Information Technology - a deliberate choice for progress

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1. The talkative Finn

In Europe you can buy comic cards describing the characteristic features of the inhabitants of different EU countries. Some caricatures are straight forward, like the bratwurst-loving German, some satirically point on the opposite of a national feature. The "talkative Finn" hints at the occasional shyness of a Finn, especially when expected to perform "small talk".

In contrast, Finns are very communicative. Out of a population of 5 million people already 3 million carry a mobile phone where-ever he or she goes. Among the students the mobile density is almost 100 %, which can be seen on university campuses or in the city street-life.

Finland has had a leading role in the development of wireless communication systems and networks. Based on a direct dial car phone system (ARP) the NMT standard was developed as a cooperative task between Nordic countries in the late 70ies. During the next decade a fully digitalised network was developed essentially by Finnish engineers. As the first country in the world Finland introduced the GSM telecommunication system in 1992. Now, 9 years later the analog NMT network will be shut down, which characterises the pace of change of the new technology.

2. A mentality for technology

The industrial era started in Finland during the mid-part of the 19th century. The main driving force was the supply of wood for paper-making, hence paper mills were the first large scale industrial plants at that time. However a rapidly growing population needed clothing, which boosted an early textile industry as well. In parallel mechanical engineering was developed to satisfy industry requirements on a domestic bases. Large transportation distances tempted to make use of accessible water-ways. Accordingly shipbuilding and the use of steam power became attractive. The first paddle-steamers were built in 1833.

In 1882, exactly 100 years before the NMT network was introduced, the first Finnish telephone company was founded i Helsinki by Daniel Wadén. Before that his small electrotechnical workshop had manufactured the first telephone sets. The same year electric illumination bulbs were installed in the Finlayson linen factory, electric power was generated by a newly imported Edison dynamo. Both these occasions took place only half a decade after the breakthrough inventions had been made.

During rapid development phases many inventors do not get the international recognition they are worthy of. This happened to a young Finnish diploma engineer, Erik Tigerstedt, who made two important contributions to the information and media sector in early 1900. In 1914 he filed a patent, which crucially enhanced the efficiency of the electron tube. Eventually his idea of a coaxial

arrangement of cathode, grid and anode become common praxis and has remained so until today. He also was the first to develop a working method of adding an optical sound track to moving pictures.

The potential of utilising radio engineering for meteorological purposes was early realised by professor Vilho Väisälä, who in 1931 founded a company for the manufacturing of radio sondes. The balloon-carried equipment measured temperature, air pressure, humidity and wind speed at different altitudes and relayed the information back for further processing. The company Vaisala Oy is still in business and is one of the world leaders in manufacturing automatic weather stations for remote locations.

3. The information Big Bang by the numbers

Low population density and long distances between urban areas have been one of the driving forces behind the development of wireless telecommunication in the Nordic countries. But the information revolution is not just gossiping from your car. The wireless connection is a prerequisite for an individual continuous access to global networks providing social and financial services. That's why telecommunication is a key issue in the years to come.

To the layman information technology consists of three main components, the mobile phone, the Internet and the PC (at home or at work). In a not too far away future the mobile phone will be replaced by a pocket computer. Wireless broadband technology provides a real carry-with-you Internet-connection and facilitates real-time video communication. In the broader perspective production steering, process control, remote sensoring etc. take advantage of distributed signal processing and wireless communication.

During the last decade Finland has strongly invested in the new technology. Several factors influenced this development. Partly as a result of the domestic finance and banking restructuring the recession between 1991 and 1994 was deeper than in other OECD countries. Unemployment is still high, roughly 10 %. Before the crises measures had already been taken to compensate for fading industry sectors like textile and heavy metal in favour of a more flexible, high tech oriented structure. Actually, the recession speeded up this process. A third factor was Finland's ambition to become a member of the European Union.

In 1980 the export of industrial products was dominated by wood, pulp and paper, all together 45 %. Metal industry and the rest areas represented 25 % each. The electrical and electronics (EE) industry stood for 4-5 %. In 1990 wood, paper and pulp had decreased to 39 % and the EE sector accordingly increased to 12 %. Since 1997 electronics has been one of the main pillars of Finnish export. In 1999 the partition between wood and paper, EE and metal was 30, 29 and 25 % respectively. The value of the EE sector was $ 10 billion, whereof $ 7 billion came from the telecommunication and electronics industry. During the last ten years (1990-99) the production value of this sector has increased more than five-fold, the number of employees has almost doubled, rising from 35.000 to 68.000.

Such a development would not have been possible without huge investments in R&D and basic research as well. Since the mid-eighties the R&D expenditure has increased from 1.2 % to 3.2 % of the GNP. In 1999 the expenditure was $ 3.5 billion, whereof 58 % was funded by the industry itself. A major part, 65 %, of the research funding was directed to the information technology sector.

The international management research institute IMD in Lausanne, Switzerland, annually publishes a ranking list of the economic strength of 70 industrial countries. For this purpose the institute uses 250 indicators based on statistics and surveys. According to The World Competitiveness Yearbook 1999 Finland was ranked as the third nation on the over all scoreboard, passed only by USA and Singapore. Finland received a first rank in the subclass "people" and second rank in the subclasses "research and development" and "management". Among individual indicators Finland had several "firsts", here are some examples: Connections to the Internet, mobile phones, new information technology, relocation of R&D facilities, financing resources, university and industry co-operation, educational system, university education.

4. The education challenge

The value of higher education has been recognised for a long time. This is reflected by the fact that Finland in spite of the small population has 20 universities. In addition 31 polytechnics provides college level education. The number of students enrolled in the universities is roughly 150,000. Annually 12,000 students are graduated at the Masters level, 10-15 % continue to a doctorate degree. The number of PhDs in 1999 was1165.

Organised engineering education started in Finland in 1848. Today Finland has tree universities of technology and three schools of engineering within general science universities. The total number of engineering students is 31,500, the annual intake being 4300. 2500 students take their diploma degree (MSc) every year.

According to a national IT programme the intake of students to relevant curricula (computer science, signal processing, electronics, telecommunication, electrical engineering and automation) has been increased with 1000 as compared to the 1997 intake level.

The polytechnics are not only concerned with engineering, but provide education in health care (nursing) and economics as well. The number of students enrolled in degree programmes is 60,000. The exam output is 7000 so far, but is expected to rise significantly during the next five years.

5. The information society

Up to this date everyone has been very enthusiastic about the new technology offering the convenience of e-mail, better person availability, provided her/his mobile is on, and an instant access to information via the Internet. However, we still know very little about what the impact of an all connected society will have on life in the long run. Small companies already offer a variety of services, most of which are merely satisfying our curiosity than giving added value to a professional activity. The purpose of, say, bank servicing is to handle routine matters with as little customer interference as possible. E-commerce changes the character of real world shops and marketplaces. Internet-shopping will create a variety of new distribution networks.

The biggest challenges are in business and politics, more transparency means more influence from the consumer/citizen. The stock market has already moved to the personal communicator or home-PC. This will have an impact on the dynamics of capital flow. Excess information increases complexity and the society will need novel means to sustain stability.

In medicine distant examination services and telecommunication of patient records will enhance the quality of health care. Rapid diffusion of scientific results improves the synergy between science branches, thus creating new paradigms and better understanding beneficial for the society.

Baltic Sea Award 2010

Ärade pristagare,
Herr landshövding, lagtingets talman, representanter för landskapsregeringen,
kommerserådet Anders Wiklöf
mina damer och herrar

Honored recipients of the Baltic Sea Award 2010

We are all well aware of the influence of rivers, lakes and seas for the development of a human culture. The Mediterranean Sea is often considered as the churn of the Western civilization. The famous historian Fernand Braudel has in several works described the cultures along the Mediterranean coasts and what influence the sea has had on trade and economy.

Recently an Italian physicist Felice Vinci published a wild idea namely, that the classical tales of Illia and Ulysses actually originated from Northern Europe and the Baltic Sea. He has some interesting arguments. As a result of harsh climate changes in the North refugees moved to the Mediterranean area bringing with them their own version of a high Bronze culture, some of them settling on Crete. The weather experienced by Ulysses and his crew matches the Baltic much better than the Mediterranean: storms, fogs, high seas, etc. Even some of the names of certain locations seem to fit the tale. Troy is Toija close to Salo in South-Western Finland, Dagö or Hiiumaa is the Island of Chios, Naxos the city of Neksø on Bornholm. Ithaka would be the Danish island of Lyø. However this reminds us merely of the national romantic fantasies of Olof Rudbeck in the late 17th century.

På basen av den dokumenterade historien kan vi säga att Östersjön varit ett kulturhav under tusen år. Men trovärdiga legender stöder tanken att innanhavet varit en länk för både röveri och handel mycket längre tillbaka. Härom vittnar särskilt vikingatiden. Jomsvikingarna opererade från öar i södra Östersjön. Vikingaleder gick från Sverige och Danmark mot de baltiska länderna och det östra riket Rus. Färder längs Djepr förde nordborna till Bysans, på vägen uppstod kolonien Kiev med täta kontakter till Norden. Valdemars seglingsled är också ett bevis på hur en spirande sjöfart via Åland förenade Danmark, Sverige, Finland och Estland. Leden hade även krigiska syften, Valdemar Seir brandskattade Visby och erövrade både Estland och Kurland. Senare uppstod som bekant Hansaförbundet - på gott och ont.

I länderna kring Östersjön finns det en rik flora dokument och urkunder, som anknyter till havet och dess betydelse. De berättar hur historiens vindar sväpt över vattnen, om hur kungar farit på friarfärd, och rustat till krig, då planerna inte löpt som man tänkt sig. Över 12.000 fartygsvrak har identifierats på Östersjöns botten, men man räknar med att det totala antalet ligger närmare 100 000. Östersjöns vatten har länge haft en konserverande verkan, men till följd av utsläpp och obalans mellan de olika livsformerna, har denna egenskap försämrats under senare tid.

Åland är Östersjöns polstjärna, havets gräns i norr. Läget mellan Finland och Sverige har betytt att nästan alla historiska händelser i Norden har svept över Åland och lämnat sina spår. Idag är Åland en förebild för autonoma språkområden. Innovationsandan fanns redan 1808, då man tillfälligt lyckades värja sig mot en överlägsen fiende. Men till full blomstring kom den under senare hälften av samma århundrade, då grunden lades för den åländska sjöfarten. Under senare tid har man fått skota om många gånger och hitta på nya sätt att försörja sig. Företagsamheten har varit en speciell

styrka när man värnat om kulturens bevarande. Idag visar Åland vägen för förnybar energi. Målet att med vindkraft bli självförsörjande elproducent och dessutom exportör, kommer ytterligare att stärka Ålands ställning som ett framtidsland, ett välfärdssamhälle där individen går före kortsiktiga marknadsekonomiska intressen.

Stiftelser och fonder ger ett ovärderligt stöd till forskning, kultur och förbättrande av människans livsvillkor. Till detta hör även ansvaret för naturen. Genom att belöna driftiga och målmedvetna personer kan en organisation som Östersjöfonden skapa en allmän medvetenhet om mervärdet av en havsmiljö, dess kuster och skärgårdar. Kommerserådet Anders Wiklöf har visat stor framsynthet genom att grunda fonden och donera dess grundkapital.

After almost a century being a divider the Baltic Sea has become a sea joining 10 nations in a common struggle for the well-being and quality of life of their citizens - provided we also have a concern about the quality of life of the Sea.
I will now continue by presenting the recipients.

Millennium-blog
January 2011

Engineering - crossing borders in science

Engineering is the art behind technology. It's the skill to solve problems related to domestic life and the infrastructure of a complex society. Engineering has not always been considered as a branch of science, its roots can be found in military support services such as road building and bridge construction. After the Industrial Revolution engineering was merely seen as something emerging from a dusty factory workshop. However, by the end of the 19th century it was clear that technology based manufacturing required a deeper understanding of mathematics and basic sciences. Moreover, running an industrial enterprise asked for managerial and financial skills.

In 1977 **Alfred D. Chandler**, the late professor of business history at Harvard, showed in a Pulitzer Prize winning book, The Visible Hand: The managerial revolution in American business, how investments in transportation (railroads, shipping) combined with coordination and efficient administration enhanced the formation of large companies such as Du Pont, General Motors and US Steel. Those companies were in many senses self-sufficient, raw material entered in one end and the final product rolled out in the other end. The development during the last decades has, much due to the information boom, gone in the opposite direction. The real capital lies in knowledge and the control of information flows. The use of subcontractors aims at minimizing costs and risks and refining special skills in a competitive landscape.

The cross-disciplinary character of engineering is best demonstrated by the mobile phone. After technology breakthroughs in wireless data transmission, electronic packaging and signal processing *design* and *usability* arose as the most important sales argument. Engineering has to combine with human behavior patterns, aesthetics and social trends, things that change with time and provide a continuos feedback on technology.

The cognitive mode *flow* refers to an individual experience of euphoric attention on a certain task or problem. Time is irrelevant, so are food and sleep, the mind is focused on the mission. Flying and mountaineering are often used examples. Most scientific achievements are the result of a flow-like engagement. The flow process also works collectively, after a few initial innovations a chain of actions leads to new insight and eventually new technology. This happened after **Alexander Graham Bell** made his first phone call. Information technology has proceeded like the DNA double-helix, on the one leg hardware and on the other leg software, interconnecting parts consisting of computer architecture, sophisticated software and a wide variety of new applications.

It’s paradoxical that, as the operating systems of laptops and mobile phones compete in being user friendly, the development in administration software reach new heights in complexity. Instead of being freed for intellectual tasks, people spend time on laborious office forms. Once public health raised great expectations that it could benefit from savings due to IT. The development has merely gone in the opposite direction. The potential is still there provided data systems become less reluctant to modifications or exchange. Such a development would increase competition between suppliers. Where is the “flow gear” of management software?

There are, of course, many areas, where, say, a physical phenomenon invites to new innovations, but the route to success is much thornier than in the IT case. Utilization often requires theoretical

insight and strong belief. A typical example is a century old discovery, superconductivity. In spite of promising options superconductivity has only been used for very exclusive purposes, MRI-tomography and physics research. Especially in medicine there are many problems waiting for technical solutions, eg. the artificial heart. Perhaps even more urgent are procedures to restore pancreas islets in sufferers of type 1 diabetes. Environmental issues offer a large variety of problems in need of solutions. Substitutes to fossil hydro-carbons are topping the list.

In his blog in the New York Times psychologist **Steven Pinker** argues that the new culture nurtures technology. Access to Internet, search machines and social media will not make humans stupider, but rather extend their intellectual capabilities. This is necessary in a world flooded with information. However, no matter the supply of data, creative thought and thorough reflection demand contemplation and rewiring of neural connections. Thats why education is so important and why universities should be fostered to explore the roads to new insight.

Progress in welfare and global stability is built on knowledge and innovations. Some innovations will turn into indispensable tools for the society. That's how technology emerges. Such technology declines, that appears to have less or no value for the individual. In the end the human being, her penchants and social needs determine technology directions. The Millennium Technology Prize encourages creative minds to contribute to this evolutionary process to the benefit of mankind as a whole.

Speech at Doctor h.c. dinner, 19.5.2011, Åbo Akademi

Distinguished recipients of the doctor honoris causa. It is my pleasure to salute You this evening on behalf of Åbo Akademi.

The honorary doctorate has a long tradition ranging back to 1470, when Oxford University awarded Lionel Woodville the title. Woodville would later become the bishop of Salisbury well-known for its monumental gothic cathedral.

The honorary doctorate marks the highest possible academic distinction to be offered a person. The motivation usually has a broader base than a specific scientific achievement. It can be a deeper impact on a whole discipline, but mostly it is also connected with recognized mentoring of students and international cooperation. But like important, the merits might as well relate to achievements within the society, in culture and arts, trade and industry, public administration etc.

I will try to build a metaphoric bridge between Finnish avantgarde culture and Austrian science. I hope You all can feel involved somehow.

A couple of weeks ago Mauri Antero Numminen gave a Studia Generalia lecture on his passion for Sociology. I enjoyed his presentation very much, as I myself share an interest in the subject. Perhaps we could say that sociology as the mother of all life sciences. Sociology tells how humans interact either by cooperating or fighting each other. In the bottom we have psychology. Sociology reigns in economy and business, in political systems, in religion and even in engineering. Had we educated our engineers in sociology, Nokia would probably have managed better in the international mobile and smart phone competition.

M A Numminen finished his lecture by performing one of his popular recordings from the 60ies, the introduction to Ludwig Wittgenstein's famous Tractatus. This gives me a connection to the Austrian city of Linz.

Although the third largest city of Austria, Linz may not be very familiar to many of us. However, it is a remarkable city. Among other things three Ludwigs used to live here. Ludwig van Beethoven fled Vienna due to a dispute with Goethe. He stayed at the home of his pharmacist brother Johann. Maybe the hidden agenda was some romantic feelings for his sister-in-law, Teresa. Anyway, he composed the 7. symphony while staying in Linz.

Ludwig Boltzmann spent his childhood in Linz. He was to become the scientist who changed the direction of physics research. His theory on thermodynamics influenced, among others, Albert Einstein.

The third person was Ludwig Wittgenstein, who attended primary school at Linz. Wittgenstein was one of the greatest but also most controversial philosophers of the 20th century.

I think those three great minds, the composer, the physicist and the philosopher are excellent representatives of the values cherished by the academia.

Why Linz? In 1999 I had the pleasure of participating in a university rectors group assessing the governance of Johannes Kepler University in Linz. I was especially fascinated by the faculty

structure. When the university was founded in 1966, the city fathers, chamber of commerce and other founding partners had restricted the scientific fields to three:
Faculty of social sciences, economics and business.
Faculty of Law - not more nor less.
Faculty of engineering and natural sciences.
Social science has to be interpreted largely, covering humanities, history and languages along with psychology and sociology. In my opinion the connection between economics and social sciences is very important.

In some respect Åbo Akademi has followed a similar scheme, however with a somewhat different combination of fields.

Welcome professor Serdar Sericiftci from the Johannes Kepler University of Linz. I believe you represent a great university and a city with great traditions.

Being completely outside the nomination of honorary doctors, I consider myself objective when congratulating the rector, the prefects and the whole community of Åbo Akademi for selecting excellent recipients of the highest possible academic degree. Some of You, Doctors honores causa to be promovated tomorrow, have an important influence on the society and on economic life, others work in the forefront of their respective scientific disciplines. I reckon all of You have some sort of personal link to Åbo Akademi. Your work and impact is highly appreciated. Thank You!

Please enjoy the celebration in honor of Your achievements.

Internatinal CAMURE-8 Conference, Naantali 24.5.2011

Distinguished guests
Ladies and gentlemen

The presentations at this conference have impressed me very much, maybe because my understanding of the subjects is quite shallow. I have an education in electrical engineering and have made my career in research on superconducting magnets and machines. But we share a common interest in energy and environmental research, thou. Perhaps we also have some common knowledge of thermodynamics.

In a way thermodynamics had an impact on the foundation of this city of Naantali or Nådendal in Swedish. At the beginning of the 15th century a Birgittine convent was built some kilometers inland from here, in a valley, Vallis gratie, the Valley of gratitude or mercy. However, the valley was not that merciful, moisture and poisonous gases rose from the grounds and the inhabitants of the community got ill and many died. Accordingly the ruler of that time Christoffer the Bavarian, king of Sweden-Finland, decided to move the convent to a healthier place, close to the sea. He signed the city charter in 1443.

One of the most influential scientists in thermodynamics was Ludwig Boltzman, who lived during the latter part of the 19th century and tragically committed suicide in 1906. He went to primary school in the Austrian city of Linz, but soon moved to Vienna, where he studied and made his main contributions to science. He was a popular lecturer and many of his colleges envy him. But the strongest opposition was directed towards his new theories. In those he stated that gases consisted of fastly moving particles, atoms or molecules, colliding with each other and exhibiting a statistical velocity distribution. What he actually showed was that temperature is not a fundamental variable of a thermodynamic state, but a certain distribution pattern of chaotically moving particles.

The work of Boltzmann had an impact on Max Planck, when investigating blackbody radiation. On statistical grounds Planck guessed the equation for the dependance between temperature and intensity. The equation in turn implied the quantum nature of matter. A young unknown physicist at that time, Albert Einstein, published four seminal papers. The year was 1905. One less famous paper was the PhD-thesis, wherein Einstein, based on Boltzmann's theoretical work calculated the Avogadro's number to a much higher accuracy than was done before. Also the article on Brownian motion was based on statistical mathematics.

Boltzmann gave physics a new direction, the real 20th century revolution came with relativity and quantum mechanics. Now hundred years later it seems that our understanding of the physical world again is in crises. We have not been able to unite gravity and macrocosmos with the laws of the quantum world. We are puzzled by teleportation and weird action at a distance. Even the Big Bang has been scrutinized and questioned by well-known mathematician Roger Penrose. Do we really understand matter, time, not to mention reality? I think there are really big questions out there to be solved.

Probably the request for new energy sources is one of the most urgent questions for mankind. It concerns us right now in our own life time. Although there are climate sceptics denying man caused climate change, we know that the fossil resources are limited and that a world economy based on

fossil fuels is unsustainable. We also know that a continuous accumulation of carbon dioxide in the atmosphere sooner or later will cause climate catastrophes.

The themes of this conference are of utmost importance. All forecasts say that the use of fossil fuels will increase another fifty years due to emerging economies in Asia, India and South America. Developing countries in Central America and Africa will demand their share of material well-fare as well. Sun and wind will have a bearing on distributed systems, but we still need gross production of transportable fuels for terrestrial vehicles and aviation. A hydrocarbon like petrol is one of the most effective forms of energy storage. The challenge is to develop procedures to transform biologic raw material like algae or oil plants into an energy dense fuel. We also have to change from fossil polymers to structural materials based on growing fibers.

Bertrand Russel described science as a lamp, the voltage of which we are able to increase. Higher voltage symbolizes the increase of knowledge. But as the light reaches further out into the darkness, the surface towards the darkness also increases. Perhaps we never will find a “theory of everything”, but history tells us that new knowledge means better understanding. By developing new paradigms of the physics of the smallest, we can find solutions to problems on the macro scale. Cold fusion was a flaw, but still no one has been able to prove table top fusion theoretically impossible. Maybe someday it will be possible to force hydrogen atoms to tunnel through the electrostatic threshold and sustain a slow fusion process and simultaneously produce a stream of excess energy.

Please enjoy Your stay in Finland and Nådendal.

J-T Eriksson's address at the MTP award event, June 13, 2012

Your Excellency the President of the Republic of Finland (Sauli Niinistö), Esteemed Laureates of the Millennium Technology Prize (Shinya Yamanaka, Linus Torvalds), Ladies and Gentlemen

"We can only see a short distance ahead, but we can see plenty there that needs to be done." This quotation by Alan Turing could apply to the present state of European economy, but was also true for electronics and computers in the 40ies and 50ies. This month marks the 100th anniversary of the birth of Alan Turing the man who uncovered the Enigma military code and laid the ground for information science. Both innovations nominated for the 2012 Millennium Technology Prize have a connection to information technology.

The boundary between technology and science is not always clear. Princeton professor David Billington defines technology and engineering as the making of things that did not previously exist, wheres science is the discovering of things that have long existed. I think, this is very true for the Millennium Technology Prize. According to criteria of the prize the innovation must have an impact on the quality of life and sustainability, today as well as in forthcoming days. It should also bring a substantial advantage as compared to existing technology. In the present round the International Selection Committee evaluated several precious nominations. However, after studying them in two separate meetings, the Committee unanimously agreed upon two clearly outstanding candidates.

Ladies and Gentlemen
Ants are peculiar creatures and very cooperative. If one ant finds something tempting, a worm for instance, it signals through it's pheromones to other ants the location and soon there is a trail from the new protein source to the anthill. Computer models simulating ants are able to solve very complex tasks like the traveling salesman's problem. The open source philosophy works along the same lines. The World Wide Web acts as the terrain, computer nerds are the ants. The idea of the Linux operating system was developed in one individual's head and the same person also made the fundamental innovations of the computer code before it was opened for public cultivation. We can see two reasons for recognition, a great innovation and a philanthropic ideal.

The information needed for a human being to develop from the first cleaving of a cell to an adult individual is concealed in the dna of the stem cell. Embryonic stem cells provide the most perfect set of genetic material. Beginning life, however, forms an ethical obstacle to many people. Strong efforts to find a substitute were made, but not until 2006 a group at the Kyoto University led by one of the present laureates succeeded in transforming a skin cell to a so called induced pluripotent stem cell. The bioengineering procedure behind the success was unique and required deep insight in biochemical genetics. Thanks to openness the technique rapidly initiated intensive global activity. An unlimited supply of the patient's own pluripotent stem cells offers hope of curing chronic diseases like diabetes and Alzheimer.

Alan Turing developed a thought experiment, the Turing Machine, the purpose of which was to investigate the nature of computer algorithms: can one decide whether a program will stop or continue infinitely in a closed loop. Turing concluded that you never can tell. Mark Twain, the spiritual father of Huckleberry Finn and Tom Sayer, once said, "The most interesting information comes from children, for they tell all they know and then stop".

Thank You!

Editors
Scientific American, 7.1.2013

In the October issue of the Scientific American the Editors suggest that the Nobel Prize in sciences should be opened for groups and organizations. The subject is highly relevant as scientific results increasingly are due to the work of large groups. Much of innovative thinking emerges in the social networks of the research community. Scientific team work earns recognition. Universities are ranked annually. Equivalently research institutes or groups could be assessed and given credit on a "science lead" list of, say 50. The content would most certainly be more alive than university rankings and over time accumulate global attention and prestige. Collected data offers opportunities to analyze the progress of science and better than today identify frontiers and omissions.

In contrast, however, societal trends point in the direction of iconizing individuals. Media focus on success stories - or misfortunes. In the fine arts personal skills are promoted. Even science needs its icons. The objective is to identify a mental bifurcation, a leap from one paradigm to a new insight. Such an event happens only in the brain of a single person, even thou supported by environmental influences on the contexts of individual reasoning.

The challenge in an awarding process is to track down the origin of an idea. Karolinska Institutet in Stockholm nominated John Gurdon and Shinya Yamanaka for this years Nobel Prize in Physiology or Medicine. As a first, Gurdon succeeded in cloning a viable tadpole out of a mature intestinal cell of a frog. Yamanaka evaded ethical concerns related to embryonic stem cells by developing a procedure to create induced pluripotent stem cells. The elegant decision by the Nobel committee immediately won wide acceptance.

The exclusiveness of the Nobel Prize is much due to the revolutionary progress in natural sciences during the first part of the 20th century. Quoting Swedish author Jan Guillou, "our grandparents entered the 20th century driving a horse cart, just over a half-century later man walked on the Moon". The scientific development is reflected by the Nobels. The golden age of science prizes begins with x-rays and culminates with the transistor, both closely connected to basic research and the new physics. They also have a strong bearing on human welfare and the technological development to come. Along with the Nobels one can track chains of key mentors. Giants like Ernest Rutherford, Physics Prize in 1908, personally influenced a dozen of future laureates. Mentoring has always been crucial in educating top scientists, thus underlining the value of individual impact.

Should Apollo 11 have earned NASA a Nobel Prize? Recognition was hardly a problem, the achievement in itself generated much more enthusiasm and fame than any award.

Esteemed awards, like the Nobel Prize, the Fields Medal, the Millennium Technology Prize, the Japan Prize and the Wolf Prize, are all intended for individuals. The evident goal is to encourage young people to make a scientific career - and to focus. Humans identify themselves rather with laureates than organizations.

Jarl-Thure Eriksson
Chairman, International Selection Committee
The Millennium Technology Prize
Finland

Press Seminar for British science journalists at the Finnish Embassy, London, GB 23.4.2013

From bunsen burner to brain-mapping: how to communicate science to this generation of scientists and the next.

Jarl-Thure Eriksson

Your Excellency, Ladies and gentlemen

The Swedish author Jan Guillou recently said than "our grandparents entered the 20th century in a horse cart and 70 years later man walked on the moon." Science is progressing before our eyes. We are worried about the growing generation's interest in science, but in fact young adults today are much more educated in science than they were 100 years ago.

However, there are reasons to be concerned. The instant availability of news and information feeds a mental demand of being up-dated all the time. Ambition is one of the strongest motives for achievements, fast fame seem to be offered from artistic successes as musicians or actors. Science requires patience, concentration and a real hunger for insight.

I reckon, I must have inherited an interest in natural phenomena. My father gave me a hammer on my 1-year birthday. That was an excellent tool to discover the inner structure of mundane objects, like glass bottles or the skull of my little sister, fortunately I was interrupted in time. Later, about 12-13 years old on the lunch-break at my grandparents I was browsing through a Donald Duck Magazine. Mickey Mouse was reading a book on relativity by A. Einstein, whereby Goofy came to the conclusion that Mickey must be very smart. That gave me a kind of obsession for the big questions in science.

As a graduate student I was given the opportunity to investigate superconductivity for technological purposes. Eventually we built one of the first superconducting electrical motors in the late 70ies. Later, when involved in future studies, my attention was drawn to the theory of complexity and further into the mysteries of artificial intelligence and cognitive processes. In order to penetrate the processes of living organisms and the most challenging of all, the brain functions, we have to develop a better understanding of complexity and chaotic behavior. The only tool available so far is our own brains, which by experience interpret moods from a face or social conflicts.

Penetrating the history of science and engineering is very awarding. Quite often you meet the interesting life of strange people. They have been motivated by a strong belief in an idea, but usually they had to fight the conservatism of the surroundings, even their *alma mater*. For young people these stories are adventure.

From history you can see patterns of how thinking develops. You can even see waves of progress on a national level. The French had a love for mathematics, Britons pragmatically combined science with innovations: the industrial revolution, the steam engine, etc., empirical science became very important. Michael Faraday was the true experimentalist, who's work flourished in the electro-magnetic theory by James Clerk Maxwell. During the late 19th century mathematical theory and experimental physics were combined in Germany, thereby building strong foundations for theoretical physics. German scientist Robert Bunsen (1811-1899) investigated the emission spectra

of the elements and needed a pure heat source, the Bunsen gas burner. Spectrography was to reveal the fingerprints of the quantum character of the atoms.

The historic frame is important. I enjoy reading New Scientist regularly. Although it might be boring to recapitulate Big Bang, relativity or quantum mechanics once in a while, you always hope for new insight from novel perspectives. That is why I think science writers should be professional writers as well as scientifically educated, at least educated. Especially I appreciate two talented British authors: John Gribbin for his book Science, a history, and Graham Farmelo for his Paul Dirac biography: The strangest man.

According to the PISA rankings Finland has been credited for top skills in mathematics and science. Partly this is due to a national tradition of emphasizing basic abilities, but also due to the education of well motivated teachers. You can almost rank the success in mathematics of high school students' according to the personality of their teachers. Finland supports schools and teachers with awards and national competitions.

Dear audience

The exclusiveness of the Nobel Prize is much due to the revolutionary progress in natural sciences during the first part of the 20th century. The golden age begins with x-rays and culminates with the transistor, both closely connected to basic research and the new physics. They also have a strong bearing on human welfare and the technological development to come. Along with the Nobels one can track chains of key mentors. Giants like Ernest Rutherford, Physics Prize in 1908, personally influenced a dozen of future laureates. Mentoring has always been crucial in educating top scientists, thus underlining the value of individual impact.

Technology is the connecting link between science and economy. Great Britain has recently introduced a technology prize, the Queen Elizabeth Prize for Engineering. On behalf of the Technology Academy of Finland I want to congratulate the QEPE Foundation for recognizing the whole team behind the WorldWideWeb. The Technology Academy of Finland, which administrates the Millennium Technology Prize, hopes for good cooperation. There has already been agreed upon awarding prizes alternative years.

The process of the Millennium Technology Prize is now in the phase of seeking nominations for next years laureates. We expect strong nominations from Great Britain. So far, prizes have been awarded five times, the first one to - Tim Berners Lee. The 2nd went to Shuji Nakamura, who developed the blue and white LED lights. Robert Langer developed implants dosing cures into brain tumors and Michael Grätzel invented the organic solar cells. Last year the prize was awarded to Shinya Yamanaka and Linus Torvalds for the pluripotent stem cells and the Linux operating system respectively. Yamanaka received the Nobel Prize in Physiology and Medicine later last year.

Esteemed awards, like the Nobel Prize, the Fields Medal, the Millennium Technology Prize, the Japan Prize and now the Queen Elizabeth Prize for Engineering, are all intended for individuals. The evident goal is to encourage young people to make a scientific career - and to focus. Humans want to identify themselves with successful individuals.

Speech at Doctor h.c. dinner, 22.5.2014, Åbo Akademi

Mr President (Martti Ahtisaari)
Your Excellency
Spem Doctores Lauream
Ladies and Gentlemen

It is my great pleasure to welcome You the night before the big celebration. Åbo Akademi University is honoured for having so many friends representing a wide global influence. You have all in one way or the other contributed in making Åbo Akademi a great university.

There are three universities in Finland claiming to be the legitimate hairs of the first university in Finland the Royal Academy in Åbo, founded by 13 years old Queen Kristina. We have to admit that the direct successor was Helsinki University, after the war of 1808-1809 under the new name The Imperial Alexander University of Finland. However, the academic tradition was continued in Åbo by the foundation of Åbo Akademi in 1918 and Turun Yliopisto in 1920. At the Inauguration Ceremony on July 15, 1640 the first chancellor, count Per Brahe at the time Governor-General of Finland gave a speech saying:
”… the great harm which was caused by the fact that it was not possible… for our youth, noble or common, to study the lawful sciences, since there was no academy in our country…Due to these reasons our most gracious Queen and the most respectful Council of State of Swedish realm, have given their convent to funding an academy that is, a university here in Åbo.”

The 17th century was a tumultuous era, the Thirty Years War spred disaster all over Europa. However, enlightenment was on it’s way. Descartes was one of the forerunners. He was invited to Sweden by Queen Kristina. Unfortunately the cold winter of 1650 led to the philosopher’s early death in pneumonia.

The twentieth century has equally been chaotic with two world wars, but again an era of great cultural and technological progress. The Swedish writer Jan Guillou once said that ”our grandparents entered the twentieth century driving a horse cart, roughly half a century later man walked on the moon”. An even more dramatic sociological change is going on right in front of us, something comparable with the revolution caused by Gutenberg and his printing press. It started with the transistor and the big electronic computing machines. When the first PCs and MacIntoshes came in the early 80ies we began to talk about the Information age. Then came the mobiles and laptops. Now we have smartphones and tablets. All the information of the known world is stored in cloud servers and can be reached by the internet.

Changes offered by technology have a great impact on the behaviour of individuals and on the society. You, dear guests of honor, have all addressed problems in a changing world, by creating consensus and a basis for democracy in regions of conflict or by promoting civil law or political awareness for the good of individual integrity and human rights. An envoyé possessing cultural knowledge is a bridge builder between nations.

Young people of today read news digitally and satisfy their curiosity by googling, checking Wikipedia or listening to famous scientists on YouTube. The real challenge for the university is to

combine wisdom with adventure and thrill. Also a major challenge for those educating teachers. Åbo Akademi salutes all of you involved in education and information science.

Chemistry is said to be the oldest of all sciences, it started with wine fermentation. Chemistry is one of Åbo Akademi's strongest disciplines, paper and forrest used to be main stream, now attention is focused on catalytic systems, carbon dioxide capture, biofuels and biotechnology. Medical treatment is a part of biochemistry. Pharmaceutical methods are under continuous development, drugs fight cancer, drugs help your body to heal itself. Drugs eliminate the need for surgical actions. We are honoured to have several celebrities with chemistry and pharmaceutical backgrounds among us.

Communication is not just chatting or twittering, it is making yourself understood when you speak. The production of speech in the brain is a complex process, possible only in humans. Several cortex locations are to operate in synchrony in order to activate the speech producing center. This process is easily damaged by impacts on the brain. We are grateful to have an expert on neurology and brain research among us.

In July 1640 Chancellor Brahe finished his speech by thanking everybody present for celebrating the inaugural ceremony. Therefore… I quote:
"to complete the task they are asked to go to the Castle, where on behalf of Her Royal Majesty all would be received accordingly and wined and dined." - end of quotation.

Tomorrow the festivities will culminate at a dinner with excellent wines in the same Castle as 374 years ago.

I wish you all a memorable celebration during the day to come.

Presentation of the winner Stuart Parkin at the Millennium Technology Prize Award Occasion

Jarl-Thure Eriksson

7.5.2014

President of the Republic of Finland (Sauli Niinistö)
Winner of the 2014 Millennium Technology Prize,
Your Excellences, Ladies and gentlemen

Let me take you on a spin to the world of spintronics. The Milky Way spins, the earth spins and so does the electron. As a result, electrons act as small magnets, a property very important in iron and other magnetic materials. When spinning electrons are combined with electrical conduction something interesting happens, we can control the current with a magnetic field. The electronics of spinning electrons is called spintronics.

The International Selection Committee states as follows:
“Professor Stuart Parkin is awarded the Millennium Technology Prize for his pioneering contribution to the science and application of spintronic materials, his work leading to a prodigious growth in the capacity to store digital information. Dr. Parkin's achievements ignited the ‘big data’ revolution and transformed human access to knowledge.”

The Millennium Technology Prize is awarded for innovations with an impact on the quality of life and a sustainable development influencing the lives of a large number of people. The work of Stuart Parkin is a beautiful example of an engineering process, starting from the physical phenomenon and leading to a new set of products of high societal value.

Stuart Parkin was born in the United Kingdom in 1955 and received his academic degrees from Cambridge University. In 1982 he joined the IBM San Jose Research Laboratory in the United States. In due time he was appointed Director of IBM Spintronic Science & Application Center and in parallel Consulting Professor in Applied Physics at Stanford University. Recently he has taken up the esteemed Alexander von Humboldt Professorship at the Martin Luther University of Halle-Wittenberg.

Spintronic research was pioneered by Stuart Parkin in the early 90ies, his work leading to the development of micro scale devices for magnetic information storage. Magnetic memories don’t forget, thats why they are important. Thanks to Stuart, Gigabyte memories ware installed in music devices and mobile phones and started the evolution of cloud services.

It might be bold to compare the achievements of Stuart Parkin to the invention of the transistor. But it is not far from the truth, the transistor made pocket size computers possible, spintronics gave them their memory and opened new windows to education and an open society, the best tools for security and democratic order.

Millennium Technology Prize 2016 Jarl-Thure Eriksson May 24, 2016

Mr. President, laureate of the Millennium Technology Prize 2016, Your Excellences,
Ladies and Gentlemen

The 2016 Millennium Technology Prize is awarded to Professor Frances Arnold for her pioneering contribution to the science of bioengineering. She is the originator of ”directed evolution”, a process that increases the production rate of new proteins, especially enzyme catalysts. Her method uses the power of biology and evolution to solve many important problems, replacing less efficient and harmful technologies.

The Millennium Technology Prize is Finland's tribute to innovations for a better life. It highlights the impact of science and innovation on society, encouraging the development of cutting-edge research findings into innovations. The awarded innovation has to enhance the quality of people’s lives in a sustainable manner. The International Selection Committee held its first meeting in November 2015 and then narrowed down the 79 nominees to 8. In the last February meeting the committee had a critical discussion on the final candidates and concluded jointly that there was clearly one outstanding candidate, Frances Arnold. The final decision was made by the Board of the Technology Academy Finland. The members of the International Selection Committee are in addition to myself, Jaakko Astola, Professor of Signal Processing at Tampere University of Technology; Dr. Craig Barrett, former CEO and Chairman of the Board of Intel Corporation, US; Dr. Hans-Joachim Freund, Director of the Fritz Haber Institut, Germany; Academician Riitta Hari, Director of the Brain Research unit at Aalto University; Sir Peter Knight, Senior Research Investigator at Imperial College, Great Britain; Merja Penttilä, Research Professor at VTT; Dr. Ayao Tsuge, President of the Japan Federation of Engineering Society and member of the Science Council of Japan. I want to thank the committee members for their professional contribution and excellent cooperation.

The groundbreaking work of Frances Arnold has a great impact on areas such as pharmaceuticals and medical treatment. Her method has been crucial in the development of a type 2 diabetes drug. Brain imaging can be drastically expanded by a procedure, where a certain protein binds itself to neurotransmitters and thereby offers such brain chemistry images, which are necessary in the research of degenerative brain diseases, such as the Parkinson disease, but also in the mapping of cognitive connections in different mental tasks.

Frances Arnold has from the start of her career been a pioneer in a previously male-dominated field. She was the first woman to be elected to all three US National Academies. She has been awarded the Draper Prize and the National Medal of Technology and Innovation, which was presented to her by the President of the United States, Barack Obama.

In a Los Angeles Times interview Professor Arnold stated: “Enzymes are the catalysts of life, everything made by nature is made by enzymes. Microbes such as bacteria and yeast use enzymes to make fuels from biomass,” end quotation. Directed evolution improves those enzymes to convert cellulose or other plant sugars to biofuels, industrial chemicals and new materials. The facilitation of a green chemical industry, based on renewable raw materials has been one of Arnold’s greatest goals.

Thank You!