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# Notes and Comments

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Yoram Dinstein\*

Science, Technology and  
Human Rights

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## I. *Introduction*

The rapid development of science and technology, particularly in the last generation, has had a tremendous impact on human rights. Many, perhaps most, human rights are adversely affected — in actuality or potentiality — by modern machines.<sup>1</sup> The subject has been discussed at great length by scientists and statesmen, lawyers and laymen, preachers and futurologists. But, to understand it in its proper perspective, it is believed that a typological approach is called for. It is necessary to distinguish between four different types of cases, in accordance with the nature of the relationship between science and technology, on the one hand, and human rights, on the other. The relationship may be subsumed under four alternative headings:

- (i) Science and technology may be at the root of a human rights problem and, at the same time, at the root of its solution.
- (ii) Science and technology may be neither at the root of a human rights problem nor at the root of its solution.
- (iii) Science and technology may not be at the root of a human rights problem, yet may be at the root of its solution.
- (iv) Science and technology may be at the root of a human rights problem without being at the root of its solution.

The first type of cases is especially germane to the subject of air pollution. Air pollution is produced primarily (though not

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1. In a seminar convened by the United Nations in Vienna, in 1972, the impact of recent scientific and technological developments on the following human rights was discussed: (a) the right to privacy; (b) the right to democratic government; (c) the right to work; (d) the right to rest and leisure; (e) the right to health; (f) the right to food; (g) the right to education and culture. *Seminar on Human Rights and Scientific and Technological Developments (Vienna, 1972)* 7-12 (Document ST/TAO/HR/45). The list is by no means exhaustive.

exclusively) by the emission of fumes from automobile exhausts and industrial smokestacks. The phenomenon of smog, which is now virtually taken for granted in urban and industrial centers, infringes on the enjoyment of the human right to health.<sup>2</sup> The quality of air in the developed countries has declined steadily in the last decades, and in some places air pollution has already caused many fatalities.<sup>3</sup> The hazards to health emanate from the scientific and technological advances that made the industrial revolution possible and that brought about the car era. Yet science and technology can also alleviate the problem through the development of pollution control devices, which can be installed in cars,<sup>4</sup> as well as in industrial plants.<sup>5</sup> Pollutants may even be removed altogether. Thus, an electric car may possibly replace the omnipresent vehicle with the internal combustion engine spewing noxious gases. Hence, science and technology are at the root of the problem, but they are also at the root of the (complete or partial) solution, provided, of course, that society is willing to spend the required resources in order to make that solution practicable.

The very discussion of air pollution in terms of human rights may give some people pause. Generally speaking, environmentalists are inured to examining pollution issues through the lens of State duties rather than human rights. Still, the obligation devolving on a State to keep the level of pollution within reasonable bounds may be viewed as corresponding to the human right to health. In other words, it is arguable that the individual human being is entitled to insist, as of right, on the State taking the necessary technological measures so as to make the environment more congenial to his or her health. This submission is corroborated by the text of the 1966

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2. On the human right to health, see Article 12 of the 1966 International Covenant on Economic, Social and Cultural Rights cited in note 6, *infra*, as well as Article 25 of the 1948 Universal Declaration of Human Rights (1949 Supp.), 43 Am. J. Int. L. 127 at 131; Article 5(e) (iv) of the 1965 International Convention on the Elimination of All Forms of Racial Discrimination, [1965] United Nations Juridical Yearbook 63 at 66; and Article 11 of part II of the 1961 European Social Charter (1949-1961), 1 European Conventions and Agreements 338 at 346

3. See Anonymous, "Considerations of Technological and Economic Factors in Air Pollution Control" (1975), 44 Cincinnati L. Rev. 573 at 580

4. See Anonymous, "Legal Aspects of Banning Automobiles from Municipal Business Districts" (1971), 7 Colum. J.L. & Soc. Prob. 412 at 413

5. On available forms of air pollution control technology with respect to sulphur oxide emissions (produced by burning coal), see W. F. Cockrell, "Coal Conversion by Electric Utilities: Reconciling Energy Independence and Environmental Protection" (1976-77), 28 Hastings L.J. 1245 at 1267-1268

International Covenant on Economic, Social and Cultural Rights (which came into force in 1976). Article 12 of the Covenant proclaims:

1. The States Parties to the present Covenant recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health.
2. The steps to be taken by the States Parties to the present Covenant to achieve the full realization of this right shall include those necessary for:

...

- (b) The improvement of all aspects of environmental and industrial hygiene.<sup>6</sup>

Looking at ecological problems from the vantage point of human rights signifies that every person has an interest protected by law to live in uncontaminated surroundings. If the idea is carried to its logical conclusion, every individual should have a procedural *jus standi* (before judicial, quasi-judicial or administrative bodies) to complain against violations of his or her substantive right to health. Given the will to do so, all pollution hazards may be categorized as contraventions of human rights.<sup>7</sup>

The second type of linkage between science, technology and human rights is largely based on an optical illusion. By way of illustration, as a result of recent scientific advances, it is now possible, through prenatal and at times even pre-conceptual parental screening, to determine whether a fetus is afflicted with certain defects.<sup>8</sup> If it is established that the fetus has, *e.g.*, Down's syndrome (mongolism), the question arises whether society can impose abortion on the pregnant mother.<sup>9</sup> After all, deformed children are a burden to society in the modern welfare State, and there may be a collective interest not to be encumbered with the onus of raising them. This collective interest may, however, collide head-on with the individual interest of the prospective mother to give birth to her child. A related bone of contention is at what point a fetus turns into a human being, so that performance of an abortion

6. [1966] United Nations Juridical Yearbook 170 at 174

7. Cf. H. L. Dickstein, "National Environmental Hazards and International Law" (1974), 23 Int. & Comp. L.Q. 426 at 439

8. See J. R. Waltz and C. R. Thigpen, "Genetic Screening and Counseling: the Legal and Ethical Issues" (1973-74), 68 Nw.U.L. Rev. 696 at 699-701

9. On the legal, ethical and religious issues pertaining to compulsory abortion of defective progeny, see J. M. Friedman, "Legal Implications of Amniocentesis" (1974-75), 123 U.Pa.L. Rev. 92 at 122ff.

will transgress against its right to life.<sup>10</sup> These are intricate issues with profound legal, ethical and even religious connotations. Nevertheless, science and technology, though ostensibly involved, are in fact at the root neither of the problem (congenital deformity or mental retardation) nor of the possible solution (abortion). The role played by science and technology in this context is very limited: they merely enable us to become aware of the problem ahead of time (before birth) and consequently make it possible to consider anticipatory measures. But only ethics and law can cope with the problem and offer a solution.

The third type lies in between the two preceding categories. Here science and technology, while not at the root of the human rights problem, are at the root of the solution. Take organ transplantation as an example. The scarcity of organs available for transplantation creates an excess of demand over supply, and the selection of recipients is literally tantamount to a life-or-death decision.<sup>11</sup> When there is one donor and three patients in dire need of a new kidney or heart, whose life will be extended (it being understood that selecting one individual to live implies exclusion of the others who may thereby be doomed)? The dilemma is grave, though not entirely new. Doctors have always had to determine which patient should get priority treatment and, particularly during an epidemic, the choice is liable to have terminal consequences for those not fortunate enough to benefit from immediate medical attention. But what is the solution? On ethical grounds, the problem is well-nigh insoluble. Moralists and lawyers have been arguing about it, in one form or another, since the dawn of civilization, without getting any closer to the fount of justice. Attempts are now being made to propose (or at least to consider) legal principles for allocation of scarce medical resources, such as dialysis treatment for kidney failures.<sup>12</sup> However, it must be borne in mind that, in part, the issue can be settled on technological grounds. That is to say, dialysis treatment may become more readily available if the costs are defrayed by society. And in theory it is possible to replace human

10. The modern tendency is to regard the right to life as commencing at the stage of viability (when the fetus is potentially able to live outside the mother's womb, albeit with artificial aid). See N. Shapiro-Libai, "The Right to Abortion" (1975), 5 *Israel Yearbook on Human Rights* 120 at 134

11. See Anonymous, "Patient Selection for Artificial and Transplanted Organs" (1968-69), 82 *Harv. L. Rev.* 1322

12. See Anonymous, "Scarce Medical Resources" (1969), 69 *Colum. L. Rev.* 620-691

organs by artificial devices, which will make it unnecessary to search for donors for transplantation.

Finally, there are instances in which science and technology are only at the root of the human rights problem, but not at the root of the solution. This is, perhaps, the least understood category, so it deserves some elaboration. A simple illustration is that of the polygraph or the breathalyzer. These are devices, produced by modern technology, which can be used to undermine the fundamental freedom from self-incrimination.<sup>13</sup> As such they create a problem. A suspect may be compelled (even by law) to exhale and give a breath sample for an analysis that may reveal consumption of alcohol.<sup>14</sup> And refusal to take a polygraph test<sup>15</sup> may be regarded as evidence of consciousness of guilt.<sup>16</sup> But this is not up to scientists and technologists to determine. It is for lawyers to decide whether the results of lie-detector or breath-detector tests should be admissible in evidence in a criminal trial and, if so, what the ground rules ought to be.

Other examples relate to the potentially deleterious effect of surveillance contrivances and computers on the human right to privacy.<sup>17</sup> The use of sophisticated auditory and visual surveillance methods — such as wiretapping and photographing — make it possible to monitor and record confidential conversations at great distances.<sup>18</sup> The proliferation of data processing devices in the age of the computer has provided the means to gain and disseminate intimate information concerning almost every individual.<sup>19</sup> The

13. On freedom from self-incrimination, see Article 14(3) (g) of the 1966 International Covenant on Civil and Political Rights, [1966] United Nations Juridical Yearbook 178 at 183; Article 8(2) (g) of the 1969 American Convention on Human Rights (1971), 65 Am. J. Int. L. 679 at 683

14. See B. M. Dickens, "The Control of Living Body Materials" (1977), 27 U. Toronto L. J. 142 at 176

15. On the precise meaning of a polygraph test, see Anonymous, "Pinocchio's New Nose" (1973), 48 N.Y.U. L. Rev. 339 at 340-41

16. See Anonymous, "The Emergence of the Polygraph at Trial" (1973), 73 Colum. L. Rev. 1120 at 1143

17. On the human right to privacy, see Article 12 of the 1948 Universal Declaration of Human Rights, *supra*, note 2 at 129; Article 17 of the 1966 International Covenant on Civil and Political Rights, *supra*, note 13 at 183-84; Article 8 of the 1950 European Convention for the Protection of Human Rights and Fundamental Freedoms (1949-61), 1 European Conventions and Agreements 21 at 25; Article 11 of the 1969 American Convention on Human Rights, *supra*, note 13 at 683

18. See J. F. Murphy, "An International Convention on Invasion of Privacy" (1975-76), 8 N.Y.U. J. Int. L. & Pol. 387 at 394-95 and 409

19. See A. R. Miller, "Personal Privacy in the Computer Age: the Challenge of a

intrusion into, indeed the invasion of, privacy is starkly obvious.

Still another example pertains to the spheres of information and education. Modern technology renders brainwashing feasible: George Orwell's *Big Brother* is here several years ahead of the schedule of 1984. Brainwashing makes a mockery of the human rights to information<sup>20</sup> and to education.<sup>21</sup> Brainwashing may appear to be a form of imparting information and implanting education. But forced information or education runs counter to the basic concepts underlying the human rights in question. If you take the human right to education, its essence is not education *per se*; *i.e.*, any education. The thrust of the right is attaining education of the person's (or the parents') choice. The important thing is not to have education, but to have education in accordance with one's convictions.<sup>22</sup> We do not want educated robots, but educated human beings. Education in the form of brainwashing, imposed on a person against his will, is therefore a violation of human rights.

An even more radical case in point is that of "perverted science" (to use Winston Churchill's famous expression<sup>23</sup>), which was employed by the Nazis to torture human beings to death through so-called experimentations. In these agonizing processes inmates of concentration camps were subjected to poisons, epidemics, freezing conditions and extremely high altitudes.<sup>24</sup> Not to mention that technology enabled the Nazis to produce the Holocaust, *viz.*, the efficient extermination of millions of Jews in the gas chambers.

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New Technology in an Information — Oriented Society" (1968-69), 67 Mich. L. Rev. 1091 at 1107-1109

20. On the human right to information, see Article 19 of the 1948 Universal Declaration of Human Rights, *supra*, note 2 at 130; Article 19 of the 1966 International Covenant on Civil and Political Rights, *supra*, note 13 at 184; Article 10 of the 1950 European Convention for the Protection of Human Rights and Fundamental Freedoms, *supra*, note 17 at 26; Article 13 of the 1969 American Convention on Human Rights, *supra*, note 13 at 684

21. On the human right to education, see Article 26 of the 1948 Universal Declaration of Human Rights, *supra*, note 2 at 131-132; Article 13 of the 1966 International Covenant on Economic, Social and Cultural Rights, *supra*, note 6 at 174-75; Article 5 (e) (v) of the 1965 International Convention on the Elimination of All Forms of Racial Discrimination, *supra*, note 2 at 66; Article 2 of 1952 Protocol (No. 1) to the European Convention for the Protection of Human Rights and Fundamental Freedoms (1949-1961), 1 European Conventions and Agreements 39 at 40

22. See Y. Dinstein, "The International Human Rights of Soviet Jewry" (1972), 2 Israel Yearbook on Human Rights 194 at 202

23. W. S. Churchill, Speech (June 18, 1940), *Into Battle* 234 (1941)

24. J. Katz, *Experimentation with Human Beings* (New York: Russell Sage Foundation, 1972) at 292ff.

In all these instances the promotion of human rights is menaced by scientific and technological inventiveness. Yet science and technology are mute when it comes to seeking a solution to the problem. Only the barriers of ethics and law can save humanity from such technological “progress”.

## II.

What do the four types of relationships between science, technology and human rights indicate? They indicate, to my mind, that, as Rabelais stated, “science without conscience is but the ruin of the soul”.<sup>25</sup> It is conscience that should rule the use of science and prevent the abuse of it.

It is often suggested that science is neutral, and that no scientific invention *per se* can possibly have an inimical impact on human rights. Only those who put science to use are supposed to be putting stumbling blocks in the path of fundamental freedoms. That is true in many cases, but we must not regard it as an infallible verity. To give an extreme example, one can discover a virus that will eliminate the whole of mankind in a few minutes. Such scientific gifts we can do without, irrespective of the identity of the scientist and the Government in whose hands the secret will repose. An issue which is perhaps not quite as patent — though it may very well be as potent — in its repercussions is that of genetic engineering and bionics. We are now faced with the possibility of the production of “new versions of man”, like clones (genetic copies of persons) and cyborgs (mixtures of men and machines).<sup>26</sup> We may even encounter, in the not too distant future, hybrids of men and apes whose very presence on this planet will create a plethora of complex ethical and legal problems. As has been pointed out, “experimentation in the direction in which molecular biology is now taking us is experimentation . . . in morality and in law”.<sup>27</sup> We must remember that law is an order of human behaviour.<sup>28</sup> Hence the cardinal question whether such hybrids can be viewed as human beings (who

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25. F. Rabelais, *Gargantua and Pantagruel* (1532), Book II (Pantagruel), ch. 8 (Gargantua's letter to Pantagruel)

26. J.-G. Castel, “Legal Implications of Biomedical Science and Technology in the Twenty-First Century” (1973), 51 *Can. B. Rev.* 119 at 123 and 127-128

27. T. A. Cowan, “Moral Creativity in Science and Law” (1967-68), 22 *Rutgers L. Rev.* 446 at 461

28. See H. Kelsen, *General Theory of Law and State* (Cambridge: Harvard University Press, 1949) at 3



are capable of bearing rights and duties under the law), or apes (who are not). Science fiction? Perhaps. Still, it may be safer to make sure that this brave new world of thinking animals does not materialize.

The only way to ascertain that science does not inflict a calamity on mankind is to distinguish between pure scientific research — which must be allowed without any reservation or qualification — and the practical technological application thereof. The fact that scientific research has come up with something new does not necessarily mean that we must automatically and blindly rush to make technological use of it. Not every theoretical breakthrough should be permitted to become a reality. An unlimited confidence in science merely demonstrates ignorance of it.<sup>29</sup> Lawyers must intervene to verify that some brilliant novel ideas remain in the form of diagrams and equations. A risk-benefit analysis of infant technology may end up with the decision not to open Pandora's box.<sup>30</sup>

Most scientific discoveries and inventions pose no threat to human rights, but they may be abused by those manipulating them. Thus, it is a cliché that the invention of the wheel was one of the greatest advances in the ascendance of man. Yet, in the hands of the Spanish Inquisition, the wheel had a pernicious effect by being turned into a torture rack. As well, the same technological breakthrough which launched the "green revolution" could introduce apocalyptic dimensions into herbicide warfare.<sup>31</sup> Once more lawyers must step in with a view to imposing safeguards that will minimize the risks to society.

There is much built-in opposition to any attempt to regulate science and technology, thus impinging on the *laissez faire* policy which has predominated in this field since time immemorial. But here, as in so many other areas of human endeavour, the *laissez faire* policy is obsolete. As it is, there is no automatic transmutation of pure science into applied science. A number of criteria are currently resorted to before a decision is taken to move ahead. Principally these are economic criteria. The question constantly

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29. See E. Cahn, *Confronting Injustice* (Freeport, New York: Books for Libraries Press, 1972) at 363

30. See H. P. Green, "Law and Genetic Control: Public-Policy Questions" (1976), 265 *Annals of the New York Academy of Sciences* 170 at 173-74

31. See E. Stein, "Impact of New Weapons Technology on International Law: Selected Aspects" (1971), 133 *Recueil des Cours* 223 at 236

asked is whether the proper economic return will ensue from a given investment. But other considerations — social, psychological and the like — also play their part in the decision making process. Thus, an important technological undertaking may be aborted owing to overriding reasons. What is suggested here is that another criterion be added to those commonly accepted already, namely, the ethical yardstick of the impact of a new invention on human rights.

### III.

One of the main problems in the sphere of science, technology and human rights (as in that of the environment) is the existence of a “perception gap” between developed and developing (a euphemism for under-developed) countries in regard to the dangers confronting mankind.<sup>32</sup> Frequently, developing countries adamantly refuse to let human rights considerations impede the progress of bringing the benefits of science and technology to their peoples. The proposition that emerges from the line that they espouse is, “let us have as much applied science as possible, and on the infrastructure of science and technology we shall build an edifice of respect for human rights”. On the other hand, developed nations — that is to say, States that have already set up the scientific infrastructure which developing countries strive to establish — expostulate against abuses of science and technology. The proposition that emanates from what they say is, “beware of science and technology because development may come at the expense of human rights”. The situation, in other words, is reminiscent of the Thousand-and-One-Nights story about the fisherman and the genie. When the genie of science is concealed in the bottle, we want it out so that it will fulfill our fanciful desires. But when it is out, we feel threatened and want to secure it back in the bottle. The Director General of the International Labour Organization, in a report on man and the environment, has appropriately referred to Goethe’s sorcerer’s apprentice, who finds it easier to raise the spirit than to lay it back.<sup>33</sup>

Developing nations believe that, as long as they have not raised the spirit of science by themselves, human rights will remain intact within their boundaries. Consequently, they feel and behave like

32. See C. M. Hassett, “Air Pollution: Possible International Legal and Organizational Responses” (1972), 5 N.Y.U. J. Int. L. & Pol. 1 at 3 and 33

33. *Technology for Freedom: Man in His Environment: the ILO Contribution* (1972) Part I at 2 — Report of the ILO Director General

nonchalant spectators when developed countries relate tales of woe about the negative aspects of science and technology. But environmental disasters may take their toll across international frontiers. In some places "black snow" has fallen owing to pollution abroad.<sup>34</sup> The use of supersonic transports (SSTs) anywhere may jeopardize life everywhere due to depletion in the atmospheric ozone layer.<sup>35</sup> And there are many other examples (such as radiation from nuclear tests) which can attest that no nation is remote enough to be immune.

The extraterritorial activity of developed States in the field of applied science presents problems — at times even special problems — for backward countries. This has been widely recognized insofar as offshore fishing is concerned. Developing nations, whose indigenous population may practically live on fishing carried out in old-fashioned ways, resent the fact that modern fishing fleets from developed States appear in front of their coasts and pre-empt the natural resources of the seas. On the initiative of the Latin American countries, international law is now in the process of being changed through the introduction of 200-mile offshore exclusive economic zones into which the entry of foreign fishing vessels is prohibited.<sup>36</sup> Thus, science and technology may have to stop in front of the exclusive economic zone and give way to superior claims.

A somewhat different area of particular significance to developing nations is the so-called brain drain, *i.e.*, the emigration of top scientists and professionals to well-developed States offering them more lucrative positions. In a sense, this is not a question relating to the impact of science and technology on human rights, but actually a problem generated by the human rights of scientists and technologists. Scientists and technologists, like all other persons, are entitled to benefit from the human right of every person to leave any country, including his own (freedom of emigration).<sup>37</sup> It is true

34. See E. Hambro, "The Human Environment: Stockholm and After" (1974), 28 Year Book of World Affairs 204 at 210

35. See H. L. Dickstein, "International Law and the Environment: Evolving Concepts" (1972), 26 Year Book of World Affairs 245

36. See A. L. Hollick, "The Origins of the 200-Mile Offshore Zones" (1977), 71 Am. J. Int. L. 494-500

37. On freedom of emigration, see Article 13(2) of the 1948 Universal Declaration of Human Rights, *supra*, note 2 at 129; Article 12(2) of the 1966 International Covenant on Civil and Political Rights, *supra*, note 13 at 182; Article 5(d) (ii) of the 1965 International Convention on Elimination of All Forms of Racial Discrimination, *supra*, note 2 at 65; Article 2(2) of the 1963 Protocol (no. 4) to the European Convention for the Protection of Human Rights and Fundamental

that the simultaneous departure of large numbers of, say, physicians may have an exceedingly detrimental effect on a specific developing country and, particularly in time of epidemic, their freedom of emigration may have to be temporarily suspended. But total denial of the right of scientists and professionals to leave a country would create a modern form of indentured labour or white collar serfdom, which is in flagrant violation of human rights. Evidently, if a person received a grant from his Government, and contracted to work for it for an agreed upon period, this contractual obligation has to be met or financial compensation will have to be paid. But it does not follow that a country may demand exorbitant indemnity for all the years of education from which an individual benefited, for that would amount to an indirect curtailment of freedom of emigration.<sup>38</sup>

It should be borne in mind that the brain drain may affect the same country both as a contributor and as a recipient. Thus, for instance, British physicians emigrate to the United States and Canada, yet many Indian physicians immigrate to the United Kingdom, and physicians from Nepal or Bhutan leave for India. But, whereas a certain developing country may suffer grievously from the brain drain, and special temporary concessions must be made to it so as to prevent denuding it of the upper echelons of scientists in time of emergency, developed States should never be permitted to use the pretext of the brain drain to circumscribe freedom of emigration. This is particularly true of a Big Power, and that is why Soviet attempts to excuse violations of the rights of Jewish scientists to emigrate to Israel by brandishing the banner of the brain drain have not been crowned with success. When the USSR imposed a ‘‘diploma tax’’ on all Jewish graduates from institutions of higher learning (in 1972), the pressure of world public opinion forced it to abolish the tax within less than a year.<sup>39</sup>

#### IV.

We find ourselves in this sphere in a position somewhat akin to that

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Freedoms (1961-1970), II European Conventions and Agreements 109 at 110; Article 22(2) of the 1969 American Convention on Human Rights, *supra*, note 13 at 686

38. See Y. Dinstein, ‘‘Freedom of Emigration and Soviet Jewry’’ (1974), 4 *Israel Yearbook on Human Rights* 266 at 273-274

39. On the ‘‘diploma tax’’, see Z. Alexander, ‘‘Immigration to Israel from the U.S.S.R.’’ (1977), 7 *Israel Yearbook on Human Rights* 268 at 292-296

faced by mankind after the first *sputnik* had been launched into orbit in 1957. Everybody realized forthwith that rules regulating the race into outer space must eventually be formulated, but at the same time everyone knew that more experience was needed before a definitive draft could be essayed. Space lawyers had to weigh "the possible dangers of attempting to crystallize the law too soon against the certain dangers of waiting too long".<sup>40</sup> Only by trial and error have the norms pertaining to outer space begun to consolidate over the years.

The same is true in the field of science, technology and human rights. Rules must ultimately emerge, but they cannot be set forth conclusively yet. Currently we are in a speculative stage. Lawyers speculate about possible developments in the future and offer tentative solutions for consideration. Some believe, for instance, that the time will come when a Cybernetics Treaty and a Molecular Biology Treaty will be concluded as detailed codes of protective measures.<sup>41</sup> It is quite palpable, however, that we are not ready for such texts at this juncture.

When we take stock of the present situation, we can only state the obvious by saying that scientific and technological progress must not stop. If we are dissatisfied with some of the byproducts of that progress, we must not lose sight of the enormous benefits that have accrued to mankind from science. In 1811, when methods of production changed with the industrial revolution, the Luddites broke the new machines to which they attributed the economic ills of that period.<sup>42</sup> Many people today seem to be similarly inclined, though for different reasons. They want to destroy the machines that pose a threat to human rights and fundamental freedoms. However, smashing machines never helps. What we must do is control those who make or operate the machines.

How to go about it? Some believe that national policies can protect human rights from the hazards inherent in scientific and technological advances. But that is not the case. National standards may be useful within the boundaries of a single State. Still, only international guidelines can possibly serve as a shield for the whole of mankind. In the realm of ecology, too, for years exclusively

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40. C. W. Jenks, *Space Law* (New York: Praeger, 1965) at 6

41. See C. W. Jenks, "The New Science and the Law of Nations" (1968), 17 *Int. & Comp. L. Q.* 327 at 339

42. See J. S. Watson, *The Reign of George III, 1760-1815* (12 *Oxford History of England*, 1960) at 570-571

national (as distinct from international) standards were common. This national approach and orientation brought parts of the Western world to the verge of an environmental disaster. In some respects, pollution has already caused irreversible harm to the environment: it may be too late to try to rectify now the blunders of the past. Similar blunders must not be perpetrated in regard to other subjects relevant to science, technology and human rights. We must commence the process of defining international ethical standards that will determine the proper and improper uses of science and technology from the viewpoint of human rights.

Defining criteria for the application of science and technology is essential, but it is not enough. It is also imperative to establish international control mechanisms that will supervise the implementation of these tenets. This crucial task cannot be left to the discretion of governments, inasmuch as governments are often the leading culprits in permitting science and technology to encroach on human rights. If governments were the guardians of fundamental freedoms from scientific usurpation, one is immediately led to ask *quis custodiet ipsos custodes?* Proposals to set up an International Ethics Review Board have already been put forward.<sup>43</sup> It is high time that such a Board become a reality.

## V. Conclusions

Our conclusions are:

1. The advancement of science and technology is of decisive importance for the welfare of people everywhere.
2. Freedom of scientific research must not be impaired.
3. A distinction must be made between scientific research and technological application. Not every new invention should necessarily be realized in practice. As a general rule, new inventions that are liable to be used primarily for the infringement of human rights must be regarded as unacceptable.
4. When practical technological application is acceptable, it is essential that it be subjected to regulation and control in accordance with ethical standards. Abuse of new inventions must be prevented.

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43. See B. J. Gardner, "The Potential for Genetic Engineering: a Proposal for International Legal Control" (1975-76), 16 Va. J. Int. L. 403 at 424ff.

5. Ethical standards ought to be formulated on the international level.
6. Impartial international control mechanisms should be set up to weigh the various considerations and determine whether or not a controversial scientific discovery is to be allowed actual implementation.
7. The most fundamental principle is that man is the measure of all things. Science and technology must be subservient to human needs.