

EDUCATION**Forces of Change in Global Education**

DIPLOMATIC PLANET INTERVIEW
WITH
Dr. Richard Berendzen

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Introduction - Fundamental shifts at the higher education levels in who is being educated and where that education will take place and the need to attract and retain teachers within the traditional University setting are just large pieces of the puzzle that colleges and universities are trying to sort out.

The changes in the student population, where the teaching experience will occur, and the growth in the amount of information and the amount of knowledge that has to be sorted and differentiated - are real areas of focus and concern for the educator of the 21st Century.

The Forces of Change in Higher Education

DPlanet: Dr. Berendzen, what is the framework from which to look at Innovation as a focal process in the Academic sector - what are the trends and issues that you see as creating the opportunities for innovation ?

Dr. Berendzen: Looking first at the United States, higher education is going through an interesting and significant transformation that is fundamentally driven by changing demographics. In the US we have an ever increasing number of 18 year olds, while the percentage of these 18 year old high school graduates who would like to go on to college is increasing as well. Interestingly, these "on to college" increases predominantly are women.

The stereotype of a college student as being an American born male of European ancestry is rapidly changing. The students of the next decade or two in the US at the college level will increasingly be female, I would guess that it will be over 60% soon. If you take out certain fields like engineering and business administration and a few others, then it is already well over 60%. Increasingly, the college population in the US will be of non- European backgrounds.

Community colleges and junior colleges particularly will burgeon in enrollments but all of higher education will likely have more students.

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Dr. Berendzen is a member of the Advisory Board of the Planetary Society and was founding editor of the Journal of College Science.

Dr. Berendzen has published, in audio cassette format, "Pulp Physics" - on physics, astronomy and our daily lives. The Woodrow Wilson International Center for Scholars in association with Smithsonian Productions published an audio CD - "A History of the Heavens - A Dialog Interview with Dr. Berendzen" in 1998.

His books include: "Man Discovers the Galaxies" (Co-author); "Touch the Future: An Agenda for Global Education in America" ; and "Is My Armor Straight: A Year in the Life of a University President".

Dr. Berendzen received a BS from the Massachusetts Institute of Technology (MIT), and MA and Ph.D degrees from Harvard University. He also has been awarded several honorary doctoral degrees.

Source: Dr. Berendzen and The American University

There will be degree inflation over the next two or three decades. The bachelor's degree will increasingly be a stepping stone to a Master's degree. At the beginning of the 20th century, back in 1900, very few people had a bachelor's degree - practically no one had a doctorate. Today bachelor degrees are common, Master's degrees are fairly common and there are a fair number of Ph.D's. In ten or fifteen years, Master's degrees will be as common as bachelor's were just twenty years ago in the United States.

The fields of concentration will continue to be much oriented towards where the jobs seem to be - technology professions and also healthcare - and things which deal with an aging population. In the next forty years the fastest growing population group will clearly be those over the age of

sixty. In fact, people over the age of eighty is the fastest growing cohort of all.

There is an increasing number of people in the US who do not speak English as a native language. This creates not just an issue of bilingual education, but higher education must deal with the diversity of cultures and backgrounds - making integration an imperative at all levels.

These changes mean that the traditional Euro-centric education which has been the heart of the US educational system for the last hundred years will probably remain that focus, but its "centricity" also needs to be rethought. We have to realize that we live in a multi cultural, interlocked world -- not just in business and the Internet, but in everything we do. From the weather to ozone layers, from scientific research to cultural fashions to pop culture - all of these are inter-related and now resonate around the planet.

Impact Areas

How do these elements translate into the actual delivery of the educational system ? Internet has become increasingly significant in US higher education. In the last five or six years, PCs are prevalent everywhere, students increasingly go online to get their resources rather than going to a conventional library. Now we have an interesting challenge as to what differentiates knowledge versus learning - knowing

versus learning. When do you simply find information and when do you understand that information ? If your computer search engine has found a resource of material for you and if in fact it has more or less synthesized that resource - what has the student learned ? - or will the mere process of learning how to have the computer work for you become the learning process in itself ?

The higher education system must re-define what we mean by 'learning'.

Every Generation Faces Technological Advance !

New technology is something that each generation has faced for at least the last 7,000 years. For this generation it has been the process of having your computer carry out a set of tasks, back a generation or two it was television, before that it was electricity itself, and automobiles. The technological innovations go back to the very first beginnings of technology, four or five thousand years B.C. and they always seem new and jolting to every new generation that had to encounter them.

For the educators of the next twenty years, we really have to ask ourselves if online education by chat rooms and email, without the contact with the teacher - is that the same thing ? What is the role of the human being in the process ? Is cyber learning, cyber teaching, cyber discussion, cyber everything the exact equivalent, the modern replacement for old human interaction. Maybe it is, maybe we need a new paradigm and we have not yet become accustomed and comfortable with this.

But before we immediately assume that Internet and computers are going to dominate the planet, lets remember that a generation or two ago many people said that the professors and teachers would be replaced, well before the end of the 20th century, by television sets. That didn't happen. It didn't happen because people need people and seem to need the human interaction.

Learning to Use Technology is Our Challenge

I think the innovations that are needed now in education are to understand how to use new amazingly powerful technologies and yet at the same time maintain the humaneness, the human-ness, of the education process.

That college student of 2015, the young person who is perhaps ten or fifteen years from college today, needs to learn not only facts, needs to learn not only procedures for the computers and other devices, but that person needs to learn how to be a human being, how to live within that multi-cultural society and needs to be taught what it means to be a cultured, refined, caring and involved human being in a multi cultural environment.

The Global Impact

What about the rest of the world ? The United States is not the only nation that is going through these transitions, Western Europe and much of Asia are facing similar issues.

But now we come to the painful part - those who are left out. I suspect that the primary beneficiaries of these new technologies will not be people now residing in what are called the third world countries, the developing nations. They will not have

the benefit of large, well stocked libraries, museums or teaching corps in place who can instruct students as we would expect in some of the industrialized nations.

Even the term 'industrialized nation' which we use as a gentle way of referring to those nations with higher per capita incomes than those who do not, is archaic. It is a term not from the 20th century, but from the 18th and 19th centuries as England, France, Belgium and eventually the United States, all became industrial powers.

The argument was made by Daniel Bell and many others decades ago that the US had become a post-industrialized society. There is no doubt about it, today the US is predominantly a service society and increasingly so.

Industrialization in the US, as people know, is dropping as a percentage of our GNP. But what about these countries that have not even reached the industrial threshold, much less the level of post industrial ?

Technology - Advances and Barriers

On the one hand the Internet and these new technologies offer them the opportunity of getting in to The Hermitage, into the Library of Congress, into places that their students and their teachers could not otherwise, possibly, access. On the other hand, they have to have the technology - the computers and the modems - and they have to have fundamentally the electricity and the phone-lines, (there will come a time where phone lines of course are unnecessary).

But most of all, they have to have the resources, which includes human resources. They have to have people who understand how to do this. It is not enough to simply have a computer with the modem and give it to an untutored student with no guidance whatsoever. Perhaps it would be better than the current situation, but it would not be sufficient.

Remember that you are dealing in the third world and developing nations arena with countries that are plagued with other societal problems. These problems are so profound that they make new knowledge, learning and education almost seem secondary, tertiary or not even relevant on the scale of what is possible.

When you have countries, as in sub-Sahara Africa for example, in which the reported HIV level is 50% of whole blocs of the population from age twenty to fifty, then how can you expect them to turn resolutely to education. But if they do not allocate resources to education, then they will sink further behind on the world economic scheme.

Balancing Reality with Hope

After that painful picture, there are pockets of good news.

I believe that there is genuine opportunity for many countries that have been traditionally referred to as pre-industrial or non industrial, or as developing nations - a good example is India.

India is already becoming a major leaguer in computer technology. Indeed much of the banking in the US is now done in India, with the transactions carried out

electronically. Americans who receive cost benefits from having those data collected and analyzed offshore never realize that their information has been shipped to Bombay, worked on and then shot back here at the speed of the Internet.

So the technologies, and indeed the wealth, which is going to develop in some of those countries, I think, is enormous. When you realize how much Internet has expanded and how much it has changed the economy of the US -- when you realize that these small and large technology firms are driving the world economy -- and then you couple that with the fact that only a minute fraction of the world population of 6 billion today are wired, then you see that the potential for growth is utterly staggering.

Teaching the Next Level of Technology

What does this mean to the educator ? You cannot have all of this teaching without having the teachers. There are the obvious issues of being wired and modems, but there is perhaps the less obvious and yet more fundamental problem of whether you've got a well trained teaching corps in place that understands these technologies and encourages the learners to learn.

We have not yet reached the educational opportunity for the vast majority of the world's population and will we ever be able to ? Will their countries permit it, will their cultures welcome it, will their economy enable it, and will the teachers be there to do it ?

Technology Doesn't Ease the Burden of Teaching

The innovation in Academics that has got to take place is multi-fold. The complexity of these opportunities is a real burden on the educators of the future. It might seem superficially that their task might be less because the computer technology might do the work for them.

But I would argue that it might just be the reverse. Because the teachers themselves will have to keep up with a new changing technology which will require life long learning, not only for the students but for the educators. So literally, we never stop learning.

In the United States, twenty five years ago, there was a program started called ElderHostel. It was intended for people who would normally be called retirees and they continue on learning. It is a model I believe which will apply not just for those people and not just in the US, but literally worldwide.

Education and the Innovation of Education are going to start with pre kindergarten children, two to four year olds who will be using mouses and going on Internet and playing games over computers as they are today in some specialized schools. Those skills will become routine and the learning process will continue on the rest of their lives.

The 20th Century Versus the 21st Century

I suspect that all of the innovation and change that so dazzles us this century - going back from the Wright brothers to today, - we went after all from Kitty Hawk to the Lunar landing, we have even left the Solar System with our probes, in one century -

If that is what we did in less than one hundred years, then imagine what the next few decades may bring in new technological change.

DPlanet: What are the resources needed to underwrite the growth of the Educator and that high level of Innovation that you have described ?

Dr. Berendzen: With respect to resources needed, it is moneys for many things. It is clearly moneys for the computers and the software, and the technology to have it linked, but it is also for the teacher preparation. And where then will that come from ?

In the United States we say that education is at a local level, its in the local community, then up to the state level, and to a lesser degree to a national level - only about 5% of the higher education budget is at the federal level and that is mostly for student loans.

In the United States these resources will come partially from tax moneys, largely at the city and state level, lesser at the national level. They will come out of private individual's pockets - but they are also going to come increasingly out of business and industry itself because industry already realizes the importance of continuing education for its employees.

Business's Self Interest in Education

Increasingly, I believe, business and industry will realize the importance of pre-education, the education prior to ever getting that employee and then the continuing education of its employees. I believe that business and industry will want to support not only the public schools, but specialized education that applies to their fields of enterprise.

For the rest of the world, it will be a similar model, but sometimes more difficult where there is not the free market system that applies so well in the US. Whether the resources will come from international agencies, I don't know.

But there will certainly be large efforts for that. Major foundations such as Ford, and Carnegie and others will no doubt give funds for it. I suspect that some of the technology moguls of today, the Bill Gates's, and the others, may make contributions, but those contributions will be small compared to the actual, international needs.

So I imagine that some of the third world and developing nations are going to continue to find, in spite of all of the best will and good efforts of everyone - that there will be a real gap between what they need and what they get.

DPlanet: That leads into the Hyper Tier Network Divide - particularly when you look at institutions where you have the resources and the brand name, the archival content, the intellectual, proprietary teaching material that can be monetized - referring to the relationship that you described between the commercial area and the academic area.

Dr. Berendzen: That seems to be a result of this, but it is just hard to take a hazy glance into the smog of the future. In 1900, what were the major business names in the United States ? Some of them have now gone into oblivion. Others are still around, but they are hardly the major names -- US Steel, the petroleum companies which were broken apart by the laws to stop monopolization. In 1900 nobody had heard of IBM, nobody had heard of Microsoft, or Intel.

So I suspect that many of the industry leaders and the business leaders of the next thirty years have yet even to come into being or be well defined.

The Risk of the Digital Divides Appears Real

But globally, the issue for educators is going to be, if they don't have the resources, if they don't have the vision, if they don't have national leaders, heads of state and major educators - if they don't have statesmen of such vision, that can understand how there are not just challenges, but there are opportunities here, it will definitely create a divide.

Either they get on it, or they don't. Either they take advantage of these new opportunities or they fall almost irretrievably far behind. And the real decision time on that is coming, I believe, in the next ten years.

If nations have not started to wire themselves, if they have not started to educate their teachers and their professoriate to be prepared to teach their students, if they have not assembled the money from either their own resources or from international agencies to enable this to happen, with a clear cut, visible and realistic plan of where and what is going to happen, not broad generalities, but actual facts -- then I think those countries are going to fall increasingly far behind, and they are going to be left into basic cottage industries of doing hand goods while the rest of the world is moving into technologies that we haven't even begun to invent.

Its Not Just Telecommunications Technology

We are focusing here on Internet and information technology companies, but there are whole other domains - bioengineering, genetic engineering, the human genome project, the space program - these are technologies that are going to transform this planet more rapidly and more profoundly than anything we have done in the last hundred years.

The combination of computers and humans, artificial automata, parts of your body like the old Six Million Dollar Man on the television show in the US of a few decades ago, will increasingly become a reality. These changes require not only the knowledge about computers and information technology, but also about genetics and greater understanding of the human body.

The whole area of space exploration and astronomy is a different topic, but it is as vast as the cosmos itself.

The nations that do not catch up with this, as I said, will be left almost irretrievably behind. They are going to watch from the sidelines while other nations land human beings on Mars, and drill down beneath the surface of Europa, and as others take genes apart and reassemble them.

Labor and "Tech" Labor

DPlanet: That would encourage patterns of migration from populated pockets that we consider cheap labor markets and out of the developing nations - if they can accomplish that emigration - to areas where there are education, health and

nutrition access, and tools so that the next generation can step into these opportunities that you have described.

Dr. Berendzen: I truly believe so. I truly think the limiting factor today on the further expansion of the US and the global economy as well as the vitality of the technological era in which we are living is not the speed of the modem and the speed of your computer, it is human beings.

The sheer difficulty of finding enough well-trained, well-educated people who can continue to be trained to keep up with the changes is the challenge. Already, industry is finding these difficulties in the United States human resources.

What would be painful to see is the world divided into those who have these technologies and skills and talents, and those who do not even come close to it.

And now we have some very painful things that need to be discussed publicly and openly. We will always need people to keep the infrastructure of society running.

We are going to need and to value people who can build things with their hands - carpenters and plumbers and repair people and auto mechanics. Twenty years ago, maybe you learned about being an auto mechanic by watching your friends. In the future it is going to require a real education to learn those skills. There's no question about it. Those trades and skilled technicians will become, if anything, more prized in the future, because a smaller percentage of the population in the future will seek out those jobs.

At the same time, even those fields are already becoming more technological - cars are becoming increasingly robotic computers -- so it is going to require new talents and new skills, even for going into those kinds of trades and technical professions.

Professionals in Fifty Years

DPlanet: What do you suggest then as that perfect world - fifty years from now - with an expansion into space, with a lot of the basic health problems solved, or mitigated, the communications abilities truly global and the physical access, truly global - What does that then give us as an academic or a university environment for all of these doctorates ?

Dr. Berendzen: There are a multitude of fields for them to go into, and the hot fields will be not just the computer technology, but things related to human beings.

The health care profession, tending for the very young, particularly where the largest population cohort is under the age of 10, and for the very elderly - I already mentioned the graying of the US society.

Its going to be people going through a painful transition where a whole community - a small town in New England, for example - is attempting to transform itself from the industry that has traditionally supported it to something else. Fifty and sixty years ago there were towns in New England that got most of their money from making shoes. Well the shoe industry changed and you can't find those shoe places in New

England anymore. The whole industry died and for a time it seems that those towns faced oblivion.

I suspect you are going to find that happening painfully around the US and around the rest of the world.

We're going to struggle to find people to work in the agricultural field. We are going to have to continue to produce food crops after all, but agriculture is going to increasingly become technological. People will learn better how to produce more out of one acre so we do not deplete the mineral content of that one acre. It's not really an issue of farming as we traditionally know it, but really a new kind of scientific farmer.

I think people need to be encouraged to know those opportunities exist and lead to a good livelihood and some dignity, some prosperity and some status.

The Future – Consequences

The future, it seems to me could be extraordinarily bright for industrialized societies and for the rest of the world, where we can solve diseases and expand life-expectancies - but there are also potential dangers. Ones with momentous potential consequence. Dangers which educators should teach about. Ones which deal with the ethics and propriety of what we are doing, and our very process.

While the Internet, for example, links us with the world, it also deprives us, increasingly, of our privacy. Almost everything that we do goes down to a computer bank somewhere, and somebody, somehow can have access to it. Who is going to protect our privacy?

This interplay of using new technology for good versus using it for ill is as old as technology itself. Mary Shelley, after all, wrote her now famous book *Frankenstein* as a parody of that. She was not anti scientific. She was talking about scientists dealing with the human body and pushing their experiments to an extreme, and turn it into a creature - what we then call 'The Monster'.

The issue here is for this technology that we are creating not to become a monster that is out of control or to become our own Frankenstein's Monster. With all of our advances and information, and education, we don't want to create something that deprives us of our privacy, that allows our medical records, our banking transactions, our most private communications, our national and international secrets to be available to anyone who can crack it and hack into it. Of course, the US and other countries are talking about spending billions of dollars to prevent hackers and Cyber terrorists from being able to do that.

Every Issue - Positives and Negatives

DPlanet: The flip side of the privacy issues is the potential for mis-information, the use of discreditable information and to instantly communicate propaganda on a global scale - which I define as information that has an agenda behind it, not fact and not disclosed purpose. The potential there is very high, and we have to equally safeguard against that as much as we have to safeguard against the invasion of privacy.

Dr. Berendzen: You are absolutely right and let me phrase it in another way. I think

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HAVE YOU CHANGED THE FUTURE TODAY?!

you are raising a profound issue, that there is so much mis-information on the Internet, today, it is almost mind boggling.

When I talk with students, they believe that the Internet is like the Holy Grail. If they can go on-line, they have found Truth. Now that Truth might be from a government source, it might be from a University, or it might be from "Bob's Private HomePage", and the student will treat them equally.

The amount of garbage that is out there, some of which is bordering on slander, and gossip, as well as scientifically untrue information, is outrageous.

On the other hand, dictatorships in the future are going to find it increasingly difficult to keep the free flow of information outside their borders. Today, they can somewhat do so because of the limited access to modems and phonelines. But with a modem-less computer, coming soon and already available in some communities, that restraint would no longer be possible. No longer can a dictatorship totally have a closed information system.

DPlanet: Looking at The University - its branded content is supremely valuable, you know the source, you know its credibility - similar to buying a General Motors car or a Whirlpool dishwasher, you know what you are getting.

Dr. Berendzen: I have yet to see anyone write and I would like to see it - an article, on the Internet, or a book, that discusses all of the ying and yang, the pros and the cons of this new technological era. In particular go back and liken it, as I did with the Frankenstein analogy, a moment ago. But there are so many of those goods packaged with potential bads.

When the automobile first originated, look at Charlie Chaplin's famous silent film parody of what was happening on the assembly line, and its mindless, boring, awful work and drudgery - Yes, but that assembly line also produces the vast numbers of goods that we want.

DPlanet: The Ford model, where he had to raise the standard of living of the labor force to become a consumer - to enable them to enjoy what they were producing -- is really at the heart of some of your earlier comments.

Dr. Berendzen: It is. Ford - even with of his later life anti-semitic tendencies which made him a less attractive figure -- what he did was sheer genius. Introducing the work week, the minimum wage, producing every single part of the car, his own forest, his own shipping, his own trucking lines, everything - making it for the multitudes. His innovation and genius made him the wealthiest person on the planet.

History as the Teacher

DPlanet: These topics all relate to your interest and teachings in the History of Science - What perspective should history provide us on these technology-based issues ?

Dr. Berendzen: Today a substantial percentage of the time of the young people in the US is spent before a screen - probably a television screen, possibly a computer

monitor.

Who would have thought at the beginning of the 20th Century, who would have thought in 1950 even, that that would be the case. When television began, who would have thought that it would take over such a dominating role in our society.

Who would have thought that people would have spent vast amounts of their time playing computer games ? It is changing popular culture. It is changing the way we spend our time.

The most valuable thing that any human ever has is Time. It is the most complex idea that the human mind has yet embraced except, perhaps, that of "God". What is Time ? You can't create it, you can't stop it. Is it multi-dimensional ? What is Time ? We only know that we live for a finite amount of it, and we are spending it, and an increasing percentage of it, on ways that nobody had anticipated twenty years ago.

What's going to happen over the next several decades ? What I imagine is that the news industry is going to change, profoundly. We already see it with the 24 hour day cable television. The conventional idea of a newspaper and magazine is going to go through a real revolution. I am not sure that twenty years from now magazines are going to survive, particularly news magazines. Why would somebody want to buy a magazine which is surveying the last week or the last month when they can get it on line instantaneous from two minutes ago, via Internet. It is going to change who is giving us that information.

Will it remove the spin or will it add spin ? Will it remove the spin of the particular journalist who is writing it - or will it add the spin of the commercial providers who allow you access to it ?

I don't know the answer, but what I do know is that our use of film, television, everything that goes into our senses will undergo changes. Even 'smellavision' which people have talked about for decades, now becomes realistic. Holograms projected into your very room, with surround sound on all sides. That technology should be readily available in ten years.

How this is going to change the use of our time, the use of our education, I cannot even imagine. But what I do know is that it will !

Culture and Pop Culture

So, popular culture which now commands a sizable fraction of all that we do, is going to change. I think popular culture will increasingly become International - not so much just American centric. The US may influence the rest of the world even more, through its popular culture and secondly, the information flow of knowledge in terms of news, which is really another form of education.

Ideal Life ?

DPlanet: Is the ideal then an Internet Services Provider, the franchise of the future that sells the services and distributes the programs that are individualized - the news, education, information and activity diet and exercise for the Brain and the Body ? -- A complete service package that selects what information gets through to you and when, and what irrelevant noise is avoided - selecting different diets and regimens of information and interaction depending on various personal factors.

Dr. Berendzen: We are at the point of overload and so you are going to have to select very carefully. You realize that the VCR is being replaced by the DVD, that cassettes are being replaced by CDs and the CDs are being replaced by something else --- and the vinyl records were the standards from just fifteen years ago. The turnover rate in technology is incredible and fast.

The implications for the educator and the innovation in education are, to me, utterly profound. It is like running on a rapid treadmill to keep up with these changes - changes in absolutely every field - the way the historian has accessed the information, the way the political scientist understands his or her field, the way the politician communicates with the public, it is no longer by giving a stump speech, but by going on the Internet.

And then there is the other side, and I keep stressing that, it is not going to go away, human interaction, the touching of flesh, the politician seeing the person, shaking hands, the twinkle in the eye. That physical contact with others is going to stay an important component as long as human beings remain.

I do not believe that television and the Internet are going to replace teachers. It will add to the teaching, it will be new a dimension of teaching, but human interaction is going to remain vibrant.

I believe that eCommerce is going to boom and boom and boom. Yet, I don't think that shopping in the conventional sense is going to disappear.

Multi-Generational Machines

DPlanet: We have books that have transferred knowledge across generations; the Egyptian hieroglyphics have transferred information across millenia. We have some tapes, wax and wire recordings - intact nickelodeons and original rolls that reproduce the same sounds today as they did in the 1890's - sounds and video impressions that are older than a human's life span. But now we have machines and information and recordings that have their own multi generational impact. How is Time being measured when machines have viable lifespans of several hundred years ? - as you mentioned, it is a concept central to our human experience.

Dr. Berendzen: That is very provocative and deserves an entire discussion.

I happen to believe that artificial automata - robotics - are potentially one of the dynamic, enormous fields for the 21st Century. We all think of robots as being cure little R2D2's modeled after a vacuum sweeper - but the notion of a real artificial automata which not only has a brain in the form of a computer chip which has a vastly larger memory storage than anything a human has - that can beat a Kasparov at playing chess, and he said that it did so unfairly because it knows virtually every move of any master, including himself - but now we teach the computers to teach themselves.

So they don't just accumulate knowledge, but it is getting very close to reasoning. And if a computer can begin to reason, as well as adapt so it can replace its own parts - then you really do wonder if someday the earth will be inherited by some

artificial automata - they have a life span much greater than our 70 -80 years, more durable, they will be able to think faster - and think may be the right word, not just memorization.

They are not there yet, but now you get to some interesting and some very profound questions. If you get artificial automata to that level will it be moral to kill it ? After all what constitutes killing, what constitutes life - Does it have a soul, what is a soul, would you know a soul if you saw it ? Does it have to be biological and organic in nature to be of value ?

These are things that teachers and professors will have to deal with over the next century, and educators will have to have the cultural, societal, political and human tools as well as the technological tools in order to do so.

The Impact on the Quality of Time

The notion about Time and how human beings spend it is such a profound idea and there has not been enough written about it anyplace that I know.

As a homily - someone told me that when you are born you are given an endowment of time, an account with exactly that many seconds in your bank. How are you going to spend that allotment ?

The questions then are also how to make that bank bigger, so life expectancy is not 79 but 99 - and is the quality of those remaining seconds really of value ? Are you sitting isolated, or are you on line and physically vital, or are components of your decaying, aging body being replaced by microchips and electronic components as you yourself are becoming partly a robot - an automaton.

The discoveries to be made this century are going to be mind boggling - or we might have a century that is fairly tranquil.

Since Newton we have had quite a bit of technological advance - maybe we are due for a quiet period. I don't know.

If we get a clear unmistakable signal from outside our solar system from intelligent beings, all of these problems will disappear from our radar screens.

Today we believe that the speed of light is the limit - maybe it is not. Or I might be wrong.

DPlanet: Thank you.

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