Ştefan Odobleja: A Scientific Visionary, precursor of Cybernetics and Artificial Intelligence

Marin Vlada[1], Adrian Adăscăliţei[2]

(1) University of Bucharest, 14 Academiei Street, RO-010014, Romania
(2) "Gh. Asachi" Technical University of Iaşi, 67 D. Mangeron Blvd., Iaşi, Romania
E-mail: vlada[at]fmi.unibuc.ro, adrian.adascalitei[at]yahoo.com

Abstract

The article describes the contribution of the Romanian scientist Dr. Ştefan Odobleja (1902-1978) to the emergence, development and development of Cybernetics, whose ideas and concepts meant the emergence and development of computer science. The scientific activity of Stefan Odobleja, a military physician, makes his ideas, results and visions a precursor to Cybernetics and Artificial Intelligence. His major work "Psychologie consonantiste", first published in 1938 and 1939, in Paris, established many of the major themes of cybernetics regarding cybernetics and thinking systems ten years before the work of Norbert Wiener (1894-1964)-mathematician, published, in 1948. Odebleja's contributions are all the more important if he is considered to be a physician, because they have created ideas and concepts complementary to some ideas introduced by N. Wiener. It can be appreciated that during 1920-1940 the ideas and studies on Cybernetics appeared, the science that laid the system concept (for man and the car), the structure of the systems (control and communication between the components of a system) and which led to the construction of the systems computing (computer system). Dr. Stefan Odobleja was recognized as a precursor of Cybernetics at the 4th International Cybernetics Congress, held in Amsterdam in August 1978. His Communication "Diversity and Unity in Cybernetics" was presented at the Congress by Dr. Stelian Bajureanu. After the presentation of Odobleja's work, the participants chanted "40 Years of Cybernetics," although they were celebrating "30 Years of Cybernetics" and mathematician Norbert Wiener.

Keywords: Cybernetics, System, Feedback, Model, Structure, Artificial Intelligence

1 Cybernetics, Science of systems, Structures and Models

> Motto: *"The Art of Creation is a Global Art: The Art of Thinking"* Ștefan Odobleja (1902-1978).
> "*Thanks to the psycho-physical reversibility, we can materialize the act of creation. Undoubtedly, the inventive machine has not yet been created, but we can see its creation soon*." Stefan Odobleja, "Consonant Psychology", Paris [8]
> "*By trying to build machines that simulate and reproduce human brain activity, and because the most important computational models were made by simulating the activity of the nervous system, it can be said that Informatics was born as a chapter of the medical sciences*" Solomon Marcus (1925-2016) [17].

Human thinking has invented the sciences. Science is a model and philosophy of thought. In 2014, *Solomon Marcus* describes "The 10 Human Needs" where the number 2 need is expressed as: "*The need for refreshment. As we daily need to refresh our body through rest and movement and the use of water and soap, we need a refreshment of our mind, our senses and our psyches*."[17]
Man's adaptation to nature and his survival in nature, depending on the area and time, forced man to organize not only survival, but rather to organize his experiences, learn from the obstacles with which he confronted, and especially to plan their future activities. All this is done through thought, as a manifestation and normal functioning of the brain. For these reasons, there are no two

"identical" people with the same thoughts, primarily because there is no single criterion to compare two "thoughts".
"*The automated models of the 1940s, the Turing machine of the 1930s and the electronic computer produced by John von Neumann and his team in 1948, looked at the nervous system. "In my book (Grammars and Finite Automats from 1964) there is a great chapter about the neural system, as it is modeled by S. C. Kleene's finite automata and grammar. ... Things continued through everything that followed in the disciplines cognitive and Artificial Intelligence, so we published the article "The Human Brain, Many Hypotheses - Few Clarifications," in the "Academica" journal of the Romanian Academy*" S. Marcus [18].
Today, it can be appreciated that there are three significant periods in the emergence and evolution of Informatics, and in the construction of computers:

1. *Period 1920-1940* (Fundamentals and Concepts), in which: the ideas and concepts of calculus theory were grounded; recursive functions were studied; formal systems have been defined and the limits of calculability have been established; the concept of algorithm has been finalized as a support for a computing machine (Turing machine or Post machine). During this period, the ideas and studies on Cybernetics[1], the science that laid the concept of the system (for Man and the Machinery), and the system science (control and communication between the components of a system), science that led to the construction of computing systems;
2. *Period 1940-1960* (Design and Implementation), in which: ideas and concepts of calculus theory were implemented; computer systems and peripheral equipments (based on research and results in several areas: systems, data structures, electronic circuits, memories and storage devices, algorithms and programming languages) were built;
3. *Period 1960-1980* (Hardware and Software Performance, Interactivity). During this period: an explosive development of the computing equipment occurred - due to the appearance of the microprocessor; high performance operating systems[2] (UNIX, DOS, RSX-11M, etc.) have been obtained; programming languages[3] have been developed (Algol, Fortran, Cobol, Simula, Pascal, C, etc.); intelligent / expert systems, generated by the Artificial Intelligence languages (List, Prolog, etc.) appeared.

Analyzing the development of ideas, theories, concepts, and building of computing systems, one can assert that there are two important directions in computer evolution:

- *Hardware Component* - represented by systems (computing units - microprocessor, storage units - memory, communication units-bus), electronic circuits (equipments), Input / Output devices;
- *Software Component* – represented by algorithms, languages and programs (operating systems, programming languages, computer systems and applications).

Cybernetics has helped define a schematic scheme for a cybernetic system that applies to all hardware and software components: INPUT → PROCESSING → OUTPUT (fig. 1).

[1] "Cybernetics is a transdisciplinary approach for exploring regulatory systems—their structures, constraints, and possibilities.", https://en.wikipedia.org/wiki/Cybernetics
[2] On August 4, 2017, there were 611 operating systems (including versions) and 656 Linux distributions, http://www.operating-system.org/betriebssystem/_english/os-liste.htm
[3] On August 4, 2017, updated list https://en.wikipedia.org/wiki/Timeline_of_programming_languages

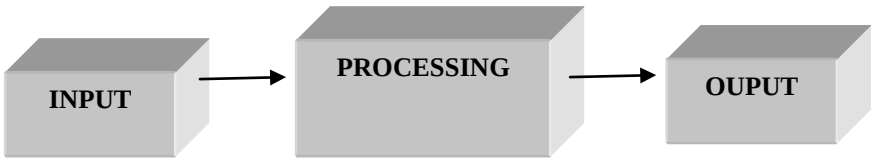

Fig. 1. The unified / general scheme of a cybernetic system

Time has shown that this scheme of a cybernetic system shapes the structure and functioning of the most important concepts in Informatics:

- *Computer system (computer)* - where INPUT = input devices and input data, OUTPUT = output devices and output data, and PROCESS = execution of programs using operating system, microprocessor and memory;
- *Algorithm* - where INPUT = input data, OUTPUT = output data, and PROCESS = computation process represented by pseudo-code;
- *Program* - where INPUT = input data, OUTPUT = output data, and PROCESS = computational instructions represented in a programming language;
- *Information System* (Problem Solving) - where INPUT = input data, OUTPUT = output data, and PROCESS = procedures and instructions represented in a programming language.

These aspects were not realized if calculability problems (calculus theory) and problems related to the development of computer systems (cybernetic systems) of the electronic computer were not elucidated [12].
In this context, the invention and construction of the modern / digital computer was possible through the emergence of new sciences and new products:

- *Computer Science and Cybernetics*[4];
- *Languages and Algorithms*;
- *Input/Output Devices*;
- *Memory and storage environments*.

In the field of Cybernetics, Romania is represented by the scientist Ştefan Odobleja (1902-1978) - a military medical professional, being one of the precursors of the Generalized Theoretical Cybernetics and Artificial Intelligence, the author of the 2 volume "Consonant Psychology" published in Paris for the first time date in 1938 (volume I) and then in 1939 (volume II). The paper has set out many of the major themes on cybernetics and thinking systems (introduced the concept of feedback, with the meaning of reversible links or reverse links, provided the telecommunication model, as well as the

[4] The roots of the cybernetic theory: "*Ştefan Odobleja (1902–1978) was a Romanian scientist, one of the precursors of cybernetics. His major work, Psychologie consonantiste, first published in 1938 and 1939, in Paris, established many of the major themes of cybernetics regarding cybernetics and thinking systems ten years before the work of Norbert Wiener(1894-1964) was published, in 1948.*" [12]

ideas on automation of thinking - which underlies Artificial Intelligence). From this point of view, Stefan Odobleja was a real visionary for a new thinking - algorithmic thinking, which led to the emergence of computers. An important role in the two volumes is that, for the world premiere, the concepts of System and Model are introduced.

As a discipline, Cybernetics (the name comes from the Greek "cybernetos" meaning "stormy") was established by Norbert Wiener, Warren McCulloch and Walter Pitts ("A Logical Calculus of the Ideas Immanent in Nervous Activity", 1943), Arturo Rosenblueth and others such as W. Ross Ashby ("Design of Brain, 1952), mathematician Alan Turing and W. Gray Walter (one of the first to build autonomous robots from animal behavior study).

"Cybernetics is a homogenous and coherent scientific complex, a science resulting from the blending of at least two sciences - psychology and technology; it is a general and integrative science, a crossroads of sciences, involving both animal and car psychology. It is not just a discipline, circumscribed in a narrow and strictly defined field, but a complex of disciplines born of psychology and centered on it, branched out as branches of a tree in its stem. It is a stepwise synthesis, a suite of multiple, often reciprocal, modeling; syntheses and modeling in which, as a priority, and as a great importance, the modeling of psychology on the technique and then the modeling of the technique on psychology. Cybernetics is an intellectual symphony, a symphony of ideas and sciences." Stefan Odobleja[5], 1978 [11].

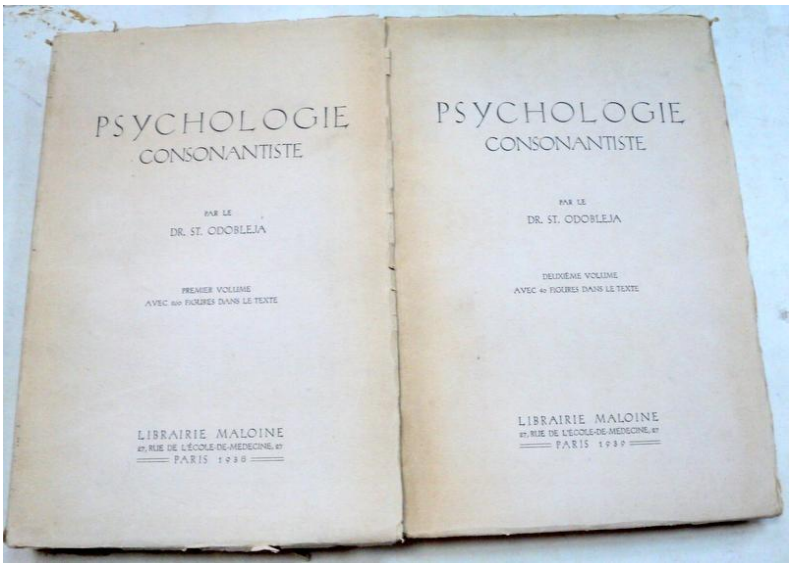

Fig. 2. The book's cover: Ștefan Odobleja "Psychologie consonantiste ", Paris, 1938 [8]

Below are some of Stefan Odobleja's ideas:

- The first thought that Thinking has, Thought is to meet.
- The law of reversibility is fundamental and defines life by reversibility: "life is a vicious circle of actions and reciprocal reactions. A complex reversibility of physicochemical phenomena, a reversible couple of actions and reactions. A complex phenomenon where each partial phenomenon is, successively, either a cause or an effect.
- The possibility of automating the human thinking process and developing mechanisms to transfer this process to a machine are precursor ideas of Artificial Intelligence.

[5] https://en.wikipedia.org/wiki/%C8%98tefan_Odobleja

- The logic of resonance would have, after Odobleja, four subordinate disciplines: geometry of logic, kinematics of logic, logic dynamics, and logic mechanics. Thus, the forms of thinking, conceived in the act, in the process of their exercise (logical-psychological), were to find a geometrical (spatialized) representation.

The ideas are extracted from "Psychology and Neurophysiology", the works being a world premiere. These thoughts were accomplished ten years before the publication of the work of mathematician Norbert Wiener (1894-1964) [2, 23].

With an admirable scientific belief, in the two volumes of 1938, Stefan Odobleja strongly supports the reality of the concrete facts, crystallized around and with the consonant theory: rigorous duality, symmetry, dichotomy, binarity, bivalence, bipolarity, correlation with the opposition, alternation , circularity or reversibility, selectivity, specificity, transformations and retreats, actions and reactions, attractions and repulsions, agreements and disagreements, unions and deductions, etc. Odobleja comes to establish the essential relationships between scientific concepts, expressed in the form of laws - known resonance laws or consonant laws. These were, in short, the logical premises of consonant psychology. The possibility of mechanizing the processes of thought, materialized in the scientific-consonant fields, was a natural consequence of their logical-psychological analysis [8,9].

Odobleja's "The Logic of Resonance" project, a project with an impressive grandeur: "By comparing it with traditional and mathematical logic, we find that Odobleja defines its object of study in the traditional sense (the classical forms of thought: notion, judgment, syllogism); but the method is conceived (geometric and physical modeling) in the sense of physical-mathematical sciences. The logic of resonance would have, after Odobleja, four subordinate disciplines: geometry of logic, kinematics of logic, logic dynamics, and logic mechanics. Thus, the forms of thinking, conceived in the act, in the process of their exercise (logical-psychological), were to find a geometrical (spatialized) representation. This creates the premise of the corporalization of thought, its embodiment in the patterns of geometrical sketches. If the geometry of logic or geometric logic, as Odobleja sometimes called it, was the external, pictorial-schematic moment of thought, the kinematic logic had to be the sculptural, rigid-bodied moment. The dynamics of logic would represent the animation of this inert golem[6], which would be nothing more than artificial thinking, modeled on the image and the likeness of the natural one, except that it could not be carried out by itself except in the last moment, that of automation . "Acad. Alexandru Surdu [19].

2 Odobleja's Contribution to the Fundamentals of Cybernetics and Artificial Intelligence

> "*The ideas of the "Great lonely person" who was the Romanian scientist Stefan Odobleja, could not impose themselves because - as we have previously shown - he was not lucky to enjoy any scientific community, a strong enough institution and a favorable social context, as well*." Nicolae Jurcău, 1998 [2]

At the time, Stefan Odobleja was aware that his ideas were advanced to contemporaries and expected the latest technology to confirm. Stefan Odobleja was aware of the originality of his ideas and therefore addressed the international scientific world. In 1937, the International Military Medicine Congress was held in Bucharest, where Dr. Stefan Odobleja received the "General Dr. Alexandru Papiu, physician " award, with the work "La phonoscopie" published by Gaston Doin & Cie Publishing House, Paris. He also launched a prospectus announcing that "Consonant Psychology" is in print in Paris. On that occasion, being present at the Congress, William Seaman Bainbridge, chief medical officer of the 7th American Mediterranean Fleet, announced this book

[6] In Jewish folklore, a golem is an animated anthropomorphic being that is magically created entirely from inanimate matter (specifically clay or mud). The word was used to mean an amorphous, unformed material in Psalms and medieval writing.

appearance in the United States, and a summary was published in the American Psychological Abstract.
"It is known that it is harder for you to convince yourself of a truth than to find it, because truth has been found most often through intuition, if not through a hazard. While someone else's belief requires, in order to produce, the deductive way, with heavy and numerous syllogisms. Moreover, for the one who found it, the truth seems to it to be simple and manifest, while for others we have to erase their previous opinions, a process that is always disagreeable, and which opposes opposition through a very natural reaction, whose roots go beyond psychological and even biological, for physical phenomena are already dominated by the conflict of action and inertia. " Ştefan Odobleja from the preface of the work "La Phonoscopie" published by Ed Gaston Doin & Cie, Paris (1935) and translated into Romanian in 2011 [7].
After World War II, Romania was under the influence of the USSR and isolated from the free world, and Cybernetics was considered a reactionary science that "the imperialists used to destroy the revolutionary conquests of socialism." For Romania, only after 1968, began an international opening period. At the International Cybernetics and Systems Congress, held in Bucharest in 1975, Odobleja participated with the work "Consonancial Psychology", which he was able to present, with the approval of the Chief of the Cybernetics Department, Dr. Aldo Masturzo of Italy (Editor, Cybernetic Medicine, International Society of Cybernetic Medicine), although some Romanian specialists have been reserved under the influence of the politicians of the time – https://www2.gwu.edu/~asc/key_journals.html.
In an interview in 2013, the son of the scientist, Mr. *Stefan Odobleja Jr*., says that due to his illness, Stefan Odobleja did not attend the 4th International Cybernetics Congress, held in Amsterdam in August 1978. His communication "Diversity and Unity in Cybernetics" was presented at the Congress by Dr. eng. Stelian Bajureanu (in 1975, he gave his doctorate in Cybernetics, being among the first doctoral theses in the world in the field of Cybernetics). After the presentation of Odobleja's work, the participants chanted "40 Years of Cybernetics," although in reality they only commemorated "30 Years of Cybernetics"; in addition, the mathematician Norbert Wiener was celebrated. With this event of recognition of the Romanian priority on Cybernetics, who led the Congress, J. Rosse came to Romania and awarded "Norbert Wiener" medal to Nicolae Ceausescu, the political leader of Romania, for the special merits in Cybernetics of Romanian Researchers. [13]

In 1979, the Romanian Academy Publishing House published the collective work "Romanian Precursors of Cybernetics", a book in which the merits of Stefan Odobleja are acknowledged, and in 1981, the Romanian Academy consecrated the work "Odobleja between Ampere and Wiener" has been distributed around the world [13] [4,5,9].

the susceptibility of the patient, and illustrative cases are quoted at length.

All those who wish to undertake the treatment of their rheumatic cases with gold salts will do well to study this little volume.

COLLEGIATE HEALTH

It is scarcely open to question that the educated man or woman ought to possess some knowledge of the laws of health as affecting the individual and some acquaintance with the procedure by which these laws may be applied by Governments for the well-being of the nations. Adequate instruction in such matters is perhaps specially appropriate in the case of students, who while at college are under the stress of competitive mental or physical effort, and who in after life, when engaged in professions or in public administration, may become themselves responsible for the health of others. For these and kindred reasons the ruling bodies of a number of American colleges have deemed it wise to cause to be conveyed to the generality of their undergraduates—that is to say, not to students of medicine only—more explicit guidance on healthy living than is usual in this country.

In a work[4] now in its fourth edition Professor C. E. TURNER of the Massachusetts Institute of Technology presents this health instruction to students in a com-

[3] *Le Traitement des Rhumatismes Chroniques.* By Dr. Jacques Forestier. Paris: J. B. Baillière et Fils. 1934. (Pp. 99. 12 fr.)
[4] *Personal and Community Health.* By Clair Elsmere Turner, M.A., D.P.H. Fourth edition. London: H. Kimpton. 1935. (Pp. 680; 131 figures, 4 coloured plates. 12s. 6d. net.)

former days a small manual by Dr. Jex-Blake covered the same ground. The present volume may be regarded as an up-to-date description of the same subjects.

In a small handbook on Phonoscopy[5] Dr. ODOBLEJA of Bucarest describes the principles of the method of delimiting solid and hollow organs by listening with a stethoscope while coin or finger percussion is made in the vicinity. The author makes considerable claims for the value of the method, and applies it to the examination of the liver, heart, lungs, and abdominal organs.

CHILD PSYCHOLOGY

Those who study in detail the psychological problems of childhood have long realized the great value of the work of Professor CHARLOTTE BÜHLER, and an English translation of a small book entitled *From Birth to Maturity*[6] presents in simple form the results of research in Vienna on the development of the normal average child. The book began originally as a series of lectures to students and teachers, but it has grown considerably in the process of editing, and has completely lost the

[5] *Martini's Principles and Practice of Physical Diagnosis.* Edited by Robert F. Loeb, M.D., from the authorized translation by George J. Farber, M.D. Philadelphia and London: J. B. Lippincott Company. 1935. (Pp. 213; 30 figures. 9s. net.)
[6] *La Phonoscopie. Nouvelle Méthode d'Exploration Clinique.* By Dr. St. Odobleja. Paris: G. Doin et Cie. 1935. (Pp. 202; 29 figures. 30 fr.)
[7] *From Birth to Maturity. An Outline of the Psychological Development of the Child.* By Professor Charlotte Bühler, Ph.D. London: Kegan Paul and Co. Ltd. 1935. (Pp. 237; 15 figures. 7s. 6d. net.)

somewhat stale stamp too often characteristic of the reproduced lecture. Indeed, it is a freshness of outlook and enthusiasm which is the main feature of a book full of interest for paediatricians, teachers, and intelligent parents. A final chapter on the influence of heredity on the psychological development of the child states, without solving, many interesting problems for future work. An appendix summarizes briefly the methods of investigation employed. These can be studied in more

THE LONDON AMBULANCE SERVICE

On April 1st, 1930, the Local Government Act, 1929, came into operation, which transferred to the London County Council the powers of the late Metropolitan Asylums Board and twenty-one boards of guardians, and, with these powers, the ambulance services formerly maintained by these authorities.

Fig. 3. Reviews, Handbook of Phonoscopy, pag 534 din British Medical J. 1936 Mar 14 [14]

Stephen Odobleja died in September 1978. As a sign of recognition of his entire opera, in connection with Ştefan Odobleja, we recall:

- he was elected post-mortem member of the Romanian Academy;
- since 2005, the village of Valea Hoţului, from Izvorul Aneştilor, Mehedinţi county, where he was born, is called "Stefan Odobleja.
- In his memory there is the "Stefan Odobleja" Memorial House in his native village;
- The Foundation "Ştefan Odobleja" from Drobeta Turnu Severin was founded, led by his son, eng. Ştefan Odobleja Jr.
- The Romanian Post edited an envelope in 1988 (when it was 50 years since the publication of the book "Psychology Consonantiste", Paris) and a stamp in 2011.

Fig. 4. Envelope 1988 edited by Posta Romana (50 years since 1938) and stamp 2011

Stefan Odobleja's ideas and thinking are today sources of insight for many researchers in various fields of science.

For example, in an article published in the journal Laser Therapy (2014) by a team of physicians, it shows [16]: "*The Romanian scientist Odobleja Ştefan (1902–1978), the founder of cybernetics, defined for the first time in the world the psyche as a system. "The psyche is a system consisting of multiple elements: dynamic, reversible and associated". The reverse connection termed by Odobleja "vicious circle" or reversible link is then identified in different psychic processes. Affectivity is a vicious circle, directly subordinated to the great circle: the life. Knowledge is a small vicious circle, directly subordinated to the affectivity, and through it, to the life". Assoc. Prof. Dr. Dragos Cârneci states that emotion is not a function of the brain, but a label that refers to a set of its functions. The brain does not have a system that mediate emotion, but subsystems that mediate fear, anger, disgust or pleasure. In the 1980s Le Doux, studying the adverse conditioning to auditory stimuli, showed the existence of two neural pathways involved in the mechanism of this conditioning, regarded as one of the phobias mechanisms in psychiatric diseases. The two pathways are: a path that link the thalamus directly to the amygdala (1) and another path leaving the thalamus to the primary auditory cortex (2)*".

Ştefan Odobleja (1902 - 1978) is the author of a remarkable work - Psyhologie consonantiste , Librairie Maloine, vol.I, 1938; vol. II, 1939 -, considered to be one of the forerunners of the present - day cybernetics and the founder of a general cybernetics as a theory of the laws of consonance between the sciences. Essentially, this is an original work of the foundations of a science consist of establishing its logical concepts, their geometrical model, their definition and classification, establishing their common laws.

The consonantiste psyhology and the present-day cybernetics are different not only by generality. The latter is the outcome of a neopositivist foundation of sciences, which is algebrical, symbolical and logical - mathematical, while the consonantiste psychology is geometrical, figurative an logical - classical. On the basis of the letters Odobleja tried to develop a logic called "the logic of resonance", that is a logic of the common substratum, in resonance or consonance with the conceptual contest of sciences.

Unlike the formalist - symbolic orientation of the contemporary logicians, Odobleja considers thinking in development, as a psychological process belonging to human's activity in general and to the scientifically one in particular. His logic does not apply to the forms of thinking already set, but to their becoming. Thus in Odobleja's opinion, the mechanization of thinking does not imply a device for reproduction thought already conceived but a device for effective reasoning , for producing thought. According to Odobleja, there is a creative artificial thinking which implies,

similarly to the consonance laws of sciences, a geometrical positioning in space of the results of thinking, their physical (kinematical and dynamical) model, and finally a mechanization of these processes. Each of these phases has its own counterpart in the real of logic, i.e.: geometrical logic, kinematical logic, dynamical logic and mechanical logic.
This was a vast project, which Odobleja had no time to accomplish. But he left us a bulky manuscript, about 15.000 pages, with a lot of notes, drawings, sketches and a few pages to be published [13].

Conclusions
The ideas of the "Great lonely person" who was the Romanian scientist Stefan Odobleja could not impose themselves because - as we have previously shown - he was not lucky to enjoy any scientific community, a strong enough institution and a favorable social context, as well [2]:
The reversibility law (feedback) is present at the interpretation of all the domains that Stefan Odobleja approached.

Examples (The examples might continue):

- Psycho-physiology: "The intellectual exercise develops the brain and its development incites to the development of the intelligence";
- Psycho-pathology: "Between the cerebral structure and the cerebral function, between the cerebral pressure and mental disorder there is reversibility and reciprocity of determination, The lesion produces disorder and the mental disorder produces lesion";
- Language: "The image evokes the spoken word; in its turn, the spoken word evokes the image";
- Sociology: "The functioning of a society determines its structure but (the structure) influences, in its turn, upon the functioning"; philosophy: "Any philosophy is the crop of the past experience, in its turn any philosophy determines the experiments and behaviors in future";
- Aesthetics: "Art is the product and the expression of the individual and society which comprises him; in is turn, art influences the individual and the society".

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