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The Importance and Contribution of Cybernetics for the Contemporary Information Society

Reflection on the Anniversary of the Founder of Cybernetics Norbert Wiener (*1894 – †1964)

November 2004 will be the 110th anniversary of the birth and the 40th anniversary of the death of the founder of cybernetics, Professor Norbert Wiener. He was born in Columbia, Missouri, US, as the son of Leo Wiener. His father was of a Russian descent and worked as a professor of Slavic languages and literature at the Harvard University. Norbert Wiener was a gifted child and at the age of fourteen, in 1909, he graduated from the Tufts University. He studied mathematics at Bertrand Russel at the Cambridge University and later at David Hilbert in Göttingen. From 1919 he lectured at the Massachusetts Institute of Technology where he became an associate professor at the age of 25. Here he was also appointed a professor in 1931 and with a few short interruptions he worked here until his death in March 1964 when he was struck with a repeated heart attack while visiting Stockholm on business.

His work is described in biographic works:

Ex-Prodigy: My Childhood and Youth (1953) *I Am a Mathematician* (1956)

Specialised works on cybernetics:

Cybernetics or Control and Communication in the Animal and the Machine (1948)

Extrapolation, Interpolation and Smoothing of Stationary Time Series with Engineering Applications (1949)

The Human Use of Human Beings – Cybernetics and Society (1956)

Differential Space, Quantum Systems and Prediction – co-authors A. Siegel, B. Rankin, and W. T. Martin (1966)

His biographies record about 300 expert articles published in various science magazines. Martin Seymour-Smith included his best-known work *Cybernetics* in the Most Influential Books Ever Written (London, Citadel Press, 1998); where next to books such as the Bible it had and still has its great importance.

The foundation of cybernetics showed and supported the importance of team work when tackling interdisciplinary issues. It was documented what enables the work of such a team, apart from motivation to cooperate in an efficient fashion and own professional competence: it is the ability to apply a systematic approach and the capacity of the scientific team members to communicate with each other.

Cybernetics postulated the systematic approach as one of the basic conditions for further scientific research. The fact that a system is more than a mere group of elements explains how intelligent behaviour emerges in complex systems and how such systems can be researched or even created purposefully. In relation to the systematic approach, the broad possibilities of using models and simulations in the analysis and designing of complex systems were pointed out.

Cybernetics described the general rules of control and proved that these rules apply both on living organism and on technical equipment. It generalised the principles of feedback and explained the necessity of negative feedback for the regulation, controllability and stability. The explanation of target behaviour of complex systems was a contribution of equal importance.

Cybernetics precisely defined the term "information" which until then had been perceived rather intuitively, it suggested the way of measuring information and explained the importance of information and communication for the control. Besides this it laid the foundations for addressing many other practical problems associated with the transmission of

messages, coding of messages, permeability of communication channels, the necessary level of redundance for the protection of transmission against undesired noise, etc.

Technical cybernetics laid the foundations for the construction of digital computers and their control via binary programmes and a whole range of other complex devices, such as industrial as well as non-industrial robots and various programmes in the area of artificial intelligence. Last but not least, the results of cybernetics supported the origin and further development in robotics, both in terms of industrial robots and humanoid robots with artificial intelligence elements.

Especially in early 1980s individual disciplines of cybernetics (computers and their programming, transmission of messages, artificial intelligence disciplines, system theory, game theory, theory of automatic regulation and regulators, automation, industrial robotics, etc.) began to detach from one another and specialise while addressing their own specific issues (for example, the contemporary society knows very little about cybernetics and certainly people cannot see a link between cybernetics and the very popular personal computers).

The above-mentioned trend can be documented by the approach to the issues of controlling companies and economic, social, political and other phenomena in the contemporary human society. Even though Professor Wiener, in his book *Cybernetics and Society* pointed out to the importance of cybernetics in controlling a system as complex as the human society, today cybernetics is a science nourished by a limited number of scientists in the world, mostly oriented at technical disciplines. It certainly has not become a generally known paradigm for the approach to control processes that the human society needs to master nowadays. It seems that it is for the harm of the human society that frequently likes to call itself the "information society". Chaos and a number of negative phenomena do exist in the present society as the result of mistakes in control that we make while addressing topical serious problems, global as well as local. But practical implementation of the principles of cybernetics and the use of the theory of cybernetics in controlling all areas of the society can contribute to the sustainable development of the life on Earth in the future.

It appears that the possible renaissance of cybernetics could be associated with the fact that the application of cybernetics will mean a significant contribution to our society. Then, at last, it would become the focal point not only for the general public but also the mass media that has been omitting it unconditionally recently.

The position of cybernetics can improve if experts in this field focus on answering questions, which in the future will help the society in tackling some of its important problems. Without trying to make an exhaustive list and without setting priorities we can provide the following topical problem areas:

- Control in unstable or turbulent environment
- Control in situations where the control target suddenly changes radically
- Control of multiparametric systems, their modelling and simulation
- Control where the target and control algorithm are not clearly defined (fuzzy control)
- Control where significant time delay affects the regulation loop
- Methodology and evaluation of the value and use of information

The application of homeostasis on the present global market and regional markets could provide a more convincing and scientific answer to the actual possibilities of the market self-regulation and the finding of a balance. The same applies to the environmental balance of our planet. If the society wishes to survive the third millennium successfully, among other things it has to know how to control its evolution the surrounding world efficiently. In both cases cybernetics can provide an efficient tool to support the control. Let us view the further development of cybernetics as a commitment to the legacy of the life and work of Professor Norbert Wiener.

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