The Merger of Knowledge with Power

Essays in Critical Science

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To Zia Sardar, friend and comrade,
for making this book possible,
and much besides.

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Preface

These essays were mainly written during the long period that I taught the History and Philosophy of Science at the University of Leeds. Before then I did postgraduate research in mathematics at Trinity College, Cambridge, arriving there from Swarthmore College, USA, where I received my liberal education.

My sense of social responsibility for science goes back to my upbringing in a radical family in America. My awareness of the cosmological dimensions in criticisms of science was stimulated by my work in the early Campaign for Nuclear Disarmament, and then enriched by my studies and teaching in the history of science.

My major philosophical work, *Scientific Knowledge and Its Social Problems* (Oxford University Press, 1971), was devoted to laying the foundations for an understanding of the social activity of science in its 'industrialized' phase. I could not accept the traditional view of science as an accumulation of nuggets of truth, nor could I follow the prevalent philosophical concern for a 'logic' of science. Rather, basing myself on the experience of research of myself and friends, as well as on my knowledge of the way the world works, I characterized science as a special craft activity of creating and solving problems in the study of Nature. On this basis I could analyse the social dimensions of scientific work, in particular the problems of quality control and ethics. I could also show some of the characteristic difficulties in the way of applying science to problems of industry or social welfare. The ideas of 'criteria of adequacy', 'pitfall' and 'quality control of science', now in common use, can be traced to this book. In its concluding section I used the term 'critical science', explicitly on the analogy of the *philosophes* of the eighteenth century, and also warned against its pitfalls.

During the 1970s I moved away from academic research, and pursued two very different paths simultaneously: inner meditational experience, and active involvement in the social aspects of science. This latter was done through my position as Executive Secretary of the Council for Science and Society (London) (1973–76), and later as a member representing the public interest

on the Genetic Manipulation Advisory Group. It was during my period at the Council that I met, and instantly formed a friendship, with Zia Sardar. On more than one occasion we considered collaborating on a book of criticism of science; but for myself the book could not really begin until I had a conception of a positive conclusion, and this was never forthcoming. Early in the 1980s I began work on a philosophical novel, called *Science among the People*, using a story about an ordinary middle-class neighbourhood as a vehicle for my dialectical philosophy of the knowledge and the practice of science.

My main research in the 1980s has been conducted in collaboration with S.O. Funtowicz, on quality control in scientific information, through the management of its uncertainties. We have devised a notational system for expressing the different sorts of uncertainty by which such information is affected; and this is based on a dialectical philosophy of scientific knowledge, including its quantitative basis. The system was developed through several research contracts; and a book, *Uncertainty and Quality in Science for Policy*, has been accepted by the publishers Kluwer.

Through all this time I have been writing essays on a variety of topics, most on request for a symposium, conference or Festschrift. A selection of these form the present book. Some are reprinted with few changes, while others have been nearly or completely rewritten. In general, the references have not been systematically updated, so they are not to be taken as guides to the literature at the present time.

The title of this book is a commentary on the vision of Francis Bacon, to whom we owe so much of the idealism that has motivated modern European science. His greatest work starts off with the statement that 'knowledge and power meet in one'; and he had long previously called for a 'marriage' of the rational and empirical approaches to science. Now in the later twentieth century there has indeed been a meeting of knowledge and power; but, contrary to the hopes of prophets of science down through the ages, it seems to be less of a marriage of equal partners than a merger of unequal corporations. The need for a critical presence around and within science has never been greater.

In one sense this book is obsolescent as it appears, for the changes in the social practice of science are accelerating; even the most recent essays here cannot provide a full perspective for what may soon be coming. But taken as a whole, they give a background of understanding; and my next philosophical task is to comprehend a future for science where there may be few constraints and many surprises.

Introduction

Within the last generation the public perception of science and technology has changed drastically. Although we still depend on 'science' (in this extended sense) for the operation and improvement of our material culture, few will still believe that science has the answer to all human problems. Indeed, we are now confronted by a set of problems, increasing in number and in intensity, which are the results of technological and industrial developments; and for which science, while a necessary element of their solution, will by no means be sufficient. Whereas before one could imagine science advancing boldly, steadily rolling back the frontier between knowledge and ignorance, now we must cope with our ignorance of the ramified effects of science-based processes. The 'hard facts' for which science is the paradigm example are, in these new problems, painfully conspicuous by their absence. Now we must collectively make some very hard decisions in the near future, lest our natural environment become degraded beyond repair; and for these, the best that science can provide will be rather uncertain and 'soft' data-inputs. We are living in an age where these perturbations of our environment are producing a sort of 'science-based ignorance'; and the greatest danger of all is that we should remain ignorant of our ignorance, and thereby live in an illusion of security from science.

The world of science itself has been correspondingly transformed. The old image of the rather other-worldly seeker after truth, who by his knowledge and integrity was automatically given credence for his pronouncements, has given way to a variety of different actors in conflicting roles. These include the scientist-worker and the scientist-entrepreneur, as well as the science-journalist and the citizen-scientist, themselves encountering the scientist-expert and the scientist-regulator. The teaching of science is now beginning to respond to these changed realities; although the core of science is still taught as immortal, impenetrable hard facts, there is an increasing awareness of the social dimension of science in its applications and problems. All this is encouraging for the development of an appropriate response of science to its new challenges. How well the world of traditional established science will respond

to these new currents, and make its proper contribution to the solution of the problems created by its own successes, still remains to be seen. It may take a full generation of recruits whose common sense of science has been formed by a social and ecological consciousness before the traditional conceptions, valuable and valid in their own times but now outmoded, can be replaced. My work over these years has largely been devoted to assisting in the development of that new consciousness.

Thus the world of science faces a host of new problems, which were scarcely imaginable to the brave prophets of science, from Francis Bacon to those of the recent post-war period, such as J.D. Bernal. If there were a simple solution to them all, then this book would be a treatise rather than a collection of essays. My many-sided approach to the problems reflects their complexity; the absence of a definitive solution reflects the state of the world in which we live. Ever since the invention of nuclear weapons, we have faced the possibility of being destroyed by our science-based inventions. Now the same result may come from the ordinary operation of our science-based industry. If the solution does not lie within science, then how far beyond it must we go?

As a guide to the structure and contents of this book, I recall that there are two radically different conceptions of science. From the outside, as presented by most teachers and publicists, it is a set of answers, usually beyond criticism by an inexpert audience, and by their form giving no hint of the boundary between knowledge and ignorance that they represent. But from the inside, for those engaged in research, the accomplished answers are interesting only as tools for the solution of new questions. The real life of science is on that boundary between knowledge and ignorance that we call the research frontier. The art of doing exciting and innovative research is to know what sorts of questions to ask, i.e. where in the area of ignorance that lies beyond the last solved problem is there the possibility of a fruitful exploration. This living science is reflected in the quality of a great teacher, who not only presents what is known in a clear and compelling form, but who also manages to convey (even if only implicitly) the excitement of discovery, on problems solved and on those not yet solved. In this sense, a good question is worth a dozen good answers; for then curiosity is awakened, and anyone can imagine being the one to find the answer. That is the way that real comprehension and enthusiasm is generated, for what is learned then is truly the creation of the learner.

Here my discussions run through a fourfold approach, starting with a review of our present situation, through its roots, then advancing some new insights that are useful for our comprehension of science, and concluding with some positive steps. The style is suggestive rather than definitive; I exhibit a variety of ways of grasping a problem, corresponding to the variety of my experiences of attempting to understand it. The open questions are not listed formally as research exercises; for the complexity of the problems, so far as I understand them, precludes such a simple method. But since everything I say here is tentative and exploratory, reflecting the development and hopefully the

continuing maturing of my ideas, the questioning character of my enterprise should be easily appreciated.

The collection of essays opens and closes with selections from my earlier book. To some extent this is to provide a record of the development of my ideas and insights; but also because I believe that what I wrote then is still useful for defining the work as a whole. In the epilogue I show again that for me the commitment to humanity must be at the core of the scientific endeavour, if it is to be worth pursuing at all.

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WHERE WE'RE AT

The world of science is changing, and at an accelerating pace. In the Introduction to my *Scientific Knowledge and its Social Problems* (Oxford University Press, 1971), I emphasized this change, although then I could appreciate only some of its aspects. Then I spoke of 'industrialization', and of the problems of maintaining the health and vitality of science (as traditionally understood) under these new conditions. The motto I chose, still looking backwards, was 'science is not soap': the production of scientific knowledge requires very special conditions of morale and commitment if the quality of the product is to be maintained.

Since then, my outlook has broadened, and I have a better understanding of science as seen from the outside. If I were to choose a single brief motto to express the change in the status of science, it would be this contrast: In the old days, 'science' took the credit for penicillin, while 'society' got the blame for the Bomb. Now, every schoolchild knows who it was that saved the whales: not Science, but Greenpeace.

Although in many ways science represents the best in our civilization, and traditionally had been thought to be free of the taint of its worst aspects, still it has been decisively shaped by its cultural context. Now that modern European civilization has passed the half-millennium mark in its history of expansion and domination, it is easier for us to consider it as whole, including the natural science that conveys its essential character. I attempt this in the first essay in this section, 'A critical awareness of science'. This was produced for an occasion where, I believed, I was invited as someone who would challenge received views on the essential beneficence of science. This I attempted to do; and even though I have softened the text in places, it may still convey a strident, negative tone to some readers. If so, that is the result of my lack of literary skill; and I hope that the other essays will provide a balance.

If there is any single topic that expresses the new challenges to science, it is 'risks'. From pollution threats to industrial and natural disasters and new diseases, all these phenomena have a common element: uncertainty about their occurrence and about their harmful effects. The management of risks, mainly through regulation, thus becomes one of the central tasks of our high-technology society. There has been a strong tendency to treat it all as an applied science, whose accredited experts do everything possible for the protection of the public and deserve trust and gratitude on that account. That view has been vigorously contested; and now there is general agreement that values are inescapably involved in the assessment of risks, and politics in their management. Some have taken that position to extremes, arguing that it's all a matter of lifestyles to worry about nuclear power plants. Risks thereby present a challenge to the philosophy of science, to show how the more 'objective' elements of risk assessment are real, and the more 'subjective' elements are valid, in this paradigm case of the application of science to policy problems. For the essay on 'Risks and their regulation' I have amalgamated four earlier ones, which together provide a contrasting set of themes and approaches.

One of the classic controversies concerning risks in recent years was the debate, mainly conducted in the USA, over the possible hazards of recombinant DNA research. This was initiated by a unique act of statesmanship in a scientific community: a public warning that certain sorts of experiments were potentially hazardous, and the imposition of a voluntary moratorium until the risks were brought under control. The goodwill achieved by this action was dissipated within a short time, and a heated debate raged in 1976 and 1977, with almost all the researchers united against a varied collection of external critics and a few defectors. To some extent this was a characteristically American phenomenon, since the regulation of the research in the UK was accomplished on the customary consensual basis with a minimum of public strife. However, there were real issues at stake, at their core being the questions of what is the problem and who is to have control over its definition. Studying the DNA debate at that level can be instructive for understanding what may seem to be confused and unnecessarily contentious debates on other risks questions.

Although I do not wish lightly to discard the hard core of rationality and objectivity in any scientific endeavour, I do not wish to defend all that is done in the name of science against fundamental criticism. In my earlier book I analysed the problems of quality control, and showed how there is no lower limit to quality in productions called scientific, or indeed technological. It is easier to show shoddy work, or indeed vacuity, in this latter case, for the examples are more public and more easily comprehended. Defence procurement is notoriously prone to lapses of quality control; and the special character of nuclear weaponry

(being designed to prevent its own use) makes its testing quite problematic. All these tendencies combined and culminated in the Strategic Defense Initiative (SDI), where critics finally raised the question of whether it was all an expensive fantasy. With the SDI as an incontrovertible example, I can study the extent to which the whole nuclear enterprise is fantasy, and consider the related question of why no one has previously seen through the emperor's bombs. If we are to understand the present social problems of science, we must divest ourselves of the delusion that it protects us against fantasy; and this case is the easiest to describe and analyse in full.

Through all these essays, I remark wherever necessary that our civilization, of which we are all members and which is the best one we have, depends on science in a multitude of ways. In these critical analyses of our present situation, I do not imply that science is evil or misconceived, or that we would be better off without it. Science, and our understanding of it, will certainly need to change, if science and indeed our civilization are to survive. My purpose here is to illustrate problems so that the change will be the result of forethought and debate, rather than a panic response to unexpected external events and pressures. This is a task for all who are concerned with science, among whom the professional scientists and their sponsors are a minority.