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THE SIGNIFICANCE OF J. A. COMENIUS IN THE HISTORY OF SCIENCE

The merits of the great Czech pedagogue J. A. Comenius, since long rightly appreciated, are recently subject to a new and detailed examination. Thanks to this examination his work appears now in a new light, we are now able to appreciate its manifold dimensions. Comenius a politician, a religious leader, author of many pedagogic treatises and textbooks, a theologian and historian has also a chart of his own in the history of science.

It is a two-pages chart. The significance of Comenius in the history of science rests in the first place on his achievements as a pedagogue, and in the second place on his endeavours to use science as a means to a political and social reform of the world.

In the evolution of science, in its historical process a most important role is played by the emancipation of human thought from the supremacy of religious domination and its ecclesiastical organization. This emancipation runs differently in various disciplines and in relation to the manifold problems. Sometimes it consists in the breaking of bans which prohibit the use of certain methods, sometimes it was a fight for the right to proclaim certain ideas, sometimes it consisted in breaking some restrains which prohibited investigations in some definite domains of reality. The fight for a free secular scientific thought embraced different matters depending on the time, the locality and the kind of science.

This emancipation consisted not only in the destruction of external restrains and in the release from the submission to external authorities. It was often necessary to overcome his own ideas impressed upon the mind by the past, it required courage and a critical mind in dealing with the „internal priest”. The struggle for the emancipation of the free secular inquisitive thought was most difficult but

at the same time the most fruitful: It meant to do away with fideism as a method to solve difficult and doubtful problems, to do away with a theological explanation of various phenomena, to acquire the right to discuss certain questions, the right to a numerical analysis, to the proper method of induction a.s.f. This struggle had different aspects in various disciplines but historically there was no other way for a development of each branch of science but a victory in such a struggle.

Pedagogy is no exception to this rule. "The theoretical starting points" of a modern scientific pedagogy appear with the emancipation of the pedagogical thought from the bonds of a religious-clerical conception of man and his destiny, with secularity gaining ground in the solution of problems of human life. The role of Comenius in this process of emancipation has been especially important.

The two principal pedagogical theses evolved by Comenius from religious assumptions, namely the thesis of the part played by education and the thesis of the diffusion of learning have grown far above these assumptions, have turned against him, got a wholly secular content and paved the way to a scientific conception of educational problems, depriving all denominations of a monopoly in this domain.

We see Comenius often quoting the religious principle that man is master of all living beings. But the conclusion he draws from this principles is as follows: "man has been placed among living creatures in order: 1. to be a reasonable being, 2. to be a being dominating all other creatures, 3. to be an epitome of his creator and his joy"¹.

What it means to be reasonable?

Comenius gives a clear definition: "To be a reasonable being means: to investigate everything, to give names and to embrace with intellect (....), means as much as: to understand the system of the world and the magnitude of the elements, the beginning, the end and the middle period of the time, the consecutive solstices and the four seasons of the year, the yearly circuits and the location of stars, the properties of living beings and the nature of animals, the spiritual forces and human thoughts, the many variations of plants and the strength of roots, in one word — everything that is hidden and everything that is clearly visible. It includes also the knowledge

¹ *Great Didactic*, chapter IV, § 2, (Citations are taken from a revised, corrected polish edition of the *Great Didactic*, Wrocław 1956).

of handicrafts and the art of conversation in order that (...) nothing be left unknown either in a small, nor in a big thing (...). Indeed man can be named a reasonable being provided only he will be capable to understand the reasonable meaning of all things².

Such is the vast program of the knowledge of the world and of man's education. A program which in the writings of Comenius becomes a basic element of his pedagogy. Breaking away from the medieval tradition of education as a religious training Comenius stresses continuously the dominant part played by education in the breeding up of man.

The crowning point in the development of this principle, consisting in the education of man as a reasonable being, was the conception of pansophy, a conception to which Comenius devoted all his time free from other duties and occupations and all his forces. He intended Pansophy to be a knowledge of everything by everybody, a manysided and useful knowledge³.

A similar process consisting in a transition of religious assumptions into secular humanistic conceptions may be observed in the second chief principle of Comenius's pedagogy, namely in the principle of diffusion of education. Arguing for this postulate Comenius is steadily referring to religious principles which consider man to be a divine creation and which impose on everybody the same religious duties. But these same presumptions in medieval times have been responsible for a policy consisting in the diffusion of devotion and of an universal obedience to the church. Comenius referring to these principles makes use of them for quite different purposes. The equality of men serves him as an argument for education equal and common to all. "Let us assume, writes Comenius, that everybody who is born as a man is in need of education, because he ought to be a man and not a wild animal, nor a dumb beast, nor a powerless log"⁴.

This short analysis of the two chief theses of Comenius's pedagogy — the principle of education and the principle of the diffusion of learning show that the true nature of Comenius's argumentation is thoroughly secular and free from fideistic limitations and deformations. Its objective meaning rests on the

² *Ibidem*, chapter IV, § 3.

³ The author discusses this conception in detail in the introduction to the *Great Didactic* by Comenius.

⁴ *Great Didactic*, chapter VI, § 10.

emancipation of pedagogical problems from the domination of religious conceptions and from the church supremacy. In such a way the work of Comenius was understood by history, he was admired by Herder for his humanistic ideas, Michelet named him a Galileo of pedagogy and we consider him to be a forerunner of many important truths.

The role of Comenius in the history of pedagogy consists not only in the emancipation of pedagogic deliberations from the sphere of religious metaphysics and from church organization. It rests also on the formulation of certain basic problems which paved the way to scientific research. The history of science furnishes many instances when a proper formulation of a question, a proper indication to problems hitherto unnoticed play a deciding role in the development of scientific disciplines. A proper formulation of the question: why things are so and so is a starting point to a new stage in the development of science. It is especially important in the initial stages when a prescientific reflection and an extemporary proclaiming of an opinion are sole material for casually growing observations. A posing of a problem at such time stimulates the thought to certain definite problems, coordinates its efforts and puts the investigation in the right direction.

Such is in general the merit of Comenius in the history of pedagogy as a science. Many writers prior to Comenius have taken pedagogy as a subject of their works. Some of them have contributed many new thoughts and have made many valuable observations. Some of them made an accurate criticism of the medieval schools and asked for new ideas in education. All these deliberations however were partly of a moral character, were partly descriptive and were always either the result of some casual observation or of certain postulates in bringing up and were based on general principles. Comenius broke through this tradition of expressing pedagogic opinions and tried to put questions systematically and sought answers to them.

What did strike Comenius most when he was observing the process of education? What was drawing his attention? How did he formulate his questions? How did he seek to solve them? The low efficiency of schoolwork was considered by Comenius to be the most important problem. In his earliest works he stressed chaos and disorder in the schools; children interrupting one another; they hardly understand anything and learn nothing. "Kitchen maids,

vagabonds and artisans, writes Comenius, when doing their simple work can sooner learn a language, some times even two or three of them, different from their own tongue, than a pupil in a school who having much free time at his disposal learn with the greatest difficulty only one — latin”⁵. This comparison is a striking evidence of the low efficiency of scholwork. One of the principal questions asked by Comenius is: why this is so?

During his whole life Comenius sought to find an answer to this question and with his work progressing he came nearer and nearer to the right solution. How deep was he concerned with this problem is shown in one of his last dissertations: *Exit from Labyrinth*. In this work Comenius stresses that the majority of schools are like labyrinths where pupils go astray. Schools are like labyrinths because they have no clearly defined goals to attain; they have no adequate means to attain these goals and they have no clearly defined principles to make the proper use of these means.

What is the way out of this labyrinth? In his many works Comenius has pointed to a way out. In the above named dissertation Comenius indicates that such an "Ariadna's thread" which may show us an exit from the labyrinth is the "natural method" based on "human nature". In his numerous studies Comenius endeavoured to elaborate more precisely this natural method by analysing the human nature.

Beside the conception of nature Comenius introduced the conception of art in the contemporary meaning of this word, that is as *ars*. Art consists in an effectual transformation of nature. Comenius illustrates this by giving aqueducts as an example. "It has been observed, writes he, that water likes its surface to be on the same level, even in such containers which are at a great distance from one another but are connected by pipes. Various aqueducts have been constructed utilising this device by means of which when the water level is lowered, water rises again to an arbitrary height if only on the other side it flows down from the same level. This is an artificial device and at the same time quite natural. That this is so is a matter of art, but the general principle on which such phenomenon rests is the merit of nature"⁶. The general principle that can be drawn from the above is this: "the basic rules of art are to be found in nature". Comenius gives many examples of discoveries

⁵ *Ibidem*, chapter XI, § 11.

⁶ *Ibidem*, chapter XIV, § 5.

and technical improvements. They are always the effect of peeping into the nature's mysteries and making use of them for man's benefit. Comenius is an admirer of Bacon and of "mechanical devices", he demonstrates the successes of man in his relation with nature as a model of human activities in all spheres. In the field of education also.

"It is evident, writes Comenius, that the order which according to our desires should be an universal idea of teaching everything and learning everything has to be taken from and cannot be taken from anything else but from nature as a model"⁷. In developing this idea Comenius recalls the doings of men in relation to nature, living as well as still, an activity which is based always on a skilled utilising of laws by which various phenomena independently of men, are governed. That is the way machines are constructed and operated, that is the way a gardener grows his plants. Also in teaching nature has to be peeped into and its laws taken advantage of for our own purposes.

In such a way Comenius advanced consequently to acquire the knowledge of human nature. He tried to find out why is it that children learn so hard? What should be done that children would learn easily, purposefully and steadily. It is common knowledge that Comenius with special care analysed the teaching of a foreign language and in consequence devised some far reaching formulae of didactic reforms. It is also known that he advised the visual method to be introduced in teaching and in his textbooks applied the system of presenting things in pictures in connection with the teaching of words. Not enough appreciation has been shown to the fact that Comenius's efforts to make teaching more efficient were connected with a very penetrating psychological analysis, which he demonstrated in his less known works, that were not even always published.

The last dissertation of Comenius brings a deepening of these deliberations, the whole of which is devoted to an analysis of human "nature", whose special properties consist in speech, reason and ability to act, the last one being a direct effect of the physical efficiency of the hand. *Mens, lingua, manus* — these three are basic interdependent elements of human nature. Taking into consideration this interdependence Comenius undertakes a great scheme to reform logic as a science which would train the mind in the proper art

⁷ *Ibidem*, chapter XIV, § 7.

of thinking, to reform grammar and rhetoric as a science which educates the speech, and he conceived a plan of a new science which would educate action and which he called pragmatics.

Comenius was the first pedagogue who not only proclaimed certain pedagogic ideas and not only worked out certain instructions to teachers and educators, but who seeing difficulties in schoolwork has been capable to formulate problems which were in need of an investigation and started some work that should lead to a solution. Comenius not only saw that school is working wrongly, many pedagogues of his time saw this also, but sought an answer to the question, why this work is deficient and in seeking an answer penetrated deeply in an analysis of "nature" of man, in an analysis of his relation to reality of things and to the paths leading toward his development and perfection. Being under the charm of technical development, which achieved great successes by getting acquainted with the forces of nature, Comenius conceived the idea to reform the "art" of education in a similar way, he intended to transform the school into a big "didacting machine" which as every machine would work purposefully and efficiently. Striving to attain this goal he searched steadily for these "natural" properties of man and his development, the knowledge of which would be the base of an effectual activity.

Such a way to formulate problems was new to the pedagogic thought. Comenius was directing it consciously to a scientific conception of reality, to a scientific theory of action.

The pedagogic activity of Comenius was closely connected with his political and social ideas. For Comenius education meant in the first place a preparation of men to the new social relations in the world. The conception of *Pansophy*, a knowledge of everything by everybody has been intended to serve, as Comenius put it, to a "reform of human things".

In accordance with these ideas Comenius tried hard to win the benevolence of rulers and politicians for his program of universal education, for the principle of international peace and for an understanding, to induce outstanding scholars to write textbook and to organize international institutions of a scientific-educational character. In his numerous appeals and speeches Comenius stressed the responsibility resting on scholars for an orderly and progressive world.

During his stay in London in the forties of the XVII century Comenius came in close contact with the Royal Society and wrote a large work entitled *Via Lucis*, which with an introduction addressed to the members of the said society was published much later in Amsterdam⁸. It stressed the social duties of scholars consisting in acquiring and diffusing the knowledge of the world, in formulating a program of reforms in many important fields of life. Elaborating his program of education Comenius proposed to work out some "universal books", to organize an "universal college" and to diffuse an "universal language". The whole of these "universal books" had to be divided into three parts: Pansophy — a basic general knowledge of everything, Panhistory — a knowledge of some concrete events that occurred in different times and places, Pandogmatics — a knowledge of science and philosophy, of various ideas proclaimed by men.

The "Universal College" had in view to educate young men selected from all countries in order to liberate them from the "darkness, superstitions and barbarisms". The state, wrote Comenius, like the church cannot be based on "ignorance and slavery"⁹, it must rest on "light" and not on "darkness". Rendering due homage to the members of the Royal Society as eminent explorers of nature Comenius appeals to all scholars to take care that the knowledge of nature be of service to all men, and such a state will be possible only, when the light of knowledge will disperse the fallacies of social and political order, when it will open the "path of light" in human matters. The most sublime vocation of a scholar is, according to Comenius, to remove from the minds of all men the eclipse caused by ignorance and superstition, to diffuse throughout the world the "light of wisdom"¹⁰. In this way scholars will lead the fight for world's progress, progress built by man's hands¹¹.

By his activity which had in view the reform of the world through science and education Comenius demonstrated very definitely his utopian hopes evolved from the hard fate of Czech's emigrants, who were prosecuted for their faith. In their migration

⁸ *Via Lucis*, Amsterdami 1669. This book is to-day a bibliographic rarity. I use the English translation by E. T. Campagnac, published in London in 1938.

⁹ *Via Lucis*, l. c. page 130.

¹⁰ *Via Lucis*, l. c. page 12.

¹¹ *Via Lucis*, l. c. page 33.

through many different countries Bohemian Brethren dreamt of a life in peace and happiness, fancied a successful exit from the "labyrinth of the world". Their leader and patron Comenius shared these longings and expectations, sought to find a support in religious and mystic prophecies and in his own social utopias.

Since his university studies Comenius was deeply involved in a research of an utopian idea, which in the Renaissance period flourished abundantly. But his relation to the great tradition of utopian ideas has been since the beginning of a specific character; utopia was for Comenius not a story of a happy life, a fairy tale taking place in an indefinite time and space. Comenius wanted to transform a dream into reality.

The whole pedagogic work of Comenius which had in view to ensure to everybody education and knowledge of the world and life may be considered as an effort to put into reality the utopian ideals of a coming society. While the great utopian writers presented us with a picture of a full and happy life, Comenius tried to show how this end may be reached. How deep the roots of Comenius work reach into the utopian tradition is shown among others by the fact that the idea of visual teaching which Comenius developed in his *Orbis pictus* is really a school and textbook realization of the Campanelli idea. It was Campanelli who has shown how easily and promptly can children learn in his *Civitas Solis*, due to the city walls being covered with pictures, illustrating all branches of learning.

The program of world's reform through science and education, which was deeply rooted in the utopian tradition of the Renaissance thought has been for Comenius a basic and principal axis of his work. Striving to realize this program Comenius sought to establish international organizations for the diffusion of science and education, to gain the benevolence of rulers and politicians for the reform of the world.

For these reasons the personality of Comenius stands out very clearly in the history of science as that of a great scholar and a great social worker. In his dreams and expectations he was a forerunner of his epoch, he put solid foundations for a further development of pedagogy as a science and at the same time he demonstrated how in some definite historical circumstances takes shape a common responsibility of all scholars for the "reform of human things", for the happiness, peace and education of every man.