

MORAL CHOICES IN SCIENCE AND TECHNOLOGY

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On the title page of his book The Arms Race published in 1958 Philip Noel-Baker, a Nobel Laureate for Peace in 1959, cited a quotation from John Stuart Mill: "Against a great evil: a small remedy does not produce a small result, it produces no result at all".

I cite this quotation to remind us that the Russell-Einstein Manifesto, which inspired the establishment of the Pugwash Movement in 1957, focussed on the great threat of nuclear weapons that looms over our planet. (Pugwash is a lobster fishing village in Nova Scotia and the name means deep waters in the local Indian dialect). The Manifesto called upon scientists to assemble in conference to assess the perils of weapons of mass destruction, to renounce nuclear weapons and, ultimately, war itself if mankind is to survive. Clearly, nuclear weapons and wars are great evils and, as Mill said, require great remedies. Therefore the Pugwash organization calls for a level of zero nuclear weapons, and, unlikely as the prospect of total abolition of war may seem at present, it will work towards it as an eventual goal.

A few years ago some of us in Pugwash first raised the question of the feasibility of a Nuclear-Weapon-Free World (NWFW) and of formulating a treaty to enforce compliance with its provisions. The idea was summarily rejected by many arms-control specialists, military and governmental authorities and others as unrealistic, starry-eyed idealism, as unpatriotic, and even dangerous to world stability and peace. However, we have now

been joined by many leading scientists, military authorities, scholars and others in our stand for a NFWF in the not too distant future. A recent advocate of this goal is General Lee Butler who has lately stepped down as commanding officer of the U.S. Strategic Arms Command (SAC), and on the occasion of last year's annual meeting of the National Academy of Sciences he spoke strongly in favor of a NFWF. Other prominent figures now supporting this seemingly radical objective are some 60 senior military figures world-wide.

The rationale for a NFWF is the following: It is almost certain that if we do not eliminate nuclear weapons fairly soon, and adopt a treaty to enforce it, a number of non-nuclear countries will acquire them in order to achieve the unique status and power they afford. Consider a situation in which Iraq, Libya, Syria or some other rogue state possessed nuclear arms and would not hesitate to use them, thus sparking an escalating nuclear conflict with catastrophic consequences. It is sobering to note how far Iraq had advanced in this direction before it was discovered and halted by the Gulf War.

In the course of pursuing its two principal goals, Pugwash has also been engaged in many other issues such as the elimination of chemical and biological arms, problems of conventional weapons, the arms trade, military-industrial complexes, the plight of developing countries, and environmental degradation, amongst others. Obviously, many complex questions arise that involve moral choices in such matters. Clarity of

purpose in pursuing goals is a necessary pre-condition for making judgments regarding their morality; otherwise, issues can become obscured in a mist of secondary factors.

Professor Joseph Rotblat, president of Pugwash and joint recipient with Pugwash of the 1995 Nobel Peace Prize, has made the following observation: "In this nuclear age, when the misuse of science can literally destroy the whole of our civilization, scientists can no longer evade their responsibility to society by hiding behind such precepts as science should be undertaken for its own sake, science is neutral, science has nothing to do with politics, science cannot be blamed for its misapplication, and scientists are just technical workers." He then quoted the following individuals.

Herbert York, former director of the U.S. Department of Defense Livermore Laboratory has stated:

"The various individual promoters of the arms race are stimulated sometimes by patriotic zeal, sometimes by a desire to go along with the gang, sometimes by crass opportunism....Some have been lured by the siren call of rapid advancement, personal recognition, and unlimited opportunity, and some have sought out and even made up problems to fit the solutions they have spent most of their lives discovering and developing."

Ted Taylor, formerly a chief designer of atom bombs in Los Alamos, characterized incentives for such work as a kind of addiction: "... the most stimulating factor of all was simply

the intense exhilaration that every scientist or engineer experiences when he or she has the freedom to explore completely new technical concepts and then to bring them into reality."

The renowned physicist Freeman Dyson is a long-time member of the Institute for Advanced Study in Princeton. He has been a major adviser to the Pentagon on nuclear weaponry for many years, and at the same time he recognizes the awful danger to humanity that they represent. Edward Teller is another such example, but Teller apparently is propelled by his wish for power, whereas Dyson is not. Many nuclear physicists who have worked on developing weapons of mass destruction have what might be described as an ethical split-personality, i.e., knowing the consequences of their work but having to judge the creation of such weapons as necessary for ending or deterring a terrible war. In that, they resemble other scientists (and in fact anyone) who must make moral judgments by weighing up the possible good against the possible harm.

Definitions of ethics by past and present philosophers fill libraries, but they do not relieve us of individual responsibility for choices in our daily life. I was immensely impressed by Dyson's views in this connection as we discussed them during most of a night spent beside him on a bus ride from Sopot (near Gdansk on the Baltic coast) to Warsaw in 1966 following a Pugwash meeting. Recently, Dyson published an

interesting article in the New York Review of Books," entitled "Can Science be Ethical?" In it he notes that both J.B.S. Haldane, the British scientist, and Einstein maintained that ethical progress is the only cure for the damage done by scientific progress. Here is what Dyson has to say:

"The nuclear arms race is over - (*I seriously doubt this*) but the ethical problems raised by non-military technology remain. The ethical problems arise from three 'new ages' - the Information Age, the Biotechnology Age and the Neurotechnology Age. These three new technologies are profoundly disruptive. They offer liberation from ancient drudgery in factory, farm and office. They offer healing of ancient diseases of body and mind. They offer wealth and power to the people who possess the skills to understand and control them. They destroy industries based on older technologies and make people trained in older technologies useless. They are likely to bypass the poor and reward the rich. They will tend to accentuate the inequalities in the existing distribution of wealth even if they do not, like nuclear technology, more directly promote the destruction of human life.

The poorer half of humanity needs cheap housing, cheap health care and cheap education, accessible to everybody,

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with high quality and high aesthetic standards."

Dyson goes on to say that the gap between technology and the needs of the poor is wide - and growing wider - and that if this continues the poor will inevitably rebel against the tyranny of technology and turn to violent and irrational remedies. He says that the widening gap between technology and human needs can only be filled by ethics, and in the last thirty years we have seen many examples of the power of ethical behaviour. An outstanding one is the worldwide environmental movement which, among other victories, has seriously called into question the use of nuclear power and its by-products.

Concerning Dyson's views, I ask how is it possible to embrace such socio-ethical beliefs and still work on nuclear weapons? I will take up this dilemma later.

I would like now to revert to the same 1966 Pugwash meeting in Sopot, Poland where my discussion on ethics took place with Dyson. Shortly after the meeting began on 11th September, Henry Kissinger joined our group while enroute to the USA from Vietnam where he had acted as consultant for high government quarters in Washington. He had already attended Pugwash meetings and agreed to brief the American participants (amongst whom were senior advisers to the US government) on his Vietnamese trip. He told us that he was now convinced that the war had been lost as far as

the US was concerned and that we should get out as soon as possible. The war, however, continued for seven more years. Recently declassified papers reveal that Lyndon Johnson wanted to pull out of the war as early as 1964 but considered himself politically trapped and unable to do so. Robert McNamara, Defense Secretary under Kennedy, relates in his book, *In Retrospect*, how between 1965 and 1966 he became convinced that the war was immoral and unwinnable. Faced with the conflict between this conviction and his loyalty to the President, he practically arranged his own dismissal by Johnson in early 1967. Kissinger, in contrast, continued on the road to glory with the election of Nixon whom he served as National Security Adviser and then as Secretary of State. Despite the convictions he conveyed to Pugwash participants in 1966, Kissinger steered the USA towards the invasion of Cambodia, and for prolongation of the conflict until 1973. It is sad to think how much suffering and loss of life among Americans and Vietnamese could have been spared if the war had stopped in 1966. (An interesting sidelight is the fact that in 1967 Kissinger served as a Pugwash intermediary in an attempt to stop the war in Vietnam with McNamara's backing, as described in McNamara's book.

McNamara, Robert S. *In Retrospect: The Tragedy and Lessons of Vietnam*. New York: Randon House, Inc., Times Books, 1995. Pp.295-302.

Ibid

No one can assume the mantle of a Solomon on the subject of moral choices. Philosophers from Greek antiquity onwards have tackled this thorny subject. While there is no guide book or set of rules to follow, there is plentiful literature on the subject. One which I have found particularly rewarding is Sessila Bok's book Lying: and I would recommend it to any thoughtful person for its views on ethical values.

In some of the dilemmas discussed by Ms Bok, she illustrates that easy answers on ethical choices are not readily at hand, even though authorities such as St. Augustine, Thomas Aquinas, Francis Bacon, Immanuel Kant and others are ready and eager to educate us in these matters. She addresses the question of whether lies are morally justifiable in such prickly situations as an acute crisis which may threaten one's survival or the survival of others, or in lying to protect the public good, or to assuage the sick and dying. It is worthwhile to read her book to see how she answers these difficult questions in shades of gray.

In regard to moral choices that present themselves in the fields of science and technology, I will mention some examples to illustrate the kinds of questions and decisions that may be

Bok, Sessila. Lying - Moral Choice in Public and Private Life, Vintage Books, New York, 1979. Sessila Bok is the wife of the former President of Harvard University, and daughter of the late Alva and Gunnar Myrdal who were, respectively, a distinguished Swedish disarmament expert and an economist, both of whom were well acquainted and sympathetic to Pugwash action over the years.

involved. I will not separate science from technology here since their frontiers often merge, and there is a reciprocal flow in many areas.

For my first example I take the ethical problems associated with research and development of weapons of war, above all with nuclear weapons. The scientists and engineers who labored at Los Alamos and in other secret laboratories during World War II to develop an atom bomb had few moral doubts. But there were some who did doubt, such as Professor Joseph Rotblat, mentioned above.

Rotblat was the only scientist to resign from the Los Alamos project during the war. This occurred in late 1944 after he learned that Nazi Germany did not pose a threat of developing an atomic weapon. That possibility was the sole reason for his undertaking to assist in the Los Alamos project.

It is of interest to contrast Rotblat's attitude with that of some German scientists during World War 1. Fritz Haber was an outstanding chemist at that time, later a Nobel laureate. He was a rabid German nationalist, and with lavish governmental support set up a laboratory to develop a chemical weapon. He was able to enlist three other distinguished German scientists in his group, all of whom later received the Nobel Prize for scientific accomplishments not connected with the project. They were Otto Hahn, James Franck and Gustav Hertz. Max Born, however, who subsequently was also awarded a Nobel Prize, refused to work on the project because of its aim. The project conceived and

produced the chemical weapon chlorine which was successfully employed on the Western Front, and presaged the development of chemical weapons in general.

Much has been written about the moral aspects involved in the development of atomic and nuclear weapons which I can mention only briefly here because of time limitations.

In contrast to Dyson's views outlined previously on continuing to advising the government on developing nuclear weapons, presumably believing that he could influence matters favorably, I should like to cite the examples of George Kistiakovsky, who was chief chemist on the Manhattan project in Los Alamos and later security adviser to President Eisenhower, and that of Victor Weisskopf a distinguished theoretical physicist on development of the bomb, both of whom decided that working on the inside of the government as advisers had little influence on decisions and resigned from government activity so that they could oppose openly any policy favoring nuclear weapons.

There were others who felt likewise, apart from York and Taylor mentioned previously. A striking example is Hans Bethe's plea last year for scientists to abstain from any employment concerned with work on nuclear, chemical and biological weapons and other weapons of mass destruction. Bethe was the chief theoretical physicist at Los Alamos and served many years as a senior adviser on nuclear weapons to the U.S. Department of

Defense. He now advocates an Hippocratic-type oath renouncing work on weaponry, and which extends over much of the territory of natural and social sciences.

Let us consider for a moment the choices that such an oath can involve:

1. Deviation from the generally accepted norms of patriotism.
2. Renouncing the greater financial remuneration and career opportunities usually afforded by "defense" work.
3. Foreswearing the lure of scientific and engineering challenges of such work.

The arms industry in the USA and in most other industrialized nations is immense, and it pervades the social structure in these countries. It offers enticing employment and career opportunities to capable young scientists and administrators who may ask themselves whether to forgo such opportunities because they question the morality of producing arms. One may ask where the line should be drawn. What about those who only make spare parts or who produce an essential ingredient that they know may eventually be used in a weapon, for example, the last chemical precursor of a nerve gas?

Alfred Nobel himself made a fortune from his invention of explosives. Would one renounce the Nobel prize because of that?

The Mellon, Rockefeller and Carnegie Foundations, amongst others, were built on wealth acquired through dubious means. Is one tainted by accepting grants from such institutions? I don't think so, provided there are no strings attached which may influence the results of the research. But there are large grey areas in such questions where judgements on morality are difficult.

Recently, Sir Patrick Sheehy, head of a major tobacco industry in the U.K. offered to endow a professorship on international relations in his name at Cambridge University in England. The University gladly accepted the offer, but it was strongly opposed by Sir Richard Doll, the statistician who first demonstrated the correlation between smoking and lung cancer in the 1950's, by Professor Bodmer, Head of the Imperial Cancer Research Institute in London, and by several other distinguished scientists. A long-time friend of mine worked for the Philip Morris tobacco company. Although convinced that smoking definitely caused cancer, he believed he was in a position to influence the company in considering its social responsibilities. In the past year the problem of accepting grants for research from the tobacco industry has again bedevilled the scientific community.

There has been similar controversy, as noted previously, with regard to working on weapons and in other military areas for governments. Since World War II there has been a division

amongst scientists in the USA on whether or not to accept remunerative work or grants requiring high security clearance, and involving a pledge not to make public any findings they turn up in the course of their work. Some scientists refuse to accept such conditions, but many others consider them acceptable.

There is also the question of accepting employment with establishments where bias and discrimination are evident in company practices, perhaps not overt but nevertheless apparent to the applicant. For example, the employer may be guilty of racial, ethnic, religious or sex discrimination, but an eager applicant may turn a blind eye to these abuses.

Individuals are confronted daily with moral choices which test their ethical values, following government policies and military orders, or even directives from employers in the private sector of any industry. In World War II, for example, soldiers faced commands to attack civilian centers (as was done on Tokyo, Dresden, Berlin and London). In private businesses employees may be asked to carry out tasks that suggest sharp practice or even illegal operations. On the other hand, there is whistle-blowing which attempts to reveal malpractice of all sorts, but is a practice often punished when sensitive government policy is involved, such as environmental pollution (illegal disposal of military toxic materials, etc.). Allegations such as those made by Mr. Vanunu concerning Israel's development of nuclear weapons requires great courage. Societal surveillance and whistle-

blowing by the public has been advocated by Professor Rotblat in monitoring adherence to arms control treaties.

There are numerous recent instances in science where questions of morality have assumed paramount importance. A headline in an international newspaper lately proclaimed: "Genetic Tests Create Ethical Wilderness. Marketing is Raising Questions: How Much to Tell, and to Whom?" Work on unravelling the sequences of the human genome raises the issue of potential abuse of confidentiality as when information is made available to insurance companies, police, employers, political authorities, etc., which may be detrimental to the individual. Gene manipulation in general can be seen as beneficial for certain medical purposes, but may also represent the danger of a re-emergence of Nazi-type eugenics that postulates the creation of a "master race." What about the efforts to stifle research on fetal tissues and clinical investigations on human subjects, promising biological or chemical preventives and therapeutic agents, even after careful review by ethics committees?

I believe that as scientists we must oppose fanatics of all kinds - psychopaths and political and religious groups in particular - who beat the loudest drums and inhibit scientific progress in many fields. Such opposition is often costly in personal terms, but we must be prepared to pay the price. Of course, that is easy to say after one has passed the peak of one's career. But is there any reasonable alternative worthy of

the trust invested in us by the general public?

Individual scientists are constantly faced with ethical questions in their work, and frequently fall victim to circumstances.

Here are a few recent instances.

1. The pillorying of David Baltimore, a Nobel scientist, for defending one of his laboratory assistants who was the senior author of a paper for which he was a co-author. He had accepted the results of his assistant without question, but another worker alleged that they been fabricated. This case has finally been resolved satisfactorily by a special investigative commission which completely exonerated Baltimore.

2. Another case involved a noted immunologist who claimed to have disproved a widely accepted immunological phenomenon. based on the falsified results his laboratory assistant had reported to him. It took a Nobel scientist, Peter Medawar, to uncover the misdeeds of an unscrupulous laboratory worker.

The moral aspect of these two examples lies in the trust and loyalty accorded to subordinates even when it was mistaken. I might add that Robert Gallo, the NIH AIDS investigator, did the same by supporting a junior colleague who was finally vindicated of falsifying results after years of suffering and unemployment.

As Kurt Vonnegut says - and so it goes.

Another example of the thin line that scientists tread where moral problems are concerned is in the clash between environmental and economic issues. Ibsen embodied that conflict in his play "An Enemy of the People" written in the last century.

Since 1988, Pugwash has called for fundamental changes in human economic and social interaction with the natural environment. The "roots of conflict", as described by John Holdren while accepting the Nobel Peace Prize on behalf of Pugwash, "are the most intractable security problems of all, and those roots of conflict lie in the inadequacies of the economic and environmental circumstances of a majority of the world's peoples". Holdren states, "Either we will achieve an environmentally sustainable prosperity for all, in a world where weapons of mass destruction have disappeared or become irrelevant, or we will all suffer from chaos, conflict, and destruction resulting from the failure to achieve this."

Environmentally sound practices in industry often conflict with economic goals, and scientists and engineers in industry are frequently called upon to make the moral choice between higher profits and the development of clean technology and

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environmentally benign products. Definitions of "sustainability" imply sacrifices and a deep and lasting change in values and lifestyles on a global scale. Such change raises the specter in some eyes of income redistribution and population limitations. It threatens free market principles and centuries of religious and cultural precepts. "Sustainability" appears to deny humans the basic right to grow, which is a right often equated with progress and an avenue to a better life. However, the earth cannot sustain the present rate of consumption in industrialized countries which are heavily dependent on non-renewable sources of energy and natural resources.

But all is not bleak in the environmental field. In some industrialized nations more stringent environmental legislation has resulted in efforts by companies to develop less polluting technology and manufacturing processes. Also, major engineering schools are introducing courses into their programs which teach the engineering student to make environmentally sound decisions and choices at the design level, and thus recognize the consequences of their actions in terms of environmental safety. UC Davis's Department of Civil and Environmental Engineering and UCLA's School of Engineering Pollution Prevention Education Center, and its Center for Clean Technology, are good examples of this development.

In the last analysis, each of us must decide for himself or

herself what positions and personal actions to take on particular issues. We are all human beings with all our foibles and weaknesses. But as scientists we occupy a privileged position in society and therefore are expected to act accordingly on the high ground with all the difficulties those expectations entail.

I would like to end this paper with two quotations from our great national humorist, Mark Twain. In *The Adventures of Huckleberry Finn* he says:

"Persons attempting to find a motive in this narrative will be prosecuted; persons attempting to find a moral in it will be banished; persons attempting to find a plot in it will be shot."

Finally, faced with difficult questions I quote from Twain's answer in his *Life on the Mississippi*:

"I was glad to be able to answer promptly, and I did: said 'I didn't know'"

Nor do I have answers to the moral choices I have dealt with.

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