

SOME MORAL PROBLEMS POSED BY MODERN SCIENCE

by Warren Weaver

This talk is necessarily very personal. Although *science* is largely a public activity there are strong personal differences of opinion concerning it; and certainly *morals* and *religion* are very personal matters. What I have to say, moreover, will not be intelligible unless I start by stating some aspects of my own views concerning first science and then morals and religion. I state these private views not because I think my own position is important nor even particularly interesting. But this is the position from which I must talk.

I have just used the two words *morals* and *religion*. I must make it clear that I used both words precisely because I do not consider that they are synonymous. Historically, organized religion has been the chief home of and defender of morals. And yet quite clearly a person can be moral without being religious, at least in any orthodox or institutional sense of the latter word. Indeed at the present time there are without doubt thousands of essentially *moral* persons who do not concede any interest whatsoever in formal religion. I number many such among my friends.

But since religion has a recognized obligation with respect to morality, because I am myself so old fashioned as to be deeply committed to organized religion, and because I think that religious leaders have an obligation to be concerned with morality, whether within or without the pale, I will be speaking a good deal about religion in the rather formal and institutional sense, as well as about morals.

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MY VIEW OF SCIENCE

First, what do I mean by the word *science*? I mean an organized and tested set of techniques and procedures for analyzing nature—primarily for discovering the regularities and uniformities, chiefly the logical and quantitative uniformities, which underlie the apparent confusion of our vastly complicated universe of living and non-living matter. Soon after science succeeds in unraveling some chunk of complexity—why are some garden peas pink, some white, some red . . . why does each falling leaf have its own particular pattern of fall . . . soon after knowledge is obtained about some phenomenon, soon after we have discovered the natural laws in question and seen how they apply—then we often find that we can begin to exercise some sort of *control* over the phenomenon in question. We learn how to breed flowers of *desired* colors, the aerodynamics of the falling leaf leads eventually to the airplane that is stable in its flight.

For the scientific understanding of *how* a thing works usually consists precisely of understanding the effect of the various factors that influence how it works. And then soon you learn how to *adjust* those factors so as to achieve *control*: and whereas the beauty and wonder of science comes from *understanding*, the power of science comes from *control*.

Science is without question the most successful enterprise that man has ever engaged in. Its triumphs—its petty triumphs in making possible the gadgetry of modern life, its massive triumphs in achieving communication and transport and in the exploration of space, its wonderful triumphs in providing shelter, comfort, food, and in conquering one disease after another, its lovely triumphs in revealing the order and beauty in our universe—these are in fact triumphs without counterparts.

But science also has severe limitations. It can deal only with certain types of problems. Only parts of our lives can be aided by science—and parts which really are of relatively minor consequence. In the great crises of our lives, even in the troubled moments which occur nearly every day, it is not science to which we usually turn.

For science, being concerned with *uniformities* in nature, is in general concerned only with the universally repetitive aspects of phenomena, the things which happen time after time after time, and to everyone—whereas our lives are in fact largely affected by things which happen only once. The *unique* event—such as the occurrence of a Martin Luther, or of a Shakespeare, or of a Hitler, or of *The Ode*

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on a Grecian Urn, or the sudden cry of a child in the night—these are what really affect us.

Science is just terribly good at dealing with the logical, the quantitatively measurable, the analytical. But science cannot decide between a lovely poem and a stupid one. It cannot explain a symphony or a sonnet. It cannot analyze compassion, or patience, or tolerance, or goodness. It does not understand intuition, or shrewdness, or wisdom. Even in the realms where it is most successful, it only answers *how*, and never answers *why*. It deals superbly with the *mechanics* of life, but not with life itself.

The arrogance which characterized the exuberant youth of science, when it claimed to be all-powerful, has totally given way to a mature view of what science is good at, and what it is powerless before. Lest you think I am expressing a private and amateurish view, let me quote two authorities.

In speaking about a series of reports concerning the physics of the ultimate particles, Dr. Robert Oppenheimer has said, "These papers, for all their variety, clearly reveal one common belief. All the authors recognize that *we do not understand the nature of matter, the laws that govern it, the language in which it should be described.*"

Another outstanding expert, Dr. Eugene P. Wigner, in the speech with which he accepted his Nobel Prize in 1963, said:

Physics does not endeavor to explain nature. In fact, the great success of physics is due to a restriction of its objectives: it endeavors to explain the *regularities in the behavior of objects*. This renunciation of the broader aim, and the specification of the domain for which an explanation can be sought, now appears to us an obvious necessity. In fact, the *specification of the explainable* may have been the greatest discovery of physics so far.

In speaking of science one can talk with some degree of objectivity, for it is a very public enterprise. There is a large (but *not universal*) amount of agreement about science.

MY VIEW OF RELIGION

Religion, on the other hand, is a much more subjective matter. When I state that I am myself deeply interested in, and committed to, religion, you are not likely to have much idea as to what that remark means unless I explain it. Therefore I propose, briefly, to describe those aspects of my religious views which are directly involved in any discussion of the interrelation of science and morals.

The mythological and supernatural aspects of historical religion are not important to me, and are not even particularly attractive. The

teachings of the great religious leaders, and particularly those of Jesus, are.

In the good company of the Bishop of Woolwich, I do not believe in a God who is an elderly gentleman with whiskers, living in the top story of the three-decker universe of Hell, Earth, and Heaven. Copernicus removed the basis for that myth. Nor do I believe in a God which is not "up there," but "out there." Modern astronomy and our beginnings in the conquest of space have made that concept untenable. Chairman Khrushchev's comments on the failure of the astronauts to see any angels were intended, I am sure, to be merely cynical; but they were not pointless.

My religious convictions do not depend upon the authenticity of the miracles, nor the actuality of the immaculate conception. I am not even interested in debates about the divinity of Christ, and primarily because when I am really honest with myself, I admit that I simply do not know what those words mean.

But I am most deeply convinced that there is moral purpose in our universe and that there should be moral purpose in our individual lives. I think that *love*, in its various manifestations of unselfishness, tolerance, and concern for others, furnishes the central core of that moral purpose.

And I think that the *design* of the universe is a major evidence of the method through which the moral purpose of the universe finds its expression.

I am aware of the fact that philosophers are not impressed by the "argument from design"; and that logicians discard it completely. The latter attitude I consider irrelevant, and the former I consider unfortunate.

Whatever the philosophers and logicians say, I am more impressed, in this connection, with what the poets say: Shakespeare, for example (*Troilus and Cressida*):

The heavens themselves, the planets, and this center
Observe degree, priority, and place.
Insisture, course, proportion, season, form,
Office, and custom, in all line of order.

Or John Dryden:

No atoms casually together hurled
Could ere produce so beautiful a world.

Or, to include an artist and a scientist, may I remind you that one of the sections of Leonardo da Vinci's notebooks bore the title "The Anatomy of the Neck, in Praise of the Creator."

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To return to my personal views on religion, I know that conscience operates, and for the same reason that I know that Newton's laws operate—because I have direct personal evidence and because of the cumulative evidence of mankind. I even have direct empirical evidence to justify my practice of going to church—when I go I feel better and happier than when I do not.

I consider the Bible to be a human record of divine thought; and therefore I have no worry about historical reinterpretations nor about textual inconsistencies. Neither am I plagued by any feeling that literal word-by-word interpretation is sensible or necessary. Otherwise, as one originally trained as a mathematician, I would be intellectually and ethically embarrassed by the fact that the Bible states—I believe three times—the ratio of the circumference of a circle to its diameter and is incorrect each time.

It should therefore be clear to you by this time—if you are not too shocked at my unorthodoxy—that I am not going to be talking to you about some of the old classical topics of supposed disagreement that have, in the past, caused so many caustic comments to be hurled back and forth from the pulpit and the laboratory. I am not going to waste any time discussing whether the world was made in seven days or whether man is descended from monkeys. As we learn more about the language of the great apes, I suspect we will discover that, particularly over the last half-century, the monkeys have been bitterly protesting any suggestion that they are responsible for us. Our political conventions must convince the most tolerant and kindly chimpanzees that any interrelationship with man must be vigorously denied in every part of every jungle.

No, those older issues which form the chapter or section headings of Andrew D. White's classic volume *The Warfare of Science and Theology*—From Creation to Evolution; The Form of the Earth; The Old Sacred Theory of the Universe; From "Signs and Wonders" to Law in the Heavens; The "Fall of Man" and Anthropology; The "Fall of Man" and History; From "The Prince of the Power of the Air" to Meteorology; From Miracles to Medicine, etc.—these topics are not my concern here. I realize that there are many persons—good and devoted persons—who do feel it necessary to cross every *t* and dot every *i* in the Bible. I see no way in which such persons can live, comfortably and consistently, in the modern scientific age. I have no wish to add to their discomfort by insisting on my viewpoint: but neither have I any comfort to offer them. I believe in a science which develops and improves, and I believe in a religion which is also not static, and which also de-

velops and changes as man gradually obtains new knowledge of himself and of the universe of which he is a natural part.

**SOME PROBLEMS FOR ETHICS AND THEOLOGY POSED
BY SCIENCE RECENTLY**

With so long an introduction I would be hard put to it to find time to treat my real topic were a balanced treatment of it my interest. But that is not my intent. I wish, rather, only to call your attention to a series of questions. They are questions to which I certainly cannot furnish pat answers. But I think they are real and important questions. I think, moreover, that persons who believe in organized religion have a duty to consider these questions. I think that ministers, and teachers in theological seminaries, and religious philosophers have a pressing duty to consider these questions.

That traditional religious doctrine is inadequately adjusted to the questions I will put to you has, I think, a completely understandable origin. The great world religions all developed at a time when life was simple, when social organization centered almost exclusively around the family and the tribe, and long before man had any real scientific knowledge and the power that accompanies such knowledge.

It is therefore completely obvious that the Ten Commandments could not possibly contain explicit advice as to what to do about atomic energy, molecular biology, the genetic code, danger from fallout, the moral considerations affecting foreign aid, the exploration of space, or the ethics of distribution of the income of a great corporation. The injunction to "love thy neighbor as thyself" had clear meaning at a time when these neighbors were few in number and near enough to visit on foot with a package of food. But how do we balance up our obligations when the cry of a human being in the Congo or Southeast Asia is less than a tenth of a second away?

So now let us look at some of these problems. I am going to pose them in very explicit form. In most of my examples, I will not attempt to do more than give an instance which will indicate what the general problem is. And facing one of these problems, having of necessity to say, in effect, *yes* or *no*, which do you say? And how does your Christian belief and faith help you in deciding the answer?

PROBLEMS POSED BY MEDICINE

I am going to consider problems from four fields; first let us look at modern medicine. At Dartmouth in 1960, and at Yale more recently,

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seminars considered some of the ethical problems posed by recent advances in medical science.

First, the problem of experimentation with human subjects: Suppose a person ill with cancer—with such a type and condition of cancer that the chances are one hundred to one that the person will be dead within thirty days. Suppose the medical scientists wish to inject live cells of another type of cancer into the body of this person. This procedure has no promise whatsoever of helping the person in question, but it may produce knowledge which will help others. But there is such a thing as unexplained remission of a supposedly fatal cancer. Actually this occurs in something like one to three cases in one hundred thousand cases. So the patient *might* recover if the cells were not injected. If the patient consents, does the doctor inject the cells, or does he not?

Second, consider a mortally ill patient who cannot possibly survive. I know a recent case of a massive coronary, with such great brain damage that the patient was in a coma from which he clearly could never emerge. His heart could be kept beating for two or three days by electrical stimulation: but all the rest of his body had ceased functioning. His heart was faintly beating—but was he “alive”? Was it morally necessary, or even desirable, that his heart be kept beating as long as possible? As a still more tragic case, consider a person whose entire alimentary canal has been removed, who could never move, who could be kept alive only by continual intravenous feeding, and whose mind was nevertheless active. Must a doctor keep such persons alive as long as possible? The doctors almost invariably say “yes.” Does the Christian religion have any opinion?

Within the last month a distinguished cancer surgeon has asked me the following question: Suppose I have a new operative procedure, tested as far as possible on animals, that might save the life of a person very seriously ill with cancer. I try the procedure, and the patient dies during or immediately after the operation. I try again with the same results. Do I still try again?

Or consider the case of a young man with an aneurism located in the brain. The temperature of his entire body was lowered, and essentially all of the blood was drained out of his body. For twenty-eight minutes he did not breathe and had no pulse. During that period the aneurism was operated, and subsequently his blood was returned, his temperature brought to normal, his heart restarted—and weeks after the operation there was no evidence whatsoever of any brain damage. His I.Q. was retested, and was found to be the same as before the

operation. But for nearly a half-hour, by any clinical criterion, he was completely and unambiguously dead. Was he raised from the dead by science?

Problems of this general sort, caused largely by the advance of medical science, are going to get worse and worse—harder and harder to decide. We had better be thinking about what we are going to do. For example, it is now feasible to transplant a kidney from an identical twin into the body of his brother. Indeed some transplants not from identical twins have succeeded. Although never publicized for obvious reasons, kidneys have been transplanted from a Negro to a white man—and an attempt was made to transplant a kidney from a great ape. We are, moreover, on the verge of understanding the immunological processes which usually prevent organ transplantation. I quote from a recent scientific report: “Experiments are being done on various types of lung and liver transplants, and researchers believe that the possibility of transplanting hearts is around the corner.”

Are there any moral and philosophical questions involved here? Do you want to live, perhaps almost indefinitely, with more and more of your parts borrowed from others? If your endocrine system is altered, then so will be your behavior. Will this still be you—the moral entity that is now you? Does religion have any advice?

In one sense this particular problem ought not trouble religion. The actual molecules which make up your bodies today, as you sit here before me, were not part of you some years ago. And ten years from now you will be physically made up of a set of molecules which, at this moment, are all over the planet—in tea plants in Burma, lobster tails in South Africa, soil in Texas, and so on. And yet *you*—what is really *you*—persists. But can science and religion together *say* what *you* really consist of?

PROBLEMS POSED BY PHYSICS

Second, let us take a brief look at some moral problems created by new potentialities in the physical sciences. In the testing of nuclear devices we have let loose, on a worldwide scale, sources of radiation which almost surely increase—although doubtless only *very* slightly—the probability that babies will be born with genetic defects, congenital malformation, or mental defects, or epilepsy, etc. Concede that the increase in the risk of such defects may be very, very small—say one part in ten thousand or one-hundredth of one per cent. Who is going to worry about so small a risk?

You may risk more than that every time you cross the street. But

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this remark is pointless and in fact cynical from a moral point of view. For when you participate in a decision to test bombs, you are incurring a risk to *yourself* that you do have a moral right to assume; but you are also *imposing* a risk on all the other humans on this planet—a risk concerning which they have had no voice and of which, in fact, most of them have no knowledge.

And is this risk, when viewed on a planetary scale, a negligible one? No, it is not. If the total worldwide population of the next generation of babies—some fifteen thousand million of them—is subjected to that risk, it is calculable that the most likely result would be three thousand additional handicapped babies in that first generation, with perhaps nine-tenths of the total damage still lurking hidden in genetic defects which would come to the surface later.

Now do not let your incredulity about the *figures* keep you from thinking about the moral problem! For the arithmetic is not important: the moral problem is: "Thou shalt not kill." That is explicit and clear. But how about participating in a decision that slightly increases lethal risk for all the inhabitants of our globe? The individual risks are very small. The tragedies all occur later. And the victims can never be identified: but does that so dilute your responsibility that you never feel any necessity to face the responsibility of the resulting dead?

This is a single example of a whole range of problems. For the first time in his history, man now has the power substantially to affect his environment. He now operates on such a scale that he can—and does—pollute the purity of the air he breathes, the water he drinks, and the food he eats. He can, for the first time, have a large-scale effect on the environment of all other living creatures. The individual acts (a defective muffler on one automobile) seem so infinitesimally tiny that they do not disturb our consciences. Indeed, most persons are simply unaware of their participation in movements which, viewed as a whole, are basically immoral.

I have, on another occasion, developed this theme under the title "Statistical Morality" (*Christianity and Crisis*, January 31, 1961). The point of this formidable label is simply this. Ancient man dealt with the immediate individual case. He could see the result of his acts. Therefore a rather simple set of moral rules was sufficient for him—these are, by and large, the rules that have come down to us in all the great religions.

But modern man is, whether he likes or not, involved in decisions that affect millions and indeed billions of persons. The extent of the individual involvement is often very small, the nature of the involve-

ment is often very obscure: but the over-all effect on mankind may be catastrophic.

I ask simply: Should religious persons, and especially religious leaders, not be concerned? Should the latter not try to unfold and develop the ancient and basic principles of the Christian faith to such a point that they can usefully be applied to modern problems of statistical morality?

As a final example from the physical sciences I must at least mention the fact—by now expressed hundreds of times in popular articles—that all the large-scale laws of physics, which describe the completely dependable behavior of bullets and baseballs and planets, are nothing but the statistical result of underlying *probability*. You can confidently say that a dropped brick will fall: but concerning any one of the ultimate particles of matter, you can only describe what it is *likely* to do. Ultimately, in the physical universe, there is no such thing as determinism. Einstein died affirming that he could not believe that “God plays dice.” What do religious philosophers believe? Do they deny modern physical science, or do they think that, although doubtless correct, it can be safely ignored?

PROBLEMS POSED BY BIOLOGY

You may be thinking that the problems posed by medicine and by the physical sciences are difficult enough. But I think those posed by modern biology are still more serious. Let me, in all brevity, simply state a series of questions.

It seems on the whole likely that within a relatively few years man will have produced in the laboratory, out of inorganic starting materials, a protein macromolecule, or, say, a rudimentary sort of virus particle, which will have to be acknowledged to be “alive.” What are the moral implications?

There seems to be some reason to expect that, over the next decade or so, forms of “life” will be found elsewhere in the universe. We may encounter “intelligent” creatures. There are three kinds of at least suggestive argument to sustain this expectation. First, there are known to be some fifty “earthlike” planets less than 1,000 light-years away; there are estimated to be some 640 million earthlike planets in our galaxy; and there are estimated to be billions of other galaxies. So even if life is an exceedingly improbable affair, the number of times the “experiment for life” may have been attempted is large enough to swamp almost any infinitesimal probability.

Second, the kinds of chemical substances necessary for life—nucleic

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acids for the genetic memory, amino acids for proteins, adenosine triphosphate for energy purposes—are not unthinkable products of the chemical composition of primeval oceans and atmospheres.

Third, we are receiving radio energy from presumably point sources in celestial objects designated as CTA 21 and CTA 102 which are of a wavelength not like what we receive regularly from the heavens, and are of nearly the wavelength (4–20 inches, with a peak at 12 inches) that are most efficient for penetration of space for communicative purposes.

(It will be noted by some that I do not mention the matter of possible organic materials in meteorites; for the questions of contamination and identification have not been cleared up as yet.)

But what, if anything, will the impact be on our religious concepts of the origin, the nature, and destiny of “man” if we do in fact find life elsewhere in the universe? What, then, will the word “man” mean? Do we think that these other creatures, along with us, are included within the moral purpose of the universe?

There is very considerable reason to suppose that within a couple—or more—decades we will understand the processes of inheritance well enough to get some degree of control over the genetic constitution of men. Certainly to enter the gene is indefinitely more significant (and potentially dangerous) than to enter the atom or the nucleus. Does any religionist consider it worthwhile to think about this?

As far as I am aware, no one has ever asked concerning any living organism, including man, any *scientific* question that has not been answered in scientific terms, or which presumably cannot be answered in scientific terms. What is there left, about a man, which physics and chemistry and biology will never be able to deal with? Science itself cannot see any boundary which will limit its penetration. Can religion? What is the nature of the limitation?

In addition to the more strictly genetic question raised above, modern molecular biology is now actively engaged on another front that has extremely grave moral implications. It looks as though we would, before long, have scientific explanation for the processes of learning, remembering, and forgetting. This goes a country mile beyond the ideas of the psychologists or even the Freudian notions about the conscious and unconscious. For these newer theories locate the real seat of these processes—which we have always called mental—within individual molecules. Associated directly with, and in fact explained purely in terms of, chemical and physical concepts are theories,

now appearing every month in scientific journals, of the possible ways in which an individual molecule may *learn* and *remember*.

For example, there is evidence (even though not universally accepted) that if a creature (actually a worm, in the first experiments) eats part of the body of an animal which has learned a certain task (running a maze), then the creature so nourished can learn that same task significantly more readily. What is this—the tale of a witch doctor or the report of a scientist? Do we continue to laugh at the savage who eats the heart of a lion to make him brave?

Where do the old maxims go if the child of the future can obtain his or her store of factual knowledge, previously won only through years of industrious study, through an “injection of memory molecules”—and I should warn you that those last four words were not invented by me, they were quoted from a scientific article—if an individual molecule can learn, just where does this leave your concept of *yourself* as an individual, responsible to God?

PROBLEMS POSED BY SCIENCE IN GENERAL

Finally I want to ask one or two even broader questions, not coming directly from any one branch of science, but rather from the whole body of modern scientific insight.

I myself believe most deeply that basic principles of the moral life are to be found in various religions and, in a specially pure form, in Christianity. But just as classical laws of science—say, Newton’s laws—have to be reinterpreted so as to apply usefully to present-day problems, I think the great basic truths of Christianity must be reinterpreted so that we see how they apply, today, to problems that were unimaginable twenty centuries ago.

If religionists have indeed paid much serious attention to problems such as those just described, I am unaware of that fact, although I do try at least to scan the literature of this field.

I have in my personal library more than fifty books directed to the general subject of science and religion: but as far as I can tell, they contain no serious or realistic confrontation of the problems that I have here listed.

I am aware of the fact that Étienne Gilson and Jacques Maritain have sought to apply Thomistic principles to modern economic, political, and social conditions. And in these encouraging times of liberal stirrings within the Catholic church, it is gratifying to note that the Roman Catholic bishop from France has announced that the Ecumenical Council, in considering “The Church in the Modern World”

"would have the opportunity to debate specific issues, such as birth control, marriage, and nuclear weapons, and not just the general theological principles governing them."

But I am unaware of any considerable concern on the part of ministers, teachers in the theological seminaries of all faiths, or the philosophers of religion—who often concern themselves with problems of great generality but relatively little comfort.

I have on more than one occasion urged these questions on religious groups—for example, at an annual dinner meeting of the editorial board of *Christianity and Crisis*, the splendid paper published under the auspices of Union Theological Seminary. On another occasion, when I was connected with a study being conducted under the National Council of the Churches of Christ—a study on some of the moral problems connected with atomic energy—I posed some of these problems. Everyone seemed interested and faintly embarrassed: but nothing happened.

During 1964 and 1965 the Institute for Religious and Social Studies, under the auspices of the Jewish Theological Seminary of America, conducted a series of courses. One of these addresses itself to "Changes Facing Our Society in the Next Quarter Century." Thirteen topics are listed, having to do with sex morality, race, personal adjustment, urban society, world peace, etc.; but there is no reference whatsoever to the problems being posed by present-day and future science.

Even the ten-year history of the useful seminars conducted under the Institute on Religion in an Age of Science reveals primary emphasis on such general philosophical topics as "Values and Motivation," "Creative Aspects of Mystical Experience," "Life Purpose as Seen in History," "Spiritual Man," "A Scientific Analysis of the Meaning of Good and Evil," "The Body-Mind Problem," and so on and so on. Lofty as are these topics, they do not seem to me to connect, in any tangible way, with the kind of questions I have here proposed. I must add, however (and with great enthusiasm) that the Meadville Theological School of Chicago, representing Unitarian and Universalist viewpoints and affiliated with the University of Chicago, has developed a new design of graduate education which explicitly seeks "to serve human needs effectively in a new age of science, technology, and worldwide cultural interchange." This theological school has just established a department and center for advanced study, on a systematic basis, of the really modern aspects of the interrelation of science and religion. This department is headed by Ralph W. Burhoe, who had both theological and scientific training, and who served brilliantly

for many years as the Executive Officer of the American Academy of Arts and Sciences at Boston. Burhoe, in a recent letter to me, confirms his belief "that the present Christian theological structure is quite inadequate in its ancient or medieval forms to deal with the problems of man's ultimate concerns—meaning and purpose, dignity and moral duties—adequate for life in the coming age of one world and of scientific ideology."

I think that we must face quite squarely and honestly the question as to whether all of the old simple moral principles are applicable in the modern world. To pass, just for a moment, to the world of international affairs, how about the ethics and morals of spying? What about the ethics, morals, and political usefulness (perhaps necessity) of lying? I am reminded that Leo Szilard, the brilliant scientist who died just a few months ago, once wrote out his own Ten Commandments. Many of these reflected a sensitive, unselfish, essentially moral person. But one of them, translated from his German, was "Do not lie unnecessarily."

What *are* the morals of modern politics? Is it moral to make, during a campaign, statements which the speaker knows perfectly well he does not himself believe or credit; to make promises he knows he cannot fulfil?

Many scientists seem to think that science has no concern whatsoever for *value*, and therefore that no scientist has (for I would think this must follow) any concern for *responsibility* with respect to his scientific activities. Yet more and more scientists, I think, recognize the subtle and illusory nature of so-called facts, and rather fancy their kinship with those who are imaginatively creative in art, music, poetry, etc. What do moralists think about the problem of value in science?

And at the end, I return to the types of problem that disturb me most—those of statistical morality. I saw in a newspaper recently, in a defense of the inefficiencies of our legal procedures in fixing responsibility for crime, the old familiar claim that it is better that one thousand guilty go free rather than that one innocent man be punished. Do you really believe that? Does this, for example, take any reasonable account of the fact that the one thousand guilty, let loose on society, will almost certainly cause *many* innocent to suffer? I am sure that you have seen recent comments that the criminal "never had it so good."

A dramatic example of the difficulties in statistical morality is furnished by warfare. A field commander unhesitatingly commits ten thousand troops to an action, realizing that he must expect 10, or 20,

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or 30 per cent losses. We tolerate this on the grounds that every soldier has *some* chance of surviving, and the commander is presumably comforted by the fact that he does not know in advance *which* soldiers will be killed.

But in our Western tradition we will not permit a soldier to go to *certain* death, even though he volunteers the sacrifice. We would never approve, for example, the technique of the Kamikaze pilot.

Do you remember that in *The Brothers Karamazov*, Dostoevsky has Ivan say: "Imagine that you are creating a fabric of human destiny with the object of making men happy in the end . . . but that it was essential and inevitable to torture to death only one tiny creature . . . and to found that edifice on its unavenged tears, would you consent to be the architect on those conditions? Tell me and tell the truth." To which Alyosha replies softly: "No, I wouldn't consent."

Do you agree? As you remember what happened on the hill of Calvary, do you think it never right that one should voluntarily sacrifice himself in order that many be saved?