

LEWIS MUMFORD

Interpretations
and Forecasts:

1922-1972

Studies in Literature, History, Biography,
Technics, and Contemporary Society



A HARVEST/HBJ BOOK

HARCOURT BRACE JOVANOVIH NEW YORK AND LONDON

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Library of Congress Cataloging in Publication Data

Mumford, Lewis, 1895-

Interpretations and forecasts, 1922-1972.

(A Harvest/HBJ book)

Includes bibliographical references.

I. Title.

AC8.M78 1979 081 79-10266

ISBN 0-15-644903-X

First Harvest/HBJ edition 1979

A B C D E F G H I J

More than once in recent years I have been asked to bring together in a single volume a representative collection of my writings over the last half century. An early attempt at such a book, 'The Human Prospect,' came out indeed almost twenty years ago. But since it reflected solely the independent judgment of the editors, Professor Harry T. Moore and Professor Karl Deutsch, it has served as a challenge, rather than a deterrent to the present work. Only three of the twenty-nine selections in the earlier book have been used in the present more ample collection.

At first I hesitated to take on this task, since all my major books, with one exception, 'Green Memories,' are still actively in print, beginning with 'The Story of Utopias' in 1922. But Elmer Newman's recent bibliography of my writings made me realize how little even my later work is known to the present generation, since some of my more valuable contributions appeared in periodicals of limited circulation, now vanished or difficult to consult. In order to keep the present volume from being over-compressed or over-bulky, I have reserved for a future occasion a similar selection from my writings on architecture, urbanism, and regionalism.

By concentrating on five main themes I have warded off the temptation to present scattered, unrelated samples of my "best work" and have confined myself to those areas where I have had a fresh contribution to make. By observing these conditions, this closely interwoven collection has, I trust, turned out to be, not a mere mélange or anthology, but virtually an original work in its own right: all the more useful, perhaps, as a general introduction because my earliest thoughts and my latest often gain in significance by appearing side by side.

—L.M.

is the essence of morality; and as it turns out, it is perhaps the most important condition for the enjoyment of art. Here if anywhere, Nietzsche's words, as uttered by Zarathustra, actually hold: "Choosing is creating." Yes: choosing is creating. "Hear that, ye creating ones!"

(1952)

CHAPTER TWENTY-EIGHT

Social Consequences of Atomic Energy

The period in which we live is characterized by strange inner contradictions. While the advance of science has placed energies of cosmic magnitude at human disposal many institutions have regressed to the lower levels of barbarism. The most rational procedures of science now have as their end product in the human economy wholly irrational goals. While the venerable sage, Albert Schweitzer, receives a Nobel peace prize in recognition of his urgent summons to practice reverence for all life, the scientific laboratories of the world are busy with researches whose full-scale application in war might put every living species in peril. On one hand, our national government withholds from its citizens the knowledge needful to make sound judgments on military policy; but at the next moment the same authorities warn us that with the instruments now available, the price of victory in another war might be the extermination of the human race: a curious conception of military success. By the automatic advance in scientific knowledge, we are now committed to processes whose tempo we do not dare to retard, whose direction we do not govern, and whose ultimate results we do not stop to evaluate. Under such conditions every permission becomes a compulsion. And as long as our present knowledge continues to expand the sphere of the irrational and the pathologically automatic, the survival of man, to say nothing of his development, is plainly threatened.

The dangers of our present situation would not be so great had our responses to it been alert and timely. Even now, we should probably be able to mobilize enough political wisdom to provide a minimal basis for the necessary co-operations and safeguards, if only we could throw off the sleep-walker's insulation from reality that characterizes our collective conduct. There are doubtless many causes and reasons for this feebleness of response, and I would not pretend, within the compass of this paper, to give even a sketchy account of them. I purpose rather to confine attention to a single aspect of our present lapse in rational judgment and responsible action: that to which the sciences themselves have contributed by the very terms of

their own development. And I do this, not to throw any blame on our colleagues in the natural sciences, but to open the way for a discussion of the means by which scientists themselves might rectify past procedures by setting an example in social responsibility and sanity.

The immediate failure to evaluate and exercise a timely control over the forces whose very existence now threatens us, has its origins, at least in part, in a fatal choice that was made in the name of scientific freedom in the seventeenth century. This decision may be symbolized for us by the resolution of the Royal Society of London, at its very inception, to confine its discussions and experiments to the field of the natural sciences, and to omit all concern with matters that traditionally belonged to theology and history. The necessity to escape the limitations of purely subjective inquiry was obvious; but in defining scientific truth, in the terms Galileo and Descartes defined it, as a truth detached from all considerations of purpose, value, or practical application, science cut itself off from all human concerns except those of science itself. The new absolute for the scientist parodied the old Roman legal maxim: Let scientific truth be discovered, though the heavens fall. The unstated assumption in this maxim was the confidence that the heavens would not in fact fall.

Happily for the health of scientists as human beings, their general conduct did not always live up to the strict isolationism of their creed. Some of the greatest minds in science, indeed, from Pascal to Clerk Maxwell, never lost touch with the ultimate questions of human destiny, while still others, like Joseph Henry and Louis Pasteur, took seriously their obligations as citizens. Nevertheless, for the last three centuries, the whole weight of the scientific tradition has been on the side of detachment, of social irresponsibility, of non-concern for the uses other men might make of scientific knowledge, even though with the growth of biology and medicine strictly human interests—like those of Pasteur's wine growers—insistently invaded the laboratories. To evaluate the human results of their work, to anticipate its possible applications, to correlate the advance of science with the development of man no more occurred to scientists in pursuit of their isolated system of truths than it occurred to the capitalist enterpriser of the nineteenth century, in his equally abstract and one-sided pursuit of financial gain. Plainly, in the seventeenth century, the causal and the teleological had parted company: if one were free to analyze causes one could, so to say, damn the consequences. Beneath that belief there was another unstated assumption, implicit in the very conception of progress, namely that knowledge was, as Bacon had said, power, and that power, power over the forces of nature especially, was an unqualified good. In leaving out the prophetic concerns of Jewish and Christian theology, science had also lost insight into the dangerous liaison between power and pride: the power that lays traps for vanity and the pride that cometh before a fall.

So successful was this new methodology of science that every other scholarly discipline, even in the humanities, tended to ape science's proce-

dures and to proclaim a similar indifference to social results. When in 1910 Henry Adams sought with almost clairvoyant anxiety to enlist his fellow-historians in an assessment of the new physical forces that were so swiftly transforming Western Civilization, they turned a deaf ear to his remarkable paper because it was concerned not with past certainties, but with potentialities and future probabilities.* As a result of these widespread habits of thought, mankind entered the atomic age without looking before or after, and therefore without the faintest preparation for the drastic changes in human institutions that must result, changes that might even affect the speed and direction of scientific effort itself. Yet the outlines of this age, the dimensions of its problems, were visible at least a generation before the first atomic bomb was detonated. Ever since Becquerel's discovery of radioactivity the old stabilities and securities had been visibly threatened. Sensitive observers were at hand who saw that without a radical readaptation of human institutions, these new forces might be ungovernable, and prove in the end perhaps fatal. As early as 1905 Henry Adams, writing to Henry Osborn Taylor, had observed: "At the present rate of progress since 1600, it will not need another century or half century to turn thought upside down. Law in that case would disappear as a *a priori* principle and give place to force. Morality would become police. Explosives would reach cosmic violence. Disintegration would overcome integration."

By 1913 the novelist H. G. Wells, under the spell of the physicist, Frederick Soddy, went further: in his novel, 'The World Set Free,' he depicted the use of the atom bomb in warfare, with the total demolition of the first city attacked. Finally, in 1919, Rutherford's critical demonstrations had transformed these timely anticipations into a well grounded probability. If these fitful prophecies had been backed by systematic speculation and inquiry, undertaken by men of science, we should have had a whole generation to prepare mankind for the coming transformation. Instead, we fell into the atomic age with as little anticipation as an abstracted walker, looking for pennies on the pavement, might fall into an open manhole. The manhole was visible; but we regarded the scientific pennies as more important.

One further result must be noted in our failure to anticipate the social consequences of scientific progress and to direct it to humanly valid goals; and this is the fact that the last feverish efforts to place the inordinate powers of nuclear fission under human control took place under the restraints and compulsions of war, when small men were prompted to large decisions under the pressure of the moment, without anything like a careful canvass of alternative policies and means. Had the whole situation been examined in time, the atomic crisis might have been averted. There were two variables that it was imperative to bring under control, during the thirty years before the atom bomb was invented: one was the rate of scientific advance and the other was the rate of social adaptation. Neither of these

* See "A letter to American teachers of history" in Adams, Henry, *The degradation of the democratic dogma*, New York, Macmillan, 1919.

variables is an impersonal, uncontrollable force of nature. The rate of scientific advance is conditioned by policies of education and recruitment, by budgetary provisions for universities and research laboratories; by the amount of social approval accorded to science itself. If we had become as skeptical of the value of science as were St. Augustine and his contemporaries, science could have been starved out of existence in less than a generation. General social adaptation, though a more complex and laborious process, is likewise no purely automatic response to uncontrollable conditions. But because of the failure of our anticipatory reactions, which are the very core of intelligent behavior, decisions of utmost importance to human welfare were made, for purely military purposes, in the midst of a conflict that had already destroyed ancient inhibitions against the random extermination of life. Cosmic power plus moral nihilism is, as Henry Adams had vigilantly predicted, a formula for general disintegration. This was a case of negative social adaptation. The forces that should have been retarded were accelerated.

Now, to the honor of the scientists who produced the atomic bomb, the consciences of their leaders suddenly took fire as soon as man-controlled nuclear fission proved possible. If the awakening was too late to keep these distinguished minds from becoming accessories before the fact, it was also too partial to enable them to bring about a more general social awakening. On their own calculations, as set forth before the Senate Committee on Atomic Energy (1945-46) three years, at most five, was the limit for maintaining a national monopoly of the new weapon. They did their best, in this brief time, to repair the damage caused by their century-old indifference to social consequences. But their best was not good enough. To have aroused mankind fully to the extent of political invention and moral rehabilitation needed to provide even a minimal security, the actions of the scientists would have had to speak even louder than their words. They would have had to close their laboratories, give up their researches, renounce their careers, defy their governments, possibly endure martyrdom, if they were to convey to the public the full urgency of their convictions. Here the new sense of social responsibility failed to overcome the neutralist habits of many lifetimes. Even those who were most deeply disturbed by the possible misapplications of science continued to apply themselves to science. And while "science as usual" prevailed, it was fanciful to hope that "business as usual" and "politics as usual" could be shaken out of their rut.

If this diagnosis is even partly sound, one must now ask a further question. Does it still lie within the province of science to provide any correctives for the evils that its own practice of insulation—abetted by its sudden intrusion into the fields of politics and war—has contributed to? At this late moment, plainly, we must work against time, with the materials now available. Laudable as may be the new Society for Social Responsibility in Science, one cannot hope for immediate results from its efforts. Is it presumptuous, then, for a philosopher to suggest that, within the realm

of science itself, there are still resources that might be brought into more active play: the tradition of free inquiry, the collective pooling of knowledge, the lifting of truth above all self-imposed privacies and official restrictions that hamper its circulation among men. Without violating any prudent military taboos against the disclosure of technical means, the scientists themselves are in a position to examine and weigh the probable consequences of utilizing, to this or that extent, the agents of destruction and extermination that are now available. Even the premature peacetime exploitation of this double-edged power, before we have found any practical means of disposing of the waste-product, must be subject to searching criticism. Our present disgraceful record in the industrial pollution of air and water should forewarn us against the grave likelihood of an irretrievable pollution by atomic wastes.

In other words, what scientists failed to prepare for through the period between 1910 and 1940, when the atomic age was just over the horizon, is at least open to them now, when potentiality has become actuality, when prophecy has become accomplished fact. The ill-fated consequences they refused to anticipate then now lie before them. These consequences await methodical inspection and assessment by the only body of men capable of performing it: the scientists themselves, acting as a comprehensive faculty, drawing on their membership in every related field, from nuclear physics to bacteriology, from chemistry to embryology and psychiatry. Why should they not meet in a World Congress, under the aegis of the United Nations, and pool their data as to the effects of utilizing atomic energy in wartime extermination. Let them gauge the prospective results in terms of millions of lives exterminated, of slow-dying cripples and embryological monsters in various species, of vegetation wiped out, ecological partnerships ruined, water supplies contaminated, soil and atmosphere permanently poisoned. Let them even consider the traumatic effects on the personality of our present preparations for these events, already observable, and the worse traumas to be anticipated from their becoming an actuality. In other words, let the scientists, duly assembled in a World Congress, make a qualitative and quantitative analysis of the probable outcome of a world war in which the opposing nations used these new weapons of genocide. No living mind possesses all these data; indeed, no single group of scientists can supply it: it is only in conference that the facts can be established and the threat to life dispassionately estimated. Possibly such a full dress rehearsal in the mind would keep the world from raising the curtain on the malign drama itself. At all events, it would be better to face the consequences in advance than attempt, at the last minute, to avert them, like the physicists who sought, too late, too naively, too ineffectually, to prevent the exploitation of the atomic bomb. Let the truth now be told, as perhaps the one means left to keep the heavens from falling.

There is, I submit, nothing in this Great Assize of scientific knowledge, undertaken, not to promote a national interest but to safeguard the human

race, that is foreign to the procedures and purposes of science itself. In such a Congress, the scientists would confine themselves to observable results and statistical probabilities alone. In proposing to meet for such a purpose they would challenge the questionable practices that have broken down world-wide communication in the sciences and restricted not only international communication but cross-reference among practitioners in different fields. But their task would be the task of reasserting the integrity and moral responsibility of science itself, as accountable to mankind for correcting, within its own department, the evils that might issue from the incontinent or demoralized exploitation of scientific knowledge. This scientific congress need draw no military or political conclusions: they need suggest no practical steps. Their sole job would be to provide the data on which rational conclusions could be drawn and alternative policies formulated. If mankind actually lives under the grave perils at which our military and political leaders so grimly hint, there is probably a sufficient instinct for survival left in the human race to take the necessary measures of self-protection once the facts are known.

Admittedly, this proposal for a World Assize of scientific knowledge on the effects of atomic bombs, hydrogen bombs, and other means of effecting total genocide is not a panacea: it is at best but a first step toward stirring the fresh intellectual currents that may clear the air and prepare the way for further co-operative action. Nor is the proposal a novel one. In something like its present form, I put it forward six years ago in 'Air Affairs'; and independently it was broached again the other day by the mathematician and philosopher, Bertrand Russell. But it as yet lacks the only support that could make it effective: the resolute corporate backing of the scientists themselves. Suggestions of similar nature have been made from time to time by individual scientists, but popular ignorance of the total danger to life, governmental hostility to an open revelation of our erroneous policies, and moral neutralism among the great body of scientists have effectually nullified these efforts. Will scientists re-orient themselves in time to re-orient the world; or are they committed to a passive acceptance of the catastrophes their old tradition of social irresponsibility helped to create? That question is not for me to answer.

(1953)

CHAPTER TWENTY-NINE

Leonardo's Premonitions

In the mind of Leonardo da Vinci (1452-1519), one of the greatest intellects of a great age, a multitude of practical inventions accompanied his ideal projections. He and other contemporary artist-engineers demonstrated, as early as the sixteenth century, how many of the technical achievements of our own time had already been sampled in fantasy and even tested in actual or pictured models.

By now everyone is familiar with Leonardo's many daring but remarkably practical constructions, and his equally practical anticipations: likewise with his unsuccessful Great Bird. The latter was actually a glider, with wings which could not move, a failure for reasons that his near contemporary, Borelli, was soon to explain by his remarkable researches on the locomotion of animals, and in particular on the anatomy of birds. For even if Leonardo's wings had been feather-light, they would have required enormous pectoral muscles on the scale of a bird's breast to flap them.

Yet in doing justice to Leonardo, the inventor and engineer, scholars have tended to overlook how disturbed he was by his own mechanical fantasies. Like Roger Bacon, he too had foreseen in his usual enigmatic way (labelled a dream) that "men shall walk without moving [motorcar], they shall speak with those absent [telephone], they shall hear those who do not speak [phonograph]." But in another fantasy, written in the form of a letter, Leonardo conjures up the image of a hideous monster that would attack and destroy mankind. Though Leonardo gave the monster a tangible, gigantic, sub-human form, his actual performances come all too close to the hideous scientifically engineered exterminations our own age has witnessed. The monster's imperviousness to attack only completes, resemblance to the airborne atomic, bacterial, and chemical weapons that now have it in their power to wipe out all of mankind. Leonardo's description, printed in MacCurdy's translation of the Notebooks under 'Tales,' demands direct quotation.

"Alas, how many attacks were made upon this raging fiend; to him