ON THE LINK BETWEEN TECHNOLOGICAL SCIENCES AND PHILOSOPHY

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In our times the birth of novel sciences and the extension or reduction, differentiation and integration of old ones and the intensified dynamics of the unity and variety of sciences question the classification of sciences that has been used up to now and even the principle of possibility and justification of classification. Although attempts to classify sciences are as old as science itself, we cannot find any basis for judging the relationship interesting us either in the co-ordinate, or in the hierarchical and subordinate models. Of course, philosophy was included in all types of classification, but technological sciences — perhaps because of their late appearance — have not taken the right place corresponding to their importance in the system of sciences. Although A. Comte revealed and followed with attention the so called "applied sciences", but since he considered them secondary he dealt only with the classification of primary "theoretical" sciences. (His idea was developed further by W. Ostwald.)

Even now it is usual to subordinate technological sciences to "pure sciences". This is at least an anachronism with regard to the highly increased importance of that group of sciences since the beginning of the scientific-technical revolution (the 50's of our century).

There was an academic debate on this topic in Hungary in 1954 and among technicians a conception had been formed by this time, according to which technological sciences do not reflect any object given in nature, but they reflect the secondary, man-made form of objective reality. But still the technological disciplines are often interpreted as applications of natural sciences. (E.g. by Lukács György and Fogarasi Béla.) Modern classifications of sciences aiming at completeness are often lost in details and finally they do not give any basis for the judgement of interactions between groups of sciences. Limiting ourselves to one aspect of classification, namely to a classification according to the object investigated by them, we get the following four groups of sciences:

1. Philosophical sciences (Ph)
2. Natural sciences (N)
3. Social sciences (S)
4. Technological sciences (T)

Simplifying the real relations and thinking of the logical and not of the real spatial classification, we can imagine the successive situations of the four science-groups as follows:

"Ph" is directly adjacent to "N" and "S", and "N" to "Ph" and "T", and vice versa, as well as "S" to "Ph" and "T". Today this is so much obvious that almost everybody recognizes the existence of philosophical problems in natural sciences (particularly in the so-called theoretical natural sciences) and in social sciences, that both natural and social sciences have inputs and outputs towards technology.

The next "neighbours" of technical sciences are, however, natural sciences and social sciences — rather than philosophy. It seems that philosophy can be related to technological sciences only through natural or social sciences. This is incontestably the most characteristic but not their only way of communication. The mechanism of interaction between the two scientific spheres is rather complicated. One part of the philosophical problems of technology comes from the direct* challenges of technical progress towards philosophy, and the other part arises in the boundary zone of T + N, or T + S, as they get from technological sciences into philosophy and back to technological sciences with the intermediation of natural or social sciences.

(Perhaps it is not unneccessary to mark out our stand-point between two extremes. Among experts of technological sciences a positivistic-like indifference towards philosophy can often **be o**bserved, as well as its reflection in philosophy: the neglection of the philosophical problems of technology. Both parties disclaim competence of philosophy in that sphere. Its background among others is the real difference existing between the structures of engineering and philosophical thinking. M. Maruyama explains this kind of non-understanding by different paradigms.**

The other one-sidedness with opposite sign is the vulgarization of the relation between philosophy and the special sciences. Here philosophy is considered as a method directly suitable for the solution of concrete production (and within it technical) problems. Such mistakes can be encountered in some contributions of engineer-researchers seeking for the possibilities to apply philosophy to practice and in didactic arguments aiming at proving the "usefulness" of philosophy, but disregarding the qualitative differences of technological and philosophical approaches.

Consider an example of *primary boundary problems*. The general definition of the subject of technological sciences is a significantly philosophical problem. That is: our conception on the subject of a special discipline depends on the

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* Of course it too, exists in social media because both technology and philosophy are social phenomena.
** Paradigmatology and its application to cross-disciplinary, cross-professional and cross-cultural communications. Chicago, 1973.

interpretation of object–subject, theory and practice, purpose and means, necessity and human activity, and other philosophical categories. Even the simplest definition of subject of technological sciences requires the use of several elements of dialectical materialistic ontology and epistemology, Marxist social philosophy, dialectical logics etc. Thus the *subject of technics* is the following: iterative, general, essential and neccessary features of planning, creation and operation of systems consisting of natural and artificial factors, and used as means of purposeful human activity.

The definition of the subjects of technological sciences contributes to the interpretation of their place occupied in the cognition and modification of the World, to the interpretation of the interrelations of the particular and general methods of technical-scientific cognition, and helps to understand the sources and values of technical knowledge. There are also questions, raised by technological sciences *directly* to philosophy. Of course no philosophical solutions can replace the requirement that any technological science (e.g. chemical technology, sanitary engineering, textile-technology, etc.) defines its own subject.

The task of philosophy is to discover the general common aspects in the precesses of technical and engineering cognition. A special theory of technical knowledge has to be worked out, but the general rules of cognition and especially of scientific cognition can be referred to technological sciences by deduction. Young technological sciences are going to exceed the empirical level that has characterized them up to now.

The fact that recently the technological sciences appear as direct productive forces is frequently absolutized by earthbound practicism.* If we break with the fallacy that natural sciences alone give theory and technological sciences give only practice, then becomes evident that technological sciences are divided into *basic* researches, *applied* and *developing* researches, and for harmonization of these parts on a scientific-political and science-organizing level there is a requirement not only for material means, but for right intuition and principles, too, that can only be derived from the scientific philosophy of our era.

Let us consider the *secondary relations* of philosophy to the engineering sciences.

Problems of technological sciences, as for example the application of mathematical methods, the fitting of technical knowledge into the up-to-date model of the universe are usually transformed into philosophical problems *through natural sciences*. Several "existence problems" of our days go from philosophy, *through social conditions or social sciences*, into technological sciences which until quite recently have been disregarding the human aspects of technology.

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* But a significant part of the economical $R + D$ investments of our country (Hungary) is given to theoretical technical basic-research.

The scientific-technical revolution sets, however, new task for the technological sciences in this field, too. The effect of technical development on human work is also a phenomenon belonging to the sphere of philosophy. The more the production exceeds the use of simple mechanical movements, the less we can count on an unambiguous causal concatenation of natural necessities in the teleological arguments of human activity. The feature of natural laws transformed into technical ones in production is the multiplicity of alternatives and intersecting tendencies.

The role of man is not diminishing but increasing in automated production processes, as the more complicated a production process is, the more integration is required, and this demands the control equipment to have a link, which is universal, absolutely flexible and able to decide in all circumstances. Therefore we have to begin with the psychical, social and moral personality of man in the course of technical planning and it requires to exceed the engineering attitude.

The definition of the social role and function of technological sciences is also a matter of philosophical attitude. The future of man greatly depends on the purpose of utilizing technology (N. Semionov.)* The task of technological sciences is to work out technical solutions, which divert the dangers threatening the biological existence, body and mentality of man, but philosophy can influence politics to use the achievements of engineering for humane purposes, and philosophy (the Marxist philosophy) gives an ideological basis for the struggle to create social conditions suitable for these goals.

We could continue with a number of examples. The problem of development of technological sciences arises: how and how long can these sciences develop and what does their development today consist of? Our methodological aid is the Marxist—Leninist concept of development partly conserving, partly cancelling Hegel's conception: development can be described with the spiral of the negation of negation (with the concepts of progression-regression, change and survival, unity and struggle of contradictions). This method can convert the history of technological sciences into a kind of science, whose results help in solving our present problems. The history of technology is a rich source of Marxist philosophy. As it is well known, Lenin** stated that to improve Hegel's and Marx's dialectics, philosophy has to analyse the history of human thinking, science and technology.

The philosophical study of technology and engineering sciences is also justified by the following:

* In a report published in La Pensée (1961, jul.—aug.) N. Semionov Soviet scientist, Nobel prize winner stated: "Modern science and technics open enormous perspectives to satisfy the basic material demands of every inhabitant of the World. The realization of this great humanistic task is restrained neither by scientific technical possibilities, nor by the lack of labour and resources, but by the imperfect social system."
** Lenin's Philosophical Papers.

The structural and development laws of sciences have been studied by methods of philosophy over centuries (from F. Bacon to Fichte). The later developed "science theory" and following the "science of science" have synthetized the general findings of science-logics, science-history, science-economics, science-psychology, science-ethics, and other sections (D. Solla de Price). However science-logics considers the theoretical natural sciences as the ideal type of science; it usually keeps track of physics, and speaking of the general laws of science it exhibits complete uncertainty in this respect, whether its statements apply to technological sciences* (or perhaps to social sciences).

Recently the opinion has gained acceptance that the self-reflection of science has to be completed with the general theory of technology and technological sciences. The new scientific trend, called "tekhnikovedenie" in Russian** following the pattern of "naukovedenie" (science of science) could deal with the whole of "tekhnosystema". All over the world there is a demand for "technometrics" (see econometrics) which as an exact special discipline could be the empirical basis for theoretical and philosophical generalizations with the elaboration and measurement of the quantitative indices of technical development.

A general theoretical and methodological study of technological sciences cannot replace the study of the philosophical problems of technology within the "*science of technology*", or other similar discipline. On the contrary, this new research field applies a complex approach, that demands the combination of various particular methods, moreover it is the synthetization of special results of research. For this reason only the scientific philosophy of our age can give an organizing principle and a comprehensive framework.

Without philosophical generalization the study of technology and technological sciences is a chaotic mass of facts, making impossible every realistic orientation and favouring manipulative forecasts aimed at breaking with human endeavours.

Summary

The technological sciences are considered as an independent field within the classification of sciences. There are direct and indirect interconnections between philosophy and technics. It is argued that philosophical caategories can help to define the subject of technological sciences, to discover the rules of engineering cognition. Recently a lot of philosophical problems have come from direct challenges of technical-scientific progress towards philosophy. The future of mankind greatly depends on the purpose of utilizing technology, therefore a main task of philosophy is to study the development of technology and its consequences.

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* For instance, at the 15th World Congress of Philosophy such an uncertainty appeared in some reports in the section "Structures and methods of the present science".
** E. g. several participants used this expression at the Symposium of the International Co-operation in History of Technology Committee, held in Kaluga (Soviet Union) in 1976.