EXACT SCIENCES AND THE PROBLEM OF INTEGRAL UNDERSTANDING OF THE SOCIAL REALITY

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It is argued whether the concepts and methods of exact sciences are completely unsuitable for integral understanding the social reality. These concepts and methods can only be used for modelling social processes, whereas the modelling can start only after the social phenomenon has been understood by the common sense, philosophy and historical research. Therefore the integral understanding of the social reality in all its complexity and diversity remains the task of social scientists themselves. What is needed is the co-operation between exact and historical sciences, and not the attempt to replace one by the other.

Keywords: *exact sciences, historical sciences, social reality, self-organisation, autopoietic systems.*

Introduction

According to my conception all the exact sciences are the idealised physics-like sciences (since Galileo) (see Chalmers 1992; Vihalemm 1995a, 1995b, 1999). Rein Vihalemm has said that *in the philosophy of science* the *science* can be treated as a kind of theoretical (or idealised) object that results from physics (starting from Galileo). The etalon of science is the mathematical physics. The mathematics in physics serves the task of formulation of general quantitative laws that physics uses for explaining and predicting phenomena. Therefore the physical-mathematical sciences can

be treated as the exact sciences. The historical sciences (so to say, non-exact sciences) are all the other sciences from chemistry (partly) and biology (in the most part) to many social researches and to all humanities. The exact sciences use mostly the language of mathematics, but may partly use also the natural language. Mathematics in the exact sciences is primary. The historical sciences use (mostly) the natural language, whereas the symbols are used only in a small part.

The methods used in exact sciences (mechanics, quantum mechanics, relativity theories, cybernetics and cybernetics-like theories, etc.) have been most successful primarily from

the point of view of creating technology, though their direct aim being the cognition of nature through mathematics and experiment or observation (which is a quasi-experiment). The construction of technology is subject to a practically complete control of human consciousness. Many social scientists, too, have been interested in the perspective of total human control but with respect to society. Ever since their emergence three centuries ago, the reputation of exact sciences has been high; consequently, there are no sciences today – including social sciences – which do not, at least to some extent, use exact scientific methods. In search for the understanding of society, many social sciences (probably the majority) rest in one way or another upon clearly defined mathematical means, empirical observation and measurement. Up to now society's development has often been pictured in the manner that when society leaders influence "the right thing", a state can be reached where the development of society as a whole leads to some optimal condition. But do the expectations to apply *exact* scientific concepts and methods for the understanding of human systems have any reasonable foundations at all? The answer, as I shall try to show next, is no. The above-mentioned expectations would be justified only, if the *ceteris paribus* conditions were satisfied in reality. But they are not.

Methods of exact sciences and social life

The exact scientific approach enables to *predict* or *explain* (via mathematical logic) the behaviour of *idealised* objects in conditions that are fixed by scientific theories. The exact

scientific approach enables, to some extent, to control and reshape nature with higher clarity than common consciousness. This might lead (and has already led some researchers) to the conception that the only correct way to cognise society is to observe and measure what the societies are up to at the moment. The representatives of exact sciences are interested only in the "how?"- question (by what *laws, rules, programs, algorithms,* etc.?). The social scientists, however, must start from the "why?"- question. The "why?"-question must be understood in an Aristotelian way, i. e. as the inseparable unity of material, formal, efficient and final causes. The "why?"-question consists of four questions: "What is it made of?", "What is it?", "What was the source of change to it?", "What is it for?"[1]. As the exact scientific approach aims at fixing the universal quantitative (mathematically formulated) laws, the way people themselves think of society or *why* they act accordingly, i. e. people's personal motives and *values*, are not considered important. In this approach, the human being is also treated like an object constructed by a researcher's project; therefore, during the research process, there is no fundamental difference between a human being and an object researched by exact sciences. Exact sciences analyse relations between idealised objects, but in the society, the relations between human beings (as well as human beings and na-

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[1] This unity of causes may be interpreted as a philosophical concept of self-organisation (grasping both the process (without organiser!) and its result). The first three causes may be interpreted as a philosophical concept of organisation (involving the organiser, the process and its result). (See, e. g., Näpinen 1983a, 1990, 1993, 1994, 1998; Vihalemm 1981: 135–141; 2001.) On the philosophical concepts of organisation and self-organisation I have written in (Näpinen 1983a, 1993).

tural phenomena), that social sciences deal with, are more important. Furthermore, a social scientist has to study also people's own conceptions about how and *why* people act the way they do. Researchers have often tried to conceive a theory of the corresponding society merely on the basis of a social scientist's conception. Conceptions of people of the corresponding time and place have been ignored. Social sciences, unlike exact sciences, however, cannot in principle be non-historical, i. e. based on the *mathematical project* leading to idealisations. The historical approach, based on *analogies*, is *classifying* and *qualitatively descriptive*, since this approach deals with phenomena that contain unique events and cannot be reduced to regularities. There is no need to try to create a new theory in order to understand unique events; instead it is necessary to try to reconstruct the popular concepts that have dominated and still dominate the corresponding society, and to evaluate them. A social scientist has to unravel the questions *why* people act the way they do with respect to each other, *why* they co-operate, what affects their *choices* and how these choices develop into certain complete events.

For scientists following Newton's ideas, the world was in principle (from the point of view of omniscient God) totally determinable. The uncertainty hitherto existing was connected merely with temporary narrowness of mind and limited means of calculation, which the further development of science and technology had to overcome. The world studied in classical physics and in classical exact sciences in general was reduced to an automaton that follows, without deviations, the program that has been inserted into it; in principle nothing new could happen in this world. It was

the abstract, *non*-historical reality. Human and social life, however, primarily represents the emergence of novelties, while society, unlike nature, renews considerably even during one generation.

In cybernetics (that can be considered, in a certain sense, a typical representative of classical exact sciences) as well as in synergetics the objective processes are modelled in order to control them[2]. The cybernetic models make it possible for a man to strive for desirable results using the *program* created by himself. The synergetic models take into account that the program forms in the course of self-organisation. However, both the cybernetics and synergetics are exact sciences (though the latter, especially in Ilya Prigogine's theoretical works, for the first time in exact sciences clearly takes into account the *history* of systems and their *self-organisation*, being therefore a *non*-classical exact science (Näpinen 1983b)). It must be stressed that in exact sciences the approach to the interaction between organisation (management) and self-organisation does not go (and due to the specificity of exact sciences must not go) farther from certain boundaries. The limits mean that exact sciences in their models of influence upon self-organisation give only such recommendations according to which the future state of an object of management is given from the *outside*. *Exact sciences do not make any contribution to the opening of the creative potential of the*

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[2] I have been following and analysing philosophically the synergetics as the theories of self-organisation (mainly the ideas of Ilya Prigogine) for a couple of decades already. (See, e. g., Näpinen 1982, 1983a, 1983b, 1989, 1990, 1993, 1994, 1997, 1998, 2001a, 2001b, 2002; Näpinen and Müürsepp 2002; Vihalemm and Näpinen 1986, 1987.) Cybernetic and synergetic modelling I have compared in (Näpinen 1993).

elements of the system. In the social systems it is the creative possibilities of the elements (i. e. of the human individuals), that appear to be determining (Näpinen 1993: 387). Exact sciences do not teach every man, but the governments. The latter do not necessarily think about the welfare of "every" man. Moreover, not every man wants to follow blindly the directions of the power. Human beings are not similar to computers: they are not totally rational. (For example, the theories of microeconomics treat the humans as completely rational beings and are therefore not realistic.)

The society is (must be) primarily a system for realisation of humans' qualities. The social processes, involving the possibilities for free individual choices, change rapidly, *irreversibly* and, to an important extent, unpredictably. Consequently, the measurement gives us nothing in respect of finding out the future of society. As the social processes (and *all* the other processes in natural conditions) are in principle irreversible, the measurement of society is redundant: *no measurement of single individuals' activities or social relations in the present time gives us the kind of information, which may eliminate the uncertainty of society's future.* Society's development primarily contains qualitative leaps, which begin with chances that are in principle unpredictable. *As there exists the phenomenon of self-organisation of social life, it is not correct to reduce all the actions of people to achieving the prognosticated results.* Certainly, some actions have in principle unpredictable results. The determinants of self-organisation could lie among those which are a lot more decisive and consequential for people's fate or for the formation of a human being than

just acts caused by the desire for temporary and local profit (i. e. which have predictable results). Human qualities (honesty, sense of justice, wisdom, benevolence and considerate attitude to the world in general) emerge precisely through non-utilitarian action. Humans should not be in any way hindered by anybody if they act without pursuing direct profit or effect, for this hindering is equivalent to destroying people's *new* chances (which nobody can predict) to self-realise their *human qualities. Human actions in the history of human society are not reduced to serving narrow goals, pursuing benefit or profit, satisfying needs, manipulating people and objects for gaining efficiency.*

The most basic human value is freedom – the freedom from obstacles and *for* self-realising human individuals' qualities, among which the wisdom is the central one. The truly social problems cannot be solved, but wisdom can transcend them. The computer-based models in exact sciences "have proved unable to deal with competing viewpoints and seem insensitive to shifting values …, thus limiting the application of their wisdom to compartmentalized situations" (Human Values Project: 6.1 Insights: wisdom and requisite variety: p. 3). It must be said that any set of human values can be looked upon as self-organising. This set of values is in principle unlimited. It may even be that there exist values, which do not have names yet.

The self-organisation as a phenomenon that cannot be constructed

We have to regard the internally active reality differently from how the representatives of

exact sciences have treated nature and society so far. The theories of self-organisation (developed by Ilya Prigogine, Hermann Haken, Manfred Eigen, Stuart A. Kauffman and others) in exact sciences have by now shown that *a human being can deliberately construct and organise merely a tiny part of the world because of the existence of the phenomenon of self-organisation*. It is very important to stress that from Ilya Prigogine's theory of non-linear, non-equilibrium thermodynamics of chemical reactions follows the conclusion:

> In principle, a self-organising system cannot be constructed, since its organisation and behaviour cannot be prescribed and created by an external source. It emerges autonomously in certain conditions (which cannot be prescribed either). The task of the researcher is to investigate in what kind of systems and under what kind of conditions self-organisation emerges. (Vihalemm 2001: 195)

This conclusion remains valid also in social (human) systems. Nature and society (culture) *together* form a self-organising system, which is not subject to total human control (Näpinen 1994). Social institutions live their own lives, which are not subject to attempts to reform them *radically*. (Only the *piecemeal* social engineering, as Karl Raimund Popper (see, e.g. 1961) has argued, is acceptable here.) Internal determinants at work in society have emerged during a long period of development in order to serve complex functions, which we often find difficult to apprehend. The task of a social scientist is therefore to discover these systems with internal determinants and to describe the conditions, under that the system of internal determinants emerges and works for the benefit of mankind. But it must always be remembered that nobody can predict the precise results of such historical processes.

Ilya Prigogine has introduced into the mathematical natural science the discussion in the natural language about the real, historical time. One may hope that in future the natural language in these discussions will be replaced by mathematical formulae. I do not share that hope. The real time, in principle, cannot be grasped by the idealised physics-like science, in the language of mathematics. *Discussions about the real, historical time in the natural (non-mathematical) language should not be considered as a temporary stage that will pass in science; the real time and everything connected with it (irreversibility, chance (randomness), instability, non-recurrence, uncertainty, complexity that cannot be observed, temporal and spatial non-uniformity, etc.) cannot in principle be understood through mathematics (and a scientific experiment or observation as a quasi-experiment)* (Näpinen 2001b, see also Vihalemm 1995a). For understanding the self-organisation of the natural world in all its diversity and complexity (that grasps the determination by the world as a whole including humans and therefore in principle cannot be controlled by anyone) we have to use the natural language only. If we try to replace the discussions about the real time in the natural language by mathematical formulae, we shall lose any connection with *ir*regular aspects of nature *and* society as a self-organising world. Only regular aspects in their "pure" form can be fixed by mathematical theories.

As the mathematics in physics serves the task of *modelling* the real world, the task of formulating the general quantitative laws that physics uses for *explaining* and *predicting* (by the so-called mathematically formulated natural laws and *arbitrary* initial conditions) phenomena, mathematics (as well as mathemati-

cal logic) cannot be treated as means for the *integral (including humans)* understanding of the world (nature). The mathematical theories in exact sciences show how and *to what extent* the natural systems can be constructed by the way of idealised physics-like science. A self-organising system, as it was already emphasised, cannot be constructed. Therefore, for the integral (including humans) understanding of the world, the common sense, philosophy and all historical researches are needed.

The human systems and the conception of autopoietic systems

Some representatives of the so-called second-order cybernetics have considered the human systems as biological autopoietic systems. First of all I mean Humberto R. Maturana and Francisco J. *Varela (1980, 1992). But as it has been* claimed by Vincent Kenny (1992), *the* healthy (non-pathologic) human systems must not be considered by the metaphor of autopoiesis. The main difference is that

> For the autopoietic system the individual properties of its components are irrelevant beyond having the capacity to materialize the organization. However, for the genuine social system the opposite is the case: the properties of the individual components are paramount because a genuine human social system is a space for the realization of individual human beings. (Kenny 1992: 6)

Vincent Kenny is very right when he claims that

> a social system is characterized by the subordination of society's institutional structures and rules to the realization of the humans who constitute it. We find non-social or parasocial relations in its corollary, i. e., where humans undertake relations and interactions, which do not give priority to their own individual realization but require only their behaviour. (Kenny 1992: 7)

"The more a human system acts as if it were autopoietic, the more allopoietic its members become: *the personal properties of the participants are ignored, abused, or actively negated.*" (Kenny 1992: 7; italics added) One may say that *our* human systems exist not for the realisation of properties of human individuals. And he is right. So far most of western societies and their substructures have been developed as *pathologic* systems. In such conditions the very different human properties (the range of which is in principle unlimited) cannot appear and manifest. The increasing discardability of people "is the basic manifestation of the pathology of our culture" (Mariotti 2000: 7). To the question asked by Maturana and Varela (to what extent human social phenomenology may be seen as a biological phenomenology?) Humberto Mariotti gives the *following answer: "social phenomenology can surely be seen as a biological phenomenology – but it is a pathologic* condition." (Mariotti 2000: 6; italics added)

Niklas Luhmann (1990, 1995) has generalised the Maturana's and Varela's concept of autopoietic systems to include also psychological thinking systems and socio-communicative systems. For Luhmann social systems are communicative systems with human bodies and minds as surroundings. Luhmann's view of information is partly based on Shannon's concept of information. Moreover, he believes that this cybernetic concept of information can be used only in human social communication. But Shannon's concept of information does not give the answer to the question: *what* is information in the context of *historical reality*? (see Näpinen 1984: 94–96). Therefore, I think that Luhmann's theory, too, has problems with understanding the *qualitative* aspects of human systems.

The second-order cybernetics remains the "hard" science, i. e. its representatives prefer the exact scientific concepts and methods and dislike the "soft" sciences. Because of that the second-order cybernetics cannot pretend to be the integral (including humans) understanding of the reality.

What is really needed is the *co-operation* between the exact ("hard") and historical ("soft") sciences, and not the attempt to replace one by the other. Ilya Prigogine's theories serve as a good example of such a co-operation[3]. They start from the describing (in the *natural* language) of the *self-organising* reality that in principle cannot be constructed.

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Therefore, I have argued that the concepts and methods of exact sciences are completely unsuitable for the *integral understanding* of social life, belonging to the historical reality. Even if they enabled us a complete control of a part of society, it would not mean that we understand that part. The leader does not understand his subjects just because they follow his orders without question. Social sciences should not model themselves on the exact sciences (which are aiming at predicting and explaining phenomena) but rather force themselves to give up the ambition to make accurate medium- and long-term predictions, and often even the accurate short-term predictions. Healthy (not pathologic) social systems are self-developing and self-organising, and therefore they cannot be forecasted, constructed, manipulated, but at best understood. In order to understand ourselves, our society and nature, we must learn to think in the Aristotelian way: to consider the world as a big living organism where we belong to (Vihalemm 1981, 2001; Näpinen 1998).

Conclusion

The general conclusions that can be drawn from the foregoing discussion are as follows. There is no justification to apply notions and methods taken from the *exact* sciences (i. e. from the idealised physics-like science) to interpret social life as a historical whole because they grasp the reality by the laws only. Understanding society *as it really is* (in all its complexity and diversity) remains the task of social scientists (as the researchers of the historical reality) themselves. The knowledge about the historical reality we get through the common sense, philosophical discussions and all historical researches. Only after the scientists have come to (due to the researchers of the historical reality) the historical knowledge expressed in the *natural language*, the modelling of the historical reality can be started. The prediction of events, using the mathematically formulated laws fixed by modelling, is really possible to some extent in case of a certain number of phenomena under certain conditions. But this does not mean that we understand the integral world containing the human being. *The understanding of the integral (including humans) world in all its complexity and diversity presupposes the recognition of the scope of ideas of self-organisation.* Acquainting ourselves with self-organisation, however, is based primarily on our everyday life and experience, which teaches us that the self-organisation is also related to the *non*-observable complexity (including, for instance, the changing relations between systems and their environments in the *historically* developing processes). The people must not hope

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[3] On the *cooperativeness* of Prigogine's approach I have written, for instance, in (Näpinen 2001a, 2002).

that somebody will organise their individual lives. They must acknowledge that social institutions (most of which are the results of the self-developing and self-organising processes) exist (must exist) for the individuals, not the other way round. The conclusion, according to ideas of self-organisation, not to exact scientific teachings, "is that every individual has to be acting on his own, for his own reasons. By doing so, they will naturally co-operate... This is the principle of self-organization." (Barth 1999–2002: 1).

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TIKSLIEJI MOKSLAI IR VISYBIŠKAS SOCIALINĖS TIKROVĖS SUPRATIMAS

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Santrauka

Straipsnyje analizuojamas klausimas, ar tiksliųjų mokslų metodai yra tinkami socialinėje srityje, siekiant visybiškai suprasti visuomenės gyvenimą. Ar pagrįstas socialinių mokslų, šiandien vis plačiau taikančių mate-

matikos metodus, lūkestis šiais metodais vis tiksliau suprasti visuomenės gyvenimą? Autorius atsako vienareikšmiškai neigiamai. Straipsnyje ginamas požiūris, pagal kurį tiksliųjų mokslų sąvokos ir metodai tinka tik socialiniams procesams modeliuoti, o modelių kūrimas gali prasidėti ne anksčiau, nei socialinius reiškinius supranta sveikas protas, filosofija bei istorinis tyrimas. Todėl visybiško sudėtingos ir įvairiopos socialinės tikrovės supratimo uždavinys lieka pačių socialinių mokslininkų uždavinys. Prasminga kalbėti apie tiksliųjų ir istorinių mokslų bendradarbiavimą, o ne bandymą išstumti vienas kitą.

Prasminiai žodžiai: tikslieji mokslai, istorijos mokslai, socialinė tikrovė, saviorganizacija, savikūros sistemos.