# SCIENCE, HEGEMONY & VIOLENCE

# A REQUIEM FOR MODERNITY


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**(UNITED NATIONS UNIVERSITY)**


## Preface

This set of essays, the first in a series of three volumes, has grown out of the collaborative efforts of a group of scholars who have individually been interested in the problems of science and culture for over a decade. They were brought together by a three-year study of science and violence, which in turn was part of a larger Programme on Peace and Global Transformation of the United Nations University. We are grateful to the directors of the programme, Rajni Kothari and Giri Deshingkar, and to the United Nations University for this opportunity to explore jointly, on an experimental basis, a particularly amorphous intellectual problem from outside the formal boundaries of professional philosophy, history and sociology of science. It is in the nature of such an enterprise for intellectual controversies to erupt at virtually every step, and the authors of the volume are particularly grateful for the collaboration of scholars and organizations which hold very different positions on the issues covered in this volume. However, it goes without saying that the views expressed and the analysis presented in the following pages are solely those of the authors. That these views are often strongly expressed only goes to show that the United Nations University is tolerant not only of dissenting ideologies but also of diverse styles of articulating them.


The volume has also gained immensely from detailed comments and criticisms from a number of scholars, writers, editors and science activists. We remember with much gratitude the contributions of Giri Deshingkar, in his incarnation as a student of Chinese science, Edward Goldsmith, Ward Morehouse, M. P. Sinha, Girdhar Rathi, Norma Alvares and Punam Zutshi.

A number of distinguished scholars participated in the formal and informal meetings arranged by us, and commented upon earlier drafts of some of these papers. We are especially grateful to the following for their many helpful suggestions: A. Rahman, T. G. Vaidyanathan, R. Rajaraman, V. Balaji, Sundar Ramchandran, P. R. K. Rao, J. P. S. Uberoi, M. D. Srinivas, Ashok Jhunjhunwala, Dharampal, Jayanta Bandopadhyay, Dhirendra Sharma, Narendra Mehrotra, Ranen Das, Sugata Mitra, Rajni Kothari, Sunil Sahasrabudhey, Paulos M. Gregorios, Narendra Punjwani, Meera Nanda, Tejinder Walia,

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A project such as this depends as much on the living intellectual traditions outside the academia as on earlier academic work. It would be unjust not to make at least a passing reference to the traditions of intellectual understanding kept alive in South Asia by those nameless groups and communities who have dared to defy conventional, agreed-upon categories of the knowledge industry, and encouraged us to argue our case in such detail.

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# 1. Introduction: Science as a reason of state

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The thinking person cannot but notice that since the Second World War, two new reasons of state have been added to the traditional one of national security. These are science and development. In the name of science and development one can today demand enormous sacrifices from, and inflict immense sufferings on, the ordinary citizen. That these are often willingly borne by the citizen is itself a part of the syndrome; for this willingness is an extension of the problem which national security has posed over the centuries.

Defying protests by (and to the mortification of) pacifists and anti-militarists, a significant proportion of ordinary citizens in virtually every country have consistently and willingly died for king and country. There are already signs that at least as large a proportion of citizens is equally willing to lay down their lives heroically for the sake of science and development. In 1985, one Japanese doctor praised the atomic bombing of Hiroshima and Nagasaki for the indirect benefits they have brought to Japan. In an election held soon after the gas tragedy in 1984, the affected citizenry of Bhopal returned the same regime to power that shared the responsibility for the disaster. Likewise, demands for new steel mills and large dams often come from the very regions and sectors in the third world which are most likely to be the first victims of industrialization.

What are the sources of such commitment to the development of science, and the science of development? Can one identify and challenge the philosophical and ideological framework within which the commitment is located? Can one not go beyond shedding tears copiously over the misuse of modern science by wicked politicians, militarists and multinational corporations, and scrutinize the popular culture and philosophy of modern science? May the sources of violence not lie partly in the nature of science itself? Is there something in modern science itself which makes it a human enterprise particularly open to co-optation by the powerful and the wealthy?

These questions have been with us ever since Archimedes devised new weapons for his city state with the hope that they would remain the monopoly of his country and not also become the property of the ungodly. But the questions had a different ring for a long, long time. From the halcyon days of Archimedes to the heady days of early colonialism, science was primarily an instrument, not an end; certainly not the end of any nation or state. Even the states which drew the most handsome economic dividends from the discoveries of modern science and technology, or justified global dominance by referring to their scientific and technological power - I have in mind the nineteenth century colonial powers - did not see science as a reason of state. The reader may remember popular anecdotes about colonial adventurers, or scientifically-minded explorers who sometimes scared off or impressed the natives of Asia and Africa with new forms of black magic based on the discoveries of modern science. The civilizing mission of colonialism thrived on this folklore of encounter between western science and savage superstitions. But in each such instance, it was science that was put to the use of the colonial state; the state was not put to the use of science.

The nature of science has since then changed, and so has the nature of human violence. We are concerned in this volume with these changes and their interrelationships. It is the contention of the essays put together here that these changes can be understood with reference to the mediatory role played by the modern nation-state, the invitation which the culture of modern science extends to state power to use scientific knowledge outside the reaches of the democratic process and, above all, the growth of institutionalized violence in place of the personalized, face-to-face, impassioned violence associated with traditional concepts of sacrifice and feuds.[1]

Ivan Illich has traced the contemporary idea of development to a speech President Harry S. Truman made in 1945.[2] Till then, the word 'development' had had other associations which had very little connection with what we understand by development today. But such was the latent social need for a concept akin to development that, once Truman gave it a new meaning, not only did it quickly acquire wide currency, it was also retrospectively applied to the history of social change in Europe during the previous three hundred odd years.

In a similar way, we can trace the idea of science as a reason of state to a speech made by President John F. Kennedy in 1962. The speech declared one of America's major national goals to be the scientific feat of putting a man on the moon. Though mega-science had already become an important concern of the state during the Second World War, science was, for the first time, projected in Kennedy's speech as a goal of a state and, one might add, as a substitute for conventional politics. A state for the first time on that occasion sought to out-rival another state not in the political or military arena, nor in sports, but in science redefined as dramatic technology. The formulation might have been older and might have been tried out haphazardly earlier but never had it been made so directly a part of the mainstream idiom of politics as in Kennedy's speech. Perhaps Kennedy was reacting to the Russian claim that the Sputniks showed the superiority of the socialist system and, especially, that of 'scientific socialism'. Perhaps he was trying to strengthen his political image as a leader who could help American society to cope with the

scientific age. Whatever the reason, for the first time Kennedy's speech showed that a wide enough political base had been built in a major developed society for the successful use of science as a goal of state and, perhaps, as a means of populist political mobilization. Spectacular science could be now used as a political plank within the United States in the ideological battle against ungodly communism.

Kennedy's speech had another implication. The boundary between science and technology had been softening for about two hundred years. The histories of science and technology could at one time be written separately. But since the early years of the Royal Society, modern scientists had intermittently been seeking legitimacy not only from the philosophical implications of their theories but also from the practical pay-offs of science. The process reached its symbolic culmination in Kennedy's concept of science - a concept which not merely incorporated technology; it gave spectacular technology the central place in science. The speech in fact anticipated the vision which occupies so much space in the popular culture of our day, namely, the image of a science which, by the beginning of the twenty-first century, will be coterminous with technology. By the mid-1980s the proportion of pure scientists to all scientists in the world had fallen to less than five per cent, and the proportion is reportedly falling at a faster rate now. The pure scientist today is an even rarer species than the scientist who does not participate in military research and development.

Yet, at the same time, we can be reasonably sure that the concept of pure science and the conceptual difference between science and technology will be carefully retained. It will be retained not because of the demands of the philosophers of science but because it is only by distinguishing between science and technology that all social criticism of science can continue to be deflected away from science towards technology. A shadowy, ethereal concept of science that has little to do with the real-life endeavours of practicing scientists can then be politically defended as the pursuit of truth uncontaminated by human greed, violence and search for power.

The studies assembled in this volume have these two basic issues - science as a new justificatory principle, and science as technological intervention - as their points of theoretical departure. However, these issues also intersect with a cultural dimension: all the studies are by Indian scholars and have primarily the Indian experience as their backdrop. This is only partly due to the accident of having an Indian editor for this volume. I shall argue that things could hardly have been otherwise.

India has been a remarkable example of an open society in which, since the early years of independence, the political élites have deliberately chosen to see science as the responsibility of the state and have, at the same time, treated it as a sphere of knowledge which should be free from the constraints of day-today politics. Every society decides what content to give to its politics and what to keep out of politics. The Indian state, representing the wishes of a powerful section of the nationalist movement and being led in the early years of independence by Jawaharlal Nehru, a gentleman Fabian steeped in the nineteenth-century vision of human liberation through science, decided to keep the practice of science outside politics but ensured that the scientific estate had a direct,

privileged access to the state. It was as a part of this 'double vision' that Nehru, the modern élites which gathered around him, and the Indian state began to build science as a major source of justification for the Indian state as well as for their political dominance. That the formula did not keep science out of politics but only introduced another kind of politics into science is one of those paradoxes which lie at the heart of the distinctive relationship between science and society in contemporary India.

Thus, to mention a sector which enters the pages of this book often enough, the powers and freedoms that were given to nuclear scientists in India since the days of Homi Bhabha, India's first nuclear boss, were near-total. Firstly, nuclear scientists were freed from all financial constraints. The budget of the nuclear programme - the entire budget, not the budget devoted to research and development - was routinely pushed through parliament without any scrutiny whatsoever. And the expenditures - the entire expenditure, not only the expenditure on laboratories - were never publicly audited. All data on performance - this often boiled down to data on performance failures, unsafe technology and insufficient regard for human rights - were protected by law from the public gaze. And all enquiries made from outside the nuclear establishment were pre-empted with the help of a special act which made it impossible to mount any informed, focused, data-based criticism of India's nuclear programme.[3]

Secondly, nuclear scientists were given enormous scope for research if they moved out of the universities into special research institutions. While universities were starved of funds and allowed to decay, research institutions were richly funded. This might not have been a matter of deliberate policy but it certainly set a context to India's nuclear policy, because what scientists gained in research opportunities in the new institutions, they lost in personal political freedom. As I have already said, the specialized institutions set up by the state were strictly guided by the requirements of secrecy and political 'clearance'; they were expected to be professional, not academic. In other words, a systematic split between political and intellectual freedoms was institutionalized in this area right from the beginning and every young nuclear scientist was forced to choose between the two kinds of freedom.

Thirdly, once some of the finer minds of India were netted by the state in this manner and some of the less scrupulous among them were given access to power, the Indian nuclear programme could be safely handed over to the civilians; the army or the defence ministry did not need to be in the picture at all. The nuclear scientists could be their unofficial proxies. Thus, India's first nuclear explosion in 1974 was a civilian enterprise, with the army only playing second fiddle. Civilian scientists planned, initiated and executed the programme; the army and defence scientists played a peripheral role, providing organizational back-up, on-site security, and control or management of the villagers to be uprooted.

In fact, contrary to popular stereotypes, modern science or scientists in India have not been used by blood-thirsty generals, scheming politicians, and greedy businessmen. Rather, the science establishment, on its own initiative, has taken advantage of the anxieties about national security and the developmental aspirations of a new nation to

gain access to power and resources. Not surprisingly, the record of mainstream scientists in India has been particularly poor in the matter of protecting democratic rights in the country. In fact, in recent years the privileged among Indian scientists have often been the most vigorous critics of civil rights groups struggling for protection against the hazards of a callous nuclear establishment.

I give the example of the Indian nuclear establishment not to make a scapegoat out of it but to draw attention to the manner in which the link between science and violence in India has been strengthened by forces within the culture of Indian science, forces which in other cultures of science in some other parts of the world have been either less visible or less powerful.

The curious case of the nuclearization of India has not one but three morals to it. First, as modern science gets more and more incorporated into technology, it necessarily has to be increasingly justified in terms of technology. The frequent exhortations to have a more 'scientific temper' (exhortations to which all Indians, but particularly the 'less civilized' traditional Indians, are subjected by the scientific and political establishments) and the repeated references to the scientific worldview as a philosophical venture in learned seminars in India are not taken seriously by 'normal' scientists (who do 'normal' science *à la* Thomas Kuhn), or by their political patrons and their admirers. For both, the slogan of the 'scientific temper' is a means of legitimizing their new-found status in Indian society. Both like to define the 'temper' as the spirit of technology and the instrumentalism which is an inescapable part of that spirit. The invocation of the 'temper' almost invariably goes with a negative reading of India's traditional cultures and ways of life, seen as impediments to a modern technological order, and with the search for uncritical legitimacy for all forms of technology - seen as an undifferentiated mass of knowledge, institutions and persons.

As a result, conspicuous technology has become gradually the official goal of science in India, as well as the main source of legitimacy for science among the Indian middle classes. Thanks to the media, government-controlled as well as uncontrolled, and thanks to the values propagated by the westernized education system, the Indian middle classes have come to see science as primarily spectacular technology. They expect this technology to allow the country to tackle its basic political and social problems and thus ensure the continued political domination of an apolitical, that is technocratic, modern élite over the decision-making process, defying the democratic system. This expectation partly explains why science is advertised and sold in India the way consumer products are sold in any market economy, and why it is sought to be sold by the Indian élites as a cure-all for the ills of Indian society.[4] Such a public consciousness moves from one euphoria to another. In the 1950s and 1960s, it was Atom for Peace, supposedly the final solution of all energy problems of India; in the '60s and '70s it was the Green Revolution, reportedly the patented cure for food shortages in the country; in the '70s end '80s it is Operation Flood, the talisman for malnutrition through the easy availability of milk for every poor household in the country. In this environment it does not matter whether the technology is innovative or replicative, moral or immoral, obsolete or new. For technology comes to represent an escape from the dirtyness of politics; it becomes an

indicator of Brahminic purity, a form of social change which ensures a place in the sun for portions of the middle classes whom the democratic process otherwise tends to marginalize, an anxiety-binding agent in the public realm, and often a media-based exercise in public relations. That is why, as with nuclear science, the adaptation in India of decades-old western technologies are advertised and purchased as great leaps forward in science, even when such adaptations turn entire disciplines or areas of knowledge into mere intellectual machines for the adaptation, replication and testing of shop-worn western models which have often been given up in the west itself as too dangerous or as ecologically non-viable.

The second moral of the story is more disturbing. Because the concept of science in this model of scientific growth is that of the ultimate key to all problems facing the country, scientists subscribing to the model can lay claims to the charisma which in some other political cultures belongs exclusively to god-kings. In the process, scientists become one of the two ultimate sources of legitimacy for the Indian state among the middle classes- the others, as I indicated at the beginning, are development experts and experts on national security. These three kinds of specialists - the scientists, the developmentalists and the security experts - are the ones to assess and pass final judgement on Indian culture, on what is good in it and what is defective. Generally it turns out that what is good in the Indic civilization, according to these specialists, is exactly that which is good for modern science and what is defective in the civilization is exactly that which impedes modern science. Predictably, this presumption of a total fit between the needs of a good society and the needs of modern science leaves no scope for any assessment and evaluation of scientists by non-scientists, particularly by those rooted in the 'little cultures' of India. Nor does it give any scope for instituting controls on the scientific establishment through a competitive political process and democratic participation.[5]

The political asymmetry or inequality between the scientist and the laity is endorsed not only by the concept of expertise which dominates the culture of modern science globally, but also by a philosophy of science which allows the laity to criticize modern science only in terms of its use value, that is, its social and political deployment and not in terms of its end values, that is, the social and philosophical goals and assumptions built into the heart of the culture and the text of modern science. Even this limited criticism of the social and political relationships of science has to be ventured, to be audible to the modern world, in terms of the criteria specified by the dominant philosophy of modern science itself. Thus, a plethora of critical evaluations of the practice of modern science in recent times have ended up by arguing, rather pathetically, that they, the evaluations, are motivated more by the spirit of modern science than the normal practitioners of modern science themselves, that the criticisms are in fact congruent with the latest discoveries of post-Einsteinian physics, microbiology and post-Freudian social psychiatry. From Erich Fromm to Fritjof Capra to Maharishi Mahesh Yogi, it is roughly the same story.

The third moral of the story is even more painful. By the very nature of its instrumental-managerial orientation to Indian society, modern science has established a secure relationship with the philosophy and practice of development in India. Indian developmentalists are now faced with the obvious fact that the developmental vision

cannot be universalized, for the earth just does not have the resources for the entire world to attain the consumption levels of the developed west. It does not have such resources now, nor will it have them in the distant future. The developmentalists, therefore, have a vested interest in linking up with the drive for theatrical science to create the illusion of spectacular development which, in essence, consists of occasional dramatic demonstrations of technological capability based on a standard technology-transfer model. Under this model, highly visible short-term technological performance in small areas yields nation-wide political dividends. This model includes a clearly delimited space for 'dissent', too. While some questions are grudgingly allowed about the social consequences of technology - about modern agronomy, large dams, hydel projects, new dairy technology, modern health care systems, space flights, Antarctica expeditions, et cetera - no question can be raised about the nature of technology itself.

Roughly similar links have grown between science and the élite perceptions of the security needs of India. Like other world societies such as Brazil, India too has begun to show a high growth rate and export potentials in defence-related industries and, like some developed societies such as France and the United States, India, too, is perfectly willing to make security anxieties a central plank of its political identity.

Apparently, what Robert Jungk says about nuclear energy holds good for modern science in general.[6] Namely, that modern science has the capacity within it to sustain a culture of science which is incompatible with democratic governance as well as with the democratic rights of those who are turned into the subjects of modern science and technology. In India at least, the culture of modern science *has* built an inverse relationship with the culture of open politics and has began to produce new forms of secrecy, centralization, disinformation and authoritarian organizational structures. Nuclear science in this respect has only been true to the overall cultural design of modern science and technology in the country.[7]

Science, I have said, has become a new reason of state. The state and its various arms can kill, maim or exploit in the name of science. Science in turn, as a *raison d'état,* can inflict violence in the name of national security or development and - this is the change - increasingly under its own flag and for its own sake. There are now scientists, political leaders and intellectuals in India - as in other similarly placed societies - who are perfectly willing to close the polity if that ensures faster scientific growth. And there are now scientifically-minded Indian citizens who are as willing to sacrifice millions of ordinary Indians to advance the cause of science and science-based development.

In such a world, the intellectual challenge is to build the basis of resistance to militarization and organized violence, firstly by providing a better understanding of how modern science or technology is gradually becoming a substitute for politics in many societies, and secondly by defying the middle-class consensus against bringing the estate of science within the scope of public life or politics. This plea for the repoliticization of science - by which I primarily mean the political audit of science by those outside the estate of science and by its victims, not state control or mechanical parliamentary or legislative scrutiny - will not be popular with those who run the one-million-strong Indian

estate of science, the world's third-largest mass of scientific manpower, nor with the urban middle classes, increasingly hostile to the idea of politics. But it might be more acceptable to those seeking to survive the loving embrace of an increasingly violent science and an increasingly violent model of scientific development at the lower rungs of Indian society.

Fortunately, India also happens to be a country where the intellectual tradition - if for a moment we forget the colonial overtones of such a statement - is truly bicultural. It has had six hundred years of exposure to the west and at least two hundred years of experience in incorporating and internalizing not merely the west but specifically western systems of knowledge. It need not necessarily exercise the option that it has of defensively rejecting modern science *in toto* and falling back upon the purity of its traditional systems of knowledge. It can, instead, choose the option of creatively assessing the modern system of knowledge, and then integrating important segments of it within the frame of its traditional visions of knowledge. In other words, the Indic civilization today, because it straddles two cultures, has the capacity to reverse the usual one-way procedure of enriching modern science by integrating within it significant elements from all other sciences - premodern, non-modern and postmodern - as a further proof of the universality and syncretism of modern science. Instead of using an edited version of modern science for Indian purposes, India can use an edited version of its traditional sciences for contemporary purposes.

This argument can be pushed in another direction. Contemporary India, by virtue of its bicultural experience, manages to epitomize the global problem of knowledge and power in our times. There is a continuity between the Indian experience of an increasingly violent modern science, encroaching upon other traditions of knowledge and social life, and the western experience with modern science as the dominant cultural principle resisting the emergence of new cultures of knowledge. There is a continuity between the experiences of the two civilizations even at the level of élite and middle-class responses to the situation. The modern Indian élites and middle classes have a fear of the present, explained away, with the help of some forms of history, as only a fear of the past. The western élites and middle classes have a fear of the future, explained away, with the help of some forms of futurology, as only the fear of a future un-restrained by or disjunctive with the present. Evidently, the élites of both worlds have in common the ambition of containing the future by controlling the present politics of knowledge. The former fear the process of democratization of India which is marginalizing them; the latter fear the possibility of future democratization of the world which will marginalize them. And, as if to spite those who pin their hopes in matters such as this on generational changes, on the expectation that the youth will liberate them from the certitudes of the past, in India the emerging middle-class élites seem to nurture the same hope of substituting science for politics, because politics for them is irrational and messy, and science is rational, neat and controllable. Meanwhile in the west a project takes shape which seeks to derive all politics from science for roughly the same set of reasons.

Put simply, the challenge for the movements for alternative science and technology in the west is to generate new knowledge in the future by participating in the politics of

knowledge today. But to participate meaningfully in the politics of knowledge today, they must take into account and build upon the ongoing intellectual and political battles in societies where alternatives, or at least alternative baselines, exist in the present, in the form of traditional systems of knowledge that have survived and are struggling against the hegemony of modern science. In India, traditional systems of knowledge may not have provided ready-made solutions to the present crisis of knowledge and power, but they have certainly become a part of the repertoire of the dissenting movements of science. Seen thus, the crisis of science in India becomes, for all practical purposes, coterminous with the crisis of science globally. And the crisis of global science, in turn, becomes an extension of the Indian experience with modern science over the last 150 years.

The essays in this volume and the volumes which will follow take up the intellectual challenge of these linkages between science, violence and culture in the east and west, and the role which the modern nation-state and the ideology of development have begun to play in these linkages. They provide a critique of the domination and violence which accompany modern science not as part of a 'mystical', 'life-denying' or 'ascetic' attempt to return to the so-called purity and innocence of premodern India but as one aspect of the point of view of marginalized Indians who have less and less voice in the 'expert' decisions which shape their lives, and who often have to use the language of mysticism and life-denial to resist being brainwashed into applauding each onslaught on their dignity, autonomy and survival as a momentous achievement of the modern Indian nation-state.

These essays seek to give voice to such semi-articulate protests. That is why the essays make no clear distinction between what is supposedly sacrosanct about modern science and what is by common consent lamentable about it, between that which is professionally admissible as a critique of modern science and that which is not. Nor do they pretend to be impartial according to the idea of impartiality which modern science seeks to impose on the laity. Together, the essays try to make a case the way a task force or a research team in a modern scientific laboratory pursues one particular hypothesis to the exclusion of others. It is for the readers and the intellectual community to judge if the case has indeed been made.

In this, our first volume, we concentrate on three aspects of the relationship between science and violence. The volume opens with an essay which examines the issues of dominance and violence as they are encoded in the cosmology that gets telescoped into the culture of modern science. Jatinder Bajaj is concerned with the way power has become - and indeed must become - central to the enterprise called modern science. His ironic essay is not only a biographical enquiry into the 'genetic equipment' of modern science, it is also a philosophical audit of the scientific vision and values of Francis Bacon, popularly viewed as the father of modern science and its first and most important philosopher. Bajaj argues that violence is written into Bacon's concept of true and useful knowledge, in his homocentric vision of the natural world, and in his masculine perception of nature, including human nature. To Bacon nature was an enemy which needed to be defeated and tortured - the expression was his - so that its secrets or powers

could be extracted for the benefit of the human race. Thus not only was he the first to provide philosophical legitimacy to the human quest for omnipotence and omniscience through science, he was also the first to reconceptualize the non-human cosmos as an experimental subject fit only for manipulative intervention. It is implicit in Bajaj's argument that what at one time may have looked like innocent metaphors about the natural world are now major clues to the character of science in our times. For the scientific enterprise, which attained its full stature in the two world wars, had actually been worked out in some detail two centuries earlier, by the acknowledged father of modern science himself.

Bajaj, while not dealing directly with the issue of culture or with the cultural context which produced the inner contradictions and ambivalences of Bacon, nevertheless includes in the analysis a significant cultural critique. The critique, ventured with the help of three examples, proposes that at some plane the Baconian worldview fits the concept of true and useful knowledge in the European worldview. The fit explains, according to Bajaj, why even those who want to break out of the Baconian grid end up by accepting the two basic Baconian premises that (1) the positive sciences yield absolute truths and (2) the western hegemony in science and/or life is inevitable, for the hegemony is ultimately based on Baconian truths about the natural world and on Baconian methods of reaching these truths. That Bajaj uses as his examples three of the best-known post-positivist thinkers - Thomas Kuhn, Joseph Needham and Edmund Husserl - gives his analysis especial relevance and, one might add, poignancy.

In the second essay, Claude Alvares locates the main argument of the first essay in a larger and more contemporary political framework. Alvares provides an impassioned social and philosophical survey of the domain in which knowledge and power intersect in a politically hierarchized world, and examines the bonds between science, colonialism and violence. In the process, he makes a case for what philosopher Ram Chandra Gandhi calls a self-conscious 'cognitive indifference' towards Galilean science and its products, for, in fact, a luddite vision.

Alvares organizes his paper around the assumptions and consequences of the scientific method. He argues that the scientific method itself has become not only anti-rational, it has become culturally and socially oppressive, ecocidal and generally anti-life. Using two overlapping 'scales of restrictions', one representing the continuum from pure experience to pure abstraction, the other from organism/nature to machine/science, he argues that modern science has come to represent the end of the continuum where abstractions and machines predominate. To the extent modern science seeks to replace the experiential by the a historically abstract, and the natural by the man-made (or rather expert-made), it has to have an expansionist thrust, and it must necessarily deny democratic participation in the production, validation and evaluation of scientific knowledge. This process cannot but lead to close links between science and violence. Alvares draws upon individuals and movements which represent the experiential apperception of the natural world, providing a philosophical baseline both for the social criticism of science and for the exploration of new forms of knowledge reflecting the visions of those who live in - and with - the world of experience, which are simultaneously a compassionate statement on nature and on

human nature. On the basis of the work of these individuals and movements, Alvares suggests that social critics and political activists in the third world will have to move towards a luddite position to defy the middle-class demands for 'sane', 'constructive' criticisms of the 'mis-applications' of science in our times.

In the next essay, Shiv Visvanathan develops some of the themes implicit in the second part of Bajaj's essay. Visvanathan's analysis explores the scope and limits of the contemporary liberal critiques of modern science and technology through a sociological scrutiny of the popular works of Robert Jungk on the social and historical contexts of nuclear weapons, development and nuclear energy. Using the example of individual scientists, Visvanathan argues that the life histories of the major nuclear physicists in this century have been a movement from innocence, freedom and conviviality - from play, discovery and *communitas* - to the tyranny of secrecy, control and, in some cases, elatory nihilism. The biographies reflect not so much the varied responses of scientists to science and society as the prototypical relationships between nuclear science and the scientists' self-defined social responsibility, which in turn reflects the culturally-defined relationship between knowledge and power in the modern west.

These larger psychological and cultural forces, Visvanathan suggests, are mirrored in the works of Robert Jungk, read as a documentation of public awareness and as a testament to the liberal imagination. Jungk's works identify three major changes in the movement from pre-war to post-war science: 'the degeneration of science as a play form; the shift within science from epistemic uncertainty to vivisectionist hegemony; and the displacement of science from the university to the company town'. Visvanathan deals with each of the three changes in considerable detail and, later, in the essays by Veena Das and Vandana Shiva, the last two processes of change re-emerge as perceived problems in popular imagination, people's movements, and in the popular philosophy of science. In Shiva's work particularly, Visvanathan's analysis of the issue of survival, of both humanity and nature, in its encounter with the disembodied structures of modern science comes full circle.

The human predicament of confronting science-as-disembodied knowledge is also the major theme in the following essay. In it Manu Kothari and Lopa Mehta grapple with the elusive problem of the sources of violence in the disciplinary culture of modern medicine. They search for these sources in (1) the worldview of modern medicine which perforce stresses diagnosis, investigation and intervention, even where none of them can be of any use whatsoever to the patient or to the process of healing; (2) the self-interest of the doctor, the hospital, the pharmacist and the multinational pharmaceutical company - all of which have become interdependent institutions under the regime of modern medicine; and (3) the nature of the expectations the lay persons have from modern medicine, expectations which modern medical specialists have encouraged and nurtured. Kothari and Mehta's elegantly wry essay should be read as an analysis of how the doctor gets caught in his self-created image of being omniscient and omnipotent and how the specific links between knowledge and power work in practice in the modern system of healing.

Unlike the first three essays, Kothari and Mehta end their critique with outlines of a prospectus for a nonviolent science of medicine which would be a syncretic structure of both modern and nonmodern forms. The liberation of modern medicine lies, they seem to argue, not in the sophisticated criticisms offered from within the bounds of formal medical sociology and medical anthropology, but in the everyday morality of the ordinary citizen, in the wisdom of the body, and in the very different kind of intervention which bases itself on the philosophy of non-intervention. (In a recent paper T. S. Ananthu has argued that the creative powers of some like Masanobu Fukuoka, alternative agronomist and the author of One-Straw *Revolution,* come precisely from a worldview which rejects over-intervention in and over-manipulation of nature; it is a worldview which enjoins one to do what one cannot but do, untouched by and beyond the reach of the modern concept of intrusive activism.)[8] In this respect Kothari and Mehta take to logical culmination the anti-professionalism implicit in Alvares' essay.

Veena Das handles the issue of the everyday morality of ordinary citizens in a different way. She examines in her work the popular construction of the links between science and violence in the modern west, and suggests that an awareness of the nature of the problem and a radical criticism of modern science subtly inform popular literature even in the science-dominated societies of the west. Analysing the works of the popular writer of science fiction, Ira Levin, she shows how he indirectly acknowledges that an understanding of contemporary evil requires examination of the way any system of knowledge becomes a new source of violence and oppression, once it has acquired power or the capacity to bestow power.

In the four paradigmatic situations which Das defines with the help of Levin's novels, human ordinariness is seen simultaneously as a cause of, a protest against, and a protection from the violence induced by four orders of technology. In the first case violence comes from the technology of magic, from witchcraft in a modern apartment house which produces the ultimate evil as a byproduct of everyday greed and competitiveness. That evil in turn is offset against the innocence and humane instincts of everyday life which protect the violated from being fully brutalized *(Rosemary's Baby).* In the second case, technology seeks to duplicate the satanic in everyday life through genetic engineering, by using the rhythm of parent-child dynamics and by carefully and 'scientifically' altering the developmental milestones of normal childhood. The plan is subverted by less ingenious minds, operating from within the bounds of normality (*The Boys from Brazil).* In the third situation, violence is connected with the magic-like technology of robotics within the boundaries of a relatively isolated community. The violence comes in a sanitized form as a consequence of attempts to actualize middle-class daydreams derived from the world of advertisements and commercials. Once again, ordinary, unheroic womanliness provides the critical consciousness which sees through placidity, order and community feelings and uncovers the hidden core of technological terror, even though in the process of this discovery the source of the critical insight is herself destroyed *(Stepford Wives).* The fourth situation is that of a magic-less, total technology of a society which is in a state of perfect violence through not being unnecessarily violent, and by not allowing violence to become an end in itself. The technology of control is so perfected in the society that the accidentally uncontrollable

has been given a place in the decision-making structures of the society. This higher-order co-optation is seen through and subverted by a person with human imperfections, motivated by the alternative rationality and wisdom associated with ordinariness (*This Perfect Day).*

In all four situations, the most fearsome part of technology, as recognized by the popular consciousness projected into the novels, is the way dissent is destroyed or sought to be destroyed - through a direct, demonic technology of anti-rational violence deployed rationally *(Rosemary's Baby),* by hiding a source of future nihilistic violence, the Hitler gene, under the 'benign' psychotechnology of everyday child rearing *(The Boys from Brazil),* through semi-institutionalized scientific violence *(Stepford Wives),* or by fully institutionalizing a science of violence which is so perfectly structured and monitored that, paradoxically, it does not have to be violent *(This Perfect Day).* In the process, we are made aware that while violence is ubiquitous, it acquires a particular tonality when it enters human relationships riding piggyback on modern science and technology.

Vandana Shiva returns to the issues raised by Alvares, Kothari and Mehta through a different route - she deals with the growth, dominance and possible decline of a science which is quintessentially reductionist and, thus, necessarily violent. This violence is directed not merely towards the objects and alleged beneficiaries of modern science but also towards its subjects and, ultimately, towards scientific knowledge itself. Using examples of violence inflicted through and by science and of popular resistance to it in agriculture and health, Shiva argues that the regime of a violent, reductionist science typifies a compact between modern capitalism represented by the multinational corporations, and the third-world élites, won over through a share of the profits from such science and through slogans about progress, development and the scientific temper.

The most damaging - some may say, encouraging - part of Shiva's critique is her reference to the self-destructive capabilities of modern reductionist science. Not only does such a science cut off its practitioners from each other in the name of specialization, it also pushes into the scientific unconscious those scientific findings which go against the grain of the dominant culture of science. It is possible to argue on the basis of her essay that modern, reductionist science is increasingly dependent on only its coercive might to perpetuate its dominance. For its earlier dependence on ideology and on its own internal self-corrective mechanisms have declined noticeably in the postwar period.

Though this introduction has dealt with the issue of the state as it mediates between science and society, most essays in the book recognize but do not directly grapple with the links between the secular power of the state and the new hierarchies set up by modern science. In the final essay by Shiv Visvanathan, therefore, a central concern of the editor has come full circle. The essay establishes a continuity between the techno-managerial vision, seen as an inescapable part of the modern nation-state system, and the quality of violence associated with modern science in recent decades. Visvanathan sees the worldviews and the ways of life of the tribal and the peasant as a statement against - and often a defiance of - the hegemonism of a vivisectionist science which ultimately has to end up as a mandate for triage. The part-object relations endorsed by the scientific

method, as Sigmund Freud might have diagnosed the psychopathology, is ultimately projected on to the human world. The laity are increasingly seen as dispensable experimental objects, and the victims' cries of agony gradually become the identifiers of a silent species waiting to be classified or analysed as a set of symptoms in a clinical laboratory. Objectivity becomes objectification. It is thus that the well-known instances of the violent application of science, such as nuclear weaponry, become blown-up versions of normal, everyday science committed to social relevance and political pragmatism.

At another plane, Visvanathan in his second essay transforms a live issue of rights (of minorities, populations displaced by development projects, and of the socially or politically 'disabled') into a formidable theoretical poser about the nature of the modern nation-state and its links with modern science. He makes a powerful plea for a place for the spiritual and the sacred in the public realm as the basis of resistance against the 'laboratory state'.

Three points should be emphasized at the end. First, the authors of these essays were invited to include in their analysis a discussion of the philosophical and ethical assumptions of their work on science and violence and not to produce overly-specific scientific papers. Most of them have done so and this has resulted in some minor repetitions. We have allowed this to pass because we wanted the authors to complete their statements; we thought such completeness necessary for a better understanding of the burgeoning movements for alternative science and technology in India and in other third-world societies. Another volume in this series will try to provide a social and philosophical audit of these movements, which have now in some cases moved into class-rooms and laboratories from villages and slums. It suffices to say here that these movements often claim that the kinds of science and technology they advocate are less violent, more compassionate and more respectful towards traditional systems of knowledge, culture values and nature. It is partly in the context of these claims that we have tried here to explore in detail some of the worldviews from within which the critiques of establishment science and of the science establishment have emerged.

Even at the risk of being repetitive, I must draw the reader's attention to the fact that many representatives of such dissenting movements, when they speak of violence and nonviolence in science, do not have in mind only the environment of science but also its text. They try to relate to other science movements operating from the baseline of a science-for-all kind of ideology only to the extent the latter are willing to go beyond the idea of equal sharing of the fruits of modern science and willing to build upon not only the experiences of suffering but also the cognitive orders of the victims of modern science.

This volume provides an insight into the worldview from within which such outsider's criticisms of science and technology in South Asia are increasingly being mounted. And it is certainly not an accident that most of the authors in this volume have links, direct or indirect, with intellectual and/or grassroot movements in India for a more humane science, in fact for a more humane relationship between knowledge and power in general.

Secondly, one must emphasize that the contributors to this volume do not share the same theoretical frame. At least two of them do not grant science the plurality which others take for granted; one of them takes a clear luddite position. The commonalities among the essays lie elsewhere - in their concern with the ethics of knowledge; in their belief that the text, in addition to the context, of a knowledge system encodes the categories of the culture which produces the system in the first place; in their belief that the growth of modern science at the expense of all other forms of science need not be the primary civilizational goal in a world in which the culture of modern science has consistently endorsed existing global hierarchies and shown utter disregard for defeated societies and systems of knowledge; and in their faith that modern science need not be perceived as the last word in human rationality, it being like all human ventures, limited by space, time and human consciousness.

Finally, the essays are held together by two important but latent intellectual concerns which are not easy to define. The first is a certain sensitivity to institutionalized, as distinct from the direct, violence associated with science in our age. Science violates not merely through the super-bombs powered by paranoia and super-greed; science violates also through bureaucratization of human suffering and through 'scientization' itself. The principle of clinical iatrogeny is not merely a differentia of modern medicine; it is built into the culture of modern science in general. That is why science is often the most violent when it looks the least violent and when the urban middle classes are most prepared to applaud its products and performance. All the essays in this volume are sensitive to this double-edged nature of scientific violence. Even Visvanathan's first essay, which deals with the overt violence of nuclear weaponry, looks at that violence through a theoretical scheme fully sensitive to the other face and the other violence of science.

The second intellectual concern which binds the essays together is their attempt to relate the critique of modern science to an implicit, almost unwitting, sensitivity to the problems of violence which the 'common man', the 'savage', the 'insane' and the 'childish' often show. The essays in this book are a celebration of the dissent from the standardized formats of dissent in the modern world which we, in the privileged sector of the third world, have internalized as parts of our socialization and acculturation to the modern world. Indeed, the essays take seriously the feelings, ideas and values which the victims of modern science share in many traditional societies and push these feelings, ideas and values to their theoretical conclusion. That the authors often support their insights with examples drawn from the western world through a mode of discourse comprehensible primarily to the moderns should not mislead us. What Chinua. Achebe says in another context can also, with a slight alteration, be said about these studies: Let no one be taken in by the fact that we deal with western issues in a western language; we want to do unheard-of things with them.

# 2. Francis Bacon, the first philosopher of modern science: A non-western view

JATINDER K. BAJAJ

Francis Bacon was born in January 1561 in Elizabethan England. His father, Sir Nicholas Bacon, held the highest judicial office of State, the Lord Keeper of the Great Seal, at the court of Elizabeth I. His mother, Anne, was the daughter of Edward VI's tutor, and Anne's sister was married to the Lord Treasurer. Born into this highly political family, the first love of Francis Bacon, it seems, was palace politics. After finishing his education at Trinity College, Cambridge, at the early age of sixteen, he was admitted to Gray's Inn, which he left in 1576 for France. He lived there for a few years under the care of the Queen's ambassador to the French Court. He returned to England for good in February 1579, resumed his studies and then pursued a career in law and politics. It is said that he was adept at palace intrigue, flattery of the powerful, and conspiring against friends. He did prosecute a personal benefactor, the Earl of Essex, and then, after the execution of the Earl, he wrote a pamphlet condemning him, allegedly to curry favour with the Queen. Aided by such means, he rose, slowly, to the position of Lord Keeper (later designated Lord Chancellor) that his father had had. He also obtained the title of Baron Verulam, and later that of Viscount St Albans.

Lord Bacon in his judicial office is known to have misused his authority to torture prisoners and to issue injudicious monopolies to please his superiors at court. He accepted bribes from litigants while occupying the highest judicial chair in England. For this he was impeached by the House of Commons and sentenced by the House of Lords in 1626 to a large fine, imprisonment at the pleasure of the King, and banishment from court for life. The sentence was not fully executed as Lord Bacon died in 1626.[1]

Despite a hectic political career, Lord Bacon found the time to write a number of literary and philosophical works. These works mainly preach a reorientation to learning, providing a new direction, organization and method for the business of acquiring knowledge about the world. In this attempt he, like Aristotle, wanted to take all knowledge as his domain, even though he criticized Aristotle, often sharply. In his major work, *A Treatise on the Advancement of Learning,* first written in English in 1605, and later expanded in the Latin version *De Augmentis,* we find him propounding authoritatively his theories on all subjects under the sun. This book largely defines the new direction and organization of learning and also outlines the ethics and norms of Bacon's ideal society. In his other major work, *Novum Organum,* published in 1921, Bacon proposed to establish a new method for acquiring knowledge, promising to give humanity a 'new engine' that would simplify the art of discovery and lead men quickly to the final truths about nature.

Bacon wrote his philosophical and literary works at the threshold of the 'modern scientific revolution'. His understanding of the future direction of western society was so exact that in no time knowledge in Europe began to be organized on the lines he had suggested, and academicians everywhere were venerating him as a pioneer. Prophet of the new science, and the new society that Europe was to build, he is still one of its pillars. Much of the scholarship expended on modern science since his time remains more or less true to the Baconian prescription for science and learning. So much so that the modern sciences that have developed since the sixteenth century are often known as Baconian sciences, and modern scholars try to resolve their often irresolvable disputes about the nature and method of modern science by referring to Bacon.[2]

That a corrupt judge and an unscrupulous politician should be the prophet of a new science and a new society perhaps reflects the nature of that science and society. Also, a study of Bacon's thought and life can be a particularly useful exercise because Bacon, in his time, did not feel the need to clothe his ideas in liberal political terminology and the scholarly jargon that has become a requisite since. Perhaps Bacon could not afford to sound liberal and vague. Liberalism (both in its broad and political senses) was the privilege of later western philosophers and politicians who wrote at a time when the west and western science had already established their dominance over the world. Bacon, writing earlier, had to be clear, precise, and forceful.

In the following pages we shall try to trace the roots of modern science as revealed in Bacon's works, relying mainly on his two major ones: his work as a methodologist of a new science in Novum *Organum* and as a prophet of the new ethics of knowledge in *The Advancement of Learning (De Augmentis).* At a time when anyone talking or writing of science finds it expedient to clothe himself in the sophisticated language of the philosophy of science, it is a pleasure to turn to the clarity and precision of Bacon's writing. That is why in the following pages we shall often quote him extensively, hoping that it will help the reader get an idea of the mind from which modern science derives its worldview.

**I. The methodologist**

Bacon saw himself, and is often seen by others, as a philosopher of science who revolutionized the method of gaining knowledge about the world. He was convinced that the ages before him had failed to make any visible progress in the sciences because they lacked the method. Thus, *in The Advancement of Learning* he declares:

Invention is of two very different kinds: the one of arts and science, the other of arguments and discourse. The former I set down as absolutely deficient.... And as the immense regions of the West Indies had never been discovered, if the use of the compass had not first been known, it is no wonder that the advancement of arts hath made no greater progress, when the *art of inventing and discovering the sciences remains hitherto unknown...'* [3] [my italics]

And again *in Novum Organum:*

Let men, therefore, cease to wonder if the whole course of science be not run, when all have wandered from the path, quitting it entirely, and deserting experience, or involving themselves in mazes, and wandering about, whilst a regularly combined system would lead them in a sure track, through its wilds to the day of axioms;... (I. 82)[4]

He was also convinced that he had arrived at the correct method which would lead people 'in a sure track to the day of axioms', through the use of which, 'if we had but anyone who could actually answer our interrogations of nature, the invention of all causes and sciences would be the labour of but a few years' (I. 112). An entire treatise, the *Novum Organum,* was devoted to expounding his methodological discoveries, which he declared was 'more important than the rest' of his work.

And as there are three ways of walking, viz., either by feeling out one's way in the dark; or 2. when being dismighted, another leads one by the hand; and 3, by directing one's steps by a light; so when a man tries all kinds of experiments without method or order, this is mere groping in the dark; but when he proceeds with some direction and order in his experiments, it is as if he were led by the hand; and this we understand by learned experience; but for the light itself, which is the third way, it must be derived from the Novum Organum.[5]

It is not surprising that Bacon is best known as the originator of the 'scientific method' of discovery, or a 'new machine for the mind' as Bacon himself prefers to call it.

*Nature of the Method*

The method that Bacon claims to have discovered is the dream-method of a positivist; a set of rules which allows the understanding 'to proceed by a true scale and successive steps, without breach and interruption, from particular to the lesser axioms, thence to the intermediate (rising one above the other), and lastly, to the most general' (I. 104). And thus it allows one to found 'a real model of the world in the understanding, such as it is found to be, not such as man's reason has distorted' (I. 124).

The method is such that it leaves no scope for the freedom of a person's mind; it leads the mind along the correct path, 'not leaving it to itself, but directing it perpetually from the very first, and attaining our end as it were by mechanical aid'.[6] It is so mechanical 'as to leave little to the acuteness and strength of wit, and to rather level wit and intellect. For as in the drawing of a straight line, or accurate circle by the hand, much depends upon its steadiness and practice, but if a ruler or compass be employed, there is little occasion for either, so it is with our method' (I. 61).

Bacon is quite aware that the human understanding, left to itself, does not act as a mechanical engine. Man sees the world in his own image. And this image derives its features from the nature of the mind in general, from the idiosyncrasies of the individual, from the individual's interaction with others, and from the philosophical dogmas current at the time. Bacon realized that these aspects of the human condition which intervene between the world and man's understanding of it are important constraints on human

knowledge. He formulated the famous doctrine of the Four Idols (I. 39-68) in a lucid exposition of the constraints under which the human understanding operates. The constraints are grouped under four categories: the Idols of the Tribe, the Idols of the Den, the Idols of the Market and the Idols of the Theatre respectively. Bacon holds that:

(i) The Idols of the Tribe are inherent in human nature and the very tribe and race of man;... all the perceptions both of the senses and the mind bear reference to man and not to the universe, and the human mind resembles those uneven mirrors which impart their own properties to different objects, from which rays are emitted and distort and disfigure them. (I. 41)

He then lists the numerous features that define the structure of human understanding. It is tempting to quote at least a few of these to illustrate how keenly Bacon was aware of the way the human mind constructs the world according to its own predispositions:

The human understanding, from its peculiar nature, easily supposes a greater degree of order and equality in things, than it really finds... (I. 45)

The human understanding is, by its own nature, prone to abstraction, and supposes that which is fluctuating to be fixed. But it is better to dissect than abstract nature; such was the method employed by the school of Democritus, which made greater progress in penetrating nature than the rest... (I. 51)

The human understanding resembles not a dry light, but admits a tincture of the will and passions, which generate their own system accordingly, for man always believes more readily that which he prefers. (I. 49)

Such are the idols of the tribe, which arise either from the uniformity of the constitution of man's spirit, or its prejudices, or its limited faculties or restless agitation, or from the interference of the passions, or the incompetency of the sense, or the mode of their impression. (I. 52)

(ii) The idols of the den derive their origin from the peculiar nature of each individuals's mind and body, and also from education, habit, and accident... (I. 53)

(iii) [The idols of the market are] formed in the reciprocal intercourse and society of man with man. (I. 43)

[This intercourse has to be necessarily carried out through the medium of words and names. And the idols of the market are the ones which] have entwined themselves round the understanding from the association of words and names. For men imagine that their reason governs words, whilst, in fact, words react upon the understanding... (I. 50)

(iv) Lastly, there are idols which have crept into men's minds from the various dogmas of peculiar systems of philosophy.... We regard all the systems of philosophy hitherto

received or imagined, as so many plays brought out and performed, creating fictitious and theatrical worlds. (I. 44)

These idols of the theatre are not innate, nor do they introduce themselves secretly into the understanding, but they are manifestly instilled and cherished into the memory by the fictions of theories and depraved rules of demonstration. (I. 61)

Bacon conducts this phenomenological exercise of clearly listing the various ways through which the human mind can colour human knowledge of the world not to point out the innate limitations of human knowledge, but to exhort us to get rid of them:

We have now treated of each kind of idols, and their quantities, all of which must be abjured and renounced with firm and solemn resolution, and the understanding must be completely freed and cleared of them, so that the access to the kingdom of man, which is founded on the sciences, may resemble that to the kingdom of heaven, where no admission is conceded except to children. (I. 68)

Bacon is not naive enough to believe that these idols, some of which, according to him, are rooted in the very structure of the human understanding, can be eliminated by mere exhortation. He is convinced that the method of true induction which he has discovered is potent enough to free the understanding from these idols. In fact, for him 'the formation of notions and axioms on the foundation of true induction is the only fitting remedy by which we can ward off and expel these idols' (I. 40). And this true inductive method, the *Novum Organum,* will help man move away from the idols of the human mind to the ideas of the Divine mind - 'from idle dogmas to the real stamp of created objects as they are found in nature'. Let us see how far this promise of a sure mechanical method is fulfilled in Bacon.

*An Outline of the Method*

Bacon gives us an outline of his conception of the scientific method in Book 1 of the *Novum Organum* (I. 100-7). This method involved collection of particulars through observation and systematic experimentation (I. 100), putting down this data in writing (I. 101) in a proper and well arranged fashion (I. 102), deriving axioms by certain method and rules from the above particulars (I. 103), and finally deriving new particulars from these axioms so that the axioms could confirm their own extent and generality (I. 106). Thus the scientific method in Bacon's conception is what all of us regard as the only method; observation, induction of axioms from the observed and testing those axioms in further observation. In Bacon's words:

Our course and method, however (as we have often said, and again repeat), are such as not to deduce effects from effects, nor experiments from experiments (as the empirics do), but in our capacity of legitimate interpreters of nature, to deduce causes and axioms from effects and experiments; and new effects and experiments from those causes and axioms. (I. 117)

Bacon is wary both of the empiricists who refuse to generalize beyond the limited particulars of their observation, and the sophists or theologists who make no or little contact with experiment. For him,

There are three sources of error and three species of false philosophy; the sophistic, the empiric and the superstitious (I. 62).... Aristotle affords the most eminent instance of the first; for he corrupted natural philosophy by logic - thus he formed the world of categories,... being everywhere more anxious as to definitions in teaching and the accuracy of the wording of his propositions, than the internal truth of things. Nor is much stress to be laid on his frequent recourse to experiment in his books on animals, his problems and other treatises, for he had already decided, without having properly consulted experience as the basis of his decisions and axioms, and after having so decided, he drags experiments along as a captive constrained to accommodate herself to his decisions; so that he is even more to be blamed than his modern followers [of the scholastic school] who have deserted her altogether (I. 73).... The empiric school produces dogmas of a more deformed and monstrous nature than the sophistic or theoretic school; not being founded in the light of common notions (which however poor and superstitious, is yet in a manner universal and of general tendency), but in the confined obscurity of a few experiments.... We have a strong instance of this in the alchemists and their dogmas; it could be difficult to find another in this age, unless perhaps in the philosophy of Gilbert (I. 64).... The corruption of philosophy by the mixing up of it with superstition and theology is of much wider extent, and is most injurious to it both as a whole and in parts. Against it we must use the greatest caution, for the apotheosis of error is the greatest evil of all, and when folly is worshipped, it is, as it were, a plague spot upon the understanding. Yet some of the moderns have indulged this folly with such consummate skill that they have endeavoured to build a system... of natural philosophy on the first chapter of genesis... [though] it is most wise to render unto faith the things that are faith's. (I. 68)

The true Baconian method thus achieves a golden mean, avoiding the pitfalls of both the empirics and the sophists, and Bacon expresses his conception of the method in a poetic vein:

Those who have treated of sciences have been either empirics or dogmatical. The former like ants only heap up and use their store, the latter like spiders spin out their own webs. The bee, a mean between both, extracts matter from flowers of the garden and the field, but works and fashions it by its own efforts. The true labour of philosophy resembles hers, for it neither relies entirely nor principally on the powers of the mind, nor yet lays up in the memory the matter afforded by the experiments of natural history and mechanics in its raw state, but changes and works it in the understanding. (I. 95)

It is obvious that the method outlined above is not a new one. Men have always reasoned from the particular to the general, and no generalizations which were not confirmed in their effects could have survived. In Bacon's England, which was just emerging from the scholastic age, his strong exhortation to come back 'to particulars and their regular series and order, and renounce their notions and begin to form an acquaintance with things',

must have been of great value. It must have been important to remind schoolmen that 'the human mind, if it acts upon matters, and contemplates the nature of things, and the works of God, operates according to the stuff, and is limited thereby, but if it works upon itself as the spider does, then it produces cobwebs of learning, admirable indeed for the fineness of thread, but of no substance or profit.'[7] But we cannot possibly attribute any novelty to this method. Further, even if it were novel it is just not adequate to fulfil the Baconian promise of a certain and sure method that would lead from the idols of the mind to the ideas of the Divine. Such ideas are so deep-rooted that they always intervene between the world and our conception of it, and as Bacon knows, 'many theories can be deduced from the phenomenon of the sky' (I. 62).

In fact, Bacon is aware of both these objections (I. 125). His reply is that it is the 'new inductive' method which will make the process of going from the particular to the general a smooth, mechanical process unaffected by any idols that the mind may harbour, unaffected even by the level of intelligence and wit of the individual.

The whole of Book I is in the nature of an introduction to the new induction that Bacon develops in the second book. It is a moving introduction. Bacon surveys the whole field of thought, shows the incapacities it has been heir to, gives glimpses of his remedies to these infirmities, lists the causes of the failures of earlier times and earlier people, and the reasons for hope, the most important of them being that he can now bestow upon humanity a mechanical method of discovery, an aid for the mind, an inductive engine, the *Novum Organum.*

*The New Induction: Book II*

In the second book of the *Novum Organum,* Bacon, after some abstruse remarks about the nature and objectives of knowledge, quickly comes to the question of defining the rules of his method. He begins by repeating the outline of the scientific method already given in Book I, and it may be appropriate to repeat it here to make clear the important place that the rules for induction occupy in the Baconian framework. He defines the scientific method, which according to him is the method that allows interpretation of nature as against merely 'anticipations of nature' that have been obtained by the ancients, in the following words:

The signs for the interpretation of nature comprehend two divisions, the first regards the eliciting or creating of axioms from experiment, the second the deducing or deriving of new experiments from axioms. The first admits of three subdivisions into ministrations: I. To the senses, c. To the memory, 3. To the mind or reason. For we must first prepare as a foundation for the whole, a complete and accurate natural and experimental history.... But natural and experimental history is so varied and diffuse, that it confounds and distracts understanding unless it be fixed and exhibited in due order.... Even when this is done, the understanding, left to itself and its own operation, is incompetent and unfit to construct its axioms without direction and support. Our third ministration, therefore, must be true and legitimate induction, the very key of interpretation. (II. 10)

Induction, therefore, is to help as a 'mechanical aid' to understanding so that it does not fall prey to its usual incompetencies, including its idols. Immediately after the aphorism quoted above, Bacon lists the various steps involved in induction, which he illustrates by an investigation of the 'form of heat'.[8]

The first step in the Baconian inductive process is the collection of all instances that exhibit the presence of the 'nature' being investigated. This collection is to form the 'Table of Existence and Presence'. Their collection is to 'be made as a mere history and without any premature reflection, or too great degree of refinement' (II. 11). Thus, for the example of heat, Bacon puts together in this Table of Existence twenty-seven instances of the presence of heat at random. In the table we find instances as varied as 'the rays of the sun particularly in summer, and at noon', and 'a severe and intense cold' which also 'produces a sensation of burning'.

The second step is to construct the 'Table of Deviation' or of 'Absence in Proximity'. Under this table instances are collected which agree with or resemble those in the 'Table of Presence', but differ from those in that the 'given nature' is absent. Thus the 'proximate instance wanting in the nature of Heat' corresponding to the presence of it in 'the rays of the sun, particularly in summer and at noon', is afforded by the 'rays of the moon, stars, and comets' which 'are not found to be warm to the touch'.

The third step is to record the data on variations of the degree of the given nature in the same body at different times, and also in comparison with different objects. This is because 'no nature can be considered a real form which does not uniformly diminish and increase with the given nature'. This collection is to be called the 'Table of Degrees', or 'Comparative Instances'.

Armed with these tables, one is finally ready to start the process of induction. This is to be carried out through the process of Exclusions, keeping in mind 'that not only is each table sufficient for the rejection of any nature, but even each single instance contained in them'. For it is clear 'that every contradictory instance destroys a hypothesis as to the form' (II. 18). Thus the next step in this method is formation of the 'Exclusive Table'. This table is supposed to indicate what phenomena are not essential to the form of the nature being investigated. For example, in the case of heat the Exclusive Table tells us that:

I. On account of the sun's rays, reject elementary [terrestrial] nature...

and

XI. On account of the expansion of the air in the thermometers and the like, which is absolutely moved and expanded to the eye, yet acquires no manifest increase of heat, [again] reject absolute or expansive motion of the whole [as the form of heat]. (II. 18)

The process of induction so far has proceeded more or less mechanically as promised. Though one suspects that a mere listing of instances which agree in the form of heat, and

instances which are wanting in the nature of heat, already requires some idea of what 'heat' is and one is afraid that the so-called Idols of the Market associated with the word 'heat' have some effect on the way these tables are formed. This seems to be the only way of explaining how instances like 'aromatic substances and warm plants' creep into the Table of Presence of heat. Again, in the formation of the Table of Exclusions one finds some evidence of the interference of the various Idols of the Mind. For example, the rejection of the 'expansive motion of the whole' in the example noted above does not seem to be indicated so much by the observation that thermometers acquire no manifest increase in heat (they do!); but by a preformed notion, which at this stage can only be called an Idol of the Theatre, that 'heat is not a uniform expansive motion of the whole, but of *the small particles* of the body' (II. 20).[9] This Idol seems to have affected Bacon's observation. It would be absurd to cavil at Bacon's tables from the twentieth-century viewpoint; the important point is that even this mechanical process of first compiling the various tables does not seem to be free of the influence of the idols that it is Bacon's main purpose here to exorcise.

The next step in the Baconian inductive process is, however, absolutely baffling. Having formed the 'Tables of Presence', 'Tables of Absence in Proximity', 'Tables of Degrees', and 'Tables of Exclusions', and yet not having arrived at an axiom about the form of the nature to be investigated, Bacon advises us now to leave the mechanical path and form what we call a 'hypothesis'. Bacon calls it 'The First Vintage' and gives an ingenious reason for now finally letting the understanding run free:

Since, however, truth emerges more readily from error than confusion, we consider it useful to leave the understanding at liberty to exert itself and attempt the interpretation of nature in the affirmative, after having constructed and weighed the three tables of preparation, such as we have laid them down, both from instances there collected, and others occurring elsewhere. Which attempt we are wont to call the liberty of the understanding or the commencement of interpretation or the first vintage.

The first vintage that Bacon obtains from his elaborate inductive exercise on the form of heat is that

Heat is an expansive motion restrained, and striving to exert itself in the smaller particles. The expansion is modified by its tendency to rise, though expanding towards its exterior; and the effort is modified by its not being sluggish, but active and somewhat violent. (II. 20)

How correct this inductive hypothesis is in the light of modern physics' conception of heat is irrelevant. In fact a comparison is impossible, because the modern physicist's world is peopled by atoms and molecules, while Bacon's smaller particles are 'not the very minutest particles, but... rather those of some tolerable dimension'. However, one thing is clear; a hypothesis like the above, claiming that 'heat is a motion... of the smaller particles', could not have been formed by someone completely free of all Idols. No amount of observation, negation and exclusion is likely to lead to such a hypothesis. In fact, Bacon concedes this when he finally agrees to let the understanding be free and form

its own hypothesis. And the hypothesis that he makes is, interestingly, a statement of the seventeenth century 'Idol of the Theatre' which asserted that the appropriate explanation of all phenomena is in terms of the size, shape, position and motion of the elementary corpuscles of the base matter.[10]

After explaining this step-wise process of induction, Bacon then lists the 'remaining helps of the understanding, that are necessary for a 'true and perfect induction'. These helps include: (1) Prerogative Instances, (2) Supports of Induction, (3) Correction of Induction, (4) Varying Investigation according to the nature of the subject, (5) Prerogative Natures, or what should be investigated first and what last, (6) Limits of Investigation, or a Synopsis of all natures that exist in the Universe, (7) Applications to Practice, (8) Preparation for Investigation, and (9) Ascending and descending Scale of Axioms.

Bacon deals at length with only the first of these additional aids in his *Novum Organum.* He isolates twenty-seven ranks of Prerogative Instances, and gives examples of each from various fields of science. The whole exposition is long-winded and abstruse, quite unlike the crystal-clear, prophetic style of Bacon in the first Book - and is full of factual errors. It is surprising that the learned Bacon, the prophet of science, living at the time of Gilbert and Galileo (both of whom he condemns) was not aware of many of the simple achievements of the science of his time. Mercifully, Bacon does not pursue his attempt at offering all his 'helps of understanding' in detail, though he ends Book II with the confident assertion that 'we must next, however, proceed to the supports and correction of induction' (II. 52). He never picks up these other parts of his induction, and here ends Bacon's methodological adventure.

How do we assess this? The first question we must ask is: Does this new induction fulfil the purpose for which it has been invented - that of providing a mechanical aid to understanding so that it does not get influenced by its own idols and is able to move through 'certain methods and rules' to the 'ideas of the Divine mind'? Is it 'the fitting remedy by which we can ward off and expel the idols'? We have partly answered this question by showing that the method does deviate from its mechanistic ideal in inviting the understanding to form a hypothesis, albeit after tabulating the elements selected. This exercise in hypothesis-formation, which is surely non-mechanical, is likely to be vitiated by prevalent notions, and it seems that Bacon was himself influenced in his hypothesis on the form of heat by the prevalent mechano-corpuscular worldview of the seventeenth century. As one reads Book Ii of the *Novum Organum,* one encounters more and more examples of observation being influenced by hypothesis, hypothesis being influenced by prevalent notions, ambiguous meanings of words generating ambiguous experiment and theory, and so on. Here we shall give just two such instances.

First, in the 'First Vintage of the form of Heat', we find the following hypothesis: 'The motion of heat is both expansive and tending upwards.' In support of this hypothesis Bacon makes the following observation:

This difference is shown by putting the tongs or poker into the fire. If placed perpendicularly with the hand above, they soon burn it, but much less speedily, if the hand hold them sloping or from below.

From our modern vantage-point this hypothesis seems absurd; we 'know' that heat does not exhibit any such behaviour. But, then, how did Bacon confirm his hypothesis in experiment? Perhaps the explanation lies in the open-fire furnaces that were the only source of heat in Bacon's time and which do direct heat upwards. Today if we were to test Bacon's hypothesis we would take pains to design a furnace that directs heat isotropically. Thus it seems Bacon was not 'wrong' in his hypothesis. He was talking about a different type of heat, the only type which would have been available to any experimenter unless he was already convinced that heat flows isotropically and went about designing a furnace that would prove this latter hypothesis. One is reminded of Kuhn's observation based on the history of Baconian sciences that the very experimental data on which a hypothesis is based starts changing when the hypothesis is changed. Thus, as Kuhn tells us, before Dalton's theory became acceptable, chemists saw all sorts of ratios between the various elements forming a compound. Proust's own measurements of the two oxides of copper yielded, for example, an oxygen weight ratio of 1.47:1 instead of the 2:1 demanded by the atomic theory. And Proust was a fine experimentalist. By the time, however, the atomic theory was finally accepted nature had been beaten into line to fit the theory. At the end, even the percentage composition of well-known compounds had changed. In fact the meaning of the term 'compound' itself had changed by then.[11] Such is the influence of the idols that Bacon sets out to exorcise, and fails.

For our second example, we shall take a prerogative instance of the sixth rank which includes instances that show physical parallels or resemblances with other forms (II. 27). Talking of such instances Bacon proposes the following:

The scrotum of males and the matrix of females are also similar instances; so that the noble formation which constitutes the difference of the sexes appears to differ only as to the one being internal and the other external; a greater degree of heat causing the genitals to protrude in the male, whilst the heat of the female being too weak to effect this they are retained internally.

How many idols have gone into making this absurd observation: (1) an attempt to see a higher degree of order and equality in things than really exists; an attempt to force resemblances: an idol of the Tribe (I. 45); (2) an attempt to explain diverse phenomena through his pet theory of heat as an expansive motion: an idol of the Den (I. 54); (3) an equation of heat with vitality, derived from normal usage of the word heat: an Idol of the Market (I. 59); (4) an assumption that the heat of the female is weaker than that of the male, obviously derived from the contemporary worldview: an Idol of the Theatre (I. 62).

Thus one sees Bacon, in spite of his method, falling into the very traps he had discerned and analysed. We happen to recognize the influence of these idols here not because we have a superior method, but because we no longer believe in the idols that were current in Bacon's time. We have our own idols, and only those who are free of them will be able to

see the flaws in arguments that we take for granted. In spite of Bacon and his method, we have to live with the knowledge that our knowledge of the world is always tinctured with the peculiar assumptions that we hold. There are no royal roads to the ideas of the Divine. We as humans can aspire only to human knowledge. Bacon's method does not come up to his positivist dream: it does not free man from his idols. It could not free Bacon from his.

Now we turn to Bacon's second claim, of having discovered a new method. Is the new induction described above really new? The answer depends upon how you view the method. If it is taken as a procedural discovery, that is, if the actual drawing up of tables of review and exclusions before going through the exercise of constructing a hypothesis is taken as a necessary component of induction, then the method is obviously new. Nobody before Bacon had followed this prescription, but unfortunately, nor did anybody after him follow it, not even the western scientists who claim to be in the tradition of Baconian science. Bacon can claim novelty only at the cost of becoming irrelevant. However, one may look upon the method as useful general advice, to keep all the experimental information summed up in various tables in mind while making an induction. In which case, the induction Bacon is talking about turns out to be a very ordinary affair. As Macaulay rather irreverently describes it in his 'Essay on Bacon', induction is something 'which we are all doing from morning to night, and which we continue to do in our dreams. A plain man finds his stomach out of order. He has never heard of Lord Bacon's name. But he proceeds in strictest conformity with the rules laid down in the second book of *Novum Organum,* and satisfies himself that minced pies have done the mischief. "I ate minced pies on Monday and Wednesday, and I was kept awake by indigestion all night." This is the *Table of Presence.* "I did not eat any on Tuesday and Friday, and I was quite well." This is the *Table of Absence in Proximity.* "I ate very sparingly of them on Sunday, and was very slightly indisposed in the evening. But on Christmas day I almost dined on them, and was so ill that I was in great danger." This is the *Table of Degrees.* "It cannot have been the brandy which I took with them. For I have drunk brandy daily for years without being the worse for it." This is the *Table of Exclusion.* Our invalid then proceeds to what is termed by Bacon as the *First Vintage,* and pronounces that minced pies do not agree with him.'[12] True, the invalid has performed all these steps instinctively. We can give Bacon the credit for making these steps explicit, for perhaps being the first to have analysed induction in the western tradition, for having done for induction what Aristotle had done for logic. But Aristotle did not discover logic, and Bacon discovered no 'new' induction.

Once we recognize that Bacon's method should be looked upon not as a new method but as an analysis of the inductive process, we begin to realize how perspicacious this analysis is. He strongly emphasizes the importance of the negative instance in carrying out a true induction, a point on which Karl Popper has constructed a whole theory of falsifiability. In fact, Bacon's grouse against the method of induction prevalent in his day seems to be that it did not accord sufficient attention to the negative instance and induced axioms from what Bacon calls simple enumeration. This process, Bacon declares, is wrong.

From a bare enumeration of particulars in the logical manner, follows a wrong conclusion, nor does such an induction infer anything more than a probable conjecture. For who will undertake, when the particulars of a man's knowledge of memory appear only on one side, that something directly opposite shall not lie concealed on the other?[13]

In *Novum Organum* he expresses the same sentiment more picturesquely:

It was well answered by him who was shown in a temple the votive tablets suspended by such as had escaped the peril of shipwreck, and was pressed as to whether he should then recognise the power of gods, by an enquiry: But where are the portraits of those who have perished in spite of those vows. (I. 46)

This emphasis on the negative instance in induction is important. However, if we follow Bacon's instruction on the negative instance to the letter, that any single negative instance must be sufficient to reject any hypothesis (II. 18) - we find that while the method is novel, nobody follows it. If we take it as an analysis of the inductive process where negative instances are generally important, then there cannot be anything new about it. One cannot think of anyone in the history of science who induced a hypothesis which was patently negatived even before being established, even though Bacon claims that before him all induction was mere simple enumeration.

Thus, whichever way we look at the new induction presented in Novum *Organum,* we cannot accept that Lord Bacon had really any new methodological concept to offer at the beginning of the so-called 'scientific revolution'. Nor can we accept that Bacon's method would lead to ultimate truths, uncoloured by the social and individual perceptions of reality, to which people had earlier had no access because of their lack of 'method'. Hence, the credit due to Bacon for being the herald of a revolution in human knowledge - which he undoubtedly was, as the philosopher of the Western scientific revolution - cannot be on account of his methodological contributions. The elements of this revolution must be looked for elsewhere in Bacon's thought - in his ideas about the organization of science and society, about the objective of knowledge, in his ethics and in his politics - to which we shall turn in the next section.

However, in this elaborate methodological exercise, which he considered to be more important than the rest of his work, we can already see a major element of the Baconian conception of science. He wanted the new science to be seen as a faithful representation of the truth about the world, as a transcript of the divine mind. Even though Bacon failed to produce the promised 'new engine' that would lead the human mind from merely human knowledge to ideas of the Divine, the idea of constructing epistemologies that would somehow prove the unique absolute truth of the Baconian sciences has remained. And while philosophers have been making prodigious efforts to provide a methodology that might show the Baconian sciences to be true, everyone involved has meanwhile assumed that what developed as modern western science since Bacon has a claim to absolute, unique truth, whether it can be proved or not. Thus, though Bacon failed in his methodological exercise, he succeeded in establishing the idea of according a mere human discipline the sanctity of divine truth. Even that idea was perhaps not very new in

the western world, since at about that time, the American continent was being decimated in the name of the absolute truth of Christianity. However, Bacon successfully channelled the idea of absolute truth into a new direction. He gave a clear exposition of the new direction that the western idea of absolute truth was to take. This is what makes Bacon the prophet of the industrial society.

**II. The prophet**

While Bacon's claim to be the methodologist of the new science that emerged in Europe is often disputed, his position as the prophet of a new culture in which the new science took root is universally acknowledged. Even Macaulay - who ridiculed Bacon's methodological claims, and felt indignation and con tempt for the despicable acts for which Bacon was responsible as a lawyer and a politician - seems to be spellbound by the prophetic 'moral and intellectual constitution which enabled Bacon to exercise so vast an influence on the world'. Even Macaulay allowed that he was one of those few imperial spirits whose rare prerogative it was to give the human mind' a direction which it would retain for ages. Raja Rammohun Roy (1772-1833), in his moving petition to the Governor-General for the provision in India of a new Education that would instruct the 'natives' in the subtleties of the new culture, referred to Lord Bacon as the dividing line between the old and the new. In fact, his protest against the Sanskrit schools, that 'the pupils will thereby acquire what was known two thousand years ago, with the addition of vain and empty subtleties since pro duced by speculative men, such as is already taught in all parts of India', echoes Bacon in both style and content. Rammohun Roy even accords Bacon the status of a prophet for India:

If it had been intended to keep the British nation in ignorance of real knowledge, the Baconian philosophy could not have been allowed to displace the system of the schoolmen, which was the best calculated to perpetuate their ignorance. In the same manner the Sanskrit system of education would be the best calculated to keep this country in darkness if that had been the policy of the British Legislature.[14]

Bacon's reputation as the prophet of the new culture of the west has persisted to our day. Thus, Farrington, writing in 1951, devotes his popular book on Bacon to undo the impression that Bacon was a failed methodologist of new science and to assign him his 'rightful place as the founder of English materialism'.[15] Therefore, to understand Bacon, and the scientific revolution he presaged, it is important to look at the new moral, ethical and cultural ideas that he was preaching.

The first element in the Baconian cultural-ethical complex is the freeing of knowledge from the constraints of the prevalent ideas of good and evil. Bacon declares this freedom of knowledge in the first few pages of his major work, *Advancement of Learning.* And, curiously, he manages to have his God on his side in this plan. In his oft-quoted words:

It was not the pure knowledge of nature, by the light whereof man gave names to all the creatures in Paradise, agreeable to their nature, that occasioned the fall; but the proud

knowledge of good and evil, with an intent in man to give law to himself, and depend no more upon God.[16]

This proposition becomes more explicit later in *Novum Organum.* There we find Bacon strongly censuring those who tend to mix 'natural philosophy' with religion and faith: 'They celebrate the union of faith and senses as though it were legitimate, with great pomp and solemnity, and gratify men's pleasing minds with a variety, but in the meantime confound most improperly things divine and human' (I. 89). And he exhorts all to free natural philosophy from this 'corruption' while rendering unto faith the things that are faith's (I. 65); though, as we shall see later, the things that are faith's in the Baconian conception turn out to be precious few.

Though separating knowledge from ethics is a basic component of the Baconian culture, it does not amount to making a separation between 'facts' and 'values' - as it is often portrayed and understood. Bacon does not want knowledge to be pursued for its own sake, or that it be freed from all values. Having freed knowledge from all constraints of good and evil, he subjects it to a new overriding constraint - it should generate power. Power and utility are in fact the key-words of Bacon's thought. These words appear as the principal values in everything that Bacon has written. For him the value of power and utility is so great that often truth, power and utility become identical concepts in his perception. Thus we find him saying in the *Novum Organum:*

Truth, therefore, and utility, are here perfectly identical, and effects are of more value as pledges of truth than from the benefit they confer on man (I. 24)... There is a most intimate connection between the ways of human power and human knowledge... and that which is most useful in practice is most correct in theory. (II. 4)

# 3. Science, colonialism and violence: A luddite view

CLAUDE ALVARES

***Introduction: Images of science and violence***

For modern man, the image of Columbia, the space shuttle, speeding past the limits set by the forces of Earth, and returning, time and again, with almost monotonous impunity, is highly impressive. A proof of modern science. No tribal from the Bastar forest could achieve such feats. Not because the tribal has no desire to soar - his *shamans* may have another route to outer space in store - but the ruling modern consciousness vetoes that as non-objective and unreal. VCRs! Nuclear reactor domes! The electronic gadgets that throng consumer shops! Multi-coloured pills at drugstores! These are testimonies to the 'fact' that *modern* science exists - apart and distinct from sciences practiced earlier.

The world of our times, however, also offers another image to the modern man - an alternative image that has maintained equal sway during the same period, one not of

creation or production or achievement, but of tragedy and destruction: world wars, Vietnam and Agent Orange, Hiroshima, Nagasaki, Lebanon. The vocabulary used in these wars of violence (shoot, thrust, explode, trajectory) would be appropriate to put another Columbia into space. The image of violence is impressive too. Anti-human weapons systems, anti-civilizational nuclear arsenals - a proof of modern science, unthinkable in the context of earlier sciences. As the knowledge of physiology deepens, Amnesty International reports newer and more excruciating forms of torture.

The dominant, domineering images of our world are of Science and Violence. The former is accepted as intrinsically Good; the latter as universally Evil. Yet, paradoxically, the more science, the more the violence.

Coincidence, or cause-and-effect? Philosophical games, as the Marxists once played them - the violence of science, the science of violence?

Violence is larger than science. As the connotation of violence has expanded, that of science has been pruned or compacted. Advocates of science are increasingly confident about what constitutes science and what is non-science, and have sufficient clout to ignore other views. The constituency of violence, on the other hand, has spread. A natural canopy forest, a bastion of plant life, is mowed down and its niches taken over by violent monocultures that cut through life like a sharp knife. Violence now includes new and strange forms of mutilation. Civilization has 'grown'.

In our times, even nations at peace are economically at war: their economies are driven by war machines and war manias. Indirect wars are equally severe and devastating. The construction of a dam in the midst of a natural river course, the destruction of its catchment-area forests, the uprooting of thousands of living organisms and beings. At least one scholar, Ivan Illich, has labelled current economic development based on modern science and technology a war activity.[1]

Yet, except for some ethologists who believe that we are all 'children of Cain', and therefore prone instinctively to aggression and violence, the majority of the world's population believes it necessary and possible to diminish the extent and potential of violence everywhere.

Can it be that, in order to reduce the potential for violence, efforts have to be made to reduce the influence of modern science and to counter science itself?

Despite the wide acceptance of the scientific temper as a positive human endowment, and despite the widespread belief that science, with its potential for welfare, provides some kind of inoculation against our native disposition to violence, can one presume that an improvement in the scientific quality of human life is directly related to violence?

We begin with two paradoxes. First, the concept of 'revolution', political and sometimes bloody, has often been redefined in our times as a series of mechanical processes executed by specialists. The green revolution, the white revolution, the information

revolution - all are apolitical transformations, achieved through science. The engineers of such revolutions, often highly conservative men, then, by definition, become 'revolutionaries', paradoxically managing to prevent change in the established order through science, to the applause of the educated middle classes owing allegiance to the established order.

Second, even the most diehard propagandist for science admits that modern science is used on a colossal scale for violence. The nuclear arsenal is its clearest contribution to a new form of totalist annihilatory violence, destined to extinguish all life and, thus, all science itself.

In such a context, the popular argument that science *itself* is a benign power, which is sometimes exploited by the establishment, has little force. Modern science is rarely, if ever, directly concerned with peace; no Government funds R&D for peace the way it supports military R&D.

On the other hand, in cultures other than those dominated by science, objects invested with unusual powers can only be used for the common good. If they are exploited for evil or for personal interest, the objects themselves lose their power. Such is the concept of *vibhuti* in the Indian tradition. In this respect, modern science stands apart: it can be used purely and totally immorally with the vague promise that sometime, eventually, the authority of one class over it would be reduced. The promise is that once science is democratized, it would voluntarily come into the hands of, perhaps, the proletariat.

The focus of this essay, however, is not violence but science. I argue that both science and the technology based on it are fundamentally violent forms of handling the world, that violence is intrinsic to science, to its text, to its design and implementation. I hope to demonstrate (1) that the notion of social structure or class as a principal determinant of the abuse of science is exaggerated, and (2) that because science is inherently violent, its continuing use for violence is assured. The non-violent effects of science are more the results of accident than design. It follows (3) that the argument that modern science should be used by third-world peoples for their emancipation is hardly justified. There is no way in which the science of our times can be dissociated from its structure of violence.

The faithful may agree that there is something fundamentally inadequate about modern science, but declare that this is due not so much to the nature of science as to its metaphysics, that scientific methodology could be incorporated within a new metaphysics to replace the Galilean, positivist core. This paper argues that it is not possible to dislocate the physics of modern science from its metaphysics. Trying to do so, one destroys both. Both rose together in warm embrace, and both must die the same cold death together as determinants of history, and of the lives of millions. We need a new cosmology for the vacuum that has already appeared.

Three points need to be made, as preliminaries to the analysis that follows:

I am not depending on scientific rationality to elucidate my various propositions. I am using basically philosophical arguments, arguments of a wider rationality than that obtainable in modern science. In my scheme of philosophical priorities, assumptions or postulates, and within their hierarchy, scientific rationality, though excellent for limited and selected purposes, is not the primary epistemology for truth.

Analysis of the connection between science and violence is itself part of an analytical structure that could be used to explain other forms of violence. This essay is concerned with the violence of a certain class of events which have a necessary relation with modern science. The connection between science and violence I propose is merely a sub-set of a much wider range of violent events. Obviously, all violence cannot be related to science.

The argument is basically a critique of *western* scientific thinking. If it appears like a clinical analysis, it is because we are engrossed in the examination of a pathology. Certainly, the same arguments cannot apply equally to, say, Chinese thinking. Neither would the arguments be of much use within the Indian tradition, where the power of abstraction to reach truth is not admitted by and large: reason has been subordinated to other instrumentalities. Neither would our arguments appeal to, say, the tribals; they might find the entire exercise a matter for extreme amusement. None of these structures of thinking - Chinese, Indian, or tribal - have hegemonic, global ambitions of the kind which western scientific rationality has. One must therefore understand this oppressive rationality and uncover its consequences for the older civilizations.

By violence (*himsa*) I mean physical and mental harm to living organisms, the earth also being regarded as a living organism. Mental harm for the moment is restricted to human beings, admitting that we are relatively ignorant of the conscious lives of non-human organisms.

Thus, the violence caused by science is to be understood literally, as real violence. One can find an analogy in the action of poisons - harmless in themselves, fatal when they come in contact with living organisms.

By science I mean Galilean science, or modern science, as it is usually termed. It is a historically specific, determined method of acquiring specific forms of knowledge whose utility for a post-modern period is gravely doubted. 'Science' with a capital S usually denotes the intellectual traditions of nonwestern societies, and the regressed intellectual traditions of western societies.

I shall illustrate the principal connections between science and violence in two main arguments, one from methodology and one from history. These may at times overlap. Elements of both arguments have been pointed out by other scholars; my intention is to provide a reasonably comprehensive picture. More illustrative material could be provided later.

The first argument, which relates to scientific method, concerns the functional, violence-disposition of the method. The method vetoes or excludes compassion. Its postulates require the excision of values. In actual operation, both the method and its metaphysics require mutilation or vivisection as an integral part of science. Aware of this disposition, often too easily translated into practice, the propagandists of science have offered to make extensive changes, including changes in the offending metaphysics; they have even offered to make science more holistic. These changes cannot alter the fundamental predisposition. The change required is not cosmetic but cosmic.

The second connection between science and violence became apparent soon after the scientific method was invented: colonialism. This is a historical and political argument, and specifically underlines the close and continuing 'blood relations' between science and imperialism. The problem has been recognized, but efforts are being made to suggest that science can be delinked from colonialism/imperialism. I shall argue here that since science and technology are both colonizing activities, any suggestions about delinking them from imperialism can only be fraudulent.

Following closely on these are two other arguments that work out an analysis from negative *consequences.* The theoretical arguments, in this second set, are sewn up with empirical demonstrations. I have divided this set of arguments into the 'first series' and the 'second series'.

The first series examines the application of modern science to life processes in agriculture, forestry, medicine and food. In all these, the application is seen as leading to serious physical harm. Suggested popular remedies include the invention of soft technologies. The real argument should concentrate on the irrelevance of modern science to such processes.

The second series, which concerns the fabrication of machines through the application of physical laws, is a problem area because it concerns the application of a basically fragmented science. The result is pollution and ecological imbalance. Industrial processes are almost always at variance with life processes and with natural events. The fragmented nature of applied knowledge produces a reaction/response in the concept of the technological fix. This is no solution. It is postponement, for one becomes involved in an absurd merry-go-round of circular production.

A radical break is required, for the connections are not merely intrinsic, they are dynamic and actively colonizing. They help increase the political clout of modern science. The final section of this paper contains suggestions on how one might counter the violence of modern science, suggestions which approach Ludditism.

**I. Method as madness**

Philosophers of western origin have themselves made devastating critiques of western science, and have required little help from their counterparts in the east. Lewis Mumford

lays bare the origins of modern science from the days of its early veneration, in two rather splendid essays, one on Galileo and another on Francis Bacon.

Mumford argues that Galileo's 'crime' was the extinction of what he calls 'historic' man: Galileo's method involved the elimination of all subjective elements, rendering suspect all qualities except the primary qualities. 'Only a fragment of man - the detached intelligence - and only certain products of that detached, sterilized intelligence, scientific theorems and machines, can claim any permanent place or any high degree of reality.'[2]

For the first time objectivity was defined in a specific, highly distorted, way. Later, such 'objective knowledge' became identified with modern science. Still later, such a stipulatory definition was enshrined within a positivist worldview. As Britain took the lead in institutionalizing this worldview and as Britain in that epoch ruled not only the waves and thus also the mind and manners of men over the globe, this new creed was eagerly accepted in different centres of the intellectual world.

Yet, as many commentators have set out to show, this particular form of objectivity was not a phenomenon foreign to the west. Western civilization, because of its absolute faith in reason (extended to elaborate rational proof for the existence of God), has been compelled to swing between two poles of what may be *called a scale or continuum of restrictions.* A society that values reason as its prime instrument for grasping truth will also tend to move along a continuum of either more or less dependence on the principal character of reason, abstraction. (Abstraction and restriction are two sides of the same coin; in the process of abstraction, one restricts reality by abstracting certain features and ignoring others.) Such a scale of restrictions has been inoperative with other civilizations like the Chinese, or the Indian, which only give a subordinate position to reason in their scheme of things. By and large western civilization has maintained a homeostatic balance between reliance on total experience and pure abstraction.

Experience consists of historical events that are irreversible and unique, and can be immediately grasped. The mystic, for example, offers a classic example of direct experience. The function of the intellect in mysticism is zero. Radical anarchism, as another example, could also fall in this category. Most non-human species operate at the level of total experience. A tribal group survives very close to full integration with experience. One should remember that no preferred values are assigned in this analysis to total experience or to pure abstraction. It is my argument that a mystic's perception of reality is no less significant than that of a pure scientist. The scientist may object to this, but the mystic could not care less.

Abstraction involves restricting experience to zero. Abstraction means zero history. The other features of abstraction are mediacy and communicability. Plato's World of Ideas is pure abstraction. The Galilean experiment, or scientific rationality, merely purified such abstraction to a further extreme. The experiment ideally restricts: it first eliminates historicity. The scientific experiment is, in fact, an exercise in pure abstraction. This may sound strange to many, since what is really supposed to distinguish modern science from

metaphysics or religion is precisely the idea that it alone is empirical, that it appeals to fact as the final arbiter.

It is when we examine closely the nature of this fact that we discover something seriously amiss: the scientific 'fact' is not the ordinary historical event or object, with all the relevant historical forces acting on it at the moment. It is a theory-laden fact, a fact created out of a certain metaphysics. The empiricism is not the empiricism of the ordinary English language, but carries its own stipulated meaning. The main feature of the experiment is that it is devoid of historicity, of uniqueness, of time. In order to experiment, one has to create one's facts to fall in line with certain postulates. These postulates themselves are not subjected to 'scientific' scrutiny nor to any systematic reasoning as to why one postulate is preferred to another.

A scientific fact has to be stripped of all its unique features, its essential nature has to be abstracted, to make the new information fit other similarly anaesthetized events. The fact that an experiment distorts reality is no longer doubted: what is striking is that such 'objective knowledge' is still passed off as the final and the only reality. The method thus becomes the sole criterion for truth. It makes possible the invention of a specific category of truth, 'scientific' truth. The point can be elucidated by a simple comparison between two western thinkers, Aristotle and Galileo.

Aristotle determined that if one were to drop a stone and a feather from a height, the stone would fall faster than the feather. And in reality, in history as a rule, stones do fall more rapidly than feathers. Galileo's invention of scientific rationality eliminated all the possible historical forces acting on both stone and feather: if all such influences were removed, he hypothesized, both stone and feather would fall at the same speed. Toricelli later constructed a vacuum to prove him right. A vacuum is total emptiness, zero experience; the scientific fact created by Galileo and Toricelli was not a natural fact, it was an artificial fact. The argument of this paper is that violence results when 'artificial' or 'perfect' nature is imposed on 'natural' or 'imperfect' nature (seen as being in an unscientific state).

Modern science is therefore not a presupposition-less activity, though it may often pretend to be. It seems to start from scratch, from empirical fact, and its postulates seem to deny all metaphysics. Nevertheless, its postulates function as a front for a new metaphysics, and because they, like all other kinds of postulates, are assumed, they distort reality and define it selectively.

There is a metaphysics that enables scientists to detonate an atomic bomb over a human population purely as an experiment, or to endorse the planting of a monocultural forest under the garb of scientific forestry. One common strand runs through all the perverse manifestations of science in our world. Our business must be to locate it and to determine how it can be progressively ruined.

The postulates upholding science are not the consequence of critical scrutiny, nor are they the result of any democratic process. The scientific worldview argues that there is no real

need for democracy in science, as personalities, history, time, have all been exorcised. Here lie the origins of modern intolerance. On the scale of restrictions, an event of pure experience, because it is unique, is incomprehensible and often incommunicable. For this reason, it is quite tolerant of other unique events. Abstraction demands the reverse set of qualities. It provides a basis for communicability precisely because the irreversible, unique, historical character of any event has been eliminated, and this placing of the event outside time and other historical forces enables public agreement on what modern science is about. The event has been reduced in status from the unique to the non-unique and repeatable. In the Indian tradition, there was no basis for such a view, as reason itself was considered defective as a method for reaching truth. The postulates were different, and while they permitted earlier science, they effectively and fortunately inhibited the rise of Galilean science.

One of the qualities of abstraction, communicability, also lays the basis for a close alliance between science and authoritarianism. The scientific worldview is a totalitarian worldview: it compels universal acceptance of its postulates, without providing an equivalent 'scientific' argument for such acceptance. While the method demands that teleology must be kept out of experiments, the general culture of science correspondingly urges that societies too should operate as if teleology were a figment of the imagination.

Science claims for itself a method for arriving at indisputable knowledge, knowledge that is not the result of negotiation, bargaining or choice, and that has no basis in politics. One is not free to choose scientific knowledge on principle. That is a given, declared final after the efforts of thousands of researchers. One is free (and often encouraged) to reject the statements of religion or art but he who refuses to accept the basic scientific worldview runs the risk of being labelled ignorant, insane, or irrational. Science has redefined the rational to mean only its own method, excluding all else.

The implications for a democratic order are obvious. Science, to be science, concentrates all knowledge within itself while access to scientific knowledge becomes itself a matter of privilege. The non-scientist is then seen as an empty receptacle into whom is poured the benefits science confers; and he must ask no questions. But democratic rights include the right to assess, or claim, true knowledge, and to reject impersonal knowledge. The right, in other words, includes the power to certify knowledge on any scale. Under the dominance of science, such rights have been eroded, and ordinary people (those who do not wear white coats) are no longer considered able on their own authority to provide true knowledge of the world.

Nature acts according to her laws. The scientist wishes to discover these laws. He may discover a few, but the totality eludes him and will always do so. Despite this, his effort is to substitute his knowledge of natural laws for such laws themselves. The scale of restrictions could be rewritten, therefore, as a scale stretching between organism/nature and machine/science.

The transformation of medieval man into modern man is now clear: the movement of western society has taken it from an organic base to a machine base, while the earlier

reliance on natural principles has been supplanted by one on principles invented by modern science. For western man, the mechanization of the world image is diametrically the opposite of what constituted the earlier organic perspective.

A caveat. Is modern science merely a reading of natural principles, of how nature works? This is the theory; this is the profession. Actually, what is achieved is a distorted view of the operation of natural principles. If a correct picture *had* emerged, there would have been no pollution or ecological imbalance on the application of such scientific knowledge. The negative consequences indicate that the picture does not fit with the demands of nature. Nature is the primary scientist, but she functions responsibly. The consequences of her inventions, so marvellously described recently by Felix Paturi and Karl von Frisch, are absorbed by self-closing natural processes.[3] Modern man creates objects artificially, but he can produce no equivalent process for the absorption of these goods post-use, or for their breakdown into elements. They then begin to clog the arteries of nature like a clot in the bloodstream.

This has an even more serious implication. The attempt of the machine to replace the organism, of science to replace natural principles, cannot remain confined to a particular culture or society. A civilization driven by a theory of science/machine *ipso facto* becomes a colonizing force, and aspires to bring under its sway every other culture that has based its survival on a natural relationship with its surroundings.

Returning to the scale of restrictions, human beings or societies that move beyond the homeostatic balance that civilizations construct, are usually vulnerable. The organic, because it is unrelated to colonization, is always open to attack. A tribal community, very closely integrated with its environment, is for that very reason prey to colonizing forces, as history has so clearly shown.

The abstraction is also not self-limiting, except in an ultimate sense. As we are no longer dealing with organic elements which have an in-built limitation, or termination at the close of their cycle, there are no limits to abstraction. The compulsion towards it becomes overwhelming, and no practitioner has any clue as to how to shut this Pandora's box. Abstraction, uncontrolled, becomes a threat to life and, as a consequence, to science itself.

Western society has produced innumerable healers, who have attempted to introduce controls of one kind or another, These have included men like Lewis Mumford or Ivan Illich, both of whom have emphasized medieval values in contradistinction to those of megamachine culture. Others include Paul Goodman, Theodore Roszak and a host of counter-culture prophets, including orientalists like F. Capra. What these philosophers have attempted is a process of reiteration, a return to the homeostatic balance. Without reiteration, they have argued, there is only the edge of the precipice at the edge of abstraction.

One final quality of the extremes of the scale of restriction is incorporation. A mystic is fully incorporated within his experience and ceases to be himself. A tribal culture can be

totally integrated into its surroundings and thus maintain a complete ecological balance. But incorporation also affects abstraction. Idealists in western philosophy have often ended up fully incorporated in their systems of thought. Scientists can be fully incorporated by their method. For instance, to those who propagate the scientific temper, the label often provides a psychological identity. The label counts for more than the individual. The individual commits psychological suicide.

This is why it is in vain for scientists to try to desert their class or professional perceptions. Scientists have recently attempted to analyse their societies critically, as fruitlessly as a character in a play trying to probe the nature of the playwright who invented him or her. The scientist *qua* scientist is merely a creature of his epistemology: scientists do not exist naturally, only human beings do. Flawed epistemologies must reflect and rebound on flawed personalities, and these in turn must induce even greater flaws in the constitution of what is human wisdom and how life may be carried out.

Political psychologists like Ashis Nandy have written on the effects of colonialism on the colonizers, how the process of colonialism and its consequent repressions called for an equivalent suppression of emotions in the colonizer.[4] There is unfortunately not much work available on the effect of the exclusion or incorporation principle on the scientist, on the way the scientist's identification with his method leads to self-mutilation, or the way scientific rationality distorts not only nature, but also the scientist.

The scientist recognizes only one overt absolute (there are numerous covert ones though) - his freedom to pursue information at all costs, social or natural. He is insistent that every principle of interference or 'noise' - from politics to values - should be excluded from his domain. At the heart of the scientific community's consciousness is a compulsive urge to experiment, to vivisect, in order to know. Yet there are no boundaries to let us know where the search for genuine knowledge ends and plain curiosity begins. One Indian biologist recently deplored the termination of a human pregnancy that was the result of artificial insemination by a chimpanzee. The alleged experiment was terminated by Cultural Revolutionaries in China, where the *in vitro* fertilization was reported to have been done. The ground for deploring termination of the pregnancy was that an opportunity for 'new knowledge' had been lost.

The most obvious and sorry record of pain, caused on a massive scale for the right to information, is that of vivisection, of which, as Peter Singer has said, either the animal is like us, in which case we ought not to experiment on it, for it would be like experimenting on one of us; or the animal is not like us, in which case the experiment is useless.

Most experiments performed on animals inflict severe pain without the remotest prospect of any significant benefits either for humans or for the animals themselves. Of the numerous experiments detailed in *Animal Liberation,* here is a sample:

Experimenters working for the US Food and Drug Administration gave thirty beagles and thirty pigs large amounts of methoxychlor (a pesticide) in their food, seven days a week

for six months, in order to ensure tissue damage. Within eight weeks, eleven dogs showed signs of abnormal behaviour, including nervousness, salivation, muscle tremors, spasms and convulsions. Dogs in convulsions breathed as rapidly as 200 times a minute before lack of oxygen caused them to collapse. Upon recovery from an episode of convulsion and collapse, the dogs were uncoordinated, apparently blind, and any stimulus such as dropping a feed pan, squirting water, or touching the animals initiated another convulsion. After further experiments on an additional twenty beagles, the experimenters concluded that massive daily doses of methoxychlor produce different effects in dogs from those produced in pigs.[5]

It was well known even before the experiments began, Singer points out, that 'massive doses' of methoxychlor would poison animals. And the very fact that different results were obtained for beagles and pigs indicates it is not possible to generalize in regard to human beings from experiments on animals. In fact, in three major cases, scientific experiments on animals led to faulty conclusions about the impact on humans.

Thalidomide was extensively tested on animals before being introduced as a sleeping tablet for human beings. The experiments on animals failed to show any abnormalities. The toxicity tests that had been carefully carried out on thalidomide had, without exception, demonstrated it to be an almost uniquely safe compound. What actually happened when it was introduced among the human population is well known. In the case of insulin, tests produced deformities in infant rabbits and mice, but not in humans, Finally, if penicillin had been evaluated by its results on guinea-pigs, it might never have been used on man.

Yet, the experiments continue on a massive scale. In Britain, according to official government figures, five million experiments are carried out on animals every year. The U.S. Department of Agriculture has stated that about forty million rats and mice are used annually for research. The Laboratory Animal Breeders Association estimated in 1966 that the number of mice, rats, guinea-pigs, hamsters and rabbits used for experiments had totalled sixty million in 1965, and would reach ninety-seven million by 1970. In 1965 between five hundred thousand and one million cats and dogs were used.

The following experiment is reported for India, performed at the K. G. Medical College, Lucknow, and is sufficient proof of how modern science can corrupt saner cultures. In 1968 K. Wahal, A. Kumar and P. Nath exposed forty-six rats to a high temperature for four hours. The rats became restless, breathed with difficulty, and salivated profusely. One animal died during the experiment and the others were killed by the experimenters because 'they could not survive anyway'.

Is not speciecism akin to Nazi science? Singer answers in the affirmative:

Blatant racism has led to painful experiments on other races, defended on the grounds of its contribution to knowledge and possible usefulness for the experimenting race. Under the Nazi regime in Germany, nearly 200 doctors, some of them eminent in the world of medicine, took part in experiments on Jews and Russian and Polish prisoners. Thousands

of other physicians knew of these experiments, some of which were the subject of lectures at medical academies. Yet the records show that the doctors sat through medical reports of the infliction of horrible injuries on these 'lesser races' and then proceeded to discuss the medical lessons to be learned from them without anyone making even a mild protest about the nature of the experiments.[6]

Here follows an experimental report on a human being, placed in a decompression chamber:

After five minutes spasms appeared; between the sixth and tenth minute respiration increased in frequency, the TP (test person) losing consciousness. From the eleventh to the thirtieth minute respiration slowed down to three inhalations per minute, only to cease entirely at the end of that period... about half an hour after breathing had ceased, an autopsy was begun.[7]

It is possible to argue that the atomic bombs dropped over Japan also fitted the same pattern. Two different types of atomic bombs were dropped on Japan: one was plutonium, the other uranium. The plutonium bomb was tested in the U.S. at Alamogordo, and later dropped on Nagasaki as a weapon. But the uranium bomb, J. P. S. Uberoi argues, was the first of its kind in history; it was tested out on the people of Hiroshima as much as a scientific experiment as a weapon. As Mahesh K. Varma puts it,

Hitlerism and Hiroshima are not aberrations or anachronisms; nor do they represent the extreme points of a malfunctioning of the Western socio-economic system. They symbolize the deepest urges of modern civilization and represent the extreme points of its functioning. The diabolism as well as the apalling banality of Auschwitz and Hiroshima is implicit in the fundamental formative idea of modern civilization, namely, that the destiny of man is to create anew himself, the world and history. Experimental atomic explosions abolish the line between the real and the experimental; and, in the last analysis, Hiroshima remains a Masterly Experiment.[8]

Much before Mumford wrote on the pentagon of power, M. K. Gandhi had arrived at the same conclusions. His analysis of modern civilization, particularly its technology, in *Hind Swaraj,* provides an almost prophetic vision of the ruin of a civilization built on the foundations of science and technology.[9]

Much of science has passed under the slogan of the conquest of nature. We are given to believe that we are in control of nature today even though we are not even certain any longer of bare survival. This alleged control justifies the scientist's authority. The 'certainty' of scientific knowledge has, through sleight-of-hand, passed over to the practitioners of science *as a class.* The Pope is not considered infallible, except when he speaks *ex cathedra.* The scientist on the other hand is considered infallible whenever he speaks as a member of the scientist class. His authority is derived from his method.

There is a class of thinkers who are sympathetic to modern science in general, but feel it has become anti-life, anti-human, And just as engineers propose technological fixes for

modern technologies that do not fit their environments, such thinkers attempt to humanize science through an infusion of alien elements. They make constant efforts, usually ignored by the majority of working scientists, to make science look more 'holistic' or to improve the prevailing paradigm. Recent years have seen numerous attempts to integrate modern science and eastern metaphysics. Whether this has helped science is not known, but it has certainly cheapened eastern metaphysics.

Modern science cannot provide the equivalent of a new vision of nature or man; the instrumentality cannot parade as cosmology. What modern science may be capable of is achieving correctional hypotheses for earlier erroneous ones. About this, Masanobu Fukuoka remarks:

Human beings do something wrong, leave the damage unrepaired, and when the adverse results accumulate, work with all their might to correct them. When the corrective actions appear to be successful they come to view these measures as splendid achievements or accomplishments. People do this over and over again. It is as if a fool were to stomp on and break the tiles of his roof. Then when it starts to rain and the ceiling begins to rot away, he hastily climbs up to mend the damage, rejoicing in the end that he has accomplished a miraculous solution.

It is the same with the scientist. He pores over books night and day, straining his eyes and becoming near-sighted, and if you wonder what on earth he had been working on all that time - it is to become the inventor of eye-glasses to correct near-sightedness.[10]

A great deal of science, then, is circular science.

Yet the gallant efforts to salvage the scientific method continue. If they are not 'interdisciplinary', they are 'multidisciplinary', which means that one merely increases the number of 'parameters' to make up for the deficiencies of Galileo's single-parameter model. But the addition of more and more partial views or 'parts', which are then sought to be interconnected, cannot produce a whole, since the parts in nature are *infinite*. For example, we cannot under any circumstances regenerate a natural forest, since a *natural* forest is its own creation. A natural forest can regenerate itself only if left alone by man. So-called 'scientific' forests, mostly monocultures and only occasionally mixed species, sit abrasively on ecological systems.

**II. Method as colonizer**

The massive investment made by western civilization in modern science has been because of the possibilities such science affords for control. In other words, the loyalty to science has had a political base.

Nature, at the other end of the scale of restrictions, cannot be controlled, precisely because of its irreversibility, uniqueness and, more important, its diversity. Abstraction increases control by homogenizing its subject matter. It eliminates the basis of diversity,

the personal and the historic, creating an artificial reality which can be completely controlled.

One of the fundamental misconceptions of our times is that science has increased our control over nature. This is a claim made by conservatives as well as radicals. What science *has* achieved is a substitution of nature's principles by its own: it has overcome nature by taking its place or by mimicry of her processes. Where science has proved to be a poor imitator, it has often retreated in ignominy. Where it has come, in its own opinion, close, it has still created havoc and ruin. We shall deal with this issue with the help of some examples later.

Because science has not been able to 'reproduce' nature in the latter's full diversity, it has sought to reduce the diversity by eliminating it, and introducing more simplified, mechanized designs instead. I will illustrate the process of elimination with two examples, one from the domain of language, the other from that of food. Both illustrate how modernity and, within it, modern science, enhance their control of nature or society by elimination, destruction or reduction of the latter's 'anarchic' characteristics, and by substituting in their place homogeneous, controllable elements.

In a recent book, *Shadow Work,* Ivan Illich clinically examines the case of Elio Antonio de Nebrija - a contemporary of Columbus - and his contributions to the origin of the modern state. While Columbus set out to extend Queen Isabella's domain over foreign lands, writes Illich, Nebrija stayed at home and proposed to the Queen a new form of control over her subjects by controlling their language (and thus, their thinking).

Nebrija's way of doing this was to bring in a grammar to standardize the popular language and eliminate anarchy in the domain of the people's speech. He wrote:

So far, this our language has been left loose and unruly and, therefore, in just a few centuries this language has changed beyond recognition. If we were to compare what we speak today with the language spoken five hundred years ago, we would notice a difference and a diversity that could not be any greater if these were two alien tongues.[11]

And again:

Presently, they [the people] waste their leisure on novels and fancy stories full of lies. I have decided, therefore, that my most urgent task is to transform Castilian speech into an artifact so that whatever henceforth shall be written in this language may be of one standard tenor.[12]

Illich comments on Nebrija's brief:

He wants to replace the people's vernacular by the grammarian's language. The humanist proposes the standardization of colloquial language to remove the new technology of printing and reading from the vernacular domain - to prevent people from printing and reading in the various languages that, up to that time, they had only spoken. By this

monopoly over an official and taught language he proposes to suppress wild, untaught vernacular reading.[13]

Nebrija is so much a part of us that today we cannot imagine books being written without a standard grammar. We shall see later, in other spheres, how modernity has created conditions within which it is impossible to discourse without the aid of the language of modern science. Illich summarizes the full impact of Nebrija's proposal for ordering public speech, for introducing a *taught* mother tongue, thus:

Henceforth, people will have to rely on the language they receive from above, rather than to develop a tongue in common with one another.... Formerly, there had been no salvation outside the Church; now, there would be no reading, no writing - if possible no speaking - outside the educational sphere. People would have to be reborn out of the monarch's womb and be nourished at her breast.[14]

In other words, the ungoverned, unmanaged speech with which people actually live and manage their lives need no longer be a serious challenge to the Crown or to the State. Human diversity need no longer prove to be a serious obstacle for the controlling interests of any society. And, most significantly, all ordinary experience must be recast in the 'official language', stamped with official approval, to be considered worthy of human use.

# 4. Atomic physics: The career of an imagination

SHIV VISVANATHAN

**I**

By World War II, capitalism had lost its poetic power, and the free market lay as a desiccated myth. At this juncture, science took over as the sustaining force of the liberal imagination. In the discourses of university dons, science was the model of communitas. The Republic of Science was deemed an open society, sustaining a creative tension between individual initiative and collective truth. In this more liberal world, the scientific method was substituted for the invisible hand and Popper and Polanyi became the Adam Smiths of this new regime.

This contemporary theology of science has been challenged from three perspectives. First, from within the philosophy of science itself, Thomas Kuhn has redrawn science as a totalitarian gestalt, observing heretically that science, like Stalinism, rewrites histories, in which the defeated became non-persons. Second, from political psychology (trying to

come to grips with the Nazi phenomenon) came the writings of Arendt, Bettelheim and Frankl. They have shown that as rational structures the concentration camp and the research laboratory were easy bed-fellows, that Eichmann had the particularly prized quality we call scientific detachment. Frankl summed up this argument in his observation that the 'gas chambers of Auschwitz and Treblinka were ultimately prepared, not in some ministry or other in Berlin, but at the desks and lecture halls of nihilistic scientists and philosophers.' [1] Third, complementing these critiques in filigreed detail, if not philosophical power, are the writings of journalists chronicling the scandal called science: the works of reporters like Daniel Greenberg, Gordon Ratray Taylor and Edward Goldsmith. To this last genre belongs the work of the Viennese journalist, Robert Jungk.

Robert Jungk is the most comprehensive historian of the nuclear regime. He represents liberal humanism at its best - secular, rational, aesthetic, Erasmian; he is knowledgeable about evil but always surprised by it. This vision stems not solely from the impeccable sociography of a liberal humanist Jew, but also from his self-view as a survivor (he barely escaped death in a Nazi concentration camp). As a survivor of one holocaust, he has become the futurologist of another, goaded by the memory of one to warn against the possible occurrence of another. Jungk sees nuclear energy as cancerous imagination, and his books are an attempt to understand its career.

His *Tomorrow Is Already Here*[2] *is* a study of America as a threat to the liberal future; *Brighter Than a Thousand Suns*[3] *is* the classic history of the making of the atom bomb; *Children of the Ashes*[4] *is* a study of the survivors of Hiroshima, of death as vivisection contending with death as sacrifice; *The Big Machine*[5] is a gentler essay on the research laboratory CERN, where Americanized science sought to recover its lost European civitas; and, finally, *The Atom Staat,*[6] a statement of nuclear energy as occidental despotism.

Underlying the anecdotal richness of the books, one discerns a set of typological constructs that determines the structure of the narrative. These are the proverbial dualisms of western science: the hiatus between the secular and the sacred, sciences and humanities, truth and power, theory and praxis. Even in his moment of uniqueness, the scientist as hero remains a creature of this captive text. The theatre for the ritual enactment was inevitably the modern university. The modern university encapsulated in the classificatory organization of its faculties these dualisms, representing also a particular relationship between knowledge and power, and the various forms of knowledge as power. Jungk becomes the master story-teller in his pages on 'Once there was a university in a town called Göttingen.'

Jungk sees nuclear physics as socio-drama. He observes that each age finds a peculiar site to act out its fantasies. It becomes a magical domain that attracts the most gifted and adventurous. Atomic physics possessed such a magnetic power after World War I. By that time, the researches of Rutherford, Bohr, Planck and Einstein had ruptured the nineteenth-century world of fin *de siècle physics,* altering the epistemic relations between subject and object, cause and effect, observer and observed. Physicists had begun their lovers' quarrel with the Newtonian world. It was a moment of discovery which became a

moment of communitas: 'Old and young became comrades of this journey into the interior.'7 Otto Frisch recounts an anecdote about Bohr's seminar, where

A young scientist [Lev Landau] sat down on a lecture bench tired from his walk and lay down flat on his back. In that position he continued arguing and gesticulating at Niels Bohr who was bending over him, earnestly trying to convince him that he was wrong. Neither of the two appeared to be aware that this was an unusual way of conducting a scientific discussion before an audience.[8]

At Munich, under Sommerfield, the conversation would move to the cafes where

Marble topped tables were covered with scribbled mathematical formulas The waiters had strict instructions never to wipe the tables without special permission. For if a problem had not been solved by the time the cafe had closed for the night, further calculations were carried out the following evening. It happened fairly often that some unknown person would have the audacity to jot down the solution during the interval.[9]

Years later, when the mathematician John von Neumann emigrated to America, he longed for these cafes 'where one could gossip for hours over a cup of coffee'. He even thought of investing his savings in one such institution. When his American colleagues objected that the citizens of Princeton would not know what to do with a Viennese cafe, von Neumann replied, 'Don't bother about that, we'll recruit a few of our European colleagues. They will sit in my cafe every afternoon for a few days just to show you how it's done.'[10]

In Homeric epics, the bard would list the names of the ships sailing off to war, the very names sounding a magical incantation. Jungk's list of scientists who passed through Göttingen in those years has a similar incantation. There were the childlike George Gamow, the gentle James Franck, Dirac and Pauli, the American wunderkind, Jules Robert Oppenheimer, Lev Landau and Norbert Wiener, Houtermans and Blackett, Fermi and Rabi and Heisenberg and Weizacker. The account reads like a troubadour singing of the romance of a distant court. These were the beautiful years of nuclear physics, of science at play, of discovery and communitas. That, combined with the epistemic openness of atomic physics, made up the paradigm for the liberal imagination. One is reminded of Rilke's lines - a thing of terror conceived in a moment of beauty....

In 1949, an old scientist at the company town of Los Alamos made a confession to Jungk. His outburst serves both as an epitaph for atomic physics and as the problematique of this genre of books. The scientist exclaimed:

What an extraordinary and incomprehensible thing, my whole youth was absolutely devoted to truth, freedom and peace, yet fate has seen it fit to deposit me here where my freedom is limited, the truth that I am trying to discover is locked behind massive gates and the ultimate aim of my work has to be the construction of the most hideous weapons of war. Could fate have been more perverse?[11]

It is the Dostoyevskyian paradox of freedom culminating in tyranny and being resolved in a many-layered fashion. Jungk wonders repeatedly whether the subversion of science was caused by the external environment of politics or whether its perversions were inherent in, and normal to, it. What emerges is a split-level analysis - a synchronic portrait of the repertoire of roles available to the scientist during a crisis of conscience and a description of the basic changes in the structure of the nuclear regime.

Jungk is a master of what anthropologists call thick description. The multitude of anecdotes he provides coalesce into a choreography of positions available to science in relation to the violence of the atom bomb as a social fact. Within such a perspective, scientists like Einstein, Szilard, Teller, Bohr and Oppenheimer appear not as idiosyncratic figures but as permutations within a scientific code. Names become role tags listing various possibilities as the table shows.

We begin with Enrico Fermi's statement, 'Don't bother me about your conscientious scruples. After all, the thing is beautiful physics.'[12] It embodies a picture of apartheid science - aloof from politics. The accompanying positions reflect various amalgams of the scientific and the political.

The atomic scientists realized the irrevocable nature of the bomb which had triggered forces science could no longer control. They sought for a Maxwell's demon to control the entropy of the resulting socio-political system. Inevitably, one of the first models offered was the social organization of science itself as a model of communitas. Archetypal of this attitude were the efforts of the Danish physicist, Niels Bohr. The great physicist believed that the scientific community was the homunculus of the future international order.

| Good science, indifferent politics | Social organization of science as a model of politics | Use of politics to further science | Political control of science |
|---|---|---|---|
| *Fermi* | *Bohr* | *Teller* | *Szilard* |
| Scientization of politics | Scientist as political Prometheus | Retreatism without retrieval | Renunciation |
| *Von Neumann* | *Klaus Fuchs* | *Einstein* | *Helen Smith* |
| Restriction | Alternative science | Good science, bad science | Humanist Hamlet, Promethean scientist |
| *Norbert Wiener* | *Nazi Science* | *Hans Bethe* | *Oppenheimer* |

Pure science had managed to avoid the violence of war by sublimating it into agonal play. The scientific paper was a precious gift, and it circulated in joyous exchanges between the three centres at the Cavendish, Göttingen and Denmark. Every conference was a kind

of potlatch, each scientist showering the others with knowledge in return for eponymous recognition.

The internationalism of science withstood the pressures of war. When the English scientist, James Chadwick, was interned in a war camp during World War I, his German teachers, Nernst and Reubens, helped him establish a small laboratory where he carried out important researches. Even during World War II, Wolfgang Getner saved his former teacher's laboratory in occupied France. When the German was appointed director of Joliot-Curie's laboratory, the two sat in a cafe and drew up an agreement on the back of a menu card that Joliot's laboratory would never be used for research devoted to war. For Bohr, scientists were never at war. He hoped to use this internationalism of science to bridge the hostility between nations, particularly between the USA and USSR. Hoping to initiate informal contacts that would facilitate an arms control agreement, he approached Roosevelt and Churchill for permission. Of the fate of the first interview, we know little; but the report of the second reveals the endemic dualism of knowledge and power. Churchill listened to the physicist for half an hour in silence and then turned around to his scientific adviser and asked, 'What is he really talking about? Politics or physics?'[13]

If Bohr proposed science as the model of the ideal polls, Edward Teller used politics to perpetuate science by promising to perpetuate politics. Lewis Strauss, chairman of the AEC, once remarked that there were three kinds of scientists: pure, applied and political. The last category sums up his henchman; Teller embodies the scientist as a political lobbyist playing on military and political fears to obtain larger financial sanctions for research. All he needed was the sealing-wax morality of *Reader's Digest* anti-communism. The father of the H-Bomb was the first of the 'sputnik scientists', scientists who played on political fears to perpetuate their own research interests.

Opposing them was a larger group of scientists who believed that it was only political organizations that could control science. These scientists, led by Szilard and Franck, participated in the democratic process, urging greater public understanding and control of science. Szilard and Franck represent the scientist as political visionary. By 1945, Szilard had already proposed international supervision of the entire product cycle of uranium. His futuristic measures included partial surrender of national sovereignty, Soviet police on American soil and vice versa. Ironically, while the scientist campaigned for the political control of science, the politician, with odd objectivity, realized that science as a text was politically indifferent. This increased the catchment area from which scientists could be recruited to further national policies. Jungk reports that despite the protests of scientists, the USA recruited former Nazi personnel who had worked on V-2 rockets to assist the armaments industry. Needless to say, Soviet Russia matched this ideological cynicism.

The indifference of science to context and ecologies makes it a powerful vector, an exponential virus. The effects are immediately obvious in the scientization of various domains, particularly modern politics through the introduction of game theory. Game theory was an innovation of von Neumann. Game theory facilitated the planning of future nuclear wars. For von Neumann's computer, 'the end of the world was only one more

question to be answered by calculation'.[14] Neumann's scenarios and the later ones of Herman Kahn represent science as a futurological exercise. They represent the eventual denial of the meaning of death in the scientific community, of Thanatos that lacks a supporting eschatology.

What frightens one is the poverty of language in these scenarios. The end of the world has been an important and continuous concern. Yet these impoverished scenarios lack an occult dimension, the poetry that magic and religion provide. They are numbers *sans* numerology, calendars *sans* ritual, the emptiness of clock time pretending to be history.

When Oppenheimer was defeated in the struggle to control the superbomb, he summed up his reactions thus:

I find myself in profound anguish over the fact that no ethical discussion of any weight or nobility has been addressed to the problem of atomic weapons.... What are we to think of such a civilization which has not been able to talk of the prospect of killing everyone except in prudential game theoretic terms.[15]

Jungk sees this as the greatest threat to the liberal imagination; and we shall elaborate it later.

Returning to the repertoire of models, we now confront a most cryptic figure in the scientist-as-politician Klaus Fuchs. Jungk's terse pages on him are fascinating and suggestive. They consist basically of two long extracts, one from an interview with the scientist's father, a Quaker pastor, and another from a long essay by a family friend, Margaret Hager.

In modern mass media as ersatz folklore, Klaus Fuchs is the scientist who betrayed a generation, the scientist who delivered the atomic secret to Russia. But in Jungk's report, the espionage agent as traitor becomes a quiet Prometheus. Fuchs' act had all the irrevocability of the Promethean enterprise. It altered human history, shattering the American monopoly of the bomb, ironically unleashing the race for the 'super' bomb. Like the Promethean gift, it was a stolen one and thus perpetually embedded in violence and guilt. Fuchs' father remarks, 'I can understand his extreme inward distress.... He said to himself: "If I don't take this step, this imminent danger to humanity will never cease." '[16] If the Promethean spirit of arrogance and doubt adheres to any scientist, it is to Klaus Fuchs. Like Prometheus, Fuchs was forced to live with the strange ambivalence of the stolen gift. Like Prometheus, he was the real thief of fire; he stole fire from the men who played God. In his acceptance of punishment lies a touch of grandeur that all Oppenheimer's later crucifixion fails to capture. Yet, ironically, in a small way, the scientist as the political Prometheus is still captive to the scientific text. The scienticized world has psychiatrized the language of guilt. One of the opening lines of Fuchs' confession reads: 'My father was a parson and I had a happy childhood.'[17] One is almost afraid of a link between toilet training and the atomic bomb.

Margaret Hager, a family friend, contends that by contemporary standards of morality Fuchs was guilty, and maintains that he was so that 'nations, individuals and humanity at large might learn in principle where the present social organization is taking us'.[18] She believed that Fuchs' act was morally a stopgap, safeguarding the human race in its forward movement to a more creative humanity. Hager's observations tempt one to complete the Promethean myth as in Plato's Protagoras:

Then Prometheus, seeing man was defenceless, stole fire. Now men were in a position to maintain themselves from day to day. But each lived apart. When they tried to form communities they failed and quarrelled to death amongst themselves. Then Zeus, touched by pity for man, sent Hermes to make up for Prometheus' deficiency. Hermes brought to man the civic art of justice and order that men might live peacefully together on earth.[19]

In the final pages of *The Atom Staat*,[20] Jungk explores such a return to Hermes.

The description, so far, has sought to emphasize the political reconstruction of science. The next list of possibilities centres round the social construction of the scientific role itself. We begin with retreatism. Einstein, and, later, Oppenheimer returned to the seclusion of Princeton to speculate on the pure sciences. Their attempt marked the return of pure science to monasticism, but the monastery was the most exclusive of scientific clubs, the Institute of Advanced Study at Princeton. The Institute reflected the pursuit of pure science as truth leavened with humanism, seeking to build pathways between the 'villages of art and the villages of science'. Here the pure scientist had annulled the pretension of applied science to call itself scientific, contending that technicist science was an instrument of power. Einstein's retreatism was marked by intermittent forays into politics. He told Ervin Strauss, his scientific assistant at Princeton, 'Yes, we now have to divide up our time between politics and our equations. But to me our equations are far more important, for politics is only a matter of present concern. A mathematical equation stands for ever.'[21] His name continued to be associated with a rag-bag of pacifist movements. Jungk tells the story of Lew Kowarski, Joliot-Curie's associate. The Polish *émigré* scientist, later to spearhead the French atomic effort, once asked a group of young American academics what they were discussing. They replied, 'Oh, we are just wondering what we are going to say in Einstein's latest letter to the President!'[22]

There is a touch of Francis of Assisi about Einstein; the same compassion and gentleness. The secluded Princeton institute in fact resembles the great monasteries of the Middle Ages seeking to preserve culture against encroaching barbarism. Yet, behind the music of intentions, one senses the same captive disjunctions between knowledge and power, the arts and the sciences, pure science and applied science. One is reminded of Walter Miller's Table of the nuclear age, *The Canticle for Leibowitz.*[23]

It is a tale of a strange epoch, in which a group of monks live in the wilderness preserving religion after the great cataclysm called the fallout. A young monk discovers within a sarcophagus, actually a fallout shelter, a circuit diagram and an accompanying set of words. Its meaning eluded the monks, but they treated it as sacred, preserving it in the finest calligraphy, a relic of a-great saint. Through gradual exegesis, they decoded the

diagram and its accompanying text, and the story ends with the world once again engulfed in a fallout.

There are two alternatives which Jungk mentions but never explores in detail. These are the possibilities of an alternative science and the notion of renunciation. He mentions the case of one of Max Born's English students, Helen Smith, who, when she realized the possible applications of the atom bomb gave up physics for jurisprudence. The renunciation of scientific research seems remote to the progressive rhetoric of science. Science can be organized, redirected, but not renounced. Implicit in the genetic structure of science is a technological Circe who programs every 'can' to mean a 'must' - that is, whatever technological reality indicates as feasible is interpreted as morally imperative. 'Can', a neutral statement of feasibility, is raised to 'ought', a normative imperative.[24] It is the can-implies-ought tenor of science that accounts for the instability of many of the solutions. Jungk hints that science as a cognitive system lacks a notion of restraint, the equivalent of an incest taboo. All it possesses is the proverbial package of dualisms. You can save the head but not the heart.

If renunciation appeared remote, even self-imposed restriction seemed problematic. But it is a pragmatic policy and deserves consideration. One recalls Heisenberg's observation that the self-imposed restriction of a dozen scientists in the 1930s would have halted the atom bomb. Ironically, it is the German scientists under Hilter - Max von Laue, Houtermans, Weizacker - who secretly decided that they would 'avoid working for Hitler's war machine or only make a presence of doing so'.[25] Sadly, this is in sharp contrast with the almost paranoid frenzy with which Allied scientists went for the bomb. Jungk cites von Laue's statement, sad and sardonic, that 'no one ever invents anything that he does not really want to invent'.[26]

In the post-war era, a specific proposal regarding the restriction of scientific communication was made by the American mathematician, Norbert Wiener. Wiener believed that the scientist must take personal responsibility for the results of his research rather than hide under the cloak of value-neutrality. When an American armaments firm requested Wiener for one of his papers, he refused, stating 'that to disseminate information about a weapon in the present state of civilization is to make practically certain that the weapon will be used'. He added: 'If therefore I do not desire to participate in the bombing or poisoning of defenceless people - and I most certainly do not - I must take a serious responsibility as to those to whom I disclose my scientific ideas.'[27] Jungk reports that Wiener's ideas were decisively repudiated by the scientific community which contended, with a sense of the mysterious, that no one could predict the final consequences of one's research. In this milieu Wiener's statement comes as breath of fresh air.

The necessity for an alternative science, that is, a science grounded in an altogether different metaphysics, was not seriously considered because of the coerciveness of immediate history. Possibly because of his faith in humanism, but also because of the spectre of Nazi science, Jungk himself dismissed the notion of such an alternative. The Nazi regime forced the dismissal of some of the finest physicists from Göttingen

replacing Jews with mediocre party functionaries. Jungk's sentiments regarding an alternative science are captured in an anecdote he relates about Göttingen in the Nazi era. About a year after the great purge, the mathematician David Hilbert was seated in the place of honour next to the Nazi minister of education. The minister asked, 'Is it really true, Professor, that your institute suffered from the departure of Jews and their friends?' The scientist replied, 'Suffered? No, it didn't suffer, Herr Minister. It just doesn't exist anymore.'[28] The perfidies of Nazi and Stalinist science have given the idea of an alternative science a parochial or totalitarian odour of politically distorted truth. Yet one feels today a deep need to work out the axioms of an alternative science. For example, the ethical power of the anti-vivisection movement needs to be separated from the fact that Hitler and Mussolini were advocates of such idea. Faddism and political accident must be separated from the logic of an alternative metaphysics.

Jungk is ruthlessly honest in exposing the unstable nature of many of the solutions caught in the dualistic grid of western science as a collective representation. We observe cases of official science and extracurricular humanism, of atoms for peace and atoms for war. We have cases of scientists warning the public against the dangers of atomic warfare while simultaneously pursuing a science devoted to it. This instabilitymarks the remarkable scientists' movement against the bomb. Inspired by Szilard, Franck and Einstein, the scientists' movement had all the innocence and futility of a children's crusade. Its initial successes were impressive. It was mainly because of their efforts that civilian control of atomic energy became possible. Yet it is this great movement that reveals that idealism alone is inadequate. To understand this, one has to see it through the cynical eyes of General Groves, overall military co-ordinator of the bomb. Leslie Groves is usually portrayed as a bumbling peasant among the aristocratic scientists of Los Alamos. When Groves observed the initial retreat from the company town of Los Alamos back to the freedom of the university, the shrewd peasant in him made him retort that 'his little sheep would find their way back'.[29] He was right. By 1947, the scientists' crusade against the bomb had failed and they were trudging back to Los Alamos. Groves remarked later, 'What happened is what I expected, that after they had this extreme freedom for six months, their feet began to itch, and, as you know, almost everyone has come back to government research because it was just too exciting.'[30] Jungk analyses this pendulum-like swing between good science and bad science through the career of Hans Bethe, an outstanding physicist.

During the war years, possibly because he was an *émigré* from Nazi Germany, Hans Bethe felt no qualms about atomic research. But after the bombing of Hiroshima, his attitude changed. He felt personally responsible and became a leading opponent of armaments research. He left Los Alamos, returned to the university and established at Cornell an outstanding centre for theoretical physics. Jungk's description turns biblical here. He reports that in the middle of 1949, 'That paradise of pure research was invaded by Teller, advocate of the Hell bomb. Teller intended to lead Bethe to temptation. He begged him to return to Los Alamos for one year, since his collaboration in the production of the bomb was indispensable.'[31] When offers of money failed to work, Teller offered the prospect of knowledge, new insight into thermonuclear reactions and the opportunity of working with new computing machines, hitherto restricted to military

uses. Bethe was flattered but hesitant. He sought the advice of his colleagues. He saw Oppenheimer at Princeton, but the scientist was ambiguous. Then, during a walk with his friends Placzek and Weisskopf, Bethe became convinced that in a nuclear war there were no victors, for 'We would lose the very thing we fought for.'[32] Between 1949 and 1950, Hans Bethe still remained an extreme opponent of the bomb. He was among the twelve scientists who questioned Truman's ordinance to pursue research into the H-Bomb. These twelve condemned the act as genocidal, inimical to the basic tenets of Christianity. Yet by 1951, Hans Bethe, along with Oppenheimer, was participating enthusiastically in H-Bomb research.

Jungk asks, 'How does one explain such macabre enthusiasm which has swept away all earlier scruples and objections...?'[33] Oppenheimer himself provides a clue in his later ruminations:

It is my judgement that when you see something that is technically sweet you go ahead and do it and you argue about what to do about it only after you had your technical success. That was the way it was with the atomic bomb. I do not think anybody opposed the making of it. There were some debates about what to do after it was made. I cannot very well imagine if we had known in late 1949 what we got to know by early 1951 the tone of our report would have been the same.[34]

It is this technicist imperative (what the scientist finds 'technically sweet', he finds nothing less than irresistible) that haunts Jungk.

Probably the most fascinating figure in this *danse macabre* is the American scientist, Jules Robert Oppenheimer. Jungk captures the idiosyncratic uniqueness of the man and yet reveals his archetypal qualities as scientist. Even in the epic world of Göttingen, Oppenheimer acquired a legendary reputation as the wunderkind, 'often improvising on the spur of the moment entire dissertations so that hardly anyone else had a chance to speak'.[35] But the prodigy of the Göttingen, era realized that the Muses had eluded him in the later years. While his contemporaries - Pauli, Dirac, Heisenberg - had enormous contributions behind them, Oppenheimer was still not associated with any major discovery. It was at this stage that he was asked to co-ordinate the construction of the atom bomb. As a scientific orchestrator, Oppenheimer was a genius, truly the Toscannini of the atom bomb, a theoretical physicist with experimental brilliance, a polymath who could discuss Proust, Dante, the Gita and pure physics with equal verve, a fox among the scientific hedgehogs. Jungk repeatedly cites the zeal with which Oppenheimer pursued his study of the Gita or his explorations into literature. He recounts that Oppie joined the University of California at Berkeley because of a few old books, the enchanting collection of sixteenth and seventeenth-century French poetry in the library. In his preface, Jungk writes that if Shakespeare had to write *Hamlet* today, he would have made Hamlet not a prince but an atomic scientist.

What Jungk reveals, however, is that it is a humanist Hamlet struggling against a scientific Prometheus. In fact, it is Oppenheimer who reveals the weaknesses of humanism in controlling science. When the bomb exploded, this was the man who

exclaimed that the scientist had known sin. Yet this is the same man whose role in the bombing of Hiroshima was described as providing a technical answer to a technical question, and who participated enthusiastically in the final plans for the H-Bomb. One has to confront the eerie power of the man. He is both innocence and evil, the idiot and the possessed, scientific sophisticate and political innocent, emerging eventually as the most Dostoyevskyian figure in modern science. The other roles mentioned become mere refractions of this archetypical portrait of the scientist as hero. Jungk unravels the structure of this modern myth brilliantly. His interpretation is reminiscent of Akiro Kurosawa's film 'Rashomon' where the same event is seen through three separate viewpoints. Similarly we have three separate variants of the Oppenheimer legend: Oppenheimer as the scientist crucified, followed by Oppenheimer as a self-confessed Judas. But the obviousness of the two stories screens the other equally real picture of Oppenheimer as Pontius Pilate. We begin with the first two versions.

The post-war years saw the heightening of what Durkheim might have termed Oppenheimer's 'mana'. Unlike many other scientists who had retreated to their specialist warrens, Oppenheimer remained a public figure, a charismatic presence translating the esoteric adventures of science to the public at large. Aristocratically distant and yet strangely populist, to the common man he was the scientist as hero. But to the paranoid world of militarist America, he was the hesitant egghead, dithering over the H-Bomb, a rootless scientific intellectual and therefore a security risk. Adding drama to this was the struggle between the two scientists, Teller and Oppenheimer. The man who orchestrated the atom bomb was hesitant about the H-Bomb, while Teller was its most frenzied advocate. The militarist pressure groups manoeuvred an investigation into Oppenheimer's activities, and he was deprived of his security clearance. Oppenheimer became a scientific Dreyfus, stripped of his epaulettes by the country he served. The humiliation of Oppenheimer stirred the public who saw in him the conscience-stricken symbol of the atomic age. 'Even before the proceedings had started, the halo of martyrdom was already bestowed on him.'[36]

The picture of the scientist as political martyr is then juxtaposed to the picture of the scientist as Judas, particularly because of Oppenheimer's self-confessed betrayal of Haakon Chevalier. In the mid-thirties, Oppenheimer had an elaborate but erratic network of leftist contacts, which he later abandoned. To the American intelligence this fact, however, made him politically suspect. Oppenheimer had been appointed director of Los Alamos despite their objections. Refusing to relent, they kept him under perpetual scrutiny. Succumbing to their hound-like persistence to identify his alleged communist contacts, Oppenheimer invented a colourful story of Chevalier as a communist agent.

Haakon Chevalier, a lecturer in Romance languages in California, was a close friend of Oppenheimer. The two friends spent hours discussing Anatole France and Proust and trying recipes in Oppenheimer's kitchen. Chevalier never realized that Oppenheimer had implicated him. He was subjected to continuous harassment and eventually forced to leave for Paris, where he worked as a translator. Unaware that Oppenheimer was the source of his troubles, Chevalier wrote to him to help him obtain a security clearance. The two friends met in France in 1953, when Chevalier recounted his problem again.

Even then Oppie never confessed that he had betrayed Chevalier. On taking leave, he embraced him and his wife. Haakon Chevalier was to shudder later at the recollection of this parting gesture.

The dramatic power of the two variants cannot be denied.

The trial of Oppenheimer had all the stuff of drama, anguish, doubt and ambiguity of a conscience-stricken scientist. The Chevalier affair adds to it. It emphasizes the human frailty of the man in power. The composite picture is that of Oppenheimer as Dreyfus-Galileo, ersatz images that emphasize vulnerability to disguise power. But the subversive power of modern science as myth lay precisely in this. It transformed the vivisector into the sacrificial lamb. As subtle a historian as George de Santillana wrote an essay exploring the similarities between the Oppenheimer and Galileo trials. Even the struggle of the survivors of Hiroshima lacks the mythical power, the poetry of the trial and exile of Jules Robert Oppenheimer. The FBI once convicted the gangster Al Capone for an income tax evasion, an irony which escaped no one. But history offers a greater irony: Oppenheimer was convicted falsely and thus enabled to escape a more serious charge. A petty conviction covered the trial of a war criminal. It is this that we must confront, a seeming innocence that hides genocidal intent. The portrait of Oppenheimer as Judas Iscariot obscures the element that is missing in the triptych: Oppenheimer as Pilate washing his hands of genocide.

We are not merely talking of Oppenheimer's fascination with power, his need to cling to it. Many of the younger scientists were disappointed that he distanced himself from the scientists' crusade against the bomb, with his truth-by-expert-committee approach. They felt that the scientist who claimed he had known sin had made no suggestion as to how he might show remorse in a practical form. We are not even considering his pendulum swings between official science and extracurricular anguish. What makes him Pilate is the eerie inocence of pure science washing its hands of genocidal guilt.

Talking to a French diplomat after the war regarding the prospect of establishing a supra-national European laboratory, Oppenheimer emphasized that the proposed laboratory should be devoted, not to the development of atomic energy and nuclear engineering, but to pure, application-free, fundamental research. Oppenheimer added in the course of the conversation that 'the bomb was in fact no more than a gadget. Now we should be allowed to return to deeper problems.'[37] The finality and naively of this statement is amazing. It is as if he had dismissed the applied scientist, the Faust, in him as an aberration. One is reminded of the equally atrocious statement cited by that hagiographer of science, C. P. Snow, that 'when the bomb exploded the scientists were sad and the technicians happy'. This kind of statement can disguise two falsehoods. First, it ignores the technicist imperative within science; and, second, it ignores the scientists' responsibility for the bombing of Hiroshima.

Much is made of the feud between Teller and Oppenheimer. But this struggle only disguises the vivisectional unity of the two opponents. Teller appears as a one-dimensional Oppenheimer, the scientist who had stopped reading his humanist classics.

Yet, despite such differences they merge into one another. Both co-operated in the making of the H-Bomb. Oppenheimer does not lose to Teller, he becomes Teller. Behind the occasional humanist anguish is the modern death mask. Oppenheimer is no longer the scientist who has known sin. One senses no pain in him. It is as if he had computed the atomic weight of a new element and moved on. There is no atonement. He encounters guilt in the manner one measures temperature. In Oppenheimer's career we observe not the resolution of moral anguish, but the bureaucratic closure, not heroic denouement but the closing of a file. The scientist as hero collapses into the organization man. He who had read Dante turns out eventually to be a clerk. He who boasted of having read the Gita remains only a fragile humanist. This eventually raises an important question: Can humanism control science, deepen it? Or is it only a quarrelsome sibling, competitive but eventually complementary to it? Jungk attempts to answer the question through a diachronic portrait of the nuclear regime.

**II**

The writings of Jungk possess a mimetic quality in the manner in which each work mirrors the epoch described. *Brighter Than a Thousand Suns,* a study of the physicist as the fallen hero, has an epic quality about it. Science in this era possessed hints of the medievalism of the chivalric knighthood and craft guilds. *Tomorrow Is Already Here,* a portrait of industrialized science, has all the terseness and immediacy of a newspaper report. It is almost a subversive mimicking of the manufacture of information in a mass society. The difference in style between the two books provides a clue to Jungk's perception of the changes in the nature of the nuclear regime.

Jungk discerns three major changes in the movement from one epoch to another: the degeneration of science as a play form; the shift within science from epistemic uncertainty to vivisectionist hegemony; and the displacement of science from the university to the company town. All three are symptomatic of the transformation of western liberalism into occidental despotism, heralding the coming of the atom staat.

For Jungk, as for many western intellectuals, the university, rather than the market-place, was the seedbed of the liberal imagination. Unlike the market which eroded the fraternity of the medieval aristocracy and craft guilds, the university employed heraldry, chivalric codes and craft rituals to create and maintain the fraternity of a modern democratic knowledge system. While both market and university emphasized formal freedom, the latter was successful in embedding it in a framework of communitas. Robert Jungk is fascinated by the ludic quality of the modern university, which was the domain of play. The early years of nuclear physics were the beautiful years precisely because they were the playful years. Jungk does not formally employ the notion of play, but it is implicitly present in his ethnography of physics at Göttingen

The category of play[38] seeks to understand a cultural form that transcends the more mundane sociological dichotomy between work and leisure, between the serious and the non-serious. Baldly stated, play is any rule-bound voluntary activity, conducted within strict but arbitrarily defined limits, disinterestedly pursued without any specific intention

of material gain. As an aesthetic form, it embodies a search for order, an activity deemed valid in and of itself. Jungk perceives pure science as a distinct play form. The paradigms of pure science embody a search for order, and as order is a thing of beauty, we have the affinity of pure science to aesthetics. Pure science is *theoria* which justifies itself in terms of poesis rather than praxis in that the performance of the scientific act is legitimate in itself. From this we derive the notion of science for science's sake. Rules become important in this context, and any deviation, such as the search for utility, threatens the very existence of the play form. It was this sense of play that made Rutherford insist that his work on the atom was useless, for his was a search for order and beauty, not utility. More particularly, it reveals the understanding that pure science as play must be conducted within strict limits, that play is always enacted within a bounded space that must not be ruptured.

One is reminded of Jungk's story of David Hilbert. While addressing a Göttingen meeting, the crusty mathematician remarked, 'One hears a lot of talk about the hostility between scientists and engineers. I don't believe in any such thing. In fact, I am quite certain that there is no such thing. There can't possibly be anything in it because neither side has anything to do with each other.'[39] What appears as the arrogance of the pure scientist embodies a deeper grain of wisdom. The osmotic distinction between pure science and applied science is the only system of in-built control which prevents the erosion of pure science as a play form. Pure science as play also embodies a notion of seriousness. Jungk narrates a story about Rutherford. Failing to attend a British defence meeting on enemy submarines during World War I, the New Zealander was censured for his absence, but retorted without embarrassment, 'Talk softly please. I have been engaged in experiments which suggest that the atom can be artificially disintegrated. If it is true, it is of far greater importance than war.'[40] Huizinga notes that play can rise to the heights of beauty and sublimity which leaves seriousness far beneath: 'The inferiority of play is continually offset by the superiority of its seriousness.'[41] This statement embodies the cosmic playfulness of physicists like Bohr, Rutherford, Einstein and Pauli in the beautiful years. Yet, paradoxically, the seeds of the atom staat lay in the eerie innocence of this ludic community.

Pure science as play was an aesthetic form sans ethics. In emphasizing the dangers of pursuing science for science's sake, Jungk recounts his encounter with a mathematician he met on his last visit to Los Alamos. 'His face was wreathed in a smile of almost angelic beauty. He looked as if his gaze was fixed upon the world of harmonies. But in fact he told me later he was thinking about a mathematical problem whose solution was essential to the construction of a new type of H-Bomb.'[42] Jungk adds that this scientist never bothered to watch the trial explosion of any of the bombs he had helped produce. To him 'research for nuclear weapons was just pure mathematics untrammelled by blood, poison or destruction.'[43]

Play remains play because of its sense of limits, a realization that it embodies an 'as-if' world played out within strictly defined limits. It is the degeneration of the play form contaminating the serious that horrifies Jungk. This occurs in two ways. First, science as play is taken over-seriously and, like other play forms such as modern sport, becomes

overorganized. As science gets managerialized, it is bereft of its playfulness, consequently losing its celebration of artlessness, gladness and detachment.[44] The second process involves the contamination of other domains by degenerate forms of pure science. Jungk cites the example of the entry of game theory into such serious domains as death, work, sexuality and politics. Game theory in these domains represents the degeneration of the ludic into the ludicrous:

These methods were spawned in the weapons laboratories *of* World War II to be tested on major military objectives. 'Thinking about the unthinkable' (as Herman Kahn put it) became the fashion and researchers staged elaborate games that took into account the destruction of entire nations and continents. This gave rise to an entire generation of scientifically trained gamblers oblivious of the inhuman implication of their models. At first only confined to military sciences, their methods have entered the civilian sector and found credence and application in governmental planning at all levels, including the decision making of the industrial complex.[45]

What impresses one is the reduction of the polysemic worlds of life and death to the formal language of the game. It is the poverty of language that astonishes one. Even death is no longer a cosmic phenomenon, but only an option to be weighed. Neither genocide nor nuclear destruction seems to be grasped through the wisdom of ordinary language. In the world of these new scientists, there is no cosmic rupture, only another managerial game where guilt, death, sin, all get decoded into the selfsame uniform flow to be controlled as game or sport. Not that science as play is not conducted in formal language, but at least it recognizes limits, realizing the polyvocality of ordinary life. Science as a puerile game attempts to reduce the world to a series of formal languages. The destruction of language anticipates the hegemonization of the atom staat.

It is the absence of an effective system of in-built controls in science that worries Jungk: that science has no innate sense of the sacred, of limits, of what it must not touch or must touch gently. Jungk reiterated that within the structure of the university community, the world of science finds its only checks in the humanities. One is fascinated by the ethnographic intensity with which Jungk details the various leading scientists who read poetry or philosophy. He emphasizes that Oppenheimer read Proust and Dante, that Teller wrote poems in secret and even translated the Hungarian works of Ady, that Heisenberg read Trollope. The humanist in him insists that he who has read Goethe cannot be a Faust. But the journalist in him catalogues the technicist imperative of science, the inability of the humanities to recode the scientific text in a more ethical direction. Jungk suggests that what made science impervious to the humanistic idiom was the vivisectional paradigm encoded into it. While the degeneration of pure science as play involves an alteration in form, vivisection relates to the very content of science.

## III

Between the Descartian machine and the vivisectional code there lies a vital difference. The Descartian machine was not half as hegemonic as the latter. The ritualistic segregation of mind and body did recognize limits, allow for spaces which were non-, un-

, pre-, scientific. It allowed for differences even if it hierarchized them. Vivisection, however, is indifferent. Everything is mechanical, so there are only more-or-less efficient machines. The laboratory, far from defining the limits of play, becomes the paradigm for the managerialization of the world. It is this that Jungk captures in *Tomorrow Is Already Here.*[46] Science, to the liberal mind, represented knowledge contra power. But vivisection conflated the two by emphasizing the power of science as hegemonic truth. The politicization of science has unleashed the hegemonic power endemic in science.

The epistemic uncertainty of early quantum physics now appears an aberration. For a brief period it had returned the subject back to physics. But the machine was eventually to reassert its hegemony. The career of this cycle can be compared to equivalent phases in the other paradigm of modern science, management science. Scientific management under Winslow Taylor represented the Newtonian predictability of the object. The Human Relations School was temporarily overwhelmed to discover the importance of man as subject in the problem of productivity. Human relations, like quantum physics, occasionally celebrated uncertainty or free will of the subject. But the eventual response was to eliminate man, or to incorporate a less fallible man back into the mechanical code. Science built into its experimental procedure a more formalized vivisectional code, for it realized that that which it could not predict it could not control. Vivisection provides such a guarantee by scientizing the world.

For Jungk, the history of the body becomes the crucial variable for liberalism, so that the fate of the body as metaphor embodies the fate of a civilization. To the liberal mind, the body determined the boundary of the self and the other, and the relation between public and private domains. Liberalism believed in technological progress where the machine was an instrument of man, an extension of his body. The iconography of liberal homo faber, while it lacked an occult sensibility, portrayed the tool as an extension or projection of human sensibility. The body was the grid for the technological imagination, the hand and foot a measure in more than one sense. Vivisectionist technology introduced an inversion into iconography. While man hegemonized nature by mechanizing it, he himself entered into a perpetual foetal relation with the machine.

Jungk cites the picture of a modern pilot umbilically linked to a complex circuit of machines. Every act of technological control necessitates a further foetalization of man. The picture that comes to mind is Bruno Bettelheim's report on an autistic child, Joey, who insisted he was operated by machines. He had plugged himself to an elaborate support system made of radio tubes, light bulbs and breathing machines. During meals, he plugged himself into a socket to facilitate digestion. To Joey, the fact of having a body was insufferable. Security derived from being a machine, because if the parts were bad, they could be replaced by more effective spares. Joey treated his mind and body as mechanical parts to be discarded or replaced if they functioned badly. 'If he spilled something, he would remark, "I must break my arm, it does not work right." '[47] Bettelheim cites Joey's case history as a cautionary tale of man losing his perspective as homo faber. Joey's attitude to machine is rorschach, reflecting the anxieties of the modern era. For Jungk, the logic of vivisection - that is, the indifference to the body as subject of the experiment - culminates in the science's attitude to the survivors of Hiroshima.

Jungk's *Children of the Ashes*[48] has to be contrasted with another major work on the same survivors, Robert Jay Lifton's *Death in life.*[49] The Yale psychiatrist published his study, far more comprehensive in detail, almost a decade later. Lifton studies the survivors within the matrix of relations between occupier and occupied, American and Japanese, white and yellow races. He locates the perception of survivor as patient primarily in his chapter entitled 'On Perceiving America'. He embeds the survivors' perception of being 'guinea pig material' as part of the trauma of race and defeat. As a result the language and content of science as objectification eludes him. Jungk's ethnology is far more sensitive to the nuances of the dualisms between research and healing, and to the notion of the patient as Taylorized spectacle submitting to the indifference of the clinical gaze. The events described in the book centre round the establishment of a clinic by the Atom Bomb Casualty Commission (ABCC).

The bombing of Hiroshima brought, not a feeling of atonement, but a sense of opportunity. American scientists realized in the studies of radiation sickness the full possibilities of obtaining a Taylorized index of symptoms. Impressed by the pilot plant studies on radiation, the American defence secretary, James Forrestal, wrote a letter to Truman emphasizing 'this unique opportunity for learning the medical and biological effects of radiation', which 'would be of the highest significance for the US'.[50] As a result ABCC inaugurated a special clinic for the study of radiation damage.

At first sight, the clinic was something out of a fairy-tale world. 'A patient would be examined for a whole day by the most outstanding specialists and in the most perfectly hygienic conditions. Indeed, the patient was even driven home and deposited at his own door without extra charge.... For many of them - particularly women and children - this was often their first automobile ride.'[51] Closer scrutiny revealed that the fairy-tale clinic was a Taylorized scientific boudoir. What fascinates Jungk is the objectification endemic to the scientific act. In the case of Hiroshima it was further compounded by cultural dissonance. But Jungk is careful to differentiate between the two.

The atomic clinic was built at Hijayama Hill, a sanctified military cemetery, despite the protests of the mayor. The ultramodern style and elegance were a source of confusion to Japanese patients. Many skidded on their wooden sandals upon the polished floor. Signs on all doors were in English, and so patients were incapable of finding their way about. 'Many women would not dare go there without having first visited their hairdresser. Poor people such as casual labourers borrowed clothes from their neighbours in order to make a decent appearance.'[52] The Japanese were accustomed to being examined by a single doctor, but in the clinic they were treated like something on a factory belt, passed on from one specialist to another. 'The doctors would take specimens of their blood, semen, bone marrow, skin tissues, the patients would be thumped, have lights shone in their eyes, be photographed and pumped full of serum and none of the specialists ever explained why or with what purpose all this was done to them.'[53]

# 5. Violence in modern medicine

MANU L. KOTHARI

AND LOPA A. MEHTA

## I. A paradox?

The popular image of a doctor is of an angel in a white coat. Few are able or willing to perceive the reality behind the image and the violence which today is inseparable from modern medical science. This violence is not limited to human beings; it extends to the environment, to animals, to the fiscal fortunes of a person or a society.

*Violence as a Term*

The root of the words 'violence' and 'violate' is the Latin vim, which is related to the Sanskrit vyas (he goes). The term implies interference that smacks of righteousness, thoughtlessness or willed ignorance. But violence is also transgression of what Einstein called self-evident truth. The perception of such truth does not seem to be a function of 'development', as the tragic experience of the last 200 years shows. Learnedness, industrialization and modern media - indeed, the more we have of these 'achievements', the less we perceive the self-evident truth that 'progress' and violence go hand in hand. With 'progress', more and more leaves are suffocated with grime, deforestation spreads, more fish die and more whales get harpooned, and the balance, the regenerative capacity of nature, is irreparably damaged.

*Psychodynamics of Medical Violence*

Medical violence is a curious product of the physician's arrogance, trappings of technique, and the laity's love of the fanciful coupled with an undying hope that, given enough money, there is no physical or mental problem that some Cooley or Barnard cannot solve. The ethos has been piquantly summed up by Burnet:

One might justly summarize American medicine (and all those who reverently follow the American lead) as being based on the maxim that what can cure a disease condition (assumed, simulated or natural) in a mouse or a dog can with the right expenditure of money, effort and intelligence, be applied to human medicine.[1]

The quote exposes the man-centred temper of modern medical science. It strives to achieve something for man, against man's disease and man's death. The outcome is that the USA, the UK and India increase their spending to the point of bankruptcy and get less and less of health. The Rockefeller Foundation summarized the current predicament in a book titled *Doing Better and Feeling Worse - Health in USA*.[2] In the midst of the ever-widening gulf between medicine's promise and performance, most people - including

doctors and patients - have lost sight of a self-evident fact, namely that the way to iatrogenic (doctor-made) hell is paved with professedly good therapeutic intentions. The only way out of this mess is, as Ivan Illich suggests, for the laity, the patient, to wake up to the realities effectively kept away from them by the medical profession.

L. Dossey, himself a physician, has bemoaned 'the philosophic backwardness in contemporary medicine', even though any allusion to the word 'philosophy' in the context of modern medicine is a red rag to the medical bull.[3] Medical men dismiss philosophy as incompatible with scientific medicine. Thus, thirteen years ago, a book on cancer, scientifically documented and annotated, was condemned as mere philosophy.[4] During these thirteen years, the only comment the book has elicited from the cancerology establishment, both local and global, is that the book is 'philosophical'. The data in the book have not been questioned; the reasoning has not been found faulty. For establishment cancerologists, the book is philosophy and therefore not worth serious consideration. 'Philosophy', evidently, is not used in the lexicographical sense; it is a pejorative term tagged on to anything the establishment disapproves of - even dissent within the community itself.

Cancerology's obsessive resistance to philosophy has made the discipline, in the words of biologist J. B. Watson, 'scientifically bankrupt, therapeutically ineffective and wasteful'.[5] A panel appointed by the national Cancer Advisory Board, USA, has found that highly reputed scientists could deviate from accepted standards of integrity when tempted to bolster their theorems and prejudices with huge sums of the public's money, and an American scientist has advised other scientists: 'Stay out of cancer research because it's full of money and just about out of science.'[6]

The heartlessness of modern medicine can be directly traced to its calculated myopia. 'I am absolutely convinced', says Victor Frankl, 'that the gas chambers of Auschwitz, Treblinka, and Maidanek were ultimately prepared not in some Ministry or other in Berlin, but rather in the lecture halls of nihilistic scientists.'[7] Hence the mythology reflected in movies like Coma; hence, the recurrent reality in India where surgeons merrily transplant kidneys from the desperately poor into paying patients. It is not uncommon in such transplants for the donor to get Rs 30,000 while the agent makes Rs 50,000 When we questioned the anaesthetist of a kidney transplant team about this, his reply was scientific: 'We are happy if the donor has been clinically and psychiatrically investigated, and rendered ready by the agent.' A recent review of kidney transplants in the *The New England Journal of Medicine* concluded that the ease with which a kidney transplant was done lacked any scientific basis, and medicine did not have answers to the problems the transplant created for its new host.[8] We must thank providence that Christian Barnard failed in his much publicized brain transplant and that a heart transplant is not yet available commercially.

Solzhenitsyn has shown in *Cancer Ward* that the best way of dehumanizing a doctor is to look up to him as scientific. In the west, the popular and the professional media persist in portraying all diseases in paranoic terms - 'This disease is killer number one', 'that disease is killer number n' - while claiming in the same breath tremendous advances made by

medical science in its battle against all medical problems. The result is that the doctor sees neither the disease nor the patient. All he sees is some enemy that must be destroyed at all costs. And since no killer disease - cancer, heart attack, hypertension, diabetes - has yet yielded to their ministrations, all that happens is that the frustrated physician wrecks his vengeance on disease and death, with the patient as the battlefield.

Some surveys of the medical scene in the 1980s give a fair idea of what modern medicine is, and will be, all about. To quote D. Horrobin,

Lay organizations, whether charities or governments, do not fund medical research for the sake of culture. They believe that practical benefits will follow. It is gradually dawning on the donors that for the past 20 years practical benefits have not followed. During that time there have been no substantial improvements in morbidity or mortality from major diseases that can be attributed to public funding of medical research.[9]

A. Relman, editor of *The New England Journal of Medicine, com*ments: 'We have learned how to keep alive very old, sick, and feeble - even brain-dead - people as well as infants born terribly deformed.'[10] And a journalist has recently echoed Relman. 'I do know', he says, 'that the miracles of modern medicine can prolong life far beyond the point at which it has meaning.'[11]

Science in this respect has let down modern medicine. Apparently their continuing partnership is a marriage that has soured. Yet the purveyors of modern medicine have a vested interest in the partnership, for it endows them with an invincible halo of propriety and philanthropy. It has allowed the modern medical student, teacher, practitioner, and researcher to completely ignore the fact that most human diseases and death are not only beyond science but also beyond technique - extant, evolving or envisaged.

The mindless craze for gadgets and chemicals leads medical men to create a modern medical police state where symptoms are suppressed and signs are erased. When a child has upper respiratory infection, the body enters into a dialogue with the microbes under an optimal thermal state. But this is deemed as 'fever' by the doctor. Drugs are given to bring down the fever, and antibiotics are administered to knock the microbes out. A peace talk is thus aborted, the child acquires lifelong immuno-deficiency and his natural growing-up is thwarted. Commenting on this common scenario, the English microbiologist J. A. Raeburn has prophesied, 'In years to come, the story of antibiotics may rank as Nature's most malicious trick.'[12]

A healthy adult is sent for a 'regular medical check-up', considered a business venture in medical circles, and walks out a depressed, harried patient. The reason may be that the doctor has detected a sign as yet nowhere defined but called high blood pressure. What had not bothered the patient ever must now be annihilated to ease the scientific conscience of the doctor. There is no field of medicine in which this police-state approach does not pose a physical, mental, and fiscal hazard for the patient.

The patchwork nature of such doctoring, and the hazards it poses, can be guessed from a recent medical tragedy. In an editorial in *The Lancet* of 29 January 1983, the story of the benoxaprofen (Opren) was reviewed in the wake of allegations in the media that approximately 60 avoidable deaths had occurred in Britain as a result of an 'unscrupulous pharmaceutical firm, feeble watchdogs and gullible doctors'. The firm had promoted benoxaprofen with the willing collaboration of the media that later turned critical of the drug.[13] The verdict was updated by *The Lancet* in 1984 under the heading 'The Seven Pillars of Foolishness', describing how the practice of medicine had caused the death of patients worldwide, thanks to seven suppressive 'cousins' called anti-arthritic drugs, promoted through collusion between doctors, media, government bodies, bribery and corruption.[14] Such tragedies will continue to occur till mankind wakes up to the realization that modern medicine has not and cannot live up to its claims.

If scientism accounts for the violence done to man by medical men, anthropocentrism promotes the violence done to animals. The medical student is brought up on a regime of the dissected frog in the physiology lab; of the experimented-upon dog, killed and dumped into a bucket in the pharmacology department; of the caged monkey, manipulated and tortured in the psychiatry lab. At medical science conferences, papers written with the blood of tens of thousands of experimental animals are deliberated upon. The FDA does not object to poison being administered to unwilling animals if, as a drug, it can be 'cleared' as safe for human consumption. Neither William Blake's maxim that 'everything that lives is holy, life delights in life', nor the Vedic message *isavasyam idam sarvam* (God permeates everything) is ever made known to modern medical persons. The outcome is that in trying to do good to man by doing harm to animals, the doctor loses the art of hearing the cries of suffering animals. And once he gets used to ignoring a dis-eased animal, as Solzhenitsyn seems to recognize in his *Cancer Ward,* he learns not to listen to a dis-eased human being.

*Victims of Medical Violence*

The word victim may be derived from the Indo-Aryan ancestor of the Sanskrit word *vinaki* (he separates/singles out/sets apart). It implies an individual who will be differently and damagingly treated by the person who sets him apart. Modern medical practice has an unwritten law which does precisely that: when dealing with the same disease, treatment is reserved for the patient, restraint for the doctor when he happens to be a patient.

Erik Erikson lays down the golden rule for medical men: 'Do, or not do, to another what you would wish to be, or not wish to be done by.'[15] Erikson elaborates upon this by giving the Talmudic version of the golden rule: 'What is hateful to yourself, do not to your fellowmen. That is the whole of the Torah (the essence, the law, the truth), and the rest is but commentary.'

Medical practice is just the opposite. We recall a case in which we assisted, early in our medical training. In those days, the operation of the portacaval shunt had become fashionable in medical practice; it offered rich cinema stars a way out of their alcoholic

lives, cirrhosis, portal hypertension and the danger of bleeding to death from their oesophageal veins. The surgical chief wanted experience in this kind of surgery and he asked the resident medical officers to keep a case ready. Eighteen-year-old Janardan, the only child of a widow, was admitted with seemingly matching symptoms. On doing the preliminary splenoportogram, the senior doctor discovered that the proposed operative site was but a jungle of veins. On the pre-operative day, the resident medical officer said to his chief, 'Sir, I am afraid we shall nick the vena cave and the patient might bleed to death.' The chief's answer was, 'Doctor, as far as it is not my vena cave, I am not worried.' Janardan was operated upon; he died on the table. The surgeon, the resident doctors and the students obviously knew everything save the golden rule.

Walter Alvarez, the eminent gastro-enterologist, muses over the golden rule in his autobiography, *Incurable Physician.* Referring to the 'curative' and radical surgery of duodenal (peptic) ulcer done routinely on patients, Alvarez observes:

One highly significant fact that shows how the physicians and surgeons in Rochester really felt about the operations for duodenal ulcer was that in all my 25 years at the Mayo Clinic I can remember only one of the many members of the staff with an ulcer who was operated on, and he was driven to it late in life by a complication.[16]

At our medical school, too, we have seen the most adventurous peptic ulcer surgery perpetrated only on patients; in the last thirty years not one member of the senior/junior staff has taken benefit of this assuredly curative surgery.

In another case we came across, a newborn child developed gangrene of the whole lower limb following a misdirected glucose injection. The mother was told that amputation was necessary to save the child's life. But the mother went away; she returned after a year with the child's limb intact and largely functional. Then the pediatricians decided to do an angiogram (to find out how the limb had managed to survive) so that they could present a paper in a scientific conference. We asked the worthy gentlemen about the proposed angiogram, 'If angiogram on an absolutely healthy artery can lead to an arterial shut down and gangrene, don't you think the chances of losing the limbs are infinitely greater in a situation where circulation is already compromised?' The answer was, 'We need the angiogram so that we can present the circulatory dynamics to the scientific audience.'

A study undertaken to determine to what extent doctors, faced with the prospect of having cancer, practiced what they preached, revealed some startling facts: Doctors, the 'disappointed' investigators generalized, (a) do not seek an early diagnosis, (b) permit 'unjustifiable delay' before 'curative treatment' is started, and (c) choose as their initial consultant a physician whose culpability for delay is as great as that of a general practitioner.[17] As the *British Medical Journal* recently editorialized, doctors investigate and treat themselves or their relatives inadequately by conventional medical standards.[18] The *British Medical Journal* asked the Director of Surgery at St Mary's Hospital, London, what he would do if he had cancer of the rectum. His answer was:

I am absolutely certain - and this I am sure will bring the wrath of most colorectal surgeons on my head, but no matter- - I would not have an abdominoperineal resection with a colostomy. However managed, however much we delude ourselves, a permanent, potentially incontinent abdominal anus is an affront difficult to bear, so that I marvel that we and our patients have put up with it so long. It says much for the social indifference of the one and the social fortitude of the other.[19]

Teachers in medical colleges are known to ask their colleagues to promise that, should they have a heart attack, they should not be put in the intensive care unit, known in the US as the pressure cooker. The way the psychiatric and the nursing staff view (and treat) themselves is startlingly different from the way they handle the patients. It would be interesting to find out how many psychiatrists have undergone electro-convulsive therapy, and how many had had the horrifying and now-discarded prefrontal leucotomy that won for its inventor a Nobel prize.

This divide, this doublespeak and doublethink by medical men, lies at the root of the moral issues of modern medicine. If the divide had not been there, most pills, potions, and procedures would have been abandoned a long time ago. According to a global estimate made by medical researchers, nine out of every ten prescriptions of procedures are unwarranted.

The twenty-first century computerized technology in the American medical scene also frequently leads to financial disaster for the patient. Every fifth case of personal bankruptcy in the US is due to mega-size medical bills. In big cities in India, too, when the cancer/heart/kidney failure patient, after hectic treatment, dies, it is the family that has to be 'buried'. In the case of a number of illnesses - heart attack, stroke, cancer, kidney failure - which, by modern medical consensus, are terminal and which even after treatment can only minimally restore the patient's productivity, the doctors' bills are back-breaking. We are obviously still under the spell of the myth that the millions of the Shah of Iran or of film star Nargis Dutt could buy for them a cure for leukemia or biliary duct cancer. The Shah, precisely because of the astronomic fees he could pay, was given the wrong treatment by a wrong set of specialists. After his premature death, his American, French, and Egyptian doctors engaged in a mud-slinging match as to who really killed the Shah. Nargis Dutt's 'cure' became known only for the millions spent and the number of propitiatory runs her cinema star husband, Sunil Dutt, made round the Sloane-Kettering Institute. Nature has an innate sense of equality, a sense of democracy. In all the major illnesses that modern medicine is researching upon and treating, neither the scope of the treatment nor the quantum of money spent makes any difference to the outcome. This is so, because all these problems are, and will be, trans-technique, well beyond the might of modern medicine.

It is common experience that, on a given case, the proposed diagnostic/therapeutic thrust ranges from extreme conservatism to surgical ultra-radicalism. After attributing such diversities to the physician's idiosyncrasies, two investigators say:

Perhaps all these factors are involved in clinical controversies, but we propose that one explanation has not been sufficiently recognized: that it simply makes no difference which choice is made. We suggest that some dramatic controversies represent 'toss-ups' - clinical situations in which the consequences of divergent choices are, on the average, virtually identical. The identicality of the consequences, *no matter what the investigations and what the therapy,* is a function of the basic fact that the problem being tackled is beyond the limits of technology.[20]

The 'toss-up critique' takes away from modern medicine any justification for its current craze of creating - more as an industry than as science - five-star hospitals with their lethal bills in India. Bombay, Madras, Calcutta and Delhi are already caught in the whirlwind, and even such small places as Rajkot and Indore are joining the bandwagon. These palatial hospitals thrive on the creed of fee-for-service which happens to be the motto of the world's most powerful (American) Medical Association. Translated, it means no service without fees, and, often, unwarranted services for generating fees. This twofold victimization - of the poor by denying them the right to treatment, of the rich by exploiting them - stems from the fact that doctors, and medical students themselves, do not know what it is to spend on investigations and treatment. The students get treated as VIPs in the hospitals where they grow up; the practicing doctor gets treated free, partly because of professional courtesy and partly with the idea of promoting one's practice through the doctor so obliged. The net result is that the medical man does not have to go through the experience of financial difficulties that alone can teach him to be considerate towards the patient's purse.

Yet another reason for the malady is the paroxysmal urge to organize and attend conferences/congresses/workshops/and the like, as an endorsement of medical claims to progress and the singular medical inability to own up to past mistakes and the absence of any genuine breakthroughs. VIPs inaugurate such conferences, the media give glowing coverage to them and the common man and his doctor continue to be convinced that medicine is marching ahead. Out of this institutional combination of conferences and the media is born what a physician has called 'the international safaris' - the people's readiness to squander all that they have in the hope that, given enough money, the medical Mecca of the west can cure anything.

The animal world comprises the largest victim-population. Medical researchers experiment upon animals with the idea that human beings and animals share what Romer calls a common vertebrate plan. The medical researcher is always ready to transfer the clinical gains from animal study to his practice and patients, but loses sight of the fact that, because of their very likeness to human beings, animals deserve a better deal.

Animals are blinded, dropped in boiling water, burnt on hot plates, frozen in dry ice. They are allowed to bleed by exposing the carotid artery or by incision through the jugular vein. Electrodes are implanted in the brain to stimulate pain centres; they are subjected to huge doses of radiation and then forced to run on a treadmill to see how long they can survive. They are deafened, mutilated, exposed to infection, and driven mad. Babies are removed from their mothers to study the effects of deprivation. Free-ranging

creatures are confined for years in small cages or, worse, in harnessed chairs. They are starved or forced to inhale carcinogenics or toxic material, till they die. Auschwitz, Dachau and the Gulag survive for the animals.[21]

We know from our everyday life that animals have feelings and that they experience sensations. They are born, they live and they die; they express fear, love, terror and pain. Ecologically, humans have evolutionary roots in the same world as other creatures. If we are dedicated to human service, part of our duty is to share our human rights with other creatures. We have no right to exploit, kill and torture them for our own selfish purposes. Yet the book, *Search for New Drugs,* complains, chapter after chapter, that animals suitable for experiment are not available, and then goes on to describe the trials and experiments involving the torture and death of hordes of animals.[22]

Admiration for non-human life is something the medical student learns to keep away from his consciousness. Initially, he is too busy making a career; later he is too busy treating humans. This lopsidedness may be as old as medical practice. The *Sushruta Samhita* advocates the peacock and the snake as a diet for improving the intellect and the swan as curative for nervous diseases.[23] No wonder, medical studies and practice create technocrats who are, in the words of Sir John Apley, overeducated philistines. One cannot expect them to have read an observation in Walt Disney's *Wonders of Nature:* 'People who have looked into its [the walrus's] watery eyes after it has been harpooned see an expression of amazement and disappointment that there is such cruelty in the world.' A vegetarian Indian doctor prefers not to think that the liver extract he has injected into an equally pious patient for a tidy sum comes from some slaughtered animal. He does not even know that the drug has passed through the patient's body (thrown away by the patient's liver that never needed it in the first place) into the sewers to fatten roaches and rats.

But the greatest victim of medicine is nature herself. The word 'physician' is derived from the Greek physike which means the science of nature. A physician should, therefore, be a naturalist. But anthropocentrism, the lure of money, and the awe of modernity has killed the naturalist. Two hundred years after his death, Voltaire stands vindicated; 'Doctors are men who prescribe medicine of which they know little, to cure disease of which they know less, in human beings of which they know nothing.' The little the doctors know of drugs turns them into purveyors of violence: iatrogeny, or doctor-caused-diseases, becomes a new category by itself.

The Rhine and the Ganga are choked by effluents discharged from the antibiotic plants. Drugs that are patently poisonous (such as methotrexate, which owes its origin to the vesicant action of the gas nitrogen mustard used in World War I) are used by cancerologists, transplantologists and rheumatologists, upsetting thereby microbial ecology so vitally that microbes that were benign turn inimical to humans. Nobel-Laureate Burnett has prophesied that history will show up the pharmaceutical houses of the mid-twentieth century as examples both of the productivity of science applied to industry and of the evils inherent in the technological momentum of a competitive

industrial society. This reminds one of Raeburn's pronouncement on antibiotics, to which we have referred earlier.

From the 'little' they know of diseases, doctors imagine, see and show a shadowy enemy. All major diseases remain, to use oncologist Brooke's phrase, discreetly silent for a greater part of their existence in the human body. G. Pickering, a world authority on high blood pressure, has analysed the inherent benignity of disease:

The myocardial infarction, the cerebral infarction, or the gangrene of leg which terminates a patient's life may be seen as the final episode of a series which remains silent over a long period of the patient's life before it obtrudes into his experience and finally terminates it.[24]

Yet, the proponents of cardiology and cancerology continue to speak of early detection and treatment, a ploy that brings them credit should the patient survive, and no discredit should the patient die (obviously for not having sought the doctor's help early enough). The roster of cancerologists who died of an undiagnosed or late-diagnosed cancer and of cardiologists who died of 'hears' disease ought to be made public knowledge. If there were a naturalist in a doctor, the doctor would view a disease as but a part of human physiological development that reminds the doctor and his patient alike of the perennial proximity of death.

Alexis Carrel, Nobel-Laureate and the father of modern cardiovascular surgery, wrote a small classic, *Man, The Unknown.* It suggests that medical men, even as of today, know little of the *homo sapiens.* Medical students and teachers often see a patient as a nuisance attached to an interesting disease. Appropriately enough, at teaching institutes, patients are identified either by the diagnostic tag they bear or by their bed number, never by their name. In *Anatomy of an Illness,* Norman Cousins describes his experience as a patient and concludes that modern hospital is the last place for any sick patient to be in.[25]

**II. Modes of professional violence in medicine**

We have earlier referred to Duke's *The Seven Pillars of Foolishness.* After detailing the ingenious ways in which drugs are pushed by multinationals for profit, Dukes concludes:

There is an unhappy turn of phrase currently going around in medical meetings which refers to patients as 'the people out there...' Perhaps that is merely symptomatic of the wrong-headedness which besets the world of drug experts. The patients are indeed out there, and the drugs are in here with us, being coddled in warmth. It may be the destiny of the clinical pharmacologists to bring drug policies and policy-makers back where they belong, at the bedside and in the consulting room, with the patient every patient - at the heart of things, whilst the chemists, the stockbrokers, the image makers and the detailmen wait, cap in the hand, at the door for judgement to be pronounced.[26]

Richard Asher, one of the outstanding medical thinkers of our time, has described 'the seven sins of medicine' as obscurity, cruelty, bad manners, over-specialization, love of

the rare, stupidity and sloth.[27] In their defence, doctors may argue that what Asher and Dukes have described are human foibles common to all professions, from priesthood to plumbing. Perhaps the Schweitzerean streak does guide most medical practitioners to serve their patients, but we want to draw the reader's attention to the unwitting violence that a medical practitioner inflicts on the patient through aetiology (causology), diagonsis, investigations, treatment, prognosis, research, and image-building.

A leading hospital in Bombay has on its outer walls a prominent inscription: The sick person is my God. According to the Christian scriptures, God can be served by the path of Mary - the path of contemplation, or/and by the path of Martha - the path of action. In a setting where the doctor is the saviour and the patient a victim of a disease, the path of Martha dominates. The patient buys the action, the doctor sells it - fair professional exchange that ignores the equally important but more difficult path of Mary. The latter is the path of restraint, 'inaction', a greater faith in The Wisdom of the Body,[28] a healthy scepticism of the physician's powers, and an awareness of the dangers that every new 'miracle' drug or gadget is pregnant with. Alexander Solzhenitsyn says at one place in his *Cancer Ward:*

Was it possible? Could the question arise of a doctor's right to treat? Once you began to think like that, to doubt every method scientifically accepted today simply because it might be discredited in the future, then goodness knows where you'd end up. After all there were cases on record of death from aspirin. A man might take the first aspirin of his life and die of it! By that reasoning it became impossible to treat anyone. By that reasoning all the daily advantages of medicine would have to be sacrificed.

It was universal law: everyone who acts breeds both good and evil. With some it's more good, with others more evil.

The medical man, à la Solzhenitsyn, is in the unenviable position of 'do and be damned; do not and be damned'. But if nine times out of ten the physician is either ineffective or his action is unwarranted *vis-à-vis* the self-correcting marvel called the human body, then the path of inaction/contemplation could well be preferable. We amplify below this proposition through a discussion of the hazards of active, aggressive medical practice.

*Aetiology*

Bertrand Russell said as early as 1918 that causation as a concept had disappeared in all advanced sciences. Its survival, indeed, its prosperity in medicine, implies that medicine is either not a science, and/or is not advanced. The fact is that all the major maladies - heart attack, cancer, hypertension, diabetes, arthritis - have no identifiable cause. A search for the cause justifies highly funded research. Its assertion, in practice, makes the clinician look learned. Its eventual unravelling holds out for everybody the hope of a cure - 'the pot of gold at the end of the rainbow of medical research',29 as M. Burnet describes it. Even in a manifestly casual event, such as an infection, from Pasteur's time to ours, we do not know whether it is the seed (microbes) that is causally important, or the soil (the human body).

Anxiety-making, Alex Comfort says, is the curious preoccupation of the medical profession: 'Warn against the signs of cancer and cancerophobia becomes a disease more terrible than the actual malignancy.'[30] And the doctor indulges in his penchant for aetiologizing - coitus causes cancer, coffee causes heart attacks, bread causes peptic ulcers, and so forth.

So, life for the common man, especially for one fed on the popular journals, is filled with one cancerogen after another and one nosogen (disease-begetter) after another. For him it becomes a series of dilemmas: whether to breathe (oxygen causes cancer), eat, drink or smoke (if you do, you get lung cancer, if you don't you get bowel/brain/uterine cancer), marry and breed (breeding gets you cancer of the cervix; if you don't, then cancer of the breast or the uterus). Each and every such act is fraught with the danger of some serious disease.

Such rabid cancerogenism has not produced health; it has produced only global cancerophobia. Should people eat, drink, breathe, or make love? The answer is not easy in many societies. For instance, when it comes to cancer, the American society and the many societies which follow it as a matter of faith cease to be sensible: they alternate between states of panic, fear, irrationality, and paranoia. For this, Ingelfinger blames doctors, cancer societies and, of course, the media which specialize in converting trivia into sensational news.[31]

Fortunately, there is the astounding resilence of human common sense against the anxiety-makers. As the popular limerick goes,

My doctor has made a prognosis
That intercourse fosters thrombosis
But I'd rather expire
Fulfilling desire
Than abstain, and develop neurosis.

*Diagnosis*

Dr Travis said, 'There are some words that always shock the layman. I wish we could call cancer by a symbol like $H_2O$. People wouldn't be nearly so disturbed. It's the same with the word angina.' - Graham Greene

To doctors, diagnosis is merely a word; to patients, it can be a sentence. The very word cancer, psychoanalyst Karl Menninger points out, kills some patients who would not have succumbed so quickly to the malignancy from which they presumably suffer. A patient once committed suicide on being told that she had breast cancer. Not all diagnoses of cancer are correct. Nor do proven cancers kill. But it is the word and the diagnosis of the doctor that spells death for the patient. What is true of cancer holds true for heart disease, high blood pressure, diabetes, and so on. Doctors are wont to diagnose a disease even in individuals fully at peace with themselves, for diagnosed illness is the first, unquestionable link that binds a person to a doctor. Fischer, an eminent American

physician, asks of doctors, 'Do you ever ponder the advisability of *not* making a diagnosis and thereby avoiding a death sentence?' A surgeon from Bombay was hurriedly pushed into a diagnosis of cancer of the rectum and as quickly relieved of his rectum, anus and natural passage, only to learn on a revaluation of the slides that his rectum had been noncancerous. For over thirty years he has been moving around with a colostomy bag.

# 6. Science and violence in popular fiction: Four novels of Ira Levin

VEENA DAS

The problem of evil is intrinsic to human society. Satan presents himself in many guises and the regeneration of evil is faced anew by every age. Taking a dispensationalist view of time, one may argue that the problem of evil is transformed under the dispensation of science, and to understand the problem of science and violence is to understand the nature of this transformation.

Why should one, however, select popular fiction for such a study? It is my contention that in modern society, popular fiction plays a role similar to that of fairy tales in that it gives form to the uncanny, thereby not only bringing the repressed to the surface of consciousness but also performing a subversive function in relation to the dominant ideologies of the time.

In an excellent paper, Judith Wilt has discussed the processes by which Victorian Gothic changed into Victorian science fiction and the role it performed.

Counter-attack seems in a way the primary mode of the 'gothic'; though the term is a little difficult to define, the genre is most easily recognizable in works which dramatize a dark subversion of reigning public ideas, or a violent return to suppressed ideas. Victorian gothic texts are of special interest both to the historian of the period and to the literary critic because they display not only the return of suppressed historical doubts and fears but also a change in a literary genre as it responded to its task of subversion.[1]

She goes on to argue that for subversion, imperialism required three changes or renewed emphases in the ordinary processes of the Gothic. First, a greater emphasis had to be placed upon the future consequences of present actions than on anxieties about the consequences of past actions. Second, not only fears of progress but also fears of regression had to be given shape. Third, it was not only the fear of going out into the

colonies penetrated by the imperial powers and meeting one's own dark self that had to be articulated, but also the more interesting fears of meeting the totally 'other'.

Through this dialectic of past and future, regression and progression, the self and the other, Victorian gothic seems to have been transformed into Victorian science fiction, which was important for the articulation of the anxieties engendered by imperialist enterprise. And it is in relation to the alliance between the ideology of science, statism, and the market, that science fiction, as an important literary genre, now performs a subversive function.

I have selected four novels of Ira Levin for analysis, as all of them deal with the question of regeneration of evil, beginning with a motif clearly located in the realm of the supernatural which may be regarded as 'regressive', and concluding with the problematic of scientific technology that, in contrast, is 'progressive'. Before discussing each novel in detail, let us note the kinds of transformation that take place as we move from one novel to the other. *Rosemary's Baby is* the story about Satan succeeding in begetting a son for himself to rival the son of God and to avenge, eventually, all the indignities heaped upon the followers of Satan in the past. The locale of action is modern New York, and in some senses the novel gives expression to the fear that the world may not have become as sterilized and scientific as the modern reader might have assumed or desired it to be. It is the curious juxtaposition of the modern and the obscurant, or what we assume has become part of the past, which gives the novel its uncanny character. In the second novel, *Boys from Brazil,* the context is explicitly political wherein Satan is represented by Hitler. The leader is dead, but his loyal follower, Mengele, the 'angel' of Auschwitz, uses his considerable scientific talents to devise and conceive of a demonic plan to rejuvenate the leader himself. The doctor employs the scientific knowledge gathered in his infamous researches on twins, to perfect the technique of mononuclear reproduction. And using this technique he creates ninety baby boys who have the perfect genetic endowment of Hitler (for Hitler had let the doctor preserve some *of* his body cells in anticipation of precisely such a project). The babies have been borne by tribal women, under strict medical supervision, in the jungles of Brazil where Mengele is in hiding. The role of the mothers has been similar to that of mere incubators. There is a Society of Comrades, consisting of ex-Nazis, which ensures that the babies are placed in families resembling Hitler's, so that heredity and environment may be replicated to the extent possible. It is the great hope of Mengele that at least one of the babies will be the exact reincarnation of Hitler, through whom the fascist programme will be completed.

Thus in these two novels, the people on the side of evil are clearly recognized as evil beings. The author also invests these characters with many symbols that help the reader to identify them as such. In contrast, *Stepford Wives* moves towards a new definition of evil. Here, it is not clearly-defined villains pursuing their designs in a clandestine manner but ordinary scientists living a suburban existence, who are so threatened by the particularity and individuality of their wives that they collaborate in a project to turn them into robots, designed after their own images of perfect feminity. *This Perfect Day,* the last novel that we shall consider, is frankly futuristic. In the new era established in this novel, hunger, conflict, and aggression have been weeded out of society. There is neither

ambition nor desire for success there, so important in *Rosemary's Baby.* The whole society has been turned into a Stepford. Homogeneity is worshipped. Medicine and genetics have advanced to an extent that most kinds of variations can be controlled. Even rebellion and dissent, as we shall see, are put to use in the service of the perfect society and thus incorporated within its framework. The utopias of health and happiness for all have been realized. The place of mythic heroes has been filled by the four figures of Christ, Marx, Wood and Wei. The classification of historical figures as those who would be recognized as part of the historical past by the readers of the novel, with fictional or mythic ones, confounds the categories of the real and the fictive and gives the novel its uncanny character. The author uses the same device for place names. The reader feels that the past has not been repudiated as much as it has been reorganized.

Into these idyllic surroundings, the author introduces the figures of Chip, through whose eyes we primarily see this society. It is his voyage of self-discovery that constitutes the action of the novel and we see how the process of this discovery also entails destruction of the mechanical order created by the agency of the machine. The accompanying chart summarizes some of the more important features of these transformations.

| | **Victim** | **Instrument of victimization** | **Temporal anxiety** | **Symbol of anxiety** | **Liberation through** |
|---|---|---|---|---|---|
| *Rosemary's Baby* | Female body | Husband | Regressive | Satan | Motherhood |
| *Stepford Wives* | Person of the woman | Robotics | Progressive | Robot | |
| *Boys from Brazil* | 'Inferior' races | Genetic manipulation | Regressive | Hitler | Positing of an undeter mined future and moral choice |
| *This Perfect Day* | Mankind | Medical model of health | Progressive | Uni | Regressive return *to* (not *of)* the past |

*Rosemary's Baby*

The plot of *Rosemary's Baby is* very simple. Rosemary is a small-town girl who has married an up-and-coming young actor, Guy. They move into an old apartment house called Bramford, despite warnings from Rosemary's elderly friend Hutch that the apartment had been notorious for witchcraft in the nineteenth century, and continued to be so with an abnormal number of cases of murder, infanticide, and suicide. A series of weird incidents takes place. First, a young dope-addict, Terry, who had been given shelter by an elderly couple called the Castevets, commits suicide by a particularly violent

method. Next, Rosemary seems to begin hearing strange unmusical chants at night emanating from one of the apartments. But so absorbed are the young couple in their careers and home that all these incidents are brushed aside. Rosemary and Guy befriend the Castevets who seem to be heartbroken and full of guilt at Terry's death. Initially, Guy is hesitant to spend much time with them, but is goaded by Rosemary into accepting an invitation for dinner in their house. Later on, to Rosemary's surprise, he develops an attachment to the old couple and begins to spend long periods with Mr Castevet.

Rosemary does not know that the Castevets are members of a satanic cult which is trying to find a woman for Satan to beget a son on. Terry's suicide had spoiled their plans to use her for this purpose. It is Guy who is now tempted into a pact with Mr Castevet, to drug Rosemary and allow Satan sexual intercourse with her. Rosemary would be told that the baby was stillborn, and the couple thereafter would be free to resume their normal life. In return, Guy is promised lead roles in important plays and films.

Since the story unfolds from Rosemary's viewpoint, we learn of this plot only gradually. Rosemary herself at first thinks she had a nightmare, in which she was carried into the Castevets' apartment, strangely altered by pictures of burning churches and a gathering of strange people reciting spells in unmusical chants. Her body is imprinted with weird designs and patterns and finally a huge man with completely yellow eyes makes love to her. When she wakes up in the morning, she does, indeed, find scars on her body. When she questions Guy about this, he admits rather shamefacedly that he had made love to her when he was drunk. In a fit of rage she leaves Guy for a while, to reflect on their deteriorating relationship. In this lonely period she is depressed, eats like a glutton; finally she decides to return to Guy, and finds to her delight that she is pregnant. The Castevets persuade her to go to a society doctor, and she endures every kind of hardship during her pregnancy. She loses weight, suffers from terrible pains, has cravings for strange foods, including raw meat, but is assured by the doctor that her pregnancy is normal. A friend, Hutch, drops in to see her one day and is shocked by the change in her. He soon discovers that Roman, alias Mr Castevet, is, in fact, the son of a notorious magician who had reputedly conjured up the Devil and been lynched to death outside the same apartment house. However, Roman gets wind of his suspicions, and Hutch dies in an inexplicable coma before he can warn Rosemary.

Guy's career has, meanwhile, prospered. He gets an important role, as his rival goes blind. Hutch's death, soon after the sudden blinding of Guy's competitor, perturbs Rosemary. She stumbles on the truth about Roman, but still unaware of Guy's role, she confides in him. Guy manages to convince her that her fears about her baby are unfounded, but then she discovers that her doctor, too, is part of the same group. Suspicious of *everybody,* she now goes to an ordinary doctor for help. The doctor, however, being the product of modern secular education, attributes her fears to hallucinations and mental illness. He calls her husband and her previous doctor and hands over the 'patient' to them. Thus trapped, Rosemary is compelled to give birth in the house under heavy sedatives. On regaining consciousness she is told that the baby died at birth. Guy assures her that she had simply suffered from hallucinations and her present condition was nothing but post-natal depression. But the seeds of doubt have sprouted.

Rosemary refuses to believe that her baby died. She drugs the woman who is keeping watch over her; and armed with a knife to save her baby from the demonic people, who, she is convinced, were planning to sacrifice him in some rites, she discovers the infant wrapped in black, being rocked in a crib. As she reaches the crib, the baby opens his eyes and looks at her:

His eyes were golden-yellow, all golden-yellow, with neither whites nor irises; all golden-yellow, with vertical black slit pupils.

She looked at them watching her and knife-in-hand screamed at them,

*'What have you done to his eyes?'*
They stilted and looked to Roman.
'He has His Father's eyes', he said.

Rosemary finally has to acknowledge the truth. Her baby has been begotten by Satan himself. Her nightmare *was* real. Should she now throw the baby out of the window and follow him in a suicidal leap? Should she let him live and let the world go to God knows what - Satan knows what? But Rosemary cannot kill the baby. Not only is she seduced by his sweet and innocent look, by the fact that he is *her* baby even if the father was Satan, but also by the fact that she cannot believe that he can be *all* bad. Rosemary has accepted her fate, but without foreknowledge. No holy or unholy spirit had informed her that she was to become the mother of Satan's son. But now she cannot bring herself to destroy the baby. So the son of Satan finds a home with the most ordinary of women - Rosemary, the little Miss-Just-Out-of-Oklahama.

The story is told from Rosemary's viewpoint, which is always hovering between knowledge and truth. As ambitious as her actor husband, she even admires him for his successful lying:

And yes, he might lie now and then; wasn't that exactly what had attracted her and still did.? - that freedom and nonchalance so different from her own boxed-in propriety?

We could, perhaps, look at the characters in the novel in the following manner. Rosemary and Guy are term values for the people who sustain the modern world: they are progressive, modern, competitive. Rosemary is self-consciously so, as her rejection of her small-town Catholic identity reminds us. Guy, his name perhaps significant (just a guy), is an actor - and the theatrical world has no place for boxed-in propriety. Roman and Minnie, his wife, on the other hand, represent precisely that fear of regression that all forward-looking societies contain, the fear of the world of magic and witchcraft and lynching mobs, which has been excised from the modern consciousness. Evil is defined here as anxiety about the past which may, after all, still be in existence. Rosemary's name, 'red Mary', suggests the uncanny manner in which she will be defined, in contrast to the Virgin Mary. Thus, the anxiety about regressing to a past that may exploit the very desires to be modern and progressive, is crystallized in the opposing nature of the two couples. Mediating between these two pairs are other characters, the most prominent

being Terry and Hutch. Both have to die, but their deaths are not in the nature of sacrificial resolutions. In fact, it is their deaths that signal important changes in the event-structure of the novel. If Terry had not found the idea of letting her body be used by Satan repulsive, Rosemary might never have been chosen to be the mother of Satan's child. She had been chosen by Satan himself, as Roman tells her, for why else would He have made a dopeaddict slut of a girl like Terry prefer suicide to the honour of bearing His child? Hutch's death, on the other hand, is important, for, had he not alerted Rosemary, she might well have believed that her baby was dead. It is Hutch's death, therefore, which leads on to the fundamental dilemma posed in the novel.

Rosemary is paradigmatic of the modern person who believes that the past cannot cast its shadows on the present. She always manages to still her doubts with a rational explanation: it is only Hutch's death that forces her finally to acknowledge the extraordinary evil in which she is being ensnared.

We may well ask, if Rosemary is so ordinary, from where does she derive the strength to confront the anxieties of regression, symbolized by the return of Satan in the modern, secularized world? One answer to this lies in her changing relationship to Guy. When she is drugged and taken for the ritual of consummation with Satan, Rosemary thinks she is in the middle of a horrible nightmare, but believes Guy when he confesses to having made love to her while she was asleep. This throws her into despair.

Guy had taken her without her knowledge, had made love to her as a mindless body ('kind of fun in a necrophile sort of way') rather than as the complete body and mind person that she was...

But she talks herself back into thinking that such easy morality was what she had liked about Guy. The narrative, therefore, moves to the next round of episodes, concluding with the revelation of Roman's true identity, and Hutch's inexplicable death.

Particularly crucial disjunctions in the narrative are marked by deaths - the meaning of which eludes Rosemary until Hutch's death. Rosemary's dilemma - whether she should kill the baby who has been conceived as evil or let it live, on the assumption that even a being such as this must be given moral choices - becomes mankind's dilemma in the later works. The next two novels pursue these themes in two different directions.

*The Stepford Wives*

*The Stepford Wives* has been written from the perspective of Joanna, who, with her husband, Walter, moves to the suburban town of Stepford. Joanna is a feminist and also a professional photographer. In Stepford, she discovers, women have no interest in feminist issues, although there is a flourishing Men's Club, of which her husband, to her surprise, *soon* becomes an enthusiastic member. Although he explains that he hopes to change the attitudes of the men from within, Joanna becomes suspicious of the Men's Association. One of her two allies, Bobby, who had also recently moved to Stepford, shares her feeling of unreality of Stepford women. This feeling is compounded when they discover

that there had earlier been a flourishing Women's Association, many of whose members had since turned into dedicated *hausfraus.* As Joanna watches Kit, a former president of the association, explaining why housework is more interesting and useful than women's issues, the truth about Stepford dawns upon Joanna:

Like an actress in a commercial.

That's what she [Kit] was, Joanna felt suddenly.

That's what they all were, all the Stepford Wives: actresses in commercials, pleased with detergents and floorwax, with cleaners, shampoos and deodorants. Pretty actresses, big in the bosom but small in talent, playing suburban housewives unconvincingly, too nicely-nice to be real.

Joanna and Bobby then witness a dramatic change in Charmian, their only other supporter. Returning from a second honeymoon with her husband, the charming, petulant, somewhat unconventional woman is transformed into a typical Stepford wife. She confesses to Joanna that she considers her former behaviour inexcusable and irresponsible!

Bobby suggests the possibility that emissions from various scientific establishments all along Route 9 had polluted the water in Stepford and acted as a tranquillizer on the women. Walter dismisses this, and says that a better explanation for Charmian's transformation was that her weak and indecisive husband had finally laid down the law to her. Joanna is herself now declared to be suffering from stress caused by the move to a new place and an unsuccessful career in photography. However, Bobby and Joanna both decide to insist that they move to another town. To their surprise, their husbands agree readily to their suggestion; they want their wives to be happy, they say.

Soon after, Joanna receives a request from Bobby to let her son stay over the weekend in her house since Bobby and her husband were going away for the weekend. Joanna has a strange feeling of *déjà vu* but is reassured to find Bobby after her brief holiday looking relaxed and happy. But Bobby's fresh and relaxed look was not indicative of a wonderful holiday as she had assumed, but of her transformation into a Stepford wife.

Bobby's transformation worries Joanna. What does the future hold in store for her? She works out that whatever the thing is that transforms normal women into wives from commercial ads, it takes exactly four months to accomplish: Joanna has only one more month to save herself from such a transformation. In a panic she decides to contact a house agent to immediately move out, but Walter rushes home and confines Joanna to a room arguing that she is very ill.

Joanna finally understands that Walter is himself involved in the process of imprisoning her in this new image. Suddenly things begin to fall in place - the fact that most men in Stepford are engaged in the manufacture of robots, that the Men's Association has never been open to women, that a famous artist had visited them one day and made sketches of

her, that someone had recorded her speech for a whole day on the plea that it would help in his research on different dialects, that Walter had become secretive about money matters. Joanna manages to escape, but is found and brought back to Bobby's house. Bobby, to prove she is not a robot, offers to cut her finger and show Joanna that she bleeds like other human beings. Joanna now begins to wonder whether it is not she, herself, who has gone mad - and that Bobby really is not a robot:

Joanna went forward towards Bobby standing by the sink with a knife in her hand, so real-looking... that she couldn't be a robot, she simply couldn't be, and that was all there was to it.

In the concluding episode of the novel we see Joanna through the eyes of another woman - a young black writer who has recently moved into Stepford with her husband and children. Joanna is in the supermarket explaining to this young woman that photography is a waste of time, and that she prefers to spend her time looking after her home and children. Ajax country has found another victim!

The theme - woman as a body rather than a mind-and-body person - was initially stated in *Rosemary's Baby,* and it is amplified in *Stepford Wives.* In *Rosemary's Baby,* the fear was of regression whereas here it is of anxiety about progress. The magician and scientist are both shown to be tricksters, able to bring about fantastic transformations. But it would be a mistake to think *Stepford Wives is* only about the norms of a patriarchal society - the control which men exercise, or are supposed to exercise, over women. The husbands in Stepford use their new knowledge to implement dreams that have been formulated and perfected in a society overrun by commodity fetishism. It is the combination of patriarchal organization of power, eroticization of commodities, and use of scientific technology which gives Stepford homes that peculiar, picture-book quality, and the women bodies that neither sweat nor age, while their minds are completely tied to detergents and floor waxes. The fantasy bodies of these cherished wives are the body-made-whole or the body-without-organs of a capitalist, anti-oedipal society, living off commercials for detergents, soaps and deodorants. Whereas the household is vital in most traditional societies, in Stepford, household management has itself been transformed into ergs. When Walter returns sexually aroused from his visits to the Men's Association, Joanna wonders whether he has been seeing pornographic films. The full horror of the situation dawns only afterwards, when we realize that it was the robotic image of the wife being moulded in the Men's Association that had aroused the husband. Guy's use of Rosemary's body to further his own ambition appears benign in comparison.

The timeframe of the narrative has some significance in that there is an anxious awareness that the consequences of the present are imminent. Stepford is not a society of the future, but a place here-and-now, located in our present world. Science and the market-place have collaborated to make the nightmare of the future the present reality.

*Boys from Brazil*

In this book Levin describes how a new fascist regime will complete Hitler's unfinished enterprise. The protagonist, Libberman, has dedicated himself to tracking down important Nazi officials lest the world forget the horrors perpetrated by them on the Jews. Heading the Nazi plot is Dr Mengele, the 'angel of Auschwitz' who, in hiding in the jungles of Brazil, is using his exile to perfect and implement his science of genetic manipulation. Cells from Hitler's body, given to Dr Mengele for just such an eventuality, are implanted in the embryos of tribal women in the Brazilian jungles - and the ninety-one babies born thus have the exact genetic endowments of Hitler. There is then the problem of finding families resembling Hitler's so that the child Hitler's early experiences are replicated. A spy is therefore planted in an adoption agency to collect applications, rejected by the agency, from families in which the husband is about sixty and a minor civil servant, with a wife who is fortyish. She then has to place one boy in each family. The foster parents, conscious of the clandestine manner of obtaining the babies, readily agree to hide it from the children that they are adopted.

When the boys turn twelve, a plot is hatched to murder their foster fathers. The Society of Comrades, based in Brazil and consisting of ex-Nazis, sends out killers to the four continents in which the babies are scattered. Mengele hopes to replicate in this manner the early childhood trauma that Hitler underwent when his own father died. Other factors in the environment cannot be controlled, but, calculates Dr Mengele, at least one of the boys will have the complete mental makeup of Hitler.

To Mengele's annoyance, a young Jewish student from north America, influenced by Libberman's work, manages to get a tape-recording of Mengele's meeting in Japan at which the task of killing the ninety men had been explained to the killers. Mengele must trace and kill the boy, which he does without too much difficulty. However, Libberman has been warned that there is a plot, though he does not know quite what it is. Finally, through a series of accidents and some help from a young German, Libberman discovers the reason for it, but by that time, sixteen killings have already taken place. Mengele is so enraged by the Society withdrawing at this point that he decides to complete the assignment himself, and kill Libberman also.

Meanwhile, Rabbi Gorin, the leader of a militant Jewish organization, agrees to help Libberman in dealing with this plot. They know that one of the fathers lives in a small town in north America, but not that Mengele himself has taken charge of the killings.

The confrontation between Libberman and Mengele takes place in the home of Bobby, one of Mengele's creations, which Mengele contrives to enter, posing as Libberman. The house is protected by a pack of well-trained dogs. After cleverly neutralizing the dogs and killing Bobby's father, Mengele then encounters Libberman who mistakes him for Bobby's father and tries to persuade him to accept Gorin's bodyguards for protection. Mengele is prevented from killing him by the dogs, who hold them both imprisoned. When Bobby returns from school, Mengele is thrilled to see this incarnation of his Führer and urges Bobby to set the dogs on Libberman who, he tells him, has killed his foster father. The boy prefers to believe Libberman. He sets the Dobermanns on Mengele, who is killed. It is strange, Libberman reflects, that his helper was a 'Hitler'.

Libberman is now confronted with the problem that Rosemary had. Should a child with such parentage be allowed to live? Rabbi Gorin is convinced that all the children thus born must be murdered, for otherwise he would be submitting generations of Jews to the possibility of a horrible future. But Libberman destroys the list, arguing that there would be no difference between the Nazis and themselves if they too became 'child-killers'. Like Rosemary, Libberman decides that moral choices cannot be denied to anyone, and even the children of the modern Satan must be given an opportunity to exercise free will, and choose between good and evil. The possibility of a future Hitler is not denied by Levin. In the concluding chapter of the book we see one of the boys from Brazil painting a crowd scene. The crowd seems to be engaged in ecstatically cheering a leader, 'like in those old Hitler films'.

*Boys from Brazil* plays with the notion of time in a subtle fashion. On the one hand is fear of the past - fear that political figures like Hitler may not really be dead but just waiting for the opportune time to reappear. On the other, this fear of regressive forces is matched with a fear for the future. All over the world there may be boys with Hitler's genes growing up in ordinary families ultimately to take over our future. Further, Hitler may turn out to be, not a stranger at all but our own dark self - when, for example, Gorin proposes to follow the very methods that the Nazis had used. The anxiety about regressing to a state which presumably belongs to the past, and anxiety about a future that may reproduce that past because the sources of evil in the present were not controlled - both or either state could lead to the elimination of free will, and of moral choice. This, ironically, would lead to a repetition of the fascist past while apparently trying to prevent its recurrence. It is precisely this kind of possibility that Levin's next novel explores.

*This Perfect Day*

This novel is about a society that the reader recognizes as one of the future, but it is narrated in the present, while our own present is seen as the past. In this ideal society, the sources of 'disorder' and 'chaos' have been removed by eliminating individual choice. Homogeneity is the model - all human beings look alike, with the same slanting eyes, tan skin, black hair. The distinct markers of gender have been erased. Genetic engineering has taken care of all sources of variation, including that between the sexes, although mutations sometimes do occur. We are told that disease has been eliminated, but epidemics sometimes do occur, and at least one colony, on Mars, which is suddenly wiped out by disease, has had to be repopulated.

Names as well as bodies have been standardized. There are four names for boys and four for girls to choose from. The individuality and particularity of a person is relevant only in relation to Uni, the master computer, that makes all the decisions for an individual. The particularity of an individual is indicated by a 'namember',[1] a combination of name and number by which individuals are identified. It is important to understand that in their mutual relationships, people are substitutable. But, in relation to the great machine, each individual has a personal history, known in all its detail only to Uni.

'Uni knows best' and 'thank Uni' are the two most frequently used phrases. It is Uni that decides what work would be, whether one should reproduce or not, go on holiday or not. Even the toys and sketch pads for an individual are selected by Uni. Everyone wears a bracelet which informs Uni of their requests and also about their movements. Surveillance follows the medical model in that no individual is 'good' or 'bad', but simply 'healthy' or 'sick'. Medicines are injected to regulate the rhythms of body and mind. Similarly, everyone is assigned a counsellor whose job it is to detect signs of 'sickness', defined as conflict, friction or individualized desire. The bodily needs of the people are simple and easily fulfilled. Physical hunger is met by 'totalcakes', the need for sex by intercourse once a week with anyone, girl or boy, since they are all alike. The needs of the mind are similarly met by regulated television, *required* to be seen at certain hours. The surveillance of individuals is carried out not only through computers and counsellors but also through an ideology, any deviation from which has to be reported. Every man is his brother's keeper and must help preserve the health of others.

In this environment, we meet Chip. His official namember is Li $RM_{35}$ $M_{4419}$, but Chip is the secret name given him by his grandfather who belonged to the older generation that had helped build Uni, and who still retained some memories of the life before the Uni age set in. Chip finds his grandfather somewhat strange and exciting. The grandfather, in turn, has a very special relationship with Chip who, he hopes, will prove to be a 'chip off the old block'. Thus Chip is differentiated from the others not only by having a name but by his link with the past, and also by a physical peculiarity - a green eye - which is converted by him from a source of shame into a matter of pride.

Early in his childhood, Chip develops doubts about the perfect society in which he lives. He learns from his grandfather of some twenty different names for boys used before society came to be unified under Uni. People ate different kinds of food, rather than the now universal totalcakes. They chose their own professions. On a visit to the site where Uni is located - a visit that has the quality of a pilgrimage - Chip is taken by his grandfather to see laid bare the machines behind the façade of Uni. This not only unbares the mystique of Uni, but also teaches Chip ways in which Uni can be cheated. For he has, for the first time, entered a place without permission, just by daring not to touch the scanner, as is obligatory.

The most significant event in Chip's childhood is his farewell to his grandfather, who is transferred to another continent, presumably after Chip blurts out some of their discussions to his counsellor. Before leaving, his grandfather tells him to try and want something of his own - for instance, to think of what sort of work he would like to do, rather than assume that Uni was the best judge in all matters. Even to want to choose something for oneself, Chip realizes, is no easy task in a society where individual desire is taboo and resistance to Uni a sign of disease.

Despite stupendous obstacles, Chip manages to keep his grandfather's spirit alive. He is now classified as a genetic researcher and has been instructed not to reproduce. A small group of rebels, 'sick members', according to the society, manages to contact him, and invite him to join them. The group meet clandestinely but regularly in a museum where

they play games, crack jokes, smoke tobacco, and make love in the pre-Uni-fication mode, with passionate attachment to the partner, rather than for the satisfaction of a generalized desire. The particularity of their passions and desires surprises Chip who discovers that it is possible to have desires entirely of one's own, free of Uni.

The leader of this group has given himself the name King. He works in the medi-centre and devises a plan to hoodwink Uni so that members can get mild treatment prescribed for themselves. King is satisfied with the small personal space they have created for themselves, where they can indulge in their fantasies for a while every week. His girlfriend, Lilac, however, is keen to explore further, to the islands where the 'incurables' live, the utterly sick people whom Uni does not even try to cure. They are, instead, exiled to the islands on the peripheries of the unified land where they have a different kind of existence. Chip's ambition is pitched even higher. They should try and recruit more members and ultimately destroy Uni!

Chip teaches himself French from old books. One bit of information shocks him profoundly. They had all been led to believe that life-expectancy had gone up to sixty-two only with the progress of medical science, but the old books mentioned not just early deaths but also people who lived to be seventy and even eighty! Chip now realizes the reason why most people died at the age of sixty-two: they were people who would otherwise have been an economic burden on Uni and the society.

Chip is also persuaded that although King knows all this, he prefers to keep it to himself, so that they can preserve the small comforts that they have managed to achieve, rather than risk them in an actual struggle. This is especially repulsive because two of the rebel members are close on sixty-two.

After more research, Chip succeeds in locating the probable geographical sites of the colonies of the 'incurables'. Tragedy strikes at precisely this moment. A minor lie of Chip's is discovered and the whole group is then found out and 'treated'. All, that is, except King who commits suicide. Thus rehabilitated, they are scattered in new cities, and return to their life of regulated jobs and regulated sex. Six years elapse before memories of the short-lived rebellion begin to stir again in Chip's mind. Slowly, he begins to make new plans to resist the treatment. The imprint of a leaf on a wet rock gives him an idea. Every time he goes for treatment, he covers his arms with foil from his total cake, which prevents the medicine from being absorbed into his body. As memories return, Chip is able to trace his girlfriend who is now Anne with a number, and coerces her to escape with him. Finally, the two arrive in Madagascar, one of the colonies that they have sought all their sane lives.

The first thing they discover about the island is that it is no paradise. There is hunger, racial hatred, crime, and snobbery, but there is also freedom there to dream, have children, change professions. Chip and his girlfriend get married, make friends, find jobs, and have a baby. But Chip is still-haunted by memories of Uni, and will be satisfied with nothing but his destruction. With the help of friends, he charts out a way to reach Uni. After many hardships, when some of the group reach Uni, they are taken aback; they are

greeted by Wei who is alive - or at least the head of Wei, old and wizened, attached to the splendid young body of an athlete. Chip learns that one of his 'friends', who had helped plan and implement their mission, is in fact a spy or 'shepherd' whose job it is to shepherd such lost sheep back into the fold. Further, instead of severe punishment they get a reward. They are told that this is how people are brought to the decision-making jobs, such as programmers. The colonies function as a constant challenge to the curious and persistent, and those who have the skill and determination to reach Uni in order to destroy it, constitute the elite, and are of great use to the system. So the group is elevated from being the controlled to being the controllers. The programmers not only lead a life of luxury, some of them are also promised immortality, for many people consider it a privilege that their limbs will be used to replace their leaders' ageing bodies. In sum, the makers of this advanced society do not punish those who have shown courage, imagination and resourcefulness.

This is the crucial moment for Chip. It is also the final triumph of the controlled society, for it manages to incorporate rebellion within its fold. But Chip is not to be lured by power, even the power to do good. He kills Wei and blows up the machine. He opts for hunger, disease, crime, and the consequent disorder, rather than Uni's perfectly ordered society.

Many of the problems posed in the first three novels are brought to a conclusion in *This Perfect Day*. The fantasy body underlying the alliance between state and science is shown to be the body of the population which is completely healthy, homogeneous, and subject to no pathology. This corresponds at the individual level to the body without organs - for dirt and disease that might sully the body come from functioning organs. The needs of the body are in a one-to-one relationship with the organs of the body. Hunger involves the urge to eat, but food must not appeal to any other sense. While having a sexual orgasm is obligatory, only the genitals have been retained in the body as the seats and instruments of sexual gratification. Other sexual markers, such as breasts, or hair on the face, have been eliminated from the new design of the body. The treatment meted to the mind is analogous to that for the body.

If modern science has replaced the notion of the soul by the notion of health, we ought to take the implication seriously. In a world where health becomes the ruling concept, any transgression, whether in the nature of a sin or a moral disagreement, is likely to be assimilated into the category of disease. The individual, then, cannot be held responsible for his error. Chip is assured by his counsellor that he need not blame himself for joining the rebel group any more than if he had fallen down and broken his ankle.

The anxiety crystallized in this novel is anxiety about a future in which the dream of perfect health will have been realized, and all individuals would be in a state of perfect adjustment. Echoes of the theme of the 'superman' or the 'perfect race' are not incidental here. They seem to be inevitable to a dream of the perfect body, completely free from disease and old age.[2] the perfectly non-violent world of this conception, hatred and conflict are terms of abuse, and Satan seems to be finally dead. However, it is precisely because the society does not acknowledge the existence of evil that evil remains

completely hidden from it. Surveillance, which is a necessary part of all state systems - and in surveillance science plays a crucial role - defines normality in such a way that all sources of deviance, variation, or moral quest disappear. It is of interest to probe into how the character of Chip has been constructed, for here is one who can resist the temptation of desiring his own repression. In *Rosemary's Baby* and *Boys from Brazil,* the author gave expression to fears of regression in a progressive society. In this novel, regression is transformed into a positive force through which a progressive society is defeated. Chip has been placed quite explicitly as a backward-looking character: he has an individual name; his green eye relates him to his great-grandfather; he attempts to learn a foreign language which has been forgotten; he loves the pre-Uni-fication museum. But, most importantly, he accepts the regressive factors of disease and crime, and makes his choice, in which a certain amount of disorder is inherent, of a society where individuals are permitted to be different. Acceptance of the uncertainty and chaos of an unregulated society seem to be the only defences against the dreadful dream of 'perfect health'.

# 7. Reductionist science as epistemological violence

VANDANA SHIVA

The nexus between modern science and violence is obvious from the fact that eighty per cent of all scientific research is devoted to the war industry and is frankly aimed at large-scale violence. In our times, this violence is directed not only against enemy fighting forces but also against civilian populations. I argue that modern science is violent even in peaceful domains such as, for example, health care and agriculture, where the professed objective of scientific research is not violence but human welfare.

The argument is based on the premise that modern science is quintessentially reductionist. Its reductionist nature under-girds an economic structure based on exploitation, profit maximization and capital accumulation. Reductionist science is also at the root of the growing ecological crisis, because it entails a transformation of nature such that the processes, regularities and regenerative capacity of nature are destroyed.

The linkage between modern science and a profit-based economic system can be discerned in major and varied scourges such as desertification, diarrhoea, and deforestation. Since the alternative modes of knowledge which can provide solutions to these problems are oriented to social benefit rather than to personal or corporate profits, reductionist science scoffs at them as hocus-pocus. The fact, however, is that reductionist science itself often resorts to misinformation and falsehood in order to establish its monopoly on knowledge.

This monopoly results in fourfold violence - violence against the subject of knowledge, the object of knowledge, the beneficiary of knowledge, and against knowledge itself.

Here violence is inflicted on the subject socially through the sharp divide between the expert and the non-expert - a divide which converts the vast majority of non-experts into non-knowers even in those areas of life in which the responsibility of practice and action rests with them.

But even the expert is not spared: fragmentation of knowledge converts the expert into a non-knower in fields of knowledge other than his or her specialization.

The *object* of knowledge is violated when modern science, in a mindless effort to transform nature without a thought for the consequences, destroys the innate integrity of nature and thereby robs it of its regenerative capacity. The multidimensional ecological crisis all over the world is an eloquent testimony to the violence that reductionist science perpetrates on nature.

Contrary to the claim of modern science that people are ultimately the beneficiaries of scientific knowledge, people - particularly the poor - are its worst victims: they are deprived of their life-support systems in the reckless pillage of nature. Violence against nature recoils on man, the supposed beneficiary of all science.

In order to prove itself superior to alternative modes of knowledge and be the only legitimate mode of knowing, reductionist science resorts to suppression and falsification of facts and thus commits violence against science itself, which ought to be a search for truth. We discuss below how fraudulent this claim to truth is.

*The Politics of Scientific Knowledge*

The conventional model of science, technology and society locates sources of violence in politics and ethics, that is, in the application of science and technology, not in scientific knowledge itself.

The fact-value dichotomy is a creation of modern, reductionist science which, while being an epistemic response to a particular set of values, claims to be independent of values. According to the received view, modern science is the discovery of the properties of nature in accordance with a 'scientific method' which generates 'objective', 'neutral', 'universal' knowledge. This view of modern science as a description of reality as it is, unprejudiced by value, can be rejected on at least four grounds.

All knowledge, including modern scientific knowledge, is built through the use of a plurality of methodologies. As Feyerabend observes:

There is no 'scientific method'; there is no single procedure, or set of rules that underlines every piece of research and guarantees that it is 'scientific' and, therefore, trustworthy. The idea of a universal and stable method that is an unchanging measure of adequacy and even the idea of a universal and stable rationality is as unrealistic as the idea of a universal and stable measuring instrument that measures any magnitude, no matter what the circumstances. Scientists revise their standards, their procedures, their criteria of

rationality as they move along and perhaps entirely replace their theories and their instruments as they move along and enter new domains of research.[1]

The view that science is just a discovery of facts about nature does not get support from philosophy either. If scientific knowledge is assumed to give true, factual knowledge of 'reality as it is', then we would have to 'conclude that Newtonian theory was true until around 1900, after which it suddenly became false, while relativity and quantum theories became the truth'.[2]

The view of scientific knowledge as a purely factual description of nature is also ecologically unfounded Ecology perceives relationships between different elements of an ecosystem What properties of a particular element or resource are picked up for study or for understanding nature depends on the relationships that are taken as the context defining the properties. In other words, the context is determined by the priorities and values guiding the perception of nature Selection of the context is a value-determined process and the selection, in turn, determines what properties are seen in nature There is nothing like a neutral fact about nature, independent of the values shaped by human cognitive and economic activity Properties perceived in nature depend on how you look at them, and how you look depends on the economic interest you have in the resources of nature, Looking does not create properties, but it definitely creates conditions for their perception, Economic values of a particular type generate perceptions and uses of nature that reinforce these values, The value of profit maximization, for example, determines a particular way of looking at nature.

It is the central claim of this chapter that capitalist logic is inseparably and dialectically linked with the reductionist character of contemporary science which, in turn, has a set of distinctive characteristics which demarcates it from all other non-reductionist knowledge systems, Reductionism provides the assumptions and criteria which guide modern science, The basic assumptions are ontological and epistemological,

The ontological assumptions of reductionism are: (a) that a system is reducible to its parts; and (b) that all systems are made up of the same basic constituents which are discrete and atomistic; and (c) that all systems have the same basic processes which are mechanical,

The epistemological assumptions of reductionism are: (a) that knowledge of the parts of a system gives knowledge of the whole system; (6) that 'experts' and 'specialists' are the only legitimate knowledge-seekers and knowledge-justifiers.

*The Politics of Reductionism*

The ontological and epistemological components of the reductionist worldview provide the framework for a particular way of doing science, which is projected as the 'scientific method', that is, as the only reliable and objective way of discovering the facts of nature and correctly understanding nature, Deriving its inspiration and authority from Descartes,

modern science gives the Cartesian method a twist to christen it the sole 'scientific method', According to Descartes,

Method consists entirely in the order of disposition of the objects towards which our mental vision must be directed if we would find out any truth. We shall comply with it exactly if we *reduce* involved and obverse propositions step by step to those that are simpler, and then starting with the intuitive apprehension of all those that are absolutely simple, attempt to ascend to the knowledge of all other precisely similar steps.[3]

This reductionist method has its uses in the fields of abstraction such as logic and mathematics, and in the fields of manmade artefacts such as mechanics But it fails singularly to lead to a perception of reality (truth) in the case of living organisms such as nature, including man, in which the whole is not merely the sum of the parts, if only because the parts are so cohesively interrelated that isolating any part distorts perception of the whole

In any event, there is no warrant for the claim that the reductionist method is a 'scientific method', much less the sole scientific method. Thomas Kuhn, Paul Feyerabend, Michael Polanyi and others have convincingly argued that modern science does not proceed according to a well-defined and stable scientific method All that can be granted to reductionist science is that it is an approach, a way of looking, a mode of thought Considering its predatory treatment of nature, attested to by the ecological crisis, it is indeed a very unreliable way.

Controlled experiment in the laboratory is a central element of the methodology of reductionist science The object of study is arbitrarily isolated from its natural surroundings, from its relationship with other objects and observer(s) The context (the value framework) so provided determines what properties are perceived in nature, and leads to a particular set of beliefs about nature.

There is threefold exclusion in this methodology: (i) ontological, in that other properties are not taken note of; (ii) epistemological, in that other ways of perceiving and knowing are not recognized; and (iii) sociological, in that the non-expert is deprived of the right both of access to knowledge and of judging the claims of knowledge

All this is the stuff of politics, not science Picking *one* group of people (the specialists), who adopt *one* way of knowing the physical world (the reductionist), to find *one* set of properties in nature (the reductionist/mechanistic), is a political, not a scientific, act It is this act that is claimed to be the 'scientific method'. The knowledge obtained is presented as 'the laws of nature' - wholly 'objective' and altogether universal Feyerabend is therefore right in saying:

The appearance of objectivity that is attached to some value judgements comes from the fact that a particular tradition is *used* but not recognized. Absence of the impression of subjectivity is not proof of objectivity, but an oversight.[4]

It is argued in defence of modern science that it is not science but the political misuse of science and the unethical technological application of science that lead to violence The speciousness of the argument was always clear, but is totally untenable in today's world, when science and technology have become cognitively inseparable and the amalgam has been incorporated into the economic system Fragmentation of science into a variety of specializations and sub-specializations is used as a smokescreen to blur the perception of this linkage between science and a particular model of social organization - that is, a particular ideology Science claims that since scientific truths are verifiable, they are justified beliefs and therefore universal, regardless of the social context.

The verificationist model of science was forcefully presented by positivism It claimed that verification was direct observation of the 'facts' of nature, free from the proclivities of the observer This was, however, challenged by post-positivist philosophers Kuhn, for example, showed that facts and data in science are determined by the theoretical commitment of scientists In other words, scientific facts are determined by the social world of scientists, not by the natural world.

While the Kuhnian model challenged the neutrality of scientific facts, it failed to provide an adequate epistemological framework for handling the violence of reductionist science By insisting that 'nature fits into the realistic boxes of paradigms', Kuhn rendered his model of science materially and politically vacuous Moreover, he failed to take into account the value system of the larger society that determines the choice of scientific research. Value-determination in the Kuhnian model is done by scientific paradigms, not by social, political, economic interests. By restricting itself to the social world of scientists, the Kuhnian model is unable to deal with the more significant value-determination of scientific facts by the demands made on the science system by economic interests. Moreover, by restricting himself to the material world of the lab, Kuhn was unable to deal with those ecological situations in which reductionist claims are falsified by nature, as symbolized by ecological crises.

A more appropriate account of modern science (including technology) should extend the Kuhnian model both materially and socially. Materially, the testing of scientific beliefs has to be taken out of cloistered labs into the wider physical world. Socially, the world of scientific experiments and beliefs has to be extended beyond the social organization of science to the social organization of society. The verification and validation of a scientific system would then be validation in practice, where practice is real-life activity in society and nature.

*Profits, Reductionism and Violence*

The artificial cognitive dichotomy between science and technology dissolves when science is viewed as a set of beliefs guiding practice, and technology as practice guided by scientific belief. The duality between belief and action, thought and practice, is responsible for encouraging many to mistake the cognitive weaknesses of reductionism for cognitive success

Reductionism, however, is not an epistemological accident. It is related to the needs of a particular form of economic organization. The reductionist worldview, the industrial revolution and the capitalist economy were the philosophical, technological and economic components of the same process. Individual firms and fragmented sectors of the economy, whether privately or publicly owned, have their own efficiency needs in mind; and every firm and sector measures its efficiency by the extent to which it maximizes its gains, regardless of the fact that in the process it also maximizes the social and ecological costs of the production process The logic of this internal efficiency is provided by reductionism: only those properties of a resource system are taken into account which generate profits through exploitation and extraction; properties which stabilize ecological processes but are commercially non-exploitative are ignored and eventually destroyed.

The rationality and efficacy of the reductionist and non-reductionist knowledge systems are never evaluated cognitively The rationality of reductionist science is declared a *priori su*perior, even though it can be argued that if reductionist science has displaced non-reductionist modes of knowledge, it has done so not through cognitive competition, but through political support from the state and the state's development policies and development programmes which provide both financial subsidies and ideological support for the appropriation of nature for profits Since the twin myths of progress (material prosperity) and superior rationality have lost their sheen in the working out of development patterns and paradigms, and have been visibly exploded by the widespread ecological crisis, the state has stepped in to transform myths into an ideology When an individual firm or sector directly confronts the larger society in its commercial appropriation of nature, people can assess the costs and benefits for themselves; they can differentiate between progress and regression, rationality and irrationality But with the mediation of the state, the citizen-as-subject becomes the object *of* change rather than its determinant and consequently loses the right to assess progress. If they have to bear the costs instead of reaping any benefit of 'development', it is justified as a minor sacrifice for the 'national interest'.

The link between the state and the creation of surplus value provides the power with which reductionism establishes its supremacy Institutions of learning in agriculture, medicine and forestry, for instance, selectively train people in reductionist paradigms, which are given the names respectively of 'scientific agriculture', 'scientific medicine' and 'scientific forestry', to prove the superiority of reductionist science Stripped of the power the state invests it with, such a science can be seen to be cognitively weak and ineffective in responding to problems posed by nature As a system of knowledge about nature, reductionist science is weak and inadequate; as a system of knowledge for the market, it is powerful and profitable

*Reductionist Ecology*

Reductionism has lately invaded the specialized branch of biology dealing with organisms' relations to one another and to their surroundings, known as ecology It appears in the garb of the saviour of the ecosystem, now in peril too grave to be denied or

ignored. Nothing could be more ironical than the claim of the destroyer to be the saviour But if the claim is ironical, the remedy that reductionist ecology proposes is grotesquely chilling, as we shall presently see But let us first see how a pioneer of this ecology goes about it. Argues Garrett Hardin in his 'Tragedy of Commons':

Picture a pasture common to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long desired goal of social stability becomes a reality. At this point the inherent logic of the commons remorselessly generates tragedy...

Adding together the component partial utilities the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination towards which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.[5]

Hardin chooses not to disclose the assumptions underlying this perverse logic (Hardin's, which he foists on the poor unprotesting herdsman). These assumptions are: (a) that each herdsman sees himself as an atomized individual who is pitted against the rest of the community in deadly competition for grabbing as much of the common goods as he can; (b) that in all societies production is not for satisfaction of needs, but for exchange in a monetized market with a view to making immediate profit; and (c) that every herdsman is so short-sighted ('rational' in Hardin's vocabulary) as to sacrifice his future survival on the altar of immediate gain.

Such a poor opinion of herdsman's intelligence comes naturally to the ruling élites (especially of the 'modernizing' third world) and to establishment scientists who, comfortably cocooned in their claustral specializations, remain innocent of history or sociology or social psychology. However, history tells us that competition has not always been the driving force in societies. And sociology tells us that it need not necessarily be so today and tomorrow. Even today, despite the frenetic drive for 'modernization', considerable parts of the rural societies of third-world countries are still outside the competitive market, for exchange is still the predominant motive for production in subsistence economies.

The general logic of the 'tragedy of the Commons' does not operate in such situations. It is true, though, that in certain circumstances - those, for instance, in which the commons cannot provide for the basic needs of the population - a tragedy may occur even without competition. But that tragedy can be handled. There is another situation in which tragedy is inevitable and becomes unmanageable. It is created when the largest commons, nature, is mindlessly pillaged and life-support systems irreversibly ruined by those who are

confident that they will not suffer the consequences of their action. Such a situation (which is no longer hypothetical but has become a harsh fact of life) is created by big business, multinational or national, which has perfect mobility of capital (from one sector to another and from one country to another). It is therefore unencumbered with the responsibility for preserving natural resources. It has no difficulty in folding up one business and moving into another even more profitable one.

That is the real tragedy of the commons. In the words of Daniel Fife:

The tragedy of the commons may appear to be occurring but in fact something quite different is really happening. The commons is being killed but someone is getting rich. The goose that lays golden eggs is being killed for profit.[6]

The survival of common property, such as pastures and village copses, and common goods, such as a stable ecology, are possible only in a society in which checks and controls on the utilization of resources are built into the organizing principle of the society. The breakdown of such a community, with the consequent collapse of the principles of common ownership and shared responsibility, spells progressive degradation and the eventual ruin of common resources. This is happening in most third world countries.

The remedy preferred by reductionist ecologists for such a state of affairs is a reflection of the ethics with which their kind of science works. For no matter what label is given it - Hardin calls it 'ecology' and the third-world élites call it 'development' - the reductionist prescription is a prescription for genocide combined with ecocide. Some are frank about it, as Garrett Hardin is. He pulls no punches in advocating the liquidation of the poor (especially in the third world) through 'game management' and/or 'war of attrition', and justifies both as 'lifeboat ethics'. Some, such as the third-world élites, though coy about it, plan to achieve the same result by depriving the poor of their life-support system, thereby condemning them to slow death in the name of 'development'. It becomes in effect a war of attrition.

So much for genocide. As for ecocide, we shall choose a few out of several examples.

*Eucalyptus Planting*

Desertification and its consequence, famine, has already caused the death of over 900,000 people in Ethiopia. In the Sahel, 40 to 90 per cent of the livestock has died.

Nearer home, starvation deaths owing to scarcity are a recurrent phenomenon in Rajasthan, Madhya Pradesh, Orissa. Although officialdom has no eyes for it, and the 'free but cooperative press' of India - J. K. Galbraith's description - has no space for it, such deaths occasionally make a splash when a political bigwig is accidentally confronted by it, as happened during the Prime Minister's tour of drought-hit Orissa when a hapless woman named Parasi Punji made bold to tell the Prime Minister how drought had forced her to sell her sister-in-law for Rs 40 to feed her three starving children.

Since ancient times societies have known that forests are the best insurance against desertification and famine. The reductionist version of this response to desertification is itself a prescription for desertification. Under the World Food Programme, FAO is planting eucalyptus in Ethiopia. Under the social forestry schemes for ecological repair, the World Bank, SIDA, USAID have coaxed India into putting farmlands under eucalyptus. People who for centuries have been planters and protectors of trees have suddenly been marginalized. Knowledge of tree planting has become the sole preserve of international and national bureaucracies. Throughout the world, irrespective of local ecological conditions and economic needs, the prescription is only one - eucalyptus. The biological wealth and diversity of the tropics have been destroyed to make room for the reductionist solution, even though eucalyptus causes rather than cures deserts, upsets the cycle of life, the hydrological cycle and the nutrient cycle.

The ecological audit of eucalyptus plantations reveals that it involves heavy economic costs through the destruction of the hydrological stability and soil productivity in the following ways:[7]

First, in regions which have water scarcity, the high water intake of eucalyptus destroys the natural processes that replenish soil moisture and recharge the sources of underground water, turning the region into a completely arid zone. Moreover, eucalyptus damages the innate allelomorphic capacity of all other plants, seriously depleting the gene pool. The process initiated by large-scale cultivation of eucalyptus in water-scarce regions therefore leads inexorably to desertification.

Second, on fertile agricultural lands, eucalyptus, when planted and harvested in short rotation, heavily diminishes soil nutrients, destroying the soil's capacity for biological productivity. Moreover, eucalyptus destroys the environment for soil fauna that are at once 'factories' for reproducing soil fertility, and efficient 'machines' for maintaining the soil structure.

In the countries of the South, desertification has become an increasingly severe threat to human survival. The recently published UNEP report on deserts estimates that about 3.5 million hectares of productive and fertile rain-fed land is being lost annually. The food crisis in Africa testifies to the cost of desertification in human and economic terms. It is also a reminder that many of the economic problems of the poorest of mankind are rooted in the ecological destruction caused by excessive demands on the natural resources by the élites of the world.

Eucalyptus emerged as a magical candidate for all kinds of afforestation programmes during the 1960s because it is a fast-growing species. This belief was, however, challenged and it was shown that many indigenous species have higher growth rates than eucalyptus. It was then admitted that

The whole question of fast growth has come to light only because of the pulp industry gaining importance. How to get adequate pulp quickly was our problem. It is with this

reference that we had to try various species not only indigenous, but also exotic. While trying the exotics, we found the eucalyptus quite useful.[8]

In spite of eucalyptus being fast-growing and productive only in the narrow context of wood-fibre production, it was prescribed as a universal means for achieving increased productivity of biomass for the satisfaction of diverse needs. And so, a reductionist view of forestry wedded to the pulp industry was universalized at the cost of conservation of soil and water.

The rapid decline, and even total destruction, of water resources as a consequence of large-scale planting of eucalyptus has been reported from all parts of India. Sunderlal Bahuguna recorded the following statement of an elderly forest ranger in the Nainital *tarai* of Uttar Pradesh: 'We felled mixed natural forest of this area and planted eucalyptus.... Our handpumps have gone dry as the water-table has gone down. We have committed a sin.' Mahashweta Devi described the impact of eucalyptus on the water resources in the tribal areas of Bihar and West Bengal in the following words:

I am concerned with the India I know. My India is of the poor, starving and helpless people. Most of them are landless and the few who have land are happy to be able to make most of the given resources. To cover Purulia, Bankura, Midnapur, Singbhum, Palamau, with eucalyptus will be to rob my India of drinking and irrigation water.[9]

On 10 August 1983, the farmers of Barka and Holahalli villages in Tumkur district, in Karnataka, marched *en masse* to the forest nursery and pulled out millions of eucalyptus seedlings, inserting tamarind and mango seeds in their place. According to them, eucalyptus plantation in the catchment area of the streams feeding their agricultural land had made them go dry. Describing the state of the main stream feeding the village Guttalagolahalli, a local farmer complained, 'Earlier we would take our cattle to this stream in the summer. But now, as the stream is dry, we have to fetch water from a well.'[10]

Yet, forestry experts refuse to accept this, presumably because it hurts their own dominance and that of the interests they serve. The president of the Forest Research Institute of India, K. M. Tiwari, and R. S. Mathur, in a paper published in a special issue of the *Indian Express,* writes:

Of late in India a lot of controversy has arisen over the water consumption behaviour of eucalyptus planted in afforestation programme in social forestry. It has been alleged that eucalyptus plantation consumes large quantities of water to the extent that they deplete local water resources such as streams, wells, etc. This notion does not appear to be correct, as no experimental data in support has so far been presented.... There is no scientific basis in the popular fallacy that eucalyptus lowers the ground-water table.[11]

Scientific fact and empirical reality have thus been conveniently reduced to a fallacy. With the help of a controlled experiment, the foresters have manufactured a new justification for the propagation of eucalyptus. Having found that all recognized and

established scientific information was delegitimizing eucalyptus as a fast-growing tree, the forest establishment in India has rejected these data and initiated their 'controlled' experiments after the emphasis on eucalyptus in Indian social forestry was challenged in 1981. The Forest Department of Uttar Pradesh produced some data in 1983 on the biomass production of a few tree species, including eucalyptus hybrid (Table 7.1).[12]

The data of this single-plant experiment on one-year-old juveniles became the proverbial straw the official foresters clutched at to legitimize the bias of their kind in favour of eucalyptus. This gave the green signal to all eucalyptus plantations, in all agro-climatic conditions, in all parts of the country. In the history of forestry science in the world there is no parallel to this unrealistic extrapolation of a juvenile single-plant data to large-scale afforestation programmes unmindful of the well-established fact of non-uniform growth rates of eucalyptus at different ages.

One can easily see the inapplicability of the Kanpur data to mature trees. Eucalyptus, the low leaf litter of which is well known from measurements made in plantation studies, comes out as the best leaf producer in the Kanpur 'controlled' experiment. *Pongamia pinnata,* which is famous for its high crown biomass output, is reduced, in the Kanpur experiment, to a tuber crop with extremely low crown biomass output, less even than its root. The much advertised Kanpur data does not reflect the field reality and does not satisfy minimum scientific criteria. Reflecting on this point, D. R. Bhumla, a renowned agricultural scientist, at a Planning Commission meeting on eucalyptus, cautioned:

There are no data to show that eucalyptus produced more biomass than other species like *Acacia nilotica, Dalbergia sissoo* and *Prosopis juliflora.* Hence there was no strong case for advocating eucalyptus in social and farm forestry. However, it might be useful for pulp production On unirrigated lands, raising eucalyptus plantation would result in disaster. The poor and marginal farmers should be provided with enough data on eucalyptus before persuading them to take to eucalyptus.[13]

Reductionist forestry science is intimately linked to forest-based industry, notwithstanding its claim to be 'objective'. When its violence to nature through desertification, and its violence to man through famine, is exposed, official foresters turn on the victims of desertification and accuse them of colossal ignorance of the science of forestry. But this science does not balk at manufacturing data to legitimize misinformation; it violates the tradition of science itself to deny people the right to know and to hide, under the protective umbrella of the state, the nexus between modern science and capital accumulation.

Table 7.1 Results reported by the U.P. Forest Department Laboratory, Kanpur

| Species | Water consumed in 1 yr (litres) | Biomass production (gm) | | | | Total biomass produced/litre of water (gm) |
|---|---|---|---|---|---|---|
| | | Shoots | Roots | Leaves | Total | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Acacia auriculacformis* | 1231.50 | 1023 5 | 361.6 | 327.9 | 1713.0 | 1.39 |
| *Albizzia lebbeck* | 1283.90 | 1132.4 | 085.6 | 136.8 | 2354.8 | 1.83 |
| *Dalbergia sissoo* | 1534.05 | 1129.3 | 775.5 | 99.7 | 2004.5 | 1.31 |
| *Pongamia pinnata* | 459.15 | 168.0 | 274.7 | 77 5 | 519.7 | 1.13 |
| *Syzigium cumihi* | 1190.25 | 1278.0 | 593.7 | 514.3 | 2386.0 | 2.00 |
| *Eucalyptus hubrid* | 2526.35 | 2519.8 | 2094.3 | 549.9 | 5209.0 | 2.06 |

# 8. On the annals of the laboratory state

SHIV VISVANATHAN

**I**

Joseph Conrad was one of the great students of modernity-as-violence. In his *Nostromo* and *The Heart of Darkness,* he showed how western man had constructed the savage as the other in order to impose his own savagery on him. The jungle became the theatre of that enactment. Conrad's novel, *The Secret Agent, is* a study of anarchist violence in England at the beginning of the twentieth century. It is an analysis of terrorism-as-faith, an unravelling of the belief that one act of violence can literally erase bourgeois society.

In a fascinating passage, the first secretary of the Russian embassy explains the logic of violence to the anarchist, Verolac. He remarks that the power of terror should not reside only in the physical impact of the bomb, but should spread further through the aura it creates. An ordinary bombing, he explains, is as banal as class hate.

But what is one to say to an act of destructive ferocity so absurd as to be incomprehensible, inexplicable, almost unthinkable; in fact, mad? Madness alone is terrifying, inasmuch as you cannot placate it either by threats, persuasion or bribes. Moreover I am a civilized man. I would never dream of directing you to organize a mere butchery. I wouldn't expect from a butchery the result I want. Murder is always with us. The demonstration must be against learning - science. But not every science will do. The attack must have all the shocking senselessness of gratuitous blasphemy... it would be really telling if one could throw a bomb into pure mathematics... what do you think of having a go at pure astronomy?[1]

The secretary asks the agent to blow up the Greenwich observatory, the custodian of time. 'The whole civilized world has heard of Greenwich. The very boot-blacks in the basement of Charing Cross station know something of it.'[2]

Conrad presents the act as a senseless one. He does not explore the possibility that science itself could be a mode of violence or tyranny. He failed to grasp the possibility of a lonely tribal striking a futile blow at Indian Standard Time or at the glass-encased Standard Metre. The anthropology of the act eluded him.

The iconography of the act provides the justification for this essay. It involves, I believe, three separate statements: (1) the realization that science could encode a structure of domination and violence; (2) the violence of science is not a pathology confined to the fringes or frontiers such as atomic physics or genetic engineering; it is a pathology which resides in the banality of its everydayness; and (3) the act of protest inaugurates what has been called the insurrection of the little knowledges. One must interpret all three statements within the wider framework of the history of science.

I contend that historians of science have been maintaining two parallel sets of registers. There are, first, the textbook histories depicting science as an impersonal method which elevate the idea of order to a collective truth. Accompanying this is an act of bracketing and ritual separation. Theories like racism in anthropology, orientalism in linguistics, IQ in psychology, social Darwinism in political economy and biology, are bracketed off as 'pseudo-sciences' or as distortions of normal science. I suggest an alternative explanation. The marauding genius of science needs these spaces - these 'pseudo-sciences' - for the free play of its imagination. This collective unconsciousness of science constitutes an integral part of the scientific experiment. Marking it off saves science as a phenomenon but contributes little to our understanding of it. It does not explain why these theories so often recur in science.

One can see the same trend in the modern discourse on development. Development should be regarded as a scientific project. It represents the contemporary rituals of the laboratory state. As a project, it is composed of four theses, ingrained in the logic of western science, of modernity as technocracy. One can call them:

1. *The Hobbesian project,* the conception of a society based on the scientific method;

2. *The imperatives of progress,* which legitimize the use of social engineering on all those objects defined as backward or retarded;

3. *The vivisectional mandate,* where the other becomes the object of experiment which in essence is violence and in which pain is inflicted in the name of science;

4. *The idea of triage,* combining the concepts of rational experiment, the concept of obsolescence, and of vivisection - whereby a society, a subculture or a species is labelled as obsolete and condemned to death because rational judgement has deemed it incurable.

Development as a technocratic project includes all four themes. In fact, if concepts could ever be death warrants, the above glossary could be regarded as genocidal. The next section contains a brief discussion of these concepts.

**II**

The genealogy of modern science is often traced to the tracts of Bacon and Descartes. They were no doubt influential, but the triptych is only complete with the work of Thomas Hobbes. If Descartes captured the philosophical expertise of the machine as imagination, and Bacon the rules of the experimental method, Hobbes complements them with the conception of a society based on the scientific method. Bacon's scientific utopia, the *Novum Organum,*[3] on which the Royal Society was based, was less grandiose and totalitarian than the Hobbesian *Leviathan*,[4] which haunts us to this day. Bacon's conception of Solomon's House was more cautious. The Royal Society merely sought a charter for a bounded association within a more encompassing society. The Hobbesian state was a schema for science as society. Both were critiques of the intellectual dominance of Aristotle, but Hobbes' attack was a more mordant one. In fact, the early members of the Royal Society condemned Hobbes for his lack of caution.[5] Because of this, the Hobbesian project is important. It forges links between science and power; it links science integrally to the issues of fear, death, terror and violence. The charter of the Royal Society is an attempt to wish away this problem. In the charter of the Royal Society, the moment of conception is the moment of fission. In an open declaration about the dualism of knowledge and power, the charter clearly states that problems of politics are beyond its ken.

For Hobbes, modernity demands a movement from the state of nature to civil society. The description of the state of nature was not so much a historical account as an analytical one with historical nuances. The state of nature was a state of anarchy; a chaos of meanings, emotions, dreams, fantasies and hallucinations. It encapsulated the factionalism of religious strife, the divisive heresy of Levellers, Diggers and other inner-directed groups. Like the society of Hobbes' time, the state of nature was one of rampant disorder where

every man is enemy to every other man. There is no place for industry, no culture of the earth, no navigation, no instruments for moving, no knowledge of the face of the earth, no account of time, no arts, no letters, no society.[6]

With no science and no society, 'the life of man is solitary, poor, nasty, brutish and short.'[7]

To combat this condition, civil society, which is rational, scientific, stable and ordered, is conceived. The axiom on which rational society is constructed is that the sovereign or the state has the monopoly of terror and of man-made instruments of death. Modernity as society is inaugurated not merely through a contract; but as a theorem, a Euclidean list of propositions which makes society possible. Science, thus, colonizes society at the very moment of inauguration, by conceptualizing it and by policing it. Both the scientist and

the sovereign are prior to the Hobbesian polls. Society is based on the violence of the sovereign, but repeated violence makes society uneconomical. To the fear of death is added the structure of quietude, of monolithic order, and that is the role of science.[8] The state as the source of ultimate power does not antedate science; it is coterminal with science. In that sense, science is the civics of the Hobbesian world. To be is to be scientific, and to become in every sense of the term a subject and citizen. Science is the grammar of power, and violence of the state becomes a symptom of the breakdown of science. It is in this context that Hobbes examines the problem of sedition.

For Hobbes, sedition is irrational and unscientific. Sedition is any language that does not conform to the rules of science. Included in it are such events as primitive Christianity, Aristotelianism, occult science, and all the other bacchanalia of the mythopoeic imagination. So are all 'fancies, imaginings, passions, expressed in metaphor, poetry, or other imprecise and extravagant modes of speech'.[9] For Hobbes, science provided a mathematical precision of language which made order eternal. The sovereign recedes before the eternal order of science; he becomes a referee, a Hessian Magister Ludi, but one with enormous power.

The Hobbesian project has been the great dream of modern man. It underlies the logic of all technocratic totalitarianism - whether that of Lenin, Stalin or the new laboratory states of the twentieth century. Locke's social theory was merely an attempt to moderate this scientific urge. Locke posited a distinction between political and scientific communication. Political society, Locke felt, had not reached the clarity of the scientific discourse.

Modern society has oscillated ever since between the Lockean and Hobbesian visions, the movement always being towards recovering the frictionless world of Euclidean politics. The violence of modernity arises not merely from the violence of the state, but from the violence of science seeking to impose its order on society. In fact, through a strange twist, the modern state exists more and more as a big machine guaranteeing the production and reproduction of science. In fact it is the grammar of science that provides for the everyday fascism of modernity-as-technocracy. I move now to the next concept in our glossary - progress.

**III**

I saw them bury a dead child
In a cardboard box
(This is true, and I don't forget it)
On the box there was a stamp.
'General Electric Company
Progress is our Best Product'
Louis Alfredo Arrago
Guatemala, 1967

Modernity was a vision of conquest. Every structure of conquest needs a calendar, as a liturgy of its power. To do so it has to capture or rewrite time. Time till modernity was capable of reversal. Therefore, the first project of modernity and of modern science was to escape from their own pasts, from the traditions of Christianity and Aristotelianism. The medieval cyclical theory of time, which allowed for decadence and reversal, yielded to a linear, irreversible notion of time. The time of modernity became gradually the time of the world. Imperialism was not merely the logic of capitalism but it was also the charter of science. Bernard-Henri Levy states this succinctly.

The Greeks did not invent imperialism, because they believed in geography and lived with the illusion that there were scattered and peculiar times, appropriate for each substance and each particular place. The Athenian configuration was not and could not be imperialist in our sense of the word, because its supporters thought time did not exist and that Thebes, Athens and Sparta each had its own chronology, almost like substance. The moderns, on the other hand, were able to invent the idea of empire because they no longer believed in nature or geography, but in infinite, uniform and homogeneous space reduced to a single law of identical temporality.[10]

However, modernity, which had escaped from antiquity, still had to confront the 'other' - both as other civilizations and the other-as-tribe. What were these other societies juxtaposed or located along the same, contemporary space? The answer that evolutionary theory gave can be read in the collective representation called the museum.

The museum is an act of classification where artefacts are juxtaposed to each other in a logico-spatial manner.[11] One can witness even now exhibits on technology or cognition arranged in the following way. One 'sees' the primitive canoe or spear. Next to it is arranged the sailing ship or cannon and the exhibits eventually culminate in a submarine or tank. What is a logico-spatial order is then read as time series, where each ex hibit is literally seen as evolving into the other. Progress is defined as the ordained linear movement across this sequence.[12] This is the basic assumption underlying the law of stages, present in the work of Auguste Comte (1798-1857), Karl Marx (1818-83), Herbert Spencer (1820-1903) and all the other evolutionary thinkers and scientists.

As a result, other civilizations or tribal cultures are seen as 'contemporary ancestors', the past the west has already lived out. The west, the modern west, is, in turn, the future these societies will encounter. The museum thus becomes an index of the map of the world, a taxonomy identifying cultures in time. One is forced to confront the violence encoded in this innocent bit of anthropology.

A society with a hunting culture is more primitive and less evolved than one with a hoe culture or simple pastoralism; and these in turn are more primitive than one with industrialization.[13]

Implicit in this model of progress are several sets of implications:

1. The increasing accumulation of science is seen as a sign of 'grace'. The west is seen as paradigmatic of scientific and technological culture.

2. The west-as-modernity obtains the mandate of power and responsibility over this-world left behind by history. It is science as the modern man's 'gaze' that brings the primitive and the archaic back into contemporaneity. It is science once again that must aid in their march to modernity. In the meanwhile, the latter become the objects of the experiment, the programme called modernization.

3. Progress and modernization as scientific projects automatically legitimate any violence done to the third world, as objects of experimentation. The classic example is that of Marx, who indirectly justified the British colonial presence in India as the trigger for India's movement towards modernity.

Historians of science tend to condemn the notion of progress, the evolutionary law of the three stages, as 'pseudo-science'; bracket it off as an aberration of science or as a discarded paradigm. Such an act of erasure will no longer do. To use an analogy from science itself, one knows that Einsteinean physics encompasses the Newtonian paradigm; yet the scientists and technologists operate with it in many spheres. The superseded Newton is never condemned or bracketed off as pseudo-science. Likewise, the schemes of progress and evolutionism operate to this day in the policies of modernization and development, where states are imposing the inevitability of development on reluctant cultures. Neither the action of the states nor experience of the cultures can be explained away as the unfortunate products of a pseudo-science.

**IV**

The experimental method so crucial to modern science is not only a system of political controls but it incorporates a unique notion of violence - that of vivisection. Within such a framework, the laboratory becomes a political structure and the basis of a wider vision of society. One can illustrate this with reference to the development of public health in India.

In September 1896, plague struck Bombay and its surrounding areas and raged without let-up for twelve years and eight months, culminating eventually in the death of thousands of people. Today, it is remembered in medical history, and commemorative stamps, as a tribute to Haffkine after whom the plague research institute in Bombay is named. Within the structure of medical discourse, Haffkine's work is regarded as one of the great justifications for vivisection. The *British Medical Journal* announced that Haffkine had arrived in India from the Pasteur Institute in Paris 'to test on man the remarkable results which he had obtained on animals in the laboratory with reference to the cholera bacillus'.[14] The note added that it was struck by Haffkine's enthusiasm for the test.

Simultaneously, there was a plague in Egypt which is now almost forgotten. Sir John Rogers, who was then Director-General of the Sanitary department in Egypt, immediately

instituted a series of sanitary measures. Persons found infected were isolated. All persons who had come into contact with the patient were put in quarantine, where they were fed and also compensated for the loss of time. Simultaneously, a whole set of sanitary measures, such as limewashing of infected houses and disposal of garbage within the city precincts, was carried out. The plague in Egypt ended within six months, the eventual death toll being a mere forty-five.

When the epidemic was raging in India, many doctors brought to Haffkine's notice the importance of instituting sanitary measures. But Haffkine represented what the committee called 'the laboratory point of view'. He rejected these suggestions and threw the entire weight of his scientific reputation to ensure that no sanitary measures were undertaken while his vaccine was being tried out.[15]

Vivisection, the inflicting of pain on 'lesser animals' for the purposes of scientific research, is as old as Galen and Celsus, but received scientific imprimatur in the writings of Descartes. When one of his visitors remarked on the poverty of his library, Descartes pointed to the animals he had been dissecting and replied, 'These are my books.'[16] Descartes' texts were alive and the great methodologist believed that the cry of an animal was not due to pain, but could be compared to the creaking of a wheel. The Descartian text acquired the status of a textbook in the works of Claude Bernard and François Magendie.

Bernard defined the nature of vivisection precisely. The organism, he stated, had to be taken to pieces in the same way as a machine is dismantled.

After dissecting the dead, one must go on to dissect the living, to uncover the functioning of those parts that are hidden or concealed. It is the operation of this character that acquires the name vivisection.[17]

The hospital, said Bernard, is only the antechamber of medicine, while the laboratory constituted its sanctum.

Bernard's work reflected the intrinsic violence of science as vivisection. Vivisection is the infliction of pain for experimental purposes of understanding and control, where pain and suffering are justified in the pursuit of scientific knowledge as an absolute value. François Magendie 'sacrificed' 4,000 dogs in making a distinction between sensory and motor nerves. Some of the early vivisectors might have been sadists, but Bernard exemplifies the schizophrenic attitude of 'normal science' to vivisectionist violence. Bernard remarked that

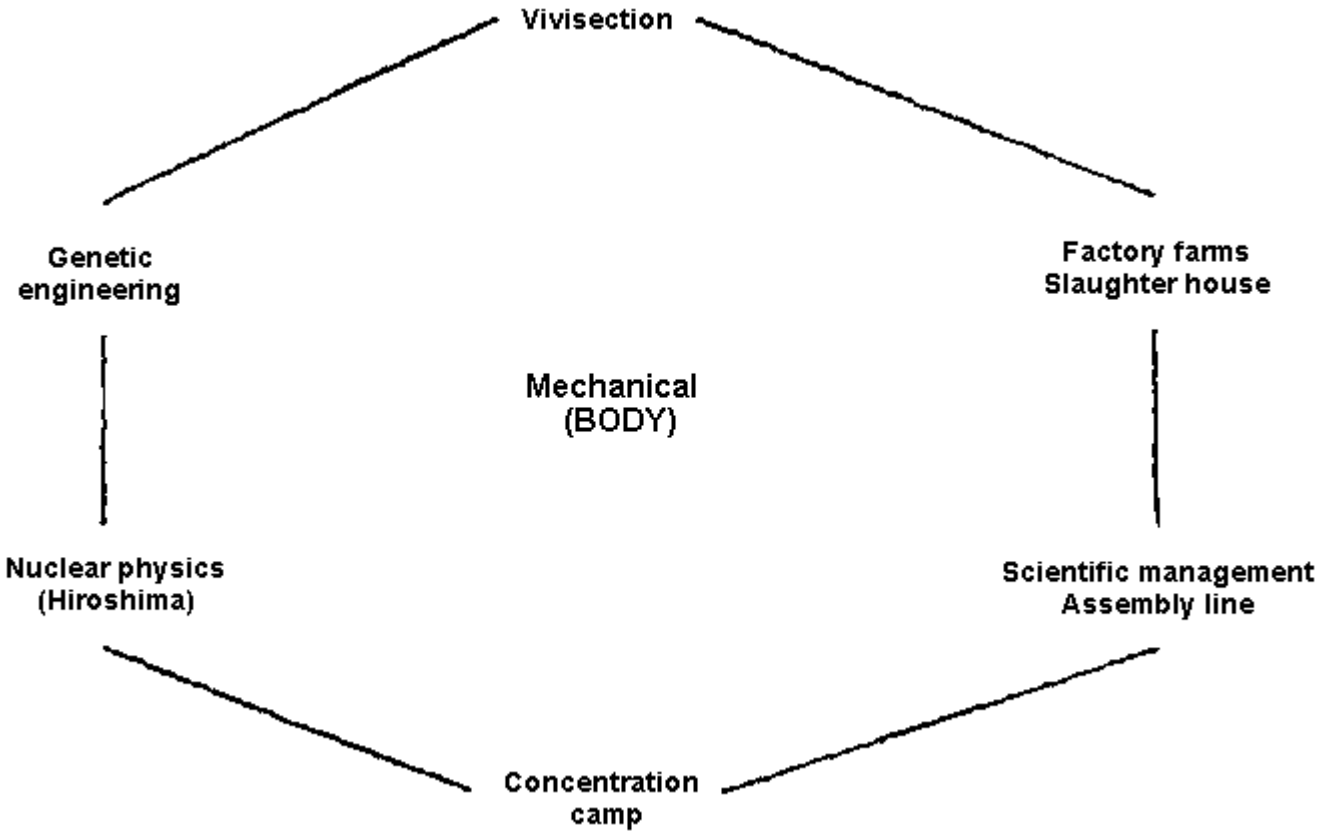
the physiologist is not an ordinary man: he is the scientist possessed and absorbed by the scientific idea he pursues. He does not hear the cry of animals, he does not see the flowing of blood; he sees nothing but the idea and is aware of nothing but the organism that conceals from him the problem he is seeking to resolve.[18]

It was necessary to quote Bernard in such detail because vivisection, which has acquired a central and permanent status within science, has now become totally banal. The pervasive everydayness of it covers the metaphysical shock one would otherwise have experienced. Today, over a hundred million animals are used up in the pursuit of research, in experiments ranging from hair dyes to cancer research. Peter Singer cites a 1971 survey carried out by Rutgers University which provided the following estimates of the numbers of animals used each year in US laboratories: 85,000 primates; 500,000 dogs; 200,000 cats; 700,000 rabbits; 46,000 pigs, 23,000 sheep; 1.7 million birds; 45 million rodents; 15-20 million frogs; 200,000 turtles, snakes, lizards - a total of 63 million animals.[19] One can add to it now a roll call of patients, prisoners, the poor, inmates of old people's homes, and nameless peasants in the third world.

The socialization of vivisection in science has been so extensive that even children regard it as a normal part of the educative experience. Gerald Carson cites the example of a child 'who gouged out the eyeballs of house sparrows, punished them with electric shocks when they refused to respond to light and won a science prize for $200'.[20]

Opposition to vivisection has usually been dismissed by scientists as sentimentalist. But one must see it as a paradigm for general scientific activity extending towards wider domains of control, incorporating innumerable sets of violence within the genre of vivisection. This scenario is reflected in the following chart. One witnesses the violation of the body in the search for 'scienticized' production and control. The violation of the body soon leads to the vivisection of the body-politic in theories of scientific-industrial development. And these examples are transforms of one another. The vivisectional code underlies and underwrites the violence implicit in all of them.

**Scheme**




The scheme tries to show that the scienticization of a problem carries with it the seeds of vivisectional violence. As a concrete example one can begin with scientific management. Modern management has its origins in the vivisection of the animal body. The first assembly lines were developed in the slaughter houses. The meat conveyor belts in the packing industry anticipated Ford's assembly lines. Braverman gives the following description of them:

The animal was surveyed and laid off like a map; and the men were classified into thirty specialities and twenty rates of pay, from 16 cents to so cents. The so cent man was restricted to using the knife on the most delicate parts of the hide, or to use the axe in the splitting of the backbone. In working on the hide alone there are nine positions at eight different rates of pay. A 20 cent man pulls the tail, a 221/2 cent man pounds another part of the hide...[21]

The disassembling of the body later became the model for the assembly line. It was only a short step then to vivisecting body motions to establish the basis of Taylor's scientific management. The Taylorist experimental attitude is captured especially in his descriptions of his object of study, the Dutch worker, whom he calls Schmidt. Taylor records how he decides to instruct Schmidt in order to determine the mechanics of work. He tells him,

you will do exactly what this man tells you tomorrow from morning till night. When he tells you pick up a pig (iron), you pick it up and walk and when he tells you to sit down and rest, you sit down. You do that right straight through the day. And what's more, no back talk. Do you understand that? When this man tells you to walk, you walk; when he tells you to sit down, you sit down and you don't talk back to him.[22]

Taylor himself admitted that he was surprised to find a human animal so amenable to experiment.

The 'Fordification of agriculture' is now reflected in factory farming. The notions of animal husbandry, once common to traditional agriculture, have yielded ground to the notion of animal machines. The writings of Peter Singer and Ruth Harrison have systematically detailed these processes.[23] What appears as ordinary scienticized production techniques, reflecting the violence of vivisection, acquires new power when reflected in more dramatic cases of vivisection - the concentration camp and the bombing of Hiroshima.

The excesses of the Nazi regime are explained in terms of the individual psychopathologies of Hitler, or the authoritarianism inherent in German culture. Yet these studies do not fully explain the particular nature of violence as it occurred in the concentration camps. The problem is caught in Fredrick Wertheim's *Sign for Cain* where he remarks:

The mass killings in the concentration camps cannot be subsumed under any of the old categories. It is not bestial, because even the most predatory animals do not exterminate their own species. It is not barbaric, because barbarians do not have such organized, planned advanced techniques for killing people and processing them into commercial fertilizers.... It was not the work of madmen, for many of the perpetrators and organizers led (both before and after the killings) normal, average, bourgeois, working class, professional or aristocratic lives.[24]

Part of the explanation for the pedantic orderliness of the concentration camp lies in the fact that its violence was a direct consequence of the normal science of the time. One can grasp this argument at two levels. Firstly, by tracing the scientific debates of the time, and, secondly, through the wider notions of science, especially as they appeared in the records of the Eichmann trials.

The concentration camp had its roots in the nature versus nurture debates of the time. Eugenics was a part of the normal science of the time. In fact, as many as eight universities in America, including Harvard, Cornell, Brown and Northwestern, had established departments on the subject.[25] The mass killings of patients in the hospital was a direct application by doctors of established eugenic and psychiatry theory. Many of these doctors were outstanding intellectuals. Max de Crinis was a professor of psychiatry at Berlin University, and Director of the psychiatric clinic of Charite, one of the most famous hospitals in Europe..[26] The mass killings had all the workings of a community psychiatry project, involving a network of mental hospitals, university professors of

psychiatry, directors and staff of the hospitals voluntarily working out the normal science of their scientific theory. The first concentration camps that came into being were seen as experiments in re-education. The doctor-psychiatrists who guided it looked upon it as an attempt to eliminate 'useless eaters' - the mental patients. In 1939, there were 300,000 such useless eaters in German psychiatric hospitals; by 1946 the number had been reduced to 40,000. It was only after the basic methods of killing were worked out in these hospitals that the gas chambers were dismantled and moved to other locations. This time the 'inferior materials' were Jews, gypsies and Poles.[27]

The concentration camp was an industrial research laboratory organized completely by doctors and scientists. In fact, histories of synthetic chemistry which celebrate the synthesis of ammonia and indigo by the companies of the IG Farben group fail to emphasize its complementary role in the organizations of these camps which went beyond the use of Xyklon-B. It is in this context that I want to establish a parallel not often considered seriously, the parallel between a paradigmatic scientist like Winslow Taylor and an individual like Adolf Eichmann. Two points must be noted here: that Eichmann thought of himself as a scientist-bureaucrat, and secondly that the banality of Eichmann's evil lay in his scientific attitude. Eichmann deserves to be recognized as the Winslow Taylor of the concentration camp. Let us not forget that the originators of the assembly line and Eichmann confronted the same problem - the management and disposal of the body. The concentration camp operated on the same logic, only the materials handled were human hair, teeth, skin or fat. All one has to do is to picture Werner Hyde, professor of psychiatry, lecturing before high Nazi officials on the merits of carbon monoxide.

The question of the 'banality of evil' in the Nazi bureaucracy has been raised by Hannah Arendt[28] and Bruno Bettelheim.[29] Bettelheim emphasizes that by all 'scientific' standards Eichmann was a 'normal' person. Half a dozen psychiatrists had certified him as normal. One psychiatrist even said he was 'more normal at any rate than I am after having examined him'.[30] Another found that Eichmann's 'whole psychological outlook towards his wife, children, mother and father was not only normal but most desirable'.[31] With Bettelheim one can then wonder how to account for the incongruity of the murder of millions and the normality of the man in the dock? Bettelheim's explanations concern the structure of scientific and legal detachment. He notes that Eichmann lacked what might be called a fully expert knowledge and remarks that Eichmann had only read two books on the subject but he considered them as embodying 'a scientific approach to the problem'. Bettelheim adds that without this notion of scientific detachment, the inhumanity of modern totalitarianism cannot be understood.

The last example that I wish to discuss is the bombing of Hiroshima. The bombing of Hiroshima embodied the violence of vivisection at three phases of its career. Firstly, in the very decision to bomb the city; secondly, in the attitude to the survivors of Hiroshima; and, thirdly, in the continuities of nuclear research itself.

Friedrich Wertheim points out that there is a persistent myth that scientists as a group were against the dropping of the bomb. He contends that the leading scientists not only

helped the governments in making the decision but picked Hiroshima and Nagasaki as experimental sites. The cities were free of the devastation of incendiary bombs and were thus appropriate sites for the scientific evaluation of the nuclear impact. But what is more frightening is the general absence of atonement after the bomb. In fact, in *The Children of the Ashes,* Robert Jungk shows that scientists saw in it new possibilities for science.[32] The city became in their eyes an industrialized table of symptoms to be subjected to clinical gaze. Jungk describes scenes at the ABCC clinics where patients were studied in a Taylorist fashion, to be 'thumped, have light shone in their eyes, be photographed, pumped full of serum'.[33] None of the specialists ever explained why or with what purpose all this was done to them. If a patient asked, 'What do you advice, doctor? What can I do to get well again?', the reply was always the same, that the clinic was not a therapeutic establishment but a research institute.[34]

The disjunction between research and healing, implicit in vivisection, reminds one of the statement of the French physiologist Charles Richet.

I do not believe that a single experimenter says to himself, when he gives curare to a rabbit, or cuts the spinal marrow of a frog, here is an experiment that will relieve or cure the disease of some man. No, in truth, he does not think that. He says to himself, I shall clear up an obscure point. I shall seek out a new fact.[35]

The third element in the Hiroshima story is the return of the scientists, some of whom who had protested against the bomb, back to the laboratories which produced the bomb. Jungk cites the case of the brilliant Hans Bethe who had condemned the bomb as anti-Christian and genocidal, and who a few years later became one of the enthusiastic exponents of the H-Bomb. Such macabre enthusiasm can only be understood by focusing on the internal structure of science as a mode of cognition, where violence is justified in the objective pursuit of knowledge. There seem to be no internal checks to its cognitive imperatives.

A colleague of mine once remarked that vivisection anticipated Auschwitz, and Auschwitz the vivisectional imperatives of the new experiments in planning and development. The objectivity of science is embodied even in the plan of the revolution, be it that of Mao or of Stalin. They all justify the imposition of suffering on millions in the name of scientific development. One wishes that critics of science would confront this genre of violence somewhere in the timetable of their programmes.

**V**

Villagers Die in Bhabha City - *The Times of India*

I sometimes wonder what is worse
A secret or a lie
A word unspoken or left unsaid
When either way a man is dead.
I still maintain,

It is not death that is important
But the manner of dying
Like a child's first poem
Wiped by a careless eraser.

Lurking quietly within modernity-as-a-scientific-project is the idea of triage. Triage has been the silent term mediating between the ideas of vivisection and progress. Vivisection as an experiment has implicit within it the idea of indifference, and progress implies obsolescence. Triage interweaves these ideas as the obsolescence of those one is indifferent to.

With the reappearance of triage, as a formal concept, modernity has come full circle. If progress demands the summoning of The Other into modernity, triage is the dispensing with of the Other. Both concepts include the idea of science as memory. Science once felt that these societies had no history; today, it seems to have decided that they have no future. If the tribal was once whipped into modernity because he was a savage, today he is being bludgeoned back as being incapable of science. The decision in both events is articulated as part of the discourse on rationality, while societies and cultures are now being destroyed because they are considered refractory to the scientific gaze. Triage is the final abandonment of modernity as a universalizing project. The western encounter with the other ends in its eventual logic as erasure. Triage blends with the other great strand of modernity-as-rationality, the atomic holocaust; the two death warrants threaten to put an eventual stop to the world as a modern world.

*Triage* is a French word which referred, in the eighteenth century, to the sorting of coffee beans or pelts. It acquired a certain stability in medical dictionaries as the method of screening patients to determine priority of treatment, particularly when the demand for medical treatment outran the supply of medical facilities and personnel. Richard Rubenstein in his book on triage cites an example of such a process. It relates to the manner in which scarce penicillin was distributed among American soldiers during World War II. Rubenstein explains:

Some of the stricken men had received their wounds in battle, others in brothels; it was decided only soldiers with venereal dis-eases would be given penicillin, even if it meant that some of the wounded would die without it.[36]

# Contributors

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the impact of modern technology in India for the Committee for Cultural Choices and Global Futures.

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VEENA DAS, whose main work has been on Hinduism and comparative religion, is presently working on human violence. She is a professor of sociology at the Delhi School of Economics, University of Delhi, and the author of *Structure and Cognition: Aspects of Hindu Caste and Ritual* (New Delhi: Oxford University Press, 1977). She has also edited *The Word and the World: Fantasy, Symbol, Record* (New Delhi: Sage Publications, 1986) and co-edited *Welfare and Well-being in South Asia* (forthcoming).

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*Loss and Recovery of Self Under Colonialism* (New Delhi: Oxford University Press, 1983) and *Traditions, Tyranny and Utopias: Essays in the Politics of Awareness* (New Delhi: Oxford University Press, 1987).

The seven essays in this volume argue that a new kind of organized violence has been unleashed on the global scene, particularly in the third world, by the establishment of science in collaboration with the existing political and economic establishments. Starting from the premise that the worldview of modern science and technology in the late twentieth century has provided a 'legitimate' model of violence and domination, the essays examine the content of the 'rational' patterns of behaviour and lifestyles being imposed on citizens in areas such as social organization, agriculture, medicine, environment and gender. The violence, the argument goes, is not an accidental byproduct of the practice of post-Enlightenment science but lies at the heart of the modern scientific vision.

The distinguished contributors to the volume come from areas as diverse as physics, medicine, philosophy, ecology, environmental and civil rights movements, sociology and psychology. They were brought together for this purpose by the Committee for Cultural Choices and Global Futures, Delhi. The Committee is an association of scholars in search of a more holistic, politically sensitive, social knowledge and its concerns are the ecology of plural knowledge, cultural survival, and humane futures for the 'victims of history'.

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