

THE FUTURE OF ENERGY, CLIMATE, EDUCATION AND HUMANITY

“The saddest aspect of life right now is that science gathers knowledge faster than society gathers wisdom.”

“Anti-intellectualism has been a constant threat winding its way through our political and cultural life, nurtured by the false notion that democracy means that ‘my ignorance is just as good as your knowledge.’”

Isaac Asimov

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Lecture delivered at the Newark College of Engineering, November 8, 1974.

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Thank you, thank you. I have ... can you hear me as I talk now, or do I have to lean into this? Can you hear me when I speak like this? Anyone? OK.

I had a pretty exciting time coming to Newark.

Because you see, my correspondence was from my office. Which is not where I live. And when I was told that I would be picked up I carefully wrote a very clear letter explaining exactly where I lived. Which made it inevitable that they send the people to my office.

As I stood there in the street, waiting for the car, listening to the minutes tick away, realizing I had to be up here at eight o'clock. I grew desperate. Finally on the intercom, I called my wife and said: “Would you call my office and ask if there are any jerks there looking for me?”

She did, and then she called back, and she said that is where they were, so I told them to come here. I said: “Why did you do that?” I said: “It is four blocks. They will never make it!”



Figure 1. Isaac Asimov, Russian-born American Professor and science fiction writer.

They almost did not.

I had to wait another ten minutes.

Then, but finally we got here with five minutes to spare. And we knocked at a locked door.

And a security guard opened it, and said: "You cannot come in."

And the two young men who were with me, who looked like college students; very unsavory characters, said: "Well that is all right about us", he says, "But this is the lecturer." And the guard peered at me, and he said: "That is the lecturer?" And they said yes. "I happen to know that the lecturer is upstairs."

So we went through another door where there was not any guard.

And here I am. Now this other lecturer is not going to say a word to you, but I shall bet he collects the fee.

Ahhh ... but anyway, now you see why I hate to travel. My discussion on the future of man applies very, very well to what has just happened to me as you will shortly see. Let me explain.

I once, when I was not quite nineteen, wrote a story called "Trends." It was the first story I ever sold to John Campbell of the old "Astounding Science Fiction." It appeared in the July 1939 issue.

And in it I dealt with the first flight around the Moon and back. I had it placed in the 1970's. The first attempt, which was a failure, was in 1973. And the second attempt, which was a success, was in 1978. The actual flight took place in 1978, so I was ten years conservative. In addition, my flight was all there was, whereas in real life the flight around the Moon was preceded by all kinds of orbital and sub orbital flights, and dockings, and mid-course corrections, and communication satellites, and navigation satellites...everything under the sun.

So you can see how wrong I was. In fact I was even wronger than that because when I wrote my story back in 1939 ... 38, it was printed in 39, when I wrote that story, I had definite ideas on how the space flight was to take place.

First place, I had my inventor build a spaceship in his back yard.

In the second place, I took the attitude that any man who good enough to build a spaceship was good enough to fly the spaceship.

I mean the inventor was the astronaut; a great saving in time and labor.

Furthermore, I did not bother establishing any computer banks anywhere, especially not in Texas. Because to this day, to be perfectly honest with you, and that is what I would like to be, perfectly honest ... to be perfectly honest with you, I do not really see what the big deal is about getting to the Moon with the computers and the mid-course corrections. I know you are a bunch of engineers, and you know better than I do, but I ask you ... once you get there beyond the atmosphere, do you or do you not see the Moon?

And if you see the Moon, steer for it, right?

In fact the only thing that bugged me ... the only thing that bugged me in that story is where you launch the space ship from. I lived in Brooklyn all my life, and I looking around Brooklyn I could see there was no place you could safely launch a spaceship ... without arousing the anger of the citizenry.

And so I thought that I had better launch it outside Brooklyn somewhere. And that sort of promptly got me into trouble because I was not sure, for certain, that there was any place

outside Brooklyn.

I mean I heard rumors to that effect, but I am a pretty difficult fellow to fool. I like definite evidence. But I realized that I have to do something, so I launched the ship ... the spaceship ... from the farthest limits of the known world. To wit, in Jersey City.

I am not kidding. Really did. And yet I sold this story.

Not only sold this story, but it has been reprinted five times. The last time in 1973. By which time I suspect that most people had a pretty good idea that the details in my story were wrong.

Well why was this, do you suppose? I shall tell you. The story was not printed because of any of the engineering details ... you should excuse the expression. It was published because I had something in it that the editor had never seen before. I had postulated resistance to space flight. There was a whole organization of people on Earth who were sore as anything at the people who were trying to get out into space. They thought people should stay on Earth and mind their own business. And this had never been postulated before. Never!

Up till that moment in time, the only way in which space travel was treated was either by having the hero go out to Deneb or someplace, and fight the oyster men there, and marry the beautiful princess who lays eggs, without any reference whatsoever to Earth or the people thereof. On the other hand, the other way of handling space flight was to have the hero land on the Moon, or on some other place thereto akin, and then come back and receive a ticker-tape parade with everyone being very pleased at this heroic action.

It never occurred to anybody that there might actually be resistance to the whole notion; people might think it was a rotten idea and a waste of money.

After I wrote the story, again, nobody had the idea. I do not think another story ever appeared in which there was any hint of opposition to space flight. I mean, on principle. Until such time as the opposition did develop.

And so you are entitled to ask how is it possible that an eighteen year old boy, very unsophisticated and naive, who literally and honestly was dubious as to whether there was anyplace outside Brooklyn. How it was possible that he could see something clearly that older and thicker heads failed to see?

And it goes against the grain to have to explain this to you because I would much prefer to have you think I was very smart, and had some kind of key to the wisdom of the universe. I mean, that is a great thing to be able to impress you with. But instead I am going to have to tell you the truth, and you are going to see how disgustingly simple the whole thing was.

I was going to Columbia University at the time, and as I do not need to tell any of you here, the tuition rates were something appalling. I mean, as I recall it was three hundred and sixty five dollars a semester.

And I could not afford it. And so I looked about for all kinds of things to do in order to eke out the tuition. And one of the things I did was to join the NYA, National Youth Administration, which was a kind of relief for deserving students. They gave you little insecure jobs, and paid you the munificent sum of fifteen dollars a month. And this enabled you to get through your tuition.

And the job I got was to serve as a kind of secretary to a sociologist who was preparing a book entitled: "The Social Resistance to Technological Change." And what I was supposed to do was as follows: I had to go to the library with a list of references from him, and ask for the books. Turn to the pages where I was to find the reference, copy them out longhand ... because this was the days before Xerox. Luckily too, otherwise I would have starved. Copied them out

longhand, took them home, and typed them up. Now, it was impossible for me to copy them out and type them up without reading them.

As a result, I read perhaps ninety percent of the book. Because you must understand how learned books are written in case you ever want to write a learned book. First thing you do is get a thousand references, chosen at random, you then put them into the book, in the order you reach them, and stick two or three lines of your own between each of them to act as mortar, and you are all set.

Well, when I read all of these references I discovered, to my amazement, that all through history there had been resistance, and bitter, exaggerated, last ditch resistance to every significant technological change that had taken place on Earth. Usually the resistance came from those groups who stood to lose influence, status, money, as a result of the change. Although they never advanced this as their reason for resisting it. It was always the good of humanity that rested upon their hearts.

For instance, when the stage coaches came into England, the canal owners objected. Not that they would lose money, although they would, but they feared for humanity. Because as the stagecoaches tore along at fifteen miles an hour, the air whipping past the nostrils of the people on board, would by Bernoulli's Principle, suck all the air out of the lungs.

You know, when I tell this story to a non-engineering audience I cannot mention Bernoulli's Principle, which is what gives it that real taste.

Well naturally the stage coach people laughed heartily, and all they had to do was run a stage coach at fifteen miles an hour with people inside and show them there is no harm. But they memorized the argument ... for when the railroads came in.

Well then, reading all this, and this was over a period of months ... I read it, and read it ... I said to myself: "Hey, you know I can make a syllogism out of this" because I had taken up liberal arts and the humanities, and they taught me about syllogisms.

I do not know if you guys know about syllogisms. It is ... the units of a syllogism is one Aristotle.

Well, see, that is ... to put it in engineering terms: One Aristotle per second is a fast syllogism.

It goes this way: Major premise: All technological changes meet resistance. Minor Premise: Space travel represents a technological change. Conclusion: This is the tricky one: There will be resistance to space travel!

And I said "Gee!" And I wrote the story and sold it. My first story, it is astounding, and they printed it. And here I am, a genius at having foreseen this.

But now, the question is, if it is that simple you can understand how a dumb kid of eighteen could think of it. The question now arises, how was it all that everyone else did not see it?

And this leads us to the conclusion which you could also have gotten from my adventures in getting to Newark. Which is this: People are stupid. We would not be in the mess we are in if that were not so. Because believe me, we are in a mess. Now, it is not very difficult to see that we are in a mess, or even to see years ago that we were in a mess.

Let me tell you about a story I read in back in 1933. There is a gentleman here who has a copy of "Before the Golden Age" in which I tell this story. I trust that gentleman will not listen.

In 1933, I read a story called "The Man Who Awoke" by Lawrence Manning. In it, did the hero wish to see what the world of the future would be like, and he was not in the kind of science fiction story where he would have a time machine, so he had to do something else. What

he did was to invent a potion, which when he drank it, put him to sleep for five thousand years, and then woke him up a little hoarse, but otherwise OK.

Now when I was young, I was only thirteen at the time, I read that and it seemed perfectly good. But now, you see, these days I apply engineering principles to something like that. I say to myself: "Gee, a potion that puts you to sleep for five thousand years and then wakes you up unharmed. How do you test it?"

I figured it out how, it's all right, there is a way. You give a smaller amount to a dog, and wait five thousand years.

Anyway, he found himself a vault in which he would lie undisturbed for five thousand years.

Gee, the Great Pyramid at Giza did not suffice to keep Cheops undisturbed for maybe five hundred years, let alone five thousand, but that is all right. Nobody is looking for this guy.

And he stayed there five thousand years, and then woke up unharmed. Oh, give or take a few months; I mean, you know, you can not be too exact on a thing like this. And he somehow thought that he was going to come out and see a very futuristic world with all kinds of extremely super modernistic devices flying through the air, and magical food pills and all that. And instead, what did he find? He found a very constricted world. A world in which everybody lived rather ... rather not very lavish lives. You know, they dressed in homespun, and they walked everywhere, and they worried a lot about what the next meal would be. And so he said to them "What is this?" he says. "You guys are leading such constricted lives. What is all this futurism I expected?" So they said: "Oh well, you do not understand." He said: "We are short on energy. Very short on energy because some thousands of years ago there was a generation or two of human beings who burnt up all the coal and oil on Earth, and left nothing for us." And our hero said "Strange you should say that." He said: "I happen to be from the very generation that did this for you!"

And so they tried to lynch him, naturally.

And he got back to the vault just in time, slammed the door, and took another potion to see if anything new happened five thousand years later still.

That was the first of five stories, but that was the one I always remembered because, you know ... they always say ... used to say when I was a kid that science fiction was escape literature. They sneered at us. I mean, here are a bunch of rotten kids, usually with pimples on their faces. And with big glasses; especially those big glasses. And also they were snooty kids too smart for their own good. Always going around getting high marks in class.

I mean in every possible way, not decent kids.

And here were a whole world of decent kids worried about the important things in life like baseball scores. And matching cards, or whatever the heck they did. And playing hooky from school. Real things. And here are these guys reading science fiction to escape from reality. To escape from this world. Literally get out there. And stupid things like the Moon, and missiles, population problems, and all sorts of things like that. And, for instance, the possibility that the coal and oil might vanish.

Heck, when I read that when I was thirteen, I started thinking. I did not think in syllogisms then, but I now realize as I look back on it, that it amounted to a syllogism.

Major premise: The Earth's volume is finite. Minor Premise: The total volume of coal and oil on the Earth is less than the total volume of the Earth. Conclusion: The volume of coal and oil are finite.

You would think that this was so obvious! Now, let us start and make this conclusion the

major premise of the next syllogism:

Major Premise: The volume of coal and oil are finite. Minor Premise: We are burning some every day. Conclusion: We will use it all up eventually.

Well, I got that in 1933. And so you see how science fiction helps you escape. It helps you escape to the kinds of problems that will keep you worried for forty years.

Before the rest of you guys!

Well, here we are. We have just come through a thirty year period of mankind's maximum prosperity, on the whole. We have done very well since World War II. We have ... the world as a whole has eaten better, has lived better, has had a higher standard of living than it has ever had before. Now, you might tell me that through this entire thirty years there have been millions ... hundreds of millions of people always hungry, always starving, with very little, and I shall say yes; it has been rotten. My point is that before now, it has always been rottener. And we have not really appreciated how temporary this is.

For one thing, we have had ample supplies of food, and part of the reason for that was that we have had an extremely good spell of weather for the last thirty years. In fact, there are some people who say that this last thirty years was the best thirty year spell of weather that we have had in the last thousand years. Now you may remember cold spells, and floods, and droughts, and all the rest of this stuff. But there has been less of it the world over than usual. In addition, just as we have had this good weather, we have also been applying energy at a far greater rate than ever before to farm machinery, to irrigation machinery. In addition, we have been using insecticides and pesticides of various sorts, to sort of clobber those little beasties and those weeds who think they are going to get some of our food. And in addition to that we have also developed new strains of grain, so called "green revolution," that grow a lot of protein very fast. And what with all these things put together, our food supply has been going up.

But now, look what happens.

The very thing that makes it possible for us to use more and more energy is our industrial technologized world. And another thing that our industry produces is dust. And the air is dustier now than it has ever been before in human history. Except perhaps very temporarily after a large volcanic eruption.

This means that the Earth's albedo, the percentage of light from the sun that it reflects back into space before it hits the ground, has been going up slightly because dusty air reflects more light than clear air does. And ... well, not very much more, but enough. It has been making the temperature of the Earth drop since 1940. It has been going down steadily. Again, not very much. You are probably not aware that the summers are cold, or that the winters are extraordinarily icy, they are not. The drop in temperature may be one degree. But it is enough to cut down on the growing season in the northern climates. It makes the weather a little bit worse. It sends the storm tracts further south, so that the Sahara Desert creeps southward, so that the monsoon rains in India fail a little bit. Just enough so that the harvests are not as good as they used to be, and the Earth's reserve supply of food sinks to its lowest in recent history.

And just as this is happening; and it is going to continue happening because the air is not going to get un-dusty unless we stop our industrial activity. And if we stop our industrial activity, that is going to be because we have suffered some complete disaster.

So, the weather is not going to turn better. The air is going to stay dusty, and it is going to continue getting a little colder. And at the same time, it is getting hard to get energy. Energy is much more expensive than it used to be; oil prices are up. And that means that fertilizer is more expensive than it used to be. And it turns out that the green revolution depends on strains

of grain that require ... yes, they do what they are supposed to do ... but they require a lot of irrigation; a lot of water, and a lot of fertilizer. And the fertilizer is not there. And the irrigation machinery is hard to run now with expensive oil. And, of course, the pesticides are produced in high energy chemical factories; their price goes up. Everything is combining to cut down on the food supply. And to arrange it so that in years to come, we may have trouble keeping our present level of food, let alone increasing it.

Of course you might say: "Well, heck! Mankind got along thirty years ago, before the good weather spell came, when there were droughts in the Midwest, and dust bowls, and when there was comparatively much less farm machinery in use, and irrigation machinery, and there was no green revolution, and we were not using pesticides ... except Paris Green and other tasty things like that. And when we were not worrying, we were not worrying about all the other means of improving the food supply either, so we shall go back to what it was then, and we shall live the simple life."

There are always people who think that all we have to do, after all is abandoned, all this foolish technology that we have made ourselves slave to, and go back like our ancestors and live close to the soil with the good things of nature. That would be great if we could do it. If we could go back to the way it was before World War II, technologically, we could support all the people that lived on Earth before World War II. The catch is that in these last thirty years one billion and a half people have been added to the population of the Earth. And we have been feeding them largely because of all these things that we have done in these last thirty years, the good weather, the fertilizers, and the pesticides, and the irrigation, and the green revolution, and all the rest of it. If we abandon that, we also have to abandon a billion and a half people; and there are going to be very few volunteers for the job.

Alas, this goes in general. We are in a situation where we cannot go back. We cannot abandon technology. We can not say "Well, heck! We shall go back to the good old fireplace with wooden logs! We do not need this damned central heating!" There are two things about the fireplace with those good old natural wooden logs. In the first place, it is a rotten system for heating the house, which is why everyone switched to first the coal furnace, and then the oil furnace. They did not do that because they hated nature. They did not do that because they turned their backs on things that were nice, and just wanted filthy modern stuff, no.

The wood fire does not work! That is what it does not!

And in the second thing, if all of us decide to have wood fires the way our pioneering ancestors did, we should better remember that there were maybe three million of our pioneering ancestors, and there are two hundred million of us. And there ain't enough wood. And the price will go up instantly. And there will be a black market. And the forests will be destroyed.

And the same will be if you substitute for electric lights, candles. There is something very romantic about studying by candle light unless you try it.

And if you think studying by candlelight is bad, wait until you try to run a television set by candle light.

Well then, what are we going to do in the future? Population is still going up. Population right now is higher than it has ever been in the world's history; it stands at just under four billion. And the increase, the rate of increase is higher than it has ever been in world history; two percent a year. Never been anywhere near that high. Right now, the world's population is going up by two hundred thousand hungry mouths every day. By the year 2000, barring catastrophe, the Earth's population is going to be seven billion. Nobody thinks the Earth's food supply is going to nearly double by the year 2000. It may be that our food supply won't go up much at all. There is

going to be terrific amounts of famine. What can we do about it?

Well, throughout the history of life on Earth, there have been periods where a given species has, for one reason or another, spurted its numbers upward temporarily. There has been a surprisingly good supply of food, the weather has been just right, somehow there have been no predators ... something has happened, and the numbers went up. They always went down again, and always the same way; by an increase in the death rate. The large numbers of the species starved when the food ran short. They fell victim to some disease, when as a result of being on short rations they were weaker. They made good marks for predators. It always went down. And the same thing will happen to mankind, we do not have to worry. The death rate will go up, and we will die off through violence, through disease, through famine.

The only thing is, must we have our numbers controlled in the same way that all other species have them controlled? We have something others do not; we have brains. We can foresee. We can plan. We can see solutions that are humane. And there is a solution that is humane, and that is to lower the birth rate.

No species in the history of the Earth has ever voluntarily lowered its birth rate in order to control its population, because they did not know what birth rate was, how to control it, that there was a population problem. We are the only species in the history of the Earth.

There is no need to decide whether to stop the population increase or not. There is no need to decide whether the population will be lowered or not. It will, it will!

The only thing mankind has to decide is whether to let it be done in the old inhumane method that nature has always used, or to invent a new humane method of our own. That is the only choice that faces us; whether to lower the population catastrophically by a raised death rate, or to lower it humanely by a lowered birth rate. And we all make the choice. And I have a suspicion that we won't make the right choice, which is the tragedy of humanity right now.

But supposing we do? Supposing we imagine that we have entered the 21st century, and that we have survived? Then the question is: what kind of a world will we have survived into? What will the 21st century world be? If we survive, if there is a civilization, if there is a technology.

Well, in the first place it is going to be a low birth rate world. It will have to be; that is the conditions of survival. It will have to be a very low birth rate world, because the population will be too high at the beginning of the 21st century, and it may take a century to lower the population to some reasonable value.

So, that throughout the century, the birth rate will have to be lower than the death rate; and the death rate, we hope, will be low. So that babies will be comparatively rare, mothers will be never multiple mothers very much. I imagine that it will be the kind of world where every woman will be expected to have no more than two children. If she has only one child, good. And if she has no children, fine.

I mean, people think of that, instantly they think of race suicide. "Oh my goodness! We are all going to vanish!" We will have billions of people on Earth, more than we have ever had prior to this century! And through all of history before, we have had lower populations. No one worried that we would vanish from the Earth! And besides, if it looked as though we were going to vanish from the Earth, all that has to happen is the word goes out: have babies. And you would be surprised how fast we can make it up.

Do you know that through all of the disasters in history, that only one disaster as far as we know has ever actually lowered the world's population? The Black Death in the 1300's. Which may have killed off one third of all humanity. Lowered the world population, and took it

a century to make it up.

Those were the days when death rates were very high; of course it would take a century to make it up. Nowadays we can make it up in maybe twenty years.

And since then, the disasters that have come: World War I, World War II, the Influenza pandemic of 1918 ... have not even made a wiggle in the rise of human population.

So we have great powers of increasing like rabbits. We need not worry if we allow the population to drop. God, how easily we could reverse that if we had to.

But, there are other things to remember. If we do have a very low birth rate, then what are we going to do with women?

Throughout history, the purpose and function of womankind has been to have lots of children. Now, no sane woman, if she came upon this whole thing cold, would want a lot of children; they are a lot of trouble, and they are dangerous to the health.

Seriously! When the germ theory finally came in and people learned how to arrange it so that women could have babies in reasonable safety, the world discovered to their surprise that women had a longer life expectancy than men. This had never been understood before, because throughout history women had, on the average, lived years and years less than men had. With all the dangers men faced, the hard work in the fields, the hunting accidents, the killings in war, everything else, women died faster for one reason and one reason only: childbirth. Every woman had one baby after another until one of them killed her. Usually, it did not take long.

Well then, why do women do this? Because they are carefully told that being a wife and mother is the most glorious thing in the world, the one thing they are fit for, the most noble activity they can possibly have, and ... and this is told to them until they believe it. And if they do not believe it, there is a lot of trouble made for them.

Well, I won't go into the whole thing. I suspect that you women know all about this already, and you men would rather not listen.

But notice the difference: once you want women not to have children, you are going to have to give them something else to do! It is absolutely impossible to tell a woman that she can not have children, and at the same time that she cannot do anything else either except maybe wash an occasional dish.

Because if you tell a woman that, she will figure out some way to have a baby.

I think I know the way, too!

Well then, in the world of the 21st century in order to keep the birth rate down, we are going to have to give women interesting things to do that will make them glad to stay out of the nursery. And the interesting things that I can think of that we give women to do are essentially the same as the interesting things that we give men to do. I mean we are going to have women help in running the government, and science, and industry; whatever there is to run in the 21st century. And what it amounts to is we are going to have to pretend ... when I say "we," I mean men ... we are going to have to pretend that women are people.

And you know, pretending is a good thing because if you pretend long enough, you will forget you are pretending and you will begin to believe it.

In short, the 21st century, if we survive, will be a kind of women's lib world. And as a matter of fact, it will be a kind of people's lib world because, you know, sexism works bad both ways. If the women have some role which they must constantly fulfill whether they like it or not, men have some role which they would have to constantly fulfill whether they like it or not. And if you fix it so that women can do what suits them best, you can fix it so that men can do what suits them best too. And we shall have a world of people. And only incidentally will they

be of opposite sexes instead of in every aspect of their life.

And then, here is another thing that you will find in such a world: you will have to find age blindness too, in addition to sex blindness.

You have to understand that throughout history, mankind has lived in a world of youth. You know, we talk about the youth centeredness of our culture. There is nothing else it can be. Throughout history, the life expectancy has been somewhere between twenty five and thirty five, depending upon the time and the place. Very few people have lived into middle age and beyond. Very few. We have had a world of young, even today in those lands where the birth rate is higher ... considerably higher ... than the death rate. You have places where half the people are younger than fifteen.

Well naturally, where most of the people are young, you concentrate on the young! When there are very few old people, you do not worry about them very much. They come in handy in their small numbers. The old men were the repositories of tradition. In the days before we had written records ... let alone electronic records and computers ... the only people who remembered the way it used to be a long time ago ... forty years ago ... were old men with gray beards! So you respected them! They represented wisdom! And you let them rule the state and the church. The word "priest" comes from the Greek word for "old," and the word "senator" comes from the Latin word for "old" ... as you can tell by the relationship to "senna" which also comes.

And of course, the old women were feared. There were fewer old women than there were old men, because the only way a woman could become an old woman was to either have no children, or be extraordinarily lucky. Usually the former. And old women somehow suffered a great deal more than old men did because they lacked that magnificent sign of age: the beard.

Think about it! An old man had a long gray beard that covered up his entire face; it is like looking at some kind of thicket.

A woman, however, had a bare face so that you could see the wrinkles! Which ordinary people hardly ever saw because there were hardly ever any old people to have wrinkles. Not only that, people generally lost their teeth by the time they were forty because there was no such thing as dentistry. So that, the old women had gums that came together, and it brought the chin and the nose close together, which looked funny. In fact, if you will look at the caricature of "the Witch" as we see it now on Halloween, it is just an old woman without teeth, and with a wrinkled face. And I think a great many of the fears of witches really represented the fears of the strange appearance of old women, which of course nowadays we do not have because old women look young.

But what do you do in a society in which the number of old people increases? You have a lot of old people just when you do not need them anymore. We do not need them as repositories of tradition anymore. We have got everything in writing, and in documents. And we are getting more, and more, and more old people all the time. The life expectancy now is seventy now in the United States; people never die for goodness sakes! I mean, it is one of the reasons why there is a generation gap; all the old people hang on to the jobs until they are forcibly retired. And then they must be forcibly retired. And there is nothing else you can think of doing for them so you give them a watch, and a pat on the back, and a ticket to a park bench.

Now in the world of the 21st century, it is going to get worse and worse. There are going to be few young, and there is going to be even a more extended life span perhaps, so that old people beget more and more. What are we going to do with them?

We know what we think of old people. They are sort of drags. They are sort of dead

heads. They do not have bright thoughts the way young people do. They are not creative. They are not ingenious. They are not daring. They are sort of stick-in-the-mud. Conservative. Stodgy. I mean, they ain't with it.

Well, if we are going to have more old people, and we are going to avoid dying of over-population, we are going to die of old age! And we are not going to die with a bang; we are going to die with a whimper.

Well you know, that may not be so. Let me point out that our youth-centered culture is youth-centered particularly in one important way: education. For years, and centuries, and millennia, it has always been assumed that education is the prerogative of the very young. That there is such a thing as finishing your education.

As a matter of fact, young kids are not stupid. Young kids go to school, and they see that old people do not. Now, going to school is a drag. And every child realizes that when he grows up, one of the rewards of growing up, of making it, is going to be ... not to go to school.

School is the price of being young and helpless! Not going to school is the reward of being grown up, and strong, and powerful. You associate school with weakness and childishness. You associate non school with strength and adulthood. Every kid knows that he is going to be rewarded for reaching the age of sixteen, or whatever age he is allowed to get out, he is going to be rewarded by never having to go to school again, never having to open up another book, never having to learn another fact, never having to think another thought. We teach kids that to be grown up is to be able to be stupid for the rest of your life.

All right, you take a person who has quit school at sixteen. Who has been taught that he never has to think again. And he lives on for another thirty years complete with whatever he can remember that he was taught in grade school thirty years before, and nothing else. And then you say: "Well here is a guy with no new thoughts. Here is a guy without any creative ideas. Here is a guy who is just a dead head." And that is the way old people are.

That is the way you make old people be. And then you use as an excuse for making old people like that the fact that you think that is the way they are. It is called arguing in a circle. We won't be able to do that anymore. In the 21st century, we are going to have to think of education not as a task to be completed, but as a process to be continued.

The one thing that really separates the human species from all other species of plants or animals, is that we can learn with far greater facility than any other species can. Now, whatever it is that a species can do well, it enjoys doing! There is no question but that a bird must enjoy flying. That a fish must enjoy swimming. I mean, our great philosophers say that in their songs, you know? Fish gotta swim, birds gotta fly!

Well men have to learn the process, which is something we are adapted for, is pleasurable; unless the pleasure is beaten out of us in childhood, very carefully and very doggedly! Give mankind half a chance! And learning is a delightful process that he will do all his lifelong! In fact people do do it. Even those who are most dead set against book learning will learn things that they like; the best way to bowl, the latest baseball scores, who knows what! What they want to learn, they learn with great facility.

And the thing is in the 21st century, if we survive, we can imagine that our technological society will advance even further. There will be even more computerization and automation. The dull work of the world will be done by machines. Men and women themselves will be able to do the kind of work they want to do. Undoubtedly, some of them will want to be research scientists, or symphony conductors, or they will want to be great artists, or writers, who knows? There will be enough people who will want to be that, and there will be people who will want to

learn how to bowl perfectly, or how to collect leaves, or how to build battleships out of toothpicks. What is the difference? Whatever it is you do that makes you happy, and adds to the joyousness of the world, is justified. And there will be room for everything. And in an extended life span, if say when you are forty, you decide to start all over again and study Greek, and become a big expert in Greek literature, who is to stop you? I foresee a 21st century in which the educational process will be organized so that every human being has a right to institutional help for education in any field he wishes, in any direction he wishes, at any age he wishes. Education and learning will be the name of the game.

And when that happens, I am sure it will be surprising how completely useful people can be throughout their lives, until actual physical senility hits.

And I think this will be a great life. It will be a world without racism too. It will have to be, or it won't survive for the simple reason that the only way we are going to apply a lower birth rate, is to apply it all over the world in a fair and non selective manner. It is the only way it will work. As it is, one of the problems we have, and perhaps the most intransigent, is there are sections of the Earth, sections of the world's population, who strongly suspects that when people like myself talk strenuously about population control and lowering the birth rate, that what we really have in mind is getting some of the people that we secretly think are not the best in the world, to lower their birth rates. Reduce their numbers. Get rid of them altogether, perhaps, then the rest of us can have a better time on this Earth. Maybe even there are some people who really think this way. But as long as this feeling exists, it is going to be very difficult to get people to lower their birth rates. And I suppose if we can somehow succeed in convincing the world generally that nobody hates anybody, and that there is room on Earth for all kinds of people, then it will succeed. And in a world like that, you see, everyone is going to have to pretend they are not racist. And if they pretended long enough, they may get to believe it. And the world will be much better off for that reason.

You know, we can talk sometimes about managing our own evolution. About cloning people. About deciding how with genetic engineering we are going to improve ourselves. But how do we improve ourselves? We do not know. We have improved domestic animals a great way. We have got cows that give milk by the hundreds of gallons. We have got sheep that are wool ... all the way through.

We have got turkeys that are all breast.

And horses that can run like the wind.

But you see, these things are all things that please us. We do not have to ask them what pleases them! But when it comes to human beings, when we are going to change ourselves, we have to ask what pleases us! And we do not really know.

Now I suppose lots of people are going to supposing you could arrange everybody so that they all have certain characteristics, what would you want them to have? So ... we want everyone should be geniuses. Well, I have got some personal knowledge of geniuses, and let me tell you one in a long while is all you can stand.

I mean, I personally do not want anyone around me who is a genius; I can just barely stand myself.

Or we want everyone who is sort of a deep thinker, everyone who is sort of sensitive, and kind, and humane ... naah! Any race, any set of human beings that are all alike are not only dull, but useless, really.

I was asked a few days ago ... really was, I am not making this up ... whether I did not think an intellectual elite ought to run the world. And I said, by an intellectual elite, you mean

people like me? Because I did not know what he meant by an intellectual elite. I thought maybe it might mean people like him, in which case, no!

And he said: "Yes, people like you." And I said no, that would be no good because I am only smart in certain ways, and very stupid in other ways. And if everybody was like me, and we were running the world, we would all be smart in the same way, and all be stupid in the same way, and it is the stupidity that is going to kill us. I said, what we need are people of all kinds running the world! Some of whom are smart in one way, and some of whom are smart in the other way, and with everyone's smartness in different directions, so that they can sort of cancel out; so that everybody's stupidity can be caught by someone else's smartness in the same direction.

In the same way, that is what we want. The greatest ... the greatest gift that mankind has is its vast gene pool. All the different genes it has. All the different characteristics; the smart and the stupid, the strong and the weak. Because it is the variety that makes it possible for us to meet different emergencies, and what is weak under one set of conditions might be strong under another, what is stupid at one time is smart at another, and so on. We cannot throw out anything for fear that that is exactly what we shall need someday.

The way I like to put it is, naturally we all think it is much better to be a brilliant nuclear physicist, than to just be a plumber. But, who would you rather live next door to, a brilliant nuclear physicist or a plumber? And unless you are married to one, think: how often would you wake up in the middle of the night badly needing a nuclear physicist?

Well then, I am coming now to the end of the 21st century. We have got a world without sexism, ageism, racism. We are not going to have a world without war, but that is nothing unusual. We have got a world without war now.

You do not think we have? Think about it. What kind of wars can we afford to fight? Two kinds. We can afford to fight a little war where you send bombs in envelopes, or stick some sticks of dynamite in an automobile in a busy place. There is no way of stopping that, and these days explosives are cheap. But what are you gonna win with a war like that? You can keep it up for a thousand years, and kill individuals, but you do not make any decisions that way. It is not really a war, you are just amusing yourself!

On the other kind of a war that we can fight is an all out nuclear war. It is cheap. It only takes half an hour.

And we have all the weapons we need. The capital investment has already been made. The only thing is that after the half hour is over, there is nothing left to do, and very few generals are going to be promoted in that half hour.

Which instantly kills it for the military.

Well then, can we fight the old fashioned fun war, where you and an enemy choose up sides, and you pick out a place, and you throw bombs at them, and they throw bombs at you for four or five years, and then you decide who wins and who loses, who pays the indemnity, and who does the helping.

Can not do that anymore, because nobody has got the gasoline for it. Except the Arabs. And they can not fight a war unless somebody gives them something to put the gasoline in.

So we are already in a world without war. The only thing is that what we need in the 21st century is a world that realizes it is a world without war.

And one more thing: If we have a world without racism, ageism, sexism, war ... it is gonna be a pretty dull world. Here we have lived all through history with a certain amount of excitement and risk in the world, and it is sort of a shame to sort of sit around this careful cold

world of the 21st century and thereafter, in which not only is everybody happy, but everyone is very cautious... Because, you know, we live by slogans. Immediately after World War II, our entire foreign policy was based on the slogan "No more Munich's." Until we got into the Vietnam War by shouting that, and now it is "No more Vietnams." And well, in the 21st century, I shall tell you the slogan right now. Those of you who will live into the 21st century, come put a wreath on my grave, because this will be the slogan: "No more 20th centuries."

So, everyone is going to be cautious in scientific advances. They are going to ask: "Before we do this, will it destroy the ozone layer? Before we do that is it going to make us too dependent on this or that? What are the side effects? How much cancer will it cause?" You know, that sort of thing. So that you will be moving very slow ... and you figure what kind of a world is that? You are going to sort of crawl yourself to death!

Well, in the 21st century we shall have to find a new horizon that is right there; out there. We shall go back to the Moon, only not this time to just get on it and come back. We are going to establish a colony there, and we are going to have a group of people on the Moon who will then be able to make long space flights because they are used to being cooped up and enclosed in an engineering environment subjected to low gravity. And they will work out other worlds in the solar system.

And then, you know, we can be as risky as we want. The whole thing ... we have always lived with risk, and that has been the great thing about life. The trouble is we have now reached the point where risk is risking everything! And you can not afford to risk everything. Until now in the world's history, whenever we have had a dark age, it has been temporary and local. And other parts of the world have been doing fine. And eventually, they help you get out of the dark age. We are now facing a possible dark age which is going to be world-wide and permanent! That is not fun. That is a different thing. But once we have established many worlds, we can do whatever we want as long as we do it one world at a time.

And out there beyond are the stars.

And the interesting thing is that if we can get through the next thirty years, there is no reason why we can not enter into a kind of plateau which will see the human race last, perhaps, indefinitely ... till it evolves into better things ... and spread out into space indefinitely. We have the choice here between nothing ... and the virtually infinite. And the nice thing about it is that you guys in the audience today, when I say guys I mean it in a general term embracing gals ... when you guys in the audience today will still be barely middle aged when you will know which choice has been made.

See, I have been so shrewd that I fixed it so that I was born in 1920.

Which means I shall be safely dead.

Before the crunch comes!

But you guys will see for yourself. I hope you see a world in which mankind has decided to be sane. But I must say in all honesty that I figure that the chances are against it.

Thank you.