A Survey of Operator Algebras - I. Kaplansky

The Opening of Jeffery Hall - R. L. Jeffery, A. J. Coleman

The Responsibility of the Scientist Today A. Grothendieck

QUEEN'S PAPERS IN PURE AND APPLIED MATHEMATICS — NO. 27

QUEEN'S UNIVERSITY, KINGSTON, ONTARIO

1971

A SURVEY OF OPERATOR ALGEBRAS - I. KAPLANSKY

THE OPENING OF JEFFERY HALL - R.L. JEFFERY, A.J. COLEMAN

THE RESPONSIBILITY OF THE SCIENTIST TODAY - A. GROTHENDIECK

QUEEN'S PAPERS IN PURE AND APPLIED

MATHEMATICS - NO. 27

QUEEN'S UNIVERSITY, KINGSTON, ONTARIO, CANADA

1971

TABLE OF CONTENTS

Preface

Except for Mendelsohn's talk on Recent Progress in Combinatorics, this volume of the Queen's Papers records the addresses delivered at the official opening of Jeffery Hall. It also contains a relevant paper by Alexandre Grothendieck.

The mathematicians who had been dispersed in four corners of Queen's University were united in the new Mathematics Building in March 1969. However, it was not until the afternoon of Friday, October 7, at a ceremony over which Principal J.J. Deutsch presided, that the building was formally opened by Chancellor Stirling and named in honour of my predecessor.

During the morning, Irving Kaplansky gave a vivid Survey of Operator Algebras in his normal lucid style. Nathan Mendelsohn's talk on Combinatorics was given without the benefit of the extensive notes which he had prepared. As part of the agony of those times, together with his brief-case, he had been forced to leave them behind armed guards at the American university where he had lectured on the previous day. Unhappily, because of personal circumstances, Mendelsohn was unable to prepare his talk for publication. In the afternoon, I seized the opportunity to inflict on a captive audience some of my views about the state of Mathematics in the Second Half of the Twentieth Century. The occasion was the first on which Kaplansky, Mendelsohn and I had combined our talents since 1939 when, as undergraduates at the University of Toronto, we

comprised the first team to win the Putnam Competition.

Ralph Lent Jeffery was Head of the Department of Mathematics at Queen's University for eighteen years, from 1943 to 1960. Each of his three predecessors held office for thirty-four years on the average! Mathematically, Jeffery was a slow-starter since his original intention in life was to be a fisherman. But his mathematical career, once begun, was characterized by unswerving - almost single-minded - devotion to research which he pursued with the tenacity of purpose and toughness of body and mind which we commonly attribute to the Nova Scotia fishermen who were the friends and colleagues of his youth. His address at the Banquet in his honour was of special interest to his friends at Queen's but will be read with delight by all who are interested in the development of mathematics in Canada during recent decades. A portrait of Ralph Jeffery by Grant Macdonald hangs in the Nellie Jeffery Conference Room. The portrait was commissioned by friends and former students of Jeffery. The room was panelled and carpeted at Jeffery's expense in memory of his first wife. Recently, in his eightieth year he married for a second time providing us with new evidence of his vigour and good sense!

At the Banquet, Jeffery was introduced by his former student, admirer, and fellow graduate of Acadia University,

H.W. Ellis whose remarks are reproduced in this volume.

Dr. J.A. Corry is one of Canada's most respected students of Political Science. He was Principal of Queen's during the gestation period for Jeffery Hall, so it fell to his lot to rule over the conflict of interests engendered by the problem of siting a new building for mathematics. In his address he modestly refers to his crucial role in this connection. Surely his political sagacity is convincingly attested by the fact that he placed the building on the one remaining central site!

Architects usually feel that their buildings speak for themselves. The firm of Marshall, Merrett, Stahl, Elliott and Mill is no exception to this rule. Indeed, the fortress-like exterior of Jeffery Hall proclaims to some that mathematics is the firm foundation on which the other sciences rest while to others it suggests the dour Presbyterian solidity - even stodginess - of Queen's scholarship. The interior has delighted all who use the building by its functional convenience and aesthetic cleanness and simplicity. However, we felt that at the Opening the role of the Architects should be explicitly acknowledged and we were glad when Tom Mill, the member of his firm most intimately involved in working with our Committee of Users in planning and constructing Jeffery Hall, agreed to speak for the Architects.

By happy cooperation among various groups - not least the Ontario Department of University Affairs which supplied the cash - a new physical facility for the use of mathematicians came into being. It is my earnest hope that we and our successors will be worthy of the name which Jeffery Hall bears so that it may continue for many generations to serve as a centre in which mathematics and its applications will gladly be extended, studied and learned.

Alexandre Grothendieck visited Queen's from January through March 1971 to lecture on Group Schemes. He dazzled his auditors with his knowledge and charmed everyone with his modesty. Grothendieck is widely acknowledged as one of the most original and prolific mathematicians of our day. Recently he awakened to a vivid sense of the social responsibility of mathematicians and founded a movement called SURVIVAL of which the object is to arouse all intellectuals to awareness of our responsibility for the contemporary and future environment of man. The editors of QPPAM deem it a privilege to help disseminate Grothendieck's ideas by reproducing his article which was translated from the original French by Gordon Edwards who is currently a Ph.D. candidate in Algebra at Queen's.

April, 1971 A.J. Coleman

The Responsibility of the Scientist Today

by Alexandre Grothendieck
(translated by G. Edwards)

INTRODUCTION:

The great war of 1939-1945 was a blood letting without precedent in human history. It has been estimated that fifty million people lost their lives in Europe alone. Since then, with the advent of nuclear, chemical, and bacteriological weapons to augment the classical armories, our destructive potential has been multiplied by a factor in the thousands or even in the millions. A small fraction of the arms now stockpiled would suffice to annihilate not only the entire human population of the globe, but (according to experts) all organic life on earth. Thus the proliferation of military power and stocks of weapons throughout the world poses an ever-increasing danger not only to our species, but to life in general. This predicament, unparalleled in the long history of biological evolution, must be met with immediate radical action.

Nevertheless, the great majority of scientists do not hesitate to collaborate with the military establishment either directly or indirectly. In doing so they render themselves psychologically incapable of recognizing the magnitude of the peril, and lull themselves and others into a state of pass-

ivity that amounts to a complete renunciation of any responsibility to the human community. This document, based on talks given at the Orsay Faculty of Sciences (June 26, 1970) and the University of Montreal (July 8, 1970), is primarily a plea for a fundamental change in attitude and behaviour on the part of scientists - namely, for a policy of <u>total non-collaboration with the military</u>.

I am thinking especially of younger scientists, who are not yet thoroughly shackled by long-standing habits of thought and action - or at least not as much as their elders. Young people do however have the disadvantage (if you can call it that) of not having seen war and its consequences at first hand. Anyone who has seen a man killed like a dog before his eyes, or who has stood helplessly by while a guard whips an unarmed prisoner to death, is marked for life - he understands what war entails. But for those who have never seen anything like that, citing a million deaths in Vietnam or Biafra evokes only polite astonishment or incredulous indignation. Even the last world war is just a textbook matter to most people under thirty. It is so far away, both in time and in space! It is the stuff of literature!

So it is when one considers the prospect that humanity may disappear in the next few decades - three billion people! three billion years of evolution! - it is just too enormous

to be grasped; it remains a faceless abstraction, utterly devoid of emotional content, and hence impossible to take seriously. We struggle for raises in pay, for freedom of speech and of the press, for job security, against racism, against the Vietnam war or against war in general - but the annihilation of all life on earth transcends our imaginations; it seems unrealizable. One is almost ashamed to speak of it for fear of seeming to seek "easy effects", when in fact it is one of the most "anti-effectual" themes of all.

I have been reproached for not analyzing the "true causes" of the evils against which I propose to act - causes with labels such as "class structures", "profit motives", etc. Such reproaches however have generally proven to be just one of a hundred other reasons <u>for not acting</u>, for continuing with the same old daily grind as before. Must we argue true causes indefinitely? Isn't that just one of the many ways of putting off our present responsibilities until the hypothetical day when society will have changed? If your house is on fire, the first thing to do is drench it with water - the analysis of true causes is for later. And if you want to fight against an apparatus that you consider reprehensible and mortally dangerous, you begin by refusing to accept pay from that same apparatus and by warning those who have not yet recognized the danger. Anything else is just empty chatter.

A more serious reproach, I am well aware, is the limited nature of the action that I am recommending against the military establishment. It is merely a preliminary to more radical action. But it is an essential first step, for until scientists divorce themselves from the military they simply cannot take a strong moral stand. It is accordingly addressed to the individual level, and calls for an individual moral commitment from each one of us. Thus its psychological importance far outweighs its practical importance. To be really effective, at the practical level, action must be coordinated and organized - even if only on a small scale at first. Imagination and perseverence is required to gradually extend awareness of these considerations among colleagues, students, and the general public, so that effective action can be undertaken on a significant scale.

I would like to thank all those who have helped me to arrive at a better understanding of the problems discussed here, both in private conversation and in public discussion. I am particularly indebted to my friend Gerard Daechsel, who through his patient perseverence has made me realize the enormity of the perils that threaten us all.

1. Aspects of the World Today:

The principal positive aspect of the modern world, pertaining to most of the developed nations, is the obvious increase in standard of living and in personal security, particularly in matters of health and employment. Another very positive aspect is the growing interpenetration of cultures - a kind of cultural internationalism, springing from the pervasive use of electronic media and from the spectacular burgeoning of the tourist trade. Tourism creates a seasonal collision between people of diverse nationalities, thereby enabling the average man in the developed countries to eliminate at least some of his chauvinist tendencies (which are usually based on ignorance of others).

Unfortunately, this superficial knowledge of other cultures has not created a genuine feeling of solidarity with the rest of humanity, not even among the educated "élite". Citizens of developed nations have not fundamentally modified their attitudes toward those of the under-developed nations. Consider the indifference of French public opinion during the Indochinese and Algerian wars, the cynical attitudes of American trade unions toward the Vietnam war, and the relative indifference of world opinion with regard to the Biafran tragedy, in which almost all the great powers were involved in one way or another.

Total antipathy toward under-developed nations prevails even in socialist countries, despite litanies of official propaganda denouncing the Vietnam war or the Fascist coup in Greece. The occupation of Czechoslovakia encountered nothing but indifference among the masses in the USSR, but the border incidents with China actually evoked widespread disappointment that the USSR had not "given those orientals the punishment they deserve".

The gap between the haves and the have-nots is growing year by year. The stagnation of the have-nots is evidently aggravated by the expense of maintaining an army, which consumes most of the financial aid they receive from richer countries. When they are not being directly exploited by these great powers, they are regarded as mere pawns on the international chess-board, and manipulated accordingly. This frustrating situation is just one symptom of a growing cynicism in international relations over the last few decades, manifested also in the mounting savagery of the wars conducted or compacently sustained by the great powers, and the ruthless repression of various minorities - national, racial, religious and political. So many images come to mind that one scarcely knows where to begin.

One of the most abject and humiliating features of the twentieth century is the concentration camp. These camps

have been living nightmares for millions of individuals. They began to proliferate in Germany when Hitler took power, being used first for political prisoners (mainly communists), then for prisoners of war and various ethnic groups (especially Slavs), and above all for Jews. They were the setting for the liquidation of millions of people, including six million Jews. What prodigious efforts of organization and ingenuity must have been exerted by thousands of skilled German technicians in order to transport, liquidate, and dispose of the bodies of this ocean of human misery in just a few short years. It is a bitter fact that the country pursuing these policies was one of the most advanced in the world, both technologically and culturally.

Other well-known examples of concentration camps are those used during the Stalin purges to hold vast multitudes of political prisoners while orchestrated convulsions of collective hysteria swept over the USSR. A good deal less known are the French concentration camps, in operation from 1938 to 1945. They were created by the government of the popular front (what irony!) to intern a few hundred thousand republicans and Spanish anarchists who poured into France to avoid the massacres that marked the end of the Spanish civil war. Even before the outbreak of the second world war, thousands had died from mistreatment and intolerable conditions in the

camps at Argelès, Vernet, Gurs, and elsewhere. In the wind of xenophobia blowing through Europe at that time, no one concerned himself with the lot of these prisoners. The Vichy agreements put the camps at the disposal of the German forces, who used them to detain most of the foreigners living in France at the time of the German invasion. Many convoys of Jews were sent from there to the German gas chambers, beginning in 1942.

The concentration camp is not an historical anachronism of the 30's and 40's. Even today it is the daily universe of millions of human beings, whether in the form of soviet "labour camps", "refugee camps" in the Middle East, or political camps in Greece. In the event of political or military convulsions, there is no reason to suppose that it will not be revived on a scale and under forms comparable to the worst we have ever known.

The modern spirit of cynicism can also be seen in the savage wars of the twentieth century. The last world war, fought with weapons infinitely less potent than those at our disposal today, was a blood-bath unparalleled in the history of mankind. We still wear the scars of that war, without having learned the lesson that it taught. This monstrous cataclysm is still portrayed officially, on one side (the Germans and their ex-allies) as the fault of a single man, and on the other side as a titanic struggle between the forces of

good and the forces of evil, ending happily with the triumph of good over evil.

The latter position is unfortunately not much closer to the truth than the former. It suffices to recall some of the episodes that marked the last throes of the war: the fire-bombing of Dresden; the halting of Soviet troops before Warsaw, to give the Germans time to stamp out the popular insurrection; the repression by the Swiss authorities of thousands of refugees fleeing the German death camps; the delivery of non-Soviet communists to the Gestapo by the Soviet authorities; the incarceration and repression of Jewish refugees arriving in Palestine by the British; the senseless annihilation of Hiroshima and Nagasaki by the American atomic bombs. About a hundred million people are still paying the price for the deals made by the victorious powers, decreeing within the Soviet sphere of influence some of the countries least disposed to communism (such as Poland and Roumania), and within the Western sphere of influence some strongly communist countries such as Greece. They will doubtless continue to pay for a long time to come.

Twenty-five years have elapsed since then, but there hasn't been any noteworthy elevation in the principles and practices of international relations. Since 1945 we have had a dismal succession of savage wars: Indochina, Algeria,

Korea, Vietnam, and finally Biafra, conducted with the active complicity of almost all the great powers, socialist as well as capitalist. The USA has almost automatically given its support to any régime, no matter how reactionary or inhumane, as long as it declares itself anti-communist: Formosa, Haiti, Dominican Republic, Battista's Cuba, ... We have seen the invasion and occupation of Czechoslovakia by Warsaw Pact troops, followed by the sinister comedy of "normalization". We have seen the United Nations persistently refusing to recognize mainland China, which in itself comprises one quarter of the entire human population. On another level, we have seen the persistence of racial prejudice in its most virulent form: anti-black in the USA and South Africa (among the most prosperous and advanced countries in whatever concerns the white population), and anti-semitic in most of the communist countries.

To complete this disheartening "moral tableau" of our times, there is the systematic reappearance of torture - a practice which had virtually disappeared from the so-called civilized societies since the end of the eighteenth century, only to reappear in perfected form in Hitler's Germany and Stalin's Russia. It has been the inseparable companion of every war since then (notoriously in the Indochina, Algeria, and Vietnam wars), and the established policy in most police

states (like Greece or Brazil).

2. The Multiplicity of Perils:

Throughout the world, human communities feel themselves threatened by diverse "perils". In the capitalist west (the self-styled "free world"), the spectre of communism is seen as the foremost menace to personal liberty and to the values of western middle-class culture, which they identify with culture generally. To combat this "communist peril", the so-called democratic countries help to establish and maintain police régimes comparable to or worse than those they denounce in the communist world - Spain, Portugal, South Vietnam, Haiti, Dominican Republic, etc. Sometimes the accent shifts to the "asiatic peril" (one of the wartime leitmotifs of hitlerism) or even the "yellow peril", portrayed as an insidious threat to the cultural heritage of the west - which is considered the only heritage worth saving, in spite of the fact that the historical birthplace of western culture was in the orient, and in spite of the universalization and standarization of culture that we see all around us.

In communist countries, the ogre of "capitalistic imperialism" has been conjured up for the past fifty years as the principal threat (both internal and external) to the conquests of the proletariat. Today it seems to be mainly a convenient

pretext for maintaining arbitrary police powers and for justifying operations such as the invasions of Hungary and Czechoslovakia. The time is probably not far away however when the official "principal peril" in the USSR and its satellites will be the "yellow peril" mentioned above. In other parts of the world, other more localized perils anaesthetize the consciences of significant numbers of people and serve as motivation (i.e. pretext) for numerous injustices and cruelties: the "black peril" in South Africa and the USA; the "Zionist peril" in the arab world; the "arab peril" in Israel; and so forth.

Anyone observing this concatenation of complementary perils cannot fail to be struck by their extraordinary resemblance, or rather by their fundamental identity. In each case, the existence or expansion (real or imagined) of a human community which is perceived as distinct from another human community, is denounced by the latter as a "peril". No matter whether the distinction is religious, linguistic, ethnic ("racial"), economic, or political, the phenomenom is basically the same. Stories of such perils by the thousands fill our history books, dating back to the invention of writing some six or seven thousand years ago - countless perils, most of which survive only in the memories of a few specialized historians in some obscure culture or some forgotten epoch.

We may press back further, before the dawn of civilization, even before the first agricultural societies, to the fortuitous meeting of two antagonistic tribes of humans. Such a meeting (according to many anthropologists) would have been perceived as a mortal peril by each tribe, and would have been the signal for a ferocious and merciless battle, ending only with the extermination of one of the tribes.

In spite of the evident differences between this ancestral situation and modern military conflicts (a numerical factor of thousands or millions, and subjugation instead of outright annihilation) it is impossible not to recognize something essentially identical in them. We are still subject to the primitive reaction of aggression which comes down to us from time immemorial, which is in fact a trait peculiar to humans, making us more brutish than beasts of prey (who do not massacre their own kind). It is the very same reaction that is dominant today in most relations between alien human communities, and particularly between nations.

Let us return to the ancestral prototype for a moment, as a model of modern conflicts (simplified to be sure, but essentially faithful on the psychological plane). Is the feeling of peril perceived by each of the antagonistic tribes well-founded, or is it illusory? In view of the outcome, it is difficult to deny that it is well-founded indeed. Never-

theless, the "peril" is not based on objectively motivated antagonism, but rather on an elementary psychological mechanism of automatic fear and hostility. It would be pointless to speculate on the origins of this mechanism, but in the context under consideration it is clearly inimical to the interests of the two tribes, to the individuals comprising those tribes, and to the human species itself, which has nothing to gain through the annihilation of one tribe by the other.

Only much later did the opposite tendency - mutual toleration leading to cooperation between distinct groups of humans - begin to appear, around the time when the first agricultural societies were established. We may call it the "rational" or "ethical" tendency, as opposed to the "atavistic" tendency described above. Originating in a natural desire for the kind of peaceful coexistence necessary to agricultural communities, the ethical tendency ultimately led to the concept of the essential solidarity of all human beings, and even the one-ness of all living things (for example in the teachings of Lao-Tze and Buddha). The gradual development of the ethical tendency as a fundamental prerequisite for the formation of civilized societies must be regarded as one of the most vital conquests of the human spirit - a conquest however, which is evidently far from finished.

From this perspective, history can be viewed as an uncertain struggle between two diametrically opposed tendencies, creating tensions and conflicts down through the ages. One may justifiably wonder whether mankind might not have attained its present level of technical expertise tens of hundreds of thousands of years ago, were it not for certain unhappy genes or traditions which have transmitted this self-destructive atavism, the hereditary sickness of our species, to each successive generation of human beings. This automatic reflex of hostility and fear has been and remains the source of innumerable sorrows, atrocities, and collective cataclysms for mankind. Each new day confirms the fact that it is the strongest impediment to the social and moral progress of the human species.

The most vital task facing mankind today is the liquidation of this ancestral reflex and the full realization of the solidarity which binds all men together, regardless of their superficial differences. It is infinitely more important than the advancement of scientific knowledge and technique, for until this vital task is accomplished, scientific technology will continue to serve the destruction and degradation of mankind, as has been the case in more and more alarming proportions. Only to the extent that this task is accomplished can we be assured that scientific progress will serve to liberate

man rather than to annihilate him, so that scientists may be pioneers of the future rather than the gravediggers of their own species and, in fact, of all life on earth.

It is high time that we human beings awaken to the true magnitude of our common heritage, far surpassing the artistic and scientific achievements of our most prestigious geniuses, far surpassing even the cultural legacy bequeathed to us by the most brilliant civilizations of the past. It is the sum total of all the countless processes of biological evolution that have occurred on the face of the earth, ever since the appearance of the first primitive cell in the warm "organic soup" of the primeval ocean some three or four billion years ago. In the last analysis, the only truly indispensable human heritage that must be preserved at all costs is the human species itself - for whatever the spirit or the hand of man has done in the past can be surpassed and will be surpassed by other men some day, even if they have to begin again from scratch. But the preservation of humanity is inseparably linked to the preservation of the many delicate mechanisms which maintain the intricate biological equilibrium needed to support life on earth. Ecologists have told us that the massive use of nuclear, chemical, or bacteriological weapons anywhere in the world may initiate an irreversible process of biological degradation leading to the annihilation of all

life on earth within a few short decades. Even if a large scale armed conflict should leave millions of human survivors, there is no guarantee that they will find themselves in an environment sufficiently intact to support them and their descendents.

Compared with the imminent destruction of this extraordinary heritage, how insignificant the conflicts of contemporary societies seem, fought in the name of the most diverse ideological principles: communism, capitalism, the free world, white solidarity, islamic socialism, the yellow peril, aryan supremacy, jewishness, class consciousness, the "American way of life",... . I do not mean to suggest that these principles are necessarily valueless or necessarily equivalent in value, but rather that (as in mathematics) finite quantities, though strongly unequal among themselves, are all equally negligeable in comparison with an infinite quantity. These individual conflicts, sustaining each human community in its fear of "the other", manages to blind them all to the enormous peril into which the entire human species is being precipitated by such conflicts. Our ultimate patrimony, bequeathed to us by over three billion years of biological evolution, is of little or no concern to them, obsessed as they are with what they conceive as their own self-interest.

To preserve our priceless heritage from the stupid destruction now menacing it, men of conscience in all countries must immediately take up the fight. They must publicly proclaim the use of arms for settling national and international disputes to be illegal. They must publicly proclaim the military apparatus in every country of the world (beginning with their own) to be illegal. They must refuse to collaborate with the military in any way, and exhort others to do the same, so that one day, before it is too late, the military establishment will be outlawed in fact and the military machine will be dismantled as a vestigial left-over from a barbarian era which has finally passed.

3. The Responsibility of the Scientist:

The entire human population of the globe could be wiped out by just a fraction of the weapons that have been accumulated around the world. The indifference of educated men of all nationalities in the face of this menace is simply astonishing. No segment of society is better equipped to know the facts and to understand the implications of this perilous situation than the intelligentsia, and especially the scientific intelligentsia. Yet they refuse to admit the gravity of the situation even to themselves. Their rationalizations are cast in a strangely uniform mold, most often expressed by

simple professions of faith: "I just don't believe in these apocalyptic visions of the destruction of mankind;" "Things are never as bad as people say - everything will work out in the end;" "Even in medieval times doomsday was periodically prophesied; and look - we're still here!" How familiar these utterances sound! How many times were they heard before the catastrophe of 1939, presaged as it was by so many signs and portents that so few people were able, or willing, to read clearly: "Everything will work out in the end ..." To be sure, everything did work out in one way or another - for the survivors. In a conflict of comparable magnitude today, there might not be any survivors at all. It is no longer "merely" a question of one million lives, or ten million lives, or a thousand million lives; it is now a question of the survival of humanity.

Human beings have an astounding propensity for refusing to face up to gruesome realities. In spite of the most extreme antisemitic propaganda, most of the Jews who remained in Germany under Hitler's régime clung to their comforting illusions right up to the doors of the gas chambers: "So schlimm kann es ja nicht sein ..." ("It can't be as bad as all that ...") - which of course didn't prevent things from being precisely what they were, far surpassing the imaginations even of those who escaped by the skin of their teeth. This same power

of self-delusion makes people hope, every time a new weapon more horrible and more deadly than its predecessors is introduced, that it will mean the end of war because "no one will dare to use it". This was said about the use of poison gas in the first world war (which was itself styled as "the war to end all wars"); but gas has been abandoned only to make way for far more effective chemical weapons, some of which are currently being used in Vietnam. As for atomic weapons, their very existence was unknown to most people until they were used to flatten Hiroshima and Nagasaki, killing hundreds of thousands of people outright and reducing thousands more to the status of "untouchables": survivors contaminated with radioactivity and children born with hideous malformations. Since then there has been no lack of generals and politicians and even eminent scientists (particularly in the USA) insistently urging the use of nuclear weapons, either massively in a "pre-emptive strike", or in "limited conflicts". Nevertheless many intellectuals (scientists included) continue to justify their own lack of concern with the same blind arguments: "No one would dare be the first to use such weapons ..." .

The scientist, as the principal architect of technological progress, must assume a major part of the responsibility for the unprecedented dangers that modern technology has posed for mankind. Better informed than the majority of the human

population, the scientist has no excuse for closing his eyes to the imminence and the dimensions of the perils he has helped to create. Because most countries (whether communist or capitalist) are anxious to preserve their precious "gray matter", the scientist is generally treated like a spoiled child in today's world, enjoying privileges which are denied to vast numbers of people: good working conditions, comfortable surroundings, financial security, more extended means of information, repeated contacts with colleagues from other countries, more leisure time, greater freedom to learn and reflect ...* . The scientist enjoys an undeniable prestige among the general public (reflecting the prestige attached to technological prowess) and an enviable material security. No one could be less justified in claiming "helplessness" or "personal insecurity" as an excuse for doing nothing to combat the dangers already cited - if only to the extent of refusing to collaborate with the military and warning the public of the real gravity of the situation.

---

* Some countries use the "rod" as well as the "carrot" to keep their scientists in line (e.g. prohibition from emigrating), but this is rarely used without its gratifying complement. Only very rarely is a régime stupid enough to chase away or destroy its own scientific élite, as in the time of the Stalin purges or in present-day Greece and Brazil. Usually it is the other way around, as exemplified by the feverish competition between America and Russia at the end of the second world war to get as many German scientists as possible.

It is painfully clear that most scientists, whatever their nationality, simply do not wish to recognize the seriousness of these threats to our survival nor to admit any responsibility toward human society. In fact, through their passivity and complaisance with regard to the military, they often become (wittingly or unwittingly) accomplices. Nuclear, chemical, and bacteriological weapons are not only constructed with scientific know-how, but even by scientists, including some of the most eminent ones. It is true that these scientists are only a minority, particularly in peacetime, and that they are more or less disavowed (or rather disapproved of) by a large part of the scientific community. But it is a feeble enough kind of disapproval, to be sure. The fact that a scientist actively collaborates with the military in this way does not prevent him from holding important positions in any number of scientific societies, nor from having cordial relations with most of those who, for their own part, cannot condone such collaboration. This sort of promiscuity generates the impression that the moral question of collaboration with the army is simply a matter of taste or preference -

like whether one is a vegetarian or not. It is considered bad form to attach an excessive importance to these "subtle" distinctions.

While only a small number of scientists work directly for the military, virtually all scientists collaborate "passively" by accepting army contracts, or by organizing seminars or colloquia financed partially or totally by military funds, without even giving it a second thought. In doing so, scientists have willingly cooperated in establishing the powerful grip that the military now has on "pure" scientific research, to some extent throughout the western world, but particularly in the USA. The domination of pure scientific research by military money has finally alarmed even the civil authorities, who have judged it necessary to limit the practice - much to the disappointment of the scientists, who would prefer to see the "military manna" continue unabated. Practically all the scientists of the western world have accepted, or would accept if the opportunity presented itself, military subventions - whether for private research, or for the organization of specific scientific activities, or in the form of salary from an institution regularly furnished with military funds. The massive collaboration of the scientific community with the army (often at the same time that the most savage wars are being prosecuted by that same army) is the greatest scandal among scientists today. It is also the most obvious sign of their abdication of responsibility toward human society.

What accounts for this lack of moral and intellectual lucidity on the part of most scientists? What are the reasons for their extraordinary passivity? Let us examine some of the contributing factors.

(a) The refusal to accept reality, which in moments of individual or collective peril often forestalls the recognition of danger and prevents the adoption of adequate defensive measures, springs from a well-known psychological mechanism. It is doubtless the same mechanism that prevents us from truly imagining our own disappearance - from convincing ourselves on any but the intellectual or speculative level of our mortality. Incurable invalids condemned to inevitable death often exhibit the same phenomenon; occasionally the patient himself gives a vivid description of the process. This mechanism works most effectively in dangerous situations which develop gradually and progressively out of a familiar context hallowed by custom or usage - one that conjures up no menacing images in the mind. Such was the case during the rise of Nazism in Germany. It manifests itself in a beatific optimism with respect to everything, and passivity in the face of events. Do not confuse such optimism with hope, the principle of action, for it is the very negation of hope. This refusal to face reality is the same for all men, regardless of their intellectual level. Today, when we are confronted with the

threatened extinction of all life on earth, the same irrational mechanism blinds most of us from the facts (including the intellectual and scientific élite) and paralyzes our defensive reactions. One can only hope that it may be overcome in certain individuals by sustained effort, together with full awareness that such inhibitory mechanisms exist.

(b) As already remarked, the scientist enjoys a privileged place in society, from the standpoint of material security and social prestige as well as in the quality of his working conditions. Leading a comfortable existence and being generally content with his lot, he is not predisposed to worry about great social problems or the future of the species. Characteristically, colleagues in the satellite countries of the USSR - whose position in society is as precarious as the situation of their country relative to its powerful protector - are most inclined to admit the magnitude of the dangers courting the species. But they are too weighed down by their own daily problems to take an active interest in these matters - indeed such an interest (if expressed in acts) would expose them to certain risks. Thus on the level of action, societies of affluence and societies of chronic insecurity have one and the same effect on the scientist: passivity. In addition, the scientist is generally absorbed in his own work to such

an extent that he is virtually isolated from the world's problems. It would undoubtedly require a determined effort on his part to suspend his professional interests for the sake of involvement and commitment in the directions indicated. As for me, I found it necessary to overcome great interior resistance before deciding to systematically discuss the questions raised in the present exposition at every possible opportunity, both publicly and privately.

Points (a) and (b) are concerned with obstacles that impede the scientist from recognizing the nature of the problem and his own responsibilities. But even when he begins to realize these things, other obstacles hinder him from translating his realization into action:

(c) Purely speculative or intellectual activity does not lead toward action, because very often, to the intellectual, thought alone is considered as an action sufficient in itself. This view, though correct in large measure in the realm of research, is manifestly aberrant when applied to one's behaviour and one's responsibilities toward others. In particular it overlooks the multiple inter-relations between thought and action. Thought and action either mutually fortify or mutually corrupt one another. Many scientists affirm

in all good faith that their acceptance of money from the military does not imply any moral support of the military, nor does it entail any limitation in their own moral and intellectual independence from the military. Such a divorce between thought and action is typical of the attitude of the intellectual, and in the final analysis, such a divorce ultimately corrupts both thought and action. Repeated one thousand, ten thousand, a hundred thousand times from one end of the scientific community to the other, it amounts to a collective abandonment to the most banal kind of opportunism. A scientist may make a comfortable supplement of two thousand dollars during the summer months by accepting a "summer contract" with the American army, with no strings attached beyond the acknowledgement of the army's financial assistance. This sum may represent a second car for him, or for his wife, or for his son who is away at college. It also represents about fifteen times the total annual income of one of the thousands of Vietnamese slaughtered during the same period by the same army. But of course, as his colleagues will hasten to assure him, there is absolutely not the slightest connection between these two facts.

(d) Another cause of inaction is the feeling of impotency and insignificance in relation to the mammoth forces that

govern the world - a feeling not peculiar to scientists or intellectuals. There is also a universal tendency (in the east as in the west) to consider it ridiculous or fruitless to try to act in accordance with "abstract moral principles" - the only principle recognized as valid is the principle of effectiveness. Ironically, this cult of effectiveness, used as a justification for inaction and dominating the minds of hundreds of thousands of scientists throughout the world, leads to a collective behaviour of absolute ineffectiveness (except on the level of immediate personal or professional advantages). In spite of defeatist attitudes however, it is possible, through energetic and perseverent action, to extend little by little the public awareness of vital concerns to such an extent that effective, coordinated activity can be undertaken on a truly significant scale. As a recent example of such a process, consider the movement against the Vietnam war and the army in general in the USA, deriving most of its impetus from the student milieu. After initial setbacks, this movement achieved a momentum that stunned all observers, including the Nixon administration. In this connection, the relatively reserved stance of most professors suggests that we must depend on an alliance between the youngest scientists and the students for any kind of unequivocal action, for they

are more susceptible to new opinions than their elders are. It goes to prove once more the inseparable unity of thought and action; the evolution of one necessarily influences that of the other. An ambiguous stance encourages thought to isolate itself from the world of action, and often prevents it from admitting or even seeing the most obvious facts. Conversely, a clear and decisive act can produce a salutory shock to the mind, diverting it into new channels and stimulating further action as a consequence. Contrary to the illusions of numerous intellectuals, there can be no strong and healthy thought among those whose acts are feeble and timorous.

4. Standard Justifications and their Refutations:

With a few notable exceptions, the reactions of scientists on the question of collaboration with the military have been quite uniform (as expressed in numerous private and public discussions). Let us review the arguments generally martialled to justify this collaboration, arranged in decreasing order of frequency. (It is interesting to note that the order of frequency is usually reversed in eastern Europen countries - people there tend to invoke points 3 and 4 more often, which touch on more genuine difficulties than points 1 and 2.)

1. Machiavel, or the Noble Ends. "By accepting money from the military for purely scientific ends, funds are diverted to useful ends that would otherwise be employed for harmful purposes."

This argument is the most frequent and the least serious of all. It does not stand up under analysis, whatever side one examines it from.

a) Scientific research is indispensable in the competition between advanced countries, above all for technological reasons, but also for reasons of prestige. Most countries are anxious to preserve their precious capital in gray matter and to maintain it in a functioning state; in such countries scientific research will always be financed by the state. However, by accepting their funds through military channels, scientists help to augment the importance of the military in the life of the nation - to the extent that the army finances research, the part of the national revenue devoted to the military will be increased accordingly. Thus even if scientists accept massive amounts from the military, it will not diminish even by one the number of weapons the army has at its disposal, nor the number of victims massacred by this same army when it is engaged in a war, as is actually the case in the U.S.A. To pretend the contrary is nothing but hypocrisy.

b) In view of the real issues, the consideration of these

"amounts distracted to useful ends" (representing an infinitesimal fraction of the total budget) is entirely ludicrous. The proliferation of military might poses a grave threat to the survival of the species. To fight against this proliferation has become a question of life or death for humanity. Nobody is better equipped or has more authority than the scientists to recognize the danger and to proclaim it. Instead, for the sake of an immediate and ridiculous profit, they give their own moral weight to the military establishment, whether they wish it or not. The support of pure scientific research lends a degree of respectability and even an aura of innocence to the army. How can one hope that the man-in-the-street or the politician will wake up to these ignoble escapades that might prove fatal to all of us, when he sees the entire scientific community collaborating with the very apparatus that poses these threats?

c) That scientific research is necessarily "useful" (and should therefore be favoured with crumbs from the military table) is extremely contestable and ought to be thoroughly reconsidered. Certainly research is an agreeable activity for those who engage in it, sometimes even exalting. That doesn't establish its utility, or that its positive consequences, outweight the negative ones. Too often it has served the

vilification of man, from the beginning of the industrial revolution until today, when it may well prove to be the tool of its own final destruction. In fact the men whose activities have been the most dangerous and deadly for humanity over the past thirty years are not heads of state, nor generals, but scientists - for without them, the military would have remained relatively inoffensive. From this global perspective, I am convinced that no scientific discovery, however useful it may appear to be, can compensate for or justify the collaboration of a scientist with the military.

2. The Transitivity Argument. "Whether one is paid by civil or military funds makes no difference. The money ultimately comes from the same coffers, those of the State, which is responsible for military policy and the waging of wars. Thus the distinction between civil and military finances is a subtlety, and refusing the second in favour of the first is a kind of pharisaism."

This kind of argument, very widely held, attempts to establish that one should accept such-and-such a thing because it is "similar" to some other thing that one has already accepted. It is a kind of transitivity argument; everything turns out to be similar to everything else. In the limit, there is nothing that one can refuse.

a) In view of the actual state of the moral and mental development of humanity, we do not intend to challenge the

necessity of some kind of governmental apparatus, financed by the citizenry. The national revenue is distributed by this apparatus to diverse segments of the government, one of which is the army. To accept money from the military simply magnifies the importance of that particular segment, and gives it added prestige. It is true, to the extent that citizens elect or tolerate their government and associate themselves with its actions (for example, by military service in time of war), they are equally coresponsible for the existence, the role, and the use of "their" army. But this does not and should not prevent those who regard the military as a specific and perhaps fatal disease in the social body from fighting it with every means at their disposal. When a mortally dangerous influence is spreading and invading the healthy parts of an organism, it is cynical indeed to refuse to fight it or to accuse those who combat it of pharisaism.

b) Most of the arguments advanced against the kind of action that has been proposed are essentially excuses for doing nothing or for following the line of least resistance; the transitivity argument is no exception. Which of us hasn't used it, and how often too, as a justification for any number of compromises! But let's not use it in this way any more. Let us refuse to admit the transitivity argument unless it leads to a <u>more</u> radical action or to a <u>more</u> uncomprimising attitude.

If you are convinced that civil funds are subject to the same objections as military funds, then take the consequence and don't accept either one. And if you are not prepared to assume the practical consequences of such a decision, then recognize that fact in all simplicity and be content with a partial action, by dissociating yourself from the most obvious malignancy in the social body. Do not rationalize your own personal limitations in such a way as to discourage and to discredit yourself and others from undertaking an action which is undoubtedly incomplete, but nevertheless necessary. We have to begin somewhere and we mustn't listen to arguments that try to tell us not to begin at all!

3. Impotence, or Futility. "Whatever you do will make absolutely no difference to the general public or to the sequence of events to come. The prestige of scientists is already on the decline anyway. Therefore, you might as well look after your own affairs and make what profit you can from the present situation."

We will answer this argument on the same plane on which it places itself: the plane of effectiveness. It is true that "things as they are" possess great inertia. Only rarely does an individual have the possibility of influencing the development of the world to any appreciable extent. Nevertheless, several transformations of considerable magnitude have been brought about in the last fifty years as a result of vigourous minority action, enlisting the support of enough people

to bring about these transformationa. For example: the trade union movement, which transformed the conditions of the proletariat; Ghandi's Satyagraha movement, leading to the independence of India; the rise of the national-socialist tide in Germany, leading to the cataclysm we all know about; the revolution of 1917....

a) In our case, the first step must be to achieve an awakening of conscience and a corresponding action in a significant portion of the scientific community. More extended means of information, repeated contacts with colleagues in other countries, more leisure time and greater freedom to learn and to reflect - these are among the factors that tend to liberate scientists from a certain number of national, religious, or racial prejudices that prevail in their respective countries, and impose upon the international scientific community a kind of homogeneity facilitating cooperative effort. At the same time as this minority attempts to pursue a cooperative program, and to inform its members of the concrete tasks necessitated by the fight for survival, it will be necessary to involve as large a public as possible in this effort, to ensure that the movement is not condemned to function in isolation. The goal is not to achieve "moral purity" for a part of the scientific community, or even the whole of the scientific community; the goal is to alert the human population to the problems of

survival, and particularly to the necessity of outlawing the military. This goal must always be present in the minds of those scientists who commit themselves to act - otherwise they will just be "guardians of the temple": morally irreproachable, but with no practical means of achieving their aims. And this collaboration between scientists and non-scientists should in no way be regarded as a one-way teacher-pupil relationship. It will in fact be a potent means of collective self-education. In particular it may provide an indispensable remedy to the tendency that we have already pointed out for scientists to consider thought as an adequate substitute for action.

b) It is often objected that the influence of the scientific community on the general public is practically zero, and that the prestige of the scientist in the eyes of the public is already on the decline. It can be said in answer that these two phenomena are mutually reinforcing, and that both result from the collective abdication of responsibility on the part of scientists. If the public isn't listening to the scientific community, it is simply because the scientific community isn't saying anything; at least, nothing that concerns them. And if the scientific community says nothing, it is because it has nothing of value to say, concerned as it is with its own place in the sun. The public realizes more or less clearly

that scientists form a technocratic class like any other, though specialized and professional to a more marked degree, and that it is (like other technocratic classes) a docile instrument in the hands of those who run the world. From the moment when scientists, who up to now have been a politically amorphous mass, begin to show a collective conscience concerning their responsibilities on the planetary scale, and commit themselves to clear and unequivocal action in an attempt to fulfill those responsibilities, they will begin to overcome the discredit they have been bringing upon themselves, and they will recover the moral weight which they now lack to make themselves heard.

c) It is certainly true that ideas progress slowly, while the world situation evolves rapidly. Any excessive optimism that the necessary mutations in human behaviour will take place through persuasion alone, propagating in concentric circles about a hub of newly-awakened scientists, in time to avert any large military conflict, is unquestionably naive. To me it seems very probable that within the next few decades, humanity will suffer catastrophes that will decimate the human population. The only hope is that these catastrophes may be sufficiently limited so as not to lead irreversibly to the destruction of the biosphere within a few short generations.

But that alone will not suffice, for in order that humanity learn its lesson it must be psychologically prepared. It is therefore necessary to devote maximum effort to this task of preparation, beginning now, without being daunted by the discouraging thought that it will probably not be able to prevent terrible ordeals for humanity, worse than any it has suffered up to the present. It is perhaps not entirely impossible that, if this work of psychological preparation is energetically pursued on a massive scale, a few spectacular accidents involving the storage or transport of armaments, taking perhaps a few hundred thousand victims, might cause in the population a shock great enough to bring about the necessary process of disarmament.

4. The Equilibrium of Terror. "If a strong enough movement developed in the western countries to bring about disarmament in most of them, including the U.S.A., then Russia might take the opportunity to destroy the U.S.A., or at least to subjugate the entire western world by installing dictatorial régimes and making the western countries soviet colonies. It is important to maintain a strong military potential in order to keep the balance of power.

This argument is the polar opposite of the preceding one (even though the two arguments are often advanced by the same person!). It seems unlikely that the actions of a movement such as we have described will cause the U.S.A. to bring about an immediate total unilateral disarmament. It is true however

that a scientist in a communist country would be unable to make propaganda for the disarmament of his own country without assuming very serious personal risk. However he could conduct a campaign with documented information concerning the danger to the species posed by any new large-scale war, and the necessity in general terms of eliminating military means as a way of resolving international conflicts, without putting himself in conflict with the authorities. But it would evidently be unreasonable to expect a movement of any size to develop among our colleagues in the communist countries, a great deal more exposed to political pressures than most of us in the western world, without first generating an analogous movement, vast and dynamic, among the scientists of the capitalist countries.

a) This argument has been used constantly in all disarmament negotiations from the end of the first world war to the present: "We want to disarm, provided the others begin by doing the same." In order for disarmament to proceed, it is necessary for one country to begin, even if only by a limited and conditional step - even if only by halting the manufacture of new arms (there are already more than enough to destroy all life on earth) and waiting for the announcement of analogous measures from the corresponding power. Such a step would not

represent a serious military risk, even if extended over several years without reciprocity; and given the ever-increasing burden of military expenditure on the other side, there would be every chance that it would be followed (after a limited time) by a similar step in response. This could in turn be the signal for a new measure of disarmament on the part of the country having taken the first initiative. Never has a large power volunteered to take such a decisive initiative. It is also clear that, caught in the mesh of circumstances and traditions, subjected to great pressure by the military and certain sectors of the economy, no government would resolve on such a measure (even on a limited scale) without being strongly urged by an important and active fraction of public opinion. The only thing to be feared in reality is that the action envisioned will not be radical enough or powerful enough to initiate such a process; one needn't fear that such action will be so strong as to bring about total unilateral disarmament of the U.S.A., leading to a grip by the U.S.S.R. on the rest of the world! Let us add that Soviet opinion couldn't help being influenced by a marked change in world opinion, and more particularly of American public opinion, any more than the U.S.S.R. has been able to restrain the influence of jazz music or diverse other fads imported from the U.S.A. (in spite of official anathemas). And an important

movement among western scientists would quite rapidly become known to soviet scientists, and through them to most of the intelligentsia and bureaucrats of the U.S.S.R., thereby contributing to the kind of awareness that is the most important thing right now.

b) Unilateral and total disarmament would undoubtedly be possible even today in most countries having only a second-rate military potential; whether from the point of view of the "balance of power" or even external security, it hardly matters whether such a country maintains an army or not. The maintenance of an army and a more or less modern arsenal is a tremendously expensive proposition, and it seems to continue largely due to questions of habit and prestige. Here is a case where psychological considerations seem to clearly usurp control over motivations based on the short-term interests of the national community or its ruling classes. Disarmament of such a country may be the first step in a process which could end by winning over, slowly but surely, an increasing number of countries to a more or less total disarmament, thus demonstrating the feasibility and advantages of such a policy. Such a beginning could play a powerful role in shaping opinion throughout the world, even in the superpowers.

c) Experience has shown that the "equilibrium of terror" is no guarantee of peace. In fact the fear of the military

potential of your opponent and the thought that he might be the first to use his weapons is just a more powerful incentive to use your own weapons "in a preventative way" when the adversary seems less well-armed and less agressive then yourself. Fear is always bad counsel, and may inspire the most savage reactions in the individual as well as in groups.

d) There are alternatives to the use of weapons which can be used on a national scale to prevent foreign domination - the methods of non-violent non-cooperation. Gandhi used them to bring about the emancipation of India from the English colonial yoke, incurring vastly fewer deaths (of the order of a few hundred thousand, killed in foolish fusillades by the English troops) than any war of national liberation would have caused, and conferring on India a moral prestige which hasn't been completely forgotten in the twenty-five or so years since independence. A more recent example is provided by the Czechs, who from the moment their country was invaded by Warsaw pact troops until the leaders of the country capitulated before physical and moral pressures, used the same kind of tactics. Perhaps the Czech leaders would not have capitulated if they had suspected the extraordinary power of these methods, of if they had had a man of the stature of Gandhi at their head. These methods are tailored to the problem of combatting the imposition (either by a foreign army or by internal forces of oppression) of a form of society that

is rejected by a large majority of the population. They require a careful psychological preparation and a certain technique (implying the necessity of an apprenticeship that could be a substitute for military service) infinitely less costly and less dangerous than maintaining an army or accumulating stocks of rapidly outmoded weapons. More importantly, the application of these methods elevate and fortify the mentality of those applying them, instead of degrading them as is always the case in wars, even those waged for the most just causes. Yet the number of ultimate victims in a conflict where one of the protagonists uses such methods is drastically fewer (although not negligeable) than in an ordinary military conflict. However the weight of acquired habits and prejudices is so great that one could hardly expect to see such an attitude prevail in the space of a few decades, unless a psychological shock of considerable magnitude (as previousl envisioned) has first profoundly altered the spirit of the general public.

e) Consider even the utterly improbable alternative: total annihilation of one of the superpowers by the other (the latter remaining unscathed). In view of the ultimate aim - the survival of the human species and the survival of life on earth -

even this would be preferable to an all-out nuclear war, which would very likely set in motion an irreversible process leading to the extinction of all life on earth. The same can be said for this other alternative, a little less improbably and certainly less atrocious: the subjugation of the west by the U.S.S.R., imposing dictatorships throughout the greater part of the world. For no dictatorship can resist the ravages of time, and even if the greater part of mankind were plunged into misery, anguish, and abject submission - as long as they remain genetically sound, their chromosomes untainted by nuclear bacteriological or chemical weapons, there remains the certainty that one day their descendents will retrieve all the joys and accomplishments that man has known in his long journey through countless millenia.