

NOTES AND REVIEWS

Adriano A. Buzzati - Traverso

A NEW ENLIGHTENMENT

Perhaps modern man's major mistake was that of considering science as the quintessence of reason and of believing, accordingly, that scientific progress is synonymous with human progress.

In the famous Prague lecture "Are the sciences really in crisis in spite of their unending successes?" Edmund Husserl stated, as early as 1935, "As a starting point we shall take the drastic change in the general evaluation of science, which occurred at the turn of the century. It did not affect its scientific essence but rather what science—the sciences in general—means and may mean for human existence. In the latter half of the XIX century, the general *Weltanschauung* of modern man became exclusively dominated by positive science, man became fascinated by the ensuing 'prosperity,' and this brought about an estrangement from those problems that are decisive for an authentic humanity".¹ As we have seen, since then this estrangement has progressed to the point that scientists themselves and societies at large have become aware of the predicament.

Today it is no longer possible to draw a line between science and technology: technology *is* science. For this reason we cannot any longer accept the view that science is a model of progress as expressed, for example, by Harvey Brooks in 1971:² "It (science) is the one area of human activity which can incontro-

¹ E. Husserl, *Die Krisis der europäischen Wissenschaften und die transzendente Phänomenologie. Eine Einleitung in die Phänomenologische Philosophie*, The Hague, Martinus Nijhoff, 1954.

² H. Brooks, "Can Science Survive the Modern Age?" *Science* 1974: p. 21-30.

vertibly be said to progress, not only despite, but because of the fact that the definition of progress, unlike that in other areas, is not anthropocentric... Thus we cannot agree as to whether advancing technology constitutes progress, but in science knowledge and understanding do grow cumulatively independently of how they may subsequently be used." The relationships between science and society have become so terribly complex and intertwined that statements of this kind become untenable.

At this stage, we should scrutinize the validity of assertions like those presented in the previous chapter, re-examine the role of the scientist in today's society, discuss the limits of the objectivity of science, analyze the foundations and the significance of ethical values, and attempt to outline a program that may lead to a new meaning of progress. In other words, it appears desirable at this time to take as a model our predecessors of more than two centuries ago, those who both hypothesized the advent of the age of reason and influenced the development of the modern world. At that time, the architects of the Enlightenment regarded knowledge as a whole, rather than a collection of separate facts, and found in man the central vantage point from where the immense field surveyed in the *Encyclopédie* could be perceived and assessed. Spurred by the marvels of the exponential growth of science, men of the twentieth century have forgotten that irreplaceable perspective, and have plunged into the whirlpool of runaway science. Painful and difficult as it may turn out to be, a major intellectual effort is called for, to chart a major turn in our *Weltanschauung*, to outline the trends of a new enlightenment. A "Science of Man" is now urgently needed, as our forefathers foresaw, to use the words of Diderot: "Une considération, surtout, qu'il ne faut point perdre de vue, c'est que si l'on bannit l'homme ou l'être pensant et contemplateur de dessus la surface de la terre; ce spectacle pathétique et sublime de la nature n'est plus qu'une scène triste et muette. L'univers se tait; le silence et la nuit s'en emparent. Tout se change en une vaste solitude où les phénomènes inobservés se passent d'une manière obscure et sourde. C'est la présence de l'homme qui rend l'existence des êtres intéressante; et que peut-on se proposer de mieux dans l'histoire de ces êtres, que de se soumettre à cette considération? Pourquoi n'introduisons-nous pas l'homme dans

A New Enlightenment

notre ouvrage, comme il est placé dans l'univers? Pourquoi n'en ferons-nous pas un centre commun? Est-il dans l'espace infini quelque point d'où nous puissions, avec plus d'avantage, faire partir les lignes immenses que nous nous proposons d'étendre à tous les autres points? Quelle vive et douce réaction n'en résultera-t-il pas des êtres vers l'homme, de l'homme vers les êtres?"³

THE SCIENTIST IN SOCIETY

If we attempt to understand why the era of unlimited faith in progress by means of science and technology has come to an end we must concentrate our attention on the changes that have occurred in science as a social institution and more particularly in the behavior of the scientist, in his motivations, in his ambitions, in his allegiances and in the role that he has been playing in modern societies. Science, as we have seen, can no longer be looked at only as a body of knowledge or a particular method to acquire it; it must be seen as a social activity as well. The mutual interactions between scientific research, technological developments, and social and economic change and even ideologies are so numerous and profound that we cannot hope to understand the total picture and the variety of attitudes towards science and technology that we have mentioned without scrutinizing: the ways in which scientists behave towards each other; the relationships that have been established between the scientific community, on the one hand, and political and economic power, on the other: the structures that have been established and have evolved at national and international level to cope with the increasing impact of scientific activities on society; and how new scientific knowledge is produced, disseminated and utilized.

We have already reviewed elsewhere many aspects of these types of interactions; but for the question under discussion, it appears justified to concentrate on the transformations that have occurred during this century but especially in the last few decades in the interests, the activities and the outlook of the protagonist

³ Diderot, "Encyclopédie," in *Encyclopédie ou Dictionnaire raisonné des Sciences, des Arts et des Métiers*, Paris, 1751.

of the scientific enterprise: the professional scientist. Over the years there has occurred a progressive professionalization, politicization and nationalization of science⁴ and of scientists. The fact that our “advanced” societies feed more and more on the results produced by scientific research has brought about increasingly close interactions between the scientists and political and economic power. Governments and industry need massive production of new knowledge and technologies, while scientists have been relying at an increasing rate on the financial support and the social rewards of power. Jean Jacques Salomon⁵ has proposed the term *technonature* to indicate the area within which the interests and attitudes of scientists are inevitably linked with those of power and (at one and the same time) are responsible for the needs of power and also contribute to its objectives.

The transformation in the role of the scientist that has occurred in the last decades has brought about a fast growth of the scientific enterprise, or research system, as I have often indicated: The number of research workers has correspondingly increased at an unprecedented rate, with the result that what was once considered as a dedication of one’s life to the pursuit of truth has become a profession not substantially different from the other ones. And with the increasing demand for ever more sophisticated weapons by the national authorities, the scientists have become increasingly involved in the “military-industrial complex” relinquishing as an obsolete myth the ideal of science as international endeavour.

Quite a number of active scientists of today, particularly of the older generations, do not think that this type of description applies to their own interests and aspirations or to those of their close pupils. They are still convinced, rather, that they personify the ideals of the dispassionate, detached, humble, pure search for truth. It cannot be denied that a limited number of such relic specimens may still exist. But the exception confirms the rule: the statements of two well known physicists, one from the U.S.S.R. and the other from the United Kingdom, bear witness to our diagnosis. In 1966 Piotr Kapitza said:⁶ “The year that

⁴ J.H. Haberer, “Politicalization in Science,” *Science* 178, 713-724. Copyright 1972 by the American Association for the Advancement of Science.

⁵ J.J. Salomon, *Science et politique*, Paris, Ed. Seuil, 1970.

⁶ P.L. Kapitza, “Recollections of Lord Rutherford” (Lecture to the Royal Society, London, May 1966), *Nature*, 210, p. 280-283.

Rutherford died (1938) there disappeared forever the happy days of free science work which gave us such delight in our youth. Science has lost her freedom. Science has become a productive force. She has become rich but she has become enslaved and part of her is veiled in secrecy. I do not know whether Rutherford would continue nowadays to joke and laugh as he used to do." And John Ziman wrote in 1968; "My impression is that the sort of scientist with which we are mainly concerned in this book—that is, more 'pure' scientist than a technologist—often feels no more than cupboard love for the organization for which he ostensibly works... Of course he wants lots of money for his apparatus and may learn to become very cunning and selfish in special pleading for it, but the major purposes for which the great corporations exist—education, defense, profitable production, national prestige—may be of little moment to him. If a radar research laboratory, devoted to the development of military technology, happens to be the best place he can find for his study of compound semiconductors then he will be quite happy to have a niche there, feeling virtuous in the thought that 'wicked' defense spending is being used to support such 'good,' plowshareworthy activities as his own researches."⁷

If science has lost its innocence, it is primarily because of the way scientists have behaved, particularly in recent times: it is for the scientists themselves that the age of innocence is past. A progressive convergence of the requirements of power and the rapid advance of highly competitive research fields has transformed the scientist as a component of modern societies. Believing that his action was guided by loyalty to Science with a capital S and to his country or ideology (another form of nationalism), the scientist of the last forty years or so has, on many occasions, been ready to serve clearly immoral ends. He is no longer neutral, nor can he hope to regain his pristine virtue under present dispensation. The quantitative change in the scale of scientific research that has occurred since the Second World War has brought about the qualitative change under discussion. At one time there used to be relatively few persons who had chosen scientific research as a way of devoting their lives to a

⁷ J.M. Ziman, *Public Knowledge. An Essay Concerning the Social Dimensions of Science*, Copyright by permission of Cambridge University Press.

noble intellectual cause, unmarred by contacts with the worlds of power and production; today science has become a profession for the thousands and the hundreds of thousands. And that profession is completely integrated in the process of industrial production, whether for war or for humane purposes.

In 1926 the French Julien Benda wrote his famous essay 'La trahison des clercs'⁸ in which he accused the intellectuals of his time—those that had the duty to fight for freedom, justice, peace and the dignity of man—of having betrayed their mission in that they were ready to preach nationalism, racism, class hatred and other kinds of dangerous irrationalism. Julien Benda wrote: "Et, de fait, depuis plus de deux mille ans jusqu'à ces derniers temps, j'aperçois à travers l'histoire une suite ininterrompue de philosophes, de religieux, de littérateurs, d'artistes, de savants... dont le mouvement est une opposition formelle au réalisme des multitudes. Pour parler spécialement des passions politiques, ces clercs s'y opposaient de deux façons: ou bien, entièrement détournés de ces passions, ils donnaient, comme un Vinci, un Malebranche ou un Goethe, l'exemple de l'attachement à l'activité purement désintéressée de l'esprit, et créaient la croyance en la valeur suprême de cette forme d'existence; ou bien, proprement moralistes et penchés sur le conflit des égoïsmes humains, ils prêchaient, comme un Erasme, un Kant ou un Renan, sous les noms d'humanité ou de justice, l'adoption d'un principe abstrait, supérieur et directement opposé à ces passions... Grâce à eux on peut dire que, pendant deux mille ans, l'humanité faisait le mal mais honorait le bien. Cette contradiction était l'honneur de l'espèce humaine et constituait la fissure par où pouvait se glisser la civilisation. Or, à la fin du XIX siècle, se produit un changement capital: *les clercs se mettent à faire le jeu des passions politiques*; ceux qui formaient un frein au réalisme des peuples s'en font les stimulants."

At the present time, about one century later, we can affirm that we members of the scientific community (including myself) have witnessed and participated in the 'trahison des scientifiques' for we have been ready to accept support for our research from whatever source, without realizing that in so doing our activity was becoming tainted, and with no countermeasures in sight.

⁸ J. Benda, *La trahison des clercs*, Paris, Grasset, 1927 (reedited: J.J. Pauvert, 1965).

A New Enlightenment

The treason of the scientist is not very different from that of the intellectuals of the 1920s, in as much as we have accepted uncritically the trends of our time because they have made possible the rapid growth of our beloved research. We have not realized that our work had immense and threatening implications at the human level; we have not had the courage to refuse to partake in endeavours and enterprises that were endangering the survival of our species and, at the very least, the very values for which we had chosen to become scientists. We have also indulged in unethical practices of rivalry, competition and keeping secret the results or methodologies to make a discovery before our colleagues—practices that we have uncritically introduced into the research system borrowing them from industry and trade. Furthermore, as pointed out before, we have accepted to keep our research work secret for reasons of national defense or prestige.

The traditional attitude of the scientist to consider himself “*au dessus de la mêlée*” is no longer justifiable. Precisely because science in our time has become a social institution, and a very significant one at that, the scientist must reconsider his position, his actions and his motivations within the social context. One thing is the role that one thinks he is playing, and another, often quite distinct, is his role as viewed by others. Yet, today many scientists consider themselves as outsiders with respect to political life: scientific research is pure and neutral and, if evil use is made of its products, science and the research worker carry no responsibility. They still believe that their detached scientific attitude is the best antidote against the vagaries and ambiguities of the body politic and, for this reason, they find themselves in the best position to express objective views on whatever matter. But, as we have seen in the previous chapter, outside observers look at the scientist from a very different angle: they believe that the scientist is responsible for what is happening in the modern world and that he should accept such responsibility. There are clear signs that the traditional attitude is changing, however, and that an increasing number of scientific research workers are becoming aware of their new role and are concerned about the implications of such change.

But if we still believe—as I do—that reason is still the best foundation on which man makes sense of what happens around

and inside him, if we still share the view of Peter Medawar that “to deride the hope of progress is the ultimate fatuity, the last work in poverty of spirit and meanness of mind,”⁹ if we think that the habit of truth and the criticism of prejudices and myths that has characterized science throughout its development can only make man free, and that the objectivity of science still has a meaning, then we must face an agonizing reappraisal of our behavior. We cannot afford any longer to be self-effacing and timid. Participating in well meaning activities—such as those of the various associations for the social responsibility of scientists, or for the study of war and peace—worthwhile as these may be, this is not enough. Scientists and their academies and societies should embark also in a critical examination of the recent past and attempt to identify when and where wrong decisions were taken, and when and where compromises with power have occurred. Scientists should be ready to give up their pet research projects for the sake of their consciences. Scientists, together with other scholars, should start a worldwide movement to rescue the scientific enterprise and attempt to identify a new meaning to progress.

THE OBJECTIVITY OF SCIENCE

As we saw in the last chapter, the very core and pride of science, its objectivity, is challenged. Statements of the type of those of Scheffler and Skolimowski are frequently found in recent writings of critics of the scientific enterprise. Are they justified? Should we take them seriously, or should we simply disregard them as expressions of mystical romanticism? What do those critics mean when they claim that “data are manufactured by theory” or that “objectivity is now a sterile dogma which keeps us at bay and is a hinderance?” Personally, I do not believe that we should dismiss such assertions without comment, for they often come from the pen of the serious scholar.

Obviously, the subject of the objectivity of science would call for a systematic analysis and discussion of the vast literature on the subject. A treatment of this nature, however, would go much

⁹ P.B. Medawar, *The Hope of Progress*, London, Methuen & Co., 1972.

beyond the limited scope of this book and particularly of this chapter. I shall limit myself, therefore, with trying to identify the weak points of such criticisms and the limits within which the objectivity of science is still to be regarded as the necessary and, in a way, the unique foundation of organized and interpersonal knowledge. In other words, what follows is an attempt to explain why, in only relatively recent times, the objectivity of science has been questioned and to discuss some of the reasons why such critique should be rejected.

The nature of science and the way the scientist proceeds to discover his 'truth' has been the subject of scholarly discussions since the time of Francis Bacon; obviously, we need not attempt a presentation of the variety of interpretations proposed. Suffice it to say that until relatively recent times the prevailing schools of philosophers and historians of science, such as the 'Vienna Circle,' the neopositivists, the inductivists and the hypothetico-deductivists like Karl Popper, considered science as a pure fruit of the intellect, an element of the world of ideas, utterly uncontaminated by human activities and therefore uninfluenced by the mores of the time.

Since approximately 1960, however, new trends of thought have appeared. At a symposium in Oxford on the history of science—the year was 1961—Thomas S. Kuhn presented a paper for which he chose the title "The function of dogma in scientific research." At about the same time his book, now famous, *The Structure of Scientific Revolutions*,¹⁰ appeared. Kuhn considers the history of science as characterized by a succession of periods of 'normal science' and of 'revolutions,' followed in their turn by 'normal science.' The revolution occurs when a new 'paradigm' is proposed and accepted to interpret a set of phenomena and events. Normal science is what happens when specialists of a certain discipline contribute to the advancement of knowledge within a general paradigm that has been formulated to account for what is known. But at a certain stage of scientific development, newly acquired knowledge may become incompatible with that paradigm and then a crisis occurs, which is resolved by a novel theory or paradigm that will replace the previous one.

Kuhn stresses the point that 'competing paradigms are incommensurable,' that is, they are relatively incomparable. According to his interpretation of scientific advance, when the crisis comes

the choice between the old and a new paradigm, while being rational and not emotional, could be influenced by factors such as values attributed by different scientists to 'accuracy, scope, simplicity, fruitfulness and the like.' If any of the neo-positivists had used the term 'paradigm' to indicate a major theoretical change (say, Einstein's general relativity as contrasted with Newton's universe) they would have thought that the change was inherent in the nature of science, that it was brought about by the necessity of thought, and that it was a response to logic and experiment alone. Kuhn's interpretation, instead, allows for external influences: "Simplicity, scope, fruitfulness, and even accuracy (he writes) can be judged quite differently (which is not to say they may be judged arbitrarily) by different people."

Thomas Kuhn's work was received with great interest and thoroughly discussed in scientific circles at a time when there occurred a flourishing of studies on the sociology of science, as we have seen in the previous chapter. Several scholars of the field refused the traditional 'internal' explanation of the development of science, and preferred to consider this not as an independent variable of society, but rather as an activity that, even if not determined by economy as the Marxists claim, can be affected by external social forces. The latter approach found recently a clear formulation in Leslie Sklair's statement: "My criticism of some current thinking in the sociology of science, therefore, can be interpreted as part of a general strategy to undermine the view that the intrinsic nature of science is such as to require special explanations that set it apart from other social activities. Further, my criticism of certain philosophies of science may be interpreted as part of the same strategy to undermine the view that science is so special an activity (or rather that scientific knowledge is so special) that no sociological factors are very useful in explaining how it works. Science is part of the everyday world, it can be illuminated in a sociological fashion, and it requires no very special sociological factors to explain how it operates."¹¹

A third aspect that we should consider when studying the sources of current criticism to scientific objectivity, is to be

¹⁰ T.S. Kuhn, *The Structure of Scientific Revolutions*, Chicago, 1970.

¹¹ L. Sklair, *Organised Knowledge - A Sociological View of Science and Technology*, London, Hart-Davis, MacGibbon, 1973.

A New Enlightenment

found in a number of recent writings on the act of creation of the scientist; this creativity was found in many cases to be similar to that of the poet, the painter or the sculptor.

It seems to me understandable, even though not justifiable, that a number of people—having read or heard about the trends of thought about scientific objectivity, and in many cases people who never have had a personal experience of conducting to successful conclusion a significant piece of scientific research—these people might have jumped to some unwarranted conclusions. It would be easy to demonstrate the nonsense of statements such as: ‘theory is not controlled by data but data are manufactured by theory;’ ‘rival hypotheses cannot be evaluated’ (obviously a superficial and distorted presentation of Thomas Kuhn’s views); or of the circular argument of Henryk Skolimowski. But rather than indulge in such exercise, it is perhaps more appropriate to stress that probably no scientist today would claim that the ‘objectivity of science’ means that there exists one and only one reality, the nature of which can be discovered uniquely through scientific procedures. Current attitudes on this matter are certainly more modest: most research workers, I would think, realize that ‘reality’ is multifaceted and that we have different ways of approaching it. But the kind of reality that science reveals has one peculiar trait: it is the same and equally valid for any person that takes the trouble to go through the process of acquiring knowledge in that particular way. In other terms, science is interpersonal knowledge and it is this quality that consists its objectivity. This is also a trait clearly not shared by other ways of approaching ‘reality,’ for example, artistic experience.

In this connection, I think that Professor John M. Ziman (a theoretical physicist) has given us a very valuable treatment of the problem in his book *Public Knowledge - An Essay Concerning the Social Dimension of Science*.¹² He states, “science is not merely *published* knowledge or information. Anyone may make an observation, or conceive an hypothesis, and, if he has the financial means, get it printed and distributed for other persons to read. Scientific knowledge is more than this. Its facts and theories must survive a period of critical study and testing by other competent and disinterested individuals, and must have

¹² *Public Knowledge, op. cit.*

been found so persuasive that they are almost universally accepted. The objective of science is not just to acquire information nor to utter all non-contradictory notions; its goal is consensus of rational opinion over the widest possible field.”

Concerning objectivity, Ziman states: “Objectivity and logical rationality, the supreme characteristics of the Scientific Attitude, are meaningless for the isolated individual; they imply a strong social context, and the sharing of experience and opinion... The rationale of the “scientific attitude” is not that there is a set of angelic qualities of mind possessed by individual scientists that guarantees the validity of their every thought—as if they were, so to speak, well tuned computing machines whose logical circuits precluded them from error—but that scientists learn to communicate with one another in such tones as to further the sensible end to which they are all striving, and eventually train themselves to construct their own internal dialogue in the same language. A private psychological censor takes over from the public policeman or parent and conforms our behaviour to social norms. But he does not keep whispering into our ear, “Be honest, be truthful, be objective,” in a chorus of pious aspiration; he says, “Have you checked for instrumental errors? Is that series convergent? What is the present status of that old bit of theory?” and so on.

If we subscribe to this interpretation of scientific objectivity—that it is interpersonal knowledge and consensus of rational opinion over the widest possible field—we can easily dispose of another criticism of modern trends in scientific research, namely its analytical or reductionistic approach. Reductionism or its opposites—the variety of wholisms or holisms that have been repeatedly proposed over the years—are not articles of faith but just different procedures through which we may reach interpersonal knowledge. It does not make any sense to affirm that the analytical approach is inadequate to explain complex systems, since such an approach is the only one that allows the advancement of scientific knowledge, as its history clearly shows in every discipline. If it appears that the properties of a complex system are ‘more’ than the sum of the properties of its parts we have a clear indication that we do not know enough about the system to identify what that ‘more’ consists of. If we examine the extreme complexity of an ecosystem, it is certainly not true that

we could predict its conditions of equilibrium or its cycles just by adding the notions that we have about the biological characteristics of the species present and of their interactions with the physical surroundings. But if this is the case, it means simply that we have not adequately analyzed the multiplicities of interactions, feedback mechanisms, etc. that relate the components of the ecosystem, over the period of time studied. In that case, we would not have reached an objective description of the system, for the description would not meet a consensus of rational opinion. But once we had reached the necessary level of understanding to account for the very complexity of the system under study, we would use a holistic description that would stand the test of interpersonal knowledge.

The criticisms that reductionism is dangerous at the level of human affairs, appear justified in as much as their utterance takes the (now) obsolete stand that only science could offer adequate solutions to social problems. Such a stand is untenable because we know that things are much more complex than our predecessors thought; the stand would not be objective because it would not meet with the consensus of rational opinion.

SCIENTIFIC ETHICS AND ETHICAL SCIENCE

After reasserting the value of the objectivity of science, we must face the serious problem of how to reconcile the intrinsic risks to human needs deriving from scientific progress, indeed to the survival of the species. Once more, the problem would call for an extensive treatment much beyond the scope of this volume. But for the sake of our argument it seems to me sufficient to limit our discussion to two main issues: (1) are traditional ethical principles compatible, can we construct a new scientific ethics? (2) what should we, the scientists, do to regain peace in our conscience?

The most radical reply to the first question was made recently by Jacques Monod, who thinks that none of the ethical foundations of human societies remains tenable in face of scientific enquiry and that only the definition of a new foundation for their value system could prevent their collapse. He writes "Science, in its development, has gradually attacked and dissolved to the core the

very foundations of the various value systems which, from pre-historic times, had served as ethical framework for human societies. I believe that most social anthropologists would agree with the statement that the structure of virtually all ancient or primitive myths, as well as of more advanced religions, is essentially ontogenic. Primitive myths provide histories which almost invariably refer to one or several god-like heroes, whose sagas both account for the foundation of the group and imperatively govern its social structure and traditions, that is, its basic ethical system. The great religions may be regarded as generalizations, attempting to embrace the whole of Mankind in a similar, except much wider, interpretative ontogeny, whose recognized function is to provide a transcendent and therefore permanent and indisputable basis for a system of values. Most of the great philosophical systems, from Plato to Hegel and Marx may also be regarded as attempts to establish on an ontogenic basis an untouchable, irrefutable basis for a system of values, in turn serving as foundation of the social system.

“Whether an ethical structure is justified by reference to a founder-hero, to a universal god, to an absolute idea, to the “laws” of history, or to some “natural” foundation for human rights, all such systems, from the concepts of Australian aborigines, to the ideas of Rousseau or Marx, share one essential characteristic: namely that values and ethics are not a matter of human choice. Whether they are supposed to stand on divine, or “natural” foundations, they are beyond the realm of human freedom. Reason or faith may serve to identify and recognize values, but not to define or alter them. To Man, Ethics and values do not belong; he belongs to them.

“It is indeed easy to see the psychological purpose and the social function of raising these concepts on to so high a pedestal as to put them beyond human reach and make them untouchable. The psychological purpose is to abate and perhaps satiate the hunger for meaning; for the meaning of such absolute realities as life and death. The social function is one of stability: no social structure could survive whose very foundations could be questioned, denied or dismissed by anyone at any time. The foundations of a value system therefore must appear not only unquestionable, but as it were, inaccessible.

In spite of all the efforts of priests, statesmen and philosophers,

A New Enlightenment

cultural codes are not untouchable. They have changed through prehistoric and historic times, at a rate that no biological, genetic evolution could have approached. In spite of all these changes however, one concept remained, up to recent times, invariant: namely that *some* immutable foundation of the value system did exist, and could be found or recognized.

“It is this concept, the most essential within any ethical system, the cornerstone of any social structure, the sole (even though unreliable) substitute for genetic coding, that science now has destroyed, reduced to absurdity, relegated to the state of nonsensical wishful thinking.

“Science, as it emerged and developed, has shaped the modern world, given modern nations their technology and power. Yet these societies have failed to accept, hardly have they understood the most profound message of science. They still teach and preach some more or less modernized version of a traditional systems of values, blatantly incompatible with what scientific culture they have. The western, liberal-capitalist countries still pay lipservice to a nauseating mixture of Judeo-Christian religiosity, “Natural” Human Rights, pedestrian utilitarianism and XIXth Century progressivism. The Marxist countries still throw up a stupefying smoke-screen of nonsensical Historicism and Dialectical materialism.

“They all lie and they know it. No intelligent and cultivated person, in any of these societies can really believe in the validity of these dogma. More sensitive, more impatient, the youth perceives the lies and revolts against them, forcefully revealing the intolerable contradictions within modern societies.

“No society can survive without a moral code based on values understood, accepted, respected by the majority of its members. We have none of this kind anymore. Could modern societies indefinitely master and control the huge powers which they owe to science on the criterion of a vague humanism admixed with a sort of hopeful materialistic Hedonism? Could they, on this basis, resolve their intolerable tensions? Or shall they collapse under the strain?”¹³

I have quoted Monod rather at length for I think that his

¹³ J. Monod, “On Values in the Age of Science,” Nobel Symposium 14: *The Place of Value in a World of Facts* (ed. Arne Tiselius and Sam Nilsson), Stockholm, Almqvist & Wiksell, 1970, p. 19-27.

position is well justified and, indeed, it has already become the starting point of a vast debate. It must be pointed out that, once shown that traditional values are obsolete, new ones must be found and taught; Monod himself, however, has not yet outlined what the new ethics should consist of. We may turn to the study of the way the scientist proceeds or should proceed to see whether his practice contains the embryo of a new ethics. Anatol Rapoport pointed out in 1957 that there are ethical principles inherent in scientific practice: "the conviction that there exists objective truth; that there exist rules of evidence for discovering it; that, on the basis of this objective truth, unanimity is possible and desirable; and that the unanimity must be achieved by independent arrivals at convictions—that is, by examination of evidence, not through coercion, personal argument and appeal to authority."¹⁴ Rapoport claimed that not only science is related to ethics but that science is becoming a determinant of ethics in as much as the ethics of science must become *the* ethics of humanity. Interesting as this position is, unfortunately it falls short of presenting a new system of ethical principles derived on the basis of scientific principles. There are not clear reasons, moreover, why such a system would be necessarily valid. I am afraid that underlying this kind of proposal is the conviction that science and reason need be identified. The formulation of a new system of ethical principles is certainly one of the major tasks ahead for man: a very urgent one too, for, as Monod states, the alternative would be the collapse of our civilization. But I believe that such formulation should be left not only to the scientists, much as their participation would be needed. The task is an essential part of the program we shall attempt to outline in the last section of this book. But, in the meantime, what should we do?

A large number of replies by individual scientists or by various groups and associations for the social responsibility of scientists have been given, and it would be impossible to offer a complete and balanced review. One aspect of this extensive literature is striking: no serious attempt has been made to formulate a precise code of conduct; in very few instances have individual scientists refused to continue their activities when they felt that their research was morally objectionable; even more rare are the examples of scientists who refuse financial support from

¹⁴ A. Rapoport, "Scientific Approach to Ethics," *Science* 125, 1957, p. 796-799.

objectionable sources; and few are the cases where serious attempts have been made to include courses on the human consequences of our actions in the curricula of science and engineering studies. In a few words, it seems to me that the vast majority of the scientific community of the world does hardly pay attention to such issues, and a small minority pay lip service to humane principles but act otherwise. As an example of the prevailing spirit I shall quote only a few sentences from a recent article, proposing the establishment of a "science society council" for Great Britain¹⁵: "The first thing to say is that we came to no radical conclusions. Those which have been proposed fall into three broad groups. First, that there should be something in the nature of a Hippocratic Oath or code of ethics for all scientists, whereby they bind themselves not to take part in work which will have socially harmful consequences; second, given that we will have an increasingly science-based civilization, that moral and political decisions about the social application of scientific work should be left increasingly to scientists themselves; and third, that there should be radical—if not revolutionary—reform of the whole social system. Of these we think the first impracticable, the second dangerous, and the third beyond our competence." There then follows the reasons why they think so and the proposal; "We think that this situation could be much improved if there were to be brought into existence a body, organized by the scientific community itself and expressly charged with the task of informing the public in general, and the organs of government in particular, at the earliest possible time, of all scientific work likely to have important social consequences for good or ill."

I hope I am wrong, but I fear that the dangers of collapse of our world are too great and immediate to be met only by the mild measures suggested. I believe that a substantial group of scientists of the world should abandon for a while their laboratories and concentrate their efforts to elaborate a novel conception of their role in society, to enter into a profound and systematic discussion of the fundamentals of a new ethics and to identify urgent actions to be taken to dispel the most immediate risks. Among these the danger of nuclear war and of a further expansion of the arsenal

¹⁵ P. Sieghart, et al., "The Social Obligations of the Scientist," in: *Nature* 239, p. 15-18, Sept. 1972.

of horrors stands paramount. The time is ripe for a serious discussion of the problem and for summoning the members of the scientific community to take a stand. As a starting point I wish to propose for discussion the following 'theorem,' admittedly somewhat utopian: but I am afraid that time is running out and that we must adopt extreme positions.

1. Science is universal, in the sense that its discoveries are equally valid under the most diverse political dispensations; science knows no national boundaries.
2. Scientific discoveries lead, sooner or later, to applications of various types, currently indicated as technologies, the tenet of Francis Bacon that "the enlarging of the bounds of the Human Empire, to the effecting of all things possible" has come true.
3. Even the most humane technologies may become dangerous when applied indiscriminately (for example, antibiotics and other medical advances led to the population explosion); furthermore, technologies are often used for exploitation and for destruction.
4. Careless technologies, exploitation and destruction are made possible because men (scientists included) are loyal to national states, to parochial political ideologies, or to professional clans.
5. Further expansion of science is incompatible with human survival *because* science is universal, while *de facto* scientific activities (and especially technological developments) are sponsored and carried out to satisfy national or private ambitions.
6. It follows that further development of science is incompatible with the existence of nation states.
7. Mankind must, accordingly, choose either to stop the development of scientific activities or to eliminate nation states.
8. Scientists, personifying the imperishable values of science as an essential part of the culture of modern man, must refuse support for their research activities, unless it comes from genuine international agencies, and become missionaries for the establishment of a world government.

A NEW MEANING TO PROGRESS

"The ethic of the scientific revolutions," as Lewis S. Feuer pointed out,¹⁶ was that of an optimistic, expansive view of human life. It was filled with the conviction that science would enhance

¹⁶ L.S. Feuer, *The Scientific Intellectual*, New York, Basic Books, 1963.

human happiness. It had confidence in the human estate and in the aims and possibilities of human knowledge. It proposed to alleviate drudgery, and to transform work from an eternal curse to a human joy. It aspired, in its reading of the book of nature, to abrogate the tired dictum of Ecclesiastes 'Knowledge increaseth sorrow.' That ethic proved correct: superstitions were superseded by rational explanation; physical pain could be diminished and even abolished; working hours were shortened and labor became less strenuous and severe; death rates diminished and life spans were extended; living standards of western societies improved and social securities offered a certain amount of serenity to the workers; slavery was abolished and the longing for social justice found satisfaction over vast regions; individual liberty of choice and action became greater for men and women; personal movement, sexual freedom and access to culture became easier and responsible parenthood could be planned; and the frontiers of human knowledge rapidly expanded. But, as we have seen, the extraordinary success obtained by science has made us lose a balanced perspective on life. Modern man has put an identity sign between technological advance and progress and thus his primary concern is no longer with the human race. If we accept the definition of progress as 'the end point, temporary or permanent, of any social action that leads from a less to a more satisfactory solution of the problem of man in society,'¹⁷ we must admit that the institutionalization of science can hardly be identified with progress, particularly in recent times. The question to be asked now is not 'if not reason, what?'—as some commentators of the present predicament have done—but rather 'is it reasonable to identify reason with science and scientific advance with progress?'

The answer is obviously no, for science represents only one approach to knowledge of the world, and scientific advance may contribute to man's progress; but, once more, scientific progress must be considered only as a component of a more complex total situation.

The idea of progress is peculiar to the modern world (as it has often been pointed out), the world that was the product of

¹⁷ L. Sklair, *The Sociology of Progress*, London, Routledge and Kegan Paul, 1970.

the scientific revolution and of the Enlightenment. In 1750 Anne Robert Jacques Turgot could state at the Sorbonne: 'Manners are gradually softened, the human mind is enlightened, separate nations draw nearer to each other, commerce and policy connect at last every part of the globe, and the total mass of the human race, by alternating between calm and agitation, good and bad, marches always, however slowly, towards greater perfection.' And in 1793 Marie Jean Antoine Nicolas Caritat Marquis de Condorcet, in his 'Sketch for a Historical Picture of the Progress of the Human Mind,' showed 'that nature has assigned no limit to the perfecting of the human faculties, that the perfectibility of man is truly indefinite; that the progress of this perfectibility, henceforth independent of any power that might wish to arrest it, has no other limit than the duration of the globe on which nature has placed us.' Such faith in the perfectibility of the human condition is still inherent in the prevailing attitude of man, two hundred years later; but we begin to realize that science is not enough to guarantee the progress of man and that there lies a fallacy in the technocratic argument which confuses material and moral progress.

Within the scientific community one can notice now an increasing awareness that modern societies face a certain number of problems—such as nuclear war, population explosion and environmental decay—which represent major obstacles to the progress of the human race and do not find their solutions in science and technology.

Our options today are limited in number: we might abjure our faith in reason and follow the 'Old Gnosis,' which would give us visionary powers, primordial energies, sacramental awareness, adventures of spiritual regeneration, organic wholeness and similar somber evasions;¹⁸ we might continue to believe that science is the only source of salvation and that more science and technology can cure the ills of today's society, hiding to ourselves the ominous signs of impending catastrophes; or we might humbly recognize that the problems at hand are larger than our ability to understand, that we must widen the limits of our concern much beyond strictly scientific issues, and that, in cooperation with sociologists,

¹⁸ T. Roszak, *Where the Wasteland Ends - Politics and Transcendence in Postindustrial Society*, Garden City, New York, Doubleday, 1972.

A New Enlightenment

philosophers and other thinkers, we must attempt to find a new meaning for progress. Obviously, I consider only the latter option as viable, for it reaffirms the hope of progress and opens wide horizons for new adventures of the intellect.

In his book on *The Sociology of Progress*,¹⁹ Leslie Sklair has made a distinction between *innovational* and *non-innovational progress*: the former is 'progress by means of the production of new things, ideas and processes, with maximum *impact* on society' (through the institutionalization of invention and discovery); the latter is 'progress by means of the maintenance and diffusion of familiar things, ideas and processes, with minimal *impact* on society,' the term *impact* being used 'in a special sense to signify the effect that the different types of progress have on social structures.' It may be that, after many decades of frantic innovative progress, reason would advise us to enter a period of non-innovative progress or of profound social rather than technological innovations. At this time, of course, none of us seems to know which course we should take. For this reason I think that the moment has come for launching a far-reaching program of research on our own nature, on our authentic needs—probably quite different from the fictitious ones that have led us astray in recent times—and to identify the basic components of the human design. Historically, over the last three centuries, man has chosen to venture upon the untrodden tracks of science, entering first the ones that seemed easy to scout. Thus, with the support of mathematics, physics developed first, then chemistry, biology and the earth sciences. Man has remained isolated, as it were, from nature. Through separation of the observing subject from the studied object, and of facts from values, science has scored its triumphs but lost its own control, for scientists have become bureaucrats. 'Atomic physics has been manipulated by the very blind and uncertain forces which command and dispute over our historical societies,' Edgar Morin comments,²⁰ 'Biology in its turn will be manipulated and even anthropology, when this will become a real science; it will be corrupted in even more dangerous ways.' *Ainsi c'est le façon dramatique, incertaine, aléatoire que se pose aujourd'hui le*

¹⁹ *Op. cit.*

²⁰ E. Morin, *Le paradigme perdu: la nature humaine*, Paris, Ed. du Seuil, 1973.

problème de la nature de l'homme, de l'unité de l'homme, de la nature de la société, the French sociologist continues.

The vision of the advent of a *Scienza nuova*, of a science of man and for man, as the one so recently outlined by Edgar Morin, is probably the harbinger of a major turning in the thought and attitude of modern man. As the *philosophes* of the early eighteenth century took it upon themselves to criticize the conditions of society in preceding times and laid the intellectual foundations of the new civilization which transformed the whole world, similarly we must engage in a drastic examination and reorientation of our ways of thinking, of our priorities, of our scientific, social, economic, ethic and political structures—leaving aside the ones that our predecessors have elaborated and which are now obsolete. The *philosophes* were not philosophers in the traditional sense of the word but rather a group of assorted intellects, ranging in their prevailing interests from mathematics to politics and from biology to moral sociology, and recruited from the aristocracy or the humble classes. If the complexity of the problems of that time required the convergence of a wide range of intellectual skills, the hypercomplexity of today's world calls for the concentration of the endeavours of a vast variety of specializations coping with the whole gamut of the innumerable, intertwined problems of today. To my mind, interesting and worthwhile as they are, the current attempts to develop a 'critical science'²¹ or to develop methodologies for technological assessment are much too limited in scope, for they seem to aim at minimizing the untoward effects of the scientific enterprise as we know it today, rather than to examine it under a novel perspective, leading perhaps to a radical criticism of its structure and function.

²¹ J.R. Ravetz, *Scientific Knowledge and its Social Problems*, Oxford, Clarendon Press, 1971.