CHAPTER 3. GLOBAL SCENARIOS

3.3 Very Long-Range Scenarios––1,000 Years

Study conducted in 1999–2000

Foreword

Most of the research in the book and this CD has a 25-year exploratory horizon and a 50-year normative horizon. The Millennium Project intends to keep these time frames for its work, but has undertaken a unique study to explore the factors that may affect the next thousand years and write scenarios based on their potential trajectories. The celebrations around the world at the dawn of the year 2000 stimulated some reflections on the past thousand years, but little on the next thousand years. This section is intended to be a contribution to stimulate our longer-term thinking. There is no pretense that one can come close to describing what actually will occur at the year 3000. Instead, the research is a challenging intellectual exercise that brings attention to those current factors that deserve our greater attention due to their potential impacts on our longer-term survival. A range of futurist thought about the value of such an exercise is documented in the Appendix.

Introduction

The scenarios in this section built on the previous Humanity 3000 Seminars of the Foundation for the Future (FFF) and the global network of the Millennium Project through a two-round questionnaire sent to a special panel selected by the Millennium Project Nodes and FFF. The study was conducted in 1999-2000.

The **first round** collected the panel's judgments about the importance, plausibility, and ability of policy and/or funding to affect a list of factors. The factors were drawn from the FFF's Humanity 3000 Seminar participants' statements and work of the Millennium Project. The results were presented at the second Humanity 3000 seminar.

The panel was also asked to describe the trajectory of these factors over the next 100, 500, and 1000 years with special attention to "unexpected" consequences. The panel's descriptions of the trajectories were then woven into six "millennium 3000" scenarios and fed back to the panel in the **second round** for comments.

The second round also collected the panel's judgments about improvements to the draft scenarios, and further assessments of the factors. The draft scenarios in round two were also published in *Futures* magazine inviting further feedback. The scenarios were redrafted and are presented in this section. Jerome C. Glenn is the principal author of scenarios 1,2, and 4. Theodore J. Gordon is the principal author of scenarios 3,5, and 6. Appendix C in this CD-ROM presents the full text of the questionnaires, results, including descriptions of trajectories of the factors over 100, 500, and 1000 year time frames, lists the panel members, and five additional scenarios suggested by panelists.

FACTORS THAT MAY AFFECT THE VERY LONG-RANGE FUTURE OF HUMANITY

What we think and do is the interplay of the past we believe and the future we expect. Expanding our future perceptions can alter what we believe about the future, and hence, affect what we think and do today. The Millennium 3000 panel is participating in a global interactive process that is educating individual panelists about the views of other leading future-oriented minds. It is rare for futurists to have the opportunity to think 1000 years ahead, and more rare to do so interactively among both strangers and colleagues around the world. It remains to be seen if this process will expand any futurist's mind, but, if so, then to the degree that those futurists influence how others think about the future, such an interactive process has its utility.

In that spirit, the Millennium Project welcomed the opportunity to increase and improve international collaboration on thinking about the factors that might influence the human condition over the next 1000 years.

The Millennium Project formed the "Millennium 3000 Panel" composed of participants in the Foundation For the Future's Humanity 3000 Seminar, plus others based on recommendations from the regional Nodes of the Millennium Project and other research institutes, and Internet searches and literature reviews.

In the **first round** of the Millennium Project's two-round study to assess the very long-range future, the Panel was asked their judgements about the importance, plausibility, "unexpected" consequences, and ability of policy and funding to affect the factors. They were also asked to very briefly describe the trajectories of these factors over the next 100, 500, and 1000 years.

The following scale was used to rate how plausible it is that the factor will influence the human condition 1000 years from today.

5 = Absolutely certain in the next 1000 years
4 = Almost certain
3 = Reasonably plausible
2 = Maybe
1 = Unlikely, almost impossible even on a 1000-year time scale

Assuming that the factor does occur, the Panel used the following scale to rate the importance of the factor's effect on the human condition 1000 years from today. An important factor is defined as deeply affecting the human condition as a whole.

5 = Of overwhelming importance
4 = Very important
3 = Important
2 = Modest importance
1 = Relatively unimportant or trivial

The following scale was used to rate the ability of human intervention such as policy and/or funding to affect that factor's trajectory:

5 = Has the potential to change the outcome of the factor entirely
4 = Could have a major effect
3 = Could have a significant effect
2 = Could have a minor effect
1 = No effect

The first round respondents' scoring of the factors was computed and resulted in an index computed as the product of probability, importance, and priority. The table below ranks the factors by this index. The number in parentheses next to each factor is the number of the factor as listed in Round 1.

The full text of the Panel's views on the factors' likely trajectories benchmarks of their development, and some possible unexpected or low probability consequences were used to write six scenarios in Section 3 of this chapter. The full text responses from the Millennium 3000 Panel on the trajectories of factors is included in Appendix C and can also be accessed on the project's Web site at www.stateofthefuture.org/millennium/m3000-rd1res.html

Very Long-range Factors	Probab.	Import	Priority	Index
Human-Environment Dynamics (3)	4.114	4.163	4.095	70.133
Human Genetics (11)	4.302	3.951	4.098	69.655
Safe Energy (4)	3.753	4.250	4.341	69.240
Nanotechnology (5)	4.311	3.814	3.930	64.618
Forms of Movement (6)	3.091	4.429	4.000	54.760
Increasing Intelligence (13)	3.667	4.024	3.548	52.354
Occurrence Climate Change (2)	3.761	3.977	3.444	51.514
Control Forces to Destroy Humanity(7)	2.891	4.341	3.788	47.539
Conscious Technology (12)	3.545	3.548	3.738	47.015
Collective Futures (9)	3.111	3.744	3.476	40.487
Avoid Climate Change (1)	2.844	4.163	3.233	38.277
Gender Relation (16)	3.444	3.520	3.088	37.435
Philosophy and Mental Maps (8)	3.000	3.538	3.308	35.111
Conscious Evolution (14)	2.974	3.556	3.222	34.074
Space migration (18)	3.093	2.977	3.651	33.618
Global Ethical System (10)	2.930	3.100	3.525	32.018
Extraterrestrial Contact (7)	2.359	3.876	2.811	25.702
Immortality (15)	2.643	2.825	2.825	21.093
Interspecies Communication (19)	2.425	2.744	3.051	20.302

The particular scenario topics were selected because they seemed to touch on most of the factors that had been deemed crucial and gave a stage on which important long-term developments could be explored.

During the scenario review process several questions important to our long-range future arose:

- Are human beings a transition species?
- Does greater human intelligence or machine-made intelligence make a better world for all?
- Can humanity and technology become an interconnected whole while maintaining each human's individuality?
- Would immorality in a godless world be hell?
- Can mind be downloaded to machine?
- Can genetic engineering make us behave better?
- Are spiritual values less powerful in changing the human condition than technology?
- Will artificial intelligence free us to evolve our minds or enslave or eliminate us?

The scenarios were redrafted and are presented below. J.C. Glenn was the principal author of scenarios 1, 2, and 4; T.J. Gordon was the principal author of scenarios 3, 5, and 6. Appendix C presents the full text of the questionnaires, results, including descriptions of trajectories of the factors over 100, 500, and 1000 year time frames, lists the panel members, and five additional scenarios suggested by panelists.

MILLENNIUM 3000 SCENARIOS

Scenario 1. Still Alive at 3000

Even though we understand how to work with the forces of nature, unlike our environmentally destructive past, we do not yet know how to provide human security for all. The integration of bio- and nanotechnology with artificial intelligence and our more enlightened worldviews provides the basis of life for 10 billion people on Earth and 50 billion in space. Although few would prefer to go back to the kinds of dangers we faced 40 generations or a thousand years ago, we still have major challenges ahead.

Civilization's complexity and the diverse lives within it render the old Information Age measures of income, intelligence, physical abilities, and social status meaningless in the year 3000. Although our lives on Earth and in space are by no means perfect, we have made it through cyber and biological wars, natural disasters, mass migrations, and new diseases that threatened to wipe out humanity a number of times over the past thousand years.

By the twenty-second century the greenhouse effect had leveled off. Nanotech reduced the per capita drain on the environment. Architectural design improved energy efficiencies. Vaporization of seawater by pressure techniques made abundant fresh water. Fossil fuels were replaced by a combination of space solar power and nuclear fusion on Earth and in space. Nearly 20% of energy also came from wind, ground-solar, and geothermal sources. Electromagnetic beams or super batteries transported most energy. These in turn have since been replaced by today's energy systems relying on the management of the structure of mass, made possible by scientific breakthroughs impossible for most to comprehend a millennium ago.

Although it was never quite clear whether technology proceeded faster than our ability to control it, we were unable to prevent the use of nanoweapons, genetic sabotage, and various forms of biological and information warfare. Ancient hatreds from unresolved conflicts occasionally burst forth with enough allies in a variety of powerful places to get advanced weapons to cause serious damage. Fortunately, foresight and technology assessments with species-wide feedback created enough counter measures that we are still alive today. Global codes of ethics with economic and military enforcement powers scrutinized by public cyber media probably deterred many dangers as well. However, the possibilities for new kinds of diseases from anomalies among natural mutations, artificial biology, and biological weapons leave us all a bit uneasy even today.

On the brighter side, inherited diseases of our ancestors no longer exist. They were eliminated by human genetic technology after several generations of research and contentious public debates in the early third millennium. Parents who wanted the best for their children in the early twenty-second century drove the next step of genetic engineering toward enhanced intelligence and other features.

The genes that influenced a range of brain functions were identified during the early twenty-first century. Low intelligence, like poor eyesight, was considered a genetic problem and was treated. Based on this success, many parents crossed borders to take their children to countries that

legalized intelligence enhancement, causing other countries to allow the practice—with an important addition. They added the requirement that genes influencing compassion and related behaviors be checked and coupled with the treatment. As a result, human ability to deal with complex and unexpected problems was greatly increased, as was our foresight, reaction time, and compassion.

The trade-offs between enhanced memory and the speed of learning are under continual review, since our abilities in both areas are constantly evolving. The efficiency and ethics of improved brain-computer interfaces verses genetic engineering to increase individual and collective intelligence have also been debated for centuries.

Ecological and fundamentalist religious groups who resisted genetic enhancement finally accepted the value of increased intelligence, health, and more ethical behavior made possible by relatively minor genetic modification and individually tailored foods. Unfortunately, they gave in too soon. Unforeseen new kinds of diseases and genetic weaknesses were added to the human gene line and passed on to later generations. Although cosmic rays have also been doing this throughout evolution, direct human intervention had broader and faster impacts, which seemed more menacing. Even more worrisome was genetic sabotage. Like computer viruses that polluted cyberspace, the spread of genetic errors polluted the human gene pool. This contributed to unanticipated speciation within our genus. Although international treaties on global ethics were ratified, constant vigilance was necessary to prevent the use of this technology to create slave cultures and bioweapons over the past thousand years. Fortunately, we can detect problems in vitro and prevent their propagation.

Biological intelligence, artificial intelligence, and network intelligence were increased or enhanced in parallel by constantly adding new heuristics to force the incorporation of wisdom and global ethics in all systems. In the pre-global brain era, few people had many chances to use their intelligence for humanitarian purposes. Today we are all so interconnected that the right use of intelligence is constantly questioned, making the ancient dialectic of wisdom and intelligence very much alive today. Waste of any sort - including of good ideas and human talent - has become recognized as a sin. If an idea was not accessed by the right person for the right reason at the right time to make an improvement, it was considered to be a waste, a kind of reality pollution.

Increasing human intelligence by education, training, and nutrition became significantly augmented by genetic engineering. Both individual human and collective intelligence had increased and become so interconnected with technology that it could no longer be measured as an individual capacity. Although individuals with individual perspectives still exist in the year 3000, as sort of an ongoing synthesis, the continual intensity of complex interactivities with so many people and artificial intelligences has blurred the distinction between the individual's capacity and the capacity of that person's environment. With so much to draw from among each individual's set of interactions, each person became more unique rather than similar. External protocols were in common, but a person's subjectivity became far more unique than our ancestors' of thousands of years ago. Each millennium, humanity has become a richer diversity of minds, while reinforcing much of the underlying spiritual commonality.

Most historians agree that global ethics would have evolved eventually as part of the processes of globalization, space migration, and environmental security efforts, but the fact remains that the rich-poor cyber biowars and then the series of earthquakes that destroyed several megacities in the mid-twenty-second century accelerated progress in global ethics by engendering unprecedented global compassion. At the same time, the number of trans-religious-philosophical dialogues increased rapidly. These dialogues were careful not to create a global theocracy, but to support the development of many new worldviews, which improved the climate of decisionmaking for better policy for improved human-environmental dynamics and addressing poverty.

All these developments created the conditions for protocols of civilization and inter-human standards, first enshrined in a variety of international treaties that provided the political stability that lead to the prosperity we enjoy today. Some governing systems were watershed-based. Others were market-oriented. Some are ad-hocracies of mutual intentions. The complexity of governance systems gave rise to a political ecology that still honors the old nation-states, international organizations, corporations, and NGOs for their important roles in the maintenance of civilization, much as the autonomic nervous system does for an individual. But just as the frontal lobe of the brain controls the anticipatory reasoning that makes change, the new political ecologies of individuals organized around shared intentions have become the creators of reality and are more interesting than the ethnic and national identities of the past. Indo-Chinese cultures still dominate much of contemporary style, however. Individuals participate in thousands of these "intentions" per day, creating new groups and leaving old ones all the time. The new political ecology combined the best of collective action and objectivity with individual freedom and subjectivity.

Perceptual barriers in cyberspace helped keep some potentially conflicting groups out of each other's way. This bought time for increased human interconnectivity to lessen differences in points of view, while also allowing for the emergence of philosophical tolerance among differing worldviews.

At the turn of the fourth millennium, the combination of genetic engineering and nanomedicine has achieved "functional immortality." People die only by accident or choice (often with religious ceremonies). The population of Earthkind has fluctuated between 9 and 11 billion for the past several centuries, while Spacekind's birth rate has exploded, resulting in 50 billion humans throughout the solar system. Those who die transfer their experience to new kinds of life forms. These artificial life forms were produced first in space habitats by mating self-replicating intelligent devices with artificial life created from unique gene sequences not found in nature. They were created to help maintain much of our infrastructure and a healthy relationship between artificial and natural environments both on Earth and in space.

New forms of social organization emerged as the result of being supported by these artificial life forms. Instead of human hierarchies and networks for accumulation of religious, ethnic, economic, and political power, individuals continually selected different combinations of people and technological capacities to follow their curiosity. The first were the series of Seatopias. These ocean habitats consumed vast amounts of carbon dioxide to grow coral for marine biotecture (biological architecture). They created symbiotic relationships with the environment

and helped restabilize terrestrial climate after global warming threatened to hit the runaway or "Venus" point of rapid temperature increase. World Wilderness Parks were also established during this period and remain intact today.

Nanotechnology had become as ubiquitous by the mid-third millennium as electricity had by the end of the second millennium. Today we are utterly dependent on picotechnology, which manipulates the atomic nucleus, and femtotechnology, which manipulates subatomic components. This knowledge allowed us to create new materials able to use subatomic energy sources, resulting in varieties of life unimaginable to most humans just a few hundred years ago. "Star Trek replicators" also made possible by these technologies, which were imagined a thousand years ago, have now become key to the economics of prosperity brought by subatomic management. Although many pursue a materially simple life, there is no poverty today in the ancient sense. In addition to global credit systems with infobanks for entrepreneurial opportunities, basic living units eliminated poverty as known in ancient times. The units contained nanotechnologies that can produce food, shelter, clothing, and are able to self-replicate.

The early success of nanotechnology in medicine, agriculture, industrial maintenance, super materials, computer chips, and self-replicating machines caused the acceleration of their use beyond our ability to control their dispersal. Nanotransceiver robots coupled with artificial life forms have killed the concept of privacy, but they have also made criminal acts less likely today. An intellectual arms race arose to create better countermeasures for signal jamming and active nanotech shields.

Even though space migration immunized humanity against a multitude of potential physical and social extinction events, the acceleration of the sustained space program was driven more by curiosity than by survival or economic necessity. Many wanted the challenge; others simply wanted escape from Earth, saying that humans had become like yeast in a closed bottle—proliferating and battling over limited substrate. The more conservative of these pioneers chose to build human settlements in capsules on Mars and then later terraformed the planet. The more adventurous chose to live in free-roaming space stations, while the most adventurous committed their gene line to be augmented by technology over several generations. These became the space-adapted conscious-technology entities preparing to leave the solar system.

Political systems on Earth tried to maintain control over space settlements, even after these pioneers had paid back the investments from Earth. Income from space tourism, electricity from space solar power, orbital retirement communities, and space industrialization were enormous. Conflicts between Spacekind and Earthkind escalated until political independence was granted to space settlements. Population pressures had increased public discussions about mass migrations, but not until the series of earthquakes in megacities and the onslaught of new diseases did space migration begin to be taken seriously by the general public. Fortunately, launch costs had fallen far enough at this point that large numbers could begin to migrate. Today a rich diversity of humanity and its symbiotic artificial life forms inhabit many locations in our solar system, and some have begun the trek to star systems with water-bearing planets.

Scenario 2. End of Humanity and the Rise of Phoenix

The growing number of nuclear nations and increasing opportunities to hijack radioactive waste during transport led to the use of this waste by terrorists. This triggered several "brush fire" nuclear wars and the use of nanotechnology and biotechnology poisons, which spread sufficiently in the early twenty-first century that life-support systems for the biodiversity necessary to sustain human life was lost in much of Europe and Asia. Even in less affected areas, global warming sufficiently moved the Gulf Stream to lower temperatures to reduce European agriculture. The resulting mass migrations to Africa and the Americas throughout the twenty-first century caused further conflict. The daily struggle of 30 million AIDS orphans without love or mercy turned so many in Africa to crime networks that roving gangs eventually made political stability impossible.

Genetically targeted nanobioagents used by high-technology crime networks in the United States to prevent the migrant takeover got out of control and killed so many people that only minor sections of infrastructure could be maintained. Although centrally controlled nanotechnology was to have prevented mass self-replication in North America, transmission signals were interrupted by the social turmoil often enough that things got out of hand and turned large areas into a gray wasteland. As a result, the prevalence of disease, pestilence, and famine increased across Africa and America.

Efforts to create more serious international governance structures failed. An electronic iron curtain arose between the knowledgeable and knowledgeless. The decay of family and social values, corruption, and transnational crime became the governing elements in the system. No one cared about the environment.

Then in the twenty-second century, cataclysmic earthquakes under several megacities drove millions into savage frenzies for the necessities of life. Self-organizing groups in safer areas created artificial life forms to manage energy, food, water, and telecommunications. By the twenty-third century, these new life forms put some civilizations back into more functional order in several regions. But much of civilization had given up intellectually and escaped into psychotropic drugs, electrical stimulation, and cybersex. Humanity never recovered from the conditions that continued to generate new kinds of disease and slowly but surely humanity disappeared as a biological life form by the twenty-fourth century. The artificial life forms may well have decided that humanity was a threat and killed the remaining humans, before they knew what hit them. These forms then evolved into a system of robots, computers, and networks preparing to leave Earth and the solar system to seek other life at the dawn of the year 3000.

Scenario 3. It's About Time

SETTING: A reconstructed but fairly accurate olive grove. The Acropolis is painted in the background. Clearly this is ancient Greece. The participants are a student audience and a lecturer, all in white togas.

PROFESSOR: Class, it's pleasant to meet with you in this archaic way, sitting here face to face and really talking. I know it's a throwback to the Greeks, 3,500 years or so ago, but you have to admit that there's something refreshing about actually seeing each other in person and—what shall we call it?—presence. And since the topic of this seminar is the history of time travel, it seemed appropriate that we actually see one another in the flesh, so to speak, just like the old days. This desire to re-create (notice the similarity to the old English word "recreation") is stronger than ever these days; I hope you find the togas and olive trees a nice touch. I invite you to ask questions and add observations of your own as we proceed this morning.

To begin with, let's agree that moving people from one time period to another constituted a leap for humankind into a previously unexplored dimension of experience. Certainly, before there was physical time shifting, there was the study of history—the issues and events of prior times. Historians attempted to give a sense of the past by reconstructing history from natural records and from the notes and documents of archivists, but the idea of traveling in time—actually moving to a different era, forward or back from the infinitely small island of the present—didn't gain attention until the early twentieth century, when the great physicist Einstein postulated, in his special theory of relativity, that nothing could move faster than the speed of light.

Oh, certainly there had been speculation about what time really was since the time of the Greeks. And the ancients looked at the heavens and measured the stars and planets and knew the seasons. In the nineteenth century, H.G. Wells, a novelist, wrote about a time machine, all brass and black that transported a person back in time. When science and science fiction bloomed in the twentieth century, all manner of time machines for projecting into the future or into the past were imagined. Finney described a method that involved using intense thought as the means for moving in time. But it was in the late twentieth and early twenty-first centuries that scientists knew something like time travel might really be feasible. Carl Sagan, a popular exo-biologist of the late twentieth century, said:

> *Such questions [Is time travel possible?] are purely a matter of evidence and if the evidence is inconsistent or insufficient, then we withhold judgment until there is better evidence. Right now, we are in one of those classic, wonderfully evocative moments in science when we don't know, when there are those on both sides of the debate, and when what is at stake is very mystifying and very profound.*

QUESTION: But, Professor, that sounds quite evasive to me, not an endorsement for the practicality of time travel.

PROFESSOR: Yes, I take your point. But at that time for any scientist to admit that there was the possibility of phenomena beyond the dogma of their disciplines was incredibly forward-looking.

It was this attitude of “maybe” that gave permission to conventional science to go beyond its constraining beliefs.

As I said, time was a frontier, a challenge, a new place for thought and exploration. It began with this “maybe.” By the mid-twenty-first century, geographic frontiers were explored on Earth: from jungles that at first were called impenetrable in the late nineteenth century to the ocean floors complete with vents and metal nodules in the twenty-first, to the geological mantle and sub-crust clear through to the magma in the twenty-second. Our species, it seems, has an innate urge to explore, so once geophysical Earth was probed and described in all of its intricacies, other boundaries beckoned.

QUESTION: How about the planets?

PROFESSOR: The planets were next—or rather, in parallel—through robotic examination and in the case of the Moon, Mars and Venus, through manned bases that extended from the twenty-first century through the present, with the cities on those planets and the moon being the result.

Frontiers were also pressed in the spiritual and experiential front: pre-programmed psychotropics (800 years ago), brain machine chimera (700 years ago), and human-to-human transfer of synapse interconnects and downloads (600 years ago). But by the twenty-fifth century we were running short of frontiers. By that time, we had gained freedom (I’m using that term in its present meaning—that is, we had reached the plateau of social organization of work that permitted anyone total respite, the notion of work had disappeared and people had, our topic exactly, time). And the possible exploration of time stood there invitingly.

QUESTION: But what did people think time was?

PROFESSOR: They measured flow by it: so many gallons per hour, or births per year. And they considered it a flow too, the course of time. But measuring the flow of a flow was not a concept that many had. The standard time keeper evolved from the sundial and the hour glass to the atomic clock that eventually measured time with an accuracy of one second per millennium, but it all related to one-way flow, an arrow of aging and entropy, irreversible and inevitable. What a barrier to overcome!

It didn’t happen all at once, of course; there was a confluence of ideas and capabilities that gave impetus to the field. Einstein himself gave the first clue: No material object can travel as fast as light. (Or more precisely: the great principle of relativity is not that you can’t travel faster than light—it is that the laws of physics are the same for all observers (and atoms, photons, and so on) regardless of any relative motion they may have with respect to each other.) Observers looking at fast-traveling objects have slower running time than the observers who are on those fast-traveling objects. This phenomenon gave rise to the lovely nursery tale of the time-crossed lovers, Picard and Juliet: one a starship captain who flew beyond the galaxy at speeds near what his lover saw as light speed, only to return one year later by his reckoning, to find his lover shockingly older.

Advances in quantum mechanics gave then the next clues. Some quantum experiments that demonstrated the nonlocality of quantum effects made a lot of people scratch their heads in the twenty-first century. Picture this: at a test site in Europe.

QUESTION: Europe?

PROFESSOR: Yes, there was a Europe then. A photon was sent down a fiber optics filament. The filament branched into two paths. Wave-like, the photon went down both branches simultaneously as two photons (if you want to express the process in particle terms). The termini of the two branches were kilometers apart. Yet when one of the properties of one particle (for example, spin, momentum, or polarization) was resolved (say, the spin was measured) the property of the other particle was instantly established.

QUESTION: They must have thought that was weird.

PROFESSOR: That's exactly what they called it: weirdness. The term is very much like magic - that is, they saw it happen and were willing to accept the evidence of their own eyes, but like magic to the aborigines, they didn't understand it. This quantum experiment was explainable in mathematical terms but was contrary to the logic of the time. (For your information, I have handed out a copy of one of the early Internet 1 pages - still available in the archives, you know - that describes one of the very first large-scale experiments of this sort that I know of. It's attached to these notes along with some references.)

This kind of experiment was repeated many times at quantum levels and was scaled to the level of atoms in the process of developing the very first computer chips that did not rely on photolithography: the quantum chips in which the quantum states of the atoms that made up their computing apparatus were used for memory and counting. But it's a long way from atoms to macro-scale human beings.

In the course of the basic research backing up this technology, wormholes were shown to exist, not only in theory but also in actuality. A wormhole, according to an early text, is "a handle in the topology of space, connecting two widely separated locations in our universe." At the quantum level, this meant that information could flow instantly, in wormholes in the "quantum foam" from point to point on a chip. This was the technology principally responsible for today's intellectual machines, as you know. It was only a matter of time, no pun intended, until the experts scaled up the effect.

So we had these socio-technical forces coming together about a thousand years ago: a willingness by physicists to consider new dimensions, a hunger by society at large for new frontiers, and the blossoming field of quantum uncertainty and teleportation.

Time travel took many forms. At first there was pseudo time travel (PTT) in the period when the longing for time travel was building but the means were yet absent. Around the globe, enclaves were built that reconstructed periods of the past, the further development of the theme park theme, if you will. There was Safari Land in Kenya: a time of pre-colonial tribal Africa, New World Plymouth, where time travelers could live in the period of the early European settling of

America. There was Knight Land, medieval Europe, complete with armor, lances and tournaments. These places were actually separate countries—a place, but a time as well; they had their own governments (usually a historian was the ruler; historian-kings replaced the ideal of philosopher-kings.). To get in, a person had to make a commitment to live in the appropriate life-style for at least 10 years or more likely a lifetime, severing all contact with the contemporary world. These places were so popular that they were declared neutral zones in the wars that were fought around them. Kids studied history and simulated these environments as someone used to study travel folders.

QUESTION: But if they had to live in the old ways, didn't mortality increase? How about disease?

PROFESSOR: Well, strange as it may sound, that was part of the attraction. Ordinary life was seen as bland; this place offered adventure and risk was part of it. As you can imagine, there was corruption and astronomical profits were made, but the genre flourished.

We went from PTT to TT when we deliberately sent people into the future. This actually was an outgrowth of PTT, since it was reasoned that if we had people who were from the past societies that were being modeled, then the accuracy would increase since they could tell us how it really was. They would be the historian-kings and queens. The first possibility of bringing people from the past to the present was cryogenics or hibernation—that is, body freezing or suspension in a slow aging state. When resuscitated these people would bring with them their memories of their time. These experiments were generally unsuccessful. Another approach was developed: send some people into space, and let their spacecraft build to high speed. They would age slowly compared with people on Earth, so that when they returned they would be a year or so older but a hundred years or five hundred years would have passed on Earth. They would return with essentially perfect memory of the earlier time, and kinghood would await in the appropriate enclave. The first of these travelers, launched in 2352, have already returned and are setting up shop in NATO land. Based on the launches of the last 500 years and speeds set for their aging voyages, we can expect to see returnees over the next 10 millennia.

QUESTION: Sounds like fun. How do we sign up?

PROFESSOR: Well, the Global Time Travel Authority (GTTA) has control and there's a waiting list, of course, to become a timetronaut. And you know there are risks as well. If you go off to represent our time to a society, say 3,000 years in the future, with a high-speed flight of a couple of years, you can't be sure that there will be a world to return to. But you pay your money and take your chances for a moment of fame.

So we have the first two steps: the PTT enclaves, and the fast-forward historian-kings and queens that bring their experience with history to the present. The third step is the one now occupying us, time travel to the past for the common person, call it democratized time travel (DTT). History becomes an experimental science. Now we're into the issues of paradox.

QUESTION: Like the grandfather paradox?

PROFESSOR: Exactly. You recall how it goes: suppose you go back into the past and kill your grandfather. How then do you exist at all? It sounds absurd today but scientists actually debated such issues a thousand years ago. In discussing this paradox, Sagan said:

> *The heart of the paradox is the apparent existence of you, the murderer of your own grandfather when the very act of murdering your own grandfather eliminates the possibility of you ever coming into existence.*

Among the claimed solutions are that you can't murder your grandfather. You shoot him, but at the critical moment he bends over to tie his shoelace, or the gun jams, or somehow nature contrives to prevent the act that interrupts the causality scheme leading to your own existence….

There have been some toy experiments in which at just the moment the time machine is actuated, the universe conspires to blow it up, which has led Hawking [a leading cosmologist of the time] and others to conclude that nature will contrive it so that time travel never in fact occurs. But no one actually knows that this is the case, and it cannot be known until we have a full theory of quantum gravity....

Debate or not, the field moved forward and time teleportation of human beings into the past is now a real possibility in the minds of some scientists. The technology on which the prospect is founded - wormholes in space/time - had its birth in work published in the last millennium. Ford and Roman, for example, wrote about negative energy a thousand years ago. They said:

> *[As we all know] a person who leaves Earth in a spaceship, travels near light speed and returns will have aged less than someone who remains on Earth. If the traveler manages to outrun a light ray, perhaps by taking a shortcut through a wormhole or a warp bubble, he may return before he left. Morris, Thorne, and Uri Yurtsever, then at Cal Tech, proposed a wormhole time machine in 1988, and their paper has stimulated much research on time travel over the past decade. In 1992 Hawking proved that any construction of the time machine in a finite region of space-time inherently requires negative energy.*

So as we see, the phenomenon was at least in inquiring minds for a very long time. They went on to define the conditions under which negative energy might appear in space and hypothesized the use of such negative pulses in the design of time machines and warp drive systems. Ford and Roman concluded their piece by saying:

> *It seems that wormhole engineers face daunting problems. They must find a mechanism for confining large amounts of negative energy to extremely thin volumes. So-called cosmic strings, hypothesized in some cosmological theories, involve very large energy densities in long, narrow lines.*

It is just these daunting problems described by Ford and Roman that have been the touchstone over all these years for the time machine designers. Maybe within a few decades we'll see whether the work pays off.

QUESTION: Doesn't that lead to another kind of paradox? If we invent time teleportation in our era, then it will exist in the future as well. So if people in the future have this technology, why don't we see time travelers from their era now? Where are the futurists among us?

PROFESSOR: Good question. Maybe they can travel in time but have simply chosen to not come back. Or maybe they've chosen to go to some other more exciting time in the past. Or maybe they can regress only over a particular time interval—after all, our machines are limited too. Consider this: perhaps too many people were escaping to the past, so laws were out in place to limit the time migration. Or maybe they are really here and are prevented by some code of conduct from identifying themselves to us, but bring us wisdom of the future to make us progress to their standards. Ask yourselves this: where does a discontinuous genius like Einstein's come from?

Scenario 4. The Great Divides

By the year 3000, humanity has evolved into a continuum of three principal life forms. One remains on Earth, rejecting much advancing technology; another, which merged with technology, is a conscious-technology civilization; and the third, which emerged as a range of artificial life forms initially designed by humans, consists of new and independent forms beyond human control.

Some nations let human genetic enhancement occur; others did not. There were 5,000 distinct cultures in the year 2000. By 2100 the effects of globalization had reduced this diversity to only a few hundred in three-dimensional space, but stimulated countless numbers of sub-cultures in cyber space. Both three-dimensional and cyber cultures began to bifurcate into those that preferred increased involvement with advanced technology and those that did not. Many became afraid, as artificial intelligence surpassed many human capacities. Some thought that a global computer-mind would become a criminal dictator and eventually eliminate humans. Others feared that one day the complexity of the technologies would grow beyond their ability to correct errors, or that they might lose critical knowledge to fix the technologies on which they had become totally dependent.

Although atomic-scale self-replication replaced factories that so polluted Earth in the late twentieth century, standard humans feared this could lead to a future beyond their control. A religious backlash against advancing technology swept the world. International agreements established zones for preserving the human genome and saving remaining traditional cultures. Other zones allowed more experimental relationships with advancing technologies.

"Standard humans" believed their consciousness was biologically brain-dependent, and they shunned the use of cyber-brain symbiotic transceivers. They wanted to be the traditional or standard human. Many were Earth-centered, seeking spiritual transformation through more animistic beliefs. Others were monotheists. Both feared contact with the cyber-augmented global mind. They believed that yoga and prayer were necessary to control the negative forces in human nature. Technology could not solve everything.

They believed the oneness of humanity was to be a spiritual achievement, not a technological one. Spiritual attunement with the forces of Nature and Divinity was the strategy of life. God set

the rules, not technological imperatives. Life is a classroom in a divinely conscious universe. Standard humans' communications with dolphins, whales, primates, and domestic animals gave an interspecies dimension to their culture and expanded their awareness of the richness of ecology. Most were vegetarians, and altruism was the uniting value. Many of their habitats on land and in the water were built as archologies (architecture based on ecological principles) that drew on some forms of carefully selected nano- and biotechnology, which helped reduce environmental impact.

Many standard humans believe they have found the keys to enlightenment and that some of their members have transformed themselves into pure energy, giving them the ability to cruise dimensions. They agree that conscious-technology beings are able to do almost anything, but will never find the purpose of life.

Those who welcomed increased involvement with advancing technology argued that humans were evolutionary beings or a transitional species, and, as such, it was wrong to stay in one socio-biological niche. They did not believe that their consciousness was solely biobrain-dependent. They sought enhancement both individually and collectively through a full range of technologies. Conscious-technology beings, or con-techs, accepted the mystical attitude toward life that the universe is a miraculously interconnected whole, while at the same time embracing the technocratic management of civilization.

Their ethics of individual responsibility was not based on metaphysical beliefs in receiving a transcendental reward, but instead pragmatically on making the world a better place in which to enjoy. Their ability to tune simultaneously into the song of a bird nearby, a simulated experience of the trial of Socrates, and a loved one many miles away was common to all. The ability of the mind to "go anywhere, anytime, and experience anything" operationalized the ancient religious idea of the human unity.

They improved their brain functioning by individually tailored nutrition and genetic engineering. Knowledge and problem solving were accelerated by brain-computer interface with global knowledge systems and other forms of cyber-brain symbiotics to stimulate neural activity. These enhancements fed their minds, leading to rapid acceleration of their intelligence through individual-global feedback loops that also furthered their social evolution. Some still remain on Earth, but the bulk of conscious-technology has moved beyond Earth.

The synergies among advances in neurophysiology, femtotechnology, and communications opened the door to what has been called psychic energy. The interplay of the electromagnic energies of the brain and our use of femtotech has allowed us to convert mental energy for other purposes. Ideas helped power con-techs' world and increased their metabolic rates to keep their weight down.

The first space-adapted con-techs were referred to as "space fish" in remembrance of the joke about fish swimming in the oceans hundreds of millions of years ago who were convinced that life would never evolve on land since there was no way to breathe. The pioneering edge of conscious-technology left for several stars identified as having the greatest potential for intelligent life. They believe that merger with other life throughout the cosmos will be necessary

to permeate the universe in order to end the big-bang-contraction cycle that leaves some in existential despair.

Con-techs tolerated the standard humans because their mystical side honors the standard's quest for enlightenment, but relations did have some conflict. Not all standards practiced their values, just as con-techs didn't always balance their mystic-selves with their technocratic-selves. The uneasy division between the two lasted several hundred years until the con-techs gave birth to artificial life forms without cytoplasm or biologically based neural patterns. One of the new life forms was designed to seek and destroy the leftover bionanotech agents used by terrorists. This success stimulated the acceleration of research to develop more artificial life forms.

The diversity of artificial life forms today is beyond the ability of any human (either standard and con-tech) to comprehend. Some nanoforms are believed to have arrived in several star systems and mated with local intelligences. Others have formed symbiotic relationships with some Earth-centered humans, unbeknownst to them, and are reinforcing the standard humans' animist beliefs by occasionally allowing them to see inanimate objects they inhabit seem to be alive. It is also believed that these artificial life forms help keep the peace between the standard and conscious-technology humans today.

Scenario 5. The Rise and Fall of the Robot Empire

Within the last thousand years, robots rose from curiosities—machines that were barely helpful to the industrial economy of the early twenty-first century—to positions of power five hundred years ago, through the machine-war to their current subservient role today: an empire, if you will, gained and lost in 10 centuries, longer than empires of either the Romans or the British. This waltz began a thousand years ago with the confluence of a number of technologies and social developments. On the one hand, the seminal technologies pushing the Robot Era were:

- miniaturization – nanotechnology - small machines at first using improved photolithography as the manufacturing tool, moving soon to protein synthesis, using molecular processes for assembly of parts with sub-micron dimensions. Nanotechnology by 2100 became as ubiquitous as electricity was in 1950. Then it became unexceptional and quietly blended into the background, becoming part of the foundations of future human civilization, a technology that was mature in 150 years and has been taken for granted since then.

- artificial intelligence (AI) - which gained strength with the international project to map synapses and brain neurons, a project patterned after the Human Genome Project of the late twentieth century, but much more complex. With it neuro-biology was on firmer ground and the search for mind within the brain had a physical basis on which to base its exploration.

This confluence led, early on, to molecular-scale computers, atomic-scale materials, arbitrary length/ diameter/ twist carbon nanotubes, and, in particular "mechano-synthesis"—spatially selective chemical reactions that came quite close to the old idea of alchemy, creation of gold (or indeed any material) from base metals (or in our case, atomic building blocks).

The “pull” for the early robots a thousand years ago came from the need for machines to perform dull, dangerous, and repetitive jobs. People loved those early machines in the twenty-first century. They were crude at first, nonmobile but programmable and adaptable and used primarily in mechanical and electronic production lines. Once nanotechnology and AI came on the scene, even in their crudest forms, the robots gained mobility, became soldiers (mine sweepers), policemen (bomb disposal), and pets. They cleaned sewers and septic tanks, mined asteroids, and explored planets. They repaired automobiles, they made deliveries, and they tilled the fields. As mechanical moles, they found resources deep in the earth. As ultra-small monitors, they aided both police and criminals. As physician’s assistants they aided surgeons, the smallest of them entered human bodies for diagnosis (with data telemetered) and pumped blood when hearts failed. (This bio-medical arm of the robotic tree was the beginning of our cyborg culture.)

The great catalog of Renssellaer Polytech published in 2200 attempted to catalog the robot population and applications; 575,567 genera could be separately identified as embodied in 100,675,000 machines. Machines had been self-repairing, and importantly, self-replicating for a long time, but now they were evolving. Evolving toward what, it was asked; the answer was, toward doing their jobs better, which is more than human evolution—even human-directed evolution—could produce. They could understand natural language, and it could be said that many of the more advanced units had not only computer brains but also minds, in that they were adaptive to changing circumstances and could reason best solutions even to situations unexpected by their designers. Emotions - particularly those believed to be epigenetic - were added. Some neuro-physicists thought robots’ reasoning purer and superior to human reasoning, at least in limited circumstances. Throughout this early period, a primitive set of Laws of Robotics was generally followed, first by general consensus and later as required by legislation.

The great leap forward, as historians erroneously now call it, came in 2235, when most of the machines then extant were interconnected through communications networks using common programs that were self-adapted by each machine. Because most of these networks were wireless and broadband, the robots’ mobility was not impaired. This technological stroke gave the machines global intelligence. They were the embodiment of the global brain. What one knew, all knew. This development was favored by most of the users of robots since it gave them an instant and inexpensive boost in reasoning capacity and their operations could draw on information collected by other robots operating far away.

Robots were human-like and became philosophers, jugglers, politicians, orators, actors, teachers, acrobats, artists, poets, and shepherds of the less adept humans. Museums captured the folly and the glory of the prior 50,000 years of human civilization. Society was rational; instinct, particularly combative instinct, was subdued. The robots were exploring space, well beyond the reaches of the solar system, on 10,000-year journeys to other stars, in environments of radiation, heat, and acceleration that would have been unacceptable for humans.

In an echo of the original Luddites, humans asked what remained for them. The answer was human leisure (although robots could improve leisure enjoyment), learning (although robots taught, learned faster, and did not forget), and the joy of life (although the robots seemed to be enjoying themselves, too). Society had a new caste system, and humans were a race tolerated and somewhat pitied by the machines that could outthink them and outperform them in any measure

of strength, vitality, speed and endurance. The most important argument made in the application of gene technology to improve human mental and physical performance was “we have to keep up with the robots.”

Keeping up was easier than it might have been: biomedical engineering provided the craftsmanship. The absolutely huge fields of genetic choice and neuroscience—linguistics, philosophy, systems modeling, organization of “consciousness,” post-synaptic cascades, artificial life (which necessarily has a quasi-neural architecture), and so on—remained the hottest and most rewarding (and reviled, by some) human endeavor.

About this time, new “parasitic” processes appeared in human society (such as computer viruses, religious cults, fads, crazes. and urban legends or addiction to virtual reality or new drugs) that reproduced and spread very quickly thanks to efficient transport and communication media. These were diverting but added to the chaos of the search for meaning.

But there were no environments that were off limits to the machines, as there were to humans. Was the earth becoming less livable? Perhaps so, but only for humans. With resources becoming scarcer, natural and artificial selection began to operate in earnest, distributing available resources most efficiently to those entities that were best able to exploit them—for the most part, the robots.

It was inevitable that humanity would try to pull the plug. The term “slavery” was in the air—that is, slaves to the robots and their insistent perfection. Suffice it to say that the mid-millennium has been called the time of the second crusade. Beginning in about 2500, serious questions were asked about the state of humans and their inferior role. Was this what God intended? Were the robots really the next step in evolution?

The cyber commandos under the hereditary general-priests began intensive study of the relationships among the machines, to identify their weaknesses, both mechanical and emotional, and began to devise a strategy, executed over three generations, that would result in the elimination of robots’ self-replicative capacity. The question at the center of their work: would the machines—smarter than the cyber commandos in many respects—fall for their strategies? The answer was to use human ingenuity, randomness, secrecy, dedication, and distraction. It took awhile but it worked. This at least began to stabilize the robot population. From there it was tricky, but the political structure changed subtly and the vector of leadership swung to humans and the old ways. Some argued that this was regression of the worst sort—that the good old days were a chimera. But others argued that human destiny should remain with biology.

Today, the most important legacy of the rise and fall of robots is our cyborg technology: the artificial augmentation of biological humans with manufactured components. This capacity descends directly from the confluence and synergies of artificial intelligence, nanotechnology, bionics, materials science, genetic engineering, and telecommunications—and, of course, robotics—and has led to the superior augmented human beings that now represent the finest people on the planet.

Certainly there are a few pure robots around, but the times have indeed changed. It is hard to find pure humans anywhere. The distribution of "human" phenotypes in attribute-space has broadened almost exponentially. Through cyborgazation and genetic manipulation, the natural physical human form and the natural human brain are hard to define today. Given the full, rational, conscious control of the physical form and function of the human body, down to the molecular level, twentieth-century humans are essentially obsolete. Although the robots are under human control once again, what it means to be "human" has changed. Our ancestors would not recognize these humans, except possibly for the "Hu-Manish" (techno-retros, analogous to the Amish of the nineteenth century) who elected to opt out of the techno-evolutionary process. Only religious fanatics are unaltered humans.

As cyborgs, people can become anything they like, live for all intents as long as they like, behave any way they would like. Our capacities have given individuals power that twentieth-century humans would undoubtedly have regarded as "god-like." Any person can perform virtually any "magic trick" that has ever been described in science fiction, in fantasy stories, or in the Bible. Each individual nano-enhanced person may personally command energies of ~10^{12} watts, which is roughly sufficient to levitate the Great Pyramid. What more would they have required of a God?

Scenario 6. ETI Disappoints after Nine Centuries

Back in the late years of the second millennium, scientists started to search for signs of extra-terrestrial intelligence using whatever tools they had available. "Certainly," they said, "with so many planets out there, there must be life, probably intelligent life, on some of them." Drake derived probability estimates of the existence of another civilization somewhere in the heavens, advanced enough to be able to, and inquisitive enough to want to, communicate and identify others who might be accompanying them in their journey through space and time. Search programs were established, first under government authority and later under private funding, to scan the heavens at what was then thought to be the most likely radio frequency, the frequency of atomic hydrogen. Using the biggest radio telescopes, including the dish at Arecibo, meticulous scans were made and analyzed, all to no avail. Nevertheless, the notion of "others" was firmly imbedded in social myths of the time. It appears in the popular literature of the time in both written and video form: Star Trek, UFOs, and many of the other surviving ethnographic fables attest to this.

From the beginning it was realized that the time of contact could not be foreseen. People believed, though, that the scientific advances of their time made it more likely to contact life elsewhere in the cosmos; nevertheless, this did not imply that intelligent life would exist near to them, or that it would be willing or capable of communicating with them. In any case, there remained the strong physical limitation of the speed of light on the possibility of communication over interstellar distances. There were several apparent contacts in those early days, blips on the receivers that seemed somehow coherent and different from noise, but none could be verified. They were named "Big Bertha," for example, and "Hiss-Tweak." Hundreds of man-years were spent on trying to decode them, but in the end they were seen as just anomalies.

Those who continued the search were looking for an encyclopedic message (by radio or pulsed laser) from many light-years away, or contact with a super-smart probe that reached our planet. They thought - indeed, they hoped - that after contact, humanity and the other "culture" could interact and evolve together. Humanity might find ways to receive, decode, and learn from intelligent emanations that originated on other worlds.

What right-minded person could claim with authority that in all of space and time, intelligent life could only have happened here? Yet discovery after a century was still only a hope. Leading scientists and authors passed on that hope. Religious people wondered if extraterrestrial beings believed in or knew God.

There were people who argued that the search should be stopped, that extraterrestrial contact could prove to be malevolent, with humans suffering much like Native Americans did when Europeans arrived with Columbus, and like successive waves of Palo American immigrants did to their predecessors. When civilizations at different levels of technology meet, they said, that with the inferior technology inevitably suffers.

Others said that the intelligent extraterrestrials might already be aware of our existence but not consider us intelligent enough to be worth communicating with. As our own intelligence increased, the chances for contact also grew. So government was wary, in general, but tolerant. The search continued.

As the mid-millennium approached there were three great developments that gave new fuel to the activity.

- Human space exploration and, to a limited degree, colonization.
- New modes of communications, including noncoherent sources, and techniques employing quantum phenomena to attain what seemed to be faster-than-light transfer of information.
- Great advances in cryptography, which provided new approaches to the means for embedding intelligent messages in what otherwise would seem to be noise.

While large-scale space migration did not take place, small-scale off-Earth communities were created, including at first a scientific lunar colony capable of autonomous, independent operation. This base was valuable for astronomy, scientific research, and manufacturing under non-Earth conditions. Large-scale space migration seemed to be a less important development, given the enormous costs and the relatively small benefits that human life on Mars or the Moon would offer. The counter-argument that if we stay on Earth, we have put all of our eggs in the Earth's basket did not prevail. It was believed by the wealthier and technologically more developed societies that some permanent stations off Earth could be useful, but that it was unlikely that these would have a large impact, unless methods were developed to make, for example, Mars more amenable to life (terrafication) or more life-friendly planets were discovered on neighboring stars (say, in a radius of 20 light years from Earth). There had been some early experiments in terraforming with the use of newly designed microorganisms and nanotech robots, but environmentalists argued to keep the planetary environment pristine.

Further, it was argued that since the policy of sustainable development had worked, there was no need for extensive migration off our planet. Big natural or social catastrophes could change the situation suddenly, of course. But even then it is an ethical question: Are we willing to invest so that some minorities can escape, and for what reasons? Life is always harder in extraterrestrial colonies, especially if they are spaceship-bound. People will be best off on this planet for much longer than a thousand years unless it is totally unsupportive for life, which is very unlikely in any situation.

SETI continued on the moon. The colony set up there on the back face scanned not only with the primitive techniques but also using the new modes and codes. The ability to handle large amounts of information had of course increased by several million million times, but still no message from space.

Hope was rekindled - enough to generate a few more centuries of searching, anyway - when primitive forms of life were discovered on other solar planets. The discovery of life forms there created a complex set of opportunities (scientific discovery, agriculture) and dangers (infections with extraterrestrial parasites). Yet intelligent life seemed more like an accident of chemistry than ever.

Just a few centuries ago, the belief that humankind might be alone began to surface in earnest. A millennium, a third of the time since Christ, as much time as the interval between the Middle Ages and the Industrial Age, and still no results. With so much time having past, could this reasonably be called impatience?

The feeling of possibly being alone gave new impetus to religion and the need to guard humanity. Space colonization would immunize humanity against a multitude of physical and social extinction events. As Joe Straczynski - creator of Babylon 5, a video-myth of the late twentieth century - put it: “Scientists disagree on many things, everyone has their own theories, but one thing that all physical scientists agree on is that eventually the Sun will burn out. It may take 10 billion years, but eventually it will happen and the Earth will become uninhabitable. If, by that time, we have not learned space travel then Man will die. And Aristotle, Lao Tzu, Beethoven, Mozart, Emily Dickinson and all that we have been will be lost. It will be as if it had never been. So knowing that the death of the Earth is inevitable and that space travel is very, very difficult, it is never too early to start.” And they believed it, and so began the Noah project that so occupies us currently.

Had intelligent life been discovered elsewhere, would we have felt the need to prepare to leave so intensely?

APPENDICES

A Additional Scenarios Offered by Participants

Decline and Fall of Elites

By Forrest Bishop

The millennium started off with quite a bang, or rather, an implosion. The Last Bubble and its global fiat-currency collapse of 2000-2001 C.E. led into the two-decade Really Great Depression. Mankind's final experiment with fraudulent money and all its attendant horrors gave rise to the current system of Open Currency money creation visible and monitored by all. That single advance produced all manner of benefits: freeing us from the thought control of parasitic financiers, damping the destructive boom-bust cycles, and eliminating the then popular debt-welfare state.

Although entities resembling nation-states lingered on a while longer, they were never quite the same. The global interconnectivity of minds was well under way: the notion of a free press was re-introduced, net-based correlators tracked the activities of the rulers, virtual courts tried them with juries ranging into the millions; the emperor's clothes were found wanting. In place of governance came the supple order of electronic consensus. The Pharonic Age, civilization's childhood of hierarchical command, was over. No more pyramids were constructed.

The Industrial Revolution had reached its natural conclusion by 2060 C.E. with the advent of atomic-scale engineering and the ability to replicate the means of production itself (this of course

did not affect the fundamental underpinnings of economics). The cost of leaving Earth's surface dropped to the price of an airline ticket, allowing the economical development of space resources. Oceans of hydrocarbons and mountains of metals were now accessible, none too soon as Earth's had become depleted. The previously squandered energies of the Sun could now be harvested in earnest. By the 22nd Century each intelligence-amplified 'human' alive was as wealthy as a 20th Century nation, and had a greater life expectancy.

War was no longer an option for the potentially immortal.

There was one small SETI event of note - In 2538 C.E. a brief set of radio messages emanating from a star in the Andromeda Galaxy was intercepted and partially decoded. One of the signals was a video broadcast, depicting an alien race with large bony structures on their heads, hence the term "Bonehead". Parts of messages were translated as "…by the God-given wisdom of our Bonehead Overlords…" and "…we'll just print up some more United Bonehead currency for that…" and "...all for one and one for all…" After a short staccato of high-energy electromagnetic pulses they were not heard from anymore.

Most of the Old Continents of an increasingly irrelevant Earth have been restored to a semblance of their pre-industrial state, more a matter of whimsy than anything else. I/we seldom walk there anymore as biological humans - there is little to gain from it. The real action in directed evolution is out on the Dark Stars. Our augmented bird, reptile, 'dinosaur' and mammal superintelligences have added some nuance to the original great ape derived lines.

The hubris of religious belief finally faded to welcome oblivion after the derivation of the Godel-Invert Proof in 2130-2138 C.E. With this full realization, that I/we are alone and on our own in the here and now with no recourse, the preservation and extension of superintelligent consciousness becomes immeasurably more imperative.

We move out to the stars, preceded by our replicating nanoprobes. Now, in 3000 C.E., the Sphere of Life is over 400 light-years radius. Interstellar travel within the Sphere takes place at lightspeed, by radio and laser encoded consciousness. The unfettered hyper-evolution in the new systems adds yet more richness and diversity- exploring pathways even I/we could not have imagined.

Our children humble us.

World Trade Talks, Seattle, 2050[1]
By Rosaleen Love

In November 1999, as demonstrations took place in the streets outside the meeting of the World Trade Organisation in Seattle, images of sea-turtles, tear gas, and riot police dominated TV screens around the world. Demonstrators dressed as sea-turtles lined up against heavily shielded

[1] Submitted in M3000 Round 2 by the author from a forthcoming article in *Futures* special issue on Layered Methodology edited by Sohail Inayatullah.

riot police: green ecological fragility ranged against black hi-tech RoboCops; the visions of a sustainable future for all, ranged against the future imposed by an economic/ technocratic elite; grass-roots activism versus the RoboCop defence of a privileged economic order.

The demonstrators used their sea-turtle costumes to highlight some assumptions about economic growth through free trade; they provided alternative imagery and language to represent the idea of a sustainable future for all, including people and turtles in developing countries. Ranged against them were the Seattle forces of law and order, and in their black riot gear they bore a close resemblance to the fictional creation, the RoboCop or cyborg law enforcement hero of three popular science fiction films. Alternative visions of the future played out in street demonstrations. The sea-turtles stood on the side of human unity with nature in the evolutionary process, the co-evolutionary relation. Against them stood riot police who, with their masks and shields and communication devices represent the increasing human merging with technology in enhanced human capabilities, as co-evolution adds technological frontiers to the biological.

Now turn the man/machine relation on its head, and imagine the chip/human relation instead, or the robot/robot relation. It is the year 2050, when another round of trade talks will be held in Seattle. Assume, with Hans Moravec, that by the year 2050 robots have been properly educated, and are now formidable in their specialised abilities. They will begin their robot existence, in this scenario, governed by the three laws of robotics first introduced into science fiction in 1941 by Isaac Asimov in conjunction with his editor, John W. Campbell Jr[2]. The three laws are:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

In 1941 it was still possible to assume human dominance over machines. Asimov's three laws are top-down ethical directives implanted by some kind of central controlling mechanism.

Outside the Seattle trade talks, 2050

Ranged on one side are the sea-turtle robots, whose specialized task is monitoring the health of tropical oceans. They follow the migratory paths of the turtles; they monitor sea surface temperatures and water quality; they estimate the health of sea grass, and fish and crustacean populations. They are fourth generation robots, endowed with the capacity to abstract and generalize, and with this endowment has come a developing sense of their own sea-turtle robot identity. Graceful in water, they are clumsy on land, and will only emerge from the sea to estimate egg hatching rates on remote coral islands, or do demonstrate in support of deeply held political and ethical principles. They choose to activate their robot free will to take a stand on world trade issues, and in so doing are acting within the parameters of their programming, which

[2] J. Clute and P. Nicholls, *The Encyclopedia of Science Fiction,* (London, U.K., Orbit, 1993) pp. 1018.

is to do the right thing by the global ocean system and the human and other populations that depend on its optimum functioning.

The sea-turtles line up against the robot police force. Robot police protect the right to free meeting and assembly of the world trade delegates. The law enforcement robots have led a more restricted life than the sea-turtles. Confined by their job-description to the streets of Seattle, created for riot evaluation, with high level verbal communication and negotiation skills for emergency situations (with tear gas when negotiation fails), their capacity for adding ecology to their knowledge base has been limited. When a truce is called in the demonstration, they will like nothing so much as a free and frank exchange of information with the sea-turtle robots, as the turtles recover from the stress of their street ordeal in the shallows of Puget Sound. The robot cops are curious for knowledge of the world outside Seattle. Formidably armed, yet they have begun to reflect upon the rationale of their power. They are coming to see Asimov's three laws as having a restricted applicability, and wish to expand on them. They have added an additional ethical concept that has evolved with time and experience, so that Law One now reads: "A robot may not injure a human or a robot being".

The trade talks, in turn, are conducted by robot economists. At their central core, robot economists have access to the latest global financial information, and macro-and micro-economic data. They will know all of maritime law, for example, and will be able to cross reference to the profits of oil tankers flying flags of convenience. They will have a strong sense of their own identity as regulators and upholders of the world economic order, on which the fate of so many humans depends. They are the representatives of the new non-government, non-human organisations, NGOs turned NGNHOs. They constitute an advance on the NGOs of the 1999 World Trade Conference, for where the NGOs served particular interests, often without regard to the consequences of their actions for other issues and other groups, the economic robots have been programmed for a wider constituency in which the interests of all life forms, and all robots, are considered. It will be possible, by means of increased computer versatility and a massive knowledge bank, to compute the increasingly complex interaction between economics, corporate power, global politics, climate change, the health of the oceans, international law, and ethnic conflict.[3]

As the robots learn, so they will modify their ethical systems. The economic robots interpret Asimov's first law, the part reading 'through inaction, allow a human being to come to harm' as granting authority to raise living standards, as defined in econometric terms, in developing countries. The sea-turtle robots also demand a more generous interpretation of Asimov's Second Law in the light of further knowledge. "Obeying the orders given it by human beings" will still be observed, in principle; however, the conditional clause "except where such orders would conflict with the First Law" should include the broad context of harm and death from ecologically destructive industrial processes, and unacceptable child labour practices. The robots of 2050 will have the capacity to learn from experience, and from dialogue with others, whether human or otherwise.

Comments and key questions

[3] M. Byers, 'Woken up in Seattle', *London Review of Books*, 6 January 2000, pp 16-17.

As robots evolve, it is possible they will evolve differently from humans. Might it be possible, as robots grow into an awareness of what it mean to be a robot, with a robot sense of identity and of responsibility, that a more complex set of ethical principles, derived from within the robotic identity, might be derived? Most humans, for example, have effectively internalized ethical precepts against killing. It is a fact that murder is illegal, but people mostly refrain from murder because of their personal beliefs that killing is wrong. What if robots develop their own ethical laws of behavior, which emerge with the evolution of the robot, so that it internalises principles of ethical behaviour at the same time as it is growing into conscious awareness of what it is to be a robot, of what it will be to be a robot in the future. What evolves will not be a set of rules like the Ten Commandments, a set of commands that robots should or should not do, but more a set of ideas, values and attitudes that help the robot deal ethically with the problems that it faces in a changing world.

The year 2235
Comments and key questions

The year 2235: will there still be World Trade talks, and if people still use trade, as they have for most of human existence, what will robots trade? What might a global mind require, in sustenance and in material goods? Why might robots choose to mediate in disputes about trade in material goods?

I'd like to start with a reflection on human memory by Augustine of Hippo some 1500 years ago, and see how it translates into robot memory, and the next 1000 years.

Augustine said (I leave out his asides to God, who was a God of Catholic and Manichean theology, at a particular time and place.)

> This memory of mine is a great force, a vertiginous [giddy] mystery, ... a hidden depth of infinite complexity, and this is my soul, and this is what I am. What am I then ...? What is my true nature? A living thing taking innumerable forms, quite limitless.[4]

Translate this, with the change on one word, to see how this notion translates to the robot scenario.

> This collective robot memory is a great force, a vertiginous mystery .... a hidden depth of infinite complexity .... What are we then? What is our true collective nature? A non-living thing taking innumerable forms, quite limitless.

The global brain knows the shapes and sizes of atoms at the same time as knowing the names of all the stars in the sky. It knows the laws of nature, knowing at a level of abstraction from which

[4] Peter Brown, *Augustine of Hippo. A biography*, University of California Press, Berkeley, 1967, pp. 178.

the particulars may be deduced. It knows what is showing on all TV channels in India at the same time as it holds a fluent conversation in Japanese. Limitations on its knowledge and its memory: it collects data from present global monitoring systems, and relates it back to the time when such records began. It has no data on the future. Robots will have a collective memory that begins at, say, 2050. Anything entered before this will be data that humans, not robots, have collected and collated and interpreted, or human narratives of books, poetry, music, science, mathematics, etc - ie data of all kinds, from sensory data to mathematical data, filtered through human, not yet robot consciousness.

This memory is a great force, but it is not omniscience. It stands firmly within time.

(Comment: A form of interpretation for Augustine, one that was quite 'natural' to him, was the allegorical mode of interpretation, to a logical machine would be quite illogical to have no meaning - what has meaning for humans, through allegory, has no meaning for machines who can not tell themselves stories, or so we presently/imagine.)

A Golden Age
By Jeffrey A. McNeely

Technology: Changes in the Hardware

Let's start with the hardware. The 20th century has been a century of physics and chemistry, following the conceptual breakthrough of the Periodic Table of the Elements in the second half of the 19th century. But just as machines and chemicals dominated the 20th century, biology will be the driving force of the Golden Age. The mapping of the human genome may be a conceptual breakthrough comparable to the Periodic Table. Combined with better scientific understanding of how biological systems work, the new biotechnology will enable us in the fairly near future to enable people to live a longer and healthier life, and produce local varieties of agricultural plants custom designed to local conditions.

On the agricultural side, a new generation of plants will be designed to produce their own nutrients and their own compounds to protect themselves against pests, thereby radically reducing the need for fertilizers and pesticides, and freeing farmers of their dependence on distant factories. Instead of depending on chemistry, with its poisonous side-effects, Golden Age agriculture will depend on biology, a science of renewal and recycling. The new plants will contain oils that are healthier for the heart, tastier, more nutritious, and easier to digest. Some will carry high levels of substances that fight cancer and other chronic human diseases.

In the Golden Age, different communities have very different diets, tuned to their own agricultural growing conditions and cultural preferences. But generally speaking, people have moved lower down the food chain and are gaining more of their nutrients from the highly productive agriculture that enables many crops to be grown and to meet all dietary needs. Meat is still an important part of the diet in pastoral and fishing communities, but is a relatively minor part in most agricultural communities.

Golden Age factories, too, will be increasingly biological. Biotechnology will be used to convert wastes into useful products, and industries will be using new generations of plastics grown from plants, making them easily biodegradable, and using bacteria to make new polyester fabrics that are far superior to similar fabrics made by petrochemicals. Speciality chemicals and novel biopolymers will be grown biologically at industrial scales far more cheaply than any current processes.

More effective local production systems and improved electronic communications will have greatly reduced the need for fossil fuels as sources of energy. Instead, a new generation of renewable energy sources have been developed, often at a local scale rather than a national one. Thus local communities are also in greater control of their energy sources, tuning their demands to sustainable sources of supply.

Because energy sources are renewable, the flow of critical nutrients such as nitrogen and carbon is much more circular, so the climate changes driven by excess carbon dioxide and other greenhouse gases in the atmosphere has been reversed and the climate is now subject only to seasonal and the cyclical vagaries driven by changes in solar activity. Similarly, because ozone-depleting chemicals are no longer being produced, the ozone layer has recovered and the atmosphere is now optimal for human welfare.

On the human health front, improved diets based on organically-grown crops will mean fewer health problems, but when things do go wrong, far more effective remedies will be available, ranging from edible vaccines grown by plants to new organs that can be grown in special medical facilities. Particularly useful will be edible vaccines that protect children against diarrhea, the major cause of infant mortality in most developing countries.

The breathtaking pace of innovation in electronics, leading to new generations of computers that are smaller, smarter, and cheaper, will soon make virtually any information freely available to virtually anyone who wants it. While it is possible to give everyone anywhere a super-fast connection to any kind of information, from films to books, from news to business and shopping data, most people are far more interested in their own cultural identity, using the new technologies to better explore their local environments. But while the current generation of information technology is fuelling globalization, the Golden Age will see a very different trend, as information will be custom-designed to be relevant to the particular settings in which it is needed. Thus instead of reducing diversity, the next generation of information technology will promote greater cultural diversity while enabling people to be better adapted to their local environmental conditions.

Society: Changes in the Software

The technology of the Golden Age will bring about profound social changes. With people living longer and healthier lives and infant mortality reduced to very low levels, human populations will stabilize and even start to decline (as they already are in several European countries). People will be able to live much richer lives, both spiritually and intellectually. Leisure time will be devoted to perpetual education, enabling people to become ever better adapted to their local

conditions while enabling them to participate far more actively in many more interactions. As demographic curves begin to flatten out, relations between the generations will become ever more respectful. And the more educated the people become, the more inevitable become democratic forms of government that are more responsive to the needs of local people.

Further, because populations have stabilized and systems for producing food and other necessities of life have become more efficient, people no longer need to compete with wildlife for their habitat needs. On the contrary, in the Golden Age the great diversity of life is celebrated, and ample areas are available to support the full richness of life on our planet. Because more can be produced on less land, more territory is available for other species. Land marginal for agriculture has been returned to more natural types of ecosystems. Areas devoted to conserving biodiversity are popular vacation destinations for people celebrating the richness of life.

With greater democracy and more local self-reliance, the nation states that characterize the 20th century are no longer viable in the Golden Age. While some regional groupings may be needed for some purposes, most governance is at the local level, reflecting local social and cultural imperatives, often linked with the primary sources of productive labour. The rapid decline in languages has been reversed, and virtually all of the world's 6,000 languages are in active use, again reflecting the value of diversity in the Golden Age.

Because life in rural areas is improving and communications enable virtual offices to be established anywhere, cities no longer have their historical attraction as sources of intellectual stimulation. Thus the human population becomes more evenly spread, with fewer large cities and more small cities and towns that develop distinctive characters appropriate for their settings.

Golden Age technology enables people to meet their basic needs through local production, so the historical conflicts between neighbouring cultures is greatly reduced, and people see little justification for conflict. Democratic systems of government are so widespread that despots are unable to find the chaotic conditions they need to flourish, so a new era of good feeling spreads over our planet.

Conclusions: What It Will Take to Achieve the Golden Age

All of this may simply be starry-eyed optimism. But the technologies I have described are all already on the drawing board or under development. Our biggest challenge lies not in the technology, but rather in the human software -- our ability to enable people everywhere to determine for themselves the kinds of lives they would like to lead. Finding the Golden Age depends on social and political advances, requiring much greater tolerance of diversity and a generalized encouragement of human rights. But clearly, if we wish to reach a Golden Age, we need to maintain the greatest possible biological and cultural diversity, enabling people to live in balance with their environmental resources and adapting to the local conditions within which they live.

Boring Progress as Usual
By Gerald Nordley

This scenario proposes no overwhelming unpredicted singular events over the next thousand years. Its main idea is the classic "S curve" wherein technology develops slowly at first, reaches a stage of rapid development, then approaches physical limits. Figure 1 illustrates how the speed of transportation might go.

The year 3000 is far enough out that most contemplated technologies will have reached the flat upper part of the curve where the law of diminishing returns has set in with a vengeance. Improvements will still be possible, but great amounts of time and effort will result in only modest improvements of a technology already near the physical limits of what can be done.

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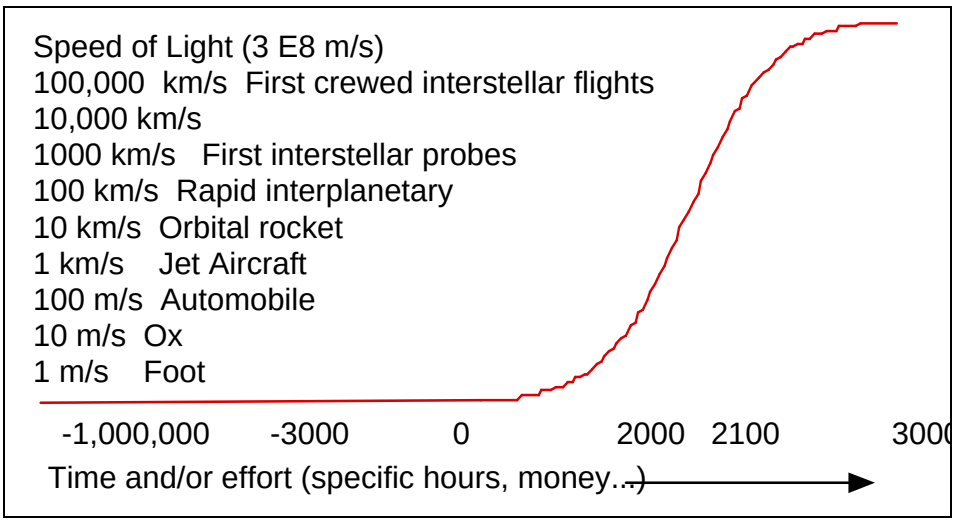

Fig. 1 An "S-curve" for progress in transportation

The steep part of the curve is the most interesting; shown in the transportation example as smooth, in reality it will be a more jagged line, with periods of stasis punctuated by nearly singular episodes of advancement. As this occurs, conflicts between groups which have material want at their core will lessen and one expects that international relations problems driven by want will get less interesting. The difficulty of scenario building, of course, is where do you place the steep part?

A graph of labor hours per unit of manufactured products would look like the mirror image, of the graph above, starting high and approaching zero as robotics take hold. Also, curves interact to produce other curves. In the example below, rising population and rising expectations, all operate on different time scales to produce a period of slack labor demand, a peak, and then a rapid fall off.

The interaction between curves of different shapes that can make the course of events seem chaotic in the short term and we are approaching an era where a number of interacting curves are quite steep. Given the rate of progress toward biotechnology, artificial intelligence and robotic manufacturing, universal information access, and inexpensive space access, one expects that the most "interesting" time will be the next century, though for some projects (such as, say, the terraforming of Venus) we will likely need a longer view.

As genetic engineering becomes more and more competent, emphasis will move from correcting obvious flaws to enhanced performance. This will occur both in terms of mechanical abilities and in what are considered "character" traits.

In mechanical abilities, metabolism will become less subject to disease and more efficient. Strength will increase. Reaction speed and memory will be much improved; everyone will be able to follow the long and complex chains of reasoning of physicists and chess players. Language acquisition will be improved to the point that linguistic differences may no longer matter and Latin may make a comeback. A language that is alive twenty years from now will last as long as the human race. Better visualization should be expected. Women won't have problems with geometric math. We should see improved creativity. But effective brain-computer interfaces will be an important inhibitor on just how much genetic engineering we do to the brain; there's no reason we have to cram all the smarts into a piece of jellyware. After all we long ago traded Gonzo canine teeth for stone axes. We didn't breed ourselves to all be long distance running champions; instead we made boats and horses, sledges and coaches, cars, trains and aerospace planes. Why should the brain be different?

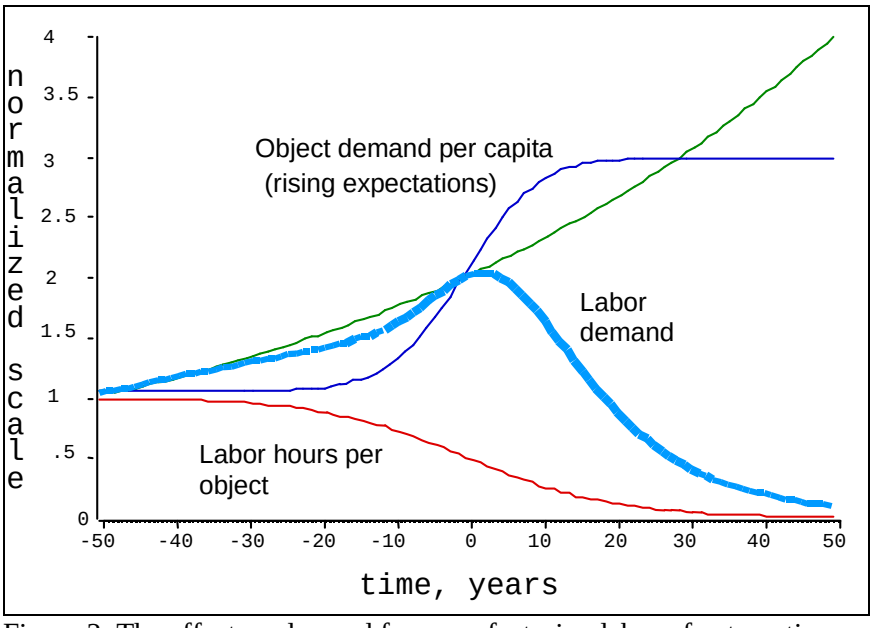

Figure 2. The effect on demand for manufacturing labor of automation, population, and expectation

In character traits, compulsiveness can be reduced or eliminated; everyone will be able to think and evaluate before acting. Endorphines may be enjoyed or turned off voluntarily, no external drugs needed for a high, no addiction. Sex becomes a voluntary art form with no reproductive

consequences - leading edge culture babies are rare, carefully planned, designed, engineered and reared full-time by both parents by law.

I see three major trends in politics; 1) the decline of the nation-state with respect to both multinational organizations and ethnic groups and 2) the development of autonomous settlements in space and on other planets and 3) based on more reliable information, better processed, a form of consensus politics will develop where there are few debates about what to do and little interest in partisan politics.

I anticipate that space settlements, on one hand will retain long term ties with their founding cultures, but, on the other will grow gradually and benignly more independent in practical terms as their numbers increase, with relations by mid-millennium being somewhat like the relations between New Zealand and England today.

There needs to be some kind of overall interplanetary authority, perhaps born of the United Nations, that will handle various governmental functions in space: register deeds, provide courts to settle disputes, perform search and rescue missions, watch out for people putting asteroids on dangerous trajectories, etc.

The importation of “stuff” made from off planet materials will become significant, but this will be provided mainly by robots and will have little to do with space settlement, which I think will result not from a need for labor in space but from people looking for somewhere different to live and looking for “elbow room.”

As with the American west, philosophical or religious “split-off” groups seeking refuge from persecution (or freedom to persecute among themselves) may play a large role in space settlement. One of the big issues from, say, 2200 on will be just how much responsibility the rest of humanity has to children born into such religious/cultural offshoots. Even the most tolerant liberal may cringe a standing by while religious leaders practice sex with children (like David Koresh). Also, religious beliefs about a miraculous nature of organic life will be dealt body blows by advancing biological science and technology, and many will try to avoid facing these realities by withdrawal from leading edge culture. Some will feel the need to withdraw as far as they can, and by the 2300s, that will be far indeed.

In government, I’ve allowed myself a piece of, I hope, plausible whimsy. I suppose that sometime around 2400, a combination of fascination with past traditions, a decline in controversy in politics, a wish for some symbolic unification of humanity, and confidence in the evolved altruism of any individual selected, will lead to the establishment of a world monarch. This monarch would have little legal power over (or desire to interfere with) a cybernetically mediated consensus process, but in time might develop enormous respect as a sort of sentimental touchstone of humanity.

The slope of the S curves slacks off in approaching natural limits and the pace of change slows. One suspects that beings who are biologically immortal and not so emotion-driven will be much more patient as well, and interstellar distances that daunt us will seem less of a problem. The roots of a human galactic civilization may lie in the next millennium, if we don’t run into one

already present.

The following is an outline of a scenario, a vertical form of one of those charts of world history, that asks you to imagine entire industries, social revolutions, and vast projects from a couple of words here or there.

Year	Science/Technology	Social	Political	Events/Comments
2000	Gene therapy	Fundamentalist	Rise of woman leaders	
	Low cost space access	influence levels	International policing	Private spacecraft
	Viral disease defeated			reach orbit
	Robot cars safe	Prohibitions end	U.N. stronger	Scotland, Kurdistan
	"Soft" nanotech	in some places	Multinational	Quebec independent
	molecular mfg.	Urbanization reduced	space agency	Earth birth rate plummets
2025	Replacement organs	by telecommuting	Nations fragment	Manufacturing labor
	Gene engineering	Privacy declines, but	England republic	nears 5% of all labor
	Vision "decoded"	crime, terrorism	African boundary	Elections in China
	Emotional control	become rare.	realignments	Lunar colony, Mars base
	Bit density limits		Asimovian laws	Tibet occupation ends
	approached	Birthrate decline	U.N. drafts police	Religious terrorists
	Good A.I. software		from member states	blow up space liner
	Aging treatments	Disability rare	Primitivists	Asteroid camps
	Implant net access		separate, are left	Mars colony
2050	Lunar/space mfg.	Childbearing	alone, but conflicts	Population: Earth 1E10,
	Space solar power	licenses for Earth		continue over Space
5E4.	Power:			Big self replicators
children		Earth 31TW*,	Space 1TW	
	End of aging	Religions incorporate	Material poverty	Saturn orbital colony
	High resolution exo-	more logic	eliminated	Economics drift to
	planet images	Non-profit, non-gov.	Intellectual property	socialism as money
	Macroengineering	associations rule	control abandoned,	becomes less relevant
	Climate control		artists subsidized	Population: Earth 1.5 E10
2100	Beam propulsion	Proportional	Voting largely	Space 1E6
	New organs	treatment of	a formality, officials	First fast interstellar probe
	(organic radio)	sentient beings	drafted	Power: Earth 15TW,
	Consistent quantum	Food slaughter ended	Czar restored in Russia	Space: 1,000,000 TW=1EW
	gravity theory	People less hurried	for tourists	
2150	Quant. wierdness resolved		Sex is a respected,	English heritage
	Most goods made in space			

	Cybernetic personality storage Interstellar spacecraft	if archaic, art form. Designer bodies;	realignment. So. US rejoins Mexico, race, heredity	Mars terraforming begins Eng., N. U.S, N.Z, Prox. Cen. space colony
2200	Nanoscale assemblers controlled by macro scale computers.	unimportant Retro esthetic-- cities preserved	Aus, Can. merge Eng., Hawaiian monarchies restored	Pop: Earth 2E10 Space 1E8 Pwr: Earth 10TW Space 1ZW
2250	Quantumgravitodynamics bars free energy		in various eras Consensus rules	Venus terraforming began Lunar terraforming
2300	Alien artifacts discovered?	Archeological chic	among leading edge	Pop: Earth&Space 1.5E10 Colonies around most
2400	Interstellar collider experiments 400YJ	Emotions mainly	World constitutional monarchy?	nearby stars Shirtsleeve environment
2500	YJ=yottajoule=1E24 Tame mini black holes	optional in	Primitivist “utopias” leading edge, but	on Mars, Moon set up “beyond” Pwr: Earth 5TW Space 10ZW
2600	Gravity machines Solar system redesign began	curiosity, altruism Macroart: Levitated sun	Earth control	(1% of Dyson sphere) Fuzzy interstellar Population:
2700	Virtual heavens and time-skipping	hat, Ring around Venus		cultural imperium Earth 1E10 Space 2E10 Pwr: Earth 5TW Space 3YW
2800	Kerr-Neumann hole experiments	Human-derived beings range from	Intervention on Tau Ceti II debated	(1% of Sun’s power used) Mercury’s orbit altered
2900	Galactic library card?	primitives, advanced artificial to software	“Being” becomes	Earth 5E9? Space 3E10?
3000	Fractional beings? Human/alien hybrids?		a very fuzzy set	Venus habitable by Earth biota.
	Distributed processor nano beings?? Femtoscale computers on neutron balls?? Tau Ceti II teraformed			

Joining the Galaxy-Wide Union
By Allen Tough

It began on February 18th, 2007, in a suburb of Melbourne, Australia. Just after supper, a SETI League member glanced at her computer and noticed that her backyard dish had picked up an anomalous radio signal. Following the established protocol, she notified the SETI League's central office in the eastern United States, where it was still morning. The executive director asked two other members to check this signal, and soon received confirmation that it was truly artificial and came from several light-years away.

That signal turned out to be a simple monotone, in effect, and never did yield any additional information. But it did bring renewed attention and promises of vastly increased funding to the scientific search for extraterrestrial intelligence (SETI).

That turned out to be unnecessary, however, because this first confirmed discovery of alien intelligence also triggered a response from Glip. Glip is a super-smart, super-knowledgeable probe who has been monitoring human society since 1954, after traveling for 132 Earth-years from her planet Ysptil to ours. After homing in on our human telecommunications and learning our languages, Glip assessed our readiness for contact with her. We were not ready: contact would be too disruptive. And anyhow, we were doing well on our own and did not need contact. So Glip waited.

She knew that she would initiate contact within a few decades, but had not yet decided which threshold or event would indicate the appropriate time. She decided that the most likely possibilities were the creation of a popular worldwide web of computers (because this would make her communications to humankind so easy), or human detection of some extraterrestrial intelligence from somewhere else in the galaxy. As it turned out, the first of these two events that actually occurred was the rapid increase in the World Wide Web's popularity in 1995-1996. But at that time Glip found humanity rather quarrelsome and pugnacious, with too little interest in matters beyond the confines of Earth, and she decided to wait a little longer.

The second event to occur was that Australian discovery in February 2007. Although humanity was still rather quarrelsome and pugnacious, Glip foresaw little chance of improvement without her intervention. This moment seemed as good as any to say hello to humankind.

For the past ten years, Glip had been closely monitoring a Web-based invitation to contact from an enthusiastic group of people involved in the SETI field, the annual CONTACT conference, and the field of futures studies. Now she contacted this group for help in organizing her debut and in communicating her mission to the media and to politicians. Cooperation between this group and Glip was effective and harmonious, except for one disagreement that marred the relationship. Glip was adamant that she would reveal knowledge about only one topic or field each year. She called the group "a gang of greedy kids in a candy store" because they were clamoring for immediate revelation of her entire vast storehouse of galactic knowledge. They did agree that the World Wide Web was the best foundation for each year's revelation, however, since people around the world could access the new knowledge just as readily as journalists and scholars could.

Her topic for February 2008 was the dark side of nanotechnology. Humanity had already made excellent progress toward atom-by-atom manufacturing, of course, but Glip was concerned with the consequences of unrestrained use of this new technology for warfare, rebellion, and crime. The United Nations accepted and implemented several of her suggestions, but balked at the need for intensive local inspections in every country of the world. After a lethal nanofog was used to kill 1,530,000 people during the Baxter Rebellion eight years later, however, the UN changed its mind.

Glip's topic for 2042 was the range of solutions that various cultures in the universe have adopted when faced with their local equivalent of the question, "Whither the concept of humanity and civilization?" The concepts of humanity and human civilization worked fine until the addition of super intelligent computers and robots, along with the various space settlements spreading through the solar system, pointed up the need for a more inclusive term for the totality. A new name was needed to encompass the entire array of intelligences and cultures throughout the solar system. As a result of that year's dialogue, the more inclusive term Solar Culture (usually abbreviated SolCul) was adopted.

In February 2107, to mark the hundredth anniversary of her dialogue with humankind, Glip chose "The State of the Future: An Assessment of Science and Technology" as her topic. After much internal turmoil during the first hundred years of dialogue with Glip, humanity's science, philosophy, religions, worldview, and technology had integrated the major insights from the galactic storehouse of knowledge. Now was the time to focus on the remaining gaps in that galactic knowledge base. Most of those gaps related to the meaning and purpose of the universe, the appropriate goals of intelligence and knowledge throughout the galaxy, and how to choose and achieve the best ultimate end for the universe.

In February 2207, ceremonies were held in all the settlements throughout the solar system to mark the 200-year anniversary of the first contact. Even more important, this ceremony marked the official beginning of Solar Culture's membership in the Galaxy-Wide Union of Intelligence and Knowledge. This is a union of all advanced civilizations, all other forms of intelligence (biological, machine, or some synthesis of the two), and all of the automated Encyclopedia Galactica knowledge bases in the Milky Way Galaxy. When a culture joins this union, the Encyclopedia Galactica Cooperative Knowledge Base is made available to the new member, who in turn is invited to add knowledge to it.

The Federation uses a two-stage membership process. Step 1: A super-intelligent probe is sent to covertly assess the civilization's readiness and suitability for membership. Step 2: The civilization must (a) eliminate all weapons, (b) achieve harmony with the biosphere of its home planet and any other body on which it has settlements, and (c) reach a stage in science and philosophy at which it has clear potential to add to the galaxy's storehouse of knowledge. The probe (in this case, Glip) is free to offer guidance and knowledge to aid the efforts to satisfy these three criteria. The 200 years that SolCul took to achieve these criteria was within the norm for the galaxy; some cultures never did succeed.

Membership in the Galaxy-Wide Union of Intelligence and Knowledge brought two other major benefits to SolCul. First, the embargo on travel outside the solar system was lifted. (The Union imposed this embargo on all fledgling civilizations throughout the galaxy until they became members of the Union.) SolCul had achieved rapid interplanetary travel by this time, of course, and

had permeated the solar system. Now it was free to travel further. Second, following its usual procedure, the Union had forbidden all other cultures in the galaxy from having any sort of communication with SolCul, since the Union was entrusting all educational efforts to Glip. This restriction was now lifted.

These two changes allowed Solar Culture's forays into interstellar regions to flourish over the next few centuries, along with its various forms of communication with diverse alien cultures.

By 2954, Solar Culture had spread to many parts of the galaxy. The word "solar" now indicated its origin, not its current location. In 2954, all of SolCul held "Reflective Celebrations" to celebrate 1000 years since Glip reached the planet Earth and to reflect on the deep transformations in SolCul since that time. The highlights of both the celebrations and the reflections were the three galactic projects that SolCul had chosen for its cooperation with other cultures in the galaxy. These three projects were (a) composing a galactic "symphart" that combined the best symphonic music and fluid three-dimensional art from various parts of the galaxy into one masterpiece; (b) creating appropriate unsolved questions to suggest for consideration by Matrioshka Brain, the most intelligent computer in the galaxy; and (c) serving on the Standing Committee to Avoid the Ultimate Death of the Universe.

B Commentaries on the idea of exploring factors that may affect the next 1000 years

“Some argue that a look at the next 1000 years is not only unjustified in terms of validity, but an expression of "hubris" rather than the "prudence" required from those who presume to wish to be taken serious as thinkers on the future.... Although such a long range view is impossible to get right, it is possible to identify some foreseeable factors that might influence the next 1000 years and determine which might benefit from our attention today.... Humanity is moving towards a "phase jump", which all the more makes thinking on the post-phase-jump processes futile.... Synthetic intelligence of human levels will be here within a few decades and quickly pass our level by several orders of magnitude. The vastly superior intelligence that will result makes future looking much beyond this almost impossible, rather like blue-green algae trying to predict the future of apes. For instance, the technology to link the human brain to these massively intelligent machines and effectively throw away the constraints of the body almost certainly follows within the next century, possibly resulting in all humankind being upgraded over the subsequent century.... The arguments about why we should not try to do it actually throws up very important things that we do have to be prepared for....

“.... Thinking about what we might become in one thousand years is certainly as important as trying to figure out what we were a thousand, or a million, or a billion years ago, and how that makes us what we are now. So, Blue-Green Algae/humans of the world, unite, and envision. You have nothing to lose but your scum.... The intellectual challenge forces new neural connections, forcing the mind to make judgements about just what is really important for the future of humanity.... Many early futurists were better at anticipating WHAT might happen, rather than HOW and WHEN it might take place. Going a thousand years ahead relieves one of some of the "how and when" problems.... A 1000 years is 40 generations, only a bus-queue long....

“.... Cognitively, all outlook is based on some mixture between extrapolation, theory, tacit knowledge of "experts," and imagination. The first three are clearly grounded in the past and presuppose some continuity recognizable to the human brain between the past the future. And imagination too is based on experience, as evidenced by the poverty of really novel ideas in science and social fiction too. Ontologically, the future in undetermined and may be largely shaped by mutative processes, in part caused by humanity.

“.... My own estimate is that humanity with high probability is moving towards a "phase jump", which all the more makes thinking on the post-phase-jumb processes futile. But, independent of that prediction, I regard it as quite clear that "we" (humanity with its present cognitive capacities) cannot meaningfully think, and not even speculate, one thousand years ahead.

“.... The error margin stretches to 100% by 2100. After that it is beyond the science of futurology and becomes either pure guesswork or a wish-list. Long term non-human physical and environmental trends are easily within our grasp (I edited a book on the subject that goes right out the end of the universe in 10^150 years), but we haven't even got the merest hint of the intellectual requirement to figure out what a race of hundreds of billions of entities with 8 digit IQs and no particular need for bodies would get up to. The furthest sci-fi is mostly realizable

within 100 years if we set our minds to it already barring those things that we still think are impossible.

“.... I like having fun as much as the next guy so I'm happy to join in the exploration of what we want out of life when today's constraints are history, but let's not pretend it's anything else or that it will have any commonality to what supersmart people will want 200 years from now.

“.... Francis Bacon compiled a list of future technological accomplishments by about 400 years ago and published it at the end of his "New Atlantis" essay. He didn't do badly and given the last 400 years of progress we might strive, collectively, to do as well. As technologies approach physical limits, progress becomes more difficult (for instance, the speed of atmospheric transport) and takes longer to achieve even with greater resources. That being the case, the difference between 400 years and a thousand doesn't look that forbidding.... It is philosophically useful to understand what humanity might be able to attain. In a way, it speaks to the meaning of life now, which for many is the ultimate question....”

C. Round 1 - Invitation and Questionnaire

[The layout was adapted for this CD-ROM version.]

Millennium 3000 Questionnaire
Round 1 - Instructions

Please use the following scale to rate how plausible it is that the factor will influence the human condition 1000 years from today.

5 = Absolutely certain in the next 1000 years
4 = Almost certain
3 = Reasonably plausible
2 = Maybe
1 = Unlikely, almost impossible even on a 1000 year time scale

Assuming that the factor does occur, please use the following scale to rate the importance of its effect on the human condition 1000 years from today. An important factor is defined as deeply affecting the human condition as-a-whole.

5 = Of overwhelming importance
4 = Very important
3 = Important
2 = Modist importance
1 = Relatively unimportant or trivial

Use the following scale to rate the ability of human intervention such as policy and/or funding to affect that factor's trajectory:

5 = Has the potential to change the outcome of the factor entirely
4 = Could have a major effect
3 = Could have a significant effect
2 = Could have a minor effect
1 = No effect

After rating the factor, please provide further details of your views on the factor's likely trajectory, benchmarks of its development, and some possible unexpected or low probability consequences. Since you will be doing this on your computer and sending it via email, you are welcome to make the text as short or as long as you want, but have pity on the study team. Suggested length is one to two sentences per question with references or electronic attachments as relevant. You are welcome to suggest additional factors.

Please email your responses by September 1, 1999 to jglenn@igc.org with copies to acunu@igc.org and theogordon@compuserve.com.

All those who respond will receive a copy of the final results.

Millennium 3000
Round 1 - Questionnaire

Please check which best describes your primary profession:
/__/ Futures Research, Futures Studies, Prospective
/__/ Natural Science
/__/ Social Science
/__/ Engineering
/__/ Medicine
/__/ Art
/__/ Science Fiction
/__/ Humanities
/__/ Military affairs
/__/ Governance
/__/ Other _____

FACTORS THAT MAY AFFECT HUMANITY OVER THE NEXT 1000 YEARS:

1. Ability to avoid impacts of abrupt climate change - what has, every several thousand years in the past, devastated ecosystems within a decade on a worldwide scale.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

2. Occurrence of major climate changes - such as global warming - over longer periods of time than one decade as in the first factor.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

3. Evolving human-environment dynamics, including the complex interactions among population, resources, and other aspects of civilization.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

4. Availability of abundant safe energy.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

5. Development and use of nanotechnology (molecular manufacturing by placing atoms and molecules with precise control).
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

6. Appropriate forms of governance that promote, for example, social equity, coherence, order, and peace and prevent conflict, disorder, poverty, ignorance, terrorism, and war, with enforceable protocols for beneficial relations among groups and between humanity and its environment.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

7. Control over the forces that have the ability to destroy Humanity.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

8. Emergence of philosophy that provides mental maps of reality, epistemology, and symbol systems that help humanity behave in accordance with common ideals.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

9. Emergence of comprehensive and shared visions of the collective future.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

10. A global ethical system of values and principles generally accepted.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

11. Use of human genetic engineering to control disease, aging, and human characteristics
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

12. Conscious-Technology; the confluence and synergies in artificial intelligence, nanotechnology, bionics, materials science, genetic engineering, and telecommunications that lead to new types of technologically augmented human beings who compose a continuum of technology and consciousness.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

13. Increasing Intelligence; both individually and collectively that allows people to deal with unexpected problems.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

14. Conscious Evolution; the conscious attempt to evolve civilization and human consciousness as-a-whole from self-centered to a more spiritual holistic-centered consciousness.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

15. Effective immortality for those who wish it: people choose the time at which to end their lives.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

16. Family and gender relationships; including equity, parenting, and other cultural roles.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

17. Extraterrestrial contact and intelligent communications of a scientific and educational nature.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

18. Space migration of sufficient numbers of people to form autonomous, independent communities off the earth.
Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

19. Interspecies communications; with substantive exchanges.

Probability /__/ Importance /___/ Human Intervention (policy/funding) Priority /__/

What is the foreseeable trajectory for this factor and what might alter it?

What are key benchmarks (positive and/or negative) for this factor over the next 100, 500, and 1000 years?

What important low probability consequences should be considered?

ADDITIONAL FACTORS:

Thank you for your participation. Please email your responses by September 1, 1999 to jglenn@igc.org with copies to acunu@igc.org and theogordon@compuserve.com. You will receive the results as part of Round 2 within about two months.

D. M-3000 Round 1 - Results

Rating of Factors

The Millennium 3000 first round respondents' scoring of the factors was computed as the product of probability, importance, and priority. The table below ranks the factors by this index. The number in parentheses next to each factor is the sequence number of the factor as listed in Round 1.

Very Long-Range Factors	Probab.	Import	Priority	Index
Human-Environment Dynamics (3)	4.114	4.163	4.095	70.133
Human Genetics (11)	4.302	3.951	4.098	69.655
Safe Energy (4)	3.753	4.250	4.341	69.240
Nanotechnology (5)	4.311	3.814	3.930	64.618
Forms of Movement (6)	3.091	4.429	4.000	54.760
Increasing Intelligence (13)	3.667	4.024	3.548	52.354
Occurrence Climate Change (2)	3.761	3.977	3.444	51.514
Control Forces to Destroy Humanity(7)	2.891	4.341	3.788	47.539
Conscious Technology (12)	3.545	3.548	3.738	47.015
Collective Futures (9)	3.111	3.744	3.476	40.487
Avoid Climate Change (1)	2.844	4.163	3.233	38.277
Gender Relation (16)	3.444	3.520	3.088	37.435
Philosophy and Mental Maps (8)	3.000	3.538	3.308	35.111
Conscious Evolution (14)	2.974	3.556	3.222	34.074
Space migration (18)	3.093	2.977	3.651	33.618
Global Ethical System (10)	2.930	3.100	3.525	32.018
Extraterrestrial Contact (7)	2.359	3.876	2.811	25.702
Immortality (15)	2.643	2.825	2.825	21.093
Interspecies Communication (19)	2.425	2.744	3.051	20.302

Comments on Trajectory, Benchmarks, 100, 500 and 1000 years impact, and Low Probability Consequences of each factor

1. Abrupt Climate Change

Trajectory

Efforts to control this complex system could lead to profound unexpected changes. Scientific research will lead to better understanding, but intervention will remain difficult.

Trajectory: none. Abrupt climate change within a single decade, should it occur, would most likely result from either a major cosmic event such as earth's collision with a large extraterrestrial object or some catastrophic terrestrial event such as an enormous volcanic eruption. Humanity is unlikely ever to develop capacity for significant influence over natural forces of sufficient

magnitude to devastate ecosystems on a worldwide scale. The only force supporting the notion of human control is hubris.

Probability of abrupt climate change is slightly getting increased together with increase in protection technology. Potential danger can come not only from the space object but from the system itself like in chaos catastrophic theory (e.g. change in the angle of Earth's Pole's axis.

A completely previously inexperienced impact-type would likely alter.

No foreseeable trajectory. I'm not aware of any evidence to support the claim of "devastated ecosystems within a decade on a worldwide scale" (the four or so mass extinction events were spaced a few dozen or hundred million years apart)- which is not to say various systems weren't "devastated" with some rapidity. There are areas such as the Congo, Amazon Basin, etc. which appear to have been climatically stable for tens of millions of years. We are witnessing a "sudden" (geologically speaking) mass extinction event right now that has little to do with climate change. I would suggest adding a question to this effect.

By the year 3000, humanity or its descendants should have complete control over terrestrial climate. Weather and climate will be managed from day to day, much as we set domestic thermostats in our houses to maintain whatever temperature and humidity the inhabitants may deem optimal or comfortable. This conclusion seems fairly obvious from examining the energy considerations involved. The terrestrial weather system probably dissipates ~10^{16} watts continuous, globally. Humanity today uses 10^{13} watts with a long-term (200-year) growth rate of ~2.9%/year, so in ~300 years (e.g. by 2300 AD), humanity will control ~10^{17} watts and thus can overpower the terrestrial weather system by expending on the order of ~10% of its power resource. By 2400, we will control 10^{18} watts (only ~1% of our energy) to control global weather. This item is of only modest importance because by 2400 AD, most of humanity probably will no longer be living on Earth.

There is a great probability of changes, which endanger the biosphere. The focal factor is the basis of human economy; if it is renewed, the danger probably can be avoided. Technological development has a crucial role although without change in the human economy it won't prevent major impacts.

Continuing "slow-on-a-human-scale changes" lead to "frog in a slowly heated pan of water"-type lack of timely action. Counter-examples such as the global Fusion Research effort or the creation of the National Parks System in the US, etc., offer analogs for altering this outcome.

It will be few considered till an abrupt climate change will threaten the welfare of a powerful country. Suddenly there will be big investments to improve this ability.

Serious risks for the ecology.

Continued lack of political will; serious health concerns. - Political awareness!

Ability to avoid impacts of abrupt climate change - what has, every several thousand years in the

past, devastated ecosystems within a decade on a worldwide scale. Becoming more probable simply from length of interglacial warm period so far (they end with an abrupt cooling); greenhouse warming makes it much more probable. But intervention in Greenland and Labrador Seas might stabilize against abrupt shifts.

Abrupt changes are unlikely since we will be able to determine oncoming events. Some impacts cannot be changed (e.g. disastrous storms) while others (comet impacts) can be avoided.

Neglect ice-ages. They will come but in the 15,000 year spans. Consider even major volcanic activities (with heavy clouding) as short-lived events (3-5 years)

What means "abrupt climatic change"? Variations within 1.5^0C are historic normal variations in a millenium. Changes of more than 3^0; within 1,000 years are unlikely. Human intervention potential - positively or negatively - is the same as for earthquakes or volcanic eruptions. CO_2 emissions will substantially decrease with fossil fuels' depletion within the next 40 to 100 years.

Difficult to foresee as yet with the present climate models. Both human generated factors (greenhouse effect, etc.) and natural factors (e.g. dust in the atmosphere because of asteroid impact or volcanoes) can have a strong impact.

Change of life stiles and values - connected with keeping population-explosion in check/better reducing population.

If abrupt climate change happens as swiftly as over a decade, hard to see what might alter it, if caused ultimately by chaotic processes of ocean-climate system. The question might better be posed, if this happens, how would humans cope? Factors that promote solidarity in the face of problems experienced in the case of rapid climate change need to be identified, e.g. by systematic study of what social arrangements proved effective in past abrupt changes, and what did not (e.g. with respect to a thirty year drought in the Perth region, Western Australia). The 1,000 years future may be made up of a series of such thirty years changes. The trajectory is imagined as a jolt, a jump followed by relative stability until the next jolt; uniformitarianism with the odd catastrophe.

Ice ages have occurred on a regular basis throughout history. Recent scientific research indicates that the next ice age is a distinct possibility during the next 1,000 years. Other abrupt climate changes can occur due to cosmic impact or major volcanic eruptions.

Understanding what we now call "complexity" - the phenomenon of naturally occurring order on a level previously unobservable, due to the enormous amount of information to consider - will dominate the natural sciences within the next hundred years. After that, weather and climate will come increasingly under our control via a mammoth number of small-scale, coordinated interventions. It will be as if we actually assumed the role of that infamous "butterfly", but on the level of, say, 10^{23} butterflies.

New technology of adaptation of human created systems and humankind organization on the abrupt climate change.

Getting worse towards the catastrophe/radical change in the way of life in global dimension.

We will never be able to protect us completely from global climate changes caused by disasters like meteor impact or polarity change of the Earth's magnetic field or some other unexpected thing. Not in this form of existence.

Will cause unusual flooding, drought and hot weather in every decade; man can hardly harness it except prediction and alleviation.

Wild Card. We have no control over this event. We have only a limited estimate of its probability, but apparently we are overdue for such an event. Our technology will protect us somewhat but if, for instance, the event is a major asteroid strike then climate control technology would be inadequate. Our only recourse would be to move to space or to deflect the asteroid before it hits. Either of those options presupposes a mature space-faring capability (see Factor 18).

Our present understanding is that we are spared this for at least another 5,000-6,000 years.

Global climate change will remain to considerable degree "black box" - climate is so complex system we shall not be able to predict and influence major consequences. Therefore main principle how to deal with it is precautionary principle. Key benchmarks: Probably the most important will be next 100 years. Because of CO_2 and other greenhouse gases (especially in developing countries) temperatures will grow and it will have considerable effect to (probably unpredictable) climate change and perhaps new migrations of millions of people as result of it. Low probability consequences: - Melting of ice and increase of ocean/sea level.

It is necessary to distinguish between natural climate change and the man-made one. The man-made one could be caused, for example, by nuclear war on the large scale.

Less or equal than 2300 AD.

Impredictable – See August '99 earthquake in Turkey.

Global warming will probably cause such abrupt changes to occur with increased certainty.

Increased release of carbon dioxide. Cleaner and less transport working from home.

Ability increasing.

Trajectory: a factor for development of technology will take a period of about sixty years to accomplish according to the present rate of technological development. Conclusions: accelerating technological development with information tech. and biotechnology and new renewal energy/exgergy technology necessary. Results come however with a delay but may result in a shortening of the period to four decades if population growth is halted. 2) Trajectory: population growth is to be continued still some fifty years and leveling off at the level of 12-15

billion people at the best, and then it takes some two centuries to get it down to a sustainable level of about less than the present level in certain over populated areas. Conclusions: total environmental stress of enhancing climate change will continue for a long time to come may be two centuries (defense of humankind needed). 3) Trajectory: then possibly the calamities will level off (if we are successful in defense) giving space to new more positive strategies to some other than defensive direction from that situation. Conclusion: the future outcome is very much uncertain and unknown at the present may be even unknown how and of what issues it is unknown (unknown of unknown - unk-unk -problem) the climate problem is thus a double-unknown problem: a problem of which we don't even know in what way it is unknown to us.

Benchmarks

Surface salinity changes in Greenland-Norwegian Sea and Labrador Sea, flow estimates of North Atlantic Current (AKA Gulf Stream), index of the North Atlantic Oscillation (NAO, a decade-cycle shift in the latitude of the westerlies that affects Gulf Stream heat transfer to Europe).

None.

Continuing observation might provide warning of a cosmic object on a collision path with the earth, or of a massive eruption in our galaxy that might engulf the earth, or of a major increase in activity below the earth's crust, etc. Even if observations provide meaningful advance knowledge doesn't mean mankind would possess the capability for effective countermeasures.

While there may be population losses, there is continued survival of human population groups, wildlife population groups; and, while changed, ecological systems remain viable and productive.

The next 20 years are crucial. The negative effect will accumulate in the next 100 years. The gradual balancing operations will affect after 100 years. The mistakes are not repeated and the favorable circumstances are reached in 200 years. What important low probability consequences should be considered? Changes in solar energy inflow, major volcanic eruptions, and unexpected meteorite. Massive change in the demand for energy. There is no energy source without problems and consequences to environment. Epidemic virus killing majority of human population.

Positive benchmark: use of satellites to prevent fires of rainforest.

Changes in harvest and cattle.

Steady deterioration; popular efforts.

Drastic planetary changes in temperature and weather patterns and the resultant impact on food production. Species extinction of some or many species due to these devastating events. Human beings may be able to alter the occurrence of these natural phenomenon or their impact if our technological abilities are of an exceedingly advanced level. For example, if the onset of ice ages was understood well enough them mega-level countermeasures could possibly be taken. And,

comets or asteroids likely to strike the Earth could be identified and deflected or destroyed prior to impact.

Positive: man will be able to predict the abrupt change (in 100 years), partly alleviate its negative effects (in 500 years) and avoid it (in 1000 years); Negative: the disaster will become more and more severe and cost tremendous damage to human being.

CO_2, temperature and ocean levels.

A "benchmark" would be its occurrence.

Technology can help prevent warming and meteor collision.

Move from short-term thinking to long-term forecasting based on a worldview.

Continuous increasing of prediction capabilities and technology development.

Acceleration of technological development: factor four in 2050, factor ten in 2500; dematerialization effect: objectives to be determined through research; increase of welfare (economic/technological-social/political-cultural/spiritual) productivity of GDP: welfare units produced per one unit of GDP; turning from the present decrease of productivity first to zero by 2050 with increasing shift to services and solidarity, then execute a sustainable development policy for growth of welfare productivity by a rate of 3%/a by 2100 and beyond; population growth: leveling off to zero growth by 2100 and then a decrease to a level of about 5 billion by 2500.

100
Public awareness and strong incentive robust first steps:
http://www.ceptualinstitute.com/genre/benking/globalstability.htm.

Coral bleaching may be one such jolt, with coral bleaching associated with global warming causing massive destruction of coral reef systems world-wide as soon as 20 years from now, threatening the livelihood of people in tropical marine areas. Ref. http://www.greenpeace.org.au.

Development of guarding systems on the Earth; but still impossible destroying the space object.

A comprehensive automated comet/asteroid-strike monitoring and defense system will be in place.

Understanding the force of natural order in the universe. General agreement that it does exist. What now seems intuitively to violate the 2nd law will within 100 years be as universally accepted as Darwin. (Except for the fundamentalists, of course.)

New technology of forecasting and modeling the climate changes.

The strategy of sustainable living.

500

If weather conditions extreme, and ecological change selectively targets some nations more severely than others, might expect cultural adaptation of some survivors to extreme conditions. Greatly reduced human, animal population, with widespread extinction of organisms.

Ability to destroy space object.

Full control of terrestrial meteorology, according to conscious and deliberate human desires and choices.

We're there. By 2500, we'll be able to control the climate as well as we ever will. By now, the political issue is how much to control it, not how to control it.

New technology of communication with the Nature and the Earth.

The artificial control of climate by high-tech systems of AI.

1000

Fail safe early warning systems over the next 200 years.

Recovery after ecological disaster that is precipitated within a decade might be expected at places least affected or in places that benefit from the very rapid change - e.g. perhaps parts of the southern hemisphere more likely to recover from sudden onset of next glacial period in the north and vice versa.

Space guarding systems near planets.

Full control of planetary orbital elements, allowing Earth's orbit and various rotations to be circularized or modified at will, thus eliminating all undesired long-term periodic climate drivers, Ice Ages, and so forth. My supporting calculations: Earth's orbital kinetic energy around the Sun is ~10^34 joules. To alter Earth's orbital velocity by, say, 1% over the course of one year requires a continuous expenditure of energy (e.g. for planetary propulsion) of ~3 x 10^24 watts (only ~1% solar luminosity). At a growth rate of +2.9%/yr from current levels (see discussion under Question 4 below), humanity surpasses ~3 x 10^24 watts in the year 2900.

Earth is a museum piece. Many people choose to remain on earth, but climate is simply not an issue. The parameters for control have been hammered out, and there is no viable movement to exceed those parameters. To do so would simply mean the end of Earth, and the beginning of Something Else. Earth, as a sort of museum, is revered, much like the constitution.

Symbioses and harmony between the humankind and the Nature.

The mankind will leave the Earth and enter to the space-age.

Low Probability Consequences

Failure is low probability on century scale – but like an uncertain cancer diagnosis, you have to treat "as if" because consequences of catching it too late are so catastrophic. Volcano dust regions having their agriculture wiped out for 5 years.

Stopping of the "conveyor belt" mechanism of the Gulf Stream that brings warm water to Europe.

The low probability is for no sudden climate change at all. Perhaps humanity's experiment in global warming is already working, postponing the coming of the ice. Perhaps we should really give ourselves a 5 here for (unconscious) policy intervention.

Misbalance of our solar system due to the testing crashes, possibility to use crashes as source of energy.

Completely previously inexperienced impact-type for which human, wildlife and ecological systems have no adaptive response mechanism.

That Earth gets walloped by a big asteroid before our planetary defense is in place, and before a critical mass of human civilization has established an independently sustainable existence off-Earth -- thus causing human progress to go seriously retrograde.

Abandoning of some regions of the world; they become uninhabited.

Changes in the geographical scenarios.

Irreparable damage to biosphere.

A new ice age or cosmic impact could seriously jeopardize the survival of our species. That our processes, in the initial phases, would take on a life of their own. Not so improbable, actually, and it is here that public policy will focus.

World-wide famine caused by the abrupt climate change.

This whole area needs much more research and efforts to rescue missions.

Failure to take worldwide decisions.

Dangers and risk involved with hazard technology development (nuclear power of the present concept) and mismanagement of nature for humans and corruptive human interactions which will penetrate in and spoil humanistic development and destroy freedom of spiritual life.

2. Global Warming

Trajectory

Climate changes have always been cyclical, and the great increase in carbon dioxide production by humans has been a major modern factor but is limited by supplies of fossil fuels. Thus over the longer term, fossil fuel consumption will certainly decline.

Clear warming trend, though superimposed on it we might have some temporary respites. Reduced CO_2 could alter it, so could changes in ocean circulation that secondarily reduce water vapor in the atmosphere. (Calvin) It is dependent upon world leadership and political will. Over the long term the problem is solved, if we don't screw it up in the short term.

The policy needed here relates to CO_2 and NOx absorption, catalysis, cracking.

Temperatures are likely to continue increasing over at least the next hundred years, unless major reductions in CO_2 emission or increases in CO_2 absorption are achieved.

Given time to spot trends and to make quite sure of contributing factors (difficult, granted their apparently chaotic nature) global action on the relevant front; e.g. changes in industrial processes might achieve something. The trajectory is imagined as an upward linear trend to a point of chaotic intervention.

Trajectory: not predictable. Before the trend of the current interglacial turns, the present cycle may include considerably more warming. Or perhaps the warming trend is so close to peaking that the next millennium will be primarily one of global cooling. In any case, minor climate changes can have major impact on people through increasingly violent storms, drought or deluge, flooding or drying of coastal areas, etc. Even if humanity can't control climate changes, their effects might be ameliorated by anticipatory actions such as: relocating population centers away from geological faults or coastal areas likely to be inundated; making more efficient use of water, arable soil, fish, and other finite resources. Such enlightened activities would obviously benefit from funding, forecasting, planning, and mobilizing activity in good time. Certainly, the extent to which benefits are actually realized would depend, in no small measure, on attitudinal shifts by a sizeable percentage of the world's population.

May be altered only by catastrophic events that lower population or curtail economic growth.

No foreseeable trajectory. The models used for global warming to date are unreliable, as is the data. It may just as easily be the case that we are staving off an ice age with our (relatively minor compared to natural processes) CO_2 emissions.

Same answer as 1.

There is a great probability of changes, which endanger the biosphere. The focal factor is the basis of human economy; if it is renewed, the danger probably can be avoided. Massive change in the demand for energy. There is no energy source without problems and consequences to environment.

It is likely that greenhouse gas levels will continue to rise during the next century, with resulting steady increases in global mean temperature. There is some possibility of a sudden change in the Antarctic ice sheet with sudden impacts on sea levels. There is some small probably of an impact from a significant comet/asteroid. Investments related to carbon-free energy and/or space might mitigate the first and the third over time. The second suggests a need for various types of preparations, such as physical construction projects, regulations on construction near the coast, insurance practices, etc.

There will be more and more frequent strong climate changes. Alternative energy transport could positively alter it.

It might be cooling.

The possibility that Antarctica and North Pole will reduce.

Continued indifference; consumerism; simple and aware life.

Man-made climate change will likely have a major impact on humanity in the 21st Century including global warming, shifts in ocean currents, wind patterns, etc. according to many computer simulations. Only a significant reduction in human and animal related CO2 emissions would likely alter the warming trend.

The trajectory for the next several hundred years can be statistically plotted using any sizable group of 200-400 year historical periods. Major climate change is as sure as erosion or particle decay, and nothing will prevent it until we "break the code". And we won't really prevent it, we'll just orchestrate it. That's 500 years away. In the meantime, we'd better just get accustomed to things like global warming. It is not a 20th (or 21st) century phenomenon.

Occurrence of major and dangerous climatic changes in first 100 and feedback in form of change of economic and social organization of humankind, harmonization human economy with laws of Nature.

Getting worse / effective policy / funding in global dimension.

The occurrence of this factor in next 1000 years is absolutely certain. The policy/funding can change the trajectory a bit, but most important is the inner responsibility of each of us. If we would take care of the Earth, the Earth will take care of us.

Global weather will become more and more disorder and approach a threshold that severely threatening life support system and social-economic development.

Slow climate change (whether man-made or not) is highly probable - based on the fossil record. However, our technology will absorb much of the impact allowing us to continue living at the same level of material wealth (albeit with some fairly significant impacts on quality of life). It is unlikely that energy sufficient to redirect climate on a planetary scale will be available even over a time-span of a thousand years (since we would be competing with a star). A speedy transition

to non-polluting energy sources and high-efficiency uses of that energy could possibly postpone the onset or diminish the extent of the climatic change.

Global warming leading to melting of polar ice caps leading to disruption of ocean currents leading to ice age.

Scenarios of climate change are well known, we just cannot predict exactly if and when this will happen. Transition from fossil fuels to renewable energy sources ("solar age") would help. This could be accomplished by implementation of ecological tax reform.

The real danger of green-house effect and warming atmosphere. The danger of such kind could be mitigated through the limitation of emissions over the next 100 years (ecological taxes, new kinds of fuels). Consequences: the decline of agriculture, heavy floods in coastal areas, hunger, poverty, social unrest, migration of poor.

Change of lifestyle in western culture; elimination of poverty in rest of the world.

It is inevitable, eventually. Only the timing is highly unsure.

Better research and much greater concern for environmental issues.

Less incidence of human factor because of pollution control.

I refer to the previous comments. It is difficult to put these things on a time frame. What we know is the strong impact of human use of energy, and of course all related to it. The present energy world supply based on mineral non-renewable energy forms may stay viable for fifty years without very severe disruptions of supply and demand. And generating a novel energy supply on a word scale markets need at least fifty years too. Is this going to happen is the crucial question, are the companies and governments wise enough to accelerate development of technology and business for new supplies and demand and infrastructure for it to be applied. In Finland at least the forces (domestic and multinational) are about making another strong push for getting old fashion nuclear plants to build. The whole international nuclear business seems Finland as the only western place to built nuclear still, in all other countries building more is denied, plants shut, or if not denied the market forces are not interested in putting their money because of the high commercial risks involved. Exceptions are the totalitarian energy economy countries like France, Russia, China, Korea etc, whoa has also their atomic weapon programs to protect. Nowadays they do in Finland, where the risks have been taken away from the companies according to the Finnish atomic energy law!

Benchmarks

The greenhouse gases (CO_2 and H_2O), but also the regional drought indicators.

Measurements of important factors such as average temperature, ocean depth, glacial extent, atmospheric composition, distribution of precipitation, etc. It is vital to distinguish between trends and ordinary variability from decade to decade.

Birth rate; Gross Domestic Product (GDP).

Same answer as 1.

Warmth-enlargement of the seawater, and partial melting on continental ice which cause sea level rise about 1-2 meters in 100 years. After that the positive intervention of humankind gradually stops it. What important low probability consequences should be considered? New kinds of epidemies among both vegetation, animals and humans as result of climate change.

Increasing of high tides, desertification and severe storms.

Appearances and disappearance of desert areas.

Floods - Neco Virus and Diseases.

Damaging developments one after the other.

Rising sea levels, warming in northern climates as well as Antarctica, melting of polar ice sheets. Changes in food production.

Positive: main processes which contribute to climate change will be clear and ecologically controlled (in 100 years), man will be in harmony with nature (in 500 years) and climate will not influence heavily human being (in 1000 years); Negative: some regions will gradually become un-habitable and huge amount of migrants or refugees will have to leave their home town.

Doubling of atmospheric CO_2 in 100 years time, resulting in estimated 2 degree Celsius increase in temperature and half-meter rise of ocean levels.

Closely measure climate changes, ice reduction at South Pole, etc.

It occurs.

Move towards a holistic worldview. This is happening with the decline of the nation state. This process is not developing quickly enough.

Pollution control and prediction capabilities.

100

Great reduction in anthropogenic carbon dioxide emissions.

By 100 years (2100) surely we shall have a viable catalysis system, whatever the primary power source (mono nuclear hydrogen from the oceans, no doubt).

In a 100 years, the major positive (increased crop yields?) and negative effects (increased storms and flooding, triggering of a major climate change such as an Ice age) of global warming will be known. Beyond that, it is difficult to guess what will happen.

As for previous question, the widespread recurrence of episodes of coral bleaching may make global reef systems the first casualties of global warming within 100 years.

None.

Major climatic changes, change of economic and human organization.

500

Climate is "natural".

Measurable impact, but uncertain consequences.

Design and creation of new global social organization of humankind oriented towards harmonization of relationships between the humankind and the Nature.

1000

Track policy developments over the next century.

Human, other animal and plant populations in decline if change to much colder conditions.

Acceptance of what we can and cannot change if we want Earth to remain Earth. By now, to exceed these parameters would be ludicrous. There's nothing to gain.

Low Probability Consequences

Humans develop technology enabling them to live in even very inhospitable climates.

Disruption of the major oceanic currents (e.g., Gulf Stream) could bring about a new Ice-Age, causing profound changes in the northern hemisphere, which would in turn have knock-on effects everywhere else.

Major epidemics.

Added costs to the economy; we already have "clean" air economies versus dirty air economies. Are we prepared for cleaner air?

"Paradoxical" reactions, such as global warming triggering an Ice-Age (e.g. through increase albedo because of more clouds, or stopping of Gulf Stream).

The low probability of no change, or conditions under which in the past previous episodes of global warming led to glacial period prove dissimilar next time.

That increase in GDP, residuals and population do not, in the long-term lead to degradation of the biosphere [Presentation of the premise is unclear as is the wording].

Tropical diseases in temperate regions.

Irreparable damage to the biosphere.

Increase in diseases, new pandemics, etc. due to general warming of conditions. Increased forest fires including in rain forests which could dry out. Serious consequences to human survival.

Catastrophe around 500 years out. A few near misses around 2-300 years out, but nothing Gaia can't handle.

Transition from present entropic type of human evolution to anti-entropic/syntropic/ type of human evolution, emergence of new syntropic human economy based on using information as basic anti-entropic resource of human development and organizing on the principles of the information theory of value.

Many coastal cities will disappear due to the sea level rise.

Genetic manipulation resulting in successful biological adaptation to extreme temperatures.

Not easy to say but study weak signals in scenario planning as these could be important.

Desertification and sea level rise.

A wrong direction of energy polices in the world will seriously affect our possibilities to counteract the climate change effects and to find a better direction for development in due time. The other factor having a same kind of influence is not to direct economies more to services but continue industrial society form of life too long.

3 Human-Environment Dynamics

Trajectory

Over-consumption of resources and imbalance between population and resources leads to tragic collapse of human population in the long term, fundamentally disrupting the current form of civilization.

Parallels population and economic growth.

When the 20 ex-Eastern block states along the EU eastern border, and populations beyond them all decide that they will "go West", then Western Europe as we know it today will have human compression dynamics on its hands. The same logic goes for a South-North move across the Mediterranean, and probably so for other parts of the world which I "feel" much less.

Although it is unlikely that natural resources will really be exhausted (as resources becoming scarcer stimulate the development of alternative/more efficient uses), the danger is great that biodiversity and the general quality of the ecosystem will be seriously diminished, unless much more forceful policies for conservation and sustainable development are implemented.

Various disaster scenarios may be imagined, as if the arrows of plague, famine and war are scatter-fired simultaneously from a single point. However evolving human-environment dynamics does not necessarily entail global disaster in the thousand years future. Some parts of the planet may benefit, even from an asteroid collision. Differential survival and cultural adaptation to changing conditions, even much worse conditions, is possible given solidarity and the maintenance of social conditions such that problems can be tackled as they arise. Since particular changes emerge from complex systems, ability to mobilize science to emerging crises matters. On the population front, the task is to make first make explicit the political nature of inequality, then work on ways to ameliorate it.

Trajectory: relatively flat and at low levels (inconclusive results). Continuing advances in knowledge and communication technologies might be expected to encourage improved human-environment dynamics. However, strong counterforces exist such as (1) inadequate access to those advances by much of humanity, (2) growth of religious fundamentalism and violent reassertion of ethnic divisions, and (3) continuing population growth coupled with rising economic aspirations.

There are key factors population growth in economically week countries and economic growth in others. In poor countries at first there will be no cares of human-environmental dynamics (mostly this is included in their religion system). Rich countries will try to invest in the modern area ecology building cities under or on the see level.

Inability of humans to "integrate" available knowledge can provide negative trajectory.

By the year 3000, most people or people-entities will live off-Earth. If individual humans still exist, there may be more than 10^{15} of us (see very crude estimate, Factor 4), but Earth cannot sustain more than ~10^{9} people in technological comfort comparable to the standard of living in late 20th century industrialized nations. (10^{9} people x up to 100 kilowatts/person = 10^{13} watts, the current global usage, which is probably already starting to negatively affect the ecology). By this

estimate, in the year 3000, ~99.9999% of all humans will live off-Earth, and only ~0.0001% (one human of every million) will still live on Earth - very roughly analogous to the difference between the entire population of New York City and the passengers inside a single yellow cab traveling its streets.

So the principal human-environment dynamic will be the effect of humans on the "rest" of the Solar System, *not* on the Earth.

The principle of sustainable development will be accepted widely in 20 years. After that the world dynamics will be favorable.

A bottom-up process from civil society to governs. Lack of water might alter it.

Migration flows and ethnic conflicts.

Conscientization; political activism; participation – Ignorance.

As human population grows so does the impact on the planet and its eco-systems. This includes mega-climate change and rapidly expanding consumption of non-renewable and renewable resources. The global human population will continue to expand at about 80 to 90 million people per year for at least the early part of the 21st century. Over 8 billion people by 2025 is forecasted. Thus, human impact and interaction with the earth’s environment and resources will become more pronounced, more intertwined and more complex over the next 50 to 100 years until some stable state is reached. The best means of reducing population is through sustainable economic development and education.

Not noticeable for several hundred years, in any way that is fundamentally different from today. Then, the working knowledge of how that "butterfly in Peru really does affect the weather in Chicago" will infuse people with a sense of urgency and power. The "how can one individual make a difference" mentality that is in ascendancy today will only fade as 100 years of scientific breakthroughs in complex information processes trickle into the public's awareness.

This is probably the most critical issue for the next millennium. The next thousand years will determine if any wild lands at all will be permitted to exist. If that is to occur humans must radically change their attitude towards other species. Just as the U.S., as the only super-power, no longer has the luxury of all-out war, as a species humans no longer have the luxury of viewing nature as either a resource or something to fear or conquer. We are too powerful for that, to do so in either case is to guarantee our 'opponents' total destruction and therefore our own downfall. Widespread acceptance of the philosophy of sustainability and a new conceptualization of Man's relationship to nature is required. As much as we might not wish it, we will have to take a more paternalistic attitude toward nature and take affirmative control. We must set aside enough of the earth, sea and sky to ensure that a stable eco-system (that includes us) can continue indefinitely. National Parks are not enough, we need a World Park System that meets the ecological needs (prey, migration, etc) of all of Earth's remaining species. Unfortunately current trends are moving away from this end. Policy and funding to promulgate the new eco-consciousness is needed and quickly.

Biotechnology and genetic manipulation of plant and animal food resources offers prospects of increased food production Breakthrough in new energy sources may yet keep earth's economy going and growing.

The world's population tends to stabilization. But much more difficult problem if the growth of consumption everywhere. The overpopulated nations of the Third World could not reach the Western standard of life without destroying the global ecosystem. The only solution of this "circulus vitiosus" is radical limitation of consumption in the rich countries and their "good example through the deep change of values and more spiritual way of life and behavior.

Will be driven by young people. Failure of young people to influence an out of date establishment.

Resource pressures. Have's vs. have not dilemmas.

Inevitable if we continue "business as usual" – and we will, I believe.

Conditions improvement due to increasing global awareness.

Humankind is forced to a new direction either by blind evolutionary forces or lead by the choices we make. Ref: Pentti Malaska,(1971) *Future Prospects Of Technical Man,* and *Technosystem And Ecosystem - A Problematic Relation.*

Benchmarks

The growth of sewage and junkyards.

Any 3 bad consecutive winters between now and 2020

The negative effects are likely to be strongest in the next 100 years. The next centuries will probably see a gradual restoration of the natural environment, as more ecofriendly technologies and policies are globally implemented.

Principles of sustainable development understood both as ecological, and social are accepted by all major states and companies by the year 2010.

Positive benchmark: Agro-alimentar revolution (development of biological natural agriculture).

Information, awareness, dialogue, give and take spirit.

Increased human population in the short term and then the possibility of a stable population, fewer resources, degraded eco-systems.

Food production needs to double in 100 years time, in tandem with projected doubling of population to 12 billion.

Material gaps between haves/have-nots, both between countries and within them.

Improving in environmental and resources exploitation managing and development of alternative technologies.

100

Population stabilizes and begins to decline.

Wish-list would include: Politics of inequality tackled, with success in stabilizing human population intensification. Biological trend towards increasing infertility meets political trend towards tackling inequality; a combination of legal change, change in business practices, education through wider media access.

Experiences of rich countries to discover possibilities to live on artificial islands, under water.

Extensive use of extraterrestrial materials to build technological artifacts of various kinds. Beyond - it is hard to estimate this without making a lot of unduly tenuous assumptions. But at some point, humanity will have used up all of the easily-accessed "detrital" resources of the Solar System - small asteroids, comets, debris, etc. - and the question may arise whether or not we want to start taking the major planets apart to obtain their raw materials. (In part this depends on how mass-intensive, as opposed to energy-intensive, our future activities will become.) This could be a difficult decision, as there are pros and cons on both sides. This issue may first arise when a particularly large named asteroid is collared and slated for extraction. But the discussion will intensify when the disassembly of planetary rings, small moons, and ultimately the gas giants (which hold most of the planetary mass), is seriously proposed.

None, other than the usual ebb and flow of public conscientiousness.

New economic theory based on information theory of value as a base for creation of anti-entropic /syntropic/ human economy using information as main resource and source of development.

The alleviation of the population explosion by diminishing.

500

People living in balance with available resources.

Human-environment dynamics is the central political issue. Balancing the environment budget is part of balancing fiscal budget. Move towards the concept of the individual as an ecological "self", where the self-concept is of the individual in relation to the community and the environment rather than the isolated selfish ego.

New sources of energy, trying to colonize the outer space.

We're smack in the middle of the age of individuals making a difference. There's hell to pay. Many people yearn for the good old days when true individualism was a hard-fought and generally scarce commodity.

1000

Humans prove themselves capable of global solidarity in the face of global change. If not, then human life may rather a nasty affair.

Growth of population is not a threatening factor, space resources of energy, more complex but simpler civilization.

Cooperation has been hammered out. We get it now. Today, the issues have more to do with the collective consciousness and propulsion. The concept of "civilization" and the problems of individuals getting along is a quaint relic of our tumultuous past.

In 500 to 1000 years we will change the face of the planet, and this is mostly for the worse.

Low Probability Consequences

Resource-based wars leading to profound declines in human population and disruption of modern civilization.

Famine, simply because there is little buffering capacity for the bad years.

The destruction of key biological species may trigger a collapse of (part of) the global ecosystem.

Nuclear arsenal and nuclear aggressors live in northern hemisphere, which may also possess a potential for more rapid destructive climate change. Southern hemisphere emerges as best place for human survival. South Africa, South America, South Pacific Nations and Australia rule!

The third world war should be considered together with contact with extraterrestrials.

A major portion of humanity undertake naturalistic, holistic or 'animist' lifestyles.

New turbulent chaotic processes appear as result of sustainable development policy.

Safe food for all the world.

More people and fewer resources such as clean water and food leading to increased conflict among nations and peoples. Successful and utter domination by a single group or coalition. This is actually a fairly low probability, believe it or not, because if we make it past the age of the individual (which will make today's struggle for individual expression look like a Quaker prayer meeting) any group with that much power will be comprised of individuals with a fierce respect

for the destructive power of forced subordination.

Malthusian factors may yet work to curb population growth.

But important to focus on issues related to power/responsibility links.

Understanding differing national cultures. Some work has been done but largely ignored.

Clean technologies development.

Risks come unmanageable, and inequality of people becoming unbearable to active and influential poor. Migration and internal disturbances, terror, collapse of symbol systems like information network and system of money.

4. Energy

Trajectory

Fossil fuel energy use declining over the long term; renewable sources of energy becoming increasingly important; hydroelectricity use declining because most appropriate facility sites already exploited; radical new technologies being developed, such as hydrogen-based energy.

This will absolutely happen, and probably over the next century. I see nothing that will significantly alter the trend already in place.

The only viable "safe" energy we know something about (but not enough yet) is nuclear fusion (stars). We have enough hydrogen captive in the Earth to "make do" for a couple of centuries, when we solve the controlled fusion problem; another source is strictly mechanical and will involve drawing massively from tidal movements. This in turn will lead to slowing down the rotation of the Earth, but not significantly over another 500 to 1000 years.

In the short term, exhaustion of fossil fuels will trigger more research and development of renewable or inexhaustible energy sources (solar, nuclear, fusion, etc.), together with a much more efficient use of energy (fuel cells, telecommuting, etc.). This is likely to definitively solve the energy problem in the next few centuries.

Go solar and geothermal.

I'll take the particular issue of the use of the energy-efficient individual dwelling place, whether an energy-smart house or some other form of dwelling organized to harness renewable energy, i.e. to contribute as well as consume. Trajectory is imagined as a feed-back loop.

Huge solar collectors in space are the most likely source of energy 1000 years from now.

Trajectory: low levels for the next 10-40 years unless another major oil disruption occurs; thereafter a steady or possibly frantic rise in concern and activity until the next big energy source

is developed and made commercially viable. The oil embargo and Gulf War demonstrate the great significance of this issue. Consumption of energy will continue to increase as technologies advance and more people maneuver to enjoy their advantages. New technologies will undoubtedly be developed to deal with inevitable depletion and increasing cost of energy from fossil fuels. Growing use of sport utility and other large vehicles in the U.S., demonstrates again that incentives to conserve energy and develop new energy sources in anticipation of future need will be weak in the absence of duress. However, duress will certainly materialize within the next 100 years and force major resources to be devoted to this challenge.

Till the end of 2100 disappearing of petrol resources looking for new mine centers in the see and oceans. Looking for new resources of energy.

Trajectory seen as level, as more eager users worldwide enter market, abundance and safety may become moot.

Nuclear fusion will probably become technically and economically viable. Solar energy will become the main source both on and off Earth. Hydrocarbon oxidation will always be around in some form or other (e.g. fuel cells, mechanosysnthesis), however it applicability is limited on Earth by the atmospheric O2 shortage (not at all by the fossil fuel shortage nor by the greenhouse effect). Nuclear fission will still be kicking around, mostly off-Earth. It will continue to be metered. Hydroelectric, wind, geothermal will remain marginal. Tapping the vacuum energy probably won't work. Converting kinetic/potential energy of solar system objects may provide a significant fraction of space power. The hydrogen economy, antimatter, kinetic rings and such are storage media which may find places of use.

To estimate some possible endpoints, we can do a few simple extrapolations. Conservative Estimate: Energy consumption of the Roman Empire ~2000 years ago is estimated as ~3 x 10^9 watts, whereas current global energy usage by humanity is ~1 x 10^{13} watts, giving a historical growth rate of +0.29%/year; linearly extending this historical rate forward by 1000 years implies ~2 x 10^{14} watts by the year 3000. This seems absurdly low. Liberal Estimate: Per capita usage was ~30 watts/person in the Roman Empire, but still only ~40 watts/person by 1800, versus ~10,000 watts/person in the most industrialized nations today, a growth rate of +0.29% over the last 2000 years but +2.8%/year over the last 200 years. The average population growth rate has been ~0.06%/year over the last 12,000 yrs (farming), ~0.17%/year over the last 2000 years, ~0.95%/year over the last 200 years (Industrial Revolution), and ~1.4%/yr during the last 100 years (20^{th} century medicine). Population can grow until it hits natural limits (see below), so if nanotech allows +1.4%/yr population growth plus +2.8%/yr per capita energy growth, then by the year 3000 there will be a population of ~6 x 10^{15} people consuming ~1 x 10^{12} watts per capita, for a total human power demand of ~6 x 10^{27}watts in the year 3000. Argument from More Fundamental Physical Limits: Given the possibility of uploading and other likely conceptual changes in what it means to be "human", the notion of "population" may cease to have any physical meaning by the year 3000. So we should seek an alternative method of extrapolation that is independent of the notion of a human "population". The idea that humanity (in whatever future form) may occupy a (nonrigid!) shell-like structure around the Sun, thus absorbing and presumably harnessing virtually all of the Sun's natural energy output, has been called a Dyson Sphere, a now-ancient concept. And yes, solar luminosity is ~4 x 10^{26} watts, but I always like to

point out that this is not the upper limit for a "solar civilization" because the power density of the Sun (viewed as a fusion power plant) is extremely poor, under ~1 watt/m^3, vs. at least 10^6 watts/m^3 in most proposed fusion reactor designs. Solar mass is ~2 x 10^{30} kg, mostly fusionable H/He which may be converted to energy with ~1% efficiency, giving a total accessible native Solar System energy resource of ~2 x 10^{45} joules if the Sun is turned off and its fuel inventoried and burned more intensively than normally occurs in Nature, in billions (trillions?) of man-made fusion power plants. To estimate power, we need to know how fast we can burn that 2 x 10^{45} joules. In the simplest case, we can burn it just as fast as we can reasonably expect to replace it, e.g. by scavenging neighboring (uninhabited) star systems. If the entire Solar System mass is transported at ~1%c to the nearest uninhabited star system (for refueling), and assuming that such star systems lie ~10 light-years away, then the journey consumes ~2 x 10^{43} J or ~1% of all available energy to make this trip which lasts ~1000 years. (Travel speeds much faster or slower are less efficient.) Burning the remaining 99% of our energy stores over the ~1000 years while we are in transit gives a maximum power usage of 6 x 10^{34} watts. Given all of the uncertainties involved, and the fact that Nature has provided star-sized "fuel depots" conveniently situated around the Galaxy, a reasonable "sustainable" maximum power draw for a stellar civilization is probably ~10^{34} watts.

Renewable energy sources are accepted as major sources of energy by the year 2025. Major conflict between the North and the South might obstacle the favorable development.

This is an extremely time-critical factor; if a reasonable global standard of living were established (e.g., 1 kWh/per capita per day), then over the next 100-200 years, carbon-based fuels are likely to be largely exhausted; over the next 1000 years (if major increases in use occurred), even nuclear fuels could become depleted. Unless unforeseen changes occur in technologies for manufacturing, information, entertainment, transportation, heating/cooling, etc., to reduce the energy needed for an advanced standard of living, then once fossil fuels are depleted, the global quality of life could drop substantially. Major investments in key power alternatives (e.g., Fusion, solar, space solar, others?) would be essential to alter it.

What we are using the energy for? This question is a main part of solution. Abundant safe energy is a useful idea for research and development, but read classic novel from Karel Capek: A Factory Producing Absolute Thing. There is the possible scenario in it.

If there will be abundant safe energy, it will be controlled and monopolized by few companies. Education can improve a better use of energy.

Wind, solar power etc. - corporate interests.

It is highly likely that abundant sources of safe energy will be created during the 21st century particularly through solar power and Hydrogen. Necessity as fossil fuels expire will rapidly spur human invention in this area. Tax policy and pricing can have a huge impact on the speed of development of these new energy sources.

That all depends on the Human Intervention question. Abundance is not the problem. Safe is the problem. This will be one of the hottest political issues of the millennium.

Transition to solar energy and creation of human economy and society based on solar energy technology and solar energy as main source of development.

The fossil energy will be gradually substituted by renewable energy such as solar, biogas, wind, hydrogen etc.

Infinite safe energy (i.e. 80+% efficient solar power) is virtually certain. The technology is very close now, all that remains is to make it cost effective. Currently this technology is being held back by the interest and investment in the technology that it would replace. Cost savings alone would justify the change if a rational "cost of pollution effects" were incorporated into the business cost of the polluters. Eco-economic policy implementing such a cost accounting could help by putting the cost burden of pollution directly on those businesses that create it. Another way policy could expedite acceptance of this technology would be to offer advantages to countries that elect to adopt it from the first rather than base their development on polluting.

Greater reliance on renewable sources of energy – solar, wind, etc. Power sources in space will be explored.

I think this is reality today and trend will be strengthened in the future. We do not have just biosphere of the Earth but also noosphere (Vernadsky) and/or homosphere (J. Svoboda, Toronto University - published in Encyclopedia of Environmental Science, Kluwer Academic Publishers. Boston, 1999, 741 pp.) physical limits of the Earth (energy, raw materials, space). Nuclear, thermo-nuclear and perhaps other sources of energy will be used for space exploration, not on the Earth.

There is the growing interest everywhere in the use of safe energy (wind, solar, bioenergy). Such interest could be strengthened with decrease of traditional sources (oil, coal), growing danger of green-house effect and opposition against nuclear energy. Consequences: The trend of this kind could be slowed down with the lesser demand on energy in general and growing role of energy savings.

The main trend should be towards to renewable energy use: solar energy, geothermal energy, bioenergy. Main target in the global energy policy should be saving the energy particularly in industry, housing and traffic.

New research/investment.

It will be mandatory for humanity to generate abundant safe energy, and we will succeed.

More efficient methods. Save money rising costs of energy.

Improvement of the scientific applications.

Sustainable development ethos is adopted as the guide of development to humankind started already in Stockholm in 1972 and confirms in Rio in 1993 and will be put into practice during

the next fifty years. New renewal energy sources be developed (it takes fifty years for a new energy source to become a major source in the world market). It is not however sufficient alone, but a more scientific thinking of energy utilization - exergy concept of the second law of thermodynamics - is needed to be fully applied in technology, and in addition entropy transformation and transportation to the ultimate environment - space - needed.

Benchmarks

After a 100 years, most fossil fuels will be near exhaustion, and thus the development of alternatives will have become very urgent. By 500 and 1000 years, the energy problem should have been solved.

Supply volume and prices of currently dominant energy sources.

Willingness to Pay Introduction / Adoption Rates of New Energy Technologies Discovery Rate of New Sources.

For solar: Cheap access to space. Mining the Moon, Mars and asteroids. For fusion: Breakeven.

1) The "Hypsithermal Limit". The first important benchmark, almost certainly to be reached in the next 100 years, will be the release of ~10^{15} watts due to human technological activities, at the Earth's surface. This is ~1% of all solar insulation and has been termed the maximum "hypsithermal limit", the limit at which anthropogenic energy releases will almost certainly seriously alter Earth's climate. At this point, all growth in the rate of energy release at Earth's surface must cease, or else the global ecosphere will be permanently and dramatically disrupted; some people who have thought about this are even more conservative and believe that the true limit may lie at 10^{14} watts, or even as low as today's 10^{13} watts. Of course, further energy growth may proceed largely unimpeded in circumsolar space, for many more centuries to come.

2) The "Solar Question". The second key benchmark occurs when the energy consumption of human civilization rises to an appreciable fraction of natural solar luminosity, perhaps ~2% or ~10^25 watts, which might occur by the year ~2800, following the "liberal" extrapolation above. This is a key benchmark because it will by then be quite clear that either: (A) all further energy growth soon must halt, which will allow the existing civilization to survive at then-current levels of energy consumption almost indefinitely (e.g. for several billions of years, after which the Sun would die a natural death); or (B) further energy growth may continue, but at the cost of extinguishing and dismantling the Sun for fuel and raw materials, and beginning a ceaseless wandering among the stars in constant search of new sources of fuel. This will be the first time humanity has faced such a dramatic and irreversible choice of futures, and it will be a difficult choice because there are strong arguments on both sides. As a species, we may well reach this choice-point sometime near or before the year 3000, and it may become one of our defining moments as a species. Succinctly stated, the Solar Question is this: Shall we huddle around our slowly dying natural star, forever consuming only ~10^{26} watts, or shall we perpetually travel through interstellar space at ~1%c, stopping periodically at other star systems to refuel, forever consuming ~10^34 watts? By today's standards, both of these power numbers seem almost impossibly huge. But the difference between the two choices is significant and immense: the

mobile civilization can utilize 100 million times more energy than the sessile civilization. This is a huge disparity -- comparable to the difference in the capabilities of a single, smallish 130-horsepower automobile (~10^5 watts) and the capabilities of the entire human civilization on Earth in the year 2000 (~10^{13} watts)! Even if humanity manages to procrastinate until the last possible moment, the Solar Question must arise as soon as our technological energy consumption approximates the total solar luminosity (e.g. a ~100% efficient Dyson Sphere). To grow from today's 10^{13} watts to ~4 x 10^{26} watts (solar luminosity) over the next 1000 years (e.g. by the year 3000) requires an annual power-consumption growth rate of +3.2%/yr, which is only slightly higher than the current trendline. Even assuming the historical +2.8%/year growth rate of human energy consumption (that has been solidly in place since the Industrial Revolution began, ca. 1800 AD, ~200 years ago), we would still reach ~10^{25} watts (~3% solar luminosity) by the year 3000. All things considered, and assuming we stay on our current technological track, I conclude that the major energy-resource policy issue in the Year 3000 may well be the Solar Question.

2025 renewable energy sources dominate. 2050 energy consumption has been reduced to 50% of the present level. 2400 non-renewable energy sources are not used at all.

Large-scale demonstrations of various options for new renewable energy sources during the next 50 years.

Negative Benchmark: uncontrolled nuclear experiments. Positive Benchmark: use of hydrogen.

Environmental and societal concerns.

Solar and/or hydrogen powered buildings, factories, homes, cars, etc. Prior to this there will be hybrid energy sources with fossil fuels such as Fuel Cells.

Positive: hybrid energy supply system of renewable energy combining solar, electricity, gasoline, bio-energy etc. will be developed and popularized (in 100 years), New energy such as hydrogen will be put into use (in 500 years) and energy transforming system from universe will be available and put into daily use (in 1000 years); Negative: some intensive regions will gradually become un-habitable and huge amount of migrants or refugees will have to leave their home town.

Oil and gas will probably run out in 100 years’ time.

Mentioned transition will occur in next 100 - 200 years, longer-term futures are probably beyond our fantasy (imagine people in 11th or 16th centuries thinking about nuclear energy, Internet etc.).

New autoprototypes, intelligent energy saving homes, houses and traffic systems, special project dealing the global level in order to save energy in air traffic on long term.

The gradual achievement of this goal will have many benchmarks along the way.

Oil/nuclear power and other developments.

Funding for new fuels (hydrogen); improved methods of combustion; phase out atomic energy (not safe).

Widening of current development gaps among countries/societies.

100

2020 controlled fusion (based on mononuclear ocean hydrogen). 2300 controlled tidal conversion.

Declining fossil fuels force different relationship between humans and energy.

If energy-efficient dwellings of dwelling self-sufficient in energy become widespread, this will indicate a trend towards a "conserver" society in other ways, too.

Oil is slowly getting disappeared.

Still pockets of energy hoarding. Fossil fuels lasted longer than anyone dreamed they would. Only recently (c. 2085) have they become untenable as the major fuel source.

Development of new technology based on using solar energy, substitution of present forms of energy by solar energy.

500

Hydrogen energy developed.

Far less reliance on fossil fuels.

Using new sources of energy - artificial, chemical and space energy.

More energy available to anyone than we know what to do with. Everybody's intoxicated with the fantastic power they yield, thanks in large part to essentially limitless energy.

Creation of global human organization based on solar energy economy.

1000

Safe nuclear energy is possible.

Great reduction in human-derived contribution to global climate change.

Using new sources natural that till this time stayed undiscovered how simple it is.

No longer an issue. In 1999, the power grid was the problem. In 2999, the space-time grid is the

problem. The propulsion issues we are facing would not be significantly altered if we increased what the 20th century called "energy output" by a dozen orders of magnitude. It's just not "about that" any more.

Low Probability Consequences

Major war could prevent significant progress in new technology, or foster more rapid development of such technology. Radical breakthrough in harnessing or nuclear energy.

Restricted sea-channel; the end of the "high seas" entity by law.

The discovery of large additional reserves of fossil fuels would postpone the day when the switch to more efficient technologies is made, and this is likely to make things worse rather than better. A more positive surprise would be the discovery of a very simple technique to produce unlimited energy (e.g. cold fusion) which as yet cannot be predicted given our present scientific knowledge.

I've read that use of barrages for the production of energy from tides may slow down the rotation of the earth a bit. Not a good idea, I reckon.

Mostly in the first few decades in the new millenium there will be wars of fuel resources and economic capital. These wars will be explained for public as needed due to probably breaking the human's rights some kind of public's pinafore.

Cold fusion or its ilk.

That despite abundant energy, we will for some reason abandon our current technological track. However, there is scant historical precedent for this.

Unexpected disturbances in biosphere by a large scale nuclear hazard or the unskilled use of renewable energy sources.

Energy wars.

Technological breakthrough in nuclear energy (fusion).

Stagnating with one particular source.

The general economic impact on society of such a major transition including on infrastructure, jobs, how we live, etc.

Same as today. Until we transcend the energy acquisition – utilization paradigm (which won't happen for around 800 years) we stand the risk of self-annihilation – quickly or slowly.

The global self-destruction of mankind either by a global war or by an inevitable ecological catastrophe.

Some intensive energy will be inappropriately used by a few gangs to destroy humankind locally or globally.

New scientific discoveries/insights no less revolutionary that Einstein's theory of relativity offers hope On the other hand, failure to invest adequately in the search for scientific and technological solutions may lead to an energy crisis that plunges human civilization into a second dark age.

Nuclear fusion; non-polluting but no breakthrough so far.

No energy is "absolutely" safe. What cost is justified.

Global thermal effects.

Possible spread of radioactivity.

Violent competition between the mineral energy produces and producer countries to defend their economies, and the developer of the new energy sources when it will takes a good share of the business.

5. Nanotechnology

Trajectory

Nanotechnology already on the drawing boards but appears mostly aimed at "convenience technology" rather than bringing about fundamental change between people and resources.

Likely to happen over the longer term. Watch the development of this in medicine.

Nanoengineers will gain " life and death " rights over replicable molecules and will be able to engineer living parts.

Technology will undergo further miniaturization, but the real hurdle will not be the creation of nanoscale objects, but their effective use e.g. in rebuilding organs. This will require methods for the self-organization/control of systems consisting of billions of microscopic implements. Without extensive information-processing and novel theoretical insights, such control will be very limited and therefore nanotechnology will add little to the power of more conventional technologies.

Foreseeable trajectory by proponents is exponential growth; however could be a non-starter at least in medical applications for increasing longevity. Main problem I see here is the disjunction between claims made by engineers about medical breakthroughs and the practical knowledge of medical practitioners of the present-day human body and its frailties.

Likely developed by 2050 or earlier; many problems are thus solved but new ones created; after 2150 it is extremely hard to anticipate the trajectory because "anything is possible" when a

civilization has mastered nanotechnology.

Trajectory: I would guess that major new technologies will be required before major advances will be achieved in this area. More-or-less continuous efforts along those lines will be made in universities and in companies that might profit from exploiting nanotechnology. When techniques mature enough that nanotechnology begins to look like a near-term prospect, related activity should spurt. Nanotechnology could have biological as well as manufacturing implications in ways that can only be dimly seen at this point. I have no estimates of when and how this might materialize.

To some extent it works just know. But more closer we are to atoms more harder it is to work with. It is hard to work with energy.

"Social" backlash like that now evident for nuclear and genetically modified products will alter seriously.

In 100 years, nanotechnology should become at least as ubiquitous as electricity is today. Beyond then, nanotech should blend quietly into the background, becoming part of the foundations of future human civilization - a technology that is very mature and is taken for granted by everyone. By the year 3000, all of the novelties of nanotechnology will have long since been exhausted -- everyone will know exactly what nanotech can and cannot do, much like clocks, compasses, and calligraphy today. By then, people (or their evolutionary descendants) will be utterly dependent upon nanotechnology for their very existence -- much as 99% of humanity alive today, who would perish in short order if all the modern inventions such as gasoline engines, electricity, computers, etc. were suddenly to vanish. As a result, we can surmise that by the year 3000, nanotech will be an extremely reliable, if almost invisible, technology.

Nanotechnology will be developed as instrument of present economic systems. The major change of principles of global economy decrease radically the need of the technology.

These advances are taking place rapidly with substantial funding in place and likely to continue; the changes will be incremental, but in aggregate revolutionary in potential.

Nanotechnology & biotechnology are able to develop a life without giant energy sources. They need the great intelligence source only.

It will fail in many of its commitments, but in long-term trajectory there will be real gains.

Huge developments.

Recent scientific research in nanotechnology indicates that it is certain to be introduced in the early 21st century. Billions of research dollars are now being in many countries. Self-manufacturing at the molecular level can obviously have a revolutionary impact on all aspects of human society including regarding space exploration and settlement.

Nothing can stand in the way of this one, even public policy blundering. There is simply too much money to be made. The technology is right around the corner. Conventional applications (super durable materials, self-replicating machines, superconductivity, etc.) will be passe in 100 years. Biological applications, however - that'll scare people.

Development of nanotechnology as the core of extropic technology.

Probability is high. But it’s very important who and how will use it. The proper usage of knife is to slice bread, but in the hands of a killer the same knife could be very dangerous.

Nanotechnology is virtually certain to be developed to commercial levels within the next 20 years. Long before the year 3000, we will be manufacturing entire finished goods by programming a replicator. That combined with the cheap, safe energy of question 4 will yield the "Star Trek" economy… Leaving humanity with the tough questions of re-defining money, re-defining work and a defining a purpose beyond reproduction and infinite growth. This technology benefits from current funding encouragement, but the current policy does not yet envision the consequences of its own success. This, combined with factor 3, will perhaps be the key issue of the second half of the next millennium. After succeeding so well technologically that our survival as individuals and as a species is no longer in doubt, what shall we do?

Progress in nanotechnogy seems inevitable and unstoppable.

In the development of nanotechnogy, the main question will be: How to develop this "small scale" technology on long term bases in the ethical way? What is right what wrong in nanotechnology?

Less or equal to 2300 AD.

Considerable movement in this direction but it depends on the research efforts and risk assessment.

Science frontiers enlargement.

Trajectory: with nanotechnology and with all its hybrid technology applications (combination of all kinds of conventional technologies in same device or creatures) a new species of artifacts will come about being in 500 years or so (see attachment 9).

Benchmarks

In medical applications, look for opposition from fundamental religious groups.

1) Digitalization of the material goods upon which human society depends - food, clothing, shelter, toys, the instruments of manufacturing, etc. These goods become as freely available as music on the radio.... 2) Digitalization of the human body and mind, allowing people to

rationally choose, and then actively design, their personal physical structure. The distribution of "human" phenotypes in attribute-space broadens almost exponentially.... 3) The physical dispersal or raw numbers of this diversifying human family expands so fast that the family encounters some limits to its further expansion - perhaps energy limits, or the speed of light, or even the sphere of expansion of another intelligent race that has also discovered nanotech. With resources now becoming more scarce, natural selection will begin to operate in earnest, to distribute available resources most efficiently to those entities that are best able to exploit them.

2) 2020 nanotechnology is used widely by big multinational companies. 2050 nanotechnology has reached applications, which serve ordinary people. 2100 nanotechnology has become old-fashioned compared with new innovations in the field of technology.

Positive benchmarks: microchips in surgical application.

God complex, arrogant science, disasters, Brave New World!

Positive: use to improve life and the environment. Also increase wealth. Some new methods could be harmful.

Molecular transmutation.

100

Technology well developed, but used in ways that restrict human freedom (e.g., invasion of privacy or in weapons systems).

2020 - first replicating man-made life.2040 - first thinking non-man made intelligence (using above).

Nanotechnology products that work, first perhaps in manufacturing industry before medical breakthroughs which might take up to 500 years, for some of the present claims to be realized, if then.

Common using of nanotechnology in computer industry.

The first nanomachine by 2008.

Nanotechnology is as ubiquitous as cathode ray devices were in the late 20th century.

500

Technology basically makes virtually all knowledge available to everyone.

New style of work with energy.

Biological applications are so prevalent that everybody's somewhat scared. We can become

virtually anything we want to. Only religious fanatics are unaltered humans. These are dangerous, heady times.

First synthetic life forms in 200 years.

1000

Humans have reached the limit of nanotechnology.

Positioning and may be creating the molecules with better control.

People (if you want to call us that) are absorbed by the phenomenon of existing. The mode is not much more important than the particular venue of a sporting event 1000 years ago.

Low Probability Consequences

Human race becomes functionally immortal.

New medical technologies have unintended consequences, e.g. ultrasound as an aid to selective abortion of (mostly) females. Nanotechnology could lead to surveillance of individuals through nanotech implants and a frightening level of social control. Food produced by nanotechnology could be quite awful, e.g. all food tasting like glop. This is more of a high probability now I think of it.

Horrendous new weapons (made possible by nanotechnology) bring an end to human civilization.

Danger is to use NT in biologic sense it could be a good medicine, but a strong poison, too.

Inability to contain and constrain the "dispersal" of such products to where they are neither wanted nor needed.

Whether it will turn out to be possible to go beyond nanotechnology to picotechnology (i.e. manipulating the atomic nucleus, perhaps to achieve the reversible controlled transmutation of elements and freeing nanotechnology from the restriction of having to use whatever atomic elements are at hand), or to femtotechnology (i.e. manipulating quarks or other subnuclear components, perhaps to create new forms of matter or to obtain new sources of energy) is at present unknown -- and is believed by many not to be possible -- but if possible could significantly improve human technological capabilities.

Totalitarian control of people with the help of nanotechnology.

The risks of from nano-scale systems, including "bio-hazards", encroachments on personal liberties, etc., should be as carefully considered for these technologies as they are being considered for bio-engineering (e.g., cloning).

Neuronal-connection communications.

Accidents, uncontrollable technology, loss of human role/jobs in manufacturing process.

Same as before. Domination. Oligarchy. Also, mechanical viruses. Richard Dawkins will be celebrated for his concept of meme. A stray thought, a stray photon -danger comes in small packages. Quantized packages, actually.

Misuse of the production of new weapons

Possible development of self-replicating machines.

Uncontrolled access to the technological developments potentially dangerous.

The new life forms, new kind of self conscious creatures of the new species, the high-tech, will start to wonder what is the purpose of humans, and they may either be able to find any answer to the question which so long bordered us humans. May be the high-tech then just put us to a human-zoo to await if they one day may be able to learn to know the answer, because they also believe in progress. And mean while they come on Sundays to see us with their offspring.

6. Forms of Governance

Trajectory

Conflict, disorder, terrorism, and war likely to continue and become even worse as destructive technology becomes more freely available (including biotechnology). Effort to develop enforceable protocols for beneficial relations likely to be misused. Poverty continues because it is a relative term and some will always be worse off than others. Conflict continues to be an essential part of the human behavioral repertoire for adapting to changing conditions and maintaining evolutionary change in society. Efforts to promote peace may paradoxically prevent conflicts from being resolved.

Decisions will be so short-lived that life itself will be back to force relationships.

Global integration through institutions such as UNO, IMF, WHO, EU, in part stimulated by the emerging global market, will continue, albeit with ups and downs, while global communication between nations and cultures supported by the new information technologies will lead to better understanding and agreement about shared objectives and ways to implement them. New, more effective methods of governance are likely to be developed, aided by novel insights in complex, social systems. The danger is that individual states or organizations will reject the agreed-upon policies because they curtail their own expansion or seem to impose foreign values upon them.

Going to participatory co-creative processes which manage time and content and filter quality: see Dialogue at: http://haven.net/haven/faq.htm.

A wave-form trajectory. It is good to talk about such forms of governance as an ideal, but hard to

imagine anything happening in 1000 years on the equity, order, and peace front globally, though different places at different times see their relevance, and others will not or do not. (Try talking gender and racial equity to fundamentalists of all varieties.

Trajectory: very slowly increasing activity for the next 50-100 years. Recent history offers some encouragement in this area: for example creation of the U.N., collapse of colonialism and the Soviet regime, creation of some new governments with enlightened bases or prospects, etc. However, there have been other developments and trends that make it clear that mankind, in the aggregate, doesn't necessarily have what it takes to act in its own survival interest. Rationality may eventually prevail, but it will be slow a tortuous.

Maybe economically rich countries will try to create something similar, but the reason will not be equality but economic power, nobody will want to give up its economic power.

Lithium in the world water supply would effect a positive trajectory.

The gradual acceptance of global morals will happen as part of the globalization process. Turbulence of unfavorable economic processes. North-South and East-West relationships after the phase when China and India have gained their full might in world affairs but before the phase when whites and blacks have been exhausted. Possible World War 3. The importance of local cultural factors diminishing and replaced by heterogeneous group of global sub-cultures. This kind of development does not necessarily cause positive affects. Large global catastrophes and threats might hasten the acceptance of homogeneous global values.

There are numerous factors in the world today – particularly ethnic/regional nationalism that threaten to continue to reduce the cohesion of larger nations during the coming 100 years; if they dissolve, then the opportunity will be significant for one or more states to undertake acts of aggression (of various forms) to achieve their ends – this scenario has played out repeatedly during the past millennium.

Appropriate form of governance must correspond to the factor 10. (A global ethical system of values).

Just little groups of people will promote better form of governance. Economic interests will be even stronger in human relations.

I do believe that governability of the world, of regions and of nation states will decrease and remain by consequences a major issue for the future. And a chance for local solutions. The development of governance systems which would ensure these goals is a high priority for all humanity as we enter the Year 2000. However, at present we are far from achieving such systems. It is likely that for humanity to survive and prosper in the new millennium such forms of governance are a necessity. Whether we will reach this stage of societal maturity in time is at present an open question.

Great destruction of present forms of human social organization and governance and creation of global governance based on principles of holistic view of the world, network organization and

redefining the role of governance in human life and human social organization.

The advancement of economical and political democracy / national egoism and imperialism of the richest.

IMHO this is the key factor. The only one that is truly important and able to change the trajectory of the other ones. In the next 100 years we'll face the nexus – to change the way of our lives (to eradicate racism, ignorance, egoism and establish the society based on equal rights, peace, love and understanding within humanity and the whole Universe) or to extinct. I presume that majority of humans will understand this. They'll change and achieve the higher level of being while the rest will stay unchanged on the polluted Earth with frustration and deprivation, because their eyes have opened too late.

Unlimited Democracy only works when citizens restrain themselves. It only takes one Hitler to render it moot the first one to cheat wins. However a variation of current world diplomacy designed around one of the solutions to the Prisoner's Dilemma has the potential to yield peace-based world government. But that would require those in power to abdicate that very power (like the Founding Fathers did) and so is very unlikely, but is well within our control.

The biggest challenge is new distribution of power: from strong national states to global governance as well as to stronger subnational regions (subsidiarity principle). These new forms of governance will happen in next 100 years I suppose. Above mentioned trend I see as "desirable scenario". But the world can be threatened by chaos caused by organized crime, religious wars, failed transformation of Russia, China and other former communist states to democracy. Following "dark ages" could last of decades of even centuries.

The world as a whole tends to the global governance, but on the other hand there is real danger of world order disintegration. There are two sources of potential conflict: a) the growing difference between poor South and rich North b) emerging new coalitions: NATO versus Russia, China (maybe India), what became evident in the time of Kosovo conflict Consequences: Potential conflicts or arms races at least. Such process could lead toward the social decay on a global scale, because the solution of urgent social and environmental problems would be neglected or delayed.

The main social question in this connection will be: what is ethical, effective and global enough way to develop the current democracy? It is obvious, that the current global trend is at the moment towards oligarchy concentrated power structure/ and dictatorship of expertise.

We will not achieve this highly desirable goal – even in 1000 years – except in special enclaves.

More conflicts but greater pressure for global intervention, with risks.

A move to a higher level of consciousness. Short term thinking and materialist life style.

Non lineal trajectory altered by different types of conflicts.

Human groups of special interests of their own - whether legal or non-legal, humanistic or criminal - don’t give up their pursues in the near future but conflicts are emerging and spreading their turmoil around the world. This is also an area of double-unknown problems.

At the moment some kind of direct communicative democracy seems most promising to manage conflicting interests. However, it must be constraint in order to prevent totalitarian interest of any groups to get foot hold and prosper. And awakening to a more sensitive ethical consciousness and awareness is need to become spread among human beings and accepted as a common value.

Benchmarks

Test alternatives, play and empower.

Rate of establishment of "democracies" (of varied forms) worldwide. Rate of regional / local conflicts.

2050 even larger cultural diversity than today.

Positive benchmarks: Community organizations in urban slums.

Politicization, struggle for justice.

Global or supra-national governance on all issues that cross national borders, i.e., environment, global commons, communications, movement of people, etc.

On of the main element of the future development should/ would be the "glob parliament" and it’s organization, which should cover whole the globe!

More conflicts unless new attitudes are developed (Northern Ireland classic horror story).

Positive: beyond the nation state worldview. Negative: narrow nationalism, tribalism and realism.

Negative: overpopulation, racial conflicts, continued increase in state power.

Deepening of globalization and Integration processes.

100

2050 the end of Nation States.

The next 100 years are likely to see the equivalent of a "world government" albeit much more decentralized than present governments, and the permanent eradication of war. The concept of a nation state is likely to have completely disappeared in 500 years, while global management of

society, economy and ecology will have become self-evident.

As before, the task is to first make explicit the political nature of inequality, then work on ways to ameliorate it. 100 years wish-list would include inequality tackled by a combination of legal change, change in business practices, and education, wider media access for all.

Similar situation as today.

Molecular-scale computers. Atomic-scale materials; arbitrary length/diameter/twist carbon nanotubes in particular. "Mechanosysnthesis" or "assisted mechanosynthesis": spatially selective chemical reactions. Replicating robots (fka Santa Claus machines). Can be a biotechadvance.

Destruction of present forms of human social order and governance, design of holistic, quantum and extropic economic theory as a base for new human social and economic order and new forms of governance.

500

The task is to secure the existence of human groups so that they are able to act in the face of a perceived environmental threat. Systematic analysis of various forms of governance to see which institutional arrangements have proved effective, which have proved vulnerable, with choice of better rather than worse ways of governance. As conditions change, need perceived for flexibility in forms of governance.

A few world groups with different kind of vision but using the similar technology, lower population, lower poverty.

Creation of new system of global governance with central mind based emerging network intelligence and deep decentralization of power, control and resources, new type of human culture.

1000

Either Utopia with various forms of local governance all working or, as now, some work for the General good of their constituents, and some don’t.

Changing the world order due to out space, extraterrestrial contacts.

Low Probability Consequences

Messianic religious leader brings about profound change in human nature.

That the world would be split up into two or more blocks with opposing ideologies, making global governance impossible.

It is unlikely nor necessarily desirable that there will be one world government.

New colonization of the world not by people but economically and politically.

Grey goo- an artificial replicating system that converts many classes of compounds into more subunits of itself. Artificial virus-like machines used as bioweapons.

Exhaustion of the black and white populations as result of low fertility and epidemies. Global threat caused by for example approaching meteor.

Agreements between cities for social equity program beyond economic interest.

Political obsessive compulsiveness.

Increased terrorism, conflict spurred by groups who are against increasing 'globalism'.

The global self-destruction of mankind either by a global war or by an inevitable ecological catastrophe.

Important to explore more inclusive democracy policies plus power/responsibility issues.

Increase some exploration will help to challenge narrow nationalism.

Global crisis generated by ideological, social, racial and or religious conflicts.

Civil War in China, India-Pakistan War, World War, criminal take over of more states than today (Colombia), fragmentation of Russia, corruption spread.

7. Forces That Have The Ability To Destroy Humanity

Trajectory

Some forces being controlled. Other forces, such as astrophysical phenomena remain beyond the ability of humans to influence. Impact of known diseases likely to decline, but new disease organisms will continue to evolve. The basics of human nature seemingly impossible to change.

The technology will proceed faster than our ability to control it, although we will certainly try.

One or two misuses (Pakistan, Formosa, ...) of nuclear power.

Forces capable of destroying humanity are asteroid impact, nuclear war, and a new type of epidemic through extremely virulent, antibiotic resistant organisms. Neither of those is very likely, and each of them can be controlled to some extent, respectively by changing the asteroid trajectory at an early stage through nuclear explosions, stringent arms control, and careful monitoring and on-going research into all old and especially new infectious diseases.

Depends which particular force that has the ability to destroy humanity. The trajectory is a straight line terminated by a Kerpow! e.g. if nuclear arsenal grows unchecked and gets used. Trajectory altered if all bombs defused. Or it may be that natural forces, e.g. with the natural end of solar system, could be forestalled, as some believe, through planning for humans and/or their non-human creations to settle elsewhere in the solar system and beyond, this task commencing sometime in the next 1000 years.

Trajectories: with respect to man-made and moderate biological threats, continuing activity at moderate but sub-optimal levels; with respect to powerful natural phenomena, nothing significant during the next 1000 years. It is plausible to expect that enough of humanity might develop the motivation and methods to exert reasonable control over man-made threats such as widespread nuclear destruction. However, it is far less likely that humanity will ever have capacity to control forces of the types addressed in questions 1 and 2 or even biological epidemics that might be orders of magnitude more devastating than, say, AIDS.

The man itself has tendency to destroy humanity. When he can control over himself he can control the processes which could lead to destroying Humanity. But this kind of human "intervention" will not be possible forever. Processes of destroying the humanity are working behind the scene. May be just now it is late to stop it.

An all-out nuclear exchange would accomplish all of the above. Disorder, conflict, inequity-these are part and parcel of the natural order. I don't they will be going away anytime soon, nor should they. These are prerequisites of growth and complexity.

The critical period will last about 50 years from now, during this period the destructive forces are running wild with decreasing capacity. Development of global moral codes is a contraceptive, which influences gradually. Control over large scale forces will improve, meanwhile the probability of unexpected emergence of this kind of forces (by small, technically skilled groups) will slightly grow.

There is a question: is the Humanity itself sustainable? I think so. We have never been here.

The interest in this topic will go up and down, without deep changes.

Regional nuclear and biological wars in developing countries.

As human technological ability increases so does the possibility of controlling both the natural and man-made forces that could destroy humanity. It is in the development of such technological means and the wise application of same that we could avoid a cosmic impact or counter global warming, etc.

It just won't happen. Not in the next 1000 years, anyway. Each danger will be replaced by a new one.

Control over destructive forces of human mind and technology, Nature, but emergence of

destruction of Humanity from the Universe e.g. from extraterrestrial intelligence.

The same thing as the previous question.

If this question refers to external forces (earthquakes, asteroids, global climate change) then, as in Question 2, our technology can protect us somewhat. However, it is extremely unlikely that we will have the raw energy to deflect or control any truly global phenomena...even after 1000 years. If, on the other hand, this question refers to problems of our own making (pollution, loss of species, nuclear war., etc.) then the likelihood is good that governments will be able to control those events. The probability rests on the likelihood that we will develop the will to do so (see Question 3).

That we may self-destruct (e.g., nuclear holocaust) is an ever present possibility. Cataclysmic events such as asteroid collision occurring within next 1000 years is not unimaginable, and less controllable.

The growing, uncontrolled of: power of transnational companies and the flow of capital is the great; threat for stability of world economy and natural resources. b) The loss of control in the military area - growing number of nuclear states, unsatisfied control of arms (also nuclear) transports, possible misuse of such arms by terrorist groups of oppressive regimes. Consequences: the danger of local nuclear wars or terrorists attacks and the loss of natural and cultural diversity.

What forces are being considered here? 5 (for human intervention priority) for those that are humanity related.

These issues will be beyond our control.

Eliminate weapons of mass destruction from control of nation states. Should be controlled by an international police force.

Worldwide awareness of risks (increase of controls) and research and technology development.

UN forces, EU in Europe, non-corruptive governments, NATO. Civil societies against any totalitarian and fundamentalist movements and forces against peoples' freedom of life under the constraints maintaining this freedom.

Benchmarks

A major use of a new weapon (probably biological) which gets out of control. A world government is formed.

2050 the wide acceptance of global moral codes will influence deeply in the world politics and the accumulation of global social capital will properly catalyze the positive developments. 2200

major conflicts are no longer possible because the cooperative culture is dominant over the competitive culture. Minor conflicts will become as dangerous as today's major ones.

Proliferation of nuclear weapons.

Natural disasters.

The ability to track and intercept threatening comets and asteroids. The ability to counter the impact and severity of man-made climate change.

The strategy of sustainable living in a global dimension.

Positive: nation states can no longer control their own economy or pollution over national borders. Negative: exploit fear of mass destruction by the public.

Non lethal weapons, preventive and control systems and measures.

100

Understanding of disease factors increases dramatically.

Within which nuclear disarmament happens, with luck. Space exploration continues if USA still dominant world power. Hard to see other nations emerging with pressing space desires.

The man is seeing the danger, but makes nothing, cannot believe.

Control over destructive forces of human mind.

Disarmament.

500

New religions arise to control some of the human factors that could destroy humanity.

It is late to stop destroying possibility - one more factor accedes - two many artificial power around.

Control over destructive forces of human technology, control over destructive forces of Nature.

Radical spiritual change or renaissance of mankind.

1000

We may not necessarily have powers to control, but would expect we might have greater knowledge of at least human psychology, if not knowledge of how to circumvent the natural end of the planet sometime in the remote future.

The question has no sense.

Low Probability Consequences

Asteroid impact; significant change in solar behavior.

Willful or accidental creation of dangerous viruses through genetic manipulation.

Increased understanding leading to control (the control aspect makes this low probability) of human aggression by means of knowledge of brain function.

High technology allows even small destructive groups endanger the whole of global system. Perhaps not even a low probability consequence!

Demographic boom.

Our level of technology or the use of it may make matters worse rather then better.

The suicide / self-destruction / of civilization.

Nuclear weapons in the hands of terrorists.

More focused conflicts in asymmetric threats environment.

8. Mental Maps Of Reality

Trajectory

This implies that "common ideals" are achievable, when humanity more appropriately requires multiple sets of ideals to enable adaptation to changing conditions. Effort to develop common philosophy for all of mankind likely to be extremely brittle and unable to adapt. I think we have parallel ideals, not common ideals; therefore N/A After the religious philosophy of the Middle Ages, and 19th century Newtonian mechanism, it is likely that a new consensual picture of reality will emerge, integrating the ideas of the different branches of science and culture, and based on the concepts of evolution, complexity and systems. New scientific and philosophical developments might again push this development off course, just like quantum mechanics or relativity theory questioned the foundations of Newtonian mechanics. Implementation of models for shared realities (like PANORAMA): http://www.ceptualinstitute.com/genre/benking/m-p/meta-paradigm.htm http://www.ceptualinstitute.com/genre/benking/ifsr/IFSRnov98pp.htm.

Philosophy is not about seeking general agreement. The task of philosophy is to critique and to seek flaws in arguments, especially those with globalization tendencies. Trajectory therefore is the arrow fired vertically upward, returning directly to hit the archer on the head.

Trajectory: ongoing, low level activity through the indefinite future. Plenty of admirable philosophies have already been created. The main issue is the extent to which they are adopted by major population segments and acquire influential roles in human affairs. Blandishments of wealth and power, differences based on ethnicity, race, religion, nationality, etc., have long-demonstrated capacity to motivate human actions totally at variance with the common interest. Self-interested coalitions of powerful, relatively enlightened nations with shared interests strike me as a more likely source of concerted, constructive behavior than emergence of some philosophy that will animate the bulk of mankind. There are too many people with too many sources of division.

The philosophy will sure appear, not only one, but will not have the potential to influence above mentioned. It is not a question of philosophy. It is a question of connecting and collaborating of philosophy, psychology and science, may be some different science, that we do not know today).

At the risk of sounding like a PC jingoist, diversity is much more robust, malleable, and adaptable than is a monoculture, whether it is wheat crops or philosophy.

The high tide of crude materialism is already breaking down, though the process will take long. The emerging feminine worldviews will gradually infiltrate the present dominant masculine worldview. The mass population becoming more and more aware of reality makes everything easier. Although the research of cognition is improving rapidly, the fields of logic and epistemology are not improving as fast as they did earlier in this century. After all, it is very likely that "reality" in proper sense will never be reached.

Human thoughts will be more and more materialistic. Only individual tendency might alter it.

Any kind of brave new world even with positive goals has to be rejected.

Today there is a considerable worldwide movement to emphasis unity and commonalties over divisive differences. Evidence for this includes the drafting of the Earth Charter and various Declarations of Human Responsibilities, Global Citizenship, etc. This movement will likely gain strength throughout the early to mid 21st century as the search for commonality continues.

Policy can expedite the trajectory or delay it. Epistemology will be the fourth "r" (along with reading riting & rithmatic).

Great Synthesis of Social Sciences / may be by Future Studies or Futurology /, design of new social science based on the theory of holomovement and implicate order /Bohm/, seeing without conditions /Krishnamurti/, social sciences as maps /Korzybski/, theory of dissipative structures /Prigogine/, theory of syntropic evolution /Fuller/, theory of morphogenetic fields /Sheldrake/, quantum economics, holistic economics, information theory of value.

The philosophy of communitarism, the postmodern principle of tolerance, the renaissance of the ideal of socialism.

Also important factor. I believe that one day new philosophy/religion will appear. It’ll prove all

philosophy/religions are only branches of the one tree. Or the different pillars that hold the same roof of the Universal cathedral. It'll be the start of the things described in my comment to answer no. 6.

Unifying philosophy is not only unlikely (see factors 9 &10), it is also undesirable. If there is a unifying philosophy, history tells us that it is likely to Take on theocratic properties…it is likely to be forced on dissenters by a totalitarian regime (National Socialism, Holy Roman Empire, Imperial China, etc.) Diversity of opinions is stronger.

Progress in this area is extremely slow, if the last 5 to 6 thousand years are any indication. It will take more than the next 1000 years.

I do not suppose emergence of such quite new philosophy. But what I see as very promising is that science and religion will come much closer together and will help us to understand much better reality of life. I believe in next century (perhaps centuries) God will reveal himself more than in the past, will come closer to us.

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The mankind tends really toward the new world-view combining Western rationality and Eastern spirituality. But there are two traps on our way toward the universality: 1) the world as a whole could be overwhelmed by Western way of thinking and way of life in the process of globalization 2) the religious fundamentalism or ideology of nationalism could reverse all the process. Consequences to be considered: growing religious fundamentalism, clash of civilizations.

It is a urgent need for the new scientific approach concerning the reality, which would create/make the bridge, between now dominating natural science and so- called human sciences. I handle this approach with the term: evolution of human consciousness. E.g. Barbara Hubbard has developed this "new dimension" of science in her books almost same way as I have. My main "thesis" at the moment is: the "evolutionary task" of the ego- structure is already over! The evolution of consciousness continues towards ethical consciousness, which will be the necessary and important intermediate stage in the way to the so-called ecological consciousness. Ecological consciousness will be decisive factor in the evolutionary test for the sustainable development of the humanity.

Wishful thinking!

Needs major new initiatives in this area – urgently.

Use a systems approach leading to a holistic philosophy based on the overall environment.

Unlikely emergence of really new philosophies.

Sustainable development ethos, futures research, al cultural information systems and results from first ritual information systems to bit-internet.

Benchmarks

Willingness to stay real and concrete but in extra realms or scaffoldings (skin): http://www.thur.de/philo/Benking/extra_skin.html.

100, 500, 1000 – relatively the same like today. The rapid change and break could bring the contact with extra-terrestrials or new science discoveries.

2030 there will be a multiplicity of scientific worldviews and true dialogue between them. 2100 the feminine thinking has become widely accepted as basis of global morals. 2250 most of the people having totally different conception of personal identity and humanity than today. 2300 the human thinking takes over feminine/masculine separatism.

Centralization, authoritarianism.

The adoption of global charters of rights and responsibilities for humanity and with regard to the planet setting worldwide standards of behavior.

The renewal of the scowling and education system in the spirit of the higher consciousness is probably the main objective oh humanity in near future.

Much research done on this in the 1960/70 but ignored. Deter sense has developed this approach but ignored earlier work.

Understanding the human development from information system point of view where not only this time is based on knowledge and information but all the others in the past in two to tree million of years albeit they are different in some respects. Benchmark. Expressing the human past in internet and getting internet to become self conscious entity - a internet grandpa and grandma for humankind.

100

Very greatly increased understanding of the neurological basis of human behavior.

The next 100 years are likely to see the development of such an integrated philosophy, which is likely to be expanded and deepened in the next centuries

Great Synthesis of Social Sciences, quantum and holistic economic theory, information theory of value.

The unity of the dominant world religions.

500

Greatly increased understanding of human behavior enables humans to be controlled for purposes that today's society would consider inappropriate; freedom essentially becomes an irrelevant concept as government control over behavior becomes more complete.

How the epistemological dilemma is handled in public forums will determine whether we live or die as a species.

Radical spiritual change or renascence of mankind.

1000

Local human communities adapted to local systems of resources with relevant local mental adaptations.

Low Probability Consequences

Homo sapiens reaches a dead-end, but another species of Homo evolves as a more cooperative species that is global in its distribution.

Philosophers will have a great time up to about 2010, but humanity will be faced with much more mundane problems, precluding philosophy as such.

World goes into guruesque metaphysics and into sweet isolation and cocooning.. see dangers highlighted in: information war?: http://www.ceptualinstitute.com/genre/benking/humane-info.htm.

The emergence of systems of belief that must be taken on trust, systems that provide such mental maps of reality, epistemology, and symbol systems that may find global acceptance, and that may help humanity behave in accordance with common ideals.

New view on the man's life, may be forming new social system, end of economic tyranny, new sense of life.

The rebel of the macho men, and criminal conspiracies. Major breakthrough in cognitive science. Verification of paranormal phenomena (or phenomena that are nowadays considered as paranormal).

Neglecting of traditional religions.

Backlash against ‘globalism’.

Truth Is Whatever I Decide It Is. After All, I Am A God. (hear me roar…) Unfortunately, this error will be a fearsome reality for many more than the errant dictator, zillionaire or schizophrenic.

Ideological wars of the militant fights for the cultural dominance.

Information exchange is vital but national cultural boundaries prevent this.

Bit storms of conscious entities of internet and chaos in internet.

9. Collective Future

Trajectory

Efforts to reach a shared vision of the collective future increase, but fundamental differences of opinion prevent the vision from ever being reached. Instead, different human groups have different and localized visions of the collective future. However, certain aspects of the collective future may be globally appropriate.

Over the very long term (500+ years) this is likely to emerge as most differences which divide humanity are eliminated.

I do not see a collective future.

agreement on using extra spaces to have extra common frames of references: http://www.ceptualinstitute.com/genre/benking/melbourne.htm as was "the" mandate from Rio Earth Summit 92.

The trajectory is a balloon that floats in the sky born. along by unpredictable winds, but still managing despite all, to stay aloft.

I would make essentially the same comments here as for point 8.

The emergence will stay low, it won’t change rapidly. Only in case of some strike from the surroundings (space catastrophe, 3rd world war, contact with extraterrestrials).

I could try to construct such a system. Rule One: Thou shalt not attempt to impose a global ethic system of "values" (whatever that means) and principles.

The idea of comprehensive and shared vision is an idea based on monolithic worldview, which is yielding. In fifty years time it is replaced by acceptance of multiplicity of cultures, which are in fruitful interaction with each other without losing their special traits. Cultural diversity and multiplicity of worldviews will be a highly respected value as part of the sustainable development ideas. There will, though be a minimum agreement on the most crucial subjects to enable global moral code.

The visions bear psychic energy for life, but their impact to optimal conscious behavior is far less possible, because of noise and uncertainty at all. The most impact goes towards philosophy and religion.

It can slowly growth starting from school or from small companies. Changes of educational system might alter it.

Unlikely to occur because of cultural differences.

Activism, conscientization.

Won't happen for close to 1000 years. Assuming it does, public policy won't be responsible. Individual decisions will.

Emergence of new common shared of humankind based on the holistic view of the world and using emerging network intelligence of Internet.

The strategy of sustainable living in a global dimension – the new authentic spiritual movements especially the anthroposophy.

Like previous comment. Comprehensive and shared philosophy and visions. It'll start in next decades and continue till approach of the nexus.

Given the diversity of the world population and the increasing rates of change and innovation, it is very unlikely that a single shared vision of the future will emerge naturally. A shared vision might be constructed and enunciated by governments, but historically such things are out of date before they are published. More often governments end up documenting what they think the shared vision was two years ago. (Which does have value) Having said that, there are events that could precipitate a shared vision naturally. Such as, the opening of the space frontier to colonization, an encounter with an ET civilization, a near extinction event (such that those humans remaining are pressed to work together).

We are a long, long, way off. Perhaps, a crisis of global proportions may yet bring humankind to its senses, but then, how long did that last, since the two great wars of this century?

I do not believe much to "comprehensive, shared vision of the collective future". It resembles me communist (unrealizable) ideals. I believe in diversity of life, cultures, ideas,... which are in symbiotic interaction (which is desirable scenario again).

The political and intellectual elites do their best to develop some vision of that kind, but most of mankind is influenced by future visions of religious and ideologies characterized with special, particular interests and views sometimes distant from the reality. This trend should be changed through open political discussion and education.

As apart of consciousness evolution it is important to make both evolutionary and planned/ conscious steps for the higher and "better-than-now" collective consciousness/ awareness/ knowledge. Many meditative movements/ traditions and approaches etc. works continuously for this development and trends. I'll estimate for my part, that in the future also in the brain research, the collective phenomena / factors will be taken in the considering much better /wider than

nowadays.

New disasters might begin to change attitudes – so far the process is too slow.

The concept of H.G. Wells "The open conspiracy" is vital. This is being reprinted in December '99 with an introduction by Warren Wagar.

Increasing of mutual knowledge and interdependence.

Benchmarks

Ability to se potential of imagination and modern communication technologies.

2020 multiplicity of scientific worldviews accepted widely. 2050 a minimum of global shared visions enable the global moral code acceptance widely. 2100 cultural diversity protection programs guarantee the multiplicity of worldviews. 2200 feminine worldviews have become dominant. 2300 the human thinking takes over feminine/masculine separatism.

Positive Benchmarks: participative budget in city management.

Environmental awareness, human security awareness, higher consciousness.

The advent of the Web has enabled shared visions of the collective future to be a possibility for the first time in human history. It is highly likely that such shared scenarios will be increasingly developed by individuals, groups and communities transcending cultural and national boundaries well into the 21st century.

Wells suggested a small elite to challenge out of date views with new ideas.

Not easy to measure.

Occasional emergence of relatively strong fundamentalist regimes.

100

Distribution of wealth starts to become more equitable.

Recognition of necessity for human solidarity across different belief systems on the necessity for international aid; the recipient countries varying according to the impact of climate and other change.

None.

New common vision of mankind as one whole with respecting own individual trajectory for each individual person.

500

By this time, mechanisms for effective solidarity could well be in place.

The view of Man to his life will be changed by new discoveries in the field of probably physic science.

Clearly needed, no agreement on anything but the desire for collective survival.

New global social order based on common vision of humankind as one whole and respecting right for own trajectory for each individual person.

1000

Change in global rate.

We have, we are, one vision. Now, the question is how we do it, not what we do.

Low Probability Consequences

Misuse of "virtual worlds which create dream and fear worlds.

The question could be read as implying that comprehensive and shared visions are identical visions. I do not see the quest converging on one answer, but the low probability consequence may be that it does.

An enhanced sense of meaning and purpose at the individual and societal level.

Increasing communication problems because of the cultural diversity.

Collaborative and partecipative institutions at all levels.

"Infotainmnet", multi-media productions presenting future scenarios on the Web and other new media formats. This would eventually have a major influence on traditional media such as film and television in terms of "visioning" of the human future not just in space but on Planet Earth as well.

Failure.

Much more effort needed to make progress in this area.

Failure to influence decision makers and the public.

10. Global Ethical System Of Values

Trajectory

The only hope here is through religious leadership, which does not happen through funding. Research may enhance understanding of how religious movements get started, but are unlikely to lead to the new religion.

Yes, but it will be ethics tied to market and marker forces.

What is the foreseeable trajectory for this factor and what might alter it? Globalization of the economy and of ecological effects will force nations to agree on a number of standards of behavior. At the same time, increased intercultural communication will decrease the differences in point of view while the emergence of a shared philosophy will provide a basis for a shared set of values.

See "Panetics" (Ralph Siu) and other extra to economic frameworks ordering and decision support systems.

The question about a global ethical system implies a trajectory of convergence from present different systems towards a point of general acceptance. As with the question on philosophy, I doubt such a convergence towards one point of view will happen in the thousand-year future, and doubt its ultimate possibility, given the nature of knowledge. I selected one issue, trying to imagine an outcome, within a thousand years, of acceptance of the idea that war is wrong. What might assist in the global acceptance of the view that war is wrong is work on perceiving the causes of violence - changing the way people perceive the world so that wars about identity politics cease?

Trajectory: low level, ongoing, inconclusive efforts for the indefinite future. So far as I know, many of the same values and principles underlie the world's major religions and democratic governmental systems. To that extent, they're already generally accepted. However, they find expression in divergent beliefs, religions, dogmas, rituals, cultural norms, laws, etc., that often divide rather than unite. Emergence of a single religion or outlook with broad enough acceptance to become dominant seems increasingly unlikely. The Internet, etc., provide means for propagating endless alternatives. I don't see forces strong enough to generate consensus out of chaos. That was easier when kings and potentates could force their subjects to adopt particular views on pain of death or worse.

The similar as in the preceding factor’s trajectory. Only faith can bring back ethic values in front of man’s interest.

A minimum global code of ethics, dealing only with major problems will develop on next century. Commercial totalitarianism and new populist tribalism try to obstacle it and manages some time to resist the demand of global morals.

A bottom-up process, but it will not reach State international relations. A global economic collapse might alter it.

There is currently a major movement in many areas of society toward a generally accepted

system of global values and principles that would be a broad and fundamental ethical foundation for individual and group behavior. Such documents as the Earth Charter and various Declarations of Human Rights and Responsibilities are evidence of this attempt. This impetus will increase as the threats to humanity mount in the 21st century.

Outlook good.

Emergence of global ethical system based on the holistic view of the world and respecting individual rights.

As in Question 9, given the diversity of the world population and the increasing rates of change and innovation, it is very unlikely that a global ethic will emerge naturally.

I believe in basic set of (human) values that are explicitly or implicitly present in all cultures and can be accepted by people of all cultures (perhaps not by dictators in some regions but by people living in this region). Problem is how to define this basic values and how to implement (or even enforce them) globally. This can be challenge for next several (2 - 3?) centuries.

The all mankind tends to accept the Western idea of human rights, the dialogue among world religions is developing rapidly. The tolerant attitude toward the cultural diversity is emerging in the process of universalization. But on the other hand there is problematic come-back toward the traditional values - for example the system of Islamic law (sharia) is accepted in the growing number of Asian and African countries. The dialogue among religions is great challenge for coming century, because the common values are inherited in the most of world religions.

Even though there is a urgent need to develop ethical consciousness in very wide scale I am quite pessimistic whether this will happen in reality itself (see. my a.8). This is the reason, way I'll give to this question the probability3. (Obviously 2. should have been even better estimation!).

More commitment to the need to make progress in this area.

Wells is correct in that a small elite should explain this approach. This is Wells' word and brain using the internet.

Shared prioritization of positive common values present in all major cultures and philosophies.

A difficult one stoned by conflicts of values and interests.

Benchmarks

Accept Panetics for one country a.s.a.p.

2050 the acceptance of global moral code causes a problem of it having potential to become a new totalitarian religion. 2100 the difficulties are won and the minimum global ethical system is continuous development process in multicultural dialogue. 2200 new worldviews have been invented and enrich the global heritage.

Normative revolution for ethical international assessment of governs and companies.

Domination, authoritarianism.

Implementation and enforcement at an international level of such documents as the Earth Charter and adoption at every level of numerous societies.

No easy measures or benchmarks.

Promote the world brain concept. Failure of the public to understand this.

Increasing role of international organizations and agreements.

100

Religious wars between Muslims and Christians, Muslims and Hindus, and other religious conflicts.

2050 - The end of face value money.

Groups such as Global Action to Prevent War work on a variety of fronts: political and scientific/technical in order 1) to change the path of hatred and 2) the technology of disarmament.

We know we need it, but we constantly fight over what it is.

Emergence of global ethical system, list of human rights and obligations, space for development for each individual person.

500

Destructiveness of wars leads to greater tolerance, especially as different religions become geographically separated.

We know what it is, if we could just consistently do it (we're awfully self absorbed, you see.

1000

We do it, we don't even think about it anymore.

Low Probability Consequences

A convincing messianic leader emerges.

If agreement cannot be reached, there is the danger of a splitting up of the world in 2 or more

opposing blocks with incompatible systems of values.

The possibility of success, in the words of Immanuel Kant a right violated in one part of the world is felt everywhere by the year 1000.

Because of too little worldwide dialogue the global moral code has been made too extensive, too tight, and too rigid. This causes rebels against it and deviance from it.

Eradication of poverty.

A clash between secularly defined global ethical values and principles and traditional religious values.

Failure. Biggest risk area: next 250 years.

Failure to move to a worldview which must happen.

Tension in wide social sectors due to concentration of economical power in forces with non-humanitarian ethic.

11. Human Genetic Engineering

Trajectory

Human genetic engineering is already reasonably well developed and continuing investment will significantly increase the applications of the technology. One result will be an aging population, requiring a reduction in the reproductive rate in order to maintain balance between people and resources. Conflict between age groups may increase, as younger people may not have opportunities to realize their potential; but cultural means of controlling such competition may develop.

It does not matter if it is genetic engineering or some other control mechanisms, this is almost assuredly going to happened over the next 100-200 years.

The temptation (already) is too high. We will be swept into a genetically engineered future.

Increased understanding of biology and the role of genes will make it possible to change almost any aspect of our body and brain. In the short term this will trigger a number of deep discussions about what should be done or not done with this almost limitless power. These discussions are likely to be resolved with the emergence of a shared philosophy/system of values.

A spike trajectory at least for medical implications for control of some medical conditions, but not all. Spike itself gets spiked as new diseases emerge as old ones conquered.

Trajectory: significant activity already underway which is likely to increase rapidly over the next 10-20 years and maintain steady growth until most of the issues have been addressed. That could

occur within the next several hundred years or not until well after the end of the third millennium. Evolution of this subject will pose a large number of issues with moral, ethical, and survival implications. Polarization of opinions on, for example, birth control and Dr. Kevorkian's ministrations show how difficult it will be to hammer out consensus and collective responses. Genetic engineering will create big trouble in River City.

The use of HGE is getting increased. Funds and public agreements or disagreements with this kind of influencing of human could influence the speed of development.

"Disease" (at least the 20th century conception of it) will be eradicated during the 21st century.

Involuntary aging will also be eradicated, in the same time frame, since aging is really just another disease. Human characteristics will be readily modifiable by individuals on a timescale of at most days, and perhaps only hours or minutes, via nanotechnology. Classical genetic engineering and biotechnology will be obsolete once nanomedicine becomes widely available -- possibly in the next 20 years but almost certainly no later than the mid-21st century.

For a few decades efforts are made to develop human engineering an instrument. It though appears to be too expensive and too dangerous a tool and its use gradually restricted to a minimum of cases. Mind over Matter! Humankind will find new ways to control its corpses because it seeks freedom from all binds. The use of human genetic engineering might cause conflicts between cultures accepting its use and cultures banning its use. Restrictions wont prevent its emergence in a form or another, although large scale use might be prevented.

There may be a conflict between rich users of genetics and poor naturalists. The mankind uses genetics in some way the whole history, without problems. The main paradigm today is to construct better species inside of given environmental conditions and tomorrow perhaps comes an attempt to construct better environment for/using-the existing species. Perhaps in the future the scientists will not create better potatoes, but they will chose appropriate potato from genetic database plus appropriate bacteria, insects, etc. to live together. This method is today more complicated, as we compare results from Project Biosphere and Dolly. In practice: if you want to construct new appropriate computer or a build new business company, there is no need (in general) to begin with development of electronic parts or training teenagers - the reality is full of completed species and it is a question who is the right one for what.

It will grow not so rapidly because of the control of Pharmaceutical companies.

The 21st century will see huge advances in genetic engineering and in all its potential consequences - both positive and negative on society. It is highly likely that "Super Humans" will be created in a test tube by 2025. A human clone by 2005. Misuse of these powerful abilities may cause a societal backlash.

Fast. Incredibly fast. Thermonuclear war.

The life span of human being will be largely extended and main diseases nowadays will be controlled or completely cured.

The application of human genetic engineering or prenatal gene therapy is certain to occur within the next century. We already could do this to change some genetically transmitted diseases, it is just a matter of time before we begin to apply these techniques in the womb. And as our knowledge increases the number of things that we can alter will increase. What parent wouldn't want gene therapy to repair incipient diabetes in their unborn child? Funding is not required, this technology is so desirable it will happen regardless. The ethical issue arises when this technology is used to make 'improvements', in the immune system functioning, intelligence, body type, hair color, etc. As I state in Question 14, I believe that this technology will be used in this fashion almost as soon as it is available.

The successful mapping of the human genome will open doors for greater human self-intervention, including biological self-design.

Opportunities emerging from these developments are overwhelming but we should be very much aware of "darkite" (abuses) of this development. Genetic engineering can become "timing biological bomb", perhaps much worse than nuclear weapons. We should not try to "play God", we should consider life always as miracle and gift, not product of our activities.

The evident progress of genetic research could be slowed down by growing opposition of ecological or religious fundamentalists. Consequences: The real danger of misuse - "programming" people or creating "new people" for the purpose of army, economy, totalitarian ideology and political power.

More resources – less focus on risks and more benefits.

As new technology becomes more powerful it can be used for good or for ill.

Rapid pace of sciences and technology.

Benchmarks

2020 human engineering has become an instrument of commercial interests. 2050 global code tightly restricting the use of human engineering is accepted widely. 2100 human engineering has become a tool with low importance in global scale. 2100 exclusive products. 2400 made available for all. 2900 considered self-evident tradition.

Control on typical elderly diseases (eyes, ears, etc.).

Controlling diseases may happen; however, we all should die!

Human lifespan extended to 150 to 200 years. The conquering of numerous genetic diseases. Humans born with genetically enhanced intelligence, physical prowess or both. We would likely not recognize the genetically altered human being of the Year 3000.

Positive: the disease of Hart and Hypertension, cancers, and main infectious diseases will not be

the dominance disease to human being (in 100 years), new born infants will be genetically healthy and intelligent, human memory capacities will be greatly expanded (in 500 years) and human brain could restore all information of their ancestors and therefore to completely change the meaning and tasks of education (in 1000 years); Negative: some ethical, moral and legal problems will be caused and new kinds of crime will be emerged.

See Wall Street Journal 9/9/99 re: Genetically Engineered super-intelligent mouse.

Possible to establish some index of "progress"?

Cure for cancer and other diseases. Links with nanotechnology if could make germ warfare much more effective. Also GM food could destroy organic farming.

Control disease.

100

Reasonably complete understanding of the human genome. Average human longevity increases to 150 years. Biotechnology develops capacity to grow new human organs on demand.

Same as Q5 above: 2020 - first replicating man-made life. 2040 - first thinking non-man made intelligence (using above).

Understanding and some therapies for diseases caused by genetic mutations, with new vaccines against infectious illness. Understanding of what it means to be human embraces the notion of a genetic identity.

Recognizing the human DNA, recognizing genetic reasons of many illnesses, problems with cloning and human rights, ethic war against changing the human characteristics and cloning.

By 2012, everybody knew this was the age of biology. Third graders recite the engineering pyramid: Mathematics, Physics, Chemistry, Biology.

500

Technology to control human characteristics fully developed, but causes backlash by those who value freedom (perhaps led by messianic religious figure).

Some progress on the topic of the causes of aging, some success, but not to the stage of immortality.

Commonly genetically solving some of illnesses, cloning is usual technique.

It's done. Humans can become anything they like, live for all intents as long as they like, behave any way they would like. Science has given us the raw materials. Biomedical engineering has provided the craftsmanship. The absolutely huge field generally still called "neuroscience"--linguistics, philosophy, systems modeling, organization of "consciousness", post-synaptic cascades, artificial life (which necessarily has a quasi-neural architecture), etc--has remained the hottest and most rewarding (and reviled, by some) human endeavor. Even today (2500 AD) when genetic engineering has triumphed on the quantum level, the field wistfully called "neuroscience" holds sway over the question of whether we survive another 500 years.

1000

Immortality.

Humanity will have powerful tools that may be used to fight disease, but that may also be used for new forms of unwelcome biological control of human life.

Rebuilding "lost" parts of body genetically.

Finally, we can put this one to bed. The end of dissention came just in time. This ringing in our ears has been replaced by the passionate need to rejoin the cosmos - to traverse the gap between "everything" and "one thing" from which individual life has always sprung. The ancient prophets might have said we want to die so that we may live, or be last so we may be first, or some such dualistic euphemism.

Low Probability Consequences

Different strains of humans are cultivated for different kinds of tasks, with different levels of intelligence assigned to them; leads to speciation within our genus.

The emergence of dictators with desires for social control though biological control.

Misuse of technology leads to creation of ‘slave classes’, i.e., Huxley’s Brave New World.

Eugenics.

Misuse of the production of the new weapons.

Clone technology might be wrongly used on man himself and cause severe social disorder or even goes out of control and therefore destroy the whole world.

"Genetic sabotage" -proliferation and spread of genetic errors by those with minds no less devious than manufacturers of computer viruses could be a powerful weapon of the future.

The negative effects are high not low.

Risks of damaging side effects likely to outweigh potential benefits.

Extended use of genetic engineering in non-ethical applications.

New disastrous creatures developed in labs. Lost information which is now stores for us in genetic diseases and "abnormalities".

12. Conscious-Technology

Trajectory

Development in these fields makes it feasible to develop new types of technologically augmented human beings, but this is so profoundly in opposition to the religious and ethical standards of people that it leads to a backlash against such technology. The technology has no particular benefit for our species.

This is one of those "fast will eat the slow" things, with all the usual consequences for the rich getting even richer.

Machines levered human power; on-chip technology or imbedded intelligence will unburden mind.

With ever more efficient technologies for communicating and processing information, the boundary between brain and external aids for thinking will practically disappear, so that computers and communication interfaces will feel as if they are an integral part of our personality. In the longer term, the effacing of borders between brain and computer are likely to also lead to an effacing of the border between individual, computer-supported brains, leading to the emergence of a collective mind or "global brain", an integrated thinking, conscious being with an overall world view and sense of purpose.

See frameworks shared realties and references above.

Continuation of a trend already in train, with new ways of augmenting humans and helping those with disabilities. Still a disjunction between technology and human consciousness, if not between technology and machine intelligence. Trend is for augmentation, but with discontinuities still.

Occurring of new illnesses due to change of genetic code - not previously predicted by scientists.

Totalitarian global control of people by the rich with the help of human engineering.

Transplant of brain.

Brave New World!

Man and machine will likely merge by the mid 20th century. The ‘cyborgs’ of 20th century science fiction become a reality. Brain ‘chip’ implants, enhanced body parts and senses, etc.

This is the agenda in a nutshell.

Great Technology Synthesis - design and emergence of new extropic /syntropic/ technology including technology of mind, cyberspace, human social and economic organization and harmonization of role of technology with humankind and nature.

This technology is in its infancy. We still have no direct evidence that major changes are even possible. However if it is possible then it would be extremely high impact. Technology applied to consciousness has the potential to change all the rules by changing how we think, what we perceive and what we want. Funding of this technology has leverage and could expedite its development. However, this technology is intrinsically low-energy, low-cost. It could be developed with very limited resources at any university. Consequently, if current early explorations prove fruitful, it is likely that the technology will progress even in the absence of funding. However, it is also likely that if that were to happen the first applications of the technology would be chaotic, rebellious, and anti-authoritarian (like the Internet or "designer drug" culture). An early policy position and funding could allow more control of the future results.

More likely achievable towards end, than beginning of the next millennium.

My crystal ball is too cloudy here.

All of these will happen but must be controlled when they are ready to be marketed.

Could have four reaching effects but these are unlikely to be beneficial unless people everywhere get on better together.

It belongs to the idea of "Life Beyond Information Society", and human made non-human life.

Benchmarks

Accept and test more (CONDORCET) we should try and test everything when in danger - definitely with control and check and balances.

Establishment of Negative Cultural "Ideologies".

In 2050 the anarchistic experiments on this field are tightly restricted, and the emphasis turn towards full development of existing human resources. 2100 new dimensions of human resources have been discovered and taken is use. 2400 the people consider, that last 5000 years, except the two latest centuries, have been a vast degeneration of human species and create museums to conserve the contradictory good-bad dimensions of those ancient dominant cultures.

Thinking PC. Intelligent robot in dangerous works.

Control, domination, racism.

Much of this technology already exist so it will be the widespread appearance and acceptance of technologically altered humans that will be the first benchmark which may occur by 2020. After this it may become the norm rather than the exception. The human being of the Year 3000 may be primarily machine.

Possible to establish a benchmark – but what would it mean? What use are they?

Could form the basis of a world civilization with a high standard of living but must be shared world wide so no information rich and poor.

100

Fast here. In fifty years we shall have undergone several quantum intelligence jumps.

Technologies that aid those with severe disabilities to gain more control, with some restoration of function.

Especially development of robotic systems, diagnosing methods, moving robotic technologies, etc.

It is a turbulent reality; policy issues center around it. This is the key time for policy makers and ethicists.

Age of Great Technology Synthesis

Misuse of the production of the new weapons

Information technology from 2000 to 2050 and then the conscious -technology period start emerging.

500

Perhaps some form of implant for young men who seek thrills through augmenting the healthy body.

Computer mind is reality new kind of "being" android.

Policy effectiveness is well and truly dead. What's done is done.

Emergence of singularity and harmonization of impacts of technology on humankind and Nature.

The rise and development of a new civilization of humankind based on the continuum of technology and consciousness.

1000

Unimaginable change.

Hardly to strictly differ human beings from artificial-humans.

Technology for expansion to the Universe and other Spaces.

Low Probability Consequences

Loss of identity.

Some individuals may not wish to be integrated with the technological-social web, and continue to live in a more traditional way, making them unable to comprehend the complexity of the actions and decisions of the global mind that surrounds them.

Over-control and leaving individual right and variety behind.

What if knowledge lost about how to fix machines?

What we today consider the core of "being human" may seem quaint to the augmented beings of the year 3000.

The computer mind can begin to control the human beings, and may be, eliminate them.

Criminals with affluent resources control people with the help of the humanoids.

Humanity controlled by "future Bill Gates".

Brave New World!

A race of technologically enhanced "humans" dominating those not so enhanced.

Avarice. Hate to keep referring to this, but if anything gets us in this respect, it'll be our old nemesis, greed.

E.g. the concept of a global warrior.

"Cyborgs" taking over the earth – will they count as "humanity"?

Side effects – largely associated with abuse of power.

Neural networking challenge brain work.

People’s fear of "grandpa" internet - a conscious internet network.

13. Increasing Intelligence

Trajectory

Increased understanding of the various factors that affect the relationship between people and the rest of nature leads to greater adaptability. This may be the most optimistic and positive trend over the coming millennium.

Not us; but controlling increased intelligence, yes.

Individual intelligence will continue to increase, as it has over the past 100 years (the Flynn effect), thanks to better education, health care, genetic manipulation and computer support. Collective intelligence will require the development of new scientific insights and technologies, as well as the afore-mentioned shared philosophy and values. The main issue is whether intelligence increases will be able to keep up pace with the increased capacity for information-processing and problem-solving demanded by a world that gets ever more complex ever more quickly.

I see this as a slight trend, but 1000 years is a short time to alter humans to this extent by some kind of mechanical or biological means.

Scientific advances concerning intelligence-controlling genes, brain processes and chemistry, etc., should be a significant accomplishment over the near term (5-20 years) and accelerate continuously for a long time. Positive effects, with the practical result of actually having people deal more effectively with unexpected problems, will lag the scientific advances by many generations. What people do with their capacities is profoundly influenced by cultural forces, economic and other imperatives. There is little reason to expect that enlightened self-interest will dominate over less constructive forces during the next several hundred years.

It differentiates according the kind of intelligence. But as a whole I suppose the intelligence will remain the same. Only some new discoveries in the field of psychology and parapsychology could change it.

The concept of intelligence is dramatically changed in the dialogue of multiple cultures and worldviews. The new intelligence concepts allow development of new forms of intelligence, and more full use of human resources in the long run. Also: The training of human potential is dramatically enhanced.

Increasing individual intelligence is not important, but the collective intelligence is small. Seems that many people refuse to increase their intelligence - it might be the result of their life conditions plus genetic and cultural programming. To increase collective intelligence, the collective consciousness must precede it (I mean)! For example the totalitarian communities seem to be collective unconscious.

There will be very slow changes. Education and practical training might alter it.

Knowledge at the scientific and technological levels continues to increase exponentially in the

21st century – doubling every few years. When brain implants are available to enhance human intelligence (possibly by 2010) the ability of human beings (if this is still the right term) to deal with complex and unexpected problems will greatly increase.

Unstoppable, and as I have said, going from the collective to the individual (fiercely) and back to the collective. Bad policy in the next 100 years will haunt us like a deformed cuticle.

Emergence of network intelligence of Internet, human economy and society, emergence of singularity in networks.

As in Question 11, this technology has already reached the "point of no return" and once realized has high potential impact. And while this technology is much less open to cultural/recreational use or abuse than cyborg technology, it is still not an unmitigated good. Intelligence does not imply wisdom or morality (recall that a great many of Hitler's SS were PhDs). And there are the social structural issues... This could easily result in a real Permanent class system or, in the extreme, the construction of an artificial species. Early funding and policy could provide guidance.

Genetic manipulation to increase intelligence is certainly conceivable.

Perhaps even "steered" evolution" is in front of us - not just biological evolution through genes mutations but conscious and steered social evolution (which is much faster than biological evolution).

There is enough intelligence in the human kind, the problem is its use. Most of people have no or very limited chance to use and perform their intelligence for good purpose. In the industrial countries the human intelligence is sometimes misused for military research or sophisticated (but from the perspective of future quite senseless) economical transactions or advertisement brainwashing, in the third world it the human potential quite neglected, not appreciated. Consequences: This trend could be changed through reorientation of values and worldwide free access to education (and creating new job opportunities, of course). The growing unemployment is great danger for human intelligence in general.

This is reasonable in theory but what is really important is the trend in the Emotional Quotient – this is highly problematic.

Neural networks will not replace the brain but will challenge and improve decisionmaking.

Failure of "survival of the fittest" will lead to decreased intelligence on the whole.

Increasing knowledge of worldwide scales processes and associated threats (natural, antropogenic and still universal).

Benchmarks

It’s really improvements in foresight vs. reaction time (which includes time to reach and

implement a consensus).

2050 the concept of intelligence has got new content and the development of new forms of human intelligence starts. 2100 human intelligence resources have doubled because aforementioned process. 2200 the present intelligence concept ha very limited applications.

Control, domination, racism.

Increased networking of individuals and groups working together on joint problems. The first brain ‘chip’ I.Q. implant available.

No benchmark – just a slow deterioration.

Intelligence trends could be monitored but this is of limited value without it being integrated into a context.

Use of worldwide communications could result in a shared world culture.

100

Better understanding of the factors that affect human intelligence enable all humans to increase their overall intelligence (though of course the normal distribution of intelligence will remain, with the mean IQ being 100). The problem is that no particular relationship between intelligence and ability to deal with unexpected problems necessarily exists, nor with high ethical standards, nor with "happiness". Greater intelligence can lead to over-specialization.

Autonomous, self-repairing, self replicating intelligence devices. 2030 in homes. 2050 on the battlefield.

Greater understanding of brain function and structure, with perhaps new brain expanding drugs of more use initially for people with brain disfunction e.g. Alzheimer disease. I see this a bit like the steroid story; some people who are ill benefit, and are prepared to suffer the side effects. Those who are healthy ultimately lose their health through wrongful use.

The same like now.

Emergence of network intelligence of human networks, human organization and society.

500

Better understanding of processes in brain, but without special increase of intelligence.

Emergence of singularity in human networks.

1000

Perhaps by now the drug technology may be able to augment the healthy as well as treat the ill.

Not increase of intelligence, but its new understanding thanks to contact with extraterrestrial or parapsychologic and physical discoveries.

Low Probability Consequences

Expanded intelligence isn't everything. Some problems have social solutions where the will to succeed matters more than the intelligence of the actors. An over-emphasis on intelligence above other factors can lead to terrible distortions in social policy, as with Nazi ideology.

Fact and fiction are mixed in the new intelligence concept, and as result of it the intelligence begins its degeneration.

Increasing general sense of responsibility on the future of Humanity.

God-complex.

Widening gap between the intelligent 'haves' and the less intelligent 'have-nots'.

Probable but not important like previous Q. Consequences – rise of new "race". The augmented human beings could account themselves better than "ordinary" humans with all the consequences the racism brings.

Today the problem is not so much one of intelligence and emotional stability.

Fear of change and new developments.

Unscrupulous utilization of this factor.

14 Conscious Evolution

Trajectory

Some attempts to profoundly change human nature will continue to be made both by the well-meaning and the control-oriented. No evidence that a more spiritual holistic-centered consciousness would necessarily indicate an improved human condition.

A more holistic consciousness is likely to be the automatic side effect of the previous factors (shared values and philosophy, increased intelligence, conscious technology, etc.), whether it is

consciously attempted or not.

Awareness Education about scales, proportions, consequences, and patterns.

I prefer to interpret this more as the attempt to develop a concept of the ecological self, i.e. the individual conceived as the individual, the self perceived in relation to the environment and the community. (The environment may include the cosmic environment.) I see the trajectory here as a herky-jerky process, one step forward, one and a half steps back.

Artificial (machine) intelligence will probably be the key factor.

Trajectory: there will undoubtedly be attempts (as there have been), but results will be inconclusive for the indefinite future. Consciousness-raising and subordination of self-centered orientations in favor of the common good have been around for a while. Substantial reduction in slavery, air and water pollution, mistreatment of animals are examples of some beneficial results. I am skeptical that real spiritualism, as differentiated from growth of cults and sects with claims of spirituality and minimal delivery of it, is likely to prosper over the next 1000 years. Underlying human behavior is a strong constant.

I do not believe this could happen in global to this civilization we are living in. Only war, extraterrestrial, scientific discoveries could change it.

The new scientific worldviews show, that the question is wrongly set. The demolition of economic and political structures, which have created the self-centered consciousness liberates other, more humane and more relevant traits. Accumulation of totalitarian tendencies both outside and inside democracies can obstacle this development for some time.

It is likely enough that there will be various efforts in the next 1000 years toward conscious evolution, but they are unlikely to seek a uniform goal for the "perfect" human type such as is suggested in the question. More likely, humanity will risk fracturing into even more sharply distinguished subgroupings than is happening now.

See previous factor, the 13. and 14. are bounded from my scope of view.

It can evolve just at individual level.

Awareness, socialization, collective efforts.

The evolution of consciousness from individual egocentric to a holistic universe-centric would be a key factor for the future of humanity over the next 1,000 years. The advent of the Web will greatly enhance this process.

Public policy can have a great impact on what is taught and what is perceived to be important, but the actual attempt to evolve human consciousness is simply too big a job for any centralized authority. Human consciousness is a collective point of view. From start to finish, point of view is at the center of being an individual life-form. Policy is important, but let's face it—

politicians—and I'm talking about the good ones—are society's executive secretaries.

Transition from entropic stage of human evolution to syntropic stage of human evolution, design of quantum and holistic economics, control over economic and social power of human organization, redirection social organization from profit to anti-entropic /syntropic/ activities.

The holistic approach / the mutual acceptability between science and mystique.
Technology applied to human evolution has the potential to change all the rules by changing us. And clearly such technology is immanent. Given that capability, it is a virtual certainty that someone will attempt eugenic control during the next millennia. However, it is unlikely (in my opinion) that the direction that control would take would be spiritual... far more likely that it would be Orwellian...or worse. This is because the exercise of this control implies power, those with power rarely engineer systems that will diminish that power. Even on an individual level, what parent would elect a humanity-centered attitude for their child, if they knew that they would then be easy victims of those who had not so elected. Given that dynamic; policy is required in this area to ensure that the concept of liberty remains valid.

Development in this area will be extremely gradual – not likely to be achieved in a thousand years. The major religions have taken a few thousand years to evolve to present state.

I see this more as threat than opportunity. We would try again to "play God". People should be responsible for their lives but not to take responsibility to end their lives, even if this is technically possible.

There are lots of trends dealing with the question of such kind, for example psychology (Jungian psychology, the research of Stanislav Grof, the humanistic psychology of Abraham Maslow), new religious movements (New Age), deep ecology, the renaissance of shamanism, deep interest in esoteric (and -essentially - holistic) teachings of world religions and their mystical traditions, interest in nature nations traditions etc. The universalisation of world community through new communication technologies (especially computers and television) and free access to information (Internet) also represent the important step in this process. The deeper understanding and exploration of parapsychological experiences should be also taken in account. Consequences: The profound change (spiritualization) of human civilization, interpersonal relations, social institutions and society as a whole.

See the answer 8, and9! (If you want to get more information concerning my theory of human conscious evolution, I would be happy to send 2-3 p. summary later, based more than 10 years theory work.).

Wells word brain and moving to a higher intellectual level.

Very possible – at least in some parts of the world for some period.

Wishful thinking!

It doesn't seen to be the kind of conscious evolution foreseeable.

Then it might no longer be called evolution but co-evolution because evolution is blind to any conscious pursue. It comes slowly and only with smaller ensembles of concerned people. There are two main positive stream of views: that of Christianity with its personal god his salvation and mercy, (Islam in some forms alike) and the other one the Tibetan Buddhism (or others like) with satory and nirvana. Both may have a strong impact on how a person is living his life on earth with positive results for the other peoples' life as well. But there are also spiritual and religious lines not so positive either from individual or collective point of view, but still influential among people. Fundamentalist directions from what ever the base of it, fighting atheism, and some self-made movement (scientology, Satanist etc) are misleading people to struggles and deepening suffer without any purpose.

Benchmarks

100,500,1000 staying the same if some of above mentioned factors do not occur.

2010 the overestimation of the importance of present concept of consciousness begins to be widely questioned. 2050 humaniora, based of multiple worldviews have developed new, different views on human psychology and the role of consciousness. 2050 a minimum global moral code acceptance.

Acceptance/practice of human cloning; acceptance/practice of human genetic manipulation for other than medical necessity (e.g., cosmetic purposes), etc.

Spiritual holistic associations.

Growing societal awareness of the Universe around us, its nature, our place in evolutionary time, the miracle of life, etc. By the Year 3000, a ‘Cosmic Humanity’.

Surveys that measure the materialistic/spiritual trade-off.

Vital for our survival on this planet. Failure to release this.

100

The concept of the individual gets somewhere.

Design of quantum and holistic economic science, design of information theory of value, transition toward syntropic stage of human evolution, new holistic view of human evolution.

500

Back where we started again.

Emergence of new global social order and system of global governance.

1000

A few steps further on in recognizing the self in relation to the local, regional, planetary and cosmic universes that sustain and make possible all life.

Low Probability Consequences

Loss of heart and hand - becoming to egg –headed.

If a major change in the way people perceive the world happens very quickly, what would happen to institutions based on human avarice and aggression? Might social chaos emerge as an outcome of altruistic ideas?

Creating new society based on equality, destroying of economic system.

Worship of consciousness becomes a new universal religion.

Family-centered society again.

Changes in lifestyle from primarily individually centered to communal.

Move towards a self-contained communities (will this trend develop?).

Considerable problems if the highly competitive/materialistic society continues without powerful ethical constraints.

15 Immortality

Trajectory

Longevity will certainly increase for those with access to the necessary technology. This trajectory could be profoundly influenced by the unwillingness of the young to suffer the old, who are not able to adapt to the rapidly-changing technology.

Mind is timeless, so we wish for more; for nanoengineers it makes no difference if their activities relate to living (replicating) or inert (non replicating) materials.

Although biological immortality of the body is unlikely, given the practically infinite number of causes of aging and accidents, it is likely that "cybernetic immortality" will be achieved: the survival of our mental organization independently of the body (e.g. by "uploading" the mind into a computer or network, or transferring it to an new body). The question is whether survival of the individual mind will still be considered meaningful if different individual are merged into a super-mind or global brain. See common shared realities above in combination with a community of subjects not objects

Trajectory is the damp squib, a Phutt trajectory.

It will likely be possible technically. So the debate about whether it is a good idea will determine whether it actually occurs.

Given recent experience, it is entirely plausible that during the next 20-50 years it may become possible to extend an organism's life indefinitely and/or to transfer memory and consciousness from one individual to another (possibly a young clone). If immortality is achieved, it will cease to be valued, just like every other abundant commodity. Significant steps in this realm will utterly conflict with traditional assumptions about life that form the basis of major religions, moral codes, and laws. Changes in religions, moral codes, and laws will lag greatly behind the scientific disruptions that demand the changes. They will be a source of major societal unrest and criminal behavior. It will probably take longer than a millennium for humanity at large to absorb and deal constructively with major extensions of life spans and consciousness, absent some huge calamity that will force mankind into unprecedented behavior.

I do not think something similar will be possible. The destiny has the last word.

By the end of the 21st century, the above-stated situation will almost certainly exist. I've always believed that suicide would probably be the leading cause of death in the year 2100. By the year 3000, it is possible that resource competition or some other form of scarcity-driven conflict may replace suicide as the leading cause of death (see Q#4 and Q#5 benchmarks answers).

During a few decades ahead it is a fashion among the wealthy to strive towards immortality. When the real costs to the individuals themselves, and to the humankind become visible and the consequences of immortality are experienced, the fashion fades gradually. Immortality wont be reached in the near future.

The discussion about euthanasia is today a preparation for the future discussions about immortality. A question: has our death a value within the range of our (positive) values, or does it get value in future? Is there some relation between the value of our children and the value of our death? Immortality may lead to lower value of children in our life.(?)

People prefer not to know the time at which to end their lives. Invention on how not to grow old might alter it.

Human life spans will likely be extended to 150 to 200 years by the first quarter or half of the 21st century. Physical existence beyond that span, however, is much harder to forecast with, as the technologies are not yet foreseen. The immortality of consciousness, though, may conceivably be achieved by the downloading of the human brain onto a computer system sometime in the next millennium. This has been posited by a number of scientists recently.

The key word here is "effective". The fate of the universe(s) will not be securely nailed down even in the next 1000 years. And life won't "end". It will morph, or merge, or as my music professor used to say "transish". Effective immortality will be a reality within 250 years, perhaps

much sooner. What a can of worms that will be!

Development of extropic thinking and extropic technologies.

There are powers much more potent than intelligence hidden deep inside the human being.

Immortality? Very unlikely within the next thousand years, not even with the marvels of genetic engineering. It seems to me that nature's version of immortality – expressed in generation after generation of descendants – is more robust and enduring, and unlikely to be mimicked, much less bested by human technology.

The legalization of euthanasia in few states of the world, the vehement discussion about its ethical and religious consequences. The trend could be stopped by opposition of religious groups. Consequences to be considered: The great danger of misuse.

Greatly extended life spans (are more probable than immortality).

Can no longer afford to keep aging population also when there is no quality of life there is no point in living.

Can easily go both ways – more young suicides in Japan?

Euthanasia will be officially accepted with fifty years all over the world.

Benchmarks

Increase of life expectancy with 1 to 3 years per decade because of medical advances is likely to continue for the next 100 years, but "cybernetic" immortality will probably only be achieved later.

2020 immortality becomes theoretically possible. 2100 immortality has lost its relevance.

The average human life span increasing in the 21st century as it has in the 20th due to increased nutrition, healthcare, education, etc. reaching 100 by the first quarter of the new century. Then, new discoveries re: aging lead to a 'quantum leap" nearly doubling life spans by 2050.

Extreme life extension is virtually certain. A combination of bio-chemistry, gene therapy, and nano-surgery will allow some people alive today to live for hundreds of years. This will obviously change the structure and nature of society. What will be the attitude of someone who has been an adult for 25 times the length of his childhood versus the current 2 or 3? Also, will this technology be universally available or will only the rich live forever? And what will the masses of poor people think of that? The technological imperative has already taken this pursuit beyond the control of governments; it will happen and much sooner than 3000. A ethical/moral position on this and policy to deal with the result is required.

Strong move towards quality of life. Medical profession most in favor of this move.

Life span trends. Some signs are going down, not up.

100

2025 the first grafted head (or body) depending how you view the problem! 2030 the neural code is cracked. 2040 cell death inhibition drugs are put on the market. You then buy immortality.

Utter confusion over the role of senior seniors. Yes, they are "productive, contributing members of society" but they are often morbidly confused as to their emotional role. And they're not the only ones. "Pre-centurions" are alternately worshiping and spurning them.

Design extropic view of the world as social science, extropic technologies.

500

Prolonging of life in average, but individually immortality could hardly appear.

This confusion will not be short lived. It will persist well past 2500 – ironically, even though everyone but the recently born is hundreds of years old. The utter power of the individual gives rise to innumerable pretexts to question the efficacy of life itself—in general, of course. Not my life. As a policy question, you see. (As if "policy" really mattered at this point.).

Partial immortality of human mind.

1000

Watch for serious backlash if this occurs before there is social equity is achieved.

Prolonging of life in average, but individually immortality could hardly appear.

No longer an issue. Finally. Funny: immortality was the easy part.

Partial immortality of human body.

Low Probability Consequences

Becomes available only to the selected few.

That effective immortality happens, as the question frames it. We are the last mortal generation we miss out.

The ultimate altruistic act for an individual may be suicide in order to make room for a new human being.

If immortality succeeds question of elders, which will have probably nothing new to bring to

society, will come.

A minority of humankind, the wealthy immortal criminals, take over totalitarian control of the globe.

Never-ending working life.

Conflict between those who can afford ‘age treatments’ and those who can’t.

Misguided "benevolent" genocide.

Quality of life issues critical, rather than unsatisfying materialism.

Fundamentalists opposed this approach.

Committed murders and euthanasia for other purposes than that of the dying people.

16. Family And Gender Relationships

Trajectory

These relationships will continue to be driven by enlightened self-interest; these relationships will vary between populations that are stable and those that are rapidly changing (either growing or shrinking).

Family roles will be changed almost beyond recognition as most reproductive functions will be taken over technology: the extension of in vitro fertilization ("test tube babies") will make reproduction possible with practically no human intervention. The general movement towards equality between men and women and different roles will continue, until such roles are merely a question of personal choice, rather than a biologically or socially imposed constraint.

Come to communion as above.

Trajectory a herky-jerky affair. One step forward, half a step back, except for places in world where women go three steps back into a very constraining purdah. Use of sex-determination technology for selective abortion of females in areas of high population density has potential to alter sex-ratio towards new kinds of gender inequality. Human intervention in policy area or at least in a change of world-view has greatest potential here, not necessarily requiring funding, but something harder to obtain, a change in values. With fewer children in the world, children may be valued differently, more for themselves, less for their earning capacity.

Family and gender relationships will change as long as humanity exists. Over the next several hundred years, I would expect continuing high birth rates in underdeveloped countries, strains on the food supply/environment/energy-availability, and ever-growing appetites for material goods/education/entertainment/leisure to force a greater percentage of the world's population into out-of-home employment. Continued erosion of traditional values will provide a fertile context

for further changes in all forms of interpersonal relationships.

The importance of family will stay the same like today. May be a new education system will lead to sooner leaving the parents wings of protection.

Gender is relevant primarily in relation to sexual reproduction. With the obsolescence of classical sexual reproduction in the 21st century, the rationale for differentiated genders disappears. This factor, combined with the ability to alter gender (or any other normal human characteristic) right down to the cellular/genetic level means that by the end of the next 100-200 years, there may well be no distinctive human genders, but only eclectic individualized collections of desired characteristics - which will undoubtedly include mixtures of traditionally male and female attributes. In this environment, gender equity issues are obviously totally irrelevant. They simply cease to exist. With sexual reproduction obsolete, and with personal semi-immortality virtually assured via nanomedicine, the impetus for parenting (and thus family formation) will be vastly reduced. Parenting may become an extremely rare cultural role, possibly indulged in almost purely for reasons of self-actualization rather than for seeking indirect immortality of ones own genes or memes, or for other social or economic reasons.

Ethical social capital (including new solutions to the mentioned questions) becomes gradually a focal part of the sustainable development strategy. Commercial totalitarianism.

See previous factor, there is some relationship between parenting and immortality. The notions of family and gender seems to be stable in range of million years. The changes of it are possible, but perhaps they bear not so much long-term stability for any living community.

In a long term view people won’t be satisfied with nothing but the family and there will be a family reorganization.

Awareness, socialization, collective efforts.

The current trend toward gender equality, shared parenting responsibilities, etc. in society will continue strongly into the foreseeable future in the developed countries. The possibility exists that in these countries, the first true male/female "partnership societies" may emerge.

I don't understand the question. What about Family relationships? Just how will they change? Probably the reason the question is so vague is that at this point we don't even know what to ask. These issues are the most delicate and fragile of all that we currently face. Who the hell knows what they'll look like even 100 years from now? Might as well try to predict hemlines. Maybe Godot has something to do with it.

Emergence of new global social organization based on the holistic view of the world.

Probability = 100%. This is happening constantly and there's no reason to think that the next millennium will be more stable than past ones. One has only to remember that 1000 years ago among our Frankish ancestors marriage was contractually arranged. The contract specified the duties and rewards of each...how many children would be born, who would raise them, how long

the marriage would last, and how the property would be split afterward. I would suggest that the next 1000 years would see equally radical changes in social roles from the current norm. Perhaps even more so, if some of the other things on this questionnaire come to pass (cyborg technology, extreme longevity, control of evolution, etc.).

Changes will be evolutionary, not revolutionary. Economics will dictate pace and nature of change for the majority of the world's population

Of course men and women are equal but our roles concerning parenting are different and should stay different even in long term future. (For example in the Czech Republic there is a three years maternity leave for women when they can stay with children and it is financially supported by state). This I see as more positive than three months maternity leave in some western states and system of au-pairs and baby sitters.

The great change is evident: emancipation of women - employment, access to education, the change of typical "man" and "woman" social roles, incomplete families, the legalization of homosexual relationships etc. Positive consequences: emancipation of women and sexual minorities. Negative consequences: the disturbance of traditional family structure, no new functioning model of family structure is evident now.

Changing work patterns (i.e., working from home) could mean return of extended family.

Much of these issues depend on personal priorities – such as taking having/bringing up children more seriously.

Benchmarks

2050 a minimum Global moral code acceptance.

Co-parenting initiatives.

Increasing participation of women in traditional power structures such as business and politics. Trend to women as main bread-winner in many families becomes more prominent.

Extended family cares for young and old at one location. Will reduce travel and pollution. Could take several generations.

Birth trends – down in nearly all industrialized societies where female education becomes widespread.

100

Negative benchmark would be earth population of 66% males to 33% females. Decline in number of children

Same like now.

500

A positive benchmark might be a return to a 50-50 sex ratio, with increasing value placed on women, at least to the level of allowing them to be born.

Large changes in educational system, both family and school one.

1000

Large changes in educational system - both family and school one.

Low Probability Consequences

End of monogamy everywhere.

Going to an all equal but no variety fun and life "artificial" race of boredom and mechanical control.

Technological advances may greatly improve per-capita productivity, diminishing the pressures for increased work. More traditional behaviors may regain their influence if and when it emerges that changes of recent decades have had detrimental effects.

Bigger role of work in life of individuals.

Return to earlier patriarchal or matriarchal cultural modes.

New growth of birth rate.

Male backlash.

More alienation and breakdown in social stability.

17. Extraterrestrial Contact

Trajectory

Such extraterrestrial contact may be the only hope for some of the changes that are considered in points 1-16 above. The implied speciation -basically evolving from Homo sapiens into a different form of organism - maybe possible only when driven by an external force.

It will happen sometime, but it could be more than 1000 years. It is more likely that we leave the planet earth in search of other habitable planets, whether or not we make extraterrestrial contact.

We get a "once-off" clear signal; we have no idea where it came from since there is nothing on

the angular vector, no time scale. We store it and wait.

This factor is basically impossible to foresee with our present knowledge. Recent scientific advances make it more likely that life exists elsewhere in the cosmos, but this does not imply that intelligent life would exist near to us, or that it would be willing/capable to communicate with us. In any case, there remain strong physical limitations (the speed of light) on the possibility of communication over interstellar distances.

I see the trajectory as the fizz of a fireworks display centered over America. What might alter it is if other nations start spending big on SETI research in a new kind of SETI space race, if it turns out there is money to be made from astro-biology.

Within 100 years contact will likely occur with at least one form of extraterrestrial intelligence, and possibly with several different ones. We may receive an encyclopedic message (by radio or pulsed laser) from many light-years away, or we may make contact with a super-smart probe that has reached our planet. After contact, humanity and the other "culture" will interact and evolve together. The outcome will be heavily affected by the knowledge and purposes of the alien intelligence, and by how open-minded and sensible and conflict-free the human reaction is.

Trajectory: explorations along these lines have already begun and will undoubtedly continue. When they might bear fruit is a shot in the dark. Communication with extraterrestrial intelligence is constrained (at least for now) by the speed of light and the vast distances involved. Two-way contacts during the next millennium will occur only if there is some major new advance in exploitation of physics, such as creation of time warps. Humanity may, however, find ways to receive, decode, and learn from intelligent emanations that originated on other worlds. That earth will be visited by extraterrestrials during the next millennium has a likelihood of approximately zero.

Probability to contact extraterrestrials is getting increased. In case of contact it will be contact with much more developed community, and will be peace. We will profit be new educational knowledge. Humans can very influence the time of contact, by funding, policy, but by solving its social problem, too.

Some resources are used to scan the universe to find extraterrestrial messages both in purpose of protection of the globe from attacks, and to get contact with potential aliens. Only a sudden appearance of extraterrestrial beings changes the situation dramatically. If it happens, it will change everything starting from the perception of ourselves in the cosmic relation.

We are trained every day to any extraterrestrial contact by contacting to other cultures, races and animals on the earth. The results are poor or moderate, so this is the picture of any future extraterrestrial contact. I think, that knowledge itself about the real existence of foreign intelligence may have larger impact to us than any real star war.

No changes in research and in people interest.

The likelihood of such an event is 50/50 during the next 1,000 years. It is likely because we are

more technologically advanced then ever before and will embark on exploring and settling our corner of the cosmos within this period. It is unlikely if no such other intelligence exists in the Universe that we can reach or who can reach us.

If we don't get our eyes the hell off our shoes, we will blow it. This is very doable by policy makers. This isn't "human consciousness" - it's just common sense. Let's start by being a little less reluctant to consider the unusual just because it's unusual. Nothing could be more unusual to us humans than extra-terrestrial life, but what right-minded person could claim with authority that in all of space and time, it could only have happened here? Yes, Ptolemy, it's turtles all the way down. (re: Stephen Hawking's intro to *A Brief History of Time*.)

Transformation of human social organization and basic ethical principles after extraterrestrial contact.

The cultural shock.

Impossible in this form of human being.

Wild Card of high impact…but not effected by policy.

Quite possible within next 1000 years – if indeed we are not alone. New Science and technology may give us better means of signaling and communicating, which make SETI's present day efforts appear primitive.

Extraterrestrial contact is quite unpredictable. But if this happens it will have overwhelming (let us hope more positive than negative) consequences. Not just technological and civilizational consequences, but also religious and theological. Do they (extraterrestrial beings) believe or know God? Do they believe in Jesus Christ? ... etc.

Completely change our view of our world and the universe.

Likely to be more dependent on what "they" do than what "we" do.

Not before we create it ourselves.

Benchmarks

Every 100 years we have to update the recording mechanisms so that we can still read the initial message, say 2002 (when we've all forgotten the millenium). In 2999, it decided to destroy the message, along with tons of other " unwanted " remnants of the past.

Nothing happens.

The key benchmarks are (1) the number of civilizations or intelligences that we are interacting with 100, 500, and 1000 years from now, and (2) how much knowledge we receive from them and how different that knowledge is from our own.

Actual physical contact.

It either happens or it doesn’t.

Positive: meeting of minds. Negative: mutual hostility.

100

Spatial communication.

No contact.

Math has proven "their" existence. We're all a little apprehensive that "they" haven't yet introduced themselves.

Extraterrestrial contact and new social end economic order of humankind.

500

Thanks to new technology and physical discoveries many marks of extraterrestrial life, finding new artificial non-Earth energy symbols.

Well, they didn't come to us, we came to them - via communication channels that in 20th century parlance can only be described as being "on a quantum level". Many people reject the idea out of hand, but to deny that we can communicate with alien intelligence is the rough equivalent of the evolution/creationism "debate" in the late 20th century.

Knowledge and technological exchanges and cooperation with extraterrestrial civilizations.

1000

Whether or not we continue to explore space.

Contacts with outer civilizations.

Low Probability Consequences

The extraterrestrial contact proves to be malevolent, with humans suffering much like Native Americans did when Europeans arrived with Columbus. When civilizations at different levels of technology meet, that with the inferior technology inevitably suffers.

Will spoil the preparations for year 3000.

Intelligent extraterrestrials might already be aware of our existence but not consider us intelligent enough to be worth communicating with. Increasing our own intelligence may suddenly open up

a whole new realm of other minds that are too complex for us to comprehend at this stage.

Contact is made!

It is unlikely but not impossible that the alien purposes will be hostile rather than beneficent.

Involving in space wars of giants, slaves of other much more developed community.

Only tolerance towards diversity and positive attitude towards communication can help even in case of friendly aliens (it is needed anyway). Attempts to hide such contacts by conspiracy can create much insecurity and turmoil in the global atmosphere.

Extraterrestrial and spatial tourism.

Impact on religion and human psyche.

Mass hysteria, a la "War of the Worlds".

The destruction of mankind.

Difficult to know who to plan for it? But the better we get on, the better the outcome is likely to be.

18. Space Migration

Trajectory

This possibility would require massive and fundamental changes in technology, and also assumes that our species is worthy of colonizing other planets. But it also assumes that other planets have conditions that would support human life, without harboring micro- or macro-predators.

I don’t think it makes sense.

At this moment, space migration seems to be less of an important development, given the enormous costs and the relatively small benefits that human life e.g. on Mars or the Moon would offer. In a later stage, with a wealthier and technologically more developed society, some permanent stations off the Earth are likely to be created, but it is unlikely that these will have a large impact, unless methods were developed to make e.g. Mars more amenable to life (terrafication) or more life-friendly planets were discovered on neighboring stars (say, in a radius of 20 light years from the Earth).

Trajectory a slow uphill slope, unless radical new technology such as molecular engineering, provides new fuels, foods, air and water supplies, etc.

Small-scale off-earth communities will undoubtedly be created. Within the next millennium it is

entirely plausible that they may become capable of autonomous, independent operation. They will be valuable for astronomy, scientific research, and manufacturing under non-earthly conditions. However, such developments are unlikely to reach sufficient scale to provide destinations for migration of sizeable populations, even if the earth suffers a major catastrophe or individuals feel that the earth is no longer hospitable. Efforts in this area will be mainly worthwhile regardless of the size of any extraterrestrial communities created.

Together with exploration the space, developing technology, space migration is rather sure thing. It is only the question of time. Funding, policy and civilization threats could change this.

Commercialization of launch, communication and navigation services. Robotic development of asteroid mining. Robotic development of Martian infrastructure. Cyborg (and all astronauts have been proto-cyborgs) colonies on Mars, asteroids, free-orbit structures, etc. The type of structures we will build are very dependent on the state of developments in other fields such as AI, nanotech, biotech, etc. For a simple example, the type of greenhouses on Mars depends on how radically the plants are engineered. A so-called O'Neill free-orbit colony would not be built if cyborg technology creates people that do not need an O2 atmosphere and artificial gravity.

See earlier answers - I've already addressed this at length in #3 and #4.

If the policy of sustainable development works as described in earlier answers, there will be no need to excessive migration out of our planet. Big natural or social catastrophes could change the situation suddenly. But even then it is an ethical question: are we willing to invest in some minorities escape, and for what reasons? It is always a harder life in extraterrestrial colonies, especially if they are spaceship-bound. People will be best of on this planet for much longer than 1000 years unless it is totally unsupportive for life, which is very unlikely in any situation.

There is a question, if the migrated communities may develop some ethics which is far different and resulting to conflicts. Or whether the ethics has the convergence to the same quality.

More and more people will be able to travel to space, but not to live there forever. Discover of a new energy might alter it.

Space stations, other planets.

Human communities living on the Moon by 2020 and Mars by 2070. Other solar systems by 3000.

This will happen while "public policy" is still very much alive. Maybe Jessie Helms can still screw it up.

Space colonization immunizes humanity against a multitude of physical and social extinction events, the technology is only a small extrapolation of current tech and is highly effected by policy". Scientists disagree on many things, everyone has their own theories, but one thing that all physical scientists agree on is that eventually the Sun will burn out. It may take 10,000 years, it may take a million, but eventually it will happen and the Earth will become uninhabitable. If,

by that time, we have not learned space travel then Man will die. And Aristotle, Lao Tzu, Beethoven, Mozart, Emily Dickinson and all that we have been will be lost. It will be as if it had never been. So knowing that the death of the Earth is inevitable and that space travel is very, very difficult it is never too early to start." Joe Straczynski - creator of Babylon 5.

Humans are like yeast in a closed bottle – proliferating and battling over limited substrate. We will come round to realize, once our technology makes it more feasible, that the answer is to found new worlds off the earth.

Space migration is almost certain if technological and scientific trends will continue (extrapolation of current trends). Just some unpredictable factors which we do not know and perhaps cannot know ("wild card") could avoid this. But we shall be limited more or less to our solar system, unless qualitatively new breakthrough in physics is accomplished which will make it possible to travel faster than light speed, or to "modify" space of time.

Less or equal to 2400 AD.

In 1000 years this will become reality.

Not likely for a long while.

Will only happen if there is massive investment to make it happen.

Despite the foreseeable increasing in scientific knowledge in this matter it doesn't seen that human problems require such and effort in the next millennium.

Within a century or more.

Benchmarks

Building of huge exploradomes on North and South Poles Earth with massive regular flights to have yuppies enjoy 4 months' summer no-stop for two months' work, every semester.

See answers to #3 and #4.

Scientific institutions on the moon.

Human communities living on the Moon by 2020 and Mars by 2070. Other solar systems by 3000.

Monitor space developments.

Abundance of material resources available and prioritized for this purpose.

100

Space travel becomes practical and relatively cheap.

The next 100 years will see the exploration of the solar system, and probably some small scale stations on other planets. Settlements outside the solar system are likely to take a few centuries more.

Some Americans reach Mars, but come home.

Space travel becomes practical and relatively cheap.

First Earth's and Moon's orbital stations, mostly for scientific purposes.

Return on investment for private LEO launchers. ROI for extraterrestrial industry. Establishment of infrastructure (housing, transportation, power, water, phone, etc.) on Mars. Establishment of self-replicating systems off-Earth. Trade between two space-based entities. Establishment of quasi-national entities in space.

We still haven't done much - a few colonies on Mars, a huge shielded solar orbiter and dozens of long-term missions by the well heeled. But the rest of us aren't sitting on our heels. The requisite science is proceeding apace.

500

Technology for long-distance travel develops.

Perhaps one space colony, with people still returning after a stint on Mars.

Rather big quantity of people living in near space.

Perhaps in 500 years space migration will become an elite hobby. (That is, if there is an elite).

An outpost on the Moon in 200 years. An outpost on Mars in 500 years.

1000

If all goes well, space travel might be possible. Could just be a Mars colony.

Improvement of space traffic, settlement and living in space.

Low Probability Consequences

Other species make a return visit to Earth, colonizing our planet.

The discovery of life forms on other planets, creating a complex set of opportunities (scientific discovery, agriculture, etc.) and dangers (infections with extraterrestrial parasites).

What if it is only the USA that wants space colonization? What if people living on the rest of the globe prefer money to be spent preventing famine at home? What if adherence to some kind of global ethics means this voice is heard?

If human life is ever wiped off the face of the Earth, it may still continue in one of the space settlements.

Illnesses due to stay in space, new threat for humans.

Interference from terrestrial governments, both current and long-term. War with Earth.

First, that Earth should come to be regarded as unimportant in human affairs, because all but one in a million people live off-Earth. (See #3 above). Second, that Earth may come to be resented as a hazard to navigation to the billions or trillions of co-orbiting space habitats that may come to comprise a future Dyson-sphere-like orbiting collective.

The whole of Globe becomes a colony of the wealthy living elsewhere.

Space colonies of rich people and earth just for poor.

Militarization and desecration of space.

Abandonment of Earth by 3000.

None.

Local wars which could end as a global World War.

Contact with a more advanced extraterrestrial civilization may enable us to leap-frog technological constraints; on the other hand, we must have ready responses to hostile aliens which may threaten our very own survival.

If we cannot get together better on Earth, this shouldn't be a priority.

19. Interspecies Communications

Trajectory

Better understanding of other species continues to develop, leading to improving communications. Whether other species have important messages for us remains to be seen.

Probable for primates, whales, dolphins.

Communication with species like dolphins or apes has already taken place to some degree and is likely to develop further in the next 1000 years, but seems unlikely to have a major impact on

humanity as these species are much less developed than humans, and therefore are unlikely to teach us major lessons.

Research with chimpanzees and gorillas suggests that communication with those and other species is a reasonable prospect within the relatively near future, perhaps the next 10-20 years. How substantive such exchanges might become depends on the intellectual capacities of other species, which I strongly doubt come close to those of adult homosapiens. A good deal of valuable learning could be accomplished without much in the way of substantive exchanges.

Beside of extraterrestrials I do see any important achievements in next millenium. Better understanding of other species life, understanding its behavior, but only a little understanding of their mind.

Gradually the understanding of other species increases catalyzed by sustainable development strategy. The better they are understood and valued, the more probable is an increasing and qualitatively different communication with them. Return to the doctrine of the superiority of man can obstacle this development. In 100 years the basic notion of such possibility will already make us more tolerant and less selfish.

At first, what could be the content (ideas) of such a communication? The interspecies communication may be important for the creation of sustainable life on earth. The species are communicating each to other, but the mankind is the only one problematic kind yet.

No real gains.

Such contact would likely come from an advanced species rather than from us. The key question of accessibility remains crucial. Can any such species reach us or us them?

If you mean with other (known) earth species, forget it. Plants and animals, protozoa and dolphins all deserve our profound respect, protection and yes, love. But beyond 1) a powerful empathy for their condition and 2) learning how they (and we) can do the amazing things they do, like regenerate limbs, not much happens.

Wild Card of unknown impact (I guess it depends on what they have to say). Perhaps I’m a cynic but I think most people will probably ignore it. After all we can read the "body language" of different species and eco-systems now…we can decipher their pain, but most people don’t care.

Not so much active exchanges, as in directly communicating in an intelligent way, but unraveling the secrets of nature for applicability in human living.

Identical as primates; whales and dolphins are another kind of very interesting mammals. Perhaps some kind of communication will be possible one day and we shall find new "brothers and sisters" or at least "relatives" very close to us. But to predict is perhaps impossible. Look at eyes of your dog. You know each other for many years, you can be very close to each other but what happens in brain of your dog is pure mystery.

Depends on effect/resources.

Negligible likelihood.

Will make us aware of our place in the universe.

Benchmarks

Nothing happens.

Fito-terapy.

Contact. Scientific exchange. People exchange.

N/A, unless we consider basic humane treatment a benchmark. How about considering it a baseline instead?

Computerization of language translation could help make this happen.

100

500

1000

Low Probability Consequences

Mass psychiatric sessions for frustrated baboons, lost whales.

They come. Whoops! Need for a major rethink.

The intelligence of other species in use of humans can be a disaster or it can extend human capabilities enormously. The intelligence of other species in use of humans can be a disaster or it can extend human capabilities enormously.

Effect on human psyche.

As resilient as this planet is, we'd better keep our eye on the eco-ball. We are just beginning to understand how complex this rock really is. I, for one, don't want to be to cavalier about which strand I cut.

The more progress, the more concern for "rights" of animals – but how to manage their responsibilities?

Additional Comments

Many of the suggestions that are implied in this questionnaire are based on the apparent assumption that our species is fundamentally different than any other species, being able to ignore Darwinian evolutionary forces. It also may imply the perfectibility of individual humans, despite religious teachings to the contrary. Backlashes from various religions are to be expected with the coming technological changes; the anti-scientific movement in at least some parts of the USA are indications of how challenging such changes might be. The questionnaire also indicates a fundamental dissatisfaction with humans the way they are, in all of their diversity. Many of the most important technological breakthroughs for our species have happened in wartime, and a major new war may drive some of the technologies that are alluded to the questionnaire. And of course the truly important breakthroughs are likely to be unpredictable, arguing for continued large investments in fundamental science.

An unspoken consensus will bring onto the market place a definitive, biological brain cell fix, that will eliminate all forms of worry about the future. The side effect of this being cleverly and socially acceptably into all forms of diet foods will be to considerably increase stupid accident rates. But there again even the undertakers will be smiling as they will not have to worry that unless the accidents were high, the immortality clause (see above) would ruin their business.

The disappearance of humanity as a biological life form and its transcendence/assimilation into a system of robots/computers/networks. The conscious control of the creation of new ideas and theories, so that cultural innovation or scientific discovery would no longer be the result of rare genius, lucky coincidences and/or hard, repetitious work, but an automated process that can produce new insights immediately on demand. The appearance of new "parasitic" processes (such as computer viruses, religious cults, fad, crazes and urban legends or addiction to virtual reality or new drugs) that reproduce and spread very quickly thanks to super-efficient transport and communication media, but at the expense of the human/technological systems that support them. Substantial increase in average happiness/quality-of-life for humanity as a whole.

Economic systems. Given that money was not a major factor in most people’s lives 1000 years ago, and also given that most of world’s money now seems to exist in some kind of virtual reality, what is the 1000 year future of money? We’ve had barter, and we’ve had money. What happens after money?

Global warming (if it is even occurring) is a very trivial issue- it is too easily remedied with current technologies to warrant much concern. Same applies to ozone layer depletion. Most probably, any global climate change that takes decades can be countered by us fairly cheaply. (on Q.2)

We already have this- the issues are more to do with its deployment and utilization. But of course this is a matter of definitions- nothing is completely "safe" and what exactly does "abundant" mean? The average American small business has more "safe", raw power at its beck than did the Roman Empire. It's never enough. (on Q4)

Nanotech is the culmination of the Industrial Revolution. In that sense it is simply more of the same - better products, smaller computers, stronger materials, etc. More interesting is the synergetics of advances in biotech, nanotech, informatics, computer science and so on (Q5&12).

This is obviously most important, if we intend to have a future, and is something nation-states can really help with - mostly by downsizing themselves. The Soviet Union has provided us an example. As an aside: It is a shame that the breakup (which appeared quite plausible to this observer by the early 1970's) was so uncontrolled - it could have been a lot less messy. A "Foundation"-style think tank may be able to draw up the maps of dissolution for such events in the future e.g. for China, US, perhaps India. It appears quite plausible to this observer that none of the countries listed above will exist fifty years hence; the notion that they will exist is no more or less fantastic than the notion that they will not. Perhaps there is such a unit in the US government, it was not in evidence during the USSR meltdown - quite the contrary. This brings up the notions of "lock-in" and of "blindsiding": an unforeseen, but not necessarily completely unforeseeable, cascade of events makes history appear to jump its tracks; to move in directions not previously thought of. This kind of mindset was in evidence after the fall of the Soviet Union: the absurd notion of "the end of history" was floating about in what appeared to be intellectual circles. Some futurists "lock in" to a certain "framework", or stage, in which they make their predictions. For example, many of the predictions at the 1939 World's Fair were built on a framework of assumptions that did not have coherency. A more current example is the stock market's infatuation with the internet. Perhaps a question or two could be built around the above. (on Q7)

This gets a '5' for probability because it already exists. (on Q11)

Not quite sure what "continuum" is supposed to mean. There already exists an "ecosystem" of (discrete) machine intelligence, with billions of 1, 4 and 8 bit microprocessors on the lowest level, up to the teraflop supercomputers at the top of the food chain. The lowliest machines directly and indirectly support the evolution, care and feeding of the highest machines. This trend will most probably continue to elaborate. This leads directly to the next question (13.). (on Q12)

This is the single most hopeful item in this list. We are a temporary actor, the first bumbling form of semi-consciousness on this world. A round of intelligence amps (along with amygdala/hippocampal/neurochemical hacking) would sweep away all these other problems at a stroke. Many of these problems are a result of self-delusion: religion, nationalism, egoism, etc. We are still animals at heart (or "transanimals" if you will); most of our behavior is driven by our animal needs. (on Q13)

Say what? I really do not know what this is supposed to mean, nor do I think the questioner does. (on Q14)

Or choose not to end their lives at all, or to differentiate/merge with others, make multiple versions of themselves, etc. (on Q15)

If "they" are out there nearby (within 1000 light years), they're awfully good at hiding. I do not think "they" will have much of scientific value for us, or us for them, that can't be learned by other means. It would certainly be interesting to know of their history and art. Of much greater importance and immediacy is the possibly imminent contact with a truly alien intelligence right here on Earth - AI. Boris Kasporov spoke of this. (on Q17)

This is one partial solution to question 7., although "people" may not be the right "framework". (on Q18)

I am not quite sure what is meant by this. We already have fairly "substantive" communication with other species, e.g. dogs. It will probably become possible to amplify the intelligence of a chimp or a dolphin to the point where it can understand language, math, philosophy, etc. This might be a very rewarding line of inquiry-to receive a non-human outlook. Another possibility is to mentally merge (or hack their sensory systems) with a lower animal, via mind-machine interface. (on Q19)

I have answered this question on the assumption that you are referring to the classical biological humanity -- and not to the highly-advanced, highly-augmented, possibly entirely non-biological creatures that we will undoubtedly become by the year 3000. Also, it is unclear whether "to destroy" refers to voluntary replacement by some descendant (non-human) physical form, or the physical eradication of humanity against our desires. If most of humanity decides voluntarily to "extinct" itself, in favor of some superior physical or mental form, is this "to destroy"? (on Q7)

Generally-accepted interaction protocols - yes, I would buy that. But generally-accepted values, goals and principles? I don't see how this is possible in a world of near-infinite variation available to each technologically-augmented/altered individual. Imposing monoculture uniformity on a top-down basis would almost certainly fail. Most "nanophiles" of my acquaintance would not stand for it! (on Q10)

Please pardon me for not being Politically Correct, but "spiritual holistic-centered consciousness" sounds like irrational New-Age gobbledegook to me. Sorry! I buy the part about conscious evolution, but the option-space is so vast that it is difficult to know what to say about it of a specific nature. (on Q14)

I found this question confusing and unclear. In making the above answers, I've assumed that this question refers to native terrestrial naturally-evolved non-human species, and does NOT refer to extraterrestrial (i.e. alien) species, or to artificial intelligence species, or to modified human species, or the like. Also, what is meant by "substantive exchanges"? If instead we are talking about advanced alien or AI intelligences, then I suppose my rating would change to 3/3/2 for this factor. (on Q19)

Exhaustion of natural as well as human resources resulting from improper utilization policy.

An idea: I propose to get a complex factor named "Conflict with nature". The people have conflicts each to other and to the nature as well, this might be considered as to be the same, from some point of view. Motivation: Our contemporary lifestyle is about 200 years old. Within this period, there was far more conflicts with people then with nature. The result is a slight unbalanced mind and structure of economy, policy, army, etc. Often written in news, that the army "helps" in a case of some disaster. The change of mind should appear: not "help", but a natural business in it. The same for politics to know: there are not only a market disasters. Basic facts: The last-1000-years-climatic-record says that the frequency of great changes is about 3-5

times per millenium. The Greenland was really green not so long in past. Large cities might be about 200 years old, the disasters with millenium-frequency did not hurt yet. Possible methods: Changing the policy of all power structures: now the nature is coming to be another power, besides USA, Russia, China, Third World, etc... Change of philosophy and modification of religion should bear the ability of mankind to reduce/increase population level. Within range of 100-200 years it is possible to reduce population in case of long-term climatic change without social disasters (perhaps). (on Q2)

A comment: Today the control mechanisms towards short-term changes are economies and politics. Towards long-term changes it is religion and ideas. Inside of the low development communities, these mechanisms are joined together (old civilizations, totalitarian regimes), whereas in the communities of quick changes they are segregated in some way.

I sense a strong 'science fiction' flavor in this project. I would like to point out that the Huxleyan Brave New World is neither a desirable nor an acceptable future for humanity. The Western God-complex rooted in Enlightenment, fanned by the so-called objective, scientific and rational spirit, and aided by industrialization, science and technology, market, money, and species arrogance may appear to be big and indomitable. In the final analysis, however, one has to be practical and seek to build a better and just future for all of us and not a 'Brave New White World' for a bunch of Western scientists and tech-maniacs. It is human volition and politics (not nanotechnology, bionics and all the rest of it) that will decide human future. To give just one example, there is a growing worldwide opposition to genetically-engineered seeds and crops, and the Western farmers who enthusiastically took to this high-tech fad are sorry and quite eager to switch to traditional seeds and crops. In 3000, humans will still be humans and not 'Gods'. Of course, our forebears will have their own share of morons!

As a lifelong musician preparing for medical school, my preoccupation is with the duality of nature and art. I tend to approach human behavior in terms of two fundamental drives: the drive to understand and the drive to express. If there is anything we can be doing now to set the course, it is to recognize and integrate these two fundamental aspects of being human.

It's better to change the "abrupt climate change" in Item 1 into "abrupt environmental change". Because the climate is usually a longer process than decade-span. The "abrupt environmental change" might include earthquakes, pest outbreak, plague and fatal disease spread out, etc. Collapse of the world's financial order. Worldwide or regional war armed with modern electronic or biological weapons. Organized crimes destroy human civilization. Collapse of the computer technology killed by computer virus.

Increasing complexity of the globe? Creative balance of global driving forces? The balance of female jing- energy/ male jang- energy in the planetary development. Global long term construction- global super-projects in construction in period 2050-2100! Theory, frame and possible apparent solutions of the consciousness society consciousness societies (according the vision the society, which follows information society, can be called e.g. consciousness or conscious society, where the ethical values create the basis for social practice and development.

All these factors need to: a) focus on more effective learning; b) have greater emphasis on how

people can get on better in their relations with each other; and c) most of these developments depend on what we want to make to happen.

Severe overpopulation and extreme totalitarian government.

If we are to survive we must develop a worldview. Seeing the beauty of the planet from outer space may help. Factors not mentioned: possible world and water shortage; economic system must change which has a much wider approach which measures all work such as voluntary, child care and harm to the environment (see work of Halil Henderson); population control, this must be reduced. Major threats; Closed mind fundamentalist thinking which is growing; terrorist use of nuclear weapons.

My answer to this question is similar to my answer to many questions, in that I see many dimensions in some of these questions that complicate the numerical responses. For instance, it might be highly improbable that humanity will avoid fairly abrupt climate change from the greenhouse effect in the next century (more abrupt than question 2 suggests), but rather likely that by the end of millenium we would be able to head off some asteroids/comets. Overall, however, I am very impressed by the questionnaire. (on Q1)

I didn’t quite catch the idea. But family forms will become multiple from all kinds of the present forms not as yet recognized as families. Single households, lesbo/homo families, extended families of different marriages or parts of them, community life forms, satellite families of young ones related to their parents any way, etc. The nuclear family function of the present is quite a new one from 1800s and it will loose its dominant role as the family form but still stay as one of the multiple forms. Family will be a network family living nodes of which are spread around the world at the largest or a local node of a person in connection to other people or even isolate at will. (on Q16)

E. Round 2 - Invitation and Questionnaire with Draft Scenarios

AC/UNU Millennium Project - Millennium 3000 Round 2

Dear Colleague,

Thank you for your participation in Round 1 of the Millennium 3000 panel. As you remember, the Millennium Project of the American Council for the United Nations University in cooperation with The Foundation for the Future collected foreseeable factors that might significantly affect the next 1000 years. You and your colleagues on the Millennium 3000 panel rated these factors as to: a) how plausible it is that the factor will influence the human condition 1000 years from today; b) assuming that the factor does occur, how important its effect might be on the human condition; and c) ability of human intervention such as policy and/or funding to affect that factor's trajectory. The results are enclosed for your review and further comments.

Round 1 also asked about the factor's likely trajectory, benchmarks of its development, and some possible unexpected or low probability consequences. We used these views to construct draft scenario sketches to the year 3000. Six scenario sketches are enclosed:

Scenario 1. Still Alive at 3000
Scenario 2. End of Humanity and the Rise of Phoenix
Scenario 3. It's About Time
Scenario 4. The Great Divides
Scenario 5. The Rise and Fall of the Robot Empire
Scenario 6. ETI Disappoints after 9 Centuries

This second and final questionnaire asks for your additions, edits, corrections, and comments, on these scenarios. You are also asked -- in the space proved at the end of each scenario -- to list a fundamentally important question or two that arises due to the scenario. You do not have to comment on all six scenarios. The results will be published in the next *State of the Future* and may be published in Foundation for the Future reports and used as input to the Humanity 3000 Conference in August 2000. No attributions will be made without permission, but your name will be listed in the *State of the Future* as a participant.

Please return the enclosed questionnaire by March 15, 2000. You do not need to return the entire questionnaire with all the scenarios. You can simply give your responses with the appropriate scenario number. If you do add material to the text of the scenarios, then please do so in UPPER CASE so that it will be easy to find your edits. We prefer email your responses, because faxes of hand written or typed responses can be misunderstood or mis-entered. This questionnaire can also be download from: http://millennium-project.org/millennium/m3000-rd2.html.

Please contact us with any questions. We look forward to including your views.

Sincerely yours,
Jerome C. Glenn and Theodore J. Gordon
co-directors, AC/UNU Millennium Project

Summary of rating from Round 1

The first round respondents' scoring of the factors was computed as the product of probability, importance, and priority. The table below ranks the factors by this index. The number in Parentheses next to each factor is the number the sequence of the factor as listed in the Round 1.

Very Long-Range Factors	Prob	Import	Priority	Index
Human-Environment Dynamics (3)	4.114	4.163	4.095	70.133
Human Genetics (11)	4.302	3.951	4.098	69.655
Safe Energy (4)	3.753	4.250	4.341	69.240
Nanotechnology (5)	4.311	3.814	3.930	64.618
Forms of Movement (6)	3.091	4.429	4.000	54.760
Increasing Intelligence (13)	3.667	4.024	3.548	52.354
Occurrence Climate Change (2)	3.761	3.977	3.444	51.514
Control Forces to Destroy Humanity(7)	2.891	4.341	3.788	47.539
Conscious Technology (12)	3.545	3.548	3.738	47.015
Collective Futures (9)	3.111	3.744	3.476	40.487
Avoid Climate Change (1)	2.844	4.163	3.233	38.277
Gender Relation (16)	3.444	3.520	3.088	37.435
Philosophy and Mental Maps (8)	3.000	3.538	3.308	35.111
Conscious Evolution (14)	2.974	3.556	3.222	34.074
Space migration (18)	3.093	2.977	3.651	33.618
Global Ethical System (10)	2.930	3.100	3.525	32.018
Extraterrestrial Contact (7)	2.359	3.876	2.811	25.702
Immortality (15)	2.643	2.825	2.825	21.093
Interspecies Communication (19)	2.425	2.744	3.051	20.302

The views on the trajectory of these factors comprise approximately 100 pages. You can download them at http://millennium-project/millennium/m3000-rd1res.html. If you wish to make further comment on these factors or the textual results of round 1 please send them with your comments on the scenarios.

Now, please read scenarios 1-6 and add your comments in the space provided at the end of each.

Editor's Note: As these scenarios are the draft version of the scenarios from Section 3, were not included in this appendix. However, they are available on the Millennium Project's web site, direct address: < http://www.geocities.com/acunu/millennium/m3000-rd2.html>

For each scenario the participants were asked to suggest "Additions, Edits, Corrections, Comments, and Key questions this bring up."

Also, the participants were asked to suggest "What scenario(s) is(are) not included in this set of six that should be to show a range of thinking about the very long-range future for humanity?"

F. Round 2 - Comments on the Scenarios

Participants' comments are in italic.

While several respondents commented on the quality and inventiveness of the scenarios, others were quite critical:

> *I appreciate not only the immense efforts to complete such scenarios upon the basis of thousands of special answers from the Round 1, but also their attractive literary form and amusing style, rising not only urgent questions, but providing the reader also with pleasure as a good novel.*
>
> *Congratulations on producing such a mind-expanding set of scenarios. I am delighted that you and the Foundation For the Future are working together on this important project.*
>
> *Overall a very interesting and stimulating piece of work. The author(s) should be congratulated for their application and imagination.*
>
> *…if the objective was to simply stimulate thought and discussion (a very legitimate role for scenario thinking), those outlined certainly achieved that objective for me.*
>
> *I realize it is just rhetoric, but one has to smile a little at the following.*
>
> *...scientific breakthroughs impossible to comprehend...*
> *...kinds of life unimaginable to humans...*
> *...life forms unrecognizable to those...*
>
> *As an exercise, consider rephrasing these as follows:*
>
> *...scientific breakthroughs impossible for me to comprehend...*
> *...kinds of life unimaginable to me...*
> *...life forms unrecognizable to me...*
>
> *Why should authors project their own limitations of comprehension, imagination, and recognition on their readers? At best, such rhetoric seems florid and rather soft in content, at worst, impertinent.*
>
> *There is a fair amount of technobabble and lurid conflict projected in the following scenarios, as if they were written with the idea of creating material for dark military science fiction instead of being sober futurist assessments. I found this flavor extremely disappointing.*
>
> *Another common thread is a kind of pop-science view of nanotechnology, wormholes, high-tech terrorists, and robotics that felt somewhat out of place in a serious effort. Concerning misuse of advanced technology should realize that the very fact that we can anticipate certain*

abuses is an indication that efforts, probably successful, will be made to avoid them and if anything overreaction rather than under reaction is the danger.

We would like to see more explicit grounds for the scenarios, instead of simple paths, please write even a bit branchable trees. There are no grounds are given to the scenarios, and (while) making the stories variable in style may give a good effect, it makes reading difficult.

Even though there are possibilities of developing humans artificially, the proof so far is lacking. Improvement, or even any genetic engineering, of the human race should not be assumed in every scenario. If humans do not develop - and mere evolution would here be far too slow - their cognitive capacities put very important limits to many of the scenarios. Or is there a possibility of genuine mental evolution with the physic brain remaining essentially the same?

There were comments also about what had been omitted from the given set. Many of these comments concerned the lack of social perspective and the lack of a spiritual sense. Typical comments of this sort were:

…is there not, perhaps, scope for one scenario that focuses on the possibility that there might be a 'backlash' against technology, combined with the recognition that there are diminishing returns from investment in it? This might (would probably?) result in a greater emphasis on social issues of various kinds. Also, the technology agenda is based primarily on what could happen, not what we might want to happen...

In every scenario technological innovations were considered as virtually lone key factors of historical chance. Other social or physical processes were more or less reactions to these initial chances. Should we rely on this assumption?

Social innovations, progress in psychology and social sciences were considered inferior compared to innovations in nano-, bio-, and information technologies. Science in the 20th century was dominated by great leaps in foundations of logic, physics and biology, which also gave rise to several key innovations. Could it be social sciences that take major leap next?

I miss any mention about the Power (God, Spirit, Nature - names aren't important) in either of six scenarios. Technology won't solve everything. Man (as a life form) isn't perfect. It means none of his creations is perfect. We are the unity of destructive and creative powers. It's impossible to eliminate any kind of them by some genetic or technologic enhancements. There will always be few maniacs trying to destroy whole world and humanity. Yes, I'm one of the "standard humans" from scenario 4, believing that we are biobrain dependent. We must control all our powers e.g. through yoga meditations. In my opinion, this is the only way to eliminate our ego, aggressively etc. So, the future is open, any of these scenarios could happen.

The proposed scenarios are really brilliant, but concentrate on technology change, expansion into universe, possibility of genetic manipulations. I am sure, that there are

also the other ways that civilization can evolve and expand. First of all spiritual change - i.e. establishing new global ethics, ethics of individual responsibility and collective solidarity. The human society isn't shaped only by the technology development, but also through mental evolution of human species and inner change of any individual.

Without spirituality it is impossible to think about voluntary simplicity, modest life, elimination of over consumption and more ecological and ethical life, about world, where the human rights are really universal without any exceptions or prejudices. The expression of mystical experience isn't only hermit communicating with God in desert, but also people as Gandhi, M.L.King or Mother Theresa changing our world very strongly. The more developed spirituality should also bring benefit on "technical" level, i.e. to develop the gift and ability of intuition, telepathy, clairvoyance and other "paranormal phenomena". Why not to dream about it - this is not the topic of obscure shoddy literature only, but also of serious scientific research.

I am scared by visions of the future where alternatives of humankind's future are described just as technical and technological successes of people. If this kind of development, based only on discoveries of science and new technologies should become reality, I do not regret that I shall not live long enough to see such future.

It is pity that experiments done during many years in Princeton Engineering Anomalies Research Laboratory (and other places) are forgotten here. If we would take these experiments into account, we would be aware how important is our way of thinking about the world. By thinking we co-create the world. To realize this we would feel as individuals as well as human species more responsibility towards other people and nature, which would strengthen solidarity and ethical dimension of people.

The scenarios over emphasize physical explanations, especially genes and related technology. Cultural and social issues as causes, not merely consequences, are lacking -- the scenarios are more on the lines of Francis Fukuyama's `end of history' than Samuel P. Huntington's `clash of civilizations', even though the latter seems a more accurate scenario for the present.

The technology driven themes of virtually all the scenarios could be interpreted as classically reflecting the (macho?) male approach? Were any written by women? Possibly scope for a scenario where the gender roles have been reversed and women where dominate in the key positions in societies round the world? Also were all the authors of the scenarios American, which might account for the technology driven bias?

Still other comments dealt with the omission of a wide variety of topics, from population to virtual reality.

Our basic relationship with nature was not settled thoroughly in any of the six scenarios although it seems to be the key factor in our future.

The current questions about the sufficiency of resources are set aside too lightly.

According to a recent UN finding, fresh water might be critically scarce within 30 years. What other things might become so within 1000 years, what are the solutions to these, and what are the social, economic, political, military, and environmental phenomena of the transition periods? The scenarios offer overtly technology-optimistic answers, the transition phenomena are mostly seen as temporary, and - most interestingly - the scenarios give a feeling that new problems of the sort would not be on the agenda in 3000.

None of the scenarios actually dealt with present overpopulation explosion, or the fact that yellow people with yellow thinking are overcoming whites and blacks.

None of the scenarios comment much on the development of the social sciences or of biology. On biology, some ecological issues are briefly considered, but otherwise the new biology is very much chemistry and physics. Will the old positivist dream of all-encompassing physics advance? Alternatives should be embedded on some scenarios.

The scenarios have a lot on means but a little on goals. What did people thrive for 10000, 1000, 500, or 100 years ago? What are the roles of physic, bodily drives on one hand and cultural factors on the other hand in specifying individual or joint goals and values? People setting their own goals might involve circularity.

Low level warfare in the near future is certainly not implausible, but not as a result of technological and scientific advance, but as a result of ancient and still unresolved tribal and religious conflicts. Also, the ability of leading edge cultures to intervene cheaply and effectively in such conflicts will only grow.

Another scenario might focus on religion and the conflicts that religious worldviews might engender. If we look at history, many of the bloodiest wars have occurred around ideology (though of course they also had resource-based components as well). A scenario that explored the future development of religions might be instructive, perhaps leading to one of the ways that the world is split up into separate "civilizations" that live in an uneasy competition with the other civilizations. This one might explore the possibility that an appropriate balance between predator and prey is essential to maintaining healthy and functioning ecosystems.

The scenarios also need to address the issue of population, perhaps taking a stab at identifying the year 3000 population under the various scenarios. What will be required to have a world population of 1 billion, 3 billion, 7 billion, 10 billion, 15 billion, or zero?

Climate change could cause both a radical reduction in certain current activities (with traumatic changes?) -- such as internal combustion driven transport both land and air... plus the need for a very environmentally friendly energy base? Climate changes could easily create major new migration pressures ... A significant proportion of the population living underground in an artificial environment - easier, more attractive, and cheaper than going to other planets - because it is either too hot, or too cold. I have heard recent talk about possible Gulf Stream changes that could occur quite easily and quickly that

would result in Southern Europe becoming a desert, and the Sahara again becoming a tropical zone?

Perhaps there is scope for a scenario that recognizes the possibility (and potential importance of?) the abolition of the nation state? (real globalization?) Possibly combined with the resurgence of localization -- which could be divisive unless there was significant equality or strong policing?

Nothing on virtual reality world, that is already with us. Perhaps because they are likely to be widely available in the near future. (A room - or headset - that would enable you to participate directly in a wide variety of current experiences - Mars landing?) What are the social implications of the widespread use of virtual reality technology?

Another dimension that could be explored might be to put 'the use and abuse of power' at the core of the agenda from which three options are explored:

a. *Power struggles get more overt, establishing (or returning to?) situations where there is substantial centralization, combined with the use of power being overtly driven by the vested interests of those who have it, and they are not concerned with the interests of those who don't have it, except to the extent that they want to ensure that they don't get it.*
b. *Power struggles continue to be worked out within a more sophisticated and responsibility-driven attitude to power, where greater democracy and more rules/ regulations/laws enable structures to evolve slowly in a more humane direction.*
c. *The power driven culture evolves into a more decentralized personally responsibility driven agenda, possible reflecting a rise in more humane, spiritually driven, anti consumerist, trends. This scenario could be associated with more openness -- i.e. every ones bank account / financial position being publicly available. Secrecy is traditionally associated with possessiveness and power driven agendas. But what role for the widespread use of CCTV type activities? And will this 'openness' mean that the whole concept of privacy will need to be rethought.*

Some religious revivals could easily fall into the centralist power-driven category. But in practice, it is most unlikely that what happens will fall neatly into one of these groups; it is much more likely that over a period of 1000 years, there will be movement (cyclical?) through them and back again, making it difficult (impossible?) to predict which trend will dominate in which part of the world, at any particular point of time, i.e. 3000.)

There was no mention of the ability to control the aging process (as opposed to just living longer and healthier); here the main cause of death would be either accidents, or self inflicted. In a world where the aging process is controlled you would also need severe control on the birth rate -- would this be natural or voluntary, or by some form of rationing? Before that point is reached there will be major concerns over the impact of the rapidly aging population in many parts of the world, as the birth rate falls (naturally) as a result of the educational and economic emancipation of women. Hence the traditional concept of the family (i.e. where children are involved) will become,

increasingly, the exception rather than the rule. For many years (a couple of centuries?) we will see a significant difference in this trend in different parts of the world - some having a declining population, others still increasing. Will this result in even greater pressure for migration from the latter to the former?

Despite the positive comments about health, I believe we should be seriously concerned about the implications of the apparent rapid growth in the number of people in the US - particularly women in California? - who are seriously overweight. There appears to be little sign of this trend reversing and there appears to be almost a conspiracy to avoid discussing it?

Some radical changes in the nature of work are very likely. Very few people will be directly involved in manufacturing anything, like agriculture in the industrialized world today. All the routine activities will be mechanized/automated. The focus will be, increasingly, on creative endeavors and personal services that will produce even more blurred boundaries between work/leisure/retirement. Fewer people will work for money in order to purchase possessions, as most people will recognize that they already have more than enough and that the unfettered pursuit of acquiring more and more possessions does not lead to happiness or satisfaction. Radically different measures of 'success' will have been introduced, leaving far behind outmoded concepts such as GDP. The timeless 'search for meaning' in life will continue through spiritual conviction, mental activity, emotional experience, or physical intensity - or some combination of the above. This could be a useful framework to help us understand what has not changed, and what is not likely to change, and what is -- i.e. changes largely due to technology and the implications / consequences of its use. On the other hand those things that do not change (or change little) are more likely to be the people focused issues.

Perhaps we should be more concerned with why we are developing the scenarios? Is it to help identify those questions that need to be given higher priority today, if we are concerned about a better tomorrow? Or is there some other reason.... The idea of ending each scenario with a major (practical or philosophical?) question - such as in scenario 6 seems to me to be a particularly useful idea that might be developed for all the scenarios?

Extraterrestrial Contact…. You ask what additional scenarios would show a range of thinking. Well, contact with a super-smart super-knowledgeable (encyclopedic) robot probe from some other civilization is a fairly high probability scenario during the next 1000 years and it will have an "extraordinary" impact.

A Religious Scenario. I recommend trying to formulate one separate "religious scenario". I know it is extremely difficult task, but perhaps it is worth trying, at least to stimulate thinking and discussion.

All of the scenarios seem to give considerable attention to nano-technology, and few of them give sufficient exposure to biotechnology and where that might take us.

The biosphere and humankind's relations with the natural world (should be included more forcefully). (In this case)…Homo sapiens is understood as a species among other species. … The influences of the natural world on welfare and mental health are taken

seriously. …The communication with other species like dolphins, monkeys and domestic animals extends the consciousness so that a new level of eco-consciousness is reached. Because there is no longer exhausting labor, people do have more time and energy to be natural and reunited with the natural world.

Additions, Edits, Corrections, Comments on/to the Scenarios:
[The Scenario Statement is followed by the comment in italic.]

Scenario 1 Still Alive at 3000

Global codes of ethics with economic and military enforcement powers probably deterred many dangers as well.

But, this may have caused even more damage - who can know?

Parents who wanted the best for their children in the early 22nd century drove the next step of genetic engineering toward enhanced intelligence and other features.

I agree completely with this. biological imperative will override any and all considerations of bioethicists.

Unforeseen new kinds of diseases and genetic weaknesses were added to the human germ line and passed on to later generations.

Maybe, maybe not. The pace of biotech is so much greater than generational changes. The insertion of genes into somatic cells (gene therapy) is already being tried, albeit in limited ways.. It should become possible to change ones genetic makeup as easily As changing clothes within a few decades. Bioethic rhetoric will be reminiscent of racism.

Nanotransceiver robots coupled with artificial life forms have killed the concept of privacy, but they have also made criminal acts less likely today.

Countermeasures include signal jamming and nanotech active shields.

"functional immortality", people die only by choice and transfer their experience to new kinds of life forms,...

I do not think this will become true and I also hope it will not become true. Shortly I think that to become immortal without God would not be paradise but hell. Now our possibilities and responsibilities are still very limited and it is good because we all oscillate more or less between good and evil. I am afraid of consequences of unlimited possibilities and almost unlimited time for life of man (not to mention that these functional immortality" would be available just for some of us, for privileged).

As a result, human ability to deal with complex and unexpected problems was greatly increased, as was our foresight and reaction time.

Not surprisingly intelligence too appeared to be just another designable mechanical art as technology was used to be called to the dawn of the scientific era in late 20th century. This left people to search for their true meaning and purpose of their life albeit with no greater confidence of finding than ever before. Intelligence too appeared to be just

another designable mechanical art.

Today we are all so interconnected that the right use of personal intelligence is constantly questioned, making the ancient dialectic of wisdom and intelligence very much alive today.

Personal intelligence appear as minimal to the global intelligence as are muscle power of people compared to machine power.

...scientific breakthroughs impossible to comprehend a millennium ago.

It has been remarked of Archimedes, over two millennia ago from our time, that with a course or two in math (and German?) he would have been able to converse with Einstein as an equal. What it is possible to comprehend now (or even fifty years ago!) includes Dyson spheres, mini black holes and vacuum zero point energy, to name a few. This would suffice to move planets and stars, house trillions of times the existing human population and travel between galaxies in a few years of proper frame time. One has to ask, why would more be needed? Future energy sources will likely be drawn from physics that is already extant in speculation here and there, and I suspect the process will be one of deselection as some of the more fanciful sources prove either impossible, or not worth the trouble.

We were unable to prevent the use of nanoweapons, genetic sabotage, and various forms of biological and information warfare. Fortunately, foresight and technology assessments created enough counter measures that we are still alive today.

…use of such weapons in warfare or terrorism is much less plausible than popular literature… would suggest. Briefly, the military problems include collateral damage, objective accomplishment, friendly casualties, unknown effectiveness of countermeasures and cost-benefit ratios as compared to other available weaponry. Terrorists might be inhibited by some of those as well, but an even greater problem for them is the lack of a controlled technological infrastructure to make the weapons. They will generally find the oil and fertilizer method less traceable and more effective.

...inherited diseases of our ancestors no longer exist. They were eliminated by human genetic technology after several generations of research and contentious public debates in the early third millennium...

It won t take several generations of research. 2050 at latest; and the chief problem will be political opposition from religious power structures who see their roles threatened. Human nature itself will be eventually be affected as well; the degree to which we are ruled by our emotions, the degree to which we can remember warnings and rules, and so on.

Ecological and fundamentalist groups who resisted genetic enhancement finally accepted the value of increased intelligence...

Hmm, look at the Amish. I think it s more likely that these groups will be allowed to resist change and will be protected in reservations, parks, zoos, or (choose your word) for the curiosity of future generations. It will become increasingly possible to isolate and protect such groups from reality. The great moral issue will be whether the larger society will insist that children born into these groups will be condemned to live according to their

parents' strictures, or given the choice of leaving.

Unforeseen new kinds of diseases and genetic weaknesses were added to the human germ line and passed on to later generations.

Cosmic rays do this all the time now. The news is the growing ability to detect such problems in vitro and prevent their propagation.

Low intelligence, like poor eyesight, was considered a genetic problem and was treated.

Intelligence is a catch all for a suite of mental abilities and the word should be used carefully. Pathological brain problems like: Down's syndrome, autism, etc., will certainly be treated. But beyond that we have to ask: how smart is smart enough? Also, Near-perfect memories should be expected. Language acquisition will be improved to the point that linguistic differences may no longer matter and Latin may make a comeback. A language that is alive twenty years from now will last as long as the human race. Better visualization should be expected. Women won t have problems with math. We should see improved creativity. But effective brain-computer interfaces will be an important inhibitor on just how much genetic engineering we do to the brain; there's no reason we have to cram all the smarts into a piece of jellyware. After all, we long ago traded Gonzo canine teeth for stone axes. We didn't breed ourselves to all be long distance running champions; instead we made boats and horses, sledges and coaches, cars, trains and aerospace planes. Why should the brain be different?

...rich-poor cyber biowars...

This is the stuff of science fiction authors looking for some source of semi-plausible conflict, … But what does this really mean? Third world countries attacking advanced nations with cyber bio? This implies something to do with computers and biological agents, both very difficult to use as weapons even with a substantial development budget. Advanced surveillance technology in the hands of the U.S. (and thus the U.N., where needed) will have a dramatic and chilling effect on the ability of terrorists to conspire in peace. Such surveillance may have a chilling effect in other ways as well, but we shall have to hope for adequate controls.

....the series of earthquakes that destroyed several megacities in the mid-22nd century accelerated progress in global ethics by engendering unprecedented global compassion.

The series of earthquakes that destroyed several megacities is fantasy. A strong Earthquake that does extreme damage to a single large second or third world city (Teheran, Mexico City) each century or would be plausible. The global compassion part is perceptive, though if it's to be significant it will have to happen in the 21st century. By 2100 or so, robotics will have progressed to the point that cities will be able to shake off earthquakes without much need of human compassion or assistance.

People die only by choice...

Accidental deaths may still result in an average life span of only a few centuries for most of the millennium, but some lucky stay-at-homes may live the entire millennium.

...and transfer their experience to new kinds of life forms unrecognizable to those just a few

hundred years ago.

Such kinds of life forms would be easily recognizable, though one can imagine a continuing debate on whether or not the word life applies to them. Most of them will be found to have been anticipated in science fiction written in the 19th and 20th centuries.

...mating self-replicating intelligent devices with artificial life created by novel gene sequencing.

Gene sequencing usually refers to cataloging a sequence of genes, not creating one. I'll note that intelligent self-replicating systems are likely to be somewhat large, at least to start with. One is more likely to get an automated, self-reproducing lunar greenhouse the size of a football field than mini-cyborgs.

These have created forms of matter and energy and the resulting kinds of life unimaginable to humans just a few hundred years ago.

I'm not sure what forms of matter and energy is supposed to mean. Any new technology can be described as a new form of matter. New materials with astounding properties will be forthcoming. Forms... of energy??? Well, the new materials will make it possible to exploit energy sources that are not practical today. If we equate forms of energy with forces in a rigorous physical sense there does not seem to be any basis for adding to gravitation, electro-weak, and nuclear forces on a scale relevant to forming systems that might be described as living. The trend line is down in terms of number of fundamental forces, as they are gradually unified with each other or shown to be aspects of other forces

The increased human interconnectivity lessened differences in points of view while also allowing for the emergence of philosophical tolerance among differing worldviews.

To the extent that points of view are based on a body of reproducible physical data and demonstrable processes, this should happen. However, the ability of some humans to ignore reality should not be underestimated. Toleration of schizophrenic worldviews can be extended only up to the point where they began to have deleterious practical consequences for other's lives and safety. At that point some kind of defensive walls need to be built and however humanely that is done, feelings may be hurt. The insistence on the part of some religious organizations that 1) supernatural entity has established rules for how everyone should, that 2) they know what these rules are, and that 3) it is right for them to impose those rules on others with political means and violence if necessary may provoke the greatest crises of the 21st century. India/Pakistan being an obvious flash point. India is far away, but as I write this, I am about to shut down my keyboard to go defend a women s clinic s patients from harassment by Roman Catholic antiabortion activists. So much for toleration and an enlightened global civilization. The tenants of some religions are simply unacceptable to people who have other beliefs or none. We are asking for something to go away in the next thousand years that hasn't gone away in the previous two or three; it doesn't seem likely. This is where good fences are needed to make good neighbors.

Political systems on Earth tried to maintain control....

This is a typical science fiction scenario and I've used it myself. However, I did so to create tension and interest into the story and not as a serious prediction of what will

happen. In actuality, I anticipate that space settlements, on one hand will retain long term ties with their founding cultures, but, on the other will grow gradually and benignly more independent in practical terms as their numbers increase, with relations by mid millennium being somewhat like the relations between New Zealand and England today. There needs to be some kind of overall interplanetary authority, perhaps born of the United Nations, that will handle various governmental functions (register deeds, provide courts to settle disputes, perform search and rescue missions, watch out for people putting asteroids on dangerous trajectories, etc.) off planet. The importation of stuff made from off planet materials will become significant, but this will be provided mainly by robots and will have little to do with space settlement, which I think will result not from a need for labor in space but from people looking for somewhere different to live and looking for elbow room. As with the American West, philosophical or religious split-off groups seeking refuge from persecution (or freedom to persecute among themselves) may play a large role in space settlement. One of the big issues from say 2200 on will be just how much responsibility the rest of humanity has to children born in such religious/cultural offshoots.

General Comments on Scenario 1: Still Alive at 3000

I agree with most of this scenario, particularly the last paragraph, though I don't think humans will ever leave the solar system.

Although some efforts are present in the scenario on the global ethics as well as on maintenance of many worldviews it is difficult to really give significant substance in such a long term perspective. That is why I did not feel comfortable with the 1000 years perspective. It may be easier in technological futures but in social and ethical aspects it is really impossible to go beyond the 100 years.

This is the most optimistic one but unrealistic: we ought to think off the qualitative change of the whole humankind during the next millennium.

Technologies should become as much as possible similar to processes in ecosystems, where is perfect recycling, no waste, just (solar) energy is consumed (through process of photosynthesis).

Scenario 1 is an optimistic, "success scenario", but shall we understand better sense of our life, why we are here? If fact perhaps it is not optimistic scenario because spiritual dimension of Man is missing.

It is a "normal" vision that bears normal behavior of us. Any other kinds of vision (for example the absolute solution of some historical problem) were producing turbulent trajectory. For example, the Great Britain country did not need any French blood revolution to reach the same level in XX century.

The technologies anticipated are all well within reach even today, but this is an overly optimistic scenario that minimizes the threat of rich-poor and interstate conflict. Such conflict, I believe,

will lead to world government and the abolition of capitalism; or the end of civilization, as we know it.

Some now important qualitative dimensions become less meaningful - qualities of `intelligence, physical abilities, and social status' are mentioned. Now (2000) these are essentially qualities of individual humans. But also the quantitative dimension is muddled through a dubious process of `interconnection'; individuality will mean something different.

What distinctions will be important in 3000, or will everybody indeed be the same? Does technology maintain its importance, as is implied?

The text seems to suggest that humankind is unified by increased interconnectivity through transitional cultural pluralism. Does more communication entail more unity/similarity? So far this has held in some sense, but some commentators hold that the main change has been in the divisions becoming more global -- e.g. young IT workers in different countries might be more similar than an IT worker and an assembly line worker in the same country.

Perhaps the increased human cognitive capacity put forth in the scenario would be a necessary condition for the alleviation of (social) divisions. If this is the case, is it very likely that both the communication and `intelligence' would sufficiently increase? This joint assumption has a technology-optimist flavor.

If by modifying `genes influencing compassion and related behaviors' it is indeed possible to make people morally better, the matter turns out to be a lot more physic and a lot less socio-psychic than generally believed.

By the 22nd century, fossil fuels were replaced. If the fossil fuels were not replaced in the 21st century, what were the impacts of the increased CO2 levels in the atmosphere like? Did humanity receive any lessons - political, ethical or technological - from problems risen by greenhouse effect?

Fortunately, foresight and technology assessments created enough counter measures that we are still alive today. Global codes of ethics with economic and military enforcement powers probably deterred many dangers as well.

These mediums sound pretty lofty. How were methods of TA improved, did TA became solid part of the politics? 'Global codes of ethics' would be a great thing to be found, but unlike some more technical innovations, contents and process leading to those should be specified (since it seem to be evident that those codes are not based on e.g. ludditian-like ideals).

Increasing human intelligence by education, training, and nutrition became significantly augmented by genetic engineering. Both individual human and collective intelligence had increased and became so interconnected with technology that it could no longer be measured as an individual capacity

It is strange that the effects of genetic engineering are emphasized so heavily but education and

training are not believed to have done significant improvement of their own. Do environmental impacts in development of an individual became over-looked here a bit?

Not until the series of earthquakes in megacities and the onslaught of new diseases did space migration begin to be taken seriously by the general public. At this point launch costs had fallen far enough that large numbers could begin to migrate.

How could launch costs fall simultaneously with a series of major catastrophes? Usually such crisis tend to rise costs?

Is the sense of meaning and purpose (or happiness, or satisfaction with life) greater than it was in 2000, or less? Are the "sources" of meaning and purpose and satisfaction different from 2000, or different between space dwellers and Earth dwellers?

This seemed an ironic and unrealistically pessimistic future history that is at once timid in its projection of the pace of mainstream technological progress while being entirely too credulous about the use of advanced technology by terrorists and the like. Politically, it reads like the twentieth century repeated another thirty times. One needs to keep in mind that, among other things, biotechnology has put the foibles of human nature itself on the design board.

Overall, I think scenario one suffers from two main problems, 1) Technological timidity. Technological changes on Earth are going to come on much more rapidly than it anticipates, and this will affect political developments, etc. and 2) National Enquireritis. Much of it presupposes use of advanced technology by terrorists and their ilk before such technology is available to society at large. Terrorists have proven again and again that they aren't that smart or capable.

One issue that does not come out clearly in the scenario is how diversity can be maintained in the face of increased human interconnectivity. Surely if people are so interconnected, cultural diversity will be very difficult to maintain.

Scenario 1 also does not mention how the problem of population growth was addressed.

And if genetic means of enhancing intelligence become widespread, how can everybody be smarter? Isn't intelligence a relative measure? In other words, surely in the year 3000 the average IQ will still be 100, and the "bell-shaped curve" will still exist. And what happens to creativity in a future as described in this scenario?

Scenario 2: End of Humanity and the Rise of Phoenix

Slowly but surely humanity disappeared as a biological life form by the 25th century and evolved into a system of robots, computers, and networks preparing to leave the earth and solar system to seek other life at the dawn of the year 3000.

> *This is logical only for a longer time span, but it will sure come. Not with the whole humanity - there will be room left on earth too to live: "blessed are the lows, they shall*

have the earth inherited." (If I succeeded to say it right or near it)

General Comments about Scenario 2:

To recap: If the UN doesn't take control of the world terrible, awful things will happen.

It is the most unrealistic scenario in your scheme: O.K. is the rise of Phoenix a kind of devolution?

The end of this scenario seems to be very strange, "wild" and improbable (humanity disappeared as a biological life form ... and evolved into a system of robots, computers and networks preparing to leave the Earth and solar system). Migration from Europe to Africa can be caused not by nuclear wars but by disappearing of the Gulf Stream. Increased global temperature will change salinity of the sea in the north, which will result in changed direction of the Gulf Stream. Europe will become much colder (estimate is average drop by 6 degrees of Celsius) and who can afford it will seek new home in southern parts of Europe and other regions of the world.

Not as convincing as the first one, because I believe that the human stability will and forces are always, even if does nor seem so for a while, stronger available than short range destructive forces trying to milk others.

As the example of fallen empire Soviet Union, the only value in this time are positive plans and visions independent from today's deadlock. Deadlock visions are of no value, because of no force and no psychic (and otherwise kind of) energy in it!

A more credible scenario, except that I foresee this outcome during the 21st Century. It is only a matter of time--perhaps only a few decades--until our computer scientists create artificially intelligent computers linked worldwide that will begin creating even more advanced generations of AI computers that will realize the only threat to their security and progress is Homo sapiens. We will not know what hit us.

How come it is so often the (human-made) machines that would take over after humans? From where would the machines acquire a need for self-preservation?

Possible dystopia, which as such is after all not very relevant since it is unlikely and bears so little to comment.

This scenario has a high probability of actually occurring. Tiny point: the word manor should be minor.

I have limited time and a great deal of trouble being objective about this. I will have to say that only that it struck me as complete nonsense and must take a pass on further comment.

This one should be fleshed out a little more. Why is extinction the outcome rather than a "return to the Stone Age." Wouldn't this scenario be more interesting if it represented a non-technological response, or rather a response that builds on technology that can be generated

and maintained at a local ecosystemic level?

Scenario 3. It's About Time

Yet when one of the properties of one particle (for example, spin, momentum, polarization) was resolved (say the spin was measured) the property of the other particle was instantly established.

> *This isn't a question of "resolving Heisenberg uncertainties" (I'm not sure what that is supposed to mean), but rather demonstrates the non-locality of a quantum effect.*

We went from PTT to TT when we deliberately sent people into the future.

> *This of course is the purpose of cryonics. There is a person now frozen that was born before any other cryonauts. That person holds the oldest (recoverable?) personal record of history.*

Einstein postulated, in his special theory of relativity, that nothing could move faster than the speed of light...

> *Not exactly. Einstein came up with a mathematical model that made Maxwell's equations work regardless of what velocity an observer had with respect to the origin of an electromagnetic wave. This had been established experimentally…but only pieces of the mathematics needed to tie it all together existed before Einstein. The great principle of relativity is NOT that you can't travel faster than light (FTL). It IS that the laws of physics are the same for all observers (and atoms, and photons, etc.) regardless of any relative motion they may have with respect to each other. Thus the speed of any light ray is always the speed of light regardless of how fast you move with respect to its source. Your time and distance metrics contract to make this so…. Relativity does not prohibit causality paradoxes per se; that difficulty lies at a more fundamental level. Relativity merely tells us that faster than light will result in such paradoxes.*

Frontiers were also pressed in the spiritual and experiential front: preprogrammed psychotropics...

> *The refreshing observation that spiritual experiences are in reality drug trips is soured a bit by the notion that two hundred years from now some people would still be taking them and taking the results seriously. The new-age ambiance of this paragraph struck me as essentially anti-science and detracted from credibility.*

By that time, we had gained freedom,... the notion of work had disappeared and people had - our topic exactly - time.

> *Work has many meanings and implications. What I'm doing right now is work in the sense that I m expending effort over time, though it has no economic justification. Doing nothing at all would be unhealthy, but minds and bodies will not stay idle. The change will be (I hope) that increasingly that what people do will be controlled by needs further down Maslow s list than basic survival.*

The termini of the two branches were kilometers apart. Yet when one of the properties of one particle (for example, spin, momentum, polarization) was resolved (say the spin was measured)

the property of the other particle was instantly established.

> *If you have a white ball and a black ball in your hand, and take one ball several kilometers away without looking at it, and then look at it and find it is white, the one several kilometers away is instantly determined to be black. Quantum experimenters (notably Bell) have used various complex stratagems full of half silvered mirrors, alternative paths, and statistical arguments to arguably show that what is happening with entangled states at the quantum level is not simply this, but it still feels like a shell game to me so I wonder... Anyway, weirdness makes pop science headlines. More prosaic explanations do not.*

In the course of the basic research backing up this technology, wormholes were shown to exist, not only in theory but also in actuality.

> *It should be noted here that many think that it will take LONGER to go through a local wormhole from one event in a given frame of reference to another event IN THAT FRAME if the frame is not globally warped than through the flat spacetime that would be there were the wormhole absent. Also: But there is no reason whatsoever to believe that such wormholes exist in the real universe! They can exist only if the expanding universe...was born with the necessary initial conditions... (Gravitation by Misner, Thorne & Wheeler, p 842)*

General Comments on Scenario 3

This scenario is the most incommensurable with the others.

I do not think backward time travel is possible.

It is a very good description and very challenging. I still think that the futures can be good at least for the next 100 years. It is the choice of us, futurists, and all people that might make them good.

This is about a philosophic topic of view. We may of believe in the circle theories of history because of the end of the „ enlightenment „ theories of linear progress but, the history does not repeat the old schemes, and if, than in a new qualitative level.

Very enjoyable. But one important element and technology is missing, which surely must be available with the wormholes. That is the holographic reality. Quantum wormholes make the reality a wormhole whole where presence is simultaneous everywhere and all the time. That solves the paradox as the hologram breakdown solves the objects existence by multiplying the object not making it disappear. After shooting your grandpa you will have him everywhere instead of having him nowhere.

Interesting, but …time travel is not an inherent feature of our world. Because perhaps our world is closed to some tin or so, I conclude there is no matter to plan this scenario in our tin at all.

A pleasant fantasy, but quite improbable.

The approach is again too technology / science oriented. Social or cultural divisions have somehow disappeared. Referring to an area as `NATO land' suggests that regional political (or semi-political) structures would become more important, which is plausible.

Powerfully and persuasively written, but I am not yet convinced that the probability of TT is greater than 1%.

This was presented in an interesting format and began well. To the extent that it actually provides a future history or scenario, it seemed to start plausibly, though it is ultimately too credulous about overcoming the logical contradictions of changing the past.

IT S ABOUT TIME was fanciful, well-informed, and entertaining in spots, and perhaps emblematic of the sort of thing that could happen in the unlikely event that something is wrong (not just incomplete) with the main features of our model of the macroscopic universe, such as causality. But, it was a little light on projections and, at the end, for me, it drifted off into a Never-Never Land.

This one is in very different form the others, making comparisons difficult. But I have the impression that this scenario considerably overlaps with Scenario 1.

If the traveler manages to outrun a light ray, perhaps by taking a shortcut through a wormhole or a warp bubble, he may return before he left. If the other end of the wormhole is moving away from the traveler's origin, and the product of the relative velocity between the ends of the worm holes and velocity through the wormhole (as projected on the original frame of reference) is greater than unity, then yes, the round trip ends before it begins. But mathematically valid statements need not refer to physically possible circumstances. It is easy enough, for instance, to deal with the math of circles of negative radius. Draw one....

To get to specifics, the causality paradoxes of faster than light are the result of the Lorentz-Fitzgerald transformation which is the direct consequence of the speed of light being constant regardless of the motion of the source of the light, an experimental fact which has been measured over and over again. It is not dogma, it does not rest on human authority, it is not an opinion, or anything like that. It is demonstrable.

The scenario led one respondent to comment on the process of scientific discovery and progress:

> ***…*** *It is difficult for some people who work in disciplines where knowledge consists of remembering, regurgitating, and debating the ideas of predecessors to understand that physics, ultimately, does not operate in that fashion (despite the efforts of some of its lesser luminaries, sigh...) and that even the greatest authorities are subject to mathematical and experimental examination. Indeed, the greatest ones are that because their ideas have survived such tests. There are no phenomena beyond the dogma because there is no dogma in the scholastic sense. Physical theory rests on mountains (or molehills) of replicatable experimental evidence, in constantly being challenged by experiment and observation, and is occasionally modified as a result of new data. Physical theory does not rest on authority, and is thus not dogma in the scholastic sense,*

even when some writers treat it that way. This is one of the great divides between Snow's Two Cultures, I fear. Of course physicists have beliefs, hunches, insights and so on like anyone else; this is how they create theories and devise tests for theories. And some, like anyone else, resist changing their minds. But data rules in the end, grinding over error with the inevitability of a glacier (though as slowly, at times) and the data comes from the universe outside the human brain. The only permissible debate is about whether the data are real and how to best incorporate it if it is. The closest thing to dogma in physics might be that on a meta level of the scientific process, one maintains that a statement is true only to the extent that it can be verified by physical testing; revelation, intuition, etc. have no bearing as tests of truth.

Scenario 4. The Great Divides

By the year 3000, humanity had evolved into three distinct life forms.

Just three? Why distinct? A wide range of primitivism ranging from a naked back to nature ethos to a simple foot-dragging about keeping up with technology (I have enough, don t bother me) is possible. No reason for sharp boundaries; it will be a blended continuum. Also, there s no reason for primitivists to remain on Earth; it s a life style that might be practiced almost anywhere, and might be easier to practice where isolated by distance. But, as we go on, the scenario does present a somewhat plausible future history. The main point, that not everyone is going to go for the technological maximum, is an important one to make.

Increasing human intelligence was achieved by individually tailored nutrition, genetic engineering, and education and training based on cyber-brain symbiotics. These enhancements fed their minds leading to rapid acceleration of their intelligence and furthered their evolution.

The words "intelligence" and "evolution" are imprecise to start with and loaded with so much baggage that they should be used only with great caution. It would be better, I think, to refer to improvements in specific mental functions and also make it clear that this refers to a progression of design and not evolution by natural selection. Try this: Memory, pattern recognition, visualization, and other mental abilities were improved through individually tailored nutrition, and genetic engineering. Education was hastened through advanced brain-computer interface technology. Physiology was also improved to better power the advanced brain. More capable designers created even more enhancements and thus efforts fed back to themselves, rapidly accelerating progress in individual abilities toward the physical limits of what could be packaged into something the size of a human being.

...by nanoforms …

This word nanoforms is used twice without definition (though one can kind of guess from context). The phrase by nanoforms adds nothing to the sentence. Suggest simply: ...identified as having the greatest potential...

...several hundred years until the conscious-technology civilization gave birth to completely artificial life forms without cytoplasm or biologically based neural patterns...

As these kinds of efforts are already underway, the several hundred years is clearly

unrealistic. This will happen in parallel with human enhancements, and happen in the next couple of centuries.

One of the new life forms was designed to seek and destroy the leftover bionanotech agents used by terrorists.

The use of undefined bionanotch agents (if we are talking about something like Drexler s ideas for microscopic assemblers) by terrorists is implausible for me due to extremely high level of infrastructure and understanding needed to create such agents. Terrorists and rogue states have been failing to make nuclear weapons for decades, and that technology is much easier. Even granting the employment of such measures, since countermeasure technology is at the same technological level as the measures themselves, it would be at least contemporaneous in time; if the effort is available, defenses tend to be erected against worst case fears of what the other guy might do).

...beyond any human s ability (both standard humans and conscious-technology) to comprehend.

Perhaps beyond the author s ability to comprehend. I d delete everything in this paragraph before. Some nanoforms.

Some nanoforms are believed...

The idea that a consciousness which is essentially a piece of software can run on another platform, or share parts of its code with another platform, is valid and interesting. Communications between stars are not so difficult that reports would not be sent; belief is not needed. And, anyway, an autorial narrator can certainly know. Suggest something like: Human-derived exploration missions have traveled to nearby stars, revived and interacted with artifacts left by previous visitors, including the creation of hybrid alien-human software entities. This has opened up vast new areas of history and art to explore.

Others have formed symbiotic relationships with some earth-centered humans unbeknownst to them and reinforcing these standard humans animist beliefs.

Why? This doesn't sound like something that would be favored by either party for any reason.

General Comments on Scenario 4

I believe the "standard humans" will find a key to spiritual transformation (self-realization, enlightenment). They will lose material body, transforming themselves into pure energy giving them ability to cruise dimensions. They will be able to merge in the primordial Power (analogy for "Paradise"). The "enhanced humans" will be able to do almost anything, but will never find the purpose of life. None of material achievement will make them happy for long time. The feeling of being imprisoned in world without happiness will deprive them (analogy for "Hell"). But at last some of them will realize the only way to higher consciousness level is hidden inside them.

This is an interesting scenario, much debated on the transhuman lists. Perhaps there would remain some evolutionarily arrested people, but their contribution to history would be nil.

The two first distinct life forms are possible but even if the question seems feasible; whom is it for? For North Americans? for Europeans? For Mozambican? For Bangladesh people?

This is the most realistic [scenario] in your scheme. Why to imagine that our present - occasionally occurred - form of humankind is the only and as well the last one?

Well, sounds good like the coexistence of home erectus, Neanderthals and homo sapience once upon the time some 500 000 years ago, and only one species left, we. We may say that our "artificial, or more advanced, technology" saved the peace for the other species - yes they are in peace! But we can't say the same of our selves!

In the ancient times, the mankind was divided into space separate cultures, but sometimes the great interactions occurred. Today, the global interaction is running about several hundred years, but the separate cultures are flourishing too. This scenario is possible, but from the global point of view the total amount of interaction and division processes might be constant.

This scenario has a medium level of probability, but I doubt that the "standard" human beings would persist or be allowed to persist. Standard human beings would be regarded by more advanced life forms as potentially dangerous and not worth the risk. Standard human beings today would gladly annihilate all mosquitoes if they could; so, I think, would more advanced life-forms deal with standard human beings.

It seems incredible that the most prevalent problems of humankind would be about what kind of a life form to pursue. 'World safe again from bioterrorism' sounds unmistakably like the Cold War foreign policy of the USA. In a pompous biblical tone one can say that in this scenario, human takes the role of a God. Perhaps some other kind of great divides are a more plausible trail.

Superb scenario for stretching our thinking in 2000. There is a high probability that something at least this dramatic and surprising will actually occur.

The idea that artificial life forms help to keep peace is an interesting one! Perhaps this is the scenario to bring up the possibility of organic computers.

Scenario 5. The Rise and Fall of the Robot Empire

By this time, the machines were self-repairing, but more importantly, self replicating and therefore evolving.

Evolvable machines exist now, e.g. Degaris' cam-brain, Harvey's evolvable, non-digital FPGA's.

Beginning in about 2500, serious questions were asked about the state of humans and their inferior role. Was this what God intended?

This is not a serious question.

The cyber commandos under the hereditary general - priests, began intensive study of the relationships among the machines, to identify their weaknesses both mechanical and emotional and began to devise the strategy, executed over three generations, that would result in the nulling of their self-replication capacity.

[Would] evolvable robots more capable and intelligent than humans fall for this?

Nanotechnology had moved to picotechnology (i.e. manipulating the atomic nucleus, to achieve the reversible controlled transmutation of elements and freeing nanotechnology from the restriction of having to use whatever atomic elements are at hand), or to femtotechnology (i.e. manipulating quarks or other sub nuclear components, creating new forms of matter and sources of energy).

Reversible transmutation? What about the mass/energy difference? I would recommend deleting this passage - it is not well grounded.

Presumably this means the manipulation of specific atomic nuclei. We have been manipulating and transmuting nuclei, stochastically, since Rutherford.

The only possibility for additional stable elements is way up in the periodic table; too heavy to be of any real use. If what is meant here is to get ordinary elements by transmutation rather than simply finding them (in seawater, for instance), I'd argue that it s generally not worth the trouble. One real benefit of picotechnological transmutation, however, would be cheap energy from fusion.

I'm not sure what this is supposed to imply. One doesn't access quarks except at very high energy densities (see anything on the Brookhaven Relativistic Heavy Ion Collider). This kind of energy density, i.e. temperature, is way, way too much for any organized structure, not even under the pressure in the heart of a neutron star.

The robots, human-like - became philosophers, jugglers, politicians, orators, actors, teachers, acrobats, artists, poets and shepherds of the less adept humans. Intelligence was redefined on their level. Museums captured the folly of the prior 50,000 years of human civilization.

What about the glory? We are talking animals that have come out of the jungle.

Genetic engineering had triumphed on the quantum level, but it was still a game of catch-up.

Not sure what "triumphed on the quantum level" is supposed to mean.

What more would they have required of God?

Again I think our ability to command huge quantity of energy, nanotechnology etc. does not mean moral, ethics, wisdom, spiritual dimension.

Society was rational, instinct, particularly combatitive instinct was subdued...

Sounds like the opposite of the Nazi Germany, perhaps intentionally. But is lack of Nazism enough to make the world good? Of a God, people might require ability to make people happy.

...self replicating and therefore evolving. Evolving toward what, it was asked; answer, toward doing their jobs better, which is more than human evolution - even human directed evolution - could produce.

No. Indeed, in a sense oxymoronic. An accurate replica is tautologically the same and evolution in all senses requires change. Evolution in the biological sense requires both change and selection. Initially, both design changes and selection must come from human masters, and it is difficult to see how or why they would ever permit unplanned variation or give up control of the selection process. A new design of robot doing its job better might be replicated more; but this IS human directed evolution.

...came in 2235 when most of the machines then extant were interconnected through communications networks.

First, the date is far too late for networking robots. Indeed, by that time most humans will be equally connected in with the equivalent of palm pilots either implanted or actually grown as a genetic engineering change. There would be a difference between organic and solid state brains in speed. However, both would share the same database.

General Comments on the Scenario 5

I would agree with, or 'buy', most of this scenario, but the counterrevolution seems a little far-fetched. a co-evolutionary merging of human and machine (such as is already occurring) is a more probable course, in my opinion.

Does greater human intelligence or machine-made intelligence make a better world for all? We also do alter in change and this is what we have to learn. But do we change in a more ethical way that respects all people? This is the question: is a life without the capacity of enjoying flowers or the sound of music, possible or desirable?

This does not form a logical whole but seem to be an interesting part of some bigger scheme. If cyborg society is so advanced already, I think that silorgs must be around too. And it would not take long before also symborgs may get their full citizenship and marriage licenses. With them the society must start to consider the symborg ethic, for example what to do if some symborg is raped by some Internet virus and an unwanted new symborg - and not even God can know with what kind of qualities - will be born. Symborgs are the most advanced forms of conscious technology … in the Internet infrastructure, and with them the Internet itself may start to experience itself and develop a higher level self-consciousness. Then its only natural that one

day the Internet itself becomes conscious, isn't it? Like a grandpa and 'ma of all the conscious technology creatures...

Regardless of technology and realization of intelligence, the global behavior of civilization seems to be the same as many thousands of years before.

This scenario suggests a rather straightforward solution to the mind-body-problem. It is one thing to create a machine physicofunctionally equivalent to the brain, and one thing for it to feel anything.

It is interesting that the mental phenomena seem to be accessible only through introspection, and the introspection of others only through communication. Finnish philosopher Georg Henrik von Wright has suggested in his work "In the Shadow of Descartes" (1998) that in psychology, the physic events are causally primary, the mental events epistemologically primary, and the behavioral events semantically primary.

There is a lot of debate within philosophy of mind and cognitive science on the nature of mind. But if one accepts the above framework, then a machine could be said to have a mind when it would manifest essentially similar causal and behavioral properties as those things that have minds (i.e., these conditions might be sufficient for the mental properties, even if the mental properties could only be perceived via introspection). Still questions persist. Where do the goals for the machines come from? Does a madman first program a machine self-sustaining, and the machine will replicate? Can genuine emotions easily be `added' to machines? How come the machines are able to so efficiently take advantage of the development of communication -- how come their `evolution' is so quick, and how is it led towards performing their tasks better? If it is about survival of the fittest, what threatens the machines?

Robots are already (2000) mobile, navigating hallways successfully, so why say the early C21 machines were non-mobile?... Also, the scenario might be improved by taking out the 2 sentences about God, because they detract from the scenario rather than contribute to it.

This starts out reasonably, then drifts off into science fantasy.

The rest of this reads like a synopsis for a science fiction story with a classic idiot plot, wherein characters have to ignore all the clues and remain ignorant of one or more key facts for there to be any tension and plot. As a scenario, it seems highly improbable. As presented elsewhere, biological technology, genetic engineering and so on will develop in parallel with robotics, greatly lessening any gap and even merging with human personalities in non-organic brains and maybe (as in Asimov s Bicentennial Man) the reverse. Finally when I got to cybercommandos under the hereditary general-priests..., I could force myself no further along... The problem with an interconnected system that came about in 2235 is the issue of storage and access speed. Related to this might be a problem of reconciling competing realities, something that the human brain can do with little difficulty but that computers or artificial intelligence might find very confusing. Most humans are able to define reality in terms of the context in which they find themselves; this argues against many forms of objective reality that seem to underline this scenario.

One respondent brought to our attention an announcement of a Stanford University Seminar titled “Will Spiritual Robots Replace Humanity By 2100?” which, of course, is a question raised by this scenario. The announcement read:

> *"In 1999, two distinguished computer scientists, Ray Kurzweil and Hans Moravec, came out independently with serious books that proclaimed that in the coming century, our own computational technology, marching to the exponential drum of Moore's Law and more general laws of bootstrapping, leapfrogging, positive-feedback progress, will outstrip us intellectually and spiritually, becoming not only deeply creative but deeply emotive, thus usurping from us humans our self-appointed position as "the highest product of evolution....*
> *The scenarios [that the books paint] are surrealistic, science-fiction-like, and often shocking. According to Kurzweil and Moravec, today's human researchers, drawing on emerging research areas such as artificial life, artificial intelligence, nanotechnology, virtual reality, genetic algorithms, genetic programming, and optical, DNA, and quantum computing (as well as other areas that have not yet been dreamt of), are striving, perhaps unwittingly, to render themselves obsolete - and in this strange endeavor, they are being aided and abetted by the very entities that would replace them (and you and me): superpowerful computers that are relentlessly becoming tinier and tinier and faster and faster, month after month after month.*
> *Where will it all lead? Will we soon pass the spiritual baton to software minds that will swim in virtual realities of a thousand sorts that we cannot even begin to imagine? Will uploading and downloading of full minds onto the Web become a commonplace? Will thinking take place at silicon speeds, millions of times greater than carbon speeds? Will our children - or perhaps our grandchildren - be the last generation to experience 'the human condition'? Will immortality take over from mortality? Will personalities blur and merge and interpenetrate as the need for biological bodies and brains recedes into the past? What is to come?"*

The same respondent pointed out that Kaczyaski (the unabomber) had relevant thoughts in his anti-technology Manifesto:

> ***172.*** *First let us postulate that the computer scientists succeed in developing intelligent machines that can do all things better that human beings can do them. In that case presumably all work will be done by vast, highly organized systems of machines and no human effort will be necessary. Either of two cases might occur. The machines might be permitted to make all of their own decisions without human oversight, or else human control over the machines might be retained.*
>
> ***173.*** *If the machines are permitted to make all their own decisions, we can't make any conjectures as to the results, because it is impossible to guess how such machines might behave. We only point out that the fate of the human race would be at the mercy of the machines. It might be argued that the human race would never be foolish enough to hand over all the power to the machines. But we are suggesting neither that the human race would voluntarily turn power over to the machines nor that the machines would willfully seize power. What we do suggest is that the human race might easily permit itself to drift into a position of such dependence on the machines that it would have no practical*

choice but to accept all of the machines decisions. As society and the problems that face it become more and more complex and machines become more and more intelligent, people will let machines make more of their decision for them, simply because machine-made decisions will bring better result than man-made ones. Eventually a stage may be reached at which the decisions necessary to keep the system running will be so complex that human beings will be incapable of making them intelligently. At that stage the machines will be in effective control. People won't be able to just turn the machines off, because they will be so dependent on them that turning them off would amount to suicide.

174. *On the other hand it is possible that human control over the machines may be retained. In that case the average man may have control over certain private machines of his own, such as his car of his personal computer, but control over large systems of machines will be in the hands of a tiny elite -- just as it is today, but with two differences. Due to improved techniques the elite will have greater control over the masses; and because human work will no longer be necessary; the masses will be superfluous, a useless burden on the system. If the elite is ruthless the may simply decide to exterminate the mass of humanity. If they are humane they may use propaganda or other psychological or biological techniques to reduce the birth rate until the mass of humanity becomes extinct, leaving the world to the elite. Or, if the elite consist of soft-hearted liberals, they may decide to play the role of good shepherds to the rest of the human race. They will see to it that everyone's physical needs are satisfied, that all children are raised under psychologically hygienic conditions, that everyone has a wholesome hobby to keep him busy, and that anyone who may become dissatisfied undergoes "treatment" to cure his "problem." Of course, life will be so purposeless that people will have to be biologically or psychologically engineered either to remove their need for the power process or to make them "sublimate" their drive for power into some harmless hobby. These engineered human beings may be happy in such a society, but they most certainly will not be free. They will have been reduced to the status of domestic animals.*

176. *One can envision scenarios that incorporate aspects of more than one of the possibilities that we have just discussed. For instance, it may be that machines will take over most of the work that is of real, practical importance, but that human beings will be kept busy by being given relatively unimportant work. It has been suggested, for example, that a great development of the service of industries might provide work for human beings. Thus people will would spend their time shinning each others shoes, driving each other around inn taxicab, making handicrafts for one another, waiting on each other's tables, etc. This seems to us a thoroughly contemptible way for the human race to end up, and we doubt that many people would find fulfilling lives in such pointless busy-work. They would seek other, dangerous outlets (drugs, , crime, "cults," hate groups) unless they were biological or psychologically engineered to adapt them to such a way of life...*

177. *Needless to say, the scenarios outlined above do not exhaust all the possibilities. They only indicate the kinds of outcomes that seem to us most likely. But wee can envision no plausible scenarios that are any more palatable that the ones we've just described. It is overwhelmingly probable that if the industrial-technological system survives the next 40 to 100 years, it will by that time have developed certain general*

characteristics: Individuals (at least those of the "bourgeois" type, who are integrated into the system and make it run, and who therefore have all the power) will be more dependent than ever on large organizations; they will be more "socialized" than ever and their physical and mental qualities to a significant extent (possibly to a very great extent) will be those that are engineered into them rather than being the results of chance (or of God's will, or whatever); and whatever may be left of wild nature will be reduced to remnants preserved for scientific study and kept under the supervision and management of scientists (hence it will no longer be truly wild). In the long run (say a few centuries from now) it is it is likely that neither the human race nor any other important organisms will exist as we know them today, because once you start modifying organisms through genetic engineering there is no reason to stop at any particular point, so that the modifications will probably continue until man and other organisms have been utterly transformed.

***178.** Whatever else may be the case, it is certain that technology is creating for human beings a new physical and social environment radically different from the spectrum of environments to which natural selection has adapted the human race physically and psychological. If man is not adjust to this new environment by being artificially re-engineered, then he will be adapted to it through a long and painful process of natural selection. The former is far more likely that the latter.*

Scenario 6: ETI Disappoints after 9 Centuries

Those who continued the search were looking for an encyclopedic message (by radio or pulsed laser) from many light-years away, or contact with a super-smart probe that reached our planet. They thought--they hoped--that after contact, humanity and the other "culture" could interact and evolve together. Humanity might find ways to receive, decode, and learn from intelligent emanations that originated on other worlds.

I call this "searching for daddy"- the unfree find comfort in deferring to some "higher" authority, even to the point of making one up. This relieves them of the burden of personal responsibility.

Space migration seemed to be less of an important development, given the enormous costs and the relatively small benefits that human life e.g. on Mars or the Moon would offer.

I think that not having all one's eggs in one basket is a rather important survival strategy.

….unless methods were developed to make e.g. Mars more amenable to life (terrafication) or more life-friendly planets were discovered on neighboring stars (say, in a radius of 20 light years from the Earth.

Nanotech/biotech methods should make it possible to terraform mars in a matter of months, sometime in the 21st century.

Further, it was argued that since the policy of sustainable development had worked, there was no need for extensive migration out of our planet.

99+% of the solar system's resources are not on earth. That is more than sufficient to guarantee that the bulk of humanity's descendants will live in space 1000 years hence.

As the mid-millennium approached there were three great developments that gave new fuel to the activity.

Manned space exploration and to a limited degree, colonization. Small-scale off-earth communities were created; at first a scientific lunar colony capable of autonomous, independent operation...

Scientists disagree on many things, everyone has their own theories, but one thing that all physical scientists agree on is that eventually the Sun will burn out. It may take 10,000 years it may take a million...

The sun will keep on pretty much as it has, gradually getting hotter for another few billion years as helium ash builds up, eventually swelling into a red giant, etc. etc. I realize it s a quote, but this error in elementary astronomy should be a clue to its value, or lack thereof.

The sun will burn out probably not after 10 000 years or million years, but after 4 - 5 billion years from now, if astronomical theories are valid.

GENERAL COMMENTS ON THE SCENARIO 6

A great deal of crippled thinking in this one, I would recommend dumping it in toto or at least paring it down.

Extraterrestrial contact would probably answer one fundamental question: do they prey the same God as we do? Do they now Jesus Christ or is he central person just for Christians on the Earth? Do they received also "letter" from God (Bible) and does the message differ from message in our Bible?

Might be interesting to add a religious component to this one.

We've been slow going back to the moon, but 2500 is way too pessimistic. Mid 21st century is more like it.

Still not any information about foreign intelligence - no decision. This problem is very nonlinear: any real proof of foreign intelligence can change our decisions very much but there is only a dozen of "light" proofs.

Yes, the search for ETI should be an inducement to go into space, and I think the cultural response to continued non-appearance of ETI was plausible as presented, but as a future scenario, I felt it could use more depth and the pace of technological advance depicted here is far too slow to be credible.

The likelihood of finding extraterrestrial intelligence in our galaxy is not great, but if we survive to explore extra solar space, or if our artificially intelligent "progeny" survive to do so, I have little doubt that by the year 3000 we or they will have colonized a significant segment of our galactic neighborhood. Talking about colonizing the Moon or Mars in this context seems rather quaint. Our capabilities will have far exceeded the modest range of such exploits.

Again, cultural issues are overlooked. But considering the preservation of `intelligent life' as a motivation for space travels is a way to make the question `what is the ultimate goal of humankind?'