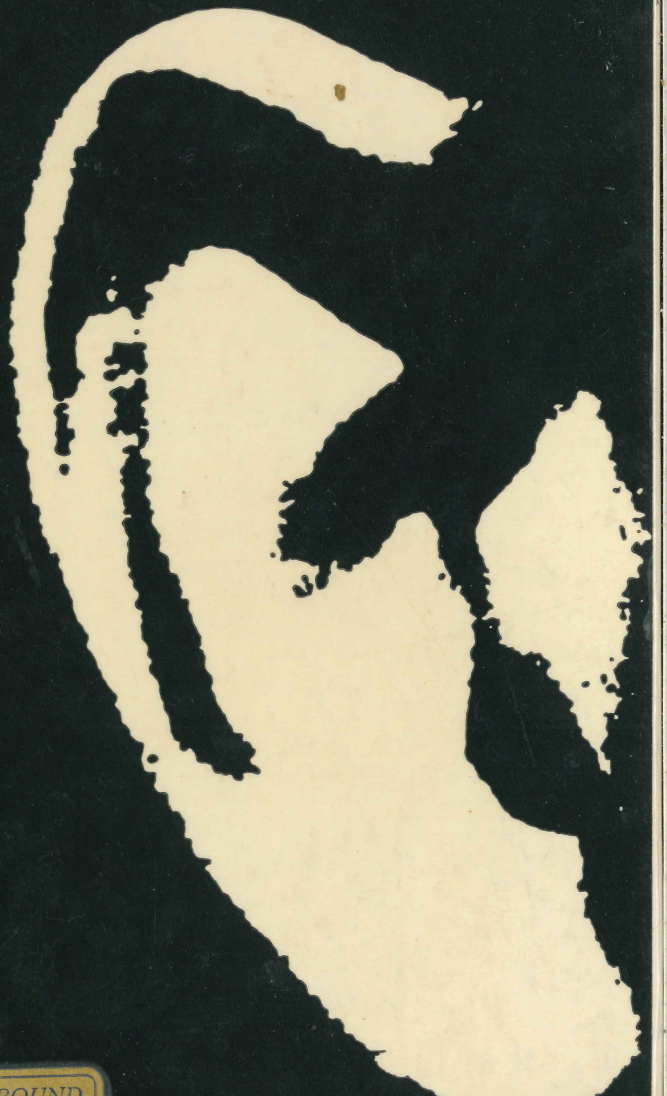
The Open Mind

J. Robert Oppenheimer



Simon and Schuste

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by

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Simon and Schuster • New York

PUBLISHED BY SIMON AND SCHUSTER, INC.
ROCKEFELLER CENTER, 630 FIFTH AVENUE
NEW YORK 20, N. Y.

FOURTH PRINTING

LIBRARY OF CONGRESS CATALOG CARD NUMBER: 55–10043
MANUFACTURED IN THE UNITED STATES OF AMERICA
BY AMERICAN BOOK-STRATFORD PRESS, INC., NEW YORK

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I

Atomic Explosives

THIS TALK is to be a brief report on the future of atomic explosives. It will have to be a very incomplete and a very one-sided talk; I can hope that you will agree with me that the part of the matter that I can discuss, if not the most entertaining, is at least the most important.

When I looked over my notes for this talk, I was reminded of a story, very old and not very funny, but relevant. There was a professor of zoology at the University of Munich, and he had the habit of asking candidates about worms, until it came to such a pass that candidates studied no other subject

very different sort of order from those involved in the great natural phenomena of quakes and of tornadoes; and the radiation and radioactivities that accompany any major atomic explosion must at least complicate its application to benign purposes. If men are ever to speak of the benefits of atomic energy, I think these applications will at most play a very small part in what they have in mind.

There is only one future of atomic explosives that I can regard with any enthusiasm: that they should never be used in war. Since in any major total war, such as we have lived through in these late years, they will most certainly be used, there is nothing modest in this hope for the future: It is that there be no such wars again. I should like to speak today on some considerations bearing upon the realization of that hope. This is a subject that seems to me worthy of careful study, and of the best thought of our times.

Some months ago, I had the privilege of working with a group of consultants to the Secretary of State's Committee on Atomic Energy. We spent many weeks exploring this problem, which is commonly defined in a sort of code as "The International Control of Atomic Energy." This is a code because the real problem is the prevention of war. Since that time our conclusions, expurgated of all secret or classified matter, have been made public, and may in one way or another have come to your attention. They were made public in order to facilitate public understanding and discussion, a discussion made more necessary by the difficulty of the problem, made more difficult by the secrecy which has been maintained and is still maintained about many of its technical ele-

ments. What I should like to do today is to add a few comments which may help to supplement the report that was made public, and to make explicit some of the things left implicit in it, to restore a balance of emphasis which was partially lost, perhaps, in the accidents of its release.

The heart of our proposal was the recommendation of an International Atomic Development Authority, entrusted with the research, development, and exploitation of the peaceful applications of atomic energy, with the elimination from national armaments of atomic weapons, and with the studies and researches and controls that must be directed toward that end. In this proposal we attempted to meet, and to put into a constructive context, two sets of facts, both long recognized, and commonly regarded as contributing to the difficulty, if not to the insolubility, of the problem.

The first of these facts is that the science, the technology, the industrial development involved in the so-called beneficial uses of atomic energy appear to be inextricably intertwined with those involved in making atomic weapons. You will hear reports this afternoon on the so-called beneficial uses of atomic energy. They come to us not in the form of answers but in the form of questions, and that for two reasons: In the first place, one of these uses is for the development of power, and this is something that has not been effectively done. No one knows to what extent such power will be economically profitable; no one knows to what extent technical problems may delay or complicate the development of atomic power as power. We have here a beginning; but we don't have any answers. We don't have a tree with fruit

or for taking even crudely into account the distinction between the guilt of individuals and that of peoples; they are themselves a supreme expression in a weapon of the concepts of total war. The second difficulty, in some sense inescapable in any form of international action, but desperately acute in this, is that such stocks of atomic weapons, however earnestly they are proclaimed international, however ingeniously they are distributed on earth, would nonetheless offer the most terrible temptation to national seizure, for the almost immediate military advantage that their use might afford.

These two examples do give recognition to the need, in any system of outlawing atomic weapons, of international action. In this I think they are sound. In fact, in another context, the study—but not the production—of atomic weapons, and inspection to prevent the illegal mining of uranium, both would seem to be essential functions of an international authority.

It is time to turn to the second of the great difficulties that have from the outset been regarded as preventing any effective international control. We have already referred to it. It is the absence in the world today of any machinery adequate to provide such control, any precedent for such machinery, or even any adequate patterns of the past to provide such a precedent. Just this is the reason why the problem is so much of a challenge, why we may be sustained by the hope that its solution would provide such precedent, such patterns, for a wider application. It did not take atomic weapons to make wars, or to make wars terrible, or to make wars total. If there had never been and could never be an atomic bomb,

the problem of preventing war in an age when science and technology have made it too destructive, and too terrible to endure, would still be with us. There would be the blockbuster, the rocket, the V-2, the incendiary, the M-67, and their increase; there would no doubt be biological warfare. There would be, and there still are. But the atomic bomb, most spectacular of proven weapons, the most inextricably intertwined with constructive developments and the least fettered by private or by vested interest or by long national tradition is for these and other reasons the place to start. For in this field there is possible a system of control that is consistent with, that is based upon, the technical realities and with the human realities in the deep sense. In this field, there is a solution that can be made to work.

Many have said that without world government there could be no permanent peace, and without peace there would be atomic warfare. I think one must agree with this. Many have said that there could be no outlawry of weapons and no prevention of war unless international law could apply to the citizens of nations, as federal law does to citizens of states, or have made manifest the fact that international control is not compatible with absolute national sovereignty. I think one must agree with this. Many have said that atomic energy could not be controlled if the controlling authority could be halted by a veto, as in many actions can the Security Council of the United Nations. I think one must agree with this too. With those who argue that it would be desirable to have world government, an appropriate delegation of national sovereignty, laws applicable to individuals in all nations,

it would seem most difficult to differ; but with those who argue that these things are directly possible, in their full and ultimately necessary scope, it may be rather difficult for me to agree.

What relation does the proposal of an International Atomic Development Authority, entrusted with a far-reaching monopoly of atomic energy—what relation does this proposal of ours have to do with these questions? It proposes that in the field of atomic energy there be set up a world government, that in this field there be renunciation of national sovereignty, that in this field there be no legal veto power, that in this field there be international law. How is this possible, in a world of sovereign nations? There are only two ways in which this ever can be possible: one is conquest, that destroys sovereignty; and the other is the partial renunciation of that sovereignty. What is here proposed is such a partial renunciation, sufficient, but not more than sufficient, for an Atomic Development Authority to come into being, to exercise its functions of development, exploitation and control, to enable it to live and grow and to protect the world against the use of atomic weapons and provide it with the benefits of atomic energy.

Whatever else happens, there is likely to be a discussion of the control of atomic energy in the United Nations Commission set up for that purpose, and not in the very distant future, I would say. Should these discussions eventuate in the proposal of an International Authority, and in a charter for that Authority, these proposals and that charter would in the end be presented for ratification to the several nations. Each

tracers. An example of this kind is the use of reactors for research. An example of this kind which is somewhat more marginal, is the use of reactors which burn and do not produce explosive material for power, and in which the best steps you can take to complicate and delay the use of this material for explosives have been taken, so that it isn't a thing that can be done in an hour's effort or in a month's effort or by a few angry individuals. I think the importance of this point is this: there are safe activities which you can leave, for instance, in the hands of the government of the United States or the corporations of the United States or the universities of the United States. For this reason, there will be good, technical liaison between the Authority and these more private agencies. This will, on the one hand, tend to correct the bureaucracy that is implicit in monopoly. On the other hand, it will give the International Authority some method of remaining cognizant of the developments in the field which happen not to have been carried out by itself.

If any great note of confidence or gayety has invested these brief words, it would be a distortion of the spirit in which I should have wished to speak to you. No thoughtful man can look to the future with any complete assurance that the world will not again be ravaged by war, by a total war in which atomic weapons contribute their part to the ultimate wreck and attrition of this our Western civilization. My own view is that the development of these weapons can make, if wisely handled, the problem of preventing war, not more hopeless, but more hopeful, than it would otherwise have been, and that this is so not merely because it intensifies the

urgency of our hopes, but because it provides new and healthy avenues of approach. In developing these avenues the fact that there is so far-reaching a technical inseparability of the constructive uses of atomic energy from the destructive ones—a fact that at first sight might appear to render the problem only more difficult—this fact is precisely the central vital element that can make effective action possible. If we are clear on this, we shall have some guide for the future.

IV

Atomic Weapons and American Policy

IT IS possible that in the large light of history, if indeed there is to be history, the atomic bomb will appear not very different than in the bright light of the first atomic explosion. Partly because of the mood of the time, partly because of a very clear prevision of what the technical developments would be, we had the impression that this might mark, not merely the end of a great and terrible war, but the end of such wars for mankind.

Two years later Colonel Stimson was to write in *Foreign Affairs:* "The riven atom, uncontrolled, can be only a grow-

ing menace to us all . . ." In the same paragraph he wrote, "Lasting peace and freedom cannot be achieved until the world finds a way toward the necessary government of the whole." * Earlier, shortly after the war's end, the government of the United States had put forward some modest suggestions, responsive to these views, for dealing with the atom in a friendly, open, co-operative way. We need not argue as to whether these proposals were stillborn. They have been very dead a long, long time, to the surprise of only a few. Openness, friendliness and co-operation did not seem to be what the Soviet government most prized on this earth.

It should not be beyond human ingenuity for us to devise less friendly proposals. We need not here detail the many reasons why they have not been put forward, why it has appeared irrelevant and grotesque to do so. These reasons range from the special difficulties of all negotiation with the Soviet Union, through the peculiar obstacles presented by the programmatic hostility and the institutionalized secretiveness of communist countries, to what may be regarded as the more normal and familiar difficulties of devising instruments for the regulation of armaments in a world without prospect of political settlement.

Instead we came to grips, or began to come to grips, with the massive evidences of Soviet hostility, and the growing evidences of Soviet power, and with the many almost inevitable, yet often tragic, elements of weakness, disharmony

* "The Challenge to Americans," by Henry L. Stimson. *Foreign Affairs,* October 1947.

and disunity in what we have learned to call the Free World.

In these preoccupations—one wholly negative, and one largely positive though very difficult—the atom, too, was given a simple role, and the policy followed was a fairly simple one. The role was to be one ingredient of a shield: a shield composed also in part of the great industrial power of America, and in part of the military and, even more, the political weaknesses of the Soviet Union. The rule for the atom was: "Let us keep ahead. Let us be sure that we are ahead of the enemy."

Today it would seem that, however necessary these considerations and these policies may be, they are no longer nearly sufficient. The reason for that one can see when one looks at the character of the arms race. The reason for that one can see when one compares the time-scale of atomic developments here and abroad with the probable time-scale of deep political changes in the world.

It is easy to say "Let us look at the arms race." I must tell about it without communicating anything. I must reveal its nature without revealing anything; and this I propose to do.

There are three countries embarked on this race: The United Kingdom—and of that we need to note only that it is unfortunate that so talented and hard-pressed a country, so close to us in history and tradition, should be doing all this separately from us—ourselves, and the U.S.S.R.

As for the U.S.S.R., it has recently been said officially, and

it was not a question of one bomb. It would become a question of ten, and then one hundred, and then a thousand, and then ten thousand, and then maybe one hundred thousand. We knew—or, rather, we did not know, but we had very good reason to think—that it was not a question of ten thousand tons but of one hundred thousand and then a million tons, and then ten million tons and then maybe one hundred million tons.

We knew that these munitions could be adapted, not merely to a slow medium bomber operating where we had almost complete air supremacy, but to methods of delivery more modern, more flexible, harder to intercept, and more suitable for combat as it might be encountered today.

Today all of this is in train. It is my opinion that we should all know—not precisely, but quantitatively and, above all, authoritatively—where we stand in these matters; that we should all have a good idea of how rapidly the situation has changed, and of where we may stand, let us say, three, four, or five years ahead, which is about as far as one can see. I shall revert to the reasons why I think it important that we all know of these matters. I cannot write of them.

What I can say is this: I have never discussed these prospects candidly with any responsible group, whether scientists or statesmen, whether citizens or officers of the government, with any group that could steadily look at the facts, that did not come away with a great sense of anxiety and somberness at what they saw. The very least we can say is that, looking ten years ahead, it is likely to be small comfort that the Soviet Union is four years behind us, and small

comfort that they are only about half as big as we are. The very least we can conclude is that our twenty-thousandth bomb, useful as it may be in filling the vast munitions pipelines of a great war, will not in any deep strategic sense offset their two-thousandth. The very least we can say is that, as Mr. Gordon Dean has emphasized, there will come a time when, even from the narrowest technical point of view, the art of delivery and the art of defense will have a much higher military relevance than supremacy in the atomic munitions field itself.

There are other aspects of the arms race; though they may be well known, they are worth mentioning. We developed the atomic bomb under the stimulus of the fear that the Germans might be at it. We deliberated at length on the use of the bomb against Japan; indeed it was Colonel Stimson who initiated and presided over these thorough deliberations. We decided that it should be used. We have greatly developed and greatly increased our atomic activities. This growth, though natural technically, is not inevitable. If the Congress had appropriated no money, it would not have occurred. We have made our decision to push our stockpiles and the power of our weapons. We have from the first maintained that we should be free to use these weapons; and it is generally known we plan to use them. It is also generally known that one ingredient of this plan is a rather rigid commitment to their use in a very massive, initial, unremitting strategic assault on the enemy.

This arms race has other characteristics. There has been relatively little done to secure our defense against the atom;

which thoughtful men leave a discussion of the subject is not wholly ununderstandable. There are two things that everyone would like to see happen; but few people, if any, confidently believe that they will happen soon. One is a prompt, a happily prompt reform or collapse of the enemy. One is a regulation of armaments as part of a general political settlement —an acceptable, hopeful, honorable and humane settlement to which we could be a party.

There is nothing repugnant in these prospects; but they may not appear to be very likely in the near future. Most of us, and almost all Europeans, appear to regard the outbreak of war in this near future as a disaster. Thus the prevailing view is that we are probably faced with a long period of cold war in which conflict, tension and armaments are to be with us. The trouble then is just this: During this period the atomic clock ticks faster and faster; we may anticipate a state of affairs in which two Great Powers will each be in a position to put an end to the civilization and life of the other, though not without risking its own. We may be likened to two scorpions in a bottle, each capable of killing the other, but only at the risk of his own life.

This prospect does not tend to make for serenity; and the basic fact that needs to be communicated is that the time in which this will happen is short, compared to the time in which reasonable men may have some confidence in a reasonable amelioration or even alteration of the great political troubles of our time.

In this prospect, surely, we shall need all the help and wisdom and resourcefulness we can muster. This, in all prob-

one of them a most distinguished scientist, who headed one of the great projects of the Manhattan District during the war, and one of them a brilliant officer, who was in over-all charge of the Manhattan District. These two men are not now employed by any agency of the government concerned with these questions; therefore they did not have access to the evidence. Thus their advice is unavailing, their public counsel wrong.

A second example may illustrate further. A high officer of the Air Defense Command said—and this only a few months ago, in a most serious discussion of measures for the continental defense of the United States—that it was our policy to attempt to protect our striking force, but not really our policy to attempt to protect this country, for that is so big a job that it would interfere with our retaliatory capabilities. Such follies can occur only when even the men who know the facts can find no one to talk to about them, when the facts are too secret for discussion, and thus for thought.

The political vitality of our country largely derives from two sources. One is the interplay, the conflict of opinion and debate, in many diverse and complex agencies, legislative and executive, which contribute to the making of policy. The other is a public opinion which is based on confidence that it knows the truth.

Today public opinion cannot exist in this field. No responsible person will hazard an opinion in a field where he believes that there is somebody else who knows the truth, and where he believes that he does not know it. It is true that there are and always will be, as long as we live in danger of

war, secrets that it is important to keep secret, at least for an appropriate period, if not for all time; some of these, and important ones, are in the field of atomic energy. But knowledge of the characteristics and probable effects of our atomic weapons, of—in rough terms—the numbers available, and of the changes that are likely to occur within the next years, this is not among the things to be kept secret. Nor is our general estimate of where the enemy stands.

Many arguments have been advanced against making public this basic information. Some of these arguments had merit in times past. One is that we might be giving vital information to the enemy. My own view is that the enemy has this information. It is available to anyone who will trouble to make an intelligence analysis of what has been published. Private citizens do not do this; but we must expect that the enemy does. It is largely available by other means as well. It is also my view that it is good for the peace of the world if the enemy knows these basic facts—very good indeed, and very dangerous if he does not.

There is another source of worry—that public knowledge of the situation might induce in this country a mood of despair, or a too ready acceptance of what is lightheartedly called preventive war. I believe that until we have looked this tiger in the eye, we shall be in the worst of all possible dangers, which is that we may back into him. More generally, I do not think a country like ours can in any real sense survive if we are afraid of our people.

As a first step, but a great one, we need the courage and the wisdom to make public at least what, in all reason, the

THIS BOOK is about two related subjects: atomic weapons and the relationship between science and the wider culture of our times. It is made up of eight lectures given by J. Robert Oppenheimer during the decade since the end of the war. It contains none of his technical writing in the field of physics. Some of the material has never been published before; most of it has been printed only in journals of limited circulation.

The book begins with a report on atomic explosives made in May 1946, less than a year after the development of the first atomic bomb. It closes with the already famous view of the world's arts and sciences which was the concluding lecture in Columbia University's Bicentennial, delivered in 1955. Together, these essays make a fascinating record of change and growth, over ten years, in the thinking of one of the outstanding scholars of this generation.

The entire book is thus an illustration of its central statement of the values to society of the open mind. Here is the author's definition of his belief in this: "An indispensable, perhaps *the* indispensable, element in giving meaning to the dignity of man, and in making possible the taking of decision on the basis of honest conviction, is the openness of men's minds, and the openness of whatever media there are for communion between men, free of restraint, free of repression, and free even of that most pervasive of all restraints, that of status and hierarchy."