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HUMAN IMPLICATIONS OF SCIENTIFIC ADVANCE

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INTRODUCTION TO SYMPOSIUM 1:

SCIENCE AND HUMAN VALUES

This Symposium, the first of the Congress, was designed to provoke discussion of the themes which make the history of science relevant to the concerns of people of all nations. The two sessions looked at science from complementary perspectives. In the first, the focus was on European civilisation; for it is here that our modern science had its effective origins, and here that its technological applications are most developed for good or ill. In the second session, the perspective shifted; the main speakers looked at European science from the outside. They offered criticisms, based on their scholarly researches, of some important assumptions about European science that have contributed to our image of it.

We were fortunate that Dr. Joseph Needham, a great scholar and humanist, could introduce and chair the first session. In his person we have someone who sees European civilisation and its science from both within and without: And he has done more than any other person to make Europeans aware of their debt to the other great civilisations. In each of the sessions the concluding remarks were made by scholars from the Socialist part of Europe; in the morning Prof. G. Dobrov (U.S.S.R.), currently at the International Institute of Applied Systems Analysis; and in the afternoon Prof. R. Richta from Czechoslovakia. Their optimistic presentations reminded us that the problems of European science can also be seen not so much as a worry as a challenge, and that there are some communities where this is the consensus.

SCIENCE AS A CULTURAL SYMBOL

Allow me to begin by quoting from a recent statement by Jean Houston, on the re-mythologisation of science.

"This was brought home to me [she writes] when I questioned a group of Catholic girls. It was in a Catholic girls' college where I was teaching, and I said: "Young ladies, I am going to name some images, and I would like you to tell me what reaches you, what turns you on." First I said to them 'the Mother of God' and there was no reaction, and then I said 'the Sacred Heart of Jesus' and 'the Annunciation of Mary' and there was no reaction. At this stage I said 'DNA' and many girls tensed up, and when I followed it with 'RNA' the breathing was perceptibly faster. Then I said 'Inter-galactic nebula', and there was an echoing chorus of "Oo-wow" - and as you may know "Oo-wow" is the modern liturgical equivalent of "Amen". If you want the whole response, it's 'Oo-wow, far out'. Well, such a controlled experiment shows you the mythological matrix of our time."*

Now this is only one aspect of the popular attitudes to science today. It long ago became a commonplace to say that scientists have come to occupy the position of the mediaeval clergy as the sages, magi and guides of mankind. The movement has reached the point when whole bookshops are entirely devoted to science fiction, often the only reading of many people, often a mirror-image of ourselves and our fears and hopes, yet so often, especially in the Western capitalist world, extremely frightening, and intended to frighten. Hence the reaction of many millions who have come to abominate science with all the dictatorial and unfeeling high technology which springs from it, not only with regard to the future, but in the here and now. Hence the anti-science movement and the "counter-culture".

* In "Beyond the Mechanical Mind", ed. P. Fry & M. Long, Australian Broadcasting Commission, Sydney, 1977, p.132.

Some of the most telling formulations of the disenchantment of the young with science have been presented by Theodore Roszak in his books, "The Making of a Counter-Culture",* and "Where the Wasteland Ends".† He and the young are against modern science because they feel that it has had evil, totalitarian and inhuman social consequences. They are not content to put this down merely to misapplied technology; their criticism of science itself goes deep. They attack "the myth of objective consciousness", detesting that "alienative dichotomy", which separates the observing self from the phenomena in Nature, and set up what they call an "invidious hierarchy", which raises the observer to an inquisitorial level, free to torment Nature, living or dead, in whatever way will bring intellectual light. They feel too that science encourages a "mechanistic imperative", that is to say, an urge to apply every piece of knowledge, in every possible way, whether or not its application is health-giving for human beings, or preservative of the non-human world in which they have to live. The scientific world-view is thus accused of a cerebral and egocentric mode of consciousness, completely heartless in its activity. It is not as if scientific methods of control were applied only to non-human nature; the "scientisation of culture" is calculated to enslave man himself. There are many techniques of human control, such as the behavioural

* "The Making of a Counter-Culture; Reflections on the Technocratic Society and its Youthful Opposition" (New York, 1968; London, 1971).

† "Where the Wasteland Ends; Politics and Transcendence in Post-Industrial Society" (New York and London, 1972-3).

and management sciences, systems analysis, control of information, administration of personnel, market and motivational research, and the mathematisation of human persons and human society.* In a word, technocracy is rampant, and the more complete the domination of Nature, the more fully does it become possible for ruling élites to increase their control of individual human behaviour.†

Since Francis Bacon's time the essence of the scientific method has been alienation, in the sense of an absolute distinction between the observer and the external world, with which he can have "no sense of fellowship nor personal intimacy, nor any strong belonging". Nothing inhibits the ability to understand, and after understanding to manipulate and exploit to the full. There is much that can be said against the "callousness" of science, yet without what one might call clinical detachment no scientific medicine would ever have come into being. In the same way the opponents of science cannot deny its pragmatic value in that pharmacological knowledge does lead to the relief, or cure, of disease, and that flight would be impossible without a knowledge of aerodynamics and thermodynamics. The anti-science movement is in rather a quandary here, for it can hardly wish mankind to return to the infancy of pre-scientific ignorance, while at the same time it is justifiably uneasy, indeed outraged, at the uses which are constantly made of scientific knowledge; and filled with fears for the future.§

* Cf. J. Ellul, "The Technological Society" (New York, 1964).

† Cf. W. Leiss, "The Domination of Nature" (New York, 1972).

§ This whole subject has been the theme of C.H. Waddington's Bernal Lecture at the Royal Society: "New Atlantis Revisited" (Proc. Roy. Soc. 1975).

I am inclined to think that the real meaning behind the anti-science movement is the conviction that science should not be taken as the only valid form of human experience. Actually philosophers have been calling this in question for many years past, and the forms of human experience - religion, aesthetics, history and philosophy, as well as science - have been delineated in many integrated surveys. Roszak himself hints this, as when he denies that scientific objectivity can be "the only authentic source of truth", or when he says that "we must be prepared to see the truth as a multi-dimensional experience".

The whole anti-science movement has arisen because of two characteristics of our Western civilisation: on the one hand the conviction that the scientific method is the only valid way of understanding and apprehending the universe, and on the other hand the belief that it is quite proper for the results of this science to be applied in a rapacious technology often at the service of private capitalist profit. The first of these convictions is held as a semi-conscious assumption by a great many working scientists, though formulated clearly only by a small number; at the same time it spreads widely through the populations, often leading to great callousness and insensitivity in personal relationships, quite beyond the power of the traditional codes of religion and ethics to modify. Similarly, the mass-production technology of the capitalist world, so freely paralleled and imitated in the Soviet Union and the Socialist Republics of Eastern Europe, has indeed supplied the

peoples of the developed world with a vast wealth of material goods, but only at the cost of debauching their aspirations, limiting their freedoms, and imposing controls every day more insidious and unhealthy.

Let us turn now to an entirely different aspect of the situation. Even in a properly balanced human society, where the natural sciences were counter-balanced all the time by what used to be called in Cambridge the "moral sciences", and other forms of human experience such as the religious and the aesthetic, there would still be great difficulty in dealing with the all but intolerable ethical choices which applied science places before mankind and will increasingly place as time goes on. The young people of the counter-culture are revolted by the necessity of making such choices, but neither they nor we can go back to the "bliss of ignorance" as in primitive times. Actually it never was bliss, of course, because the very mission of science was to lead us out of the wilderness of ancient fears, taboos and superstitions. But the promised land will never be won by science alone. The control of applied science is probably the greatest single problem for humanity today, and one might even go so far as to wonder whether the most penetrating social critiques, such as the theory of the class struggle, and historical materialism, are not simply aspects of this basic question.

No doubt man has been facing it ever since the discovery of fire, but today it threatens his very existence. Everyone knows about nuclear power and the devastating possibilities of

nuclear weapons, but such apparently simple problems as the disposal of the radio-active waste from nuclear power stations are nightmares to those who worry about the social responsibilities of science. Nowadays mathematical engineering is almost as dangerous, and the possibilities of "artificial intelligence", and the vast computing machines which can and will be built, with their fabulous information-storage and retrieval, are quite breath-taking. The privacy of the individual is now endangered, the rights of children to be taught by living teachers, and the safety of whole populations exposed to the danger of some electrical or mechanical fault when computers are harnessed to "defence".

The possibilities of biology and medicine are at least as challenging. My own professional background has made it natural for me to follow such developments. One of the largest fields in which they arise is that of generation, for this is the first time in human history that man is on the point of acquiring absolute control both of reproduction and infertility. All too soon we shall be in possession of means for controlling the sex of the human embryo. After this the sterilisation of whole groups might become a live issue. Ethical controversies have raged for years round contraception and abortion, but problems are also raised by the new foetal medicine, which can detect grave abnormalities long before birth, and by artificial insemination, which is only by convention attached to infertile marriages. Legal considerations and changes are lagging far behind the actual possibilities, such as spermatozoa banks, maintained from donors outstanding for physical or intellectual brilliance,

and possibly several generations older than the receiving womb.*

Again, now that we know the chemical structure and coding of the semantophore molecules of desoxyribonucleic acid (DNA), which carry the instructions for making each new human organism, infinite possibilities are open for interfering with this hereditary material.[†] That would be biological engineering applied at the molecular level; one could envisage the insertion of an entirely new piece of chromosome, or the removal of another. Or one could produce hitherto unheard-of hybrids by substituting a mixed-cell nucleus for the original one of the fertilised egg itself. These may seem distant prospects, requiring enormous expenditure of money; but there has already been unexpected success in transferring genes (the hereditary units) from one lot of bacteria to another. Certain viruses can pick up genes and put them into the bacterial nuclear systems. What if an antibiotic-resistant strain of bacteria were produced, which quickly spread all over the world like wild-fire, and decimated human populations? That this is a

* On all these questions see "Our Future Inheritance; Choice or Chance?", a study by a British Association Working Party, ed. A. Jones & W.F. Bodmer (Oxford, 1974).

+ See the Trueman Wood Lecture of C.H. Waddington, "Genetic Engineering", Journ. Roy. Soc. Arts, 1975, 123, 262. My old friend and collaborator takes a refreshingly cool view of the dangers before us because of the immense expense which researches in such embryology and genetics involve, and the consequent certainty of public scrutiny. I am not so optimistic, for two reasons: (a) the possible activities of totalitarian States, and (b) the doubt that public scrutiny - or debate - necessarily leads to right ethical policy. As Waddington himself says: "One wonders whether we are intellectually, emotionally, or morally, prepared to face such choices....".

real danger has been shown by a self-denying ordinance achieved very recently in California, where the scientists working in these fields agreed to establish a moratorium on such experiments, at least until more laboratories with adequate safety equipment and security become available. Here there is one very tempting possibility open to mankind, namely the possible insertion into plants of genes favouring the symbiosis of nitrogen-fixing bacteria, as happens in the leguminous plants today. If that could be arranged for the staple crop cereals it would be a gift to humanity almost as great as the gift of fire. What effect would this immeasurable increase in food production have upon the human race?

Medicine is also confronting humanity with almost insoluble problems.* The conquest of transplantation intolerance has already led to a great proliferation of organ transplants, and no doubt the surgeons in time to come will have access to whole banks of spare parts for human beings. But transplantation studies go much further, for it is now possible to make chimaeras between animal species, since certain killed viruses makes the tissues stick together, and this could be used to unite human with animal tissues. What is going to come of that? Ethical problems also arise in all cases where the treatment may be very expensive, needing elaborate machinery - for example the kidney machines which dialyse the blood, and can keep a person going even though his or her kidneys are only able to function very ineffect-

* One of the most obvious, and widely debated, is of course that of euthanasia. On all these questions, see G. Leach, "The Biocrats", (London, 1970).

ively. Who is going to choose who gets the advantage of restricted techniques in short supply?

Again, much work is being done on the fertilisation and cultivation of human eggs in vitro up to the blastocyst stage before their reimplantation into a uterus to go on developing until term. Aldous Huxley in his famous novel "Brave New World" visualised the isolation of totipotent blastomeres so as to reproduce many identical copies of low-grade human beings, and this is not at all impossible. But there are other ways of effecting such "cloning". For example, nuclei from adult cells can take the place of the egg's own nucleus itself, so that a whole regiment of individuals with identical genetic material could be created. The question would then arise: do all human beings have an inalienable right to individuality? Such is the fix that Faust has got himself into, and the young suspect that they know why.

I could go on a lot longer, but it must be evident that humanity has never hitherto had to face anything like the tremendous ethical problems posed by the physico-chemical and biological sciences. Now it is not at all obvious that the traditional ethics of the Western world, even with all its tomes of moral theology and casuistry, is the best equipped to deal with these problems, and certainly not on its own. Even within the sciences it is not obvious that the traditional modes of thinking of Western philosophy are the most adequate for the extraordinary and incredible events which go on in the world of sub-atomic particles; and indeed there are those, such as Odagiri Mizuho,

who are showing that Buddhist philosophy may give a good deal of help to the nuclear physicist which could not come from Western ideas alone.

A similar line of thought has been pursued of late by Fritjof Capra, another nuclear physicist, especially in his book "The Tao of Physics". Essentially his argument is that modern sub-atomic physics has made it quite clear that reality completely transcends all ordinary language, and that this was seen intuitively by the Taoist and Buddhist thinkers of ancient China and India. In the sub-atomic world the concepts of space and time, the idea of separable material objects, and the usual understanding of cause and effect, have all lost their meaning. Mass and energy are interconvertible, radiation is "not exactly" waves and "not exactly" particles, time does not uniformly flow, changes always include the observer in an essential way, and no precise prediction is possible. Polar opposites are complementary rather than antagonistic, particles are both destructible and indestructible, matter both continuous and discontinuous, and objects are relational events rather than substances, spontaneous dynamic patterns in a perpetual dance. Reality is beyond existence and non-existence. It is hardly surprising therefore that many minds, especially of the younger generation, are attracted to the thought of Lao Tzu and Chuang Chou, the strange systematisation of the I Ching (Book of Changes), and the insights of Tantrism and Chhan (Zen) Buddhism. The only unanswered question is how it came about that the ancient and mediaeval thinkers of India and China came to conclusions so close to those we have now arrived at with a great deal of trouble, building gigantic cyclo-