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DINNER

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December 7, 1954

THE SENSITIVE MINORITY AMONG MEN OF SCIENCE

by Leo Szilard

I shall talk to you tonight, not so much about science, as about the Men of Science.

Every year, thousands of young men enter the field of science these days; and this is important.

But tonight, I am not going to talk about the many; I am going to talk about the few.

There is a minority among men who are the "salt of the earth", and there is such a minority among scientists also.

It is this minority about which I shall speak.

A reporter, who seems to have been a student of human nature, once walked past some construction work, so the story goes, and he asked one of the workmen what he was doing.

"I am earning $2.50 an hour," the man replied.

He turned to a second workman with the same question, and the man replied:

"I am fitting bricks into this wall."

Then he turned to a third one and the man replied, "I am building a cathedral."

This third workman belongs to the minority of which I am speaking, a minority which has a far greater sensitivity than the rest of their fellow men.

It seems to be a fact that most of the creative minds among scientists belong to this sensitive minority.

And because in science creative minds rise to prominence, the whole community of scientists takes on the coloring of this minority.

Obviously, their importance is quite out of proportion to their numbers.

The title of my talk tonight is, "The Sensitive Minority Among the Men of Science."

And the sub-title is, "Why did the Germans miss out on the Atomic Bomb?"

This is the first sub-title. The second sub-title is, "Why did America come so close to missing out on the hydrogen bomb?"

At different times, different physicists have been given the dubious honor of being called the "father of the atomic bomb."

But in truth, the father of the atomic bomb was no physicist--he was a dreamer and a writer.

In 1913--one year before the First World War--H. G. Wells wrote a book called "The World Set Free".

In this book he described the discovery of artificial radioactivity and put it into the year of 1933--the very year in which it was, in fact, discovered.

In the book, this is followed by the development of atomic energy for peace-time uses and also atomic bombs.

The World War in which the cities of most nations are destroyed by these bombs, H. G. Wells put into the year of 1956--(the year in which, according to my own best estimate, the danger of such a war will reach its peak.)

(There is a vivid passage in the book in which an American, an English, and a French General discuss grand strategy in front of a large map in Allied Headquarters in Paris, when the first bomb falls, and the map, the generals, the headquarters, and Paris itself, are reduced to ashes--radioactive ashes--within a split second.

After the devastation of a large part of the world---and mind you--not before--an attempt is made to set up a world government which very nearly fails, but in the end, somehow manages to succeed.

Occasionally, it happens that a physicist reads a book.

It so happened that I read this book in 1932, but it did not make much of an impression on me at the time when I read it, or so I thought.

In the Fall of 1933 I found myself in London and I spent much of my time reading the newspapers, as an inexpensive way of learning English.

One morning I read about the annual meeting of the British Association of Scientists at which Lord Rutherford spoke.

He was quoted as saying that he who talks about liberating atomic energy on a large scale is talking moonshine.

Lord Rutherford was an expert in nuclear physics.

And as you know, an expert is a man who knows what cannot be done.

But I have a deeply ingrained distrust of experts, and so Lord Rutherford left me wondering whether he might not be wrong.

That afternoon as I was about to cross Southampton Row, waiting for the light to turn from red to green, a thought came to me.

What if there is one among the 92 chemical elements that will emit two neutrons if it is hit by a neutron?

If we piled up a sufficient quantity of such an element, we could then maintain a chain reaction in which we could liberate atomic energy on a large scale.

My field was not nuclear physics at that time but I was so fascinated by this possibility that I became a nuclear physicist.

I first thought that the element beryllium might be able to sustain such a chain reaction but this possibility faded out within the year.

Then I suspected the element indium, which also failed.

By 1935 I decided that instead of following up hunches about this element or that one, it would be more intelligent to be stupid and simply to test one chemical element after another.

After all, there were only 92 chemical elements to test and they could be tested pretty fast.

An electronic instrument was needed for these experiments and I had no funds from which to buy it.

So I went to see Dr. Weizmann.

I went to him because he was a chemist and also a Zionist.

I thought he would see my point and also he would be able to raise the funds.

I told Dr. Weizmann that I needed L.2000, which at that time was worth about $10,000.

This much was needed to buy the equipment and to hire a graduate student to carry out the test on 92 chemical elements.

With this test done, we would know where we stand, I told Dr. Weizmann.

Weizmann was most gracious about it all and said he would see what he could do.

A few weeks later I heard from my friend Michael Polanyi, who was in charge of the Chemistry Department at Manchester, that Weizmann discussed the matter with him and that they came to the conclusion that the project ought to be supported.

After that, I heard nothing further and I did not see Weizmann again until I bumped into him by chance in 1946 in the lobby of the Wardman-Park Hotel in Washington, D. C.

He seemed to be very pleased to see me.

"Do you remember when you last called on me in London?" he asked.

I told him I did.

"Do you remember what you asked me to do for you?" he asked.

"Perhaps you will not believe me now," he said, "but I did try to get those L.2,000 for you and found that I could not."

There was a short silence and then Weizmann said, "What a great thing it would have been for Palestine if we had gone through with your project.".

I have often asked myself what indeed would have happened if we had gone through with the project in 1935.

Within a couple of months we should have discovvered the fission of uranium and the neutron emission which accompanies it.

Of this much I am sure.

We would then have tried to keep this discovery secret and in this, in all probability we would have failed.

Within a matter of months the fission of uranium would have become public knowledge.

Then, more likely than not, atomic energy and the atomic bomb would have been developed in Germany first, and Germany would have had atomic bombs by 1940, at the very latest.

I am pretty certain that in 1935 it would have impossible to get any large-scale experiments under way, either in England or in America.

Conceivably, such experiments could have been set up in England after the Munich agreement in 1938, but then it would have been too late.

Germany, in possession of atomic bombs in 1940 could have taken over the world, and I haven't very much doubt that she would have taken over the world.

If this is a correct appraisal, then it would seem that the world--our world--had a narrow escape indeed.

It seems to me it would be perhaps fitting for the British Government to erect right next to the Tomb of the Unknown Soldier a nomument to the Unknown Benefactor who refused Dr. Weizmann's request for L.2000, and thereby saved Great Britain from German conquest.

There still remains a question in my own mind unanswered.

Why did I not appeal to somebody else when Dr. Weizmann did not come through with the funds?

At the very least I could have pushed Dr. Weizmann a little harder.

It is possible that sensing the nature of the enterprise and the enterprising nature of the Germans--and both of these I did sense very keenly--something within me hesitated to start the stone rolling when there was a good chance that we, ourselves, would be hit first.

All this I can only guess; I cannot be really sure of it.

Naturally, when it comes to the workings of my own subconscious, it is not possible for me to know all the answers.

Actually, the fission of uranium was discovered by Otto Hahn in Germany in 1938.

Hahn found that the atom of uranium breaks into two large fragments when it is hit by a neutron.

Fortunately he did not suspect that neutrons are emitted in this process.

And so the Germans had no way of knowing then and there, that uranium could be used to set up a chain reaction .

The neutron emission of uranium in the process of fission was discovered a few months later by Joliot and his group in Paris, and over here, by Enrico Fermi and his group, as well as Dr. Zinn and myself.

These three groups tried to keep in close touch with each other, about the work they were doing, and for a while we seriously considered keeping the discovery secret from the Germans.

But somehow our negotiations with each other broke down and in the spring of 1939, the discovery was published.

From that moment on I was haunted by the nightmare that the Germans would get ahead of us in this work and force us to surrender.

By all the laws of logic they should have done it and as far as ability and industrial know-how goes, they could have done it.

Yet when the war ended, we learned that our German colleagues somehow had missed out on a few very simple ideas.

These ideas would have led them to recognize at once that bombs could be made with quantities of material that were easily within their reach to produce.

Why did they fail?

I shall try to get across to you, if I can, the thought that the one really important step in any advance is the recognition of an as-yet unformulated problem.

This is where the Germans failed.

The Germany physicists were loyal to their country and had their government approached them with a clearly formulated program to build atomic bombs, they would have gone through the necessary steps of logical reasoning and they would have come up with the bomb.

But the machinery of a government never goes into action until there is a clear recognition of the problem and there is a memorandum on someone's desk which says that such-and-such can be done.

There was no such memorandum on anybody's desk in the German government.

Why?

In 1933 when Hitler took office, many German physicists may have been

quite sympathetic to the Nazis even though none of them seem to have been an outright Nazi.

But by 1939 all of them must have had their doubts.

There were a few who admitted such doubts to others; most of them did not admit such doubts even to themselves.

But your doubts affect you whether you admit them or not. And if doubts keep you from taking pleasure in certain ideas, those ideas will simply not come to you.

An idea occurs to you because it is fun to have it and nothing interferes with fun as much as a troubled conscience.

If an idea does slip into your mind that evokes the displeasure of your conscience, it is likely to slip out of your mind before long.

And you are not likely to go around selling it to others as you must if action is to follow thought.

Did the German physicists miss out on the crucial ideas purely by accident or did their doubts prevent them from recognizing the problem of the atomic bomb, which was as yet unformulated?

I believe this was not an accident at all; I believe that if you had lived among the Germans at that time and looked and listened sharply, you could have heard the Mills of the Gods grinding slowly and could have seen them grinding exceedingly fine.

The small group of scientists over here who tried to ram the Atomic Bomb down the throat of an unwilling American government had no qualms of conscience about what they were doing.

All through 1939 it was a foregone conclusion for us that Germany would go to war.

This was the second big war in my lifetime.

I was a boy aged 17 living in Hungary when America entered the first world war.

My young American friends have no recollection of this event, but I remember very clearly that the declaration of war by the U. S. came upon the heels of the sinking of the Lusitania by a German submarine.

America did not question the right of Germany to blockade England, but she held that if the Germans sink a ship they must save the passengers; and no submarine that torpedoed a ship was capable of doing that.

I knew, of course, that the Lusitania was the occasion rather than the real reason for America's intervention in the war; it was the straw that broke the camel's back.

I read at that time nothing but German and Hungarian newspapers, and yet, I thought that the lusitania was a fitting occasion for this declaration of war.

When in 1939 at the outbreak of the World War II, President Roosevelt warned the belligerents against the bombing of cities, he expressed the prevailing sentiment of the whole American nation.

Later, when the Germans attempted to force the quick surrender of Holland by the bombing of Rotterdam, the horror expressed over this atrocity by all of our newspapers was genuine.

The Germans argued that the bombardment was justified because it did, in fact, lead to Holland's surrender; it thereby shortened the war on the Continent, and by shortening the war in the end it saved lives, both Dutch and German.

But that time I knew of no one who found this kind of reasoning acceptable.

All through the war—up to the end of 1943--we thought that we were in a neck-and-neck race with the Germans in developing the Bomb.

We looked upon the Bomb as a tool which in the hands of the Government could avert our defeat because it would restrain the Germans from using atomic bombs against our cities.

During this period we scientists were at war with the Germans, but we were at peace with ourselves.

The first uneasiness that I noticed among those who worked with me came when massed bombing attacks were carried out by the Royal Air Force against German cities and burned and suffocated large masses of the population.

At first we were inclined to regard them as reprisals against similar German attacks. But the Japanese had never indulged in this type of warfare against our cities and yet the Strategic Air Command began to attack their cities with jellied gasoline bombs which burned and suffocated hundreds of thousands of people.

As long as only Germany indulged in this kind of warfare, we could regard it as an anomaly and condemn it as an atrocity.

It was America's own action and that of the British which gave this kind of warfare the respectability which it enjoys today.

We sensed all this very clearly at the time when it occurred and we were much disturbed.

We were even more disturbed when the war with Germany had ended and we saw that the War Department considered the use of Atomic Bombs against the cities of Japan.

The actions of governments, are influenced by considerations of expediency, as well as moral considerations; and on this score we had no illusions.

But it seemed to us wrong for America to set the precedent of using atomic energy for purposes of destruction, and we were unable to see any compelling arguments

of expediency.

(Since Germany was defeated, Japan could not possibly win the war, and they must have known this--or so we thought.)

(Once the Japanese knew that they could not win the war, it should be possible, we thought, to negotiate a satisfactory peace, short of unconditional surrender.)

The use of the bomb against the cities of Japan had a very profound effect on the scientists, but this effect became visible only very gradually after the war.

Great power brings with itself the obligation of restraint; and Hiroshima and Nagasaki have raised doubts in the minds of scientists that the United States is capable of exercising such restraints.

Because of such doubts, American scientists showed very little inclination to devote any further thought to the problems of the bomb.

Most of them felt after the war just as apprehensive of Russia as a potential enemy as they had felt before the war about Germany.

They did not trust Russia any more than they had trusted Germany, but apparently they trusted their own government much less than they had trusted it before.

The net result was that the U.S. would have missed out on the hydrogen bomb altogether had it not been for the accident that there was still one man left who--for a variety of reasons--still liked to think about the problems of this bomb.

I call this an accident because where there is only one man left, clearly--but for the grace of God--there might have been no one left.

In the years after the war, it was well known to many that practically all the current ideas on the bomb came from Dr. Edward Teller.

Even Teller was not working full time at it; nor was he entirely free of doubts whether he was doing the right thing, but still time and again he came up with an important idea.

After the Russians exploded their first bomb in the fall of 1949, it seemed to me so incongruous that there should be only one first-class mind left working on the problems of the bomb, that I brought this fact to the attention of the White House when an occasion arose.

When I talked about this to one of the officials, he seemed to grasp the significance of what I told him, and he appeared shocked.

His response, in turn, shocked me, for what he said was this:

"For God's sake, keep the name of this man secret. If the Russians find out who he is, they can blacken his name in such a way that it will not be in the power of the President to keep him at work in his job."

Not until I had heard this did I fully realize into what a mess we had managed to get ourselves here in the United States.

Recently, as a sequel to Dr. Oppenheimer's loyalty case, Dr. Teller's role in connection with the hydrogen bomb became public knowledge.

Missing the main point the public seemed to be mostly concerned whether there was delay in constructing the hydrogen bomb after the President gave the order to go ahead.

A myth is in the making that there was a conspiracy of scientists determined to sabotage the presidential order.

In a book on the Hydrogen Bomb written by Sheppley and Blair, which stirred up a considerable amount of dust, there is much talk about such a conspiracy.

They end up by saying--I quote,

"The leaders of the anti-H-Bomb lobby were the opinion leaders of U.S. science--Einstein, Rabi, Bacher, Conant, Szilard, and others. The effect of their arguments on the younger scientists was massive; they stayed away from Los Alamos in droves."

It is quite true that few of the scientists rushed to Los Alamos even after President Truman ordered the hydrogen bomb to be developed.

This is a fact and it might require an explanation.

The explanation that Sheppley and Blair give has the virtue of being simple, but it lacks the virtue of being correct.

Shortly after the President's decision on the hydrogen bomb was made public, a group of physicists assembled at a meeting of the Physical Society in New York, issued a statement. I quote:

"A few days ago, President Truman decided that this country should go ahead with the construction of a Hydrogen Bomb.

> "We believe that no nation has the right to use such a bomb, no matter how righteous its cause. This bomb is no longer a weapon of war but a means of extermination of whole populations. Its use would be a betrayal of all standards of morality and of Christian civilization itself...
>
> "We urge that the United States, through its elected government, make a solemn declaration that we shall never use this bomb first. The circumstance which might force us to use it would be if we or our allies were attacked by THIS bomb. There can be only one justification for our development of the hydrogen bomb, and that is to prevent its use."

It so happens that neither Einstein, Rabi, Bacher, Conant, nor even I, had signed this statement, but the distinguished group which signed it was quite represent-

ative of physicists all over the nation.

The University of Chicago, Harvard, Cornell, The University of California, the California Institute of Technology, Columbia University, M.I.T., the Carnegie Institution of Washington, and Princeton University were all represented.

But impressive though the names are, you can be sure that no scientist stayed away from Los Alamos as the result of reading this statement.

No scientists worth his salt, no matter how young, will be guided by authority either in a scientific matter or in a matter of conscience.

Independence of judgement and inclination to follow arguments rather than to follow authority is deeply ingrained in the nature of the scientist.

The statement which this group issued did not slow down the development of the hydrogen bomb but the doubts to which it gives expression most certainly did so.

The effect of these doubts was most marked in the interval between 1945-1950, when the problem was still largely unrecognized and unformulated.

Their effect was much smaller after that period, for such doubts never affected the recruitment of the scientists who were needed to fit the bricks into the wall.

To those of you who are concerned about our national security in the conventional sense of the word, I can give this reassurance.

With the men at hand now working on the bomb, there can be no further mishap.

The bombs are now as large as anyone could wish them to be and if smaller and smaller bombs are needed for tactical use, they will be forthcoming also.

That there is an estrangement between the government and the scientists which affects the best of our creative minds cannot be doubted.

But those of my colleagues who raise their voices to warn that this estrangement threatens the security of the U.S. are a little disingenious.

For the truth of the matter is that we have reached the point on the road where the salvation of the United States cannot come from any further advances in the science of warfare.

At the point where we stand today the salvation of the United States can come only from political sagacity.

Whether that will be forthcoming or not, I regret not to be in a position to predict.

December 7, 1954

THE SENSITIVE MINORITY AMONG MEN OF SCIENCE

by Leo Szilard

I shall talk to you tonight, not so much about science, as about the Men of Science.

Every year, thousands of young men enter the field of science these days; and this is important.

But tonight, I am not going to talk about the many; I am going to talk about the few.

There is a minority among men who are the "salt of the earth", and there is such a minority among scientists also.

It is this minority about which I shall speak.

A reporter, who seems to have been a student of human nature, once walked past some construction work, so the story goes, and he asked one of the workmen what he was doing.

"I am earning 2.50 an hour," the man replied.

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"I am fitting bricks into this wall."

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At different times, different physicists have been given the dubious honor of being called the "father of the atomic bomb."

But in truth, the father of the atomic bomb was no physicist--he was a dreamer and a writer.

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(There is a vivid passage in the book in which an American, an English, and a French General discuss grand strategy in front of a large map in Allied Headquarters in Paris, when the first bomb falls, and the map, the generals, the headquarters, and Paris itself, are reduced to ashes--radioactive ashes--within a split second.)

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It so happened that I read this book in 1932, but it did not make much of an impression on me at the time when I read it, or so I thought.

In the Fall of 1933 I found myself in London and I spent much of my time reading the newspapers, as an inexpensive way of learning English.

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If we piled up a sufficient quantity of such an element, we could then maintain a chain reaction in which we would liberate atomic energy on a large scale.

My field was not nuclear physics at that time but I was so fascinated by this possibility that I became a nuclear physicist.

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So I went to see Dr. Weizmann.

I went to him because he was a chemist and also a Zionist.

I thought as a chemist he would see my point and also as a Zionist he would be able to raise the funds.

I told Dr. Weizmann that I needed L.2000, which at that time was worth about $10,000.

This much was needed to buy the equipment and to hire a graduate

student to carry out the test on 92 chemical elements.

With this test done, we ~~would~~ should know where we stand, ~~I told Dr. Weizmann~~.

Weizmann was most gracious about it all and said he would see what he ~~can~~ could do.

A few weeks later I heard from my friend Michael Polanyi, who was in charge of the Chemistry Department at Manchester, that Weizmann discussed the matter with him and that they came to the conclusion that the project ought to be supported.

After that, I heard nothing further and I did not see Weizmann again until I bumped into him by chance in 1946 in the lobby of the Wardman-Park Hotel in Washington, D.C.

~~He~~ Dr. Weizmann seemed to be very pleased to see me.

"Do you remember when you last called on me in London?" he asked.

I told him I did.

"Do you remember what you asked me to do for you?" he asked.

"Perhaps you will not believe me now," he said, "but I did try to get those L.2,000 for you and found that I could not."

There was a short silence and then Weizmann said, "What a great thing it would have been for Palestine if we had gone through with your project."

I have often asked myself what indeed would have happened if we had gone through with the project in 1935.

Within a couple of months we should have discovered the fission of uranium and the neutron emission which accompanies it.

Of this much I am sure.

We would then have tried to keep this discovery a secret and in this, in all probability we would have failed.

Within a matter of months the fission of uranium would have become public knowledge.

Then, more likely than not, atomic energy and ~~the~~ atomic bombs would have been developed in Germany first, and Germany would have had atomic bombs by 1940, at the very latest.

I am pretty certain that in 1935 it would have been impossible to get any large-scale experiments under way, either in England or in

America.

Conceivably, such experiments could have been set up in England after the Munich agreement in 1938, but then it would have been too late.

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Hahn found that the atom of uranium breaks into two large fragments when it is hit by a neutron.

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This is where the Germans failed.

The Germany physicists were loyal to their country and had their government approached them with a clearly formulated program to build atomic bombs, they would have gone through the necessary steps of logical reasoning and they would have come up with the bomb.

But the machinery of a government never goes into action until there is a clear recognition of the problem and there is a memorandum on someone's desk which says that such-and-such can be done.

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This was the second big war in my lifetime.

I was a boy aged 17 living in Hungary when America entered the first world war.

My young American friends have no recollection of this event, but I remember very clearly that the declaration of war by the U.S. came upon the heels of the sinking of the Lusitania by a German submarine.

America did not question the right of Germany to blockade England, but she held that if the Germans sink a ship they must save the passengers; and no submarine that torpedoed a ship was capable of doing that.

I knew, of course, that the Lusitania was the occasion rather than the real reason for America's intervention in the war; it was the straw that broke the camel's back.

I read at that time nothing but ~~German and~~ Hungarian newspapers, and yet, I thought that the Lusitania was a fitting ocassion for this declaration of war.

When in 1939 at the outbreak of ~~the~~ World War II, President Roosevelt warned the belligerents against the bombing of cities, ~~I~~ ~~told what~~ he expressed the prevailing sentiment of the whole ~~American~~ nation.

Later, when the Germans attempted to force the ~~quick~~ surrender of Holland by ~~the~~ bombing ~~of~~ Rotterdam, the horror expressed over this atrocity by all of our newspapers was genuine.

The Germans argued that the bombardment was justified because it did, in fact, lead to Holland's surrender; it thereby shortened the war on the Continent, and by shortening the war in the end it saved lives, both Dutch and German.

~~At~~ But at that time I knew of no one who found this kind of reasoning acceptable.

All through the war--up to the end of 1943--we thought that we were in a neck-and-neck race with the Germans in developing the Bomb.

We looked upon the Bomb as a tool which in the hands of the Government could avert our defeat because it would restrain the Germans from using atomic bombs against ~~our cities~~ us.

During this period ~~the~~ we scientists ~~whom I knew~~ were at war with the Germans, but ~~they~~ we were at peace with ~~themselves~~ ourselves.

The first uneasiness that I noticed among those who worked with me came when massed bombing attacks were carried out by the Royal Air Force against German cities and burned and suffocated large masses of the population.

At first we were inclined to regard them as reprisals against similar German attacks. But the Japanese had never indulged in this type of warfare ~~against our cities~~ and yet the Strategic Air Command began to attack their cities with jellied gasoline bombs which burned and suffocated hundreds of thousands of people.

As long as only Germany indulged in this kind of warfare, we could regard it as an anomaly and condemn it as an atrocity.

It was America's own action and that of the British which gave this kind of warfare the respectability which it enjoys today.

We sensed all this ~~quite~~ very clearly at the time when it occurred and we were much disturbed.

We were even more disturbed when the war with Germany had ended and we saw that the War Department considered the use of Atomic Bombs against the cities of Japan.

The actions of governments, as well as individuals, are influenced by considerations of expediency, as well as moral considerations; and on this score we ~~have~~ here no illusions.

But it seemed to us wrong for America to set the precedent of using Atomic Energy for purposes of destruction, and we were unable to see any compelling arguments of expediency.

~~The use of the bomb against the cities of Japan had a very profound effect on the scientists, but this effect became visible only very gradually after the war.~~

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(Once the Japanese knew that they could not win the war, it should be possible, we thought, to negotiate a satisfactory peace, short of unconditional surrender.)

The use of the bomb against the cities of Japan had a very profound effect on the scientists, but this effect became visible only very gradually after the war.

Great power brings with itself the obligation of restraint; and ~~it seems that~~ Hiroshima and Nagasaki have raised doubts in the minds of the ~~American~~ scientists that the United States is capable of exercising such restraints.

~~After the war,~~ Because of such doubts, American scientists showed very little inclination to devote any further thought to the problems of the bomb.

Most of them felt after the war just as apprehensive of Russia as a potential enemy as they had felt before the war about Germany.

They did not trust Russia any more than they had trusted Germany, but apparently they trusted their own government much less than they had trusted it before.

The net result was that the U.S. would have missed out on the Hydrogen Bomb altogether had it not been for the accident ~~that~~, there was ~~still~~ one man left who--for a variety of reasons--still liked to think about the problems of this bomb.

I call this an accident because where ~~this~~ there is only one man left, ~~clearly~~--but for the grace of God--there might have been no one left.

In the years after the war, it was well known to ~~many~~ us that practically all the current ideas on the bomb came from Dr. Edward Teller.

Even Teller was not working full time at it; nor was he entirely free of doubts whether he was doing the right thing, but still time and again he came up with an important idea.

After the Russians exploded their first bomb in the fall of 1949, it seemed to me so incongruous that there should be only one ~~first-class~~ first-rate mind left working on the problems of the bomb, that I brought this fact to the attention of the White House when an occasion arose.

When I talked about this to one of the Officials, he seemed to grasp the significance of what I told him, and he appeared shocked.

His response, in turn, shocked me. For what he said was this:

"For God's sake, keep the name of this man secret. If the Russians find out who he is, they can blacken his name in such a way that it will not be in the power of the President to keep him at work ~~at~~ in his job."

Not until I had heard this did I fully realize into what a mess we had managed to get ourselves here in the United States.

Recently, as a sequel to Dr. Oppenheimer's loyalty case, Dr. Teller's role in ~~connection~~ development with the Hydrogen Bomb became public knowledge.

Missing the main point the public seemed to be mostly concerned whether there was delay in constructing the Hydrogen Bomb after the President gave the order to go ahead.

A myth is in the making that there was a conspiracy of scientists determined to sabotage the presidential order.

In a book on the Hydrogen Bomb written by Sheppley and Blair, ~~which~~ that stirred up a considerable amount of dust, there is much talk ~~about~~ of such a conspiracy.

They end up by saying--I quote,

"The leaders of the anti-H-Bomb lobby were the opinion leaders of U.S. science--Einstein, Rabi, Bacher, Conant, Szilard, and others. The effect of their arguments on the younger scientists was massive; they stayed away from Los Alamos in droves."

It is quite true that few of the scientists rushed to Los Alamos even after President Truman ordered the Hydrogen Bomb to be developed.

This is a fact and it might require an explanation.

The explanation that Sheppley and Blair give has a virtue of being simple, but it lacks the virtue of being correct.

Shortly after the President's decision on the Hydrogen Bomb was made public, a group of physicists assembled at a meeting of the Physical Society in New York, issued a statement. I quote:

"A few days ago, President Truman decided that this country should go ahead with the construction of a Hydrogen Bomb.

"We believe that no nation has the right to use such a bomb, no matter how righteous its cause. This bomb is no longer a weapon of war but a means of extermination of whole populations. Its use would be a betrayal of all standards of morality and of Christian civilization itself...

"We urge that the United States, through its elected government, make a solemn declaration that we shall never use this bomb first. The circumstances which might force us to use it would be if we or our allies were attacked by THIS bomb. There can be only one justification for our development of the Hydrogen Bomb, and that is to prevent its use."

It so happens that neither Einstein, Rabi, Bacher, Conant, nor even I, had signed this statement, but the distinguished group which signed it was quite representative of physicists all over the nation.

The University of Chicago, Harvard, Cornell, The University of California, the California Institute of Technology, Columbia University, M.I.T., the Carnegie Institution of Washington, and Princeton University were all represented.

But the recruitment of this group of men was hampered by the fear that their name may be blackened, that they may be charged not with disloyalty or this work about character defects. You may be cleared again and again of the same old charges and then suspended again. There is no rule that protects you from double- or triple-jeopardy. — At this point if I have to give you a simple formula I should say that the Rank and File are more disturbed by Sen McCarthy while the sensitive minority is more disturbed by Sen [illegible].

But impressive though the names are, you can be sure that no scientist stayed away from Los Alamos as the result of reading this statement.

No scientists worth his salt, no matter how young, will be guided by authority either in a scientific matter or in a matter of conscience.

Independence of judgment and inclination to follow arguments rather than to follow authority is deeply ingrained in ~~the nature of~~ all ~~the~~ scientist.

The statement which this group issued did not slow down the development of the hydrogen bomb, but the doubts to which it gives expression ~~and which were shared by all scientists whom I know~~ most certainly did so.

The effect of these doubts was most marked in the interval between 1945-1950, when the problem was still largely unrecognized and unformulated.

~~Their effect was much smaller after that period,~~ had such doubts ~~and it~~ probably never affected the recruitment of the scientists who were needed to fit the bricks into the wall.

To those of you who are concerned about our national security in the conventional sense of the ~~word~~ term, I can give this reassurance.

With the men at hand now working on the bomb, there can be no further mishap.

The bombs are now as large as ~~they need be~~ anyone could wish them to be, and if smaller and smaller bombs are needed for tactical use, they will be forthcoming also.

That there is an estrangement between the government and the scientists which affects the best of our creative minds cannot be doubted.

But those of my colleagues who raise their voices to warn that this estrangement threatens the security of the U.S. are a little disingenious.

For the truth of the matter is that we have reached the point on the road where the salvation of the United States cannot come

from any further advances in the science of warfare.

At the point where we stand today the salvation of the United States can come only from political sagacity that might bring us real peace

(Whether the scientists could contribute to this, I cannot state with any degree of assurance.

I could say with a greater degree of assurance--if the past can be taken as a measure of the future--that in all likelihood they will have no opportunity to do so.)

Whether such political security that will be forthcoming or not, I regret not to be in a position to predict.

Commencement Address AR 83711 Ext 4279
CR 63034

A devilish device!

~~Explain my presence~~
3 years ago: General Education S.

great attachment ... today
buildings, S action, The Quadrangle Flowers and ...

December 7, 1954

THE SENSITIVE MINORITY AMONG MEN OF SCIENCE

by Leo Szilard

I shall talk to you tonight, not so much about science, as about the Men of Science.

Every year, thousands of young men enter the field of science these days; and this is important.

But tonight, I am not going to talk about the many; I am going to talk about the few.

There is a minority among men who are the "salt of the earth", and there is such a minority among scientists also.

It is this minority about which I shall speak.

A reporter, who seems to have been a student of human nature, once walked past some construction work, so the story goes, and he asked one of the workmen what he was doing.

"I am earning $2.50 an hour," the man replied.

He turned to a second workman with the same question, and the man replied:

"I am fitting bricks into this wall."

Then he turned to a third one and the man replied, "I am building a cathedral."

This third workman belongs to the minority of which I am speaking, a minority which has a far greater sensitivity than the rest of their fellow men.

It seems to be a fact that most of the creative minds among scientists belong to this sensitive minority.

And because in science creative minds rise to prominence, the whole community of scientists takes on the coloring of this ~~sensitive~~ minority.

Obviously, their importance is quite out of proportion to their numbers.

The title of my talk tonight is, "The Sensitive Minority Among the Men of Science."

And the sub-title is, "why did the Germans miss out on the Atomic Bomb?"

This is the first sub-title. The second sub-title is, "why did America come so close to missing out on the hydrogen bomb?"

At different times, different physicists have been given the dubious honor of being called the "father of the atomic bomb."

But in truth, the father of the abomic bomb was no physicist--he was a dreamer and a writer.

In 1913--one year before the First World War--H.G. Wells wrote a book called "The World Set Free".

In this book he described the discovery of artificial radioactivity and put it into the year of 1933--the very year in which it was, in fact, discovered.

In the book, this is followed by the development of atomic energy for peacetime uses and also atomic bombs.

The World War in which the cities of most nations are destroyed by these bombs, H. G. Wells put into the year of 1956--(the year in which, according to my own best estimate, the danger of such a war will reach its peak.)

(There is a vivid passage in the book in which an American, an English, and a French General discuss grand strategy in front of a large map in Allied Headquarters in Paris, when the first bomb falls, and the map, the generals, the headquarters, and Paris itself, are reduced to ashes--radioactive ashes--within a split second.

After the devastation of a large part of the world--and mind you--not before--an attempt is made to set up a world government which very nearly fails, but in the end, somehow manages to succeed.

Occasionally, it happens that a physicist reads a book.

It so happened that I read this book in 1932, but it did not make much of an impression on me at the time when I read it, or so I thought.

In the Fall of 1933 I found myself in London and I spent much of my time reading the newspapers, as an inexpensive way of learning English.

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One morning I read about the annual meeting of the British Association of Scientists at which Lord Rutherford spoke.

He was quoted as saying that he who talks about liberating atomic energy on a large scale is talking moonshine.

Lord Rutherford was an expert in nuclear physics.

And as you know, an expert is a man who knows what cannot be done.

But I have a deeply ingrained distrust of experts, and so Lord Rutherford left me wondering whether he might not be wrong.

That afternoon as I was about to cross Southampton Row, waiting for the light to turn from red to green, a thought came to me.

What if there is one among the 92 chemical elements that will emit two neutrons if it is hit by a neutron?

If we piled up a sufficient quantity of such an element, we could then maintain a chain reaction in which we would liberate atomic energy on a large scale.

My field was not nuclear physics at that time but I was so fascinated by this possibility that I became a nuclear physicist.

I first thought that the element beryllium might be able to sustain such a chain reaction but this possibility faded out within the year.

Then I suspected the element indium, which also failed.

By 1935 I decided that instead of following up hunches about this element or that one, it would be more intelligent to be stupid and simply to test one chemical element after another.

After all, there were only 92 chemical elements to test and they could be tested pretty fast.

An electronic instrument was needed for these experiments and I had no funds from which to buy it.

So I went to see Dr. Weizmann.

I went to him because he was a chemist and also a Zionist.

I thought he would see my point and also he would be able to raise the funds.

I told Dr. Weizmann that I needed L.2000, which at that time was worth about $10,000.

This much was needed to buy the equipment and to hire a graduate

student to carry out the test on 92 chemical elements.

With this test done, we would know where we stand, I told Dr. Weizmann.

Weizmann was most gracious about it all and said he would see what he ~~can~~ could do.

A few weeks later I heard from my friend Michael Polanyi, who was in charge of the Chemistry Department at Manchester, that Weizmann discussed the matter with him and that they came to the conclusion that the project ought to be supported.

After that, I heard nothing further and I did not see Weizmann again until I bumped into him by chance in 1946 in the lobby of the Wardman-Park Hotel in Washington, D.C.

He seemed to be very pleased to see me.

"Do you remember when you last called on me in London?" he asked.

I told him I did.

"Do you remember what you asked me to do for you?" he asked.

"Perhaps you will not believe me now," he said, "but I did try to get those L.2,000 for you and found that I could not."

There was a short silence and then Weizmann said, "What a great thing it would have been for Palestine if we had gone through with your project."

I have often asked myself what indeed would have happened if we had gone through with the project in 1935.

Within a couple of months we should have discovered the fission of uranium and the neutron emission which accompanies it.

Of this much I am sure.

We would then have tried to keep this discovery secret and in this, in all probability we would have failed.

Within a matter of months the fission of uranium would have become public knowledge.

Then, more likely than not, atomic energy and the atomic bomb would have been developed in Germany first, and Germany would have had atomic bombs by 1940, at the very latest.

I am pretty certain that in 1935 it would have been impossible to get any large-scale experiments under way, either in England or in

America.

Conceivably, such experiments could have been set up in England after the Munich agreement in 1938, but then it would have been too late.

Germany, in possession of atomic bombs in 1940 could have taken over the world, and I haven't very much doubt that she would have taken over the world.

If this is a correct appraisal, then it would seem that the world--our world--had a narrow escape indeed.

It seems to me it would be ~~quite~~ perhaps fitting for the British Government to erect right next to the Tomb of the Unknown Soldier a monument to the Unknown Benefactor who refused Dr. Weizmann's request for L.2000, and thereby saved Great Britain from German conquest.

There still remains a question in my own mind unanswered.

Why did I not appeal to somebody else when Dr. Weizmann did not come through with the funds?

At the very least I could have pushed Dr. Weizmann a little harder.

It is possible that sensing the nature of the enterprise and the enterprising nature of the Germans--and both of these I did sense very keenly--something within me hesitated to start the stone rolling when there ~~seemed to be~~ was a good chance that we, ourselves, would be hit first.

All this I can only guess; I cannot be really sure of it.

Naturally, when it comes to the workings of my own subconscious, it is not possible for me to know all the answers.

Actually, the fission of uranium was discovered by Otto Hahn in Germany in 1938.

Hahn found that the atom of uranium breaks into two large fragments when it is hit by a neutron.

Fortunately he did not suspect that neutrons are emitted in this process.

And so the Germans had no way of knowing then and there, that uranium could be used to set up a chain reaction.

The neutron emission of uranium in the process of fission was discovered a few months later by Joliot and his group in Paris, and

over here, by Enrico Fermi and his group, as well as Dr. Zinn and myself.

These three groups tried to keep in close touch with each other, about the work they were doing, and for a while we seriously considered keeping the discovery secret from the Germans.

But somehow our negotiations with each other broke down and in the spring of 1939, the discovery was published.

From that moment on I was haunted by the nightmare that the Germans would get ahead of us in this work and force us to surrender.

By all the laws of logic they should have done it and as far as ability and industrial know-how goes, they could have done it.

Yet when the war ended, we learned that our German colleagues somehow had missed out on a few very simple ideas.

These ideas would have led them to recognize at once that bombs could be made with quantities of material that were easily within their reach to produce.

Why did they fail?

I shall try to get across to you, if I can, the thought that the one really important step in any advance is the recognition of an as-yet unformulated problem.

This is where the Germans failed.

The Germany physicists were loyal to their country and had their government approached them with a clearly formulated program to build atomic bombs, they would have gone through the necessary steps of logical-reasoning and they would have come up with the bomb.

But the machinery of a government never goes into action until there is a clear recognition of the problem and there is a memorandum on someone's desk which says that such-and-such can be done.

There was no such memorandum on anybody's desk in the German government.

Why?

In 1933 when Hitler took office, many German physicists may have been quite sympathetic to the Nazis even though none of them seem to have been an outright Nazi.

But by 1939 all of them must have had their doubts.

There were a few who admitted such doubts to others; most of them did not admit such doubts even to themselves.

But your doubts affect you whether you admit them or not. And if doubts keep you from taking pleasure in certain ideas, those ideas will simply not come to you.

An idea occurs to you because it is fun to have it and nothing interferes with fun as much as a troubled conscience.

If an idea does slip into your mind that evokes the displeasure of your conscience, it is likely to slip out of your mind before long.

And you are not likely to go around selling it to others as you must if action is to follow thought.

Did the German physicists miss out on the crucial ideas purely by accident or did their doubts prevent them from recognizing the problem of the atomic bomb, which was as yet unformulated?

I believe this was not an accident at all; I believe that if you had lived among the Germans at that time and looked and listened sharply, you could have heard the Mills of the Gods grinding slowly and could have seen them grinding exceeding fine.

The small group of scientists over here who tried to ram the Atomic Bomb down the throat of an unwilling American government had no qualms of conscience about what they were doing.

All through 1939 it was a foregone conclusion for us that Germany would go to war.

This was the second big war in my lifetime.

I was a boy aged 17 living in Hungary when America entered the first world war.

My young American friends have no recollection of this event, but I remember very clearly that the declaration of war by the U.S. came upon the heels of the sinking of the Lusitania by a German submarine.

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Whether that will be forthcoming or not, I regret not to be in a position to predict.

6/20/85
gift of Mrs. Goldie Moss
copy from which LS spoke; LS notes changes