SESSION: LIMITS TO RATIONALITY
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From: Session chairperson: Ivo Šlaus

Salient features of the contemporary world: interconnectedness, globalization and rapid changes are science generated. Quality of life and ability to cope with threats and challenges are also increased by science. "To the Age of reason we owe our prosperity, .. but also emancipation of slaves and women, the view that we are all at root the same." (Lee Smolin, Negotiating diversity, in New Scientist, July 2008). Many studies show that during the last three decades over 70% of the public considers scientific research to be beneficial, less than 15% considers it to be harmful. Similarly, public trusts scientists and physicians more than most other professions: public considers 40% of business leaders to be dishonest as well as 61% of political leaders.

Nevertheless, there is rampant pseudoscience, fundamentalism and superstition. In the New Scientist special issue of October 8, 2005 it is emphasized "After two centuries of the ascendancy, the Enlightment project is under threat....Religious movements are sweeping the globe preaching unreason, intolerance and dogma, and challenging the idea that rational, secular inquiry is the best way to understand the world."

Why - it makes no sense? It is argued that a knowledge-based society is the best approach to assure and maintain sustainable global society. Knowledge-based society depends on knowledge, a unique resource that is inexhaustible and increased by sharing and on human beings, creators and depositors of knowledge. Human intrinsic inner resources still are being underutilized. Knowledge-based society intertwines knowledge, governance and economy. However, these three have different value systems (at least on the first level), and currently the scientific method and language have been hijacked by government, politics and big business, and put in service of their values. Vested interest of governments and multinational companies intrude into scientific research (The Bayh-Dole Act facilitates this intrusion and even stimulates it, but does not assure any safeguards to protect "the soul of science" and ultimately the interest of the public and the world.) In his book "Science for sale: the perils, reward and delusion of campus capitalism" (2007) D.S. Greenberg questions what are the gains and losses of the science - mammon linkages, to whose detriment, whose benefit and will it damage the soul of science and the public and the world. Al Gore in his "Assault on Reason" (2007) argues that propaganda and PR (only a small fraction of the cost of most commercial items is related to work and material expense, advertising is a large fraction) are major threats to reason and democracy.

A complete analysis of this phenomenon is beyond this Session, and would have to include socio-economic and political aspects, demography, as well as the uncertainty, insecurity and vulnerability of the contemporary world.

The aim of this Session is to attempt to understand

- Where our rationality comes from,
- How reliable is our rationality,
- Can reason give answers to everything, and if it cannot, what are the limits of rationality,
- Rationality is an unending endeavor, as science is. (Science has no final truth, beauty yes, but no final truth - to introduce Keats).
- Rationality as well as science has been, is and will be misused and abused - what are the safeguards.

Several questions are formulated to attempt to stimulate the discussion to answer these five tasks. They are grouped, but several questions are actually relevant for more than one aim:

Group I and II

- Define: logic, rationality, thinking, doing (acting, behaving) and truth.

  i) Logic vs. thinking: Niels Bohr to a friend "You do not think, you are just being logical!"

  Logic and paradoxes, Logical systems beyond our logic: not all propositions have truth value, and different proposition can have truth values depending on the larger context in which the question is being asked. Fuzzy logic: not true or false, but "certain to some extent" taken from a "certainty-uncertainty lattice". Context driven system using data sensed from "environment" to adaptive behavior. Relation with mathematics, e.g. arithmetic with more than +, - and neutral (0).

  ii) "Few of the active processes occurring in our brains ever impinge on our awareness. We *do* most of our "thinking" without being conscious of it [H. von Helmholtz "unconscious inferences"]. Our brain (unconscious brain) is very good at taking many things into account at the same time (*how about animals - they do equally well*). Conscious reasoning is an attempt to justify a decision after we made it."(Chris Frith, New Scientists -NS, p.45). Unconscious brain cannot justify most of its actions.

- Enlightment position: We should accept opinions on the basis of reason, not authority, tradition or church. Central to this is the *belief* that the universe is a rational system (Einstein!) accessible to the detached logical inquiry and to meaningful observations and experiments. ("Meaningful" means at least reproducible, reliable and answering the formulated question.) (This is the concept of "strong rationality": "*for a proposition to be true, it has to be proved either by logic or/and empirically*". A weaker condition is relative rationality: "*proposition is true only within one's own frame of reference"*. Frames of reference are frames of values/*beliefs.* and each frame of reference is of equal validity. Evaluation of other frames of reference, even acknowledging their existence already assumes "going out of your own reference. It appears as if the relative rationality is a contradiction in itself. Relative rationality is criticized by most religions.) Observations and experiments are time dependent (e.g. universe we "saw" century ago when restricted to visible light is very different from the one we "see" now; Aristotle did do careful measurements and yet failed to come to correct conclusions). Universal unchanging principles underlie phenomena - this proposition is presently not confirmed. Dirac proposed that fundamental constants of Nature (linked also to Anthropic Principle) have changed (no experimental evidence for change), J.A. Wheeler suggested that natural laws "evolve". Does it follow that laws of logic, of rationality also evolve? Rationality should also apply to social systems, but are social system in themselves rational? There is evidence that most social systems are not rational (e.g. G. Soros on functioning of the market). Can one apply rationality to an irrational system, isn't it contradiction in itself? Is it "useful" to apply rationality to an irrational system?

- What is the aim of rationality: to know the truth or to be able to live and to have offsprings? Are humans rational decision-makes, animals that maximize gain? Positivism (A. Comte) = modern rationality (Richard Norgaard). System cannot be understood apart from our actions (Heisenberg uncertainty principle) and our values (R. Norgaard). Discuss: mind, consciousness and brain. In 1960 E. Wigner wrote a paper "The unreasonable effectiveness of mathematics in natural sciences" arguing that "mathematics is enormously useful bordering on the mysterious. There is no rational explanation for it." However, we count, we measure and use basic logic and all these activities are what the universe "teaches us". Our development, including logic, mathematics and rationality are results of the evolution selecting those of our ancestors who were "consistent" with the universe. Therefore, usefulness of mathematics (and logic) is a product of evolution. "By natural selection our mind has adapted itself to the condition of the external world ." (H. Poincare). If our brain (mind?) is the product of evolution designed to survive and to have offsprings, is it reliable to answer questions such as "Why there is something rather than nothing?" (Quantum physics has shown that "nothing" is filled, bubbling with particle-antiparticle created and annihilated. The dance of quantum particles "contributes" to the dark

energy that drives the universe apart, but this "nothing" (vacuum) has more energy - 10^{120} times too large - to fit (not necessarily explain) cosmological observations. Including supersymmetry (still an open question) would reduce this to 10^{60}. Explanation will require a paradigmatic change. Actually, each paradigmatic change (Th.Kuhn's language) is a discontinuity in a rational process.

- Proof is a model of rationality. However, after a specific issue is proved - it is closed, dead? Keith Tyson (artist) wrote "Reason excludes creativity and intuition". It excludes also freedom! "The art has the advantage over science that its methodology can be tumbling and contradictory." (KT, NS, p.47).

- Aristotle wrote that all men by nature have a desire to know: "Sapere aude!" (Dare to know). Where this desire comes from? Is this the same as curiosity, an inherent feature of human nature, as written by A. Toynbee, why are we curious? Is our curiosity beneficial for our evolution? Without curiosity we will still be in Stone Age, but do we need rationality, knowledge? Are we more creative than evolution requires?

Group III and IV

- History is not linear, not deterministic, not predictable (R. Norgaard) - each of these statements represents a different level (i.e. it can be nonlinear and still predictable). Ponder on differences between determinism and causality! Connection between causality and time. F.M. Dostoyevsky wrote in "Brothers Karamazovs" "If everything on Earth were rational, nothing would happen." compare with a century earlier thought of R. Boskovic "If everything would be fully determined, there is no need for time." Time is one of the most difficult problems in philosophy, and it is connected with rationality. Newtonian concept of time is known to be inadequate. Future is made of expected (predicted) and unexpected events. Soedjatmoko (former rector of UNU) said "Future is ethical category, since we choose it." Greeks and Romans had Chronos and Kairos. "Time is creation, or nothing" (H. Bergson).

- History of science shows that science does not proceed only rationally. Rationality is just one method - not always and not necessarily the best one. Gödel's theorem: there are truths beyond proof. Roger Penrose "Reason destroys itself" (NS, p.49) Science is not dogma. Science teaches us self-confidence and modesty. Frequently scientists become arrogant, as when they call their views "Standard model" or "Theory of everything". This is just jargon, and scientists quickly learn that the reality (truth??) is more complex: from standard theory to 73% of unknown dark energy and 23% of unknown dark matter and only 4% of actual matter (that Standard model is capable of addressing only 4%). Science is an unfinished endeavor. Science gives no final answers! Do various "end of history", "end of faith", "end of politics", "end of science" have any meaning?

- What does it mean "to be reasonable"? R. Williams, archbishop of Canterbury (NS, p. 44.) wrote that "being reasonable meant being aware where you belong in the cosmos...- "singing in tune". (My comment: *Then scientific research, except incremental research, is "unreasonable", since paradigmatic changes always transcend "singing in tune". However, "singing in tune" is one crucially important "tool" for our evolutionary development - role of social dimension.*) From the 16th century reason came to be seen as opposed to tradition and authority, ...but... we need to pause before we assume that instrumental reason will answer all the questions about how to shape a moral and humane world." Reason and values should be the product of evolution, and therefore, not in conflict. Enlightment: progressive thought in the 18th century was far in advance if the social and political realities of the time." (*Isn't it always??*). A.C. Grayling, NS, p.42).

- A broad spectrum contains: rationality, ideology, faith, irrationality, chaotic irrationality, ... (*what else?*) Where is intuition? Human actions may be associated and stimulated by any of the above, or they can be reflexes, actions based on tacit knowledge (argued by M. Polanyi), and actions described in 1)ii). The ongoing project (A.C. Grayling, NS 5 April 2008) "Explaining religion" (EXREL) bringing together biology, psychology, anthropology and history is discussing various

theories about religiosity and the current leader appears to be that religiosity exists because of the way that human cognitive architecture functions?

- Is reason another faith? (M. Midgley, NS p. 50) Limits to science: should we know all we can? Should we do all we can? Eugenics (F. Galton). Inherent in human nature (see Aristotle) is to ask all, any questions. John Donne warned us centuries ago "He that seeks proffer for every mystery of Religion shall meet with much darkness." Science (rationality) and religion can interact according to Ian Barbour in four ways: to be in conflict, in dialogue, to be independent and to integrate. S.J. Gould argued for non-overlapping magisteria (noma), i.e. independence and dialogue. John Paul II favored integration with dialogue (Religion and science are two wings of a human spirit).

- Rationality and common sense. Theory of relativity and quantum physics taught us the limits of common sense. Is common sense that segment of rationality that is caused by evolution? Do humans have another part of rationality? Where it came from? Can we ask the unthinkable? In military defense strategy of the so called 3rd generation warfare plans are prepared for unthinkable strategies, an unthinkable attack.

Group V

- Is blind *faith* in reason dangerous? "The most destructive and dangerous of all religions is the newfound faith in the power of reason and the perfectibility of man." wrote F.M. Dostoyevsky in his "Notes from Underground" and in "Crime and Punishment". The great inquisitor in "Brothers Karamazovs" said that three forces capable of enslaving the conscience of these weak rebels in the interest of their own happiness are miracle, mystery and authority. Is science, is rationality guilty of creating a perception that it is in command of all of these three: miracle - great achievements of our science-generated technology, mystery (dark energy) and authority (only rationality).

- History of scientific research is a glorious story - possibly the only one deserving the use of the word "progress". However, it is not straight, it is full of mistakes, wrong turns. Intuition, discrete leaps of faith, but also of unjustified beliefs and of prejudices are common in scientific endeavor (Einstein's "prejudices" caused him to reject the probabilistic interpretation of quantum physics, and even intruded in his Theory of relativity.) Significant progress in scientific research was made when instead of asking general questions specific "small" questions were asked, leading to specialization and to scientific disciplines, which was reinforced by economic development, notably Industrial revolution requiring Taylorian subspecializations. This led to a definition of an "expert as a person knowing more and more about less and less and finally knowing everything about nothing. " A malignant version was expressed at a recent meeting of chief executive offices and generals where one of them boasted that he has a group of excellent, intelligent experts who do not think. How spread out is this phenomenon - intelligent experts who limit themselves to a narrow field of their expertise, and leave a decision-making to others? On the other hand, can these experts at their current level of education act beyond their narrow domain? Hardly *act*, but everybody has a duty to be concerned and should (??) *interfere*.

- Based on the priority of human mind Pythagoras advocated "the city of the wise", and Plato wrote about philosopher-king. Vladimir I. Vernadsky (1863 – 1945) and Pierre Teilhard de Chardin (1881-1955) introduced the concept of collective consciousness - noosphere. Noocracy is the rule of the wise. Several concepts require comparative scrutiny: rational decision-making, knowledge-based society and noosphere.

- Rationality involves language and communication. However, meaning of words changes in time and changes depending on the context. It is pointed out that politics and business

hijacked “scientific, rational language” thereby changing the perception, possibly the meaning of certain terms. Presently, there are 5-10,000 different languages and different cultures. Cultures do interact, merge, divide, and some of us “belong” to more than one culture.

- To act, or not to act - this is the question now! Climate change now, and tobacco decades ago. As emphasized, no scientific conclusion is a dogma, and can and will be improved. This was abused by the tobacco industry and it is now abused by politicians and oil business. The opposite position: do as soon as you can do led to the use of x-ray machine in shoe shops and to overuse of x-rays in dentistry. Humans desire certainty and they conceive uncertainty as insecurity and vulnerability. Maybe it would help if we realize that on a deeper level we exist because of quantum physics which is based on uncertainty. In the enormous potentialities of the world is our freedom based, and our freedom is related to uncertainty. Many problems are emerging: manipulation of our opinions for better or worse - those fishermen of human souls. Suppression of doubt and enforcement of strict obedience. Creation of perception that all rational inquiry is serving some hidden interest. Are human beings responsible and guilty if they persevere in business-as-usual and/or do nothing? B. Pascal wrote “We think not only by our brain, but also by our heart. “ “Humankind cannot live by rational thoughts alone” is written in the Editorial, NS, 10-Nov 2007. Human beings are rational beings and have free will. By birth we have rights - human rights. Through our rationality and free will we have responsibilities. Not acting when we should is irresponsible, and we are responsible for our actions. Rationality helps us to decide when to act and to minimize possible errors.