Part XXI

Future of Informatics - Chapter 1

FUTURE in INFORMATICS ERA

(a new era - of superintelligence and Singularity - is coming!?)

Prof. RNDr. Jozef Gruska, DrSc, Spring 2015

Wednesday, 10.00-11.40, B410

TECHNICALITIES

Web page of the lecture:
http://www.fi.muni.cz/usr/gruska/future15

Ways to finish the lecture: (essays (10-15 pages), exam)

ESSAYS from 2013

- S. Boudová: Attempts to achieve immortality.
- P. Brazdil: how you envision learning in 20 years?
- M. Čermák: Informační válka: informační technlógie jako zbraň.
- R. J. G. Doblas: The present and futiure of HTML
- P. Eibenová: What is Internet doing to our brains?
- L. Dolniak: Nanorobots - state of the art and expectations
- M. F. Gomez-Lorenzo: Supercomputers - evolution over the last 20 years
- L. Jammer-Ponc: Internet security
- M. Jonáš: Approaches to specification of mathematics and natural sciences
- T. Kadlecová: Immortality - the history and future of a phenomenon
- S. Licehammer: User data aggregation and behavioral targeting
- I. Luhový: Perceived value of our future
- M. Macik: Informatics - our slave or master
- J. Mäkinen: The future of human-computer interactions
- M. Nemec: Danger of nanotechnology and need for regulation
- M. Pavla: Pluses and minuses of living to 150 for individuals and society.
- V. Podzimek: Openess - a future challenge of informatics
- M. Trněný: State of the art of military robots and future of warfare
- M. Víta: Essey on Knowledge of Ignorance

Prologue

PROLOGUE

FUTURE WILL BE MUCH DIFFERENT

During the last half a year, leaders of science and technology (for example Stephen Hawkins, Bill Gate, especially in informatics, have started to make society aware of the fact that in the near future we can expect developments, especially in superintelligence, that will change radically society and society should put a lot of effort how to cope with it (with this danger) - if possible.

This understanding is especially due to current and expected progress in artificial intelligence robotics, nanotechnologies, biotechnologies, genetics and in understanding as well simulation of human brains.

For example, the December issue of the weakly magazine RESPECT had a large article entitled **Artificial intelligence may change soon the world in a danger way.** Subtitle **Machines versus people.**

Newspaper **New York Times** keep more and more often reporting about big progress in this direction.

It starts to be clear that we are approaching one of extraordinary period in the development of human civilisation.

EXAMPLES

- Larry Page, founder of Google is the main supporter of Singularity university to study future.
- Peter Thiel, one of key investor of Facebook, is one of key sponsors of Machine Intelligence Research Institute in San Francisco

EXTREME (??) VIEWS

- Once human develop superintelligence it would take off on its own and re-design itself at as ever increasing rate. Development of AI can lead to the end of human race. **Stephen Hawking**
- In future humans will overcome limitations of their bodies and intelligence as well as resources of our small planet and become a higher civilization.
- Development of AI is calling Devil **Elon Musk, one of most successful investors in Silicon Waley. Musk put also 10 millions of $ to the research that would avert superintelligence apocalypse.**
- I am in the camp that is concerned about superintelligence. First, the machines will do a lot for us and not be superintelligent. That should be positive if we manage it well. A few decades after that, though,the intelligence will be strong enough to be of a concerned. I agree with Elon Musk and some others on this and don't understand why some people are ot of concerned. **Bill Gates, 2014**

MORE CAUTIOUS POSITIONS

- Superintellignce is not something that will be created suddenly or by accident. **Dilep Geoge, co-founder of AI startup Vicarious**.

A MORE DETAILED VIEW of SUPEINTELLIGENCE STORY

The human brain has some capabilities that the brains of other animal lacks.

It is to these distinctive capabilities that we own our dominant position on the planet.

Other animals have have stronger muscles and sharper claws, but we have cleverer brains.

Our modest advantage in general intelligence has lead us to develop language, technology, science and complex social organizations.

The advantage has compounded over time, as each generation has built on the achievements of its predecessors.

If some day we build machine brains that surpass human brains in general intelligence, then this new superintelligence could become very powerful.

And, as the fate of the gorillas now depends more on us humans, than on the gorillas themselves, so the fate of our species would depend on the actions of the machine superintelligence. Nick Bostrom, director of Future of Humanity Institute, Oxford University

OXFORD's VIEW

SIX WAYS HUMANITY could END

1. All world pandemic dieses
2. Atomic war
3. Colapse of ecosystem
4. Syntetic biology
5. Nanotechnologie
6. Artificial inteeligence

A VIEW of ROBOTS

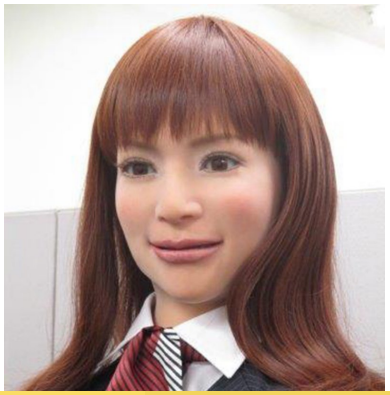
Figure 1: A usual view of a robot

EXAMPLE of CURRENT DEVELOPMENTS

Nagasaki's Hen-na hotel plan to employ humanoids this summer - as announced by Japan government.

They should check in guests, escort them to the room,...

Humanoids pretty girls should understand and speak Chinese, Japanese, Korean and English.



EXAMPLE of CURRENT DEVELOPMENTS

1. Recently a system was designed that can distinguish dogs from cats on more than on 97%.

Huge progress was done in the recent years in pattern recognition and natural language processing.

A system has been demonstrate that could hear a speech in English, write it down, translate into Chinese and then deliver he same speech in Chinese.

WHAT CAN SOCIETY DO ABOUT IT?

In this lecture we will discuss basic laws, ingredients, developments and paths that are behind this developments. As well as potential dangers and possible strategies society can develop.

In particular we will analyse the role of informatics by that and its grand challenges.

FUTURE

FUTURE

WHY TO SPEAK ABOUT THE FUTURE? - I.

In the past there used to be no lectures about future. Why? For two reasons:

- In the past there were very little reasons to expect that Future in 20-50 years will be much different from the presence. Therefore there was not much of interesting what could be said about the Future. Therefore there was no need for talking about the future.
- It usually took a lot of time, often many months, and even years, when important new developments started to be sufficiently well known and could have a broad impact.

WHY TO SPEAK ABOUT THE FUTURE? - II.

What has changed?

- There are nowadays very good reasons to assume that soon, in about 20-40 years, future will be very, very different. Therefore is a big need, for many reasons, to understand well driving forces of future. There is a big need to prepare new generation for future changes.
- Informatics concepts, methods and tools can be seen as driving forces of the exponentially fast developments in all (information processing driven) areas of society.
- The existence of internet and the current publication modes and tools allow to learn fast, often almost immediately, when important new developments take place.

CHAPTER 1. INTRODUCTION

CHAPTER 1

INTRODUCTION, FUTURE ?!!, CONTENTS

(What kind of future can we foresee for information processing and mankind?)

SUMMARY

MAIN POSITIONS - DEEP THOUGHTS

- If you try to reach for the stars you may not get one, but you won't come up with a handful of mud either.
  Leo Burnett
- We need men who can dream of things that never were.
  John Fitzgerald Kennedy
- One who is serious all day will never have good time, while one who is frivolous all day, will never establish a household.
  Ptahhotpe, 24 century B.C.
- A traveler who refuses to pass over a bridge until he has personally tested the soundness of every part of it is not likely to go far; something must be risked, even in mathematics.
  Horace Lamb

CONTENTS

- New megachallenges of science and technology and medicine
- What can be expected from this lecture?
- Brief contents of all 14 lectures.
- Basic views of future and their developments
- Why we need and can get deep insides into future?
- Examples of some useful and some wrong predictions
- Abstractions from the past.
- Role of information, ICT and informatics in shaping the future of mankind
- Forecasting of the future and the *Black Swan* principle.
- Appendix

WHAT CAN YOU EXPECT TO GET from THESE LECTURES - I.?

- To understand a new view of evolution - as evolving from the biological evolution to information-technological evolution and to their merge.
- To understand laws of the development of ICT and their impacts.
- To develop a new understanding of informatics and its grand challenges
- To understand potentials and impacts of GNR-revolution.
- To see that convergence of ICT and biology has reached a point to achieve simulation of the human brain and the development of a brain-computing.

WHAT CAN YOU EXPECT TO GET from THESE LECTURES - II.?

- To envision a future in which information technology and science keep advancing so far, and so fast, that they would enable humanity to transcend its biological limitations.That, in turn, will transform humanity (and your/our lifes) in ways we cannot yet imagine at all.
- A thoughts provoking envisages of such future, which is closer than most people can realize.Future, in which mankind transcendents our biological limitations to the extend that should have very large, important and even hard to imagine impacts.

WHAT CAN WE EXPECT to get from THIS LECTURE - III?

- A clear-eyed and sharply focused vision of not so far ahead future, especially concerning our information and knowledge producing and processing future.
- Stunning, looking almost an utopia vision of the near future when machine intelligence outpasses that of our biological brains.
- An attractive and well guiding picture of a plausible future.
- A plausible vision of technology developments and their impacts and consequences for humans.
- To get a plausible vision of future in which information technologies develop so far and so fast that they enable humanity to transcend its biological limitations.

WHAT CAN WE EXPECT to get from THIS LECTURE - II?

To see evolution as development of large and large intelligence that starts to come to a new era - that of superintelligence.

WHY CAN ALL THAT HAPPEN?

- Because improvements in information related technologies and methodologies is and will (very) rapidly - exponentially - accelerate.
- As a consequence the power of important ideas and technologies to transform the world is and will also rapidly accelerate.
- In particular, rapidly will accelerate development of non-biological intelligence and a merge of human and machine intelligence towars superintellignece

Though many people may readily agree with these observations only very, very few really fully understand their profound implications (comming very soon - in their lifetime.

BRIEF CONTENTS of ALL 14 LECTURE

BRIEF CONTENTS of ALL 14 LECTURES

Chapter 1: INTRODUCTION, SUMMARY, FUTURE

- What can you expected to get from this lecture?
- A brief content of all lectures.
- Why we need to know future?
- Deep views about future.
- How much we can envision future and what we can do for that?
- Story of the attempts to make predictions.
- How to get quite reliable predictions?
- Grounds for our predictions.
- Appendix - references, ways to pass this course

Chapter 2: EVOLUTION - FROM BIOLOGICAL to NON-BIOLOGICAL INTELLIGNECE and to THEIR MERGE

A detailed analysis of the following six epochs of biological and non-biological evolution and their impacts:

- Deep thoughts.
- Six epochs
- **Epoch 1**: Information is stored in basic physical and chemical structures - basic story of universe.
- **Epoch 2**: Information is stored in DNA. Creation of DNA and life.Carbon-based compounds became more and more intricate until complex aggregations of molecules formed self-replicating mechanisms.Life originated and biological systems developed.
- **Epoch 3**: Information is stored in neural patterns. Brains develop as qualitatively new tools to store and process information.
- **Epoch 4**: Brain is used to develop intelligence and that in turn is used to develop various technologies to store and process information.
- **Epoch 5**: Non-biological intelligence develops and a merge of biological and non-biological intelligence follows to dvelop suprintelligne.
- **Epoch 6**: Post-singularity developmens. Universe will be saturated with knowledge, non-biological superintelligence and its processing.

Chapter 3: LAW of THE ACCELERATING RETURN for INFORMATION-DRIVEN TECHNOLOGIES

- Deep thoughts
- Convergence of all technologies to information technologies.
- Main features of the evolution of (information) technologies.
- The law of accelerating returns and Moore laws.
- Examples of exponential and double exponential developments of information-driven technologies.
- Five main paradigm shifts behind ICT evolution.
- Recent developments in supercomputers.
- Main impacts of the ICT developments laws.
- Are radically more powerful computers in vision?
- What can be expected from quantum information processing and transmission?
- Visions of computers to solve efficiently NP-complete problems.
- Visions of computers to beat Church-Turing barrier - to compute uncomputable.
- Appendix I: What are computers - developments of views.
- Appendix II: The law of accelerating returns as an economic theory.

Chapter 4: NEW PERCEPTION of SCIENTIFIC INFORMATICS

- Deep thoughts.
- Old and new views of computer science.
- Why are old views of computer science no longer acceptable and why are new views of Informatics much needed?
- Information processing in nature - biological and quantum.
- Four basic components of Informatics.
- Basics of scientific Informatics.
- Grand challenges of scientific Informatics.
- Case studies.
- Informatics as a queen and servant of sciences.
- Other big challenges of scientific Informatics.
- What we can learn from history of Mathematics.
- Messages from the history of Physics.
- Appendix

Chapter 5: VISIONS, IMPULSES and ROADS to our NEW PERCEPTION of INFORMATICS

- Deep thoughts.
- New perception of Informatics- its vision and its roots.
- Growing understanding of the key importance of Informatics.
- Needs of the drive to knowledge society.
- Informatics as a tool for cross-fertilization in research.
- Informatics as blurring out differences between pure and applied sciences.
- Informatics as driving force of new education.
- Informatics as a support of multidisciplinarity.
- Information processing as a driving force of life.
- Thoughts from physics community and lessons from history.
- Needs to develop meta-science and engineering of science.
- Convergence of sciences and technologies to informatics.

Chapter 6: ENGINEERING/TECHNOLOGICAL and APPLIED INFORMATICS and their Grand challenges.

- Science versus technology.
- Deep thoughts.
- Basics of engineering/technological informatics.
- Case studies.
- Main grand challenges of engineering Informatics.
- Relations between scientific and engineering Informatics.
- Other grand challenges of engineering Informatics.
- Basics of Applied informatics.
- Ways informatics facilities its applications.
- Grand challenges of Applied informatics.
- Human Genome Project

Chapter 7: NEW, INFORMATICS-DRIVEN METHODOLOGY

- Deep thoughts.
- Main current methodologies of science.
- Basic components of the new methodology.
- Power of the new methodology.
- Case study I - Algorithms design and analysis.
- Case study II - Complexity considerations.
- Case study III - Power of randomness as of a resource.
- Grand challenges of new methodology.
- Appendix

Chapter 8: MODELING, SIMULATION and VISUALISATION

- Deep thoughts.
- Why modeling and simulation?
- Basic types of modeling?
- Basic approaches to the design of models.
- History of computer modeling.
- Potentials and pitfalls of computer modeling and simulation.
- Role and potential of visualisation.
- Types of visualisation.
- History of visualisation

Chapter 9: DEVELOPMENTS in HUMAN BRAIN and MIND UNDERSTANDING and OVERPOWERING

- Deep thoughts.
- Human brain - basics concerning its structure.
- Human brain - basics concerning its functionality.
- New megaproject of EU: Human Brain Project.
- Towards new, sixth, paradigm of modern computing - 3-D molecular computing.
- How big is information processing capacity of human brains?
- Can and when computers will reach information processing potential of human brains?
- Ultimate physical limits of computation.
- Information processing and life, cells and brains.
- Reverse engineering of human brain.
- Modelling and simulation of the human brain - why can this be done?
- Pre-history of attempts to understand our own understanding.
- Building models of human brains.
- Interfacing brains and machines.
- Getting Cyborg.
- Uploading the human brain (mind).
- Consciousness and information processing.
- Human Brain Project of EU revisited - more on goals.

Chapter 10: GNR REVOLUTION AS a ROAD to SINGULARITY – Ia. G+N

- Deep thoughts.
- Three overlapping revolutions: in Genetics, Nanotechnology and Robotics (strong AI), as paving the way to Singularity.
- Genetics: the intersection of Biology and Informatics.
- Biochemical information processing systems creating, reproducing and controlling the life.
- Can we live "forever"?
- Biotechnology-driven ways to stop aging.
- Cloning technologies and their potential.

Chapter 10: GNR REVOLUTION AS a ROAD to SINGULARITY – Ib. G+N

- Nanotechnology: the intersection of Physics and Informatics
- Nanotechnology goals and tools
- History of nanotechnology.
- Drexler's ideas
- Potential of nanotechnology in biology and medicine.
- Other potentials of nanotechnologies.
- Nanobots and their potentials.

Chapter 11: GNR REVOLUTION AS a ROAD to SINGULARITY – II. R (AI)

- Robotics and Strong AI.
- Narrow AI - state of the art.
- Toolkit of narrow AI.
- From narrow to strong AI.
- Strong AI and robotics.
- Why it takes so long for AI to mature?
- Perils of genetics developments.
- Perils of nanotechnology.
- Problems with nanobots.
- Perils of strong AI and Singularity.
- Potentials of global and fine-grained relinquishment.

Chapter 12: SUPERINTELLIGENCE nd SINGULARITY - LIFE AFTER (2045) a MERGE of BIOLOGICAL and NON-BIOLOGICAL INTELLIGENCE

- Deep thoughts.
- Superintellignece and its types.
- Singularity and Singularitarians - basic views.
- Transhumanists and their muvement (H+)
- Roads to Singularity and its visions.
- Principles of Singularity.
- Basic impacts of Singularity.
- Some key elements of singularity: nanobots and virtual reality.
- Long term impacts of Singularity - saturation of the universe with AI.
- A word of caution – what can we really expect?

Chapter 10: POTENTIAL DANGERS of GNR-REVOLUTION and WAYS to MANAGE THEM

- Deep observations
- Perils of genetics developments.
- Perils of nanotechnology
- Problems with nanobots.
- Perils of Superintelligence and Singularity
- Potentials of global and fine-grained relinquishment.
- Strategies society could take to fight dangers and their impacts

Chapter 13: LONGEVITY - LIFE OVER 100 (TILL 150 or after that?) - CAN WE FIGHT DEATH? HOW (MUCH)?

- Should and could we try to fight death?
- History of the efforts to achieve longevity.
- Why is nowadays longevity on the agenda of mankind?
- Roads to longevity.
- Centenarians.
- Earth's ability to handle longer-lived humans.
- Would/can living longer mean living better?
- Family life during longevity.
- Economical and financial implications of longevity
- Religion in the age of longevity.

FUTURE - ????? - !!!!

FUTURE ???? - !!!!

CAN WE and NEED WE to anticipate the FUTURE?

CAN WE and NEED WE anticipate FUTURE?

(Especially of Informatics, ICT and mankind?)

and

Is such a question of large importance?

If yes, for whom?

IMPORTANCE of QUESTIONS

At the heart of everything is the question, not the answer.

John Archibald Wheeler (1911 - 2008)

OTHER KEY QUESTIONS - I.

- Can we beat aging? How much and when?
- Can we beat death?
- Will we have computers with information processing power million (billion) times larger than that of human brain (humans brains)?
- Will we have computers (robots) with intelligence thousand (million) time larger than that of humans?
- If no, why? If yes, what afterwards? What impacts can this have?

OTHER KEY QUESTIONS - II.

- Does mankind has good reasons to ask such questions about the future?
- Should "ordinary" people be interested in such questions?
- Should informaticians be interested in such questions?
- Are these questions about the future that is still much too far away?

OLD MEGACHALLENGES of SCIENCE?

Old megachallenge of modern science

To try to understand geniality of God and ways he designed and run this world.

20 century megachallenges:

To understand space and time and to develop Theory of everything

NEW MEGACHALLENGES

- To beat human intelligence.
- To beat natural death.

WHY WE NEED to TRY HARD to FORESEE FUTURE?

- We should all be concerned about the future because we will have to spend the rest of our lives there.

  Ch. F. Kettering, 1949
- Most of you can expected to retire at the age 80 ± 10 and quite a few of you are expected to live over 100 (up to 150??). Most of your children are expected,almost for sure, to live over 100.
- Developments in many aspects of society is no longer linear - it is already for quite a while exponential - knowledge of the past is not enough for forecasting future.

  R. Kurzweil (2006)
- Wisdom of parents is not enough for foreseeing future.

FAMOUS VIEWS of FUTURE I

- Nothing gets old as fast as the future.

  T. Grossman
- One of the biggest flaws in the common conception of future is that the future is something that happens to us, not something we create.

  Michael Anisimov
- The future ain't what it used to be.

  Jogi Berra
- The future is widely misunderstood. Our forebears expected it to be pretty much like their present, which had been pretty much like their past.

  R. Kurzweil

FAMOUS VIEWS of FUTURE II

- I have no doubts that the in reality the future will be much more surprising than anything I can imagine. My suspicious is that Universe is not only queerer than we suppose, but queerer than we can suppose.

  J. B. S. Holding (1892-1964) British evolutionary biologist
- The future enters into us in order to transform itself in us long before it happens.

  Rainer Maria Rike
- "The future cannot be predicted' is a common refrain....But, when this perspective is wrong it is profoundly wrong.

  John Smart

FAMOUS VIEWS of FUTURE III

- Change is the law of life. Those who look only to the past or presence are certain to miss the future.

  John F. Kennedy
- Any sufficiently advanced technology is undistinguishable from magic

  Arthur Ch. Clarke
- Everyone takes the limits of his own vision for the limits of the world.

  Arthur Schopenhauer
- Almost everyone has linear view of the future - namely that development in the next X years will be similar to the one during last X years.

  R. Kurzweil

FAMOUS VIEWS of FUTURE IV

- Why it is so difficult to see future? Because people in general tend to overestimate what can be achieved in short terms (because we tend to leave out of our considerations many essential details) and they tend underestimate what can be achieved in long terms (because the exponential growth is ignored).

  R. Kurzweil (2006)
- People find it easier to be the consequence of the past than the course of the future.

  R. Kurzweil (2006)

FAMOUS GOOD PREDICTIONS

- Predictions are difficult, especially about the future.

  Niels Bohr (1885-1962
- Science fiction literature - Julius Verne (1828-1905), Herbert George Wells (1866-1946), Stanislaw Lem (1921–2006), Arthur Ch. Clarke (1917-2008), Isaac Asimov (1920-1992) ...
- Science fiction movies

Science fiction predictions are good because they are stimulating by showing as to-be-possible what is not known to be impossible.

FAMOUS WRONG PREDICTIONS of LORD KELVIN (1824-1907)

- X-rays will prove to be a hoax (zlý vtip).
- Radio has no future.
- Heavier-than-air flying machines are impossible.

In science there is only physics; all the rest is stamps collecting. Ernest ruthenford (1912)
There is nothing really new to be discovered in physics now. **A follore belief at the end of 19th century of physicists.**

FAMOUS WRONG IT PREDICTIONS

1939 The problem with television is that people must sit and keep their eyes glued to the screen; the average American family hasn't time for that. *New York Times editorial*

1943 I think there is a world market for maybe five computers. Thomas Watson, 1943)

1949 Where a calculator on ENIAC is equipped with 18 000 vacuum tubes and weights 30 tons, computers in the future may have only 1000 vacuum tubes and weight no more than 1.5 tons (A visionary Popular mechanics article);

1957 I have traveled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year. (The editor in charge of business books for Prentice Hall);

1977 There is no reason anyone would want a computer in their home. (Ken Olson, president, chairman and founder of Digital Equipment Corp.);

1981 640K ought to be enough for anybody (Bill Gates)

FAMOUS WRONG or QUESTIONABLE PREDICTIONS

- Numerous The end of the world is coming predictions.
- Famous prophetess (Delphi in Greece)
  - Question of a women: What I will have, boy or girl?
  - Answer of the Oracle: Boy no girl.
  - Interpretation I: "Boy, no girl"
  - Interpretation II: "Boy no, girl"
- Astrologers, numerologists

FAMOUS CORRECT PREDICTIONS

- Cooking - receipts
- Agriculture - rules
- Astronomy - movement of celestial bodies
- Sex of a to be born child
- Impacts of atomic bombs
- Internet around 1966

WHEN THERE IS a CHANCE TO MAKE GOOD/DEEP PREDICTIONS?

- When resources for new developments start to be available.
- When a new law of nature is discovered.
- When a new powerful resource in nature is discovered.
- When a new scientific discovery is made.
- When a significantly new technological achievement is made.
- When a way is found to see local developments from a global perspectives. (For example weather forecast on the basis of photos from satellites.)

WAYS to MAKE PREDICTIONS

- Religious believes
- Astronomy (movements of celestial bodies, eclipse on the sun/moon),...
- Astrology - even Newton and other famous scientists of that time believed in astrology
- Science (laws of physics (of motion, ...); differential equations, probability and statistics, Bayesian rule, economics, finances,
- From deterministic to probabilistic predictions.

SCIENCE and PREDICTIONS

Science has two goals:

- To explain
  - To explain phenomena in its domain.
  - To explain past and presence
- To predict.
  - To predict future of phenomena and processes in its domain.
  - To predict future of mankind

ABSTRACTION (not INDUCTION) from THE PAST DEVELOPMENTS

ABSTRACTIONS from the PAST DEVELOPMENTS

THREE ERAS of MANKIND

Neolithic era: Progress was made on the basis that men learned how to make use of the potentials provided by the biological world to have **food** available in a sufficient amount and whenever needed.

Industrial era: Progress has been made on the basis that men have learned how to make use of the laws and limitations of the physical world to have **energy** available in a sufficient amount and whenever needed.

Information era: Progress is and will be made on the basis that man learns how to make use of the laws and limitations of the information world to have **information** (processing energy) available in a sufficient amount and whenever needed.

FOUR ERAS of MANKIND - VISION I

Neolithic era: Progress was made on the basis that men learned how to make use of the potentials provided by the biological world to have **food** available in a sufficient amount and whenever needed.

Industrial era: Progress has been made on the basis that men have learned how to make use of the laws and limitations of the physical world to have **energy** available in a sufficient amount and whenever needed.

Information era: Progress is and will be made on the basis that man learns how to make use of the laws and limitations of the information world to have **information** (processing energy) available in a sufficient amount and whenever needed.

Security era: Progress is and will be made on the basis that man learns how to make use of the laws and limitations of the physical and information worlds to have **security** available in a sufficient amount and whenever needed.

FOUR ERAS of MANKIND - VISION II

Neolithic era: Progress was made on the basis that men learned how to make use of the potentials provided by the biological world to have **food** available in a sufficient amount and whenever needed.

Industrial era: Progress has been made on the basis that men have learned how to make use of the laws and limitations of the physical world to have **energy** available in a sufficient amount and whenever needed.

Information era: Progress is and will be made on the basis that man learns how to make use of the laws and limitations of the information world to have **information** (processing energy) available in a sufficient amount and whenever needed.

Intelligence/knowledge era: Progress is and will be made on the basis that man learns how to make use of the laws and limitations of the physical and information worlds to have **intelligence/knowledge** available in a sufficient amount and whenever needed.

ANOTHER VIEW of HISTORY

If we try to see the development of the last three centuries we can discover, from the science and technology point of view, the following common scenarios.

19th century was mainly influenced by the first industrial revolution that had its basis in the classical mechanics discovered, formalized and developed in the 18th century.

20th century was mainly influenced by the second industrial revolution that had its basis in electrodynamics discovered, formalized and developed in the 19th century.

21th century can be expected to be mainly influenced by informatics, especially AI, discovered, formalized and developed in the 20th century.

DEVELOPMENT of VIEWS on COMPUTING

- 19th century
  Computing (information processing) is a mental process.
- 20th century
  Computing (information processing) is a machine process.
- 21th century
  Computing (information processing) are nature processes.

HOW GOOD PREDICTIONS ARE POSSIBLE?

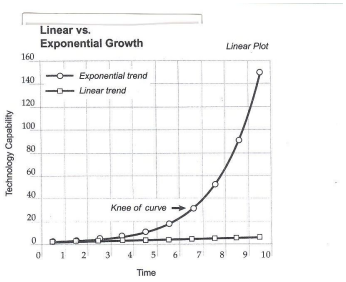
Full and detailed predictions are not always possible. However, when the past, recent and current developments are carefully analysed, and proper abstraction from that is made, quite a bit can be said for futureand with quite large reliability.

WHAT WILL the LECTURE BE ABOUT? SUMMARY

- An analysis of the recent, current and expected developments in the information and knowledge mining, storing, processing, transmission and utilization theory and technology as well as in the new, informatics-driven, methodology.
- Well scientifically and technologically grounded and imaginative speculations on the development and impacts of the information and knowledge mining, storing, processing, transmission and utilization theory and technology, as well as a new informatics-driven methodology .

WHAT ARE BASIC GROUNDS FOR for OUR EXPECTATIONS

- Technological knowledge of mankind is fast snowballing with dizzying prospect for future.
- Computers, and IPC technologies, are getting not only faster and faster they are getting faster faster (that is, the rate they are getting faster is increasing). They are not only getting better and better, they are getting faster and faster better.
- ICT performance is expected to keep growing exponentially in all important aspects.
- Tools for making better and better as well faster and faster reverse engineering of our brains also keep improving exponentially.
- Miniaturization of IPC technologies also keep improving exponentially what is expected to have enormous impact on treatment of human bodies.



Linear versus exponential: Linear growth is steady; exponential growth becomes explosive.

- Moreover, we can assume that we are nowadays only at the beginning of the rapidly fast growing exponential curves for all these improvements.
- All that is expected to have, practically for sure, enormous impacts.

A BIG CONSEQUENCE

- As a first consequence, of the increasingly faster development in ICT and AI, one should realize that the development of almost all areas of society will speed up so fast that what would need about 1000 (500) years at the current rate od development, will actually happen within next 100 (40) years.It is therefore beyond our full understanding how life will look in 30-40 years. However,...
- Since current informatics students are expected to retire at the age 80 ± 10 years, or more, you can expect that during your (working) life time you can expect what you can now hardly not only expect but also imagine.

ANOTHER FORMULATION of BIG CONSEQUENCE

Now the world is networked, and ideas are having sex with each other more promiscuously than ever, the pace of innovation will redouble and economic evolution will raise the living standard of 21st century to unimaginable heights, helping even the poorest in the world to afford to meet their desires as well as their needs.

M. Ridley, 201O

A WORD of CAUTION - impacts of the Black swan principle

History teaches us that big progress usually comes from discoveries, inventions and events nobody expects - from so-called Black Swan events.

They are events such that

- They are completely unexpected.
- They have enormous impact.
- Once they happen one can convincingly argue that we should have expected them.

How can the Black swan principle goes along with the conviction that we can foresee future concerning information-driven evolution quite a bit?

HOW MUCH CAN INFORMATICS SHAPE FUTURE of MANKIND?

- Very much and this is another point, to be discussed later, for having this lecture

APPENDIX

APPENDIX

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Ray Kurzweil I

RAY KURZWEIL II

- Ray Kurzweil is a very prominent inventor (in several fields), companies founder, science writer and a visionary in USA. He is Director of Engineering at Google.
- He received, from the US president Clinton, National medal of Technology, the highest award for technology achievements, he holds 39 US patents got, 12 honorary doctorates, wrote 5 best-sellers books, and gives in average 60 pubic lectures per year.
- In February 2011 Time magazine published about his ideas 8 pages article with title "2045 - the year man becomes immortal"
- He has been in the 5-member Advisory committee for US army for science and technology.
- He is the founder of the Singularity university, series of conferences "Singularity summit".
- Kurzweil made fortune as inventor and engineer. Recipient of 500 000 Lemensoln-MIT prize in 2001. Prominent US-magazine consider him as one of 16 revolutionaries that made America during last two centuries.
- He invented the first reading machine for the blind, first commercial text-to-speech synthesizer,....