

A presentation at the Humanity 3000 Symposium 2

Science and Technology: Looking Out 25 Generations

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The Foundation for the Future's **Humanity 3000** bi-decadal **Future of Humanity Symposia** provide for continuous review, assessment, and restatement of issues identified during the previous five years as likely to have a significant impact on the long-term future of humanity. Participants identify and discuss critical issues based on this framework and in view of changes in subject areas that have been identified as central to the study of the future.

Symposium 2 was held in October 6-8, 2005 in Bellevue, Washington. For more information:

http://futurefoundation.org/programs/hum_sym2.htm This is Joe's presentation at the symposium:

I talked with Sesh about what I should talk about at this symposium. He said that the future would be interesting and he thought that maybe 25 generations into the future would be a good starting point. That's about 625 years, if you consider 25 years to a generation.

Some of you would automatically move to the conclusion: What kind of nonsense is that, to talk out 25 generations? It's important to understand how that process of thinking out 25 generations or 50 generations or any other number of generations can be an intellectually respectable thing.

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You can say things that are credible; you can say things that are worth thinking about; you can draw conclusions that are interesting and perhaps even useful. In order to do that, you have to identify some kind of continuity between today and that 600-year future.

I use three threads that have a long, long history in humanity's experience, and that are almost sure to be durable over that 600-year period.

The first of these threads is science and technology, which is the single most highly reliable source of new developments that affect our lives personally, institutionally, organizationally, globally, or in whatever dimension you want. The second thread running through all of that is governance, or, if you like a slightly more heavy-sounding phrase, social control. We have a universal human history of social control, of the mechanisms that keep us in

line to do things that are collectively acceptable and desirable. And then the third thing, of course, is people ourselves, since that's what we're talking about. With those three threads running through the discussion and binding it all together and making it, I hope, intelligent, let me just talk about a pastiche of areas of development in 625 years.

For one thing, the 3500 human diseases and disorders that now plague us will all basically be history by then. There will be only about 85 or so of those genetically based diseases that will still be around, and those will be among the old-style people. No matter what we do in society, there are going to be some people who love the past and love to live in it, and who will reject whatever that future present will be, so there will still be some genetic stuff going on with them that's undesirable and regrettable.

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Germline remedies will be commonplace. All couples who are planning to be childbearing must be tested for germline disorders and have them dealt with. As I see it, the failure to conform to that may lead to serious penalties, like deprivation of half a year's income, whatever that income form may be 600 years from now.

A third major development, of course, will be the use of genetics for human enhancement. Remember, everything that relieves a disease or disorder carries with it the germ of improving

whatever it has already remedied. For example, astronauts have, not 10/10 vision, but substantially better; 15/10 I think is what they typically have.

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Why can't we all have that enhanced physiological capability? In the future, many of us will, but it will come in all areas. Human enhancement is going to be an unfolding development. By the time 600 years have gone by, 15 generations, we will begin to see the emergence of significant new variations among people. Not species. Speciation will take much longer than that. But we'll be able to see newly based varieties. We already have varieties: the short, squat Eskimos; the tall, thin, very narrow-framed East Africans; the blond Nordics with pale skin; the Mediterraneans; and so forth. Those are all human variations. That barnyard model of variation will apply in the future, except that we will have people deciding by their own choice what they want to emphasize. And as those choices begin to shape up, they will form associations, organizations, mechanisms for living together and sharing experience. So, I see the barnyard model in 15 generations having some very interesting effects in varieties.

I'm not sure whether we now think in terms of Howard Gardner's different intelligences - I think it's 11 different intelligences - but we're surely going to have some of that variation coming along by emphasizing different intellectual gifts: a gift for music, a gift for cognitive thinking, a gift for geometric thinking, a gift for rapport with nature, and so on.

I also see that by that time we'll be at the 600th anniversary of enhanced Olympics—of course, done under medical supervision. And those enhanced Olympics will be, as is always the case, counterpointed by the Olympics *au natural*. About 3 percent of the main Olympics will feature people of the old school who are in no way enhanced.

Life extension? Of course, the set point of our lives will be shifted. The set point, as you know, currently is somewhere around 90, with a Gaussian distribution of those who biologically are going to die younger and those dying older. We'll move it up by then, to about 105. I think we won't go further,

because in the intervening 600 years, the move up to longevities of 130 or so may not have worked out, especially if the geriatric zone becomes, instead of today's 10 years, 40 years. That would be unacceptable.

Now, think about that. That's just one model of how extended age might work.

Cloning of people will, of course, be routine. I anticipate a limit of one clone per base person. And I anticipate that there will be no cloning of clones allowed. Third, families would be limited to two clones to keep all of this under control. Finally, the total number of clones 600 years from now will be somewhere between 1 percent and 6 percent of the population, depending on the part of the world that you're in.

Brain science will have its effects by then. I like to use a very vulgar (that is, common, ordinary) terminology. "Brain technology" will be like automotive technology: fix it, repair it, replace it, modify it, change it, build it, rebuild it, and so on.

That's going to go on with everything above the neck.

You who have never laughed at a joke in your lives will have that defect worked out of you. You who have a short fuse and blow up at nothing, that's a curse and a mental defect that will be dealt with. There will be nothing in our cognitive/personality/emotional makeup that will not be re-doable.

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Remember, since we'll have so much knowledge relating genetics to mental makeup, all of that will, as I already mentioned, lead to enhancement and improvements of a fundamental and genetic nature. Schizophrenia, psychotic depression, and other severe insanities will virtually have disappeared, except for the tiny number among the old-style folks, about 6 million of them around the world who have chosen to live in the old-style way.

Still unresolved, however, even after 600 years, will be the question of the puzzle of consciousness. Can we figure out what that is and make that scientifically clear and manipulable?

Let me turn to another side of the world that lies ahead of us, and that's energy.

I see two developments that historically, in that 600-year period, will drive change. The first of these is the epidemic in 2011 in which about a 20 percent death rate leads to 600 million people dying in India, China, and Indonesia, and about 104 million in North America and Europe. The result is a labor shortage, and the result of that labor shortage is an economic boom. Now, one effect of that will be the realization by the population at large, as well as by the social leaders, that the smaller population has a great benefit over the larger population. That will initiate a general global policy of reducing global population, so by 2300 the world population is down to 4.2 billion, and by the time we reach 2625 we're down to 3.8 billion.

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The second big development affecting energy is greenhouse warming. What will be well known at that time is that as poor people acquire more money and more resources, their energy consumption goes up. But that doesn't continue forever. As the energy consumption reaches a certain level, the new increment in income does not call for a comparable or parallel increase in energy consumption. In other words, you have a curve that comes up with prosperity and then begins to level off. The international objective will be to not deprive people of the opportunity to rise up in income, but to reduce that asymptote so that we could have everything we want while energy consumption goes down. This will be based on massive conservation of energy: a drop in manufacturing costs in terms of energy by 50 percent, home-building and structural consumptions by 70 percent, and transportation by 60 percent.

The other side of the greenhouse warming will be dealing with the questions of the sources of energy and fuel. The four main ones—oil, natural gas, then natural gas in the form of methane hydrates, along with coal and tarsands—gradually will have undergone reduction. That reduction will finally level out.

Over the next 600 years, we will not have completely wiped out the use of these traditional, organic-based fuels. But, for example, coal will

become primarily the base for a chemical industry rather than for ordinary heating and cooling.

On a global scale, energy will become the responsibility of the World Energy Authority, a division of the World Governing Council, which itself, of course, will be the successor to the United Nations. As it stands 625 years from now, about 4 percent of our energy will still be based on the old fuels; about 40 percent, solar, both active and passive; 6 percent, geothermal; 7 percent, ocean thermal gradient; 34 percent, nuclear; 4 percent, tidal; and 5 percent from agriculture and waste. So, we will have come into an equilibrium, which, at 2625, will have been an equilibrium for well over 150 years.

Space is an interesting subject. I see that 625 years from now, an observatory has been operating for 400 years on the backside of the Moon and has been so important because of the ability to use it not only as an observatory but as a test bed for understanding how people can live in an oxygen-free environment: all the infrastructure requirements, the maintenance, the repair, and so on. Now, as that Moon observatory begins to be less and less important, we find that the base up there on the backside of the Moon becomes a launching pad for the 200-year round trip to an adjacent stellar system. It's anticipated that there will be about 1,000 people who will be aboard, and that they will spend, on average, 80 to 90 percent of their time estivating. And, incidentally, on the 200-year round trip there will probably be two or perhaps even three clone generations. The crew has to be so carefully selected for compatibility that the only sensible thing is to clone them all.

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Terraforming of Venus will begin as the early stages of a 10,000-year project, just to see whether it will work and what the difficulties are. Robots will still be probing outside the solar system, as they have been for 450 years, their primary function being to both test technology for long-distance travel, and, secondly, to assay hazards. Hazards are relatively poorly understood - or were poorly understood in our day. Finally, the anti-collision program is 375 years old and is currently conducting its sixth test run in space to intercept and either deviate an

object from its course or blast it apart with the same effect. These objects, of course, all simulate ones that might impact or sweep too close to the Earth.

Let me turn to a different subject, and that's global engineering. What I see happening with global engineering—which I define as a project so large that one government can rarely manage it, and, secondly, so important that the effects are all transborder—625 years from now, we will have about 30 icebergs per year being towed from Antarctica to arid zones. That has become a fairly routine activity. North Africa has been restored as it was back in ancient Rome to become, if not the granary of Rome, an important agricultural base for the world, particularly for those around the Mediterranean Sea. Just this very year, in 2625, we're moving into very serious planning of a long-term project of dropping the Mediterranean Ocean about 150 feet, building dams at each end, and using that to generate electricity, and, furthermore, to expand European farmland by several hundred square miles.

Weather control, of course, is absolutely universal, primarily focused on rain and snow. It's completely routine by 2625. And, among other things dealing with the question of energy consumption, one of the more interesting projects about to be launched to make nightlife easier and save consumption of electricity for illumination is to launch one of the first three artificial moons to light up the night sky. It's been estimated that three of them will give 90 percent of the population full vision to be able to maneuver almost anywhere.

Earthquake prevention is routine in six regions of the world. The general theme behind that is to conduct continual Richter 3 quakes in order to prevent a Richter 6 or 8. As a result, there's been no new quake in the San Francisco zone since 2044, and no significant quake in California since 2092. These projects are going on in all the major quake zones around the world.

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Let me pick up on a couple of scientific miscellanea. Ecology, about 400 years before 2625, had finally, on the basis of enormous data-gathering and data-processing capabilities, become

the scientific basis for ecological management of the globe. Today, ecology is essentially a qualitative science that provides incidental advice to the global management. But with the enormous databases capable of being collected around the world, it has moved, in 625 years, from an advisory role to a much more definitive role in environmental management. It's the core of all environmental activities.

It's rather interesting that a similar parallelism is going on in terms of organism cell structure, particularly that of mammals. It was early realized, around the turn of the 21st century, that cells have such complex structure that they, themselves, amount to having an internal ecology. It took some 150 years before the internal ecology of the cell was so understood that it could be managed in detail. That's been a main function in all our applications of biological enterprise to human health, to plants and microorganisms, and even to manufacturing.

The social sciences, again, have benefited enormously from massive data collection and processing, and have moved from being a questionable input into public-policy decision-making into a definitive science, able to shed significant light on almost any public-policy enterprise and any other large-scale enterprise before it's undertaken. Particularly it's been a great boon to the expansion of epidemiology as a fundamental factor in global management. It's also radically altered—and is now a routine part of—public participation and decision-making, augmented by all the electronic devices we have to bring to bear, and all the weighting, partitioning, and scoring systems that social sciences have developed.

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The one big disappointment for many people, by 2625, will be nano science. It will have been routinely integrated into materials and chemical activities; it will have led to all kinds of products and processes; it will be the mainstay of the general economy. But what will have completely failed are the early anticipations of molecular and atomic science devices being able to generate themselves into full macro-size devices, instruments, and organisms. Until today, nothing has been found

that will do that outside the area of animal and plant genetics.

That's a snapshot of where we could be going in the next 600 years, and some of the changes there. Let me recap that the three threads that run through this are, first, scientific developments. The thing I've left out, and which is essential to leave out, is anything smacking of science fiction.

Science fiction is, as far as I'm concerned, a total loser in thinking about the future, particularly when it gets to the organizational and personal consequences. Why is that? Insofar as it is science fiction and offers a counterfactual—something not true—as basic to its story, then anything else is open to occur. One counterfactual in a formal system allows anything else to be introduced, and so you have intellectual chaos.

The second thread running through this, of course, was governance, that is, the controls of society to keep us on an even keel and to keep us happy, contented, and more or less out of trouble. And then the third thread was people: what we will be like and how we will change.