

## **THE DILEMMA OF A SCIENTIST**

*What follows is a major portion of the article that Jacob Bronowski, the distinguished scientist and humanist, prepared for the Spring 1965 issue of Euros, which was devoted to "Survival Ethics." Euros, a new journal, is self-described as "a European review dedicated to man and his culture." It is published in English, French, German, Spanish and Dutch in cooperation with the Fondation Européenne de la Culture. The introduction to this issue states that man's survival depends on his "ability to meet the challenge of the atomic age," hence the need for "survival ethics." Dr. Bronowski directs his attention to the specific way in which the scientist is challenged by this great problem of our time.*

Nearly twenty years ago, on a warm autumn evening in 1945, I was driving over the mountains of southern Japan to the city of Nagasaki. I thought I was still in open country when all at once I realized that I was already crossing what had been the city. The shadows which flickered past me in the dusk were not rocks and trees: they were crushed buildings, the bare and skewed ribs of factories, and two crumpled gasometers.

The scale of the damage at Nagasaki drained the blood from my heart then, and does so now when I write of it. For three miles my road lay through a desert which man had made in a second. Now, twenty years later, the hydrogen bomb is ready to dwarf this scale, and to turn each mile of destruction into ten miles. And citizens and scientists stare at one another and ask "how did we blunder into this nightmare?"

I put this first as a question of history, because the history of this is known to few people. The fission of uranium was discovered by two German scientists a year before the war. Within a few months, it was reported that Germany had forbidden the export of uranium from the mines of Czechoslovakia which she had just annexed. Scientists on the Continent, in England and America, asked themselves whether the secret weapon on which the Germans were said to be working was an atomic bomb. If the fission of uranium could be used explosively (and this already seemed possible in 1939) it might in theory make an explosion a million times larger than hitherto. The monopoly of such an atomic bomb

would give Hitler instant victory, and make him master of Europe and the world.

The scientists knew the scale of what they feared very well: they feared first desolation and then slavery. With heavy hearts, they told Albert Einstein what they knew of atomic fission. Einstein had been a pacifist all his life, and he did not easily put his conscience on one side. But it seemed clear to him that no scientist was free to keep this knowledge to himself. He felt that no one could decide whether a nation should or should not use atomic bombs, except the nation itself; the choice must be offered to the nation, and made by those whom the nation has elected to act for it. On August 2, 1939, a month before Hitler invaded Poland, Einstein wrote to President Roosevelt to tell him that he thought an atomic bomb might be made, and he feared that the Germans were trying to make one.

This is how it came about that, later in the war, scientists worked together in England, in Canada and America, to make the atomic bomb. They hated war no less than the layman does—no less than the soldier does; they, too, had wrestled with their consciences; and they had decided that their duty was to let the nation use their skill, just as it uses the skill of the soldier or the expert in camouflage. The atomic scientists believed that they were in a race against Germany whose outcome might decide the war even in its last weeks.

We know now that the race was almost a walk-over. The Germans were indeed trying to make an atomic explosion, and they thought that they were ahead of the allies. But by our standards, what they had done was pitiful; they had not made a pile that worked, and they believed that the fast chain-reaction of an atomic bomb was impossible. The Nazis had made fundamental science a poor relation, and put it under second-rate party men with splendid titles. And, more deeply, the Nazis had sapped the pith and power of research, the quizzical eye and the questioning mind, the urge to find the facts for oneself. There were not enough unconventional ideas in the German atomic projects, and when the younger men did put up some, their leaders always knew better.

In short, the Germans failed; it was the allies who tested the first atomic bomb in July of 1945. By this time Germany was defeated and Hitler was dead.

The atomic scientists who had made the bomb in America were therefore shocked and distressed to hear that it was still intended to be used against the Japanese. They wrote a round robin to President Truman in which they pleaded against this decision. This is not simply a bigger bomb, they said: it changes the very scale of war and of all power; and it should be demonstrated to the world, not on men and women, but in some desert place. However the protest of the scientists was ignored, and Hiroshima and Nagasaki were made desert places.

There were, I know, scientists who hoped after this that the atomic bomb would make war unthinkable. There are scientists today, and soldiers and statesmen too, who hope that the hydrogen bomb will bring the nations to their senses. I am afraid that they are mistaken. Wars are neither made nor unmade by weapons; it is the other way about, the weapons grow out of the wars. And by the same token, if there is war, then the weapons are used; alas, I have no faith in making the desperate business of war sporting by forbidding the more unpleasant forms of slaughter. The Lateran Council outlawed the crossbow in 1139 because it was inhuman, and poets and scientists foresaw the danger of the flying balloon in 1784; but war has not become more kindly for their good sense. The evil root is war itself.

I am, therefore, out of sympathy with the cry that the scientist ought not to discover formidable sources of power, or at least should not disclose them to his frail and destructive fellow-men. As a piece of advice, this is unpractical, and as a policy it is a makeshift. It is in fact humbug—a pious wish that someone else should make the world a better place for us. Under any democratic system of government, the responsibility for the world is yours and mine; and we do not change the world by what we wish but by how we act. If we do not want the nations to make hydrogen bombs or plan war, then it is our business to say so to those whom we elect to act for us; and to say it until they listen. And it is not enough to appeal to one side, as the "Peace Campaigns" do which try to put pressure on every government except the Soviet Government. In fact I believe that not even a totalitarian government, despite its stony face, is immune to public opinion, to the voice in the crowd, to the arguments among friends.

But there is a limit to the effectiveness of public pressure in totalitarian countries, and we must recognize this when we ask what any democratic society ought to do. Yet we cannot evade the choice

which the community must make between a bomb or no bomb, between planning for war or peace, by asking the scientists to hide the choice from us. The community of voters decides that there shall be research for war, and employs the scientist to do it. Having given him that hangman's job, it must not ask him to be judge as well, to decide what is or is not good for the community to know. The scientist in this work is the servant of the nation, and he must not dictate to it, even about his own discoveries. If he does so, he betrays his trust, just as much as Dr. Klaus Fuchs did when he decided that he knew best who should share the secrets of the atomic bomb.

The public would like scientists to keep secret those discoveries which its leaders might misuse. On this view, Einstein in 1939 should not have told the President of the United States that an atomic explosion might be produced—on the ground, presumably, that Einstein could be trusted to act with wisdom and humanity, and the man whom the United States had elected to act for them could not. Is this really tolerable? Is it tolerable that the electorate should admit that it chooses its leaders to defend narrow national interests, and should then ask scientists to defend single-handed the interests of humanity?

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Then what should the scientist do who abhors the miserable misuse of science to conspire death, and who wishes that he had never had a hand in computing an aiming error? I can only speak for the scientist in a free society. The scientist in a totalitarian system faces perhaps the same crisis of conscience, but if his government allows him no alternative, he may indeed—who knows—act out his dissent in the sabotage of which he is often accused in public trials behind the Iron Curtain. The disaster of state intolerance, anywhere in the world, is that it saps both sides of the moral contract, the individual's as well as the state's. But the scientist in society has no right to dictate to society; and—this is the heart of the matter—in return society must not dictate his life to him. He must be free to follow his conscience, as any citizen should be free, in peace or in war. Like every man and woman, the scientist has a duty to himself, which demands that his work shall not only be useful, but shall conform to his sense of human fulfillment and dignity. If this prompts him to reject research for war, or atomic physics, or science itself, he must be free and able to find other work.

Above all, the dissenting scientist must be free to give his reasons and to speak his mind. This is his

true responsibility in the blundering, warring world: not to impose his will on his fellows, but to help them to find their own wills. We live in a time when science penetrates every public issue, from a city plan to the fall in the death-rate, from a fuel crisis to cigarette smoking or margarine. If the voter leaves these issues to the specialists, democracy will sink to what it became in later Athens, when a minority of educated men governed 300,000 slaves. The faith of our democracy is that at bottom every man has the ability to form a judgment on every issue; and therefore the life of democracy hangs by his willingness to educate his judgment. For example, voters have learnt a great deal of economics and of history; but in science, they and the men they elect are steeped in prejudice. I believe that nations can choose wisely, and democracy can prove its power if scientists are willing to become teachers to them. The chemist, the biologist, the mathematician can speak at first hand of the roots and the range of modern discoveries, their possible results for good or ill, the choice they offer and the meaning they give to our lives. And, more profoundly, from the statistician to the secret physicist, each scientist has a method to teach, by which the voter will measure promise against achievement, and ask if the world has any business to fall so short of what it might be.

Today the man who has worked on the issues of life and death, a guided missile or the hydrogen bomb, is seldom free to speak as he would like. I think his silence, in which secrecy and tact combine, is a loss to the community. And if in time he comes to find silence natural, the habit will dry up science itself, so that at last it fails its own nation. There is no conforming or totalitarian science. The dropping in Russia of the agricultural policies of Professor Lysenko is evidence of this, as much as the poverty of German atomic research during the war. You cannot make a discovery to any pattern but its own, which in the end is the personality of the men who make it. And if you want good science, if you want minds from whom everyone has something to learn, then you must put up with men as awkward and heretical as Isaak Newton was. The dilemma of militarism in science is not confined to a few men who have their livings to make, or whom a board of loyalty clears but sacks. Like every moral problem, it challenges the future of the nations in a most practical way. Can we have secrecy and an educated democracy as well? Can we have a state-guarded science in which there will still be dissent? And if we give up dissent, how long before science becomes a hocus-pocus like alchemy, which has nothing to contribute either to war or to peace?

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*"The problems posed by the threat of nuclear war are no different for the Catholic Church than they are for other Churches or for any religious community that attempts to cope with them. In its initial debate on nuclear weapons, the Vatican Council revealed sharp differences of attitude and opinion that have their parallel in communities around the world. But that debate revealed in a special public way not only the responsibility and burden religious groups must bear but the temptations and dangers to which they can so easily succumb. As the essays in this volume make clear, not every informed critic views these dangers in the same way."*

from the Editor's preface in

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Published by the Council on Religion and International Affairs

104 pp. / \$2.00