, if it is used as a prescription for what is “natural” in human conduct. Magazine readers seem to like to be told that they share a universal beastliness with animals—perhaps because it absolves them of the responsibility to feel human; but that is *not* what has made our species man rather than any other animal.

What has made us men has been deeply documented now by the fossil finds in Africa in the last fifty years, which have traced the biological and cultural specialization of modern man back to its origins, and by the newer work in primate ethology. More than a million, perhaps two million years ago, the hominids went on from using rudimentary tools (which the chimpanzee does) to making them and keeping them for future use. That discovery, that simple lunge into technological foresight, released the brake on evolution which the environment imposes on other animals, and sent man off breakneck at a speed unmatched in the three billion years that life has existed on earth. For without that discovery, evolution is necessarily held down to the pace of biological adaptation. But from the time of the basic human *discovery of the future*, the environment ceases to set the pace, which instead is

then set by the capacity to store knowledge and to form plans from it.

This is a remarkable finding, for it implies that the evolution of man has always been culture-driven, and that the driving component was technology. A culture cannot be inherited in the genes, of course; what the hominids passed from one generation to the next was greater dexterity of hand and more farsighted planning in the brain, which became able to manipulate symbols as artifacts. We assume that the choice of mates with these gifts, and the higher reproduction and survival rates of those who possessed them, produced a unique form of natural selection, namely, a self-selection for these culturally useful attributes. (The same selection is still at work: to this day, the correlation of intelligence quotients between bride and bridegroom is higher than between parents and children.) Thus human evolution owes its speed to the gift of technology by which we have shaped the environment; we have never fitted very well into any ecological niche, and instead have carved our own niches with our hands and brain. But even this metaphor is too formal: what has happened is that we have exploited a genetic accident which has made us able progressively to store and organize experience so that we can profit from almost any terrestrial environment.

On this grand scale of history, therefore, to quarrel with technology is to quarrel with the nature of man—just as if we were to quarrel with his upright gait, his symbolic imagination, his faculty for speech, or his unusual sexual posture and appetite. Of course that is no reason why those who choose should not dislike technology; now that it has helped indirectly to give them a brain two to three times larger than the chimpanzee's, they are surely free to use it to prefer the life or even the brain of the chimpanzee. But they cannot then take as their ground the claim that they want to return to nature, meaning the nature of man. For the nature of man is expressed in the same few universals in every culture, from the pigmy and the aborigine to Western man, and from the prohibition of incest to language; and one of these universals is technology.

By the same token, it is a flat denial of history to assert that cultures in which technology has flourished have stifled the development of more personal and sensitive expressions of human nature. On the contrary, the works of high culture that we admire come from the most advanced technological societies of their day: classical Greece, the Arab civilization, the Italian city states, Elizabethan and Restoration England—as soon as one looks at the monuments of art and architecture and literature that express the peaks of the human imagination for us, one sees that they match the peaks of technological sophistication in history. (We do not even take our religions from technologically backward civilizations: Buddha, Confucius, Christ and Mohammed were not the desert prophets of backward peoples, but grew up in great intellectual civilizations.) I shall not labor this historical analysis as I have done the biological one, because the facts here are open to everyone to inspect, and are self-evident as soon as we attend to them. The only way to get around them is to dismiss them: that is, to say that Sophocles and Michelangelo and Marlowe and Christopher Wren are fossils whose record is irrelevant to the cultural mishaps of city life in the twentieth century—the profound human problems that many citizens of America believe have been vouchsafed to them for the first time.

There is a good deal of talk now about a counterculture, and on the face of it what is being countered is only technology as a social culture. That, for example, is what the words say on the pages of Theodore Roszak's book with that phrase in the title: technology is soulless, get rid of it and let your soul breathe out. But what is important is what the words do *not* say—all the invisible sludge of rejection on which such thoughts float. The words do not say anything about the great concepts of science, of course, about the achievements of the rational intellect, or about the imaginative creation in this century of a world picture unbelievably richer and more harmonious than anything you can get from drugs. That was to be expected; the counterculture is against science. What was not expected is the heavy silence about music and painting and literature as lasting and living expressions of all that has made our

culture, and has alone made it worthwhile. Some perfunctory parade of literary commonplaces and a little mantra-chanting are, it seems, all the equipment that the soul needs on its soaring flight into the acid blue of being human. There is a hidden, plangent hatred of everything except private experience: the counterculture is against culture.

The fact, the dreadful fact, is that the assertion by those who speak for a counterculture that technology distorts human nature is not only false, as biology and as history. It is a deliberate act of mischief, for it is a recapitulation in modern dress of the anti-intellectual, irrational and illiberal prejudices that have always been endemic in America. In the past this homespun obscurantism has been a defensive faith for the old; now it is being sold to the young as a respectable brand of snake oil that will dull the itch of ignorance without personal effort. No quack commercial on television can equal this unholy piece of legerdemain. The ethic of the Chamber of Commerce, do-it-yourself, my-way-is-as-good-as-yours, who-are-you-anyway-to-prefer-brains-to-what-I-have, is artlessly turned into a hippie slogan; and we are supposed not to recognize in the rejuvenation the traditional truculence of those who have always claimed that know-nothing can do duty for know-better.

An armory of old and scaly prejudices is being foisted on the young in the disguise of a gospel of nature. For years the senior citizens and crackpots have been writing to the papers from their California refuge to warn of the peril (and the impiety) of adding fluoride to drinking water. Now the junior citizens are taking over from them, warning of the peril (and the outrage) of using chemical manure—as if the use of dung had been revealed by Shiva, and was not a technology but a magic. Solemnly they tell me that home baked is better than the bread in the supermarket (as of course it is), not for the sensible reason that personal care went to make it, but because the home oven was invented by Adam and the factory oven by science. My grandfather used to talk like that, always recalling a golden age of simplicity when technology was—was what? was old-fashioned, neither more nor less. Bernal has a nice remark about such “very sane reactionaries

at all periods warning us to remain in the natural and primitive state of humanity, which is usually the last stage but one in their cultural history." That always turned out to be, in my grandfather's stories, when he was twenty; but when was it for the teenagers who now talk like him?

The danger in this phony naturalism, this antirational vision of man as a kind of holy cow (with Zen Buddhism as an optional extra), is that it points the young away from the true ills of the state, to those lesser targets that the Chamber of Commerce can shoot at too. It is wonderful, for example, to see how happily all parties have joined in crying out against smog and oil slicks. Why not? they are indeed dangerous to life—and who is to blame a politician if he does not go out of his way to correct the impression that they are more dangerous than the competitive stockpiling of nuclear weapons. So in the register of instant clichés *pollution* now ranks with *communism* as a symbol for universal abuse which will mask all differences; and instead of *the American way of life* we all agree to preserve and hold sacred *the environment*.

There used to be a time, not many years ago, when ecologists spoke proudly of their work as *The Subversive Science* (it is the title of an early book of essays on the subject), and when it was enough to protest against the violence done to fauna and flora and to point to the threat that it carried. But all that has become a commonplace of political oratory, which most of the time merely wants to sell a new technological gimmick in place of the old. No protest has any intellectual weight now if it is not directed toward a sensible (and not a nihilistic) mode of social change, and begins with a communal and human and not a technical diagnosis.

Why has pollution become visible and threatening today as it was not forty years ago? Surely not because technology is less efficient in controlling its own side effects: quite the contrary. Nor will it do to say simply that there are now more people in more and denser cities—for there is no smog in Calcutta, for instance. If there is smog in Los Angeles, and if it is right to feel that as a universal anguish, it is because we now find it natural to concede that one man has as much business to own a motorcar as another.

Pollution is not the cost of technology in itself, nor even of the abuse of technology: it is the result of a shift in technology from the privilege of a few to the right of all.

What we have done, and should be proud to own, is to make the benefits of technology (in the sense of a high standard of health, convenience, privacy and information) as much a human right as life and liberty. In the space of a hundred years we have transformed working- and middle-class life so that it now commands as a matter of course what used to be the luxuries of upper-class privilege—running and hot water, an indoor toilet that flushes, health care and medicines, gas heating and electric light, door-to-door travel, news brought into the house, reading and letter writing, telephone conversation, and all the other norms of daily life that someone born into the working class (D. H. Lawrence, say) once could reach only by endless struggles. Of course, the proliferation of the apparatus to do these things, the water mains and the sewers, the apartment houses, the roads and the telephone wires, the tin cans and the gift wrappings, for a time has turned the landscape cockeyed. But that distortion is not the price of technology—it is the price of revolution anywhere, at any time, like the guillotine springing up in the Place de la Concorde.

With the step from privilege to everyday use, technology has become a moral and not a material demand; it is a visible expression of the drive for social justice—just as we now recognize *Das Kapital* as a work of moral rather than material indignation. What seemed self-evident to Marx, namely, that the basis of all value is work, is exactly what was not self-evident to his precursors—to whom, on the contrary, it seemed plain that the basic values were land and leisure. And the change came about as a change in the esteem of one man for another—as we see, for example, in the bitter fight in America for the abolition of slavery just at the time Marx was writing. Now the sense that all men are entitled to the same standard has spread to the standard of living, which means (everywhere in the world) the use of new techniques to wrest a modest plenty from the starveling grasp of nature.

Technology, then, is no longer a prerogative of status. It is not a weapon of national or commercial or social rivalry (as it was,

say, at the time of the Franco–Prussian war), because the spread of scientific knowledge has abolished any lasting monopoly. Now the Viet Cong guerrilla and the Negro infantryman who faces him are armed with the same exquisite and supernatural masterpieces of twentieth-century craftsmanship for which Cesare Borgia would once have given his fortune: the automatic rifle, the radar scope, the infra-red glasses and the homing rocket. And what makes that technical cornucopia shameful to us is that both sides pour it out only to kill. It is a charity that stops at home, for there the sniper and the man from the ghetto equally have nothing: no decent toilet, no services, no health care, no modern education. That men should be denied in life the artifacts that we can lavish on them for death—that is now the moral affront to our humanity. Our society has acknowledged that every man is entitled to the best that technology can make to help him; but in practice, he only gets it to help him make war.

Every civilization has been grounded on technology: what makes ours unique is that for the first time we believe that every man is entitled to all its benefits. That gives a special moral force to the protest, a sense of revulsion in the face of abuse, when young men see it used as I have just described it, in war. Paul Goodman in an essay in the *New York Review of Books* not long ago (November 20, 1969) “Can Technology Be Humane?” likened this ethical aspiration to “a new protestant Reformation.” The analogy is exact because the Reformation was a popular movement of protest to take the interpretation of the Scriptures (and their social lessons) out of the hands of privileged groups and put it into the consciousness of every man as an equal. The same claim to an equal share in all human goods, and an equal access to nature and to knowledge, gives its special quality to the technical civilization that we are trying to make. There is no other policy and no panacea ahead of the protesters: the Reformation is a fundamental search for a practical ethic of equality.

But it is logically and morally untenable to think that equality can be stabilized by training just enough scientists to keep the rest of the population supplied with a sort of minimum pabulum of comfort. Such parasitic solutions are inspired by the ethic of

famine that blows from the past, and that pretends that scarcity makes men equal—a dogma that flies in the face of history. It really is too late to credit that all comfort corrupts, all industry despoils, and running water and the electric blanket inevitably bring in their train social rivalries and nuclear warheads. The whole economic outlook of nations coveting one another's mines and landscapes as sources of wealth is as dead as mercantilism—the examples of Switzerland, Denmark and California show that. On the contrary, we have wealth running out of our ears, in every kind of technique for mass production—and an egalitarian mass which, though its values are still improvised from television commercials, is waiting to share it. What makes equal is plenty; so that we have to add to the Reformation the one concept that Luther's puritanical mind feared (for instance, in the Anabaptist revolt): an ethic of plenty.

An ethic of plenty is different in kind from the traditional codes, which as a matter of historical necessity have been inspired by the need to be frugal with natural resources and diligently to build up reserves against famine. For once it comes home to people that their material needs can all be satisfied, then frugality, diligence and thrift cease to be virtues—or can only be preserved by diverting the surplus to other false, archaic virtues, such as nationalism and war. But the way to sap the lingering superstition that virtues must be ascetic is certainly not to propose in their place another bout of puritanism, which is what the Zen Buddhists and the nature faddists preach. On the contrary, we need to learn to live with plenty: we have to discover, after all these centuries of famine, how to make our minds grasp that.

The basis of puritanism was submission to a divine or natural ordinance that people could not all have (or be) what they wanted. It came to be assumed that what they wanted was also bad: but of course this truism derives from the need to deny it to them, and not the other way about. Thus the crucial thesis in the old Protestant faith was, necessarily, that it is wrong for men to seek fulfilment (or salvation) in the satisfaction of their personal talents. But a new Protestant Reformation, if it is not to be merely ob-

scourantist, must resolutely put that thesis in reverse. The progress of cultures has always depended on the satisfaction that active men have derived from using their talents; and now that we have it in our reach to offer that to everybody, we have to complete what Freud and Henry Ford began: to make personal satisfaction one of the acknowledged norms of conduct.

The duty that now falls on intellectuals is a great and quite novel educational task: to show people that personal satisfaction does *not* lie in aping the satisfaction of others. In the presence of plenty, there is no conflict between private desire and public stringency (what used to be called, public good)—either between individual and individual, or between individual and state. What gives satisfaction then has to do so *in the long run*: not in the day-to-day of appetite, which (as the Manson family demonstrated) will not do as a goal, but in a policy to live by—to be a person by.

The question on which morality turns in an age of potential plenty is, What shall *I* be? It is indeed the question on the lips of every protester in the new Reformation. But it has to be a question cast all the way into the future: What shall *I* become, by virtue of what I do now, *to myself*. It is in this sense that all nature becomes one, and that we cannot afford to dishonor any part of the creation: because a separation there, a shrugging of the shoulders at greed or cruelty or vulgarity, is a permanent mark on one's own personality. The Germans discovered that when they closed their eyes to the concentration camps, and it faces us in every littered landscape: the man who is coarsened by my indifference, the butcher, is *me*. The human values exist in me, and when I let them idle for a turn or two, the machinery that rusts is my future self.

Such an ethic for contemporary life, a doctrine of equal respect for all human potential, cannot ignore the values of science. As Paul Goodman insists, "There is only one culture," and within it science is not value-neutral. It would be idle for me to try to expound the scientific values in a page, when I have spent much of my life in elucidating their place in the totality of values, first in *Science and Human Values* and more recently in *The Identity*

of *Man*. Yet there are some crucial things to be said briefly that are pertinent to our present discontents.

For this is a time when, as I began by saying, many intellectuals have abandoned their own history and have retreated into the counterculture of the shaman, the mystic and the witch doctor. In doing this, they have also abandoned the historical responsibility of the intellectual, which is to be the guardian of the values and the conscience of society. Whether they are scientists or scholars, literary critics or philosophers, intellectuals are not merely the vessels in which traditional knowledge reposes and the vehicles by which it is transported. Intellectuals have these functions because they *prize* knowledge, either as the expression of intellectual truth or as the experience of emotional truth. Without this dedication to truth as a universal end, intellectuals would be only a memory bank; with it, they are the goads of civilization. It is therefore critical that scientists stand fast to maintain at least their share of the ethical responsibility of intellectuals, namely, those values on which the practice of science depends and which its example teaches.

First, there is a special integrity in knowledge which makes it what I have just described, something more than a memory bank. Knowledge in this sense has as its aim the truth about the nature of things, and so it imposes an obligation to be true to the nature of things—inanimate as well as living nature. It is a human obligation, because knowledge is human, and it is the final sanction to which technology has to conform.

Second, there is an absolute bar to pretense, and specifically to the pretense that the second best will do just as well as the best. We are surrounded by this pretense, in the goods, the information and the policies that are offered to us, in the men who offer them, and in their loyalty to their self-appointed goals. The fire that must drive the new Reformation is a rage against this creeping, pervading hypocrisy, the lie of the second best.

And third, science has been uncommonly successful as a strategy to command the future because it admits no distinction between ends and means. There are no higher ends in science than truthful knowledge, and there are no other means allowed on the way than

truthful knowledge. In an age in which ideologies claim, not so much arrogantly as insolently, that they are justified in using men as means, this central value in the ethic of science has a right to be put at the center of the Reformation.

There is no blueprint of the future in these affirmations, nor do they alone make up a bible for the Reformation. But in a time when a deep sense of moral discontent is in danger of being diverted to surface ills, it is right to look to the roots of culture. The roots lie in the evolutionary history of man, which made technology the most formative of his species-specific talents; and as Bernal's prophetic vision reminds us, we are not at the end of its reach to change man and his environment together. Those who rail at this prospect in alarm have in their minds a picture of technology as an instrument to give monopoly power to a class or nation. But that phase is over; we are now in a phase of popular technology, when it has become the means and expression of a moral aspiration for justice in equality. In this Reformation setting, it is important to analyze the normative values that have made science and technology successful as practical ethics. The values of science are an important part of human nature, though only a part. And if we want to maintain any hold on the future, then their social importance is paramount: for science is the only method that we have found so far for turning human knowledge into rational action.