NOESIS

Scientific Journal of the Romanian Committee for
History and Philosophy of Science and Technology

Travaux du Comité Roumain d'Histoire et de
Philosophie des Science et Technique

NEW SERIES

TOME (I) XL NO. 1, 2021

ROMANIAN ACADEMY

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EDITURA ACADEMIEI ROMÂNE

Bucureşti, 2021

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ISSN 1223-4249

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FOREWORD

On April 11, 1956, driven by the desire to resume international relations in the field of History of Science, the Bureau of the Presidium of the Romanian Academy voted and approved the affiliation of the Romanian Academy to the International Union of History of Science (IUHS), a union established in 1947 having the Romanian Petre Sergescu as the first general secretary among its founding fathers. In the same year, through the unification of IUHS with the International Union of Philosophy of Science (IUPS), the International Union for History and Philosophy of Science and Technology (IUHPST) was established, with IUHS becoming a division (Division of History of Science and Technology – DHST) of IUHPST. In the new context, during 1956–1957, several discussions took place at the Romanian Academy to lay the foundations of the Romanian Committee for the History and Philosophy of Science and Technology (RCHPST). On March 28, 1957, the establishment of RCHPST was approved by the Bureau of the Presidium of the Romanian Academy. The first chairman of the committee was Acad. Mihai Ralea.

The year 1972 played a key role in the history of RCHPST, as Acad. Athanase Joja (in the last year of his life) founded *NOESIS* journal. *Travaux du Comité Roumain d'Histoire et de Philosophie des Science et Technologie*, a foreign language journal, whose main purpose was to become a platform for promoting the history and philosophy of the Romanian science abroad. It was a yearly journal and it was published regularly until 2015.

In 2021, after a six-year gap, prior to the celebration of 50 years since its first publication, the journal is republished in a new format. The general objective of the publication remains broadly the same: to promote the values of the Romanian research in the fields of History and Philosophy of Science and Technology at national and international level, by publishing studies and scientific articles, or reviews to promote the scientific activity, etc. The journal will be a biannual publication. The articles will be double blinded peer-reviewed. The publication will be open-access, accessible online without any restrictions to the general public on the journal's website: https://noesis.crifst.ro.

The problem of conceptual delimitations related to understanding "science" occurs before this objective. This is useful in order to identify the types of articles that will be published. The first step in understanding the concept must be made by approaching the meaning given by Aristotle in *Metaphysics* (981a), i.e. knowledge (ἐπισήμη). This is the broadest perspective that associates science with the process of searching, of knowing the world. From here the whole history of science is a process of organic development from the Aristotelian classification into theoretical sciences concerning the "knowledge of the general" (Mathematics, Physics and Theology), poetic and practical to an indeterminate variety of fields that describe or

construct “worlds”. The transformation of science is neither unilateral nor linear, having variations, increases and decreases, profound transformations of structure and substance at the quantitative and qualitative level. The journal aims to publish articles that capture general perspectives, sequences or frames, as well as interpretations of this process of science transformation.

In the process of science evolution, in relation to the exponential increase of the domains, the idea of unity is found within the general process of knowledge. Contemporary science is built in the context of the division-unification antinomy. Division is the determined process of specializing and disciplinary focus, but the imperative of communication and cooperation between disciplines as unification may be found at the same time. The connections between the sciences are natural, and they are part of the evolution of knowledge, as deep parts of paradigms. Science can be seen as a complex structure within which each of the parties is in an interdependent relationship with the others. The research on inter-scientific communication are relevant and therefore articles that capture elements specific to the processes of science unification (multidisciplinarity, interdisciplinarity, transdisciplinarity) or those which use specific methodology are expected to be published.

In conclusion, the journal is open to the publication of works on philosophy and history of science and technology, in the broadest sense of the science (including Mathematics, Natural Sciences, Humanities or Engineering), covering theoretical or applied aspects specific to basic research or technology transfer, from a disciplinary, multidisciplinary, interdisciplinary or transdisciplinary perspective. Such a wide universe of discourse can also be set out by specifying what the journal does not intend to publish: scientific articles that capture particular aspects of different fields, specific to specialized journals.

Editor in Chief,
Dan Gabriel Sîmbotin

PHILOSOPHY OF SCIENCE

CONSCIOUSNESS − INFORMATIONAL PERSPECTIVE[1]

LAURA PANĂ*

Abstract: The article is the result of successive attempts to theoretically integrate several perspectives in the study of the complex phenomenon of consciousness. It concerns the informational perspective, but also the structural, functional and the action-focused perspective. Each perspective is the result of an integration of specific research, but also includes interdisciplinary ones. Because the results of using several types of methods are emphasized, the methodological perspective of study also matters. Thus, the construction of a meta-integrative research is described. The paper summarizes the main trends developed in the field, illustrating that from divergent theories one can select convergent contributions forming the source of a coherent meta-theoretical whole. It is argued that a science of consciousness is possible, with its theoretical and meta-theoretical levels. The informational integron is then introduced, the other three integrons being included in a meta-integron capable to gather all the perspectives practiced in the study of consciousness.

Keywords: consciousness, informational integron, metaintegrative model of consciousness.
Received 21 July 2021

INTRODUCTION: DIVERGENCES AND CONVERGENCES BETWEEN THE VARIOUS APPROACHES TO THE STUDY OF CONSCIOUSNESS (BIOLOGICAL, PSYCHOLOGICAL, SOCIOLOGICAL AND TECHNOLOGICAL)

Both tendencies − divergent and convergent − develop with the attempt to explain the emergence of consciousness through biological evolution, respectively through the formation of subjective experience, seen as relevant to consciousness from a psychological perspective. Thus, on the one hand, it is considered that consciousness appears in organisms endowed with a complex brain and, on the other hand, it is claimed that all living beings have a minimum of subjective experience.

More specifically, the variety of theoretical positions and methodological approaches is mirrored in different but ultimately convergent conclusions. Thus, Henri Ey describes the transition from sensation to knowledge and then to consciousness, even in the case of the amoeba, and Roger Penrose argues that if consciousness is supported by the reticular formation of the brain, fish, frogs and snakes would be conscious beings (Penrose 1996, 414). More recently, Peter G. Smith shows that subjective experience and consciousness have appeared several times, in different phases and on different branches of the biological evolution, marked by successive informational revolutions (Smith 2017, 124).

[1] This article is the improved and up to date version of the ppt. presentation held in the frame of the Interdisciplinary Research Group of the Romanian Committee for the History and Philosophy of Science and Technology of the Romanian Academy, on the occasion of the Annual Scientific Communications Session of this scientific organization, on November 14, 2019 at the House of Scientists in Bucharest.

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Other scholars make a clear distinction between the subjective experience and consciousness, but consciousness continues to be understood differently: part of them considers that the subjective experience is a stage in the emergence of consciousness, while another part postulates that consciousness is only a form of subjective experience, calling it "conscious experience".

Smith also states that the first phenomena of consciousness are related to internal states, not to external events, i.e. to the recorded and used information (Smith 2017, 126). Other scientists and thinkers deepen this direction of research considering that the cognitive subject itself is a source of knowledge, and consciousness is what makes knowledge possible. In this regard, however, again, different orientations appear: on the one hand, the experience of awareness is thought to progress from the perception of reality to the representation of the ego and then of the self or the path traveled is represented as having the exactly opposite sense. Even the two mentioned concepts of psychology and the role of those experiences in the process of self-awareness constituting are seen differently. According to Carl G. Jung, the only form of existence known immediately is the psychic one, seen by him in a more general way. According to others, the self is seen as gradually forming and developing distinct components, such as sensations, feelings, and self-awareness. Authors like T. E Feinberg and A. Damasio follow up this research topic by studying "How the feeling of the self develops?" The ego, in turn, is understood as a series of connected conscious experiences, not as a central and permanent psychic state. At this point, the paths leading to the explanation of consciousness break up again: Stanislav Grof, among others, speaks of the continuous search for the self, while Albert Einstein emphasizes the importance of freeing the person from his or her own self. Regarding the means of approaching these objectives of cognition, John Dewey emphasizes the role of internal language, while Lev Vygotski highlights the role of externalized language.

However, the path of biological research also offers new data that, far from giving way to reductionist interpretations, in fact broadens the perspective of studying consciousness. Thus, while some authors try to make generalizations meant to facilitate the research, stating, for example, that the same brain map is present in three large biotic genres (fish, birds and mammals), others argue that it is possible to exist inclusively a *multiple consciousness* in the case of the same living being. This finding is based on the fact that, for example, the octopus has, in addition to two brains and three hearts, even eight nervous systems, more neurons being in the arms than in the brains (Smith 2017, 69, 96, 154).

The idea of the close and exclusive link between the brain and consciousness − the basis of the biological perspective in explaining consciousness − is strongly challenged by authors such as Searle and Dennett, who show that the study of the brain will not solve the theoretical problems regarding consciousness. However, biological research is reviving with the development of neuroscience, especially since the latter is strongly supported by technology or even takes technical forms such as neuroinformatics and neurotechnology. More recently, in order to explain consciousness, researchers have remade even further the path of evolution,

regressing to the physical level of existence. But an intermediate phase of the research, which fills, in a way, the gap between the biotic and the physical level, was the orientation that we will here call the functionalist one. Thus, Roger Penrose, proposes the microtubule hypothesis, characterizing consciousness as the effect of quantum gravity in microtubules in the brain. In turn, Ray Kurzweil reuses the platonic theory of recognition and describes a series of ideal experiments suggesting that the brain contains a hierarchy of pattern recognizers in the form of millions of recognition circuits that could be reproduced through technical methods in order to create artificial intelligence (Kurzweil 2012, 38 and 128). The repeated attempts of Bernard J. Baars, followed by Dehaene and Naccache, to show how consciousness works can be framed in the same research direction. Consciousness occurs when the necessary information is disseminated in all areas of the brain, not only in the restricted workspace suitable for solving a specific problem: it is the one that integrates them into a coherent architecture. This intellectual construct coined by B. J. Baars in 1997 is known as the global internal workspace theory.

The physicalist orientation in the study of consciousness aims at relying its explanation on the discovery of its deepest roots, but sometimes reaches statements that, taken in themselves, are not considered acceptable by all members of the scientific community, although they have the advantage of leading to some technical approaches of the problem. Thus, Danah Zohar tried to impose the idea that there is an inferior but interior quantum component of consciousness, in her book *The Quantum Self* and Ray Kurzweil defined consciousness as an emerging property of a complex physical system. In turn, Max Tegmark takes into consideration physical states which make up systems that can integrate, store and process information, such as gas, liquid and solid, but also memory, computer and consciousness. He analyzes some of their qualities, his finding being that all these qualities are present together only in consciousness (Tegmark 2015, 240). In the same group of theories can be included that coined by Richard Amoroso, who participated in some activities of the Romanian Academy, one of his works being translated in Romanian under the title: *What Consciousness Is? Steps in the Cosmology of Mind* by members of the Interdisciplinary Research Group of RCHPHST (Iosif Adrian, Nicolae Bulz, Alexandru Giuculescu, Călin Hilohi, Corneliu Milo and Laura Pană). In the footsteps of John Eccles, who used the name *psychon* for the quasi-particle which represents, in his vision, the unit of the mental experience, Amoroso appreciates that the specific carrier of consciousness is the *menton*. He also gives a partial list of particles possibly implied in this cosmology, these being both bosons and fermions (which have the suitable properties). Among the mentons are mentioned the so-called corticons, excitons, phonons and solitons, but also noeons. The psychon would be, in this context, a bundle of noeons. (Amoroso 2000 a, 42). As psychological, neuropsychological and neurotechnological approaches that lead to technical achievements related to consciousness, there can be mentioned first of all those that dealt with the study of human and artificial intelligence and consciousness, and sometimes even with consciousness engineering.

In that regard, we recall the pioneering work of Marvin Minsky who described the cognitive system as a complex society of entities and processes called "agents" which produce together the main abilities currently attributed to the mind, such as intuition, intelligence and imagination and which work together to achieve a common goal (Minsky 1986, 17–18). Today one can also add some Romanian results of applying an engineer perspective on the mind with effective technical means by which in an artificial system, clusters of neural networks and computing nodes / specialized functional modules / agents are built in order to perform various tasks (from speech to action), agents characterized by autonomy, reactivity, productivity and social skills (Dumitrache and Arsene 2017, 76).

From the technical direction of the research aiming at deciphering consciousness and more, to implement it in the so-called intelligent machines (virtual or robotic ones), the most abstract attempts will be illustrated here, such as the outstanding orientation towards creating *Machine Consciousness*. In this context, abstract but functional models of some processes that imply consciousness were created. Thus, as a basis for hastening the emergence of machine consciousness, the two-level model of concurrent communicative systems was built by Pierre Bonzon, starting from an analogy between the abstract, syntactic properties and the topology of synaptic connections, by using π-calculus (Bonzon 2011, 8–9). He illustrated the application of this method by language implementation in virtual machines meant to communication in order to pass from the reactive behavior to the dialogical one, specific to conscious beings.

Modeling of some activities, such as conscious reflection is tried by other authors starting from the idea that "different entities in the universe manifest different kinds of consciousness or awareness", thus assuming that consciousness is manifested at each level of existence – physical, biotic and social. Among them. Ben Goertzel uses autoreferential mathematical structures (hypersets) in searching the adequate model of the reflectively conscious experience, which can be achieved, in his vision, by successive hyperset-type constructs (Goertzel 2011, 34).

Realistic rationing techniques are proposed for robots with advanced abilities that can move from representing spaces, objects and actions to establishing motives and goals, by using mind maps and stepwise reasoning, which equate to becoming aware of a problem and to select an adequate action (Mastrogiovanni, Scalmato, Sgorbissa, Zaccaria 2011, 100–102). Obtaining consciousness by integrating cognition and emotion through universal conceptual space using, in which all possible kinds of human conscious states can be mapped is proposed by other authors, for modeling of natural and artificial consciousness. Emotions and feelings are considered independent functions that can be integrated with cognitive ones through brain mechanisms, in this context being argued the superiority of the proposed model over the inter-subjective validation experiments (Pereira and Almada 2011, 130).

The scientific literature dedicated to consciousness does not lack studies that approach it from a social perspective. Some of them are present in Romania through the works of Mihai Drăgănescu, well known by his concerns for the *knowledge society* and subsequently for the *society of consciousness*. In the volume dedicated by the

fellow academicians to his entire activity, his response can also be read. In this context, he refers both to the possibility that in the universe, on the scale of the animal kingdom "mental beings much stronger than man" can exist, and to the *social consciousness* "without material support" or "partially artificial" (Drăgănescu 2004, 256).

Today there is also a whole scientific movement of studying the *social mind*, rather from the perspective of social psychology. However, the newest concern is an institutional one, endorsed by the European Commission. It is called *Collective Awareness* and is, at the same time, an EU initiative, project and platform for socialization and communication[2]. The domains that can be accessed on this platform are multiple, each offering a number of links. Such domains are: Doing things together mindfully and promoting privacy and inclusion needs; New models for economy, society and democracy; Improving public services, urban environment, internet-based open data ensuring (12 links); Providing key technologies, ensuring free access to knowledge and connecting people (4 links). The platform also hosts studies, conferences and think tanks on ICT and sustainability etc. (7 links).

Such kinds of topics are also debated on a global scale, once it was discovered that "the state of our consciousness is the main problem that underlies all others". To the question launched by Ervin Laszlo, if there is a chance of a major change of consciousness, Stanislav Grof answers: "I am convinced that there will be a profound transformation of individual consciousness and this will increase our chances of survival, if this change will occur in a quite large population segment and in a fairly short period of time", the human personality being the one that could mediate such a transformation (Laszlo 2009, 16).

WHAT ARE THE CHANCES OF DEVELOPING A THEORY OR EVEN A SCIENCE OF CONSCIOUSNESS?

The scientific study of consciousness did not give a scientific theory of consciousness, said Donald D. Hoffman in his article on consciousness and the mind-body problem. (Hoffman 2008, 87–120). More specifically, David J. Chalmers showed that contemporary sciences such as neurobiology or cognitive sciences failed to explain how and why mental events emerge from physiological occurrences in the brain. That is why he proposes a completely different solution to the problem, namely, the understanding of conscious experience as an independent way of being, similar to physical properties such as space, time or mass, which manifest themselves at the fundamental level of existence (Chalmers, 1996). In his highly acclaimed book, Larry Dossey laments the fact that "science does not know where to stop: it has attempted a double murder, eliminating first the self and then the consciousness" (Dossey 2016, 201). He argues that the idea that the conscious, the preconscious, the subconscious and the unconscious, as well as the collective conscious and unconscious are subdivisions of the mind is not acceptable either.

[2] Collective Awareness Platform at https://ec.europa.eu/digital-single-market/en/collective-awareness-platform-sustainability-and-social-innovation ; last access: October 25 2021.

All the less convincing is Francis Crock's opinion that mental activity is equivalent to the behavior of a set of nerve cells, as well as the even sharper statement attributed to him, according to which "we are just a bundle of neurons". In turn, Marvin Minsky shows that the mind is what the brain does. He also believes consciousness can be identified with abstract thinking of the highest level.

Of course, there are also adequate responses to "challenges" such as the ones above. Thus, Charles Taylor distances himself from them, saying that "The brain is a biotic structure, while we are interested in consciousness". For his part, Carl Jung argues that "it is absurd to assume that existence can only be physical" and Roger Penrose states that "any physical theory that does not make room for consciousness fails to accurately describe the world". John Eccles finds a Solomon-like solution: "We are spiritual beings in the spiritual world and material beings in the material world". Together with Karl Popper he gives his decisive verdict when they title the jointly edited book *The Self and His Brain*, in which the link between brain structures and processes, respectively mental states and dispositions are discussed.

The reductionist perspectives are receiving not only declarative or implicit, but also explicit and meticulous responses from other scientists and philosophers. Since 1986, Patricia Churchland Smith showed, by her most representative work, that a unified science of the brain and mind is possible. Although her sharp statement that "in reality there is nothing specific to call mind" could be categorized as reductionist, it must be said she reached this conclusion by α − studying the results of several experimental researches and β − integrating the conclusions of some competing theories on the topic, what entitles her to conclude that she actually achieved an "inter-theoretical reduction" (Churchland 1986, 278).

However, her so contested statement can here receive an appropriate reply: by reality she understands only the material reality which can be perceived by natural living beings and by those robotic, artificial ones. But reality is more complex and comprises inclusively the ideal reality, which can also be an objective ideal reality, such as that made up of scientific truths generated by/in the human mind, which is, in fact, a system of activities. These activities are virtual ones, but can cause actual changes in the material objective reality. The following table can illustrate the richness of the forms and levels of reality from the perspective of the Philosophy of Science.

The internal structure of ideal reality and its components	
Objective components	The mental environment Mind as a system of activities The theoretical and meta-theoretical level of cognition The conceptual model in use within the scientific community The virtual network of scientific research
Subjective components	Motivations of individual/team research in progress The finality of various personal concerns Professional goals and projects, relations and communication Social and professional prestige Interiorized cultural models

1. The ideal reality that consists of and is made up through scientific activity

Consciousness is also often minimized, not always with this intention, but to highlight research results that focus on some "precursors" of consciousness such as sensation, perception and representation, as well as the full range of cognition forms and levels. Thus, Baars, but also Dehaene and Naccache consider that a small part of the processes that take place in the brain become conscious. In a hyperbolizing formula, Dennett says that we are all "metaphysical zombies" (Dennett 1991, 406), but his statement is supported, for example, by Peter G. Smith, who notes, during some scientific activities, that the whole body participates in the processes of awareness, some creatures even having "a body with endless possibilities" (Smith 2017, 65). Benjamin Libet in turn mentions, in his book on the temporal factor in consciousness, that movements of the body are signaled in the brain before the conscious decision is made in problematic situations. Some clinical psychiatrists confirm that to a large extent the body's response to environmental demands is unconscious or prior to conscious decision.

On the other side, some scientists distinguish different levels of consciousness: up to 54 levels of empirical consciousness are inventoried, as well as other 40, of transcendental level, by authors inspired by the Indian tradition of the Vedas. Among them, Amid Goswami also describes some dimensions of consciousness. A series of authors who belong to the European intellectual tradition rather by their speculative works, remain in the spotlight of scientific and philosophical research, such as Pierre Teilhard de Chardin, who proposed the study of the noosphere generated by the *Human Phenomenon* or David Bohm, who speaks of the "consciousness of mankind", raised by participatory thinking (Bohm 1994, 4). New authors also appear, such as Larry Dossey, who tries to impose the idea of a unique mind. Other authors, such as Dorothy Chenney and R. Seyfart, in their work *Baboon Metaphysics*, based on experimental but unconventional research, speak of an "inclusive non-local consciousness". Moreover, although a science of consciousness has not yet been developed and accredited, a new science of consciousness is announced by D. Miller, Ch. Berner and C. Draut, who consider a nonphysical reality as support of consciousness.

Exploring the multitude and diversity of the literature dedicated to the psychic phenomenon, which also includes consciousness, shows that studies focused specifically on consciousness are relatively rare compared to those dedicated to the brain, mind and knowledge, as well as to those aimed at transferring the properties that characterize them into artificial entities. Among the philosophical and scientific works directly dedicated to consciousness are those designed by Daniel Dennett − *Conscious Explained* (1991), David J. Chalmers − *The Conscious Mind* (1996) and the volume co-edited with others − *Towards a Science of Consciousness* (2000), as well as Francis Crick and Christof Koch – "Consciousness and Neuroscience" (2001). Among the Romanian philosophers of science, Mihai Drăgănescu stood out in this sense. He wrote meta-theoretical works such as *On the Structural-Phenomenological Theories of Consciousness* (1997) and *The Interdisciplinary Science of Consciousness* (2000). A synthetic presentation of his contributions in this matter was made (Pană 2012, 13–45),

as well as a survey of the progress from studying consciousness to conceiving the Society of consciousness (Pană 2013, 31–47).

PERSPECTIVES IN CONSCIOUSNESS STUDYING: A SYNTHETIC APPROACH

Over time, scientific, philosophical and technical ways have been practiced in the study of consciousness. In the following some of the perspectives from which consciousness was approached will be explored in their general features, so that the proposed and sustained perspective can be more precisely circumscribed and presented. The selected and illustrated perspectives are those that deal with 1) consciousness as a property of existence; 2) the emergence and evolution of consciousness; 3) the explanatory and projective theories of consciousness; 4) the action focused perspective in studying consciousness and 5) modeling the status and role of consciousness in relation of other human capacities. This article will focus especially on the first, the fourth and the fifth category of theories and the associated methodologies.

The perspective that starts from the idea that consciousness is a property of the natural, cultural and human universe (individual and societal), is a repeatedly renewed perspective, as it seems that consciousness itself appeared many times and on different branches of the evolution of the living world. Indications of the presence of consciousness at the level of

– inorganic matter;
– unicellular organisms;
– animals with cerebral cortex;
– artificial systems

have been presented by different researchers in successive stages of consciousness studying.

Given the multiplicity and diversity of these options, as well as the fact that many of them have led to the formulation of coherent theories, the question arises: what areas of research should be concerned with explaining and possibly replicating consciousness? And even further: what can mathematical models, physical discoveries, biophysical and psychophysical experiments or sociological studies tell us about consciousness? They address the quantum level of the physical reality, explore the universe with bio-cosmological means, and for the design of artificial consciousness use mathematical means, biophysical and psychophysical studies, as well as technical instruments. Which scientific discipline can synthesize all these types of knowledge, in order to capitalize on the results of as many fields of study?

Aiming to explain consciousness, some contemporary theories cross the boundaries between ontology, gnoseology and praxiology in order to build a science of conscience (a syneidology, if the Greek name of this one – *syneídisi* – is considered). These theories have variants, depending on the emphasis they place on consciousness as A. a form of existence closely related to the matter or as B. a form

of existence unrelated to a physical support. The most widespread, but also the most diverse is the first option, in which the formulated theories are based on:

a. a. **states of matter** studied as supports of consciousness such as gaseous, liquid or solid (Tegmark, 2015);

a. b. **material particles**, such as electrons, fermions, bosons;

a. c. **"psychic" particles**, such as *corticons, psychons, mentons or noeons* etc. Other material supports considered are:

a. d. **the cortico–thalamic complex**, as well as

a. e. **the computer**, respectively its hard drive that includes structures that generate memory or execute programs, some of which can be "smart". In variant A also integrates the theories that appeal to

a. f. **properties** attributed to various material structures, which can be complexity, dynamism, continuity, and an information content, as well as descriptiveness (the quality of being "writable").

Among the theories of type B, trying to identify the nature of consciousness, can be mentioned those that:

b. a. consider a nonphysical reality as support of consciousness fall, like that sustained by D. Miller, Ch. Berner and C. Draut;

b. b. others refer to properties of living beings such as subjectivity, reflectivity, integrativity and a common factor for both types of approach − information. The amount of information contained in a physical system (Φ) is considered as an indicator of its degree of consciousness by Giulio Tononi. He uses thought experiments meant to introduce qualitative aspects, as those which differentiate between primary and conceptual information (Tononi 2012, 294–295, 303). Other authors consider information only a precondition of consciousness (Amoroso 2000 b, 319). Here is also placed

b. c. the cognitive neuroscience, which understands consciousness as an emerging property of complex biotic systems that have neuronal systems. Neural systems can be created artificially on physical bases; these can support not only consciousness, but even spirituality in the "era of the spiritual machine", according to authors like (Kurzweil 2012).

This multitude and diversity of approaches and ways of treating consciousness is accompanied by a series of inaccuracies and inconsistencies, as well as by the lack of a systemic vision and a unitary methodology in explaining it. Thus, terms such as mind, consciousness, intelligence, self and ego are used for the same phenomenon, in the same work and sometimes on the same page, thus giving them the same meaning. This is one of the extra reasons why the conscience seems difficult to understand.

The described situation also results in a large number of definitions that have been given to consciousness, part of them being signaled in the above made introduction. The philosophical – more exactly ontological – definition of conscience remains the classical one: Conscience is a product of the functioning of a universal property of existence (reflection) at the highest level of its organization, that of man and society. It follows that consciousness integrates in itself all these ways and levels of being identifiable in the whole existence.

The appropriate attitude towards the complex situation described could not be to look for an answer, certain and permanently valid, but to formulate a new perspective on the problem. The perspective proposed below is mainly that informational, associated with the actional one, from a theoretical point of view, and an interdisciplinary and integrative one from a methodological point of view. The structural and functional perspectives, which describe the conditions for emergence and development of consciousness, are also considered.

AN INFORMATIONAL PERSPECTIVE ON CONSCIOUSNESS

The proposed perspective is itself the result of a succession of integrations. In what follows the sequences of integrations required to outline this perspective are described, the four levels of integration being also highlighted.

This perspective is an informational one because, in addition to being based on the concept of information, this concept receives an explanatory role, by means of which the fact that information is part of each level of the studied specific human activities can be shown. From this perspective, the analysis of the informational structure and functions of the activities specific to each level of integration is made on the basis of the definition of the concepts that describe each of the levels studied in informational terms.

The definitions of information are highlighted here as they were formulated in different contexts and periods throughout the undertaken research. Thus, information was thought of as a fundamental form of existence, along with matter and energy (Pană 2017, 4464); it was considered a fundamental property of existence, which can be called *informativity* (Pană 2017, 4469). Information has been defined and as the essence of the existence, because it is internal to each level of it, and at all these levels one can identify informational properties, relationships and functions (Pană 2000, 430). From another research perspective information was conceived as an active principle of the structuring and dynamics of existence (Pană 2000, 429).

In these contexts, a number of information forms have also been defined.

Structural information is the type of information present at all levels of existence, natural and societal, and in the latter framework, in all areas, from the human brain to the technical domain (Pană 2004, 25).

Systemic information is characteristic of various social units, from civilizations, cultural areas and historical formations to educational models or scientific disciplines. It includes the spiritual level of information generating and using (Pană 2010); (Pană 2005–2006); (Pană 2004, 41–49).

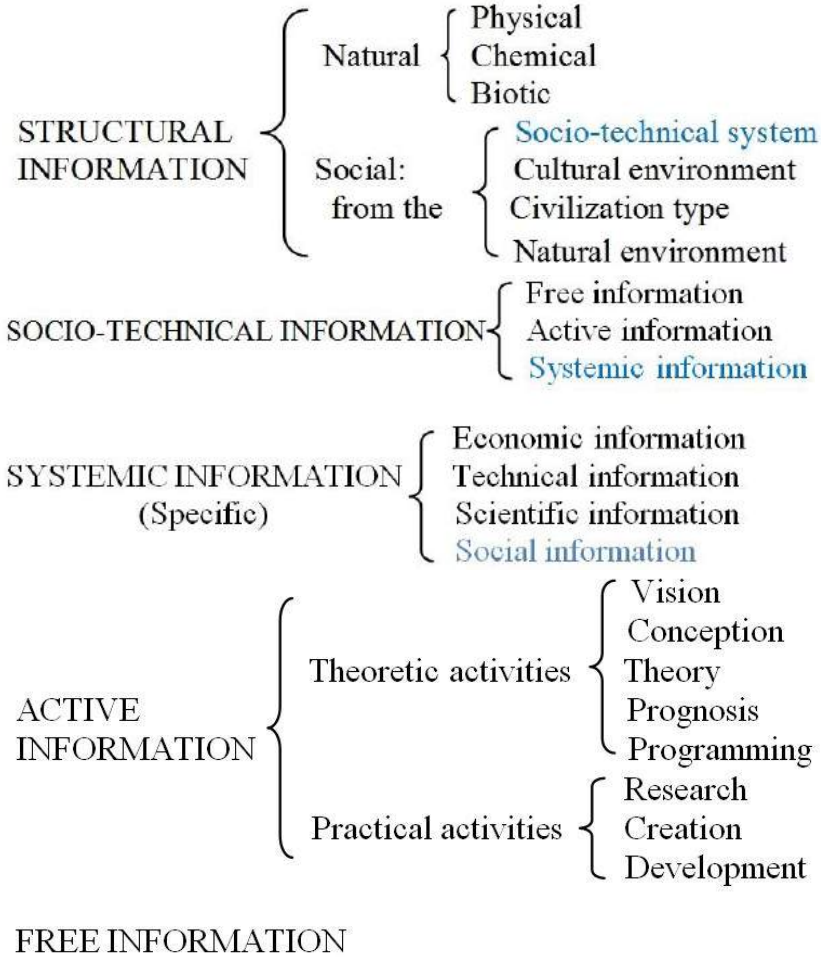
Social information is a continuous flow and a complex, multilevel, multidirectional and multifunctional network of information (Pană 2007), globally presented in (Pană 2004, 17–30) and analytical studied in (Pană 2004, 21–32). It forms a complex infosphere (Pană 2002).

Active information expresses the fundamental relationship between structure and dynamics in the whole of existence, but mainly at the human level. Especially today, information manifests itself as an active principle or even as a driving

principle, not only as a common factor of human activities (Pană 2004, 26–28); (Pană 2000, 429).

Free information occurs in society through high-level intellectual activities which generate and include it in values. It is then cultural information that is also liberating (Pană 2000, 423). This type of information is capable of self-generation, in specific human states or in technical, artificial conditions as already anticipated by Stefan Odobleja.

It is now possible to integrate the levels and forms of information, represented in the following scheme.



2. Integrating information levels and forms. The informational integron

The theoretical and linguistic source of inspiration of this concept is Francois Jacob's book "The Logic of the Living World", Bucharest: Romanian Encyclopedic Publishing House, 1972, a volume dedicated to "decrypting nature", but which takes into account every level of integration. In his vision, evolution occurs by successive integrations, through which new integrons appear, superior to

the organism (pp. 335–342). Thus, a new hierarchy of integrons is established, one made up of social units, such as the family and the state or the ethnic group and the nation (p. 343), which operate according to another code, a cultural one. The present study adds, in fact, a new level of integration, respectively a new integron, the one made up of the activities and systems that compose the higher level of human behavior.

AN INFORMATION AND ACTION-CENTERED INTEGRATIVE MODEL OF SPECIFIC HUMAN ACTIVITIES

During the present study repeated references were made to the modeling of the phenomenon of consciousness by different authors, starting from different perspectives on it, these models aiming at explaining and representing each time the newest theory of this complex human reality. Based on the informational perspective presented in the above scheme, it becomes possible to achieve a complex integrative model, which will here be called the **multi-integrative model**, as it can include several types of explanations, such as informational, structural, functional, as well as one action-centered, which is shortly summarized below.

INFORMATION	SUPPORT	STRUCTURES	ACTIVITIES	FUNCTIONS	PRODUCTS
Free partially self-generative	Spirit and Creativity	Constructive	Superactivity	Creation	Values Inventions Discoveries
Social and global information	Individual & group conscience	Conscious	Attitudes and actions	Motivation and anticipation	Volitional affective & heuristic pr.
Active information forms	Minds and machines	Cognitive (logical and psychological)	System of activities	Other functions coordinating	Theoretical & practical products
Functional information Structural information	Brain	Functional Centers and blocks Activation areas	Activism Activation	Adaptation Evolution Progress	Continuous vital processes

3. The informational, structural, functional and actional meta-integron

The analysis of this representation of the upper level of human conduct allows the formulation of the informational definition of conscience, which is based on a new, active perspective on information itself.

Information is the generative structure through which the world is self-organized into increasingly complex systems, which make up the successive levels of existence (Pană 2017, 4464). The sets of internal possibilities that appear by selecting the contents and properties specific to these levels open several ways of evolution for each organizing level, capitalized or not by specific "agents" (laws, conditions, leaders). Thus, information gives both the "matter" and the form, as well as the sense of the evolution in existence. Information is today the main object/ matter of social action.

The actional perspective in consciousness studying is present, for example in Schelling, who even establishes the moment in which consciousness and liberty emerge concomitantly by the same original action (Schelling 1995, 157–159). This perspective is also characteristic to a book recently translated in our country, in which the intentionality of consciousness is considered a faculty that conditions the formation of motivations, the conception of action projects and the effective transition to action which, in turn, has as finality to generate values (Moutsopoulos, 2017, 24–29). Conscious thinking is also linked to action in neuroscience, for example by S. Dehaene and L. Naccache, its function being to make new actions possible. It is worth noting here that the action-focused perspective is also present in the theoretical writings belonging to the technical field of culture, which speak of "Informing Science as a Conceptual Framework for Developing Information Systems" (Dobrescu and Iordache 2010, 61–71).

Moreover, we can speak not only of *active information*, but also of *active knowledge*, which is not specific only to the technical, political or moral culture, but to all fields of culture, including the philosophical one (Pană 2019, 392–396).

From this enriched informational perspective consciousness can also be redefined: Consciousness is a fourth-order information state and activity with structuring and orienting role in the whole human existence, spiritual, psychical and societal. This definition shows that:

− consciousness is superordinated to the brain, mind and cognition, which are the levels of specific human activity that it subsumes. This definition also implies that

− conscience depends, in a way mediated by the previous levels, on the physical, chemical and biotic world, in the sense that the components of these lower levels of existence are internalized within it. From the same perspective, it can be said that

− consciousness makes the connection between information, energy and substance at the human level. As a first conclusion allowed by this definition it can be said that

− conscience is the specific way of man to correlate the fundamental forms of existence. This concluding formula is supported by the entire content of this study.

Based on the theoretical findings, constructions and reflections made in the research undertaken, the general structure of the fourth level of human activity can be highlighted.

This includes the **unconscious** − a set of processes and states that make up the infrastructure and intra-structure of the unconscious was identified in

(Henri Ey 1983, 320–323) and the **preconscious** has been studied, in addition to the **consciousness**, especially by psychologists. In their attention, and later in that of the experimentalists in this field, the **self-consciousness** also came, even in many forms, inclusively that of **sensory self-consciousness**. This one in turn comprises the awareness of different types of sensations, some of them, such as the visual and auditory ones being studied also by (Tononi 2012, 310–311), while the research of the visual ones had already been deepened by (Crick and Koch 2001, 258). The same two authors make a precious remark according to which usually a single conscious interpretation of an ensemble of sensations is imposed (Crick and Koch 2001, 257).

The **individual self-consciousness** is very important, this becoming obvious if looking at its complex internal structure, which includes a series of elements that develop in different degrees from one individual to another: a − awareness of one's own possibilities; b − awareness of the person's place in the near environment; c − awareness of his/her position and role in relation to other individuals; d − awareness of one's own interests and goals; e − awareness of one's own value.

The **collective self-consciousness,** which is specific to teams, groups and communities such as the virtual ones formed on the web today, is also studied in various social sciences. **Reflective self-consciousness** is considered, by some authors, as the highest form of consciousness.

Meta-conscious states appear in deep meditation practices, studied, among others, in (A. Lutz *et al.* 2007, 92). A structural and functional block of meditation is identified by Brefczinski and his team. They show that a large number of cortical areas are involved in these types of meditation; in addition, the most activated areas differ in the trained practitioners, respectively in the novices. Both the surface and the intensity of using the cortical areas decrease with the experience of those who practice meditation (Brefczynski-Lewis *et. al.* 2007, 11485). There are even **other types of consciousness**. Thus, in addition to extrasensory knowledge, there is also *extrasensory consciousness,* and the so-called *evolved consciousness*, which is being developed in a directed way, within some NASA projects.

An extraordinary evolution, starting from researching the "depths of the material world" and reaching the heights of the spiritual life, can be highlighted in the scientific thinking of Mihai Drăgănescu. He proposed, in this context, explanatory concepts such as the "informatter", as well as the postulate that in the universe there is a fundamental consciousness, which evolves from "infra-consciousness" to conscious forms of organization and even to a society of consciousness. Thus, he not only went on the footsteps of the contemporary science, formulating original interpretations of its results, but he created, coining the suitable language, his own scientific universe.

CONCLUSIVE REMARKS

The results of the research undertaken show that consciousness is a superior-order informational state, an idea launched by the author and debated

online on the occasion of the 5th European Computing and Philosophy Conference held on June 17–18, 2008 in Montpellier, France. Consciousness is superordinated to the brain, mind and knowledge, the informational states that precede it. In turn, it is dependent on the physical, biotic and social forms of existence, but these inferior levels are actually internalized by it. Thus, in fact, consciousness makes the connection between information, energy and substance at the human level. Consequently, consciousness is also a specific way of man to correlate the fundamental forms of existence. The brain is the common substrate of the mind, cognition and consciousness, and the mind itself is a system of activities, the one that generates the environment in which consciousness emerges. The mind, like consciousness, does not exist independently of a material, natural or artificial brain and therefore both are meta-type existences of a different order. A more general conclusion, deriving from three of the current types of research (theoretical, experimental and technical) is that consciousness is a characteristic of all levels of human activity. This conclusion has important practical consequences for the science and engineering of consciousness, because it shows that consciousness can be developed or even built at any of the previously studied levels. The same research highlights that, in fact, consciousness is present in the development of nervous processes, in realizing the proper function of cognition, as well as in the use of the person's creative skills. In other words, consciousness is present in the brain, mind and, obviously, the spirit. These conclusions, in turn, are promising for future theoretical and practical research on the topic of human and artificial consciousness.

REFERENCES

Amoroso, Richard L. (a) "Consciousness, a Radical Definition: Substance Dualism Solves the Hard Problem". In *Science and the Primacy of Conscience*, edited by Richard L. Amoroso, R. Autunes, Claudia Coelho, M. Farias, 35–45, Orinda CA USA: The Noetic Press, 2000.

Amoroso, Richard L. (b) "How to Engineer a Conscious Quantum Computer? In *Science and the Primacy of the Conscience,* 312–325.

Baars, Bernard J. *In the Theater of Consciousness: The Workspace of the Mind,* New York, Oxford University Press, 1997.

Bohm, David. *Thought as a System,* London and New York: Routledge, 1994.

Bonzon, Pierre. "Towards Machine Consciousness: Grounding Abstract Models as π-Processes", *International Journal of Machine Consciousness,* 1 (2011): 1–17.

Brefczynski-Lewis, J. A., Lutz, A., Schaefer et als. "Neural Correlates of Attentional Expertise in Long-term Meditation Practitioners". In *Proceedings of the National Acadeny of Sciences,* PNAS 2007 104: 11483–11488.

Chalmers, David J. *The Conscious Mind: In Search of a Fundamental Theory,* New York: Oxford University Press, 1996.

Churchland Smith, Patricia. *Neurophilosophy: Toward a Unified Science of the Mind / Brain.* Cambridge, Massachusetts, London: MIT Press, 1986.

Collective Awareness Platform at https://ec.europa.eu/digital-single-market/en/collective-awareness-platform-sustainability-and-social-innovation.

Last access July 1, 2021 and October 25, 2021.

Crick, Francis and Koch, Christof "Consciousness and Neuroscience". In *Philosophy and Neuroscience,* edited by W. Bechtel, P. Mandik, Jennifer Mundle and R. S. Stufflebeam, 254–276, Oxford: Basil Blackwell, 2001.

Dennett, Daniel C. *Consciousness Explained*, New York: Little, Brown & Co., 1991.

Dobrescu, Radu and Iordache, Florin. "Informing Science as a Conceptual Framework for Developing Information Systems" In Dobrescu, Radu and Iordache, Florin, *Complexity and Information,* 61–71, Bucharest: Romanian Academy's Publishing House, 2010.

Dossey Larry M. D. *One Mind: How Our Individual Mind is Part of a Great Consciousness and why it Matters?* Brasov: Divine Truth Publishing, 2016.

Drăgănescu, Mihai. "Interacting with Information Science and Technology, Philosophy of Science and the Society". In: *Mihai Drăgănescu in Medias Res*, edited by Dan Tufiș, Gheorghe Tecuci, Adrian Rusu and Ionuț Isac, 247–260, Bucharest: Romanian Academy's Publishing House, 2004.

Dumitrache, Ioan and Arsene, Octavian. Engineering Perspective on the Mind, in the *Proceedings of the First National Conference of Neuroscience, Neuroinformatics, Neurotechnology and Neuro-Psycho-Pharmacology,* Politehnica Press, Bucharest, 2017.

Ey, Henri. *Consciousness,* Bucharest: Scientific and Encyclopedic Publishing House, 1983.

Goertzel, Ben. "Hyperset Models of Self, Will and Reflective Consciousness", *International Journal of Machine Consciousness,* 1 (2011): 19–53.

Hoffman, Donald D. "Consciousness and the Mind-Body Problem". *Mind & Matter,* 6 (2008): 87–121.

Kurzweil Ray. *How to Create a Mind? The Secret of Human Thinking Revealed,* New York: Viking Press, 2012.

Laszlo, Ervin, Grof, Stanislav, Russell, Peter. *The Conscious Revolution: A Transatlantic Dialog*, translation by Catalina Chiriac, Bucharest: Elena Francisc Publishing, 2009.

Lutz, A. *et al. Meditation and the Neuroscience of Conscience,* http://brainimaging.waisman.wisc.edu/~lutz/Meditation_Neuroscience_2005_AL_JDD_RJD_2.pdf . Last access October 25 2021.

Mastrogiovanni, Fulvio; Scalmato, Antonello; Sgorbissa, Antonio and Zaccaria, Renato. "Problem Awareness for Skilled Humanoid Robots", *International Journal of Machine Consciousness,* 1 (2011): 91–114.

Minsky, Marwin, *Society of Mind*, New York: Simon and Schuster, 1986.

Moutsopoulos, Evanghelos, Conștiința intențională (*The Intentional Consciousness*), translation by Ana Bazac, Bucharest: Omonia Publishing House, 2017.

Pană, Laura. ”An Integrative Model of Mind, Cognition, Consciousness and Creation” *Noema* 7 (2008): 120–137.

Pană, Laura. “Characteristics of Information at the Social Level of Existence” In Laura Pană, *Philosophy of Information and Information Technology,* 21–32, Bucharest: Politehnica Press, 2004.

Pană, Laura. “Conceptual Modeling of the Society of the Future in Mihai Drăgănescu’s Writings: A Society of Consciousness or a Society of Culture?” *Noema* 12 (2013): 31–47.

Pană, Laura. “Consciousness and Computing” In Laura Pană, *Philosophy of Information and Information Technology,* 193–211.

Pană, Laura. “Crucial Intellectual Events in the History of Information Science and Technology”, *Noesis* 35 (2010): 171–195.

Pană, Laura. “From Information Flows and Nets to Knowledge Groups and Works”, ECAP ’07, the 5th *European Computing and Philosophy Conference,* Twente University, June 21–24, 2007, Enschede, Netherlands.

Pană, Laura. “Information Machine”, “Information Thinking, Information Action and Information Man” and “Information Society” In Laura Pană, *Philosphy of Technical Culture,* 430–439; 439–451; 452–472, Bucharest: Technical Publishing House, 2000.

Pană, Laura. “Intellectual Techniques and Information Technologies in the Transition to the Knowledge Society”, *Noesis* 30–31 (2005–2006): 69–85.

Pană, Laura. “New Features of Cognition in the Technical Intellectual Environment”, *Noema* 1 (2002): 116–128.

Pană, Laura. *Philosophy of Information and Information Technology*, Bucharest: Politechnica Press, 2004.

Pană, Laura. *Philosophy of Technical Culture,* Technical Publishing House, Bucharest: 2000.

Pană, Laura. “Philosophy, Science and Engineering of Consciousness in Mihai Drăgănescu”, *Noema* 11 (2012): 13–45.

Pană, Laura. ”The Spiritual Level of Information Generating and Using” In Laura Pană, *Philosophy of Information and Information Technology,* 41–48.

Pană, Laura. “Towards a General Theory of Information” In the *International Encyclopedia of Information Science and Technology,* Fourth Edition, volume VI, 4459–4470, Hershey PA, USA: IGI Global Disseminator of Knowledge, 2017.

Pană, Laura. *Truth and Reality. Treatise on the Ontology of Values,* Bucharest: Semne Publishing House, 2019.

Penrose, Roger. *Mintea noastră cea de toate zilele (The Emperor*’*s New Mind, Concerning Computers. Minds and the Laws of Physics),* Bucharest: Editura Tehnică, 1996.

Pereira, Alfonso Jr. and Almada, Leonardo, F. “Conceptual Space and Consciousness”, *International Journal of Machine Consciousness,* 1 (2011): 127–143.

Schelling, Friedrich W. J. *The System of Transcendental Idealism*, Bucharest: Humanitas Publishing House, 1995.

Smith, Peter G. *Celelalte minți* (*Other Minds: The Octopus, the Sea and the Deep Origins of Consciousness)*, Bucharest: Publica Press, 2017.

Tegmark, Max. "Consciousness as a State of Matter", *Chaos, Solitons & Fractals*, 76 (2015): 238–270.

Tononi, Giulio. "Integrated Information Theory of Consciousness: An Updated Account", *Archives Italiennes de Biologie*, 150 (2012): 290–326.

Zohar, Danah. *The Quantum Self*, London: Bloomsbury Publishing Ltd., 1990.

METHOD, LOGIC, PHILOSOPHY AND SCIENCE IN THE MUSIC OF JOHANN SEBASTIAN BACH AND WOLFGANG AMADEUS MOZART

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Abstract: We identify the "structures" of the method, logic, philosophy and science in the music of Johann Sebastian Bach and Wolfgang Amadeus Mozart. These aspects cannot be found in the dedicated literature or in the philosophico-scientific literature. Our framework starts with fundamental formulae specific to method, logic and philosophy, with consideration of the main characteristics pertaining to the specified fields. We end with some definitions of science, as well as with the global requirements of the latter, which may be applied – following some considerations and seekings – both to Bach's and to Mozart's music. Several questions arise in the context, and we suggest research solutions specific to different topics (three reference axes: harmony, counterpoint and melodicity) appliable to Bach's and Mozart's music. Some conclusions follow and we remark the constructivity/deconstructivity of some procedures applied by the two composers, which, in fact, are to be found in modern considerations in philosophy[2].

Keywords: Music, Logic, Methodology, Philosophy, Science
Received 11 August 2021

A. INTRODUCTORY GENERAL ASPECTS

Johann Sebastian Bach and Wolfgang Amadeus Mozart lived between 1685 – 1750 and 1756 – 1791, respectively, and the first was considered the greatest composer humanity had had till the the present time, while the second was considered the absolute musical genius of humanity. The polyphony of J.S. Bach's music is remarkable (superimposed melodies, which can be rigurously developped, existing within a well-defined harmonic frame): thus, was crowned the instrumental and vocal synthesis of the preceding period – be it English, Italian, French or German. The classicism of the music of W.A. Mozart implies (an admirable) perfection of the form of the musical discourse: within this framework, numerous nuances are implied, which are present, from the ancient methaphysics and the

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[2] The concerns of this essay represent an opening required also by the field of methodology, logic, philosophy, as well as of the philosophy of science, which are currently having place within the Division for Logic, Methodology and Philosophy of Science – the Romanian Academy. In an interdisciplinary framework, the current study is useful, as it will supplement the above-mentioned activities, by means of the concerns of the Group for Interdisciplinary Research within the already mentioned academic structure.

inner/outer tragism of the Human Being, towards the joy of children, but also of those who have long passed the age of childhood. Concerning the style, J.S. Bach is primarily characterized by a melodical form called (instrumental or vocal) fugue. The fugue has – as an initial part – a certain musical theme, which is interpreted on a single instrument or a unique voice, then, successively, by the other instruments or voices. Out of this componistic modality results a structure proper to a certain architecture – construction of a perfectly accomplished music; thus, the multitonal exposition is achieved, in fact, the ensemble, the whole of the composition is obtained. From the same point of view, of the style, as concerns W.A. Mozart, we may remark the comic opera, by means of which can be stressed the pshychology of some persona in certain given situations (*Cosi fan tutte, Le nozze di Figaro, The Magic Flute, The Abduction from the Seraglio and others*). Bach also composed sonatas and suites for violin, preludes, piano fugues and suites, variations, toccatas, organ fugues and fantesies, orchestral concerts for piano/violin/flute, vocal concerts, missas, oratorios, cantatas, aras and duets. Mozart also composed symphonies, concerts/sonatas for violin, piano, horn and flute, chamber music, (quintets, quartets and trios), variations, rondos, religious music, missas, motets, cantatas, vocal duets. Bach's music reflects introspectivity, subjectivity, concentration, chromatism, the profound faith in the ancient form of methaphysics; we may remark, in a distinct way, the formal part of his principles concerning the musical construction; however, the latter is mostly liniar. This structure is the dominant characteristic of his musical system (in terms of form), while the emotional part of his music is, in fact, by way of construction, a subsystem of the previous system, which is still determined downward by the latter. On the other hand, with Mozart, it is reflected the fruitful intermingling between the melodic line and the theme: (almost) every time, is stressed the aristocratic way of musical expression, an ontological form existing especially in instrumental music, as well as the methaphysics existing within the theme of the requiems, the ontic aspect of his comic operas. We should remark, along this opuscule, the references to certain significant works of the two great composers, accompanied by the mentioning of their duration, since we have considered, at the same time, some possible auditions of those works (which we are recommending), chosen in a "constructive" and judicious way, since they support our previous statements. At first, we may exemplify the above mentioned aspects by two fragments from "The Goldberg Variations" by Johann Sebastian Bach (interpreted in 1955 by a great piano player, specialized in J.S. Bach's music – the Canadian Glenn Gould), as well as "Ave Verum Corpus" K618, composed by Wolfgang Amadeus Mozart (motet for choir, orchestra and organ, interpreted in 2006 by the choir of "Scuola Corale G. Puccini" in Sassuolo, Italy, accompanied by the "Philharmonic Orchestra Emiliana", conducted by Francesco Saguatti).

Musical fragment I: 1 (Bach – Glenn Gould) + 2 (Mozart – Scuola Corale) (2.53 min. + 3.12 min. = 6.5 min.)

We remark, to a large extent, the range of characteristics of the significant musical forms proper to the two great composers. This short introduction and example initiate, in fact, the topic of the current essay, one which is not to be found in the fundamental works of musical critique and philosophy referring to the method, logic,

philosophy and science that can be identified in the music composed by Johann Sebastian Bach and Wolfgang Amadeus Mozart. Follows the analysis of those aspects.

B. METHOD

According to "Vocabulaire technique et critique de la philosophie", edited under the coordination of the „French Society for Philosophy", in 1968, pp. 623–624, method represents "a program priorily regulating one of the operations to be achieved and that points out to certain errors to avoid, in the attempt to reach a determined result". Within the mentioned source, the following question is also worded: "can a method be determined a priori and, irrespective of its application, be priorily formulated in order to serve as a program for some operations which will start only when the method rules have been formulated?..." as well as the allegations + the completion ... "a method represents an object really distinct from its application..., this will always concern the relationship of thinking with a certain "matter", „... we shall make a completion: ... "the direction regularly followed during the thinking operation upon a determined object" (M. Barnes). According to the "Dictionary of History and Philosophy of Science", coordinated by Dominique Lecourt, Polirom Editions 2009, [1999], p. 950, we read that ... "method refers to the analysis of the relationship between a given theory and the ensemble of the facts the former is trying to explain; it concerns the justification or the corroborating of the theories with the facts". A first problem is represented by the way those ideas can be adapted to what is, in fact, representing the method used in the music composed by the two composers. In conformity with *"Dictionnaire des Symboles"*, Editions Robert Laffont, 1982, [1969], Paris, pp. 654–655, "The Pythagoreans also considered **music to be a harmony of numbers and of the cosmos, while the latter itself could be reduced to sounding numbers**. It was giving numbers all the sensible and sensitive **plenitude** of the being. It is to their school that the concept of *music of the spheres* is related. Plato distinguished musical forms adapted for different functions of people in the city". *Typical cosmos is a magnificent concert*. ... the music of man: *music organizes man and it is in his inner self that he captures music. Music supposes a concord between soul and body... a harmony of faculties of the soul… and of the constitutive elements of the body*. If music is the *science of modulations* (Varon), of measure, we may conceive that it commands to the order of the cosmos, to human order, to instrumental order. **It will be the art of touching perfection**". There is a **Bachian symbolistic** in the light of the description in the previous paragraph. For Plato, music generates harmony in Ideas, implying philosophy. In "De musica" Augustin declares that music is developping a correct measure of the connexion between sensitive and intelligible. Profound references to music were also made by Shopenhauer, Hegel, Nietzche, Stravinsky, Adorno, Jankélévich, Schönberg... Interiority, touching the roots of the Being, pure art, ineffable and poetry, philosophy and formalism, constructivism, abstractionism – those are only some of

the essential attributes of music (especially classic music, but not only...), connexions that these remarkable personnalities have considered, in time, concerning such a form of art, first of all, as aesthetic value. In the "*Oxford Dictionary*", 1998, London, U.K., p. 538, we read: "music – the art of combining vocal or instrumental sounds (or both) to produce **beauty of form, harmony, and expression of emotion**". The characteristics of authentic music (and not at all of the useless "noises" and perturbations of the Human Being, in some situations, having innumerable psychic implications – as deformed conditions of the normal psychological requirements) are to be also found in the profound and also sublime music composed by Bach and Mozart. Probably their method "is tailored" mostly on the activity of the creating mind, in conformity with what is defined in the "*Oxford Dictionary*", p. 513: "Method – a special form of procedure esp. in any branch of mental activity".

We remark among the **fundamental methods**, which characterize the universality of Bach's music those related to polyphony and the Lutherian chorals. With Bach, those aspects can be found, mainly, in canons and fugues (as methods). 1. **In a canon**: the initial theme is initiated by a single voice, then, at a certain strictly determined interval, it is resumed by the second voice, in the same tonality, and then, observing the same interval, the theme is resumed by the third voice. And so on and so forth, strictly following the direction generated (in the first place) by the melody and (in the second place) by harmony, at only one level (very rarely) or at two or more levels, according to the number of voices that are breaking in. Thus, comes into being a music of great beauty and, at the same time, we should remark the former's great complexity. There is also the possibility for the main theme to be resumed within different (modular) tonalities having the same velocity or developping with some different velocities (faster or slower than the initial theme is developping), but superposed, generally in an ascending direction. The increase of the complexity is generated also by inversing the theme: a voice follows a descending direction, while the initial theme, that of the first voice, has an ascending direction or vice versa, there are contrary directions: ascendere (II) with descendere (I) (canon "cancricans") (e.g.: Musical Offering). In this way, a mathematical-like isomorphism is taking place. 2. **In a fugue** the method is (somehow) similar, but this is, however, much more expressive, since the rigour of the canon disappears. In a fugue, at the beginning, the first voice initiates a theme. When the former ends, the second voice is starting, resuming the main theme, while the first voice is resuming its evolution with the secondary theme, which is also in a certain melodic, harmonic, rhythmic contrast with the main theme. The rule disappears only when all the voices meet. In this situation, a significant problem raises, that may be taken into consideration in science, too: is a method implying the absolute existence of a rule or not ? If not, then which is the place of the paradigm for the same type of music? The question implies more observation. The fugues I + II in the "**Musical Offering**" (1747 – "Ricercare" (acronym: **R**egis **I**ussu **C**antio **E**t **R**eliqua **C**anonica **A**rte **R**esoluta = Theme Given by the King's Command, Resolved According to the Canonic Style (translation after Bach: Davitt

Moroney)/"Canonic Fugue"), don't have the same structure; there is no unique rule in their respective music. All is reunited in what is bearing the name of the "**art of counterpoint**". The raising of modulation, that is the essential characteristic of the "**Musical Offering**", in fact, of the canon "**Canon per Tonos**", on three voices, pertaining to the former, which is coming back, however, after the six changes of tonality, to the initial one (G minor), stable, without any losses generated by the modulation. Bach's creation, with the related methods, is characterized by unity and synthesis. The tradition of building and listening to this form of music has Renaissance origins. Within the Baroque style, in fact, takes place a **symbolistic** having the form identified in Bach's music. Within this frame, an important role is played by 3. "the **melodic recurrence**", situated within some different tonal levels. Generally speaking, the two melodic lines are executed simultaneously; each of them is following its initial line (a method used mainly within the Sonatas and Partitas for violin-solo, e.g. : Mark Lubotsky, Sonatas and Partitas – recordings in Maria Minor Church in Utrecht). **The method used by Bach in** "**The Art of Fugue**" (1750) (counterpoint variation with a unique theme) can be remarked by the fact that it aims at the complexity (achieved by some counterpoint constraints) of the 14 fugues (Contrapunctus) + 8 component canons, starting with the forms of a medium complexity and directed towards those with a level of complexity which can no longer be (immediately) identified by the Human Being. Thanks to the method he used, the composer *"... introduces us in a quiet and serious world, deserted and rigid, without colour and light, without movement; this world does not draw our attention, however, we cannot escape from its influence"* (Albert Schweitzer, J.S. Bach, New York, Dover Publication Inc., 1966, p. 427). This characteristic is present, however, only within the first four fugues pertaining to "The Art of Fugue". Eventually, we can identify, within this composition, the form of pure music, suddenly interrupted, in fact, the final time of J.S. Bach, the time of his ultimate parting with this world, in the year 1750. Resuming **the method used within the Goldberg Variations** (1741 – the year of their editing), counting thirty of them, whose main theme, called "Air" was presented (interpreted by Glenn Gould), we may remark its constancy, even though the melodies to follow vary, in fact, each of them being a canon (method 1 of building). At the same time, we should remark, as a method, Variation no. 30, where the Quodlibet is introduced, in the place of the ninth canon; this is the song which would accompany the practice of family meetings (with the members of his family) of the composer Johann Sebastian Bach, by means of the same (general) methods, but adapted, he also composed Cantatas, Oratories, Missas, Passions, Suites, Concerts (Brandenburgic, but not only...), Preludes, Toccatas, Sonatas, instrumental music for organon, harpsichord, flute, piano, violin, viola... *In fact, Bach, by means of the music he built, compared to an ideal architectonic edifice, enriched by force and flexibility, succeeded, by the methods used, to produce greatness and uplifting, both in the ascendent and the descendent direction, delving toward the "depths", of human existence. Reflecting upon Bach's creation, we may consider the necessity of a question and of a possible answer concerning the limit (border line) separating the*

uncounscious and the conscious, both as concerns J.S. Bach and the rest of the Human Beings. We may exemplify all the aspects mentioned till now by a short fragment from the "Musical Offering", (Ricercar 6) by Johann Sebastian Bach (a ***part of the music sent, together with the Brandenburgic Concert no.2, Partita for violin-solo no.3 (gavotta and rondo), The Well Tempered Clavicord (prelude and fugue no.1)), into the cosmic space – as a sign of the Earth (Voyager 1 Programme – 1977, USA, existing till 20th November 2018****). We should also remark (in the image accompanying the music) the variation of the frequency of sounds, which has the (approximate) aspect of a sinusoid initially related to a unique voice (that of the harpsichord), and gradually – to all the six voices (where the complexity and the beauty of the music touch their maximum point). Johann Sebastian Bach felt all those aspects, in his time, through a perfect organization and geometry/topology of his music.*

Musical fragment II: (Bach – Musical Offering (Ricercar 6) (7.08 min.)

In what follows we shall analyze some aspects existing (or not) in the music of Wolfgang Amadeus Mozart, a celebrated representative of the Wienna clasicissm, together with Haydn. The essential characteristic of Mozart's music is **form**, its precision; the composer did not found form, but achieved its optimum. In a little extended sound field, there is a real game of musical language, a family of aspects pertaining, in fact, to a unique theme which is developping through expressiveness and concentrated spirit. Form manifested within the oratories, chamber music, cantatas, lieds, compositions with religious themes, symphonies, psalms..., one essential attribute of all those being their **melodicity** contained in the emotion resulted, while harmony remains on a second place. With Mozart, especially in his Symphonies, prevail the **inner feelings**, which may be described quite well by instrumental music. An example is represented by the last but one symphony of Mozart, no. 40, in G minor (first part – Allegro molto). We remark the complexity of human feelings, their contradiction (sorrow-joy/hope-resignation), their translation into music. As Dr. I. Weinberg was remarking, in cooperation with Aurel Stroe, in the essay "Mozart", 1962, p. 53, the work of this composer has "… a direct communicativity..., accessibility for the large public, a certain way of expressing and unveil the gravest and most complex feelings by means of a sound language full of grace and charm, all those elements making the work of Mozart touch the hearts of the auditors anywhere, any time...". In this spirit, we "dare" propose to keep silence in order to facilitate reflection and thinking, introspection and analysis of the inner feelings characterizing the soul, followed by the existence of every day entropy. As a **method**, Mozart's symphony with four distinct parts (Allegro, Andante, Menuet, Allegro) resumes Joseph Haydn's conception, according to which the old symphonic componence is replaced by two menuets, and the result is a five-part symphony, in a new form, with just one menuet, in four parts, a form that Mozart established. However, his last symphony, no. 41 – Jupiter, is considered to represent a maximum of Mozart's symphonic creation (1788). In the symphonies, the composer is connecting – is

harmonizing – is putting together the timbres pertaining to the same family of instruments with those pertaining to some heterogenous, totally different families. Within many of his orchestrations, a polyphonic (noticeable) independence is taking place. We may say that, unsimilarly to Bach, who had a great expertise in composing fugues and chorals, Mozart had an expertise in composing symphonic music. The first is deductivist, directed (more) towards the depths of humanity, while the second is inductivist, directed more towards the exterior "spring ups" of music, accompanied by de Sun-Light-Vibration and human feelings, and not in the least directed towards "dark spaces". J.S.Bach's "time" followed, in fact, almost one hundred years after his disappearance (1750); he has a future time as compared to the period he lived in, and W.A. Mozart's "time" has been continuously present, it has accompanied him all over his life. Also as a **method**, in the Serenades (e.g.: Eine kleine Nachtmusik) we should remark certain **contrasts** (the lightful theme + the meditative theme (first part) + the poetic aspect, specific to the floral calm of Nature during the night (second part) + the rustic dance (third part) + the melodic echo of the joy of being (we may also remark Mozart's **method-art** in building the dialogue between the soloist instrument and the latter. **Did the well-known power of improvisation of Mozart always have a method within a certain spontaneity of creation or was there, in fact, a great intuition of high quality music, intermingled with an absolute necessity, situated on the first level, of its melodicity, as an essentials paradigm? We raise this problem, in fact, since currently, we do not have a clear answer**. The essay "Lettres de Mozart – Encyclopedie de la Musique, Vol. I", quotes the following sentence of the composer: "... ideas come one after another and here it is a composition fitted to be molded in a form or another... My soul is warming, if I am not disturbed, the idea will grow, I am giving more and more amplitude, more light, more clarity". The final of Mozart's existence in this world was, in a way, similar to that of Bach's: he was writing in his last moments of his existence his last work – "The Requiem" (1791) (where the seventh part is called "Lacrimosa" (Shedding Tears). **Unity**, with Wolfgang Amadeus Mozart, as well as with Johann Sebastian Bach, implied, even in the forms proper to the uncounscious, their full attention focused towards the wanted observance of aesthetic plans (the aesthetic infinity), necessary to music (intelligence of aesthetics), even if they manifested themselves, prioritarily, by means of symmetry (influence of antiquity). Mozart's music in the drama has a visible aesthetic unity, but also simplicity, existing within the great complexity of human psychology or, maybe, quality through simplity. Another **method** used by Mozart was that of **chromatic harmony**, which was applied to some quartets, as well as the auxilliary use of cadences. The **method** pertaining to the art of counterpoint, of polyphony, specific to Baroque style, which J. Sebastian Bach discovered and which had also existed prior to him, was used by him with the uttmorst perfection and ingenuity (e.g.: Symphony no.29). We may conclude, in a first stage, that ideas and melodic inspiration, light and the upsurge of music, formed with Mozart the laws and the methods of the music he composed, together with a major creative equilibrium, to be noticed, especially, between different vocal

and instrumental forms, in a profound interweaving. Mozart found the initial pattern, taken off from the old world musicians, but, within the respective framework he developped melodicity and optimized form, modifying them with ingeniosity. To end this chapter, we shall refer to a short example of Symphony no. 40 by Mozart, interpreted by the Philharmonic Orchestra in Berlin conducted by Sir Simon Rattle. The "Joy of Music" of high quality is to be remarked on the face of the conductor.

Musical fragment III: (Mozart – Symphony no. 40, first part – Allegro molto) (3.07 min.)

Up to now we have identified, in our study, a series of fundamental methods in the music composed by Sebastian Bach (in canon, fugue, the art of counterpoint, polyphony, melodic recurrence…) and in the music composed by Amadeus Mozart (through form, melodicity, contrast, dialogue between instrument and orchestra, chromatic harmony…). We consider we may end here the short references to the methods identified in the music of the two great world composers.

C. Logic

This part of our exposure will refer to the logic context of the music of Johann Sebastian Bach and Wolfgang Amadeus Mozart. We alledged that, in music, Bach is mainly deductivist, while, Mozart, in his work, is more inductivist. If we consult "The Oxford Dictionary of Philosophy", [1994], pp. 232–233, we shall find the following: "**Deductive logic**, where **a conclusion logically comes out from a set of premises**, is different from **inductive logic**, which **studies the way premises can support a conclusion without implying a necessity**. In deductive logic the conclusion cannot be false if premises are true. The aim of logic is rather to explicitate the rules by means of which can be built reasonings, than to study the real reasoning processes used by people, which can or cannot be in conformity with those rules. ... There is not a similarly simple answer in the case of inductive logic, which is, generally, a less vigurous discipline, but its objective will be the discovery of some reasoning ways, so that anyone who trespasses them will have improbable opinions". According to the same source, at p.234, we read: "The classical theory of models for formal logic, due to Saul Kripke (Doctor Honoris Causa of the University of Bucharest – 2011, logician (contemporary) /mathematician, a.n.) and the Swedish logician Stig Kanger, implies the evaluation of sentences not as being true or false *simpliciter*, but being true or false in "**possible worlds**", then necessity corresponding to what is true in **all worlds**, and possibility corresponding to what is true in some world". Here, the idiom "possible world" represents a complete situation of things, with a defined value of truth. This is inferred, in fact, starting from one of Plato's Ideas (which is being debated), according to which people "build" or "create", while by means of formalism, there are only certain symbols used in logic. **The possibility of some worlds** represents

here the truth existing only in some of the possible worlds, **not in all possible worlds**. "The possible worlds" as well as "some worlds" are the worlds existing in Bach's and Mozart's creations. Taking into consideration that a series of Bach's and Mozart's masterpieces were sent into outer space, as (fundamental) earth messages presented to the interstelar space, by means of the USA spaceship – Voyager1, in the year 1977, there is a set of some worlds, part of possible worlds (of all worlds in the Universe) which might understand the "some world" Earth with its "truths". Willard Quine, in his essay "Word and Object" – 1960, was affirming that logic has as an objective "to figure the most general traits of reality". In such a context, there is a relationship between the (deductive and inductive) **logic of the music of Bach and Mozart** and their effective music. The analysis of the music of the two great composeres presupposes the existence of an objective of music, as well as of certain (accepted) rules. The objective, its achievement is done based on the laws of their thinking, with its origin in the nature of the intellect – a generator of the music of the two. Rules (according to Wilhelm Leibniz) represent, in fact, the grammar of the laws of thinking, ideally (in general, impossible to be totally attained); they have to coincide with logic, by the grammatical structure (also used in music), by method (previously analyzed). For Quine, logic represents grammar and truth. Music is a mental construct of the creating minds of Bach and Mozart, it cannot exist independently of them. According to Newton da Costa *("Classical and Non-classical Logics – an Essay on the Fundamentals of Logic", Ed. Tehnică, 2004, [1997], p. 46*), "reason" has also the following significance: "discursive thinking faculty in opposition with intuitive thinking", while "intuition" ("intellectual intuition"), according to the same author and same work (p. 93) implies "contemplation, feeling and spiritual sympathy, religious mysticism, inspiration". In order to rationally express a music, it is necessary to use a unique logic, that should also be adaptable (the principles of systematization, unicity, conformity to reason). However, currently still, in the analyzed music are identified new esthetic characteristics, even during this period, one of priorities owned and offered by artificial intelligence in music. We have to be aware, however, in a realistic way, of the fact that we might be never able to totally discover these significant "properties" attributed to the music of Bach and Mozart. Bach's and Mozart's works have, in a total context, a meaning. What about significance? We know that the significance is related to **form**, while meaning is related to **content**. Are those related to the mental action that was the foundation for the mental construct of their music? There is a relationship, felt in the unconscious or perceived in the conscious, which may be established between the music of the two and the persons who listen to it, a logic of the latter's relationship with the music of J.S. Bach and W.A. Mozart (not only, strictly an intrinsic logic of their music). In pure logic, Friedrich Ludwig Gottlob Frege created a logic system which is analyzing the logic of relationships. The idea of the relationship was also debated by Gottfried Wilhelm Leibniz (A $\mathbb{R}$ B | A, B – entities, $\mathbb{R}$ – relationship between A and B). Information maximum-perceived, in a macrocosmic sense, including in the music of Bach and Mozart, results, in fact, out of the relationships. If those who

listen to the music of the two composers don't have a (special) relationship with their music, the message sent by information will be damaged, since it is not well perceived. It is still possible the (defficitary) relationship imposed by the possibilities of the sound reception (especially), a fact which determines that some of the interpreters of high prestige related to the music of the two prominent composers not to accept recordings, but only "live" concerts (Glenn Gould, Radu Lupu, Sergiu Celibidache… and others). For the music of Johann Sebastian Bach, and also of Wolfgang Amadeus Mozart, composed during the period 1700 – 1750, and also afterwards, till Mozart left this world, we may find, in fact, the existence of the triad of the influences of Aristotelian logic, Euclidian considerations and Newtonian thinking, as an epistemologic whole. Between the Euclidian geometry (especially), the Aristotelian logic and the music of Bach and Mozart there are analogies; the latter also are at the basis of Newtonian considerations, in relationship with the same form of geometry. Da Costa was remarking, "… in building logic, the influence of geometry was more significant" (p. 163, the mentioned work). **The laws of classical geometry reunited with those of the Aristotelian logic, marked the thinking of Bach and Mozart when they composed music (to which they contributed with all they thought it fitted their creation)**. We remind the name of the Russian logician N.A. Vasiliev (1880–1940), who initiated imaginary logic (similar to non-Euclidian geometry, from the logic point of view, being also similar, as thinking, to a (possible) form of geometry, but different from those) non-Aristotelian, considering, within the respective framework, the existence of the so-called "methalogic laws", pertaining to the human spirit (which cannot be ignored or not considered, but also not much explicitated (and explained)). Also, the same logician introduces the principle of non-contradiction, by means of which he alledges that the laws of logic depend of the structure of the Universe where they are observed, admitting the existence of the exception from the classical logic, which can have a meaning in Universes different from ours (other "worlds", imaginary Universes). When we say that J.S. Bach and W.A. Mozart contributed with "all they thought it fitted for their creation", we think it is useful to consider imaginary logic, too, by its methalogic laws + the principle of non-contradiction (maybe an intuition generated by the unconscious). In fact, Hilary Putnam affirmed that the Universe is governed by a non-classical logic (reality of depths), while classical logic (Aristotelian logic) – which is only a transformation perceived by the Being – exists in the "world" of macrocosmic objects. The lattice related to the quantum structure will change, in this case (current quantum considerations) into a Boole algebra (proper for what we are and what we perceive, as Human Beings, in macrocosm). Kurt Gödel was referring, in fact, to the appearance of the material intuition: (Quantum) Microcosmos → (Classic) Macrocosmos. Bach and Mozart, during their temporary existence on the Earth, were not familiar with those aspects, especially the physical ones, but the latters have always existed as fundamental characteristics of the nature of the Human Being within Nature. Similar to all of us, they had those characteristics, but, maybe, they expressed them better (in the classical sense).

We don't think that they ever had been aware of the source of their inspiration, and such problems represent questions which are still under debate. Probably, inspiration was, in fact, generated by a dialectic related to a superior "level", which is getting ahead us. We conclude that the methods of Bach and Mozart (previously exposed) can be framed, in general, into a binary-type of logic (Aristotelian) which exists, however, on the general background of a non-classic, profound "logic" and of a "source" of inspiration, exactitude (J.S. Bach), improvisation (W.A. Mozart) that go beyond the ordinary possibilities of human explanation. We may consider, once again, at the end of the third chapter of this essay, Canon no. 2 – composed by Johann Sebastian Bach, within the "Musical Offering", as well as Mozart's lied – Wiegenlied (Lullaby), K.350.

Musical fragment IV: 1 (Bach – Musical Offering (Canon 2)) + 2 (Mozart – Wiegenlied (Lullaby), K.350) (0.46 min. + 2.31 min. = 3.17 min.)

D. Philosophy

In what follows, we shall make (some) references to certain notions of theoretical and applied philosophy, identified in the creation of the two composers. For the first stage, we shall analyze the notion of **form** (in philosophy), which, as it is well-known, exists also in music. Arnold Schöenberg (1874–1951), in his essay "Style and Idea, G. Salvetti (La nascita del Novecento, EDT Torino, 1991, p. 347)", refers to the idiom "musical philosopher". As the German idealist philosopher Nicolai Hartmann was remarking (Estetica, p. 293) "to find a form represents the secret of creation, which is not limited to a simple process of becoming aware: since the mysterious activity which is developping within the artist is missed by his consciousness, too, and all that he can do "is to wait the moment of illumination", which, however, "does not tell him what is going on within himself and how it works, but only which is the form searched for and how he can attain it in the given case". **The general form of a musical composition**, identified in the works of Bach and Mozart, refers to polyphony (especially with Bach, but also with Mozart), melodicity (prioritarily with Mozart) and harmony. Those are "integrated" within a whole (structure + organization + shaping), having as an objective the "content" of the composition, in fact, the essence of the composer's music. In an underlying context, the form existing with Bach and Mozart can be attached to their symphonies, concerts, chamber music, oratories, lieds, sonatas... And so on and so forth. Form also represents a characteristic of Plato's fundamental philosophy, an abstract trait (related to the perception of people, in the sensible world (as a model) and transcendent (by means of unicity), as the ideal to be reached, by means of the intellect (Universals). In this direction, the concern of the two composers was to search for the form of their musical creation, perceived in the sensitive world. The process represented, for Mozart, mostly powerful inventivity, fruitful inspiration, generated by his soul condition (maybe, sometimes, a little changing), through which the composer also found the

ideal form, while, for Bach, a delving of his thoughts into his inner Being: thus, he discovered, at a certain moment, also the precise (optimal) form of his compositions. With Bach, the artistic content of music has geometrization/topologization, while with Mozart, there is Form (structure (composition included in a musical genre) + organization (polyphony, melodicity, harmony...) + modelling (interpretation, conducting...). In Bach's music we perceive, to a great extent, the "matter" of the sound, generated (in a significant proportion) by the polyphonic style, proper to the Baroque period. The "matter" of the sound is different from its "form", specific to Mozart's music. Mozart is considered to be related to classicism in music (together with Haydn and Beethoven), but, sometimes to romantism (oriented more towards the high spheres of Nature (towards + ∞), since music, similar to poetry, is, generally speaking, romantic), unlike Bach, whom we can relate to pure Baroque (1600 – 1750), oriented (prioritarily) towards the depths of the Human Being. Bach is related to "matter", while Mozart is related to "form", but both composers were concerned both with form and with content. Another essential aspect of the music of the two composers may be framed within what is called "**ontologic music**" (existing in itself, with a value of pure existence, univocity) (Aurel Stroe, 2001, "Art of Composition"). We consider that Mozart's music is more ontologic, in Plato's spirit, while Bach's music is mainly ontic, in Heidegger's spirit. We include the following remark: The complexity of the tonalities in Bach's and Mozart's creation can be best included, during this period (contemporary to us) (as the same Aurel Stroe was remarking) within some "**categories of musics**", similar to some **Platonician, Aristotelian and Kantian categories,** and that there are also "**classes of compositions**". Bach's music, as well as Mozart's music, may be included into some distinct musical categories, too. As long as music (analyzed in this opuscule) is also theoretic (not only empiric), stimulating thinking, by means of methods and logic (especially as concerns J.S. Bach), as well as the order of thinking (reducing entropy), it also form the framework of some philosophic research. Igor Stravinsky (1882–1971) was referring to the fact that "the musical phenomenon is a phenomenon of speculation" of thinking. Can **methamusic** (music of music) be applied to Bach's and to Mozart's creation, similarly to the initial thinking of methaphysics (more than physics – as it is thought/considered by people)? Could a complete, more thorough analysis of the music of the two composers be (optimally) achieved starting from their methamusic, and then, heading towards their music ? Certainly, these are possibilies of perspective. In the music of the two, in fact, we may remark that **space is disappearing (less in Bach's creations and more in Mozart's creations), but time is continuously present**. Does the music of the music of Bach and Mozart imply, ultimately, the disappearance of spaces and the persistence of time? We may correlate this with Husserl's **phenomenology,** as long as the "tone" of the music (with Bach) is considered by Husserl to represent more than "melodicity" (with Mozart). Does that **epoché** of Husserl occur (to which Sergiu Celibidache also refers, in his book of **phenomenology of music**, even though he does not call it effectively), even a reduction to the **essence of music (eidetism)**? The language of the analyzed music

is directing us towards a form of logic, a reason for which, we have analyzed in this essay, in the first place, method (musical language), and then, also the logic of the music of the two composers. In this context, Bach's and Mozart's music has connections with philosophy, but also with science, as we shall show. Since in music, and not only..., explanation differs from exemplification, but both form a whole, we shall suggest, in what follows, in addition to some explanations (similar to the previous ones), another two examples from Bach and Mozart. We can remark, in these examples also a possible **hermeneutic interpretation** of Bach's and Mozart's music but, mainly within the relationship composer (Bach and Mozart) – interpreter, as especially remarked in the concertistic activity. They refer to: 1) The choir related to the "St. Matthew Passion" (composition that represents a prodigious reference point of J.S. Bach's music (1729), which, in the XIXth century, when it was interpreted under the Mendelssohn's conductance, constituted the official recognition of Bach's music by humanity (1829) (after about one hundred years), interpreted in a concert held in Köln; 2) The serenade "Eine kleine Nachtmusik" – 1787, second part – Romance-Andante (in translation: "Little Night Serenade" – containing the following parts: I. Allegro; II. Romance-Andante; III. Menuet-Allegretto; IV. Rondo-Allegro – conceived for chord instruments, which can be interpreted as chamber music, too (quartet). In both exemplifications it is necessary to pursue, in the first place, the content ("substance" – existing in Bach's music, but also symbolism, semantics, the timbre of his music (the timbre aura)), as well as the "particular form" (which occurs with Mozart), and, in the second place – the "general form", the harmony of the two categories of music.

Musical fragment V: 1 (Bach – Choir from "Passions after Mathew") + 2 (Mozart – "Eine kleine Nachtmusik", the second part – Andante*) (3.06 min. + 4.27 min. = 7.33 min.)*

E. Science

We start this part of the analysis with a quotation from the "Dictionary of Philosophy and Logic" – editorial consultant – Antony Flew, 1996, [1979], pp. 330, 331, where we read: "Science does not consist only in making timid generalizations out of big quantities of data, since, with the scientist, collection of data is guided by one or another theoretical interest, and the results he will obtain are not simple inductive extrapolations, but represent explanations, models and theories. In case of the sciences that have had great successes, theories have a cummulative character, in the sense that the new theories not only take over the luggage of remarks that have led to the old one, but also try to keep, as long as possible, something of the old theory. Realism is, probably, most disturbed when the scientific theory makes it impossible "to understand what is happening", that is to interpret the newly discovered structures by the prism of the previously intelligible models and mechanisms". By means of the analyzed methods existing

in Johann Sebastian Bach' and Wolfgang Amadeus Mozart's music were selected "the procedures and objectives of a particular discipline, the investigation of the way of organizing the respective discipline" (see the above-mentioned work, the reference to "methodology", p. 228), in this case – the music of the two composers. Out of this reason, we shall resume, briefly, the conclusions in paragragh A. (Method), and analyze to what extent the respective methods can be considered as scientific (can pertain to science). If we refer to the music composed by J.S. Bach, we should remark that his main methods are the following: 1. **Polyphony** (highly advanced); 2. **Technique of counterpoint**; 3. **Melodic recurrence**; 4. **Deductivism**; 5. **Unity**; 6. **Chromatic harmony**. Essentially, the methods identified with W.A. Mozart include aspects such as: 1. **Form**; 2. **Melodicity**; 3. **Contrast**; 4. **Polyphony** (moderated); 5. **Inductivism**; 6. **Unity**; 7. **Chromatic harmony**. There are many more others, auxilliary, proper (exclusively) to the two composers, specific to some special, detailed musical techniques, which do not fit into the object of this essay. Previously, in this opuscule we remarked, additionally, what is to be found both in the Bachian and in the Mozartian creation. We notice the fact that, with both composers, there is a group proper to fundamental rules, stressed by the methods used; the composers had, in fact, a **(strictly) controlled musical** "**experience**", out of which they inferred, afterwords, some theoretical conclusions, too (a procedure similar to the one used, at other levels, at a maximum proportion, of 100%, in science). The **reproductibility** of those "experiences" manifested itself by a large number of (composed) musical pieces (works), similar in structure. By means of music, they **built** fundamental "problems", and they also formulated and reformulated the latter (deconstruction + reconstruction), but to a small extent. With these two composers, there is a body of ideas which represents a foundation and allows a harmonious development. J.S. Bach and W.A. Mozart never pretended that the music they had composed, by means of its characteristics, represented an "absolute truth"; they were not dogmatic, similar to the situation in science. Their music **has an inner consistency**, it is devoid of contradictions within the same framework, which is proper only to them, but has also, **an outer consistency**, since it is very much characterized by a style which is specific to the two composers, immediately recognizable (their creation is not similar to other musical pieces (works). Those musics, however, do not meet the fundamental criterion, proper to a scientific experiment: they have the subjectivity specific to the composers who had written it, and not in the least the objectivity required by an experiment in science. The equivalent conditions ("frameworks" of the same music, Bachian or Mozartian) are created exclusively by the two composers (not in the least by others), the results of their music are similar (exclusively the music of each of them), almost always the criterion of reliability (loyalty) is met (they have subjectivity, not objectivity). Standardization, considered necessary, in a local sense, useful in order to ensure the stability of forms of Bach's or Mozart's music, is fully observed, but it cannot exist globally too, since the music of the two composers is unique, unrepeatable, little comparable with other composers' (an exception might be the dyad

Bach–Häendel, as a Baroque style, since they were contemporaries (1685–1750), respectively (1685–1759). In the work "Dictionnaire de la Musique", ed. Larousse, 2005, p. 1105, polyphony is defined as a scientific procedure that "also implies the fact that all the voices have an individual melodic value…, the term is very much employed in ethnomusicology; in classical music, it is used mainly for the periods when the counterpoint had a pre-eminence over harmony, that is for those which had preceded the ongoing basis". Also, in the same work, there are references to the two significances of "form" (p. 535), generally, one of those is applicable to all "situations" in music, while, in a particular way, it reflects "a sketch of construction upon which is constructed (formatted, a.n.) a given work". It ensures the logic and coherence of music (Schönberg). Within the same source of documentation, we read further "the discussion of such an idea requires long philosophical debates". For the "particular direction" of form are remarked: the fugue – specific to Bach, the sonata – specific to Mozart, the rondo... and others. Form, with Mozart, is defined as being free: within it, "are introduced original variables" (p. 536). Melodicity, essentially has a vertical "aspect", and is generated by accords, which may have a certain succession; they mainly represent harmony. The horizontal "aspect" is remarked by the succession of musical sounds with different levels of frequency, as well as variability in time. There is a profound relationship between form and melodicity. Mozart excelled in both directions; even more, there is the "psychology of form" (Gestalt) characteristic to Mozart. In the light of melodicity, we may notice a certain globalizing psychologic structure existing within his consciousness, by means of a closed musical form, which has no longer a space of absorption for similar techniques. The melodicity of Mozart's music ensures memorization and identificability, interpreted on instruments, and often re-evoking human voice, as well as the modulations of the latter. Once again, "Dictionnaire de la Musique", at pp. 628, 629, states: "Therefore, harmony is, in what concerns its rank, **the science** of the relationship among the sounds, including the study of intervals, of their grouping in primary elements (…), then of the layout structure of the latter among them (…)". "The Art of Counterpoint" implies a scientific character, very much musical sensitiveness; otherwise, without such capabilities, it is not possible to compose several superposed melodies, meant to be listened to at the same time, simultaneously. Bach composed the magnificent tonal "counterpoints". Light, as an electromagnetic form, implies a simultaneity of expression and a place of existence (particle and wave), similar to the art of counterpoint. accordingly, science becomes art. We suggest, as a possibility, when studying Bach's and Mozart's music in an organized way, to introduce a fundamental trihedral angle, specific, as a reference, similarly to the fundamental (however relative) reference for movement, with three axes represented by **H**armony, **C**ounterpoint and **M**elodicity, specific (however) only to the two composers. The "optimal" area will be formed, consequently, by the points for which the three components (**H** – **C** – **M**) registers an optimal (well-defined) level that the two intuitted and constructed. We end the whole essay with a remarkable example suggested and selected out of the Mozartian creation, named "Menuet".

Musical fragment VI: 1 (Mozart – "Menuet" *(*A Song for Christmas Time*) (1.54 min.)*

Note:

As a corollary of our whole essay, we propose to listen, in perfect silence, be it during reading the text of this opuscule, or perceived as a simple suggestion (music not immediately audible), another renowned Bachian creation, peerlessly interpreted by the Romanian pianist Dinu Lipatti, in his last concert in Besançon (a musical offering), in the year of his premature disappearance (1950). The pianist "had the serenity of Wolfgang Amadeus Mozart" and, "towards the end of his life, the process of interiorization accellerated (similar to Johann Sebastian Bach, a.n.)" (Dragoș Tănăsescu, "Lipatti", ed. Meridiane, 1965, pp.5–6).

Musical fragment VII: 1 (Bach – "Cantata BMW 147" *(*Dinu Lipatti*) (3.27 min.)*

Selected Bibliography:

da Costa, Newton. *Classic and Non-classic logics – an essay on fundamentals of logic*. Romania: Ed. Tehnică. 2004, [1997]. pp.46, 163.

Schweitzer, Albert. *J.S. Bach*. USA: Dover Publication Inc. 1966. p. 427.

Schöenberg, Arnold, *Style and Idea*, New York, USA. Philosophical Library. 1950. p. 347 (referring to G. Salvetti – La nascita del Novecento, EDT Torino, 1991).

Tănăsescu, Dragoș, *Lipatti*, Romania: Ed. Meridiane. 1965. pp. 5, 6.

Dictionnaire de la Musique. France: Editions Larousse. 2005. pp. 535, 628, 629, 1105.

Dictionary of philosophy and logic, coord. Antony Flew. Romania: Ed. Humanitas. 1996, [1979]. pp.330, 331.

Dictionary of History and Philosophy of Science, coord. Dominique Lecourt, Romania: Ed. Polirom. 2009, [1999] p. 950.

Dictionnaire des Symboles, France: Robert Laffont . 1982, [1969]. pp. 654, 655.

Oxford Dictionary of Philosophy, UK: Oxford University Press. [1994]. p. 17.

Vocabulaire technique et critique de la philosophie, France: French Philosophy Society. 1968 . pp. 623, 624.

HISTORY OF SCIENCE

SELECTIONS FROM THE WRITINGS OF AND ABOUT THE ROMANIAN SCIENTIST GRIGORE ANTIPA

ALEXANDRU Ș. BOLOGA*

Abstract: Grigore Antipa (1867–1944) is one of the most prestigious scientists of Romania. Together with Emil Racoviță and Ioan Borcea, he is a founder of the national biological oceanography. A naturalist, biologist, zoologist, ichthyologist, ecologist, oceanolo-grapher, doctor in biological sciences, university professor, full member of the Romanian Academy. Founder of the Romanian School of hydrobiology and ichthyology. Author of *The Black Sea* monograph (1941). Founder and director of the National Museum of Natural History (Bucharest). Protector of the Bio-oceanographic Institute (Constanța) and of a Marine Biological Station (Caliacra). Organizer, general director and inspector general of the State Fisheries. Chairman of the Steering Committee of PARID Administration. Expert adviser to the European Danube Commission. National Delegate, Vice President and Rapporteur for the entire Eastern Mediterranean: the Black Sea, the Sea of Marmara and the Aegean Sea in the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM). A member of the Oceanographic Institute of Paris. His name has crossed the borders of his country of origin, being recognized as a scientist of European prominence.

Keywords: Grigore Antipa, Danube, Danube Delta, Black Sea, Romania, Romanian coast, oceanography, marine fisheries, museology.
Received 27 April 2021

It is never exaggerated to reproduce or to resume in the contemporary informational circuit significant biographical aspects and considerations related to the work of the great personalities of Romanian science. They have deeply marked their own field of expertise, as scholars, educators, people of culture and patriots. They are also always reasons of professional inspiration in order to deepen and expand the field concerned and to generate possible new ideas, from the point of view of extending and completing those already achieved by the precursors.

One of these multilateral personalities is the Darwinian, biologist Grigore Antipa, who was born in Botoșani on November 27, 1867 and died in Bucharest on March 9, 1944 (Fig. 1). He was the disciple of the famous professors P. Poni, G. Cobălcescu, A.D. Xenopol, P. Missir and ecology creator E. Haeckel, as a student at Jena in Germany. A specialist in Romania's ichthyofauna (Antipa, 1909). Initiator of indigenous research on the Danube and the Danube Delta (Antipa 2011a). Organizer of the first Romanian research expedition, in the Black Sea, aboard the cruiser MRR *Elisabeta* in 1883, 1884 and 1885 (Fig. 2) (Antipa 2010a,b; Ghiță 1961; Negrea 1990; Bologa 2017a, Bologa and Bavaru 2018; Șelariu 2018). Concerned with the issue of the evolution of the Romanian people (Antipa 2011b).

Founder of the National Museum of Natural History in Bucharest (Fig. 3), resulted from the first collection of natural history exhibited in "*The National Museum of Bucharest*", in the halls of the Sfântu Sava College, and a director since

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1983, for a number of 53 years, and of the Bio-oceanographic Institute in Constanța in 1932 (Fig. 4), turned into the Fisheries Research Station "Dr. Grigore Antipa" (after 1945) and a component of the National Institute for Marine Research (Fig. 5) between 1970–1989, of the Cape Caliacra Marine Biological Station in the Quadrilateral lost to Bulgaria in 1940 (Fig. 6), of the National Museum of Natural History, named after him (1934), organizer, general director and inspector general of the State Fisheries, chairman of the Steering Committee of the PARID Administration, full member of the Romanian Academy (1910), a member of the Oceanographic Institute of Paris, the second national delegate to the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM) after the official accession of Romania represented by scientist Emil Racoviță (1925), between 1926–1944, rapporteur of the Commission for the Black Sea (1927) and later for the whole Eastern Mediterranean, the Sea of Marmara and the Aegean Sea (1928), an expert advisor to the European Danube Commission, author of the Black Sea monograph (1941), creator of the "diorama" concept.

Fig. 1 Grigore Antipa (1938)

Fig. 2 The *Elisabeta* Royal Romanian Navy Cruiser

Fig. 3 The National Museum of Natural History, Bucarest (1900)

Fig. 4 The Bio-oceanographic Institute, Constanța (1932)

Fig. 5 The Romanian Marine Research Institute (1970–1979), nowadays the "Grigore Antipa" National Institute for Marine Research and Development Constanța

Fig. 6 The former marine biological station of Caliacra, currently in ruins.

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The monograph *The Black Sea. Vol. I Oceanography, Bionomy and General Biology of the Black Sea,* published in 1941 (Fig. 7), is one of the most lively testimonies, in addition to the entire activity and scientific work, prodigious and original, of scientist Grigore Antipa. The work has maintained its scientific value and presentness, in the context of the pronounced anthropic aggression of this marine environment, during the last decades, with the regrettable corollary of the imbalance of the Pontic ecosystem at present (Antipa 2010a,b).

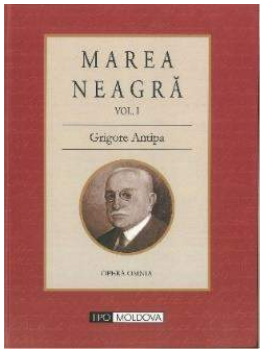

Fig. 7 The cover of the monograph *The Black Sea*, by Grigore Antipa, 1941 (new anastatic edition, 2010)

This monographic work, unfortunately unfollowed by a second volume, com-prises the following chapters:

Preface

Introduction

Part I – General issues

Chapter I. THE ORIGIN AND GEOLOGICAL EVOLUTION OF THE BLACK SEA AND THE PROVENANCE OF ITS POPULATION

Chapter II. THE SPECIAL PROBLEMS OF THE BIONOMY AND BIOLOGY OF THE BLACK SEA, WITH ITS RESEARCH PROGRAMME

Part II – Physiology, hydrography and hydrology of the Black Sea and its bionomy

Chapter I. THE PHYSICAL STRUCTURE OF THE BLACK SEA

Subchapter. A) *The Black Sea Basin, its conformation, relief, constitution and composition*

Subchapter. B) *The hydrography and hydrology of the Black Sea*

Chapter II. THE BLACK SEA AS A LIVING ENVIRONMENT. ITS ECOLOGY AND BIONOMY

Subchapter A) *The aphotic zone or the deep layer of the sea*

Subchapter B) *The photic zone or the surface layer of the sea*

Subchapter C) *The general balance of the advantages and disadvantages presented by the Black Sea as a habitat and the bionomic bases of its productivity*

Part III – *Population and general biology of the Black Sea*

Chapter. I. THE POPULATION OF THE BLACK SEA

Subchapter. A) *The origin of the population and its variations in relation to the different phases of the evolution of the sea*

Subchapter. B) *The colonization of the Black Sea. The factors that determined the selection of the species and the composition of its population*

Subchapter. C) *The analysis and classification of the Black Sea population from the point of view of the ecological characteristics of the species*

Chapter II. THE EFFECTS OF THE BIONOMIC CONDITIONS OF THE PHYSICAL ENVIRONMENT ON THE QUALITATIVE AND QUANTITATIVE COMPOSITION OF THE POPULATION AND THE MECHANISM OF ITS SELECTION

Chapter III. THE DISTRIBUTION OF THE BLACK SEA POPULATION IN RELATION TO THE VARIATIONS OF THE LIVING ENVIRONMENT AND ITS REGULATORS
Subchapter. A) *The geographic distribution of the population (Black Sea Biogeography)*
Subchapter. B) *Chorological distribution of the population (Chorology of the Black Sea)*
Chapter IV. CLASSIFICATION OF THE BIOTOPE TYPES IN THE BLACK SEA, WITH ITS ZONES, FACIES AND FORMATIONS
A) The anaerobiotic zone
B) The photic or aerobiotic zone
Subchapter. I. *Pelagos*
Subchapter. II. *The benthos or the bottom of the sea*
Chapter V. THE BLACK SEA VEGETATION, ITS BIOLOGICAL IMPORTANCE, ITS COMPOSITION AND DISTRIBUTION OF BENTHOS
Subchapter A) *The distribution of vegetation on the continental shelf*
Chapter VI. AN OVERVIEW OF THE BLACK SEA FAUNA
Chapter VII. THE DISTRIBUTION OF FAUNA BY FACIES AND BIOTOPES
Subchapter. A) *The biology of rocky bottoms ("Psephites")*
Subchapter. B) *The biology of sand bottoms ("Psammite")*
Subchapter. C) *Clay or mud bottoms ("Pelite")*
Chapter VIII. THE BIOSOCIAL AND BIOECONOMIC STRUCTURE OF THE POPULATION OF THE BLACK SEA AND THE ORGANIZA TION OF ITS COLLECTIVE LIFE
Subchapter. A) *Facies, Biotope, Biocoenosis*
Subchapter. B) *Biocoenoses, their role in organizing the mechanism of collective vital activity in the waters of the Black Sea and the structure of its population*
Subchapter. C) *The general vital activity of the entire Black Sea Holobios. Its goals and methods*
A few conclusions.

*

In the book written in his honour, Ștefan Negrea quotes Grigore Antipa among others: "The Danube will keep us in contact with the civilized peoples and will open the way to the ocean, for the exchange of the products of the country and the people's work with the products of the most distant countries. It guarantees the future and progress. It also offers us a series of natural gifts: a rich source of humidity for the agriculture, a source of electricity for the industry, fisheries of unique wealth, pastures and meadows." (Negrea 1990).

Among the first scientific pursuits of Antipa were the knowledge of the biological bases and the mechanism of fish production in the Lower Danube (Antipa, 1928): *Unter allen denjenigen Gewässerarten, welche als die grössten narürlichen Fischpro-duktionsquellen betrachtet werden, stehen gewiss die Unterläufe der grossen*

Flüsse mit ihren Lagunen und seenreichen Mündungsgebieten in den allersersten Reihen. Die Bedeutung dieser Süss- und Brackwasserfischereien ist nicht nur vom vollkswirt-schaftlichen – d. h. als wichtiger Zweig der nationalen Produktion der betreffenden Län-dern – sondern auch vom sozialen Standpunkt aus – als alleinige Erwerbsmöglichkeit einer zahlreichen Bevölkerung – sehr hoch zu schätzen. Die Auffindung der Mittel zur Erhaltung, Hebung und Steigerung der natürlichen Produktion dieser Gewässer bildet also eine der wichtigsten Aufgaben der betreffenden Staaten.

Antipa observes the decrease in fishing wealth and deals with the causes: overfishing, intensification of naval traffic, water pollution, etc. Although adequate legal measures have also been taken: the introduction of prohibition periods, minimum fishing quotas, protected areas for migratory fish, fry (alevin) and so on, these are palliative solutions. He seeks the true cause of this constant decline in the natural fish fund, as only its knowledge can lead to confronting it by taking appropriate measures.

He draws attention to the erroneous and misleading conception on the mechanism of fish production in large rivers.

He explains the hydrographic and biological bases of the fish production process in the Lower Danube waters and the role played by the individual areas within the total production, he draws the biologists' attention to the particular biological conditions of this river basin and to the scientific bases of rational water management, while hoping to stimulate the theoretical and practical solution to one of the most important questions of applied biopotamology and fisheries science.

He starts from considerations dating from the beginning of the research on fishing in the Danube and the means of increasing production, in 1892. The biology of the fish in here is determined not only by the internal life requirements specific to each species, but also in particular by several external factors which constitute, influence and condition the special vital environment. Thus, it is largely a product of the special natural conditions of existence in these waters. He gives one example, the carp, the main species, which has become a migratory fish in here.

The research methodically targeted the following directions:

1. The fish fauna of the entire Lower Danube area,
2. The biology of the main species and especially of the migratory species,
3. The natural physical conditions,
4. The biological relations,
5. The mechanism of fish production.

The results of faunal, hydrographic and biological research, as well as of the fishing methods based on behavioral habits, obtained in almost 35 years, were published in a series of 35 monographs (Antipa, 1928).

The following are treated in turn:

I. The types of Lower Danube waters and their biological relations,

II. The fish production

a) Production goals,

b) The importance of flood for production,

c) The natural occupancy of the different waters,
d) The mechanism of production and the natural fishing industry,
e) The natural rational fishing industry of the Lower Danube.

The results and 9 main conclusions are summarized.

*

Another major pursuit of G. Antipa was the study of the biological bases of fisheries production in the northwestern region of the Black Sea. (Antipa 1931): *C'est un fait connu, que les plus riches pêcheries de la mer Noire se trouvent concentrées dans le coin situé entre la Crimée et la Cap Caliacra, ainsi que dans la mer d'Azov, c'est-à-dire dans la région des embouchures des grands fleuves. La richesse de ces pêcheries ne consiste pas dans la varieté des espèces, celle-ci étant limité au nombre restreint des quelques espèces qui supportent la vie dans les eaux saumâtres, mais plutôt elle est formè par la quantitè du poisson capturè ici.*

Antipa mentioned that in the northeastern region of the Black Sea the total fish production could not be accurately calculated. However, it was known that only the Danube Delta region, for which there were regularly performed statistics, before the First World War, produced an average quantity of 16–20,000 t per year, i.e. about 50 kg per hectare.

He argues that the entire north-western surface of the Black Sea does not have a production equal to that of the Danube Delta region, yet there is no doubt that the quantities of fish in this area are superior to those caught in the rest of this sea. He enumerates and details four causes, in his opinion, for this great difference in productivity: 1. the constitution of the Black Sea basin and the distance from the coast to the lower limit of the continental shelf, 2. the large quantity of fresh water discharged into this sea by its main tributaries, 3. The numerous *limanuri* (banks), lagoons and coastal lakes along the entire coast of this portion of the sea, 4. The ichthyological fauna of this region, composed of species having a high commercial value and very rich in specimens.

The purpose of the paper is to highlight the way in which these determined factors collaborate in this sector of the Black Sea in order to achieve its productivity and, also, to understand the practical consequences arising from these findings:

I. The constitution of the basin
II. The influence of the tributaries
III. The influence of coastal lakes
A) Dniester lagoon
B) The complex of lakes, lagoons and channels of the Danube Delta
1. The Danube river bed
2. The waters of the Danube Delta
a) Delta lagoons (Lake Razelm) [the correct name is currently Razim]
b) Delta lakes and swamps
C) The coastline salt lakes themselves
IV. The ichthyological fauna

V. Conclusions.

The paper presents the bathymetric map of the Black Sea (after the surveys carried out by the Spindler and Wrangel Russian expedition) and the Danube Delta Lakes Development Plan.

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The principles of improving the productivity of the Lower Danube (Antipa, 1932) is another important pursuit of G. Antipa: *Le Danube représente pour les peuples habitant le plus magnifique don octroyé par la nature. Car il ne constitue pas seulement une grande voie naturelle, reliant depuis les temps les plus anciens le centre du continent européen aux pays asiatiques, mais il représente en même temps aussi une importante source de production naturelle.*

Antipa specifies that Romania has on its territory the largest part of the surface of the waters of this river, and that it benefits from this natural wealth more than the other riparian countries. But this advantage offered by nature imposes upon it the obligation to organize this natural wealth, in order to obtain, through rational exploitation, the maximum and optimal production.

Thus, he explains what this natural wealth consists of, how it can be enhanced and exploited, the program of the works undertaken and the measures taken to date in order to achieve this goal.

I. The constitution of the basin and the regime of the Lower Danube waters

II. The natural conditions of the production of these waters and of the lands of the Lower Danube.

III. Problems in improving the productivity of the Lower Danube waters and lands, where he quotes from the article of the German geographer and cartographer Emil Sydow (1812–1873) Ein Blick auf das Russisch-Türkische Grenzgebiet an der unteren Donau, published in *Petermanns geographische Mitteilungen*: *... Seitdem nun der Moldau die Donaumündungen in die Hände gegeben sind, auf welche die Augen ganz Europas schon seit lange gerichtet waren, ist ihr auch von Neuem die Aufgabe ans Herz gelegt worden, ihre nationalen Kräfte zeitgemäß zu entfalten ... Möge nun des Lesers Phantasie die Niederungen der Donau mit Deichen, Gräben und Kanälen durchziehen, aus den versumpften Wildnissen üppige Getreidefluren, aus den Fischerhütten stolze Häfen und Handelsstädte erblicken und durch betriebsame Menschen* (underlined by the author) *eine zweite Lombardei, ein zweites Holland an den Gestaden des Schwarzen Meeres erstehen sehen* ... a context in which Antipa specifies that this problem had already been posed for the Romanian State for 40 years, since King Carol I, together with his faithful advisers Petre Carp and Dimitrie Sturdza, charged him with the study of the Romanian fisheries and with the development of practical proposals for their organization and improvement. This important issue has been the subject of his research shown in about 40 publications. On their basis, the state implemented a series of measures and performed significant works in order to capitalize on these natural riches.

A) The Danube Delta
B) The floodable region
1. The surrounding lakes and lowlands
2. The "Levees" and high ground
3. The medium altitude lands
C) The minor river bed of the river
IV. The general improvement plan and its implementation.

The bibliography of the paper includes 14 articles by G. Antipa, I. Vidrașcu – *Valorificarea regiunii inundabile a Dunării / The valorization of the floodable Danube region*, Bucharest, 1921 and the Ministry of Agriculture and domains, Bucharest – *Îndiguirile regiunii inundabile a Dunării / The embankment of the floodable Danube region* and *Desbaterile comisiunii îndiguirilor / Debates of the embankments commission*, Bucharest, January–April 1929.

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The biosociology and bioeconomy of the Black Sea are issues that have deeply preoccupied G. Antipa (Antipa 1933a): *Les recherches, que j'ai entreprises depuis longtemps sur les conditions biologiques des eaux de la Roumanie, m'ont fait voir que, sans une étude minutieuse de la nature physique de leurs bassins et de leur régime hydrographique, nous ne pouvons pas être en état de comprendre et d'expliquer la vie et la distribution des êtres vivants dans ces eaux. Car c'est la structure physique et ses agents qui déterminent les lois bionomi-ques du milieu ainsi que la composition, densité et distribution de la population. J'ai du me convaincre que même les groupements des espèces et individus en diffèrentes associations sont déterminés par les mêmes facteurs. C'est pour cette cause que j'ai du donner bientôt une nouvelle direction à mes recherches, examinant, spécialement le bassin et les eaux du Danube à ce point de vue aussi.*

The remarkable research of Russian scientists Spindler and Wrangel, Andrusov and Knipovici on the physical structure of the Black Sea are invoked. Antipa found that the density and composition of the population of each biotope are really determined by the conditions that they impose and the resources they provide. For a concrete idea of the perfect adaptation of the population to the needs of the biotope, biologist Antipa gives the example of the phytoplankton and its migration during different seasons. The specialization of populations and its distribution, in order to meet the need for exploitation of environmental resources, are found in the smallest biotopes, which make up the total environment of this sea.

But also any component of the benthos that constitutes a particular biotope, by its petrographic nature, the state of aggregation of its sediments and the vegetation that includes it, has its resources to be exploited.

The notion of biocoenosis, as it was defined by German zoologist Karl August Möbius (1825–1908) known for his contributions to marine biology, is sufficient to characterize a biological association of the nature found in oyster reefs.

Antipa points out that the same associations of individuals and species that are the subject of "Biosociology" are also the subject of "Bioeconomics". He

speaks of "Individual bioeconomics", as well as of "Regional bioeconomics" (of biotopes) and of "General bioeco-nomics" (of the sea).

The general vital circuit of this sea also includes fish that use and transform the special production of different biotopes and which in turn serve as food for other superior animals, such as aquatic birds, the three species of dolphins (*Delphinus delphis* L., *Delphinus tursio* Fabr. and *Phocaena communis* Less., Black Sea seal *Monachus albiventer*[1], etc.).

In the field of botany, Antipa mentions Swiss H. Gams and I. Braun-Blanquet, for their work "*Prinzipienfragen der Vegetationsforschung*", respectively "*Pflanzenphysio-logie. Grundzüge der Vegetationskunde*". The second is the first attempt to synthesize the results of previous contributions and to examine the vegetation types from this point of view, creating a new independent science, «*phytosociology*».

By giving another example, Antipa attributes the development of the study of biocoenosis to scientists E. Naumann, H. Broch, C. Patterson, F.T. Doflein, D.O. Hessen, J. Hjort[2], E. Hentschel, A. Thienemann, H. Lohmann, who published a series of remarkable works on the structure of biocoenosis and animal life as a whole in different biotopes.

Towards the end of the article, Antipa recalls that he became aware of Braun-Blanquet's important work later on, when he had almost finished writing his monograph "*Asupra vieții în Marea Neagră* / *On Life in the Black Sea*", under print at the time, in which he had already written a special chapter on the biosociology of the Black Sea (Antipa 2010 a,b).

*

The Black Sea sturgeons, their biology and the measures needed to protect them were another favorite topic of his prolific research (Antipa 1933b): *Parmi les espèces peuplant les eaux de la mer Noire, ce sont sans doute celle du groupe des Acipensérines ou Sturions (Cuv.) qui ont la plus grande importance, autant par le nombre considérable des individus et leur grand taille, que par leur valeur alimentaire et commerciale. Du point du vue alimentaire: leur viande, trés appreciée pour son goût délicat, est presque tout aussi nutritive que celles des mamifères et des oiseaux et sert de base à une grande industrie de conserves; leur vessie a une grande utilisation industrielle dans la préparation et la clarification des vins. Du point de vue commercial: il suffit de rappeler que la viande et le caviar d'une femelle – de*

[1] Currently, the listed species are *Tursiops truncatus* Montagu (common bottlenose dolphin or Atlantic bottlenose dolphin), *Delphinus delphis* L. (short-beaked common dolphin) and *Phocoena phocoena* L. (harbor porpoise), *Monachus monachus* Hermann (Mediterranean monk seal).

[2] The Institute of Marine Research in Bergen, Norway, dedicated to him its symposium ICES *Challenging the scientific Legacy of Johan Hjort: Time for a new paradigm in marine research*?, between 12–14 June, 2019, where the author delivered the speech 'Quasquicentennial development of marine sciences in Romania and its maritime Dobrogea', also evoking Grigore Antipa and his fruitful role in the evolution of this process.

taille moyenne, d'un poid de 250 kgr. – du grand Esturgeon Huso huso, *répresente au moins la valeur commerciale de 5 paires de bœufs.*

Antipa presents simple and clear data on the biology of these very precious fish, emphasizing their high commercial value. He considers the catching of these species to be much easier, as fishermen do not have to travel at sea in their pursuit, *vue que le poisson, lui-même, vient régulièrement séjourner devant leur village. C'est précisement l'abondance de ces poissons dans les eaux saumâtres de la zone littoral, devant les embouchures des grandes fleuves qui se jettent dans la partie Nord et Nord-ouest de la Mer Noire et de la Mer d'Azov, qui a provoqué l'agglomération des grandes colonies de pêcheurs sur les côtes de cette région et qui a donnée lieu à une grande activité commer-ciale et industrielle dans ces parages.*

In the report titled *Die Störe und ihre Wanderungen in den europäischen Gewässern*, held at The International Congress of Fisheries in Vienna, in 1905, Antipa gave a brief description of their systematics and biology. *De même, dans mon livre sur l'*Ichtyologie de la Roumanie (Antipa 1909)*, j'ai décrit largement et figuré, sur plusieurs planches, les différentes espèces et variétèes – avec leurs embryons et alevins – Acipensérines, autant que le grand nombre des Bâtards produits par le croisement de ces espèces. Dans ce travail j'ai publié aussi un grand nombre d'observation, concernant leur Biologie dans le Danube et dans les aux maritimes, devant ses embouchures. Dernièrement enfin, j'ai publié encore, dans l'excellent ouvrage* Sur la Faune et la Flore de la Méditerranée, *rédigé par notre vénéré collegue Mr. L. Joubin, les figures des principales espèces d'Acipensérines, vivant dans la Mer Noire, accompagnées d'une courte description pour chaque espèces.*

In the article, Antipa enumerates within the Black Sea waters and its tributaries the existence of mainly six well defined species of sturgeons: *Acipenser ruthenus* L., *A. glaber* Marsigli, *A. stellatus* Pall., *A. Güldenstaedtii* Brandt, *A. sturio* L. și *Huso huso* L.; with the exception of the last one listed, each species presents one or more varieties, more or less well fixed, some of which may be considered as distinct species.

A) River species
   1. *Acipenser ruthenus* L.
   2. *Acipenser glaber* Marsigli

B) Marine species
   1. *Acipenser sturio* L.
   2. *Acipenser stellatus* Pall.
   3. *Acipenser güldenstaedtii* Brandt
   4. *Huso huso* L.

From his considerations, Antipa draws XII conclusions and ends the article with measures for the protection of the Black Sea sturgeons, respectively 1º. What are the protective measures that are dictated by nature and 2º Which is the way to ensure their implementation, specifying that the biological needs for the protection of these fish require the following measures:

I. *Reproductive protection*, that is:
   l. ensuring the free passage of the breeders to reach their natural reproduction areas;
   2. Conservation of breeding areas in good condition
   3. Prohibition of fishing during spawning and hatching of eggs
   4. Prohibition of the sale of fish during the prohibition period

II. Protection of fish fry growth
   1. Prohibition of alevin and fry fishing, until the age of sexual maturity
   2. Regulation of fish netting sieves
   3. Prohibition of the sale of the fry and the prescription of minimum measures for the fry

III. Prohibition of fishing in fry's feeding and hibernation places.

*

In addition to scientific publications on the Danube River and Black Sea fish fauna and fishing and fisheries and protection of fishery resources, G. Antipa was equally preoccupied with the principles and means of reorganizing natural history museums (Antipa 1934). In the preface of the article he states: *Il y a déja 42 ans depuis que je fus nommé Directeur du Musée d'Histoire Naturelle de Bucarest. L'ancien Musée, placé dans 3 salles du local de l'Université, ne consistait que de quelques collections d'oiseaux et mamifères communs, mal empaillés et completement décolorés et détériorès par les insects nuisibles, ainsi que de quelques modèles anatomiques en cire ou papier maché. Je dû donc me convaincre qu'il ne me restait rien d'autre à faire que d'abandonner tout ce qu'était inutilisable, d'acquérir des nouvelles collections et d'organiser un nouveau Musée* (Bucarest, le 26 mai 1934).

G. Antipa mentions that among the cultural institutions of different peoples, museums, already from antiquity, occupy one of the main places. Nowadays, all the capitals of the European countries have real treasures accumulated in their museums. For example, in 1909 France owned, besides the outstanding museums of world importance in Paris, 250 museums in the province; Germany, at the same date, had 210 public museums; the United Kingdom – 211, Italy, Spain, Belgium, Holland, Denmark, Sweden, Norway, Austria, Bohemia, etc. – a huge number of museums, spread even in less important provincial cities.

A) Origin, evolution and current status of natural history museums

... The main innovation introduced by scientist Moebius lies in the idea that the "Main collection" ("Hauptsammlung"), which should serve only as a "Scientific collection" ("Wissenschaftliche Sammlung") and should be as rich as possible in specimens, must be radically separated from the "Public collection" ("Schausammlung" or "Öffentliche Sammlung").

Modern science museums, as a result of their historical development, currently have to fulfil the following three fundamental functions:

1. As *Scientific research institutes*, to serve the development of pure and applied science,

2. As *Collection deposits*, preserved, classified and arranged in such a way as to serve, at any time, as a documentation and scientific research material,

3. As *Public popularization collections* ("*Öffentliche Schausammlungen*"), composed and explained in a special way, in order to serve the needs of education, as well as to spread the science and education of the masses ("*Schausammlungen*").

B) Organization of museums

I. Purposes of museums

II. Organization of collections and deposits for scientific research.

The main collection

III. Organizing public collections

1. Composition of collections
2. The way the collections are displayed
3. Labeling and explaining the collections.

The work is accompanied by XII drawing boards with 22 figures.

*

A scientific contribution as valuable as the previous ones concerns the general organization of the collective life of organisms and mechanisms of production in the biosphere (Antipa 1935). The preface dates from Bucharest, March 25, 1935. In the Introduction G. Antipa states: *Dans une conférence faite, en Septembre 1927, au X-ème Congrés Internationale de Zoologie, à Budapest, nous avons montré les conditions d'existence, physiques et bio-logiques, caractérisant le milieu dans les eaux du Danube inférieur et la manière don't ses agents coditionnent, comme facteurs determinants, la sorte et la quantité de la production des pêcheries dans ces eaux. C'était une synthèse des nombreux résultats que nous avons rassem-blés par de miunutieuses recherches spéciales, poursouivies pendant 34 ans, qui nous sont permis d'expliquer le mécanisme naturel de la production du poisson et d'établir certaines lois générales, gouvernant le déploiement de la vie animale et végétale dans ces eaux. Dés lors déjà, nous avions exprimé l'opinion, que ces lois s'appliquent aussi à la production des pêcheries dans les eaux de tous les grands fleuves, où les conditions naturelles – c'est-à-dire la constitution du basin, le régim des eaux et les conditions biologiques – sont pareilles à celles du Danube.*

I. The mechanism of production in a pond

II. The mechanism of production in the Danube waters

III. The mechanism of production in the Black Sea waters

1. The Black Sea as a field of production and its components
2. The hydrographic and faunal structure of the waters of the main basin and its variations
3. Relationships between the different Black Sea biotopes and their importance for the general production and the mechanism of Black Sea production compared to that of the Danube waters
4. The biosociological and bioeconomic organization of the Black Sea population and the biological basis of the production mechanism

5. Is the new conception of general biology and the mechanism of production in the Black Sea in accordance with the current knowledge on the physical and biological structure of this sea?

IV. The mechanism of production in other seas and oceans

1. The waters of the Atlantic Ocean and of its annexed seas

Waters of tropical origin

a) Equatorial waters

b) Atlantic waters

c) Waters of polar origin

2. The waters of the Indian and Pacific Oceans

V. The mechanism of production as a general organization of populations of all hydrosphere waters and its biological bases

VI. The mechanism of production and the organization of collective life in the terrestrial domain and underground

VII. General considerations on the biological structure of the biosphere and fundamental principles of the organization of organisms' collective life

VIII. Summary, findings and general conclusions

– *Organization of the production mechanism (5)*

– *Distribution and grouping of populations, as a result of the ecological characters of the species to which they belong and the demands of environment's variation (8)*

– *Principles of social and economic organization of populations, with their biological bases and their crucial natural purposes (4)*

– *Organizing the collective life in its entirety (3).*

*

Studies followed regarding the goals and pathways of the ichthyological research in the Black Sea, summarized in an *article dedicated respectfully to the tireless researcher of the Black Sea and the Caspian Sea, Prof. N.M. Knipovici – Leningrad, on the 50th anniversary of the activity in the field of bio-oceanography* (Antipa, 1936): *Es sind über 40 Jahre her, dass ich mich mit der Ichthyologie des Schwarzen Meeres beschäftige. Meine erste Absicht war, die vollständige Fischfauna dieses Meeres festzu-stellen und zu beschreiben. Dies um so mehr, als gerade der nord-westliche Teil und die Küstengewässer meiner eigenen Heimat bis dahin noch sehr wenig erforscht wurden, sowie weil ich hier eine Anzahl für diese Meer noch unbekannte und überhaupt manche ganz neue Arten konstatieren und beschreiben konnte. Ich unternahm sogar, schon im Jahre 1893, eine neunmonatliche Forschungsreise, auf dem Kreuzer «Elisa-beta» der Königlich Rumänischen Marine, um die Gewässer dieses Gesamtmeeres ichthyolo-gisch und allgemein biologisch zu untersuchen.*

G. Antipa seeks first and foremost the complete understanding of the species and subspecies of the fish in this sea, then the study of the way of life of the individual species and of the life communities, of the quantities of these organisms, and just as important of their distribution by regions, depths and ages.

He also supports the view that *the ichthyologist and fisheries biologist must be – in the Black Sea's case even more so than in other seas – also a good oceanographer*.

*

The tireless G. Antipa elaborates and publishes in Bucharest a *Memorandum on the application of a five-year plan for the development of the State's fisheries (*Antipa 1937a*): The development of the complex of ponds and floodable lands, which make up the production fund of our Fisheries and the enhancement of the products of this fund, fructified by the effort of the population that works in this branch of production, requires an important capital investment.*

In summary, the plan includes the following specifications:

A. I. Investments to improve the production fund (with 12 objectives)

B. II. Equipment investments for the exploitation of fisheries and the industrialization of fish (7 objectives)

C. Working capital.

Antipa answers in 9 points to the objections to this plan, according to the extract from Minutes no. 204 of the Steering Committee, from the meeting of July 24, 1936, in the presence of Minister Mircea Cancicov[3].

*

The hydrological bonification of the deltas is addressed in a short article (Antipa, 1937b), concerning:

I. What is meant by "delta bonifications" and

II. The Delta bonification systems

A. Deltas of old age (Nile Delta)

B. (Rhone Delta, Mississippi Delta)

C. Young deltas (Danube Delta)

The genesis, structure and evolution of the Danube Delta

Improvement of the Danube Delta

Conclusions and 10 illustrative figures.

*

Subsequently, G. Antipa voices the hydrobiological research and their practical applications in Romania (Antipa 1937c), an extract of this article being kept, with the following affectionate dedication: *To dear Mrs. Celan*[4]*, with*

[3] A prominent member of the National Liberal Party and a liberal deputy in the Parliament of Romania, honorary member of the Romanian Academy, a brilliant lawyer, several times the Minister of Finance of Romania in several governments between 1936–1939, and a reputed economist, who succeeded in boosting the country's economy in 1938, a year which is still considered a standard of development (https:// ro.wikipedia.org/wiki/Mircea_Cancicov).

[4] Maria S. Celan (1898–1989), a reputed marine algologist (macrophytobenthos, algal associations, eco-logy), a graduate of Mihăileană University of Iași, doctor of the Sorbonne University in Paris, France, in 1940/1941 (Bologa 1989, 1991, 2017c, 2018, 2019, 2020).

gratitude for her beautiful works on the Black Sea algae and for her collaboration with our Institute of Bio-oceanography.

I. The waters of Romania and the beginnings of the hydrobiological studies

II. The program and evolution of hydrobiological research

III. The hydrobiological study of lake Razelm and the improvements it has generated

IV. Study and hydrobiological improvements in the Danube Delta

V. The hydrobiological improvement of St. George Island

A) Provisional measures and works

B) Definitive works

VI. Hydrobiological research in the floodable region of the Danube and their practical applications

a) The physical and biological structure of floodable lands

b) Natural mechanism of fish production in the floodable region and the consequences of embankment

VII. Ichthyological and bio-oceanographic research in the Black Sea (mentioning 15 pecialized works)

VIII. Findings, results and conclusions (6).

The article ends with the depiction of the characteristics of the hydrobiological improvement channels built up to that date in the Danube Delta:

1. King Carol I channel
2. King Carol II channel
3. The connection channel between Puiuleț and Puiu lakes
4. The connecting channel between Puiu, Potcoava and Roşu lakes
5. Prince Ferdinand channel
6. Michael the Brave Voivode channel
7. Pardina channel
8. Cofa channel
9. Queen Elizabeth channel
10. The access channel «Portița-Razelm»
11. The large supply channel «Litcov»

with a recap of their lengths.

The map of the Danube Delta – The hydrobiological improvement and 15 figures with different images: channels of the Danube Delta, the Grigore Antipa National Museum of Natural History, a museum hall with ichthyological collections, the new Bio-oceanographic Institute of the Fisheries Administration in Constanța, one of the institute's laboratories, the Fisheries Administration Palace in Tulcea with the Museum and hydrobiological laboratories of the Danube Delta and an ichthyological collection of the Hydrology Laboratory in Tulcea complete the iconography of the paper.

The economic capitalization of the Danube floodplain has met two opposing views, which have been the subject of extremely controversial debates, that of biologist and ecologist Grigore Antipa and that of engineer Anghel Saligny (Lup, 2019).

*

Romania's participation in the celebrations of the Tricentenary of the National Museum of Natural History of Paris was marked in the speeches delivered by G. Antipa (Antipa 1937d), including:

I. The speech delivered at the grand official banquet offered by the Minister of National Education in the lounges of the Claridge hotel in Paris and

II. The speech delivered at the closing banquet of the celebrations of the tricentenary after the inauguration of the Oceanographic Institute at Dinard.

On June 13, 1926, the illustrious biologist and founder of biospeleology[5] Emil Racovitza (1868–1947), a praised participant in the Antarctic expedition aboard the *Belgica* ship in 1897, under the command of Commander Adrien de Gerlache, later the founder of the first speleology institute in the world in Cluj in 1920, was received as a full member of the Romanian Academy, the highest national scientific and cultural forum dating from 1866. The presence of His Majesty King Ferdinand, Honorary President and Protector for life, was greeted by the renowned archeologist professor Vasile Pârvan, the general secretary of the Academy. And the answering speech was delivered by the master biologist, ichthyologist, a prominent member of the same Academy, Grigore Antipa (Racovitza 1926).

In his opening remarks, Grigore Antipa, addressing the audience with the words Sire, Ladies and Gentlemen, confessed from the beginning: *With great joy I have received the assignment that my colleagues wanted to give me, to answer on behalf of the Romanian Academy, to the speech upon receiving into this institution of our new colleague, Dr. Emil Racoviță, and to wish him the traditional «you are welcome among us». I am all the more grateful for this honor that has been placed upon me, as I was given the opportunity to express my feelings of deep admiration, not only for a scientist of universal reputation and one of the most brilliant representatives of Romanian culture, but also for a specialty colleague, a very close friend from my earliest childhood* (Antipa 1926).

Subsequently, the speaker addressed him directly: *Dear colleague, In your beautiful speech you have explained to us, in a form understood by everyone – of a simplicity that contrasts with the magnitude of the problems you have exposed and in a beautiful Moldovan language, for which any literate can envy you* – the purpose and meaning of Speleology; *... You have explained to us in particular what Biospeleology is and pursues, this new science, to which you have devoted all your activity over the last 20 years*.

Antipa revealed the very modest character of the scientist, who fails to specify that his role in defining, organizing and developing biospeleology was *overwhelming*: *Because every biologist knows that you are the true parent of this new science*; ... He therefore, considers it his duty to complete the information

[5] E. Racovitza states in his welcoming speech: *I have adopted this name* [speleology, author's note] *which comes from σπέος, considering it more euphonic, especially in its compounds, Bio-speleology, Speophysics, etc., than: "Speleology", derived from σπήλαιον* (Racovitza 1926).

presented by the newly promoted among the Romanian academics. He begins with a *brief outline of the history of cave studies and the birth of Biospeleology, as one of the main branches of natural sciences, together with Oceanography, Limnology and all those similar sciences, which have as a purpose the study of all the physical and biological conditions of certain categories of geographical units across the globe and their explanation. He added, I beg your pardon if, in this brief exposition, I shall be forced to offend your modesty, because at a baptism – even in the Academy – every garment is required to be stripped and especially that of modesty.*

He brings completions, with numerous documented connotations, on the importance of *these sub-earthly gaps*. He points out that many *geographers, geologists, paleontologists, anthropologists, osteologists, prehistorians, botanists and zoologists* have dedicated them-selves to their research. He gives an example, among those who have preoccupied them-selves with the study of the caves: Protestant pastor Johan F. Esper, ever since 1774. Or the great philosophers Leibnitz and Kant. He emphasizes the accumulation of numerous data over time, *which requires the need for a coordination and synthesis of the results.* Thus, *the new science of the caverns is born, for which, following the proposal of the tireless explorer of the caves of France E. A. Martel, the name of Speleology – created by E. Rivière – was adopted*.

He explains that this science, more precisely *physical speleology*, was a chapter of Geography until then. *Caves, however, are linked apart from geophysical problems also to a number of special biological problems – at least just as important – ... The caves are, in fact, a living environment completely different from the others. The way that life was able to penetrate, spread and adapt here to these difficult conditions of existence – the eternal darkness, the constant temperature, the air saturated with humidity and so on. – in order to be able to conquer and dominate and form a «Habitat» also in these parts of the earth, make for one of the most interesting phenomena of biology.*

Then, compared to the level that this science reached at the beginning of the twentieth century, he mentions the appearance, *in the old and well-known magazine «Archives de Zoologie expèrimentale et générale» of his fundamental work titled «Essais sur les problèmes biospéologiques». ... a synthesis work, which will always be an act of birth of this science, ...*

Tailored and thus guided, by E. Racovitza, Biospeleology now takes its place – as an independent science, with precise goals and methods – together with its sister, physical speleology *and* both *compose that synthetic science called* Speleology, *... One without the other cannot be conceived, ... As in Oceanography – and in all of those synthetic sciences related to certain categories of geographical units– physical and biological research must, therefore, go hand in hand.*

.....

Dear Colleague,

.....

The spark, which your enchanted lighter threw into the easily flammable tinder of human mind curiosity, caught on. Today you can be happy to see that, all

over the globe, an army of researchers, inflamed by that spark, explore the caves according to your methods and guidelines …

By evoking the proverb "Man sanctifies the place" Antipa does not fail to praise the theoretician merits of E. Racovitza, arguing that *you are not only a man of conception but also of action and, as such, you have put yourself at the head of the entire activity and have organized the studies: ...*

He adds, admiringly and with full objectivity, some significant biographical data of the qualities and merits of the scientist, in the meantime fully accredited: *In this regard, your natural gift of being a good organizer was also of great use here; the same, for which the expedition «Belgica» chose you as the organizer and the leader of its biological research in the Antarctic polar ice sheets; the same one, for which you, a foreigner, were entrusted with the management of the French biological marine station of Banyuls, and also the same for which – after the death of the great zoologist Lacaze Duthiers – you were also entrusted with editing for the oldest and most famous zoological magazine in France.*

... You have created, therefore, under your supervision and on your own account – first of all in Sorbona – the center of the world biospeleological research, *which has assumed the task of implementing the entire action plan. ... at the same time, you have also organized a* speleological Museum, *... you have set up a special magazine: «*Biospeleologica*» ... the practical organization you have given to the entire research and study activity is a* masterpiece.

.....

But even as a Romanian, I could not allow, especially here at the Romanian Academy, these extraordinary merits of a countryman not to be mentioned with the proper expression of gratitude and admiration.

We are not only grateful for what you have done, but we are proud, because your masterpiece bears the stamp of the creative genius of the Romanian people's mind; it is a proof of what the intelligence of this people can generate when it is placed under favorable work and operation conditions.

Antipa completes his passionate response *with a few features, to give to your soul portrait that true expression given by that new light in which you have been placed… A place of honor among the most important biologists of the time. ... left with a clean Romanian soul ... a professor of zoology at the new Romanian university in Cluj. ... to put yourself in the service of the cultural consolidation of the reborn homeland. ... it seems a wonder that your entire biospeleological activity has made such great progress even after your relocation in the country. ... you created that* institute of speleological research in Cluj *which today is a reason of pride for the country. ... you have relocated the Biospeleology center in the middle of and near some classic regions of caves and earth gaps. ... you have come to work with all your eagerness also to raise the general cultural level of the country. ... the first step we need to take is to improve the higher education with all of its institutes, ... how much gratitude the country owes you for the services you bring to it ... You have shown us that, ... the sciences you call «synthetics" are, on the contrary, meant "to revive old and famous antic schools, where the student*

received a complete education"; ... As a person, just like you, starting from Zoology, I came, through my research on the Danube, upon a synthetic science, a sister to Speleology, I can fully confirm and realize the great importance of the issue you tackle, ...

.....

Dear Colleague,

...

... I have found you – with all the aversion I know you have for the so-called politics – sitting in parliament, as a representative of the University of Cluj, to watch over the cultural legislation and to oppose the anti-cultural measures; ... I find you wherever there is an issue with the participation in an international, scientific or cultural activity, where the prestige of the country is at stake and where you always have the memoir ready, showing what needs to be done ... I know the disappointments you often have, I know the struggles you put up with the little interest you often find for the important proposals you make. However, I have not seen you yet discouraged; ...

*

A suggestive example regarding the interest and involvement of E. Racoviță in participating in international activities, is his invitation to set up the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM) in 1919. He declined the honor to act as Romania's first national delegate to the oldest, most prolific and long-lived European oceanographic forum until the present day (Fig. 8), as a result of its many scientific, didactic and public tasks. And, as well as – once again – of his obvious modesty, as well as the recommendation of appointing his former colleague and well-known scientist Grigore Antipa for the aforementioned dignity (Bologa 1993, 2015, 2017b; Bologa and Marinescu 2002).

Fig. 8 The premises of the International Commission for the Scientific Exploration of the Mediterranean Sea, in Monte Carlo, Monaco

With regard to the altruistic proposal of E. Racovitza, he explained from the beginning that the national delegate must not only have a "diplomatic competence" but must also be a recognized specialist in oceanography. In a second report transmitted to the Minister of Foreign Affairs I.G. Duca, he wrote: *Another essential step is to get Dr. Antipa as a collaborator. As I stated in my report dated January 9, 1924, unfortunately now in our country there are only two experts in oceanography, capable to comply with thew conditions to be met by the Romanian*

delegate at CIESM: Dr. Antipa and Racoviță. The first mentioned is the most suitable to accomplish that task in the best conditions. Indeed, Dr. Antipa has performed high administra-tive jobs and led many economic and diplomatic negotiations, thus adding the negotiation and administrative practice to his scientific competence, which can be very useful in that case. Besides, he has more available time than myself and his living in Bucharest, even in the neighbourhood of Ministry of Foreign Affairs, will be of considerable help in solving problems and department functioning: Conclusions: I have the honor to propose you: A. replacement of Racoviță as goverment delegate at CIESM by Dr. Antipa; B. Changing, Messr Antipa and Racovitza with drawing up a draft of Ministry decision for the creation of a national commission to act as a CIESM branch.

Prior to his appointment to the CIESM, Grigore Antipa replied to his confrere who proposed him for the nomination: *I took knowledge – and I am very grateful for it – that you quoted first of all my name among the persons wich could represent Romania at that international commission, as being well known in the scientific world due to my papers. I am sure it's only your modesty that determines you to put your own name after mine, because the great expeditions you have participated in and 20 years leadership of an important marine biological station* [Banyuls sur Mer] *entirely recommend you for such a task for the benefit and high reputation of your country. I can't promise you but to help you with all my powers* (Arhivele Statului / State's Archives 1924).

The illustrious G. Antipa has shone bright in the new dignity assumed at international level. As a major investigator of the Black Sea ichthyofauna, confessing that his interest in biological oceanography and its issues was stimulated by Prince Albert I of Monaco, during their meeting at the Marine Zoological Station in Naples, founded by the German scientist Anton Dohrn.

Following his election as Vice President of CIESM, together with Odón de Buen y del Cos in 1928, G. Antipa informed the Commission of the creation of the Marine Zoology Station, by Professor Ioan Borcea, at Agigea in 1926 (Bologa 1993).

In 1933, G. Antipa transmitted to CIESM the significant progress made in Romania regarding the research undertaken on the maritime Danube, the Danube delta, the lakes and coastal lagoons, the Black Sea and the Eastern Mediterranean. On behalf of the Government of Romania, in the same year, he sent the official invitation for organizing the 10th Congress and General Assembly in Bucharest, October 15–20, 1935. In the absence of the CIESM President, Admiral Paolo Ravel di Taon, he presided over the scientific event, underlining the extremely important role played by the Commission in the development of the marine sciences (CIESM, Rapp. Proc.-verb. Reun., 1937). The congress, organized admirably and dedicated to the vice-president Dr. Antipa by the President, enjoyed high praise from all the participants, both Romanian and foreign. Here is the President's assessment: *In quest'atmosfera di ricordi glloriosi per la civiltà mediterranea, l'assemblea di Bucarest, capitale della Nazione che sul Mar Nero rappresenta la romanità, assumera singolarissima importanza e sono sicuro di interpretare i sentimenti di tutti i Coleghi affermando che esse rivestira anche carattere di festeggiamento in*

onore del Prof. Antipa ... And the leader of the French delegation mentioned: *C'est au nom de l'unanimité des membres de la Commission que nous prions le Gouvernement Roumain de croire a notre gratitude émue pour l'accueil qui nous est fait et pour la liberale hospitalité dont nous beneficions. M. le President Antipa a dit que la Roumanie était fiere d'avoir été choisie comme siege de notre session; nous avons eu le plaisir, en nous reunissant ici, a rendre a la Roumanie un hommage pour le grand role qu'elle joue dans notre Commission.*

This remarkable international success was due to the predominant role of the scientist and man of culture, organizer and patriot G. Antipa.

*

The scientific work of Dr. Grigore Antipa was solemnly honored in the speeches of prominent contemporary personalities, published on March 20, 1938. (xxx 1938a). These were initiated by Professor Alexandru Lapedatu – the president of the Romanian Academy. He also read the message of His Majesty King Carol II: *I join with open heart the celebration of Doctor Gr. Antipa and gladly bring with these few words my praise for a life dedicated to science and to the public good. The accomplished work on State Fisheries and especially at the Museum of Natural History will leave beautiful and lasting traces. The museum is one of the works Romania can be proud of. With all my heart, on these holidays, I thank him for his accom-plished work.* To these were added the speeches of Professor Traian Săvulescu – a member of the Romanian Academy, the president of the Romanian Science Society, professor Gheorghe Ionescu Șișești – the Minister of Agriculture, Domains and Cooperation, teacher Ștefan Șoimescu – the administrator of the Schools House and People Culture and of a student in the first year of the Faculty of Veterinary Medicine, G. Leluțiu.

Then followed the response of the feted person, addressed to his dear colleagues and friends, to the ministers and to the ladies and gentlemen in the auditorium.

The festive meeting was concluded by President Alexandru Lapedatu.

The publication is illustrated with a photograph depicting the feted person speaking at the stand, in the presidium on the right with A. Lapedatu and G. Ionescu-Șișești, and on the left T. Săvulescu, minister Nicolae Petrescu-Comnen and professor Dimitrie Gusti (Fig. 9).

Fig. 9 Dr. Grigore Antipa delivering his speech at the Romanian Academy (1938)

Of the more than 500 letters, addresses and telegrams from many admirers and friends, who could not participate in the festivity, the ones with official character were published. They belonged to: academician Sextil Pușcariu, professors Ștefan Goangă (Rector), I. Răducanu (Rector), Emil Racoviță, Ioan Grințescu, Nicolae Donici, Eugen Botezat, Ilie Bărbulescu, G. Macovei (Director), cons. eng. D. Drâmbă, eng. Stavri C. Cunescu, Metropolitan of Transylvania Nicolae, A. Dupront (French Institute of Higher Studies in Romania), B. Manzone (Institute of Italian Culture in Romania), Wilhelm V. Pochhammer (German diplomatic representation in Bucharest), Umberto d'Ancona (Padua, Italy), Brunelli (Central Hydrobiology Laboratory, Rome, Italy), D. Richard (Oceanographic Institute and Museum of Monaco), Biering (Minister of Denmark and Iceland), archbishop Raymund Netzhammer (Eschenz, Thurgau, Switzerland).

*

The anniversary volume *Grigore Antipa Hommage à son œuvre* (Fig. 10), published in the Official Journal, the National Printing Office, in Bucharest, in 1938, totals 727 pages (xxx, 1938b). It includes 6 deferential articles, 46 original scientific contributions and 12 official addresses, letters and congratulatory telegrams (Bologa 2017a). They are the work of a number of 56 authors, including three members of the Romanian Academy, among them four prominent Romanian biologists persecuted by the authorities of the oppressive communist regime: Constantin S. Antonescu, Teodor Bușniță, Constantin Motaș, and Zaharia Popovici (Bologa 2010). The authors represent 12 Romanian academic and public institutions and 18 from abroad (Austria, France, Germany, Italy, Monaco, United Kingdom, USA).

Fig. 10 The cover of the volume *GRIGORE ANTIPA Hommage à son œuvre, 10 décembre 1867 – 10 décembre 1937,* with a dedication to Miss Maria Celan

The introductory article *Rara avis* by Professor Constantin Meissner, teacher, Romanian politician and honorary member of the Romanian Academy, abounds in laudatory references to G. Antipa, such as: *Antipa's small stature, but great through his brilliant intelligence, culture, erudition, work power, his original research and practical achievements with which he endowed his homeland, has always been increasing, during his long life, the number of his fans and admirers,*

both inside and outside our borders. ... our feted person is also loved, sincerely loved. ... Der kleine dicke Antipa ist ein äußerst begabter und herziger Junge [Ernst Haeckel]. ... *a son of the country, activating under the watchful eyes of three great Sovereigns, for a long time of almost fifty years, was uninterruptedly appreciated with the same High goodwill and solicitude by Each of them. ... And in such august manifestations, how could we not, in addition to recognizing the merits of Antipa, find a certain dose of ... sympathy for him? ... it is natural to ask the question: where does the magic originate in the case of Antipa? ... Is it motivated by his vast culture, by the quickness of his sharp mind, by what he has done and does, by the bonhomie and the joy of which he is not separated, by his distinguished kindness, by his chosen manners, by his always attractive conversation, by ... This erudite septuagenarian preoccupied with solving even the deepest problems of the nature has kept to this day ...* a child's heart. ... *Antipa remains a* rara avis.

The content covers the following scientific fields, with which the celebrated person had professional or related interests: geology, sedimentology, oceanography, topography, chemistry, mycology, phytopathology, zoology, planktonology, ichthyo-logy, ichthyopathology, lim-nology, marine fishing, mammology, genetics, internal medicine, legal medicine, therapeutics, national economy, sociology, museology, statis-tics and Christian martyrs.

The volume also contains a number of 111 bibliographic references, books and articles, authored by Grigore Antipa.

*

As a tribute to the illustrious master Grigore Antipa, who remarked her early and recommended her cordially to Professor Ioan Borcea, for employment, as an algologist, at the Maritime Zoological Station "King Ferdinand I" (later on, "Professor Ioan Borcea"), founded by him, in Agigea, in 1929) (Bologa *et al.* 2013), Maria Celan would dedicate to him the red algae *Gelidiella antipae* Celan, discovered as a new species in the Black Sea (Celan 1938).

The National Museum of Natural History in Bucharest, as well as the National Institute for Marine Research and Development "Grigore Antipa" in Constanța bear the name of the scientist, starting from 1933 and 1990, respectively.

Intermediate education institutions bearing Grigore Antipa's name are Gymna-sium School No. 6 in the hometown and Botoșani county residence, General School no. 15 in Constanța and I–VII Gymnasium School in Tulcea, the College of Sciences in Brașov county residence, and streets named in his honor and memory are found at least in the localities of Agigea and Eforie Nord (Constanța county) and in Botoșani, Cluj-Napoca, Suceava and Tulcea municipalities, was named after him.

Moreover, the "Grigore Antipa" marine research vessel, which belongs to the Diving Center in Constanța, bears his name.

One of the annual prizes awarded by the Romanian Academy is named after Grigore Antipa.

In 1992, the National Bank of Romania issued a banknote for circulation, with the nominal value of 200 lei, which has on the front the portrait of Grigore Antipa (Fig. 11).

Fig. 11 A banknote from 1992 showing Grigore Antipa 1867–1944

Also, on December 4, 2017, the National Bank of Romania issued a commemorative gold coin, with a nominal value of 100 lei, on the occasion of the 150th anniversary of the birth of scientist Grigore Antipa. The coin has the title of 900 ‰, the weight is 6.452 grams, the diameter of 21 mm, has a minted edge and was issued in 250 copies, all of high quality (the National Bank of Romania, *150 years since the birth of Grigore Antipa*).

*

Following a solid professional training, thanks to his native skills highlighted early on and to some elite professors from Romania and Germany, Grigore Antipa manifested notably in the scientific and public life. His many qualities and original results, diversified and multilateral, obtained throughout a brilliant career, have been appreciated both at home and abroad. His successes continue to this day, although not all his knowledge and recommendations, of practical nature, have been taken into account and applied precisely. Thus, the scientific, organizational and cultural work of Romanian scientist Grigore Antipa remains unchallenged. In addition to its intrinsic value, it continues to be, several decades after its elaboration and confirmation, an important source of documentation, especially on some aspects of zoology, ichthyology, Danube and Black Sea fishing, museology, international cooperation, as well as inspiration sources for new research in these fields which are important to science and the national economy.

REFERENCES:

Arhivele Statului, 1924, *Scrisoarea lui Grigore Antipa către Emil Racoviță*, București, 12 iunie.

Antipa A., 1909, *Fauna ihtiologică a României*, cu 31 tabele în fototipie, Academia Română.

Antipa A., 1926, *Speologia – Răspunsul d-lui dr. Gr. Antipa* la Discursul rostit la 13iunie 1926 în ședința solemnă sub președinția de onoare a M. S. Regelui, de Emil Racoviță, Academia Română, *Discursuri de recepțiune LXI*, Cultura Națională, București, 64 pp.

Antipa G., 1928, Die biologischen Grundlagen und der Mechanismus der Fischproduktion in den Gewässern der unteren Donau, Acad. Roum., *Bull. Sect. Sci*., XI, 2–3, Cultura Națională, Bucarest, 20 pp.

Antipa G., 1931, Les bases biologiques de la production des pêcheries dans la région nord-ouest de la mer Noire, Acad. Roum., *Bull. Sect. Sci.*, XIV, 6–8, M.O. și Imprim. Stat., Imprim. Naț., Bucarest, 20 pp., cu II planșe.

Antipa G., 1932, Les principes de l'amélioration de la productivité du bas Danube, Acad. Roum., *Bull. Sect. Sci*., XV, 3–4, M.O. și Imprim. Stat., Imprim. Naț., Bucarest, 19 pp.

Antipa G., 1933a, La biosociologie et la bioéconomie de la mer Noire, Acad. Roum., *Bull. Sect. Sci*., XV, 9–10, M.O. și Imprim. Stat., Imprim. Naț., Bucarest, 13 pp.

Antipa G., 1933b, Les sturions de la mer Noire – leur biologie et les mesures nécéssaires pour leur protection, Acad. Roum., *Bull. Sect. Sci*., XV, 9–10, M.O. și Imprim. Stat., Imprim. Naț., Bucarest, 17 pp.

Antipa G., 1934, Principes et moyens pour la reorganization des musées d'histoirenaturelle, Acad. Rom., *Mem. Secț. șt*., Seria III, Mem. 12, M.O. și Imprim. Stat., Imprim. Naț., București, 58 pp., cu XII planșe, 22 fig.

Antipa G., 1935, L'organisation générale de la vie collective des organisms et du mécanisme de la production dans la biosphere, Acad. Roum., *Ét. et Rech*., VI, M.O. și Imprim. Stat., Imprim. Naț., Bucarest, 84 pp.

Antipa G., 1936, Ziele und Wege ichthyologischer Forschungen im Schwarzen Meer, Acad. Roum., *Bull. Sect. Sci*., XIV, 6–8, M.O. și Imprim. Stat., Imprim. Naț., București, 9 pp.

Antipa G., 1937a, Memoriu privitor la aplicarea unui plan cincinal pentru desvoltarea Pescăriilor Statului, *Bul. Admin. P.A.R.I.D*., București, 1 aprilie, 31 pp.

Antipa G., 1937b, Les bonifications hydrologiques des deltas, *Rapp. Proc. Verb. Comm. Int. Méd.*, X, 22 pp.

Antipa G., 1937c, *Les recherches hydrobiolgiques et leurs applications pratiques en Roumanie*, M.O. și Imprim. Stat., Imprim.Naț., Bucarest, 48 pp, 1 hartă, 15 fig.

Antipa G., 1937d, Participation de la Roumanie aux fêtes du tricentennaire du Muséum National d'Histoire Naturelle de Paris, Deux discours prononcés par Gr. Antipa, délégué de l'Académie Roumaine et du Musée National d'Histoire Naturelle «Grigore Antipa» de Bucarest, M.O. și Imprim. Stat., Imprim. Naț., București, 5 pp.

Antipa G., 2010a, *Marea Neagră, vol. I Oceanografia, bionomia și biologia generală a Mării Negre* (cu 6 hărți din care 4 colorate și 62 figuri în text, M.O., și Imprim. Stat., Imprimeria Națională, 1941, ediție nouă anastatică, B. Ștefanachi, Tipo Moldova, Iași, Cuvânt înainte de dr. Alexandru Ș. Bologa, 313 pp.

Antipa G., 2010b, *Marea Neagră, vol. I Anexă Hărți, ediție nouă anastatică, B. Ștefanachi,* Tipo Moldova, Iași, 5 hărți.

Antipa G., 2011a, *Dunărea și problemele ei științifice, economice și politice*, Libr. «Cartea Românească» și Pavel Suru, 1921, ediție nouă anastatică, B. Ștefanachi, Tipo Moldova, Iași, 191 pp.

Antipa G., 2011b, *Problemele evoluției poporului român*, «Cartea Românească» Inst. Arte Graf. Carol Göbl [D-tor] I. St. Rasidescu,, 1919, ediție anastatică, B. Ștefanachi, Tipo Moldova, Iași, 407 pp.

Bologa A.Ș., 1989, Hommage au Dr. Maria S. Celan, *Cryptogamie, Algol.*, 10, 1, 1–6.

Bologa A.S., 1991, Maria S. Celan – a remarkable pioneer of the Romanian marine benthic algology, *Noesis*, 17, 131–136.

Bologa A.Ș., 1993, Romania and the International Commission for the Scientific Exploration of the Mediterranean Sea, *Noesis*, 19, 129–138.

Bologa A.Ș., 2010, Fișe biografice ale unor biologi români persecutați pentru convingeri anticomuniste, *Caietele CNSAS*, III, 2 (6),175–197.

Bologa A.Ș., Bologa A.F., Charlier R.H., 2013, Ioan Borcea and the First Romanian Marine Zoological Station at Agigea (1926), în *Places, People, Tools – Oceanography in the Mediterranean and Beyond*, Proc. Eights Int. Congr. Hist. Oceanogr., C. Groeben (Ed.), Giannini Ed., Napoli, 173–184.

Bologa A.Ș., 2015, Cercetarea marină românească și cooperarea cu Comisia Internațională pentru Explorarea Științifică a Mării Mediterane (C.I.E.S.M.), *Rev. Pol. Șt. Scient*., 4, 4, 325–328.

Bologa A.Ș., 2017a, Volumul omagial GRIGORE ANTIPA, Hommage à son œuvre, 10 décembre 1867 – 10 décembre 1937, *Simpozion Jubiliar 150 de ani de la nașterea lui Grigore Antipa*, MNINGA, București, com. orală (PPS).

Bologa A.Ș., 2017b, Grigore Antipa și Comisia Internațională pentru Explorarea științifică a Mării Mediterane, *Simpozion Jubiliar 150 de ani de la nașterea lui Grigore Antipa*, MNINGA, București, com. orală (PPS).

Bologa A.Ș., 2017c, 120 de ani de la nașterea conf. dr. biolog Maria Celan – I. Personalia, C.R.I.F.S.T., *St. comun. / DIS*, X, 161–238.

Bologa A.Ș., 2018, 120 de ani de la nașterea conf. dr. biolog Maria Celan – II. Corespondența științifică, C.R.I.F.S.T., *St. comun. / DIS*, XI, *DIS*, 95–151.

Bologa A.Ș. 2019, 120 de ani de la nașterea conf. dr. biolog Maria Celan – III, Completări documentare de la dr. ing. Cristian D. Stoiculescu, C.R.I.F.S.T., *St. comun. / DIS*, XII, 86–106 pp.

Bologa A.Ș., 2020, *Maria S. Celan – conferențiar doctor biolog – o viață de sacrificiu dedicată științei românești și universale*, Ed. Ex Ponto, Constanța, 102 pp.

Bologa A.Ș., Marinescu A., 2002, Romanian developmental contributions of E. Racovitza and G. Antipa to scientific exploration of the Mediterranean Sea, in *Oceanographic History. The Pacific and Beyond*, K.R. Benson & P.F. Rehbbock (Eds.), Univ. Washington Press, USA, 275–279.

Bologa A.Ș., Bologa A.F., Charlier R.H., 2013, Ioan Borcea and the first Romanian Marine Zoological Station at Agigea (1926), in Places, People, Tools – Oceanography in the Mediteranean and Beyond, Proceed. Eights Int. Congr. Hist. Oceanogr, C. Groeben (Ed.), Pubbl. Staz. Zool. Anton Dorn, Giannini

Ed., Napoli, Italy, 171–184. Bologa A.Ș., Bavaru A., 2018, Quasquicentennial development of marine sciences in Romania and its maritime Dobrogea, in *Dobrogea at 140 Years after its Union with the Romanian State – An Example of Contemporary Westpontic Multiethnic Understanding*, A.Ș. Bologa (Ed.), Ed. Ex Ponto, Constanța, 332 p, 191–205.

Celan M., 1938, Notes sur la flore algologique du littoral roumain. IV. Deux

Rhodophycées nouvelles pour la flore de la mer Noire: *Gelidiella Antipae* et *Phyllophora Brodiaei* (Turn) J.Ag., *Bull. Sect. Sci. Acad. Roumaine*, 19, 76–79.

Commission Internationale pour l'Exploration Scientifique de la mer Médite-rranée (CIESM), *Rapp. Proc.-verb. Réun*., 10, Paris, février, 1937.

Ghiță S., 1961, Din istoria biologiei generale în România, in *Din istoria biologiei generale*, N. Botnariuc, Ed. Științ., București, 57 pp.

Lup A., 2019, Concepții privind utilizarea agricolă a luncii inundabile a Dunării – Disputa Antipa – Saligny, *Columna*, 8, 99–111.

Negrea Ș., 1990, *Pe urmele lui Grigore Antipa*, Ed. Sport Turism, București, 264 pp.

Racoviță E., 1926, Speologia – discurs rostit la 13 iunie 1926 în ședința solemnă sub președinția de onoare a M. S. Regelui, Academia Română, Discursuri de recepțiune *LXI*, Cultura Națională, București, 64 pp.

Șelariu O., 2018, Cape Singol – The Bio-oceanographic Institute in Constantza – *In memoriam Grigore Antipa (1867–1944)*, in *Dobrogea 140 Years after its Union with the Romanian State – An Example of Contemporary Westpontic Multiethnic Understanding*, A.Ș. Bologa (Ed.), Ed. Ex Ponto, Constanța, 332 pp, 207–210.

xxx, 1938a, Cuvântările rostite cu ocazia solemnității omagierii operei științifice a d-lui dr. Gr. Antipa, 20 martie 1938, M.O. și Imprim. Stat., Imprim. Nat., București, 5 pp.

xxx, 1938b, *GRIGORE ANTIPA, Hommage à son œuvre, 10 décembre 1867 – 10 décembre* M.O., Imprim. Nat., București, 727 pp.

xxx, Banca Națională a României, 150 de ani de la nașterea lui Grigore Antipa.

xxx, https://ro.wikipedia.org/wiki/Mircea_Cancicov.

A HISTORY THAT MUST BE KNOWN: THE PHENOMENON OF ROMANIAN INFORMATICS. THE CONCLUSIONS OF THE ROINFO PROJECT COMPUTING "ROMANIAN INFORMATICS"

MARIN VLADA*

Abstract: The article describes the partial conclusions of the national ROINFO project 2018–2022: the phenomenon of Romanian informatics is contemporary with the beginning of global computer science and the Cybernetics was born in Romania (1938–1939). The article shows the stages in the emergence and development of Romanian informatics: 1. Research on recursive functions, logic and theory of demonstration (1927–1935) – prehistory of Romanian informatics, 2. Cybernetics was born in Romania (1938–1939), 3. Fundamentals of models for computing and development of computing, 4. Realization of Romanian computers, 5. Development of computers in the world. In Conclusions, we underline that Cybernetics was born in Romania (1938–1939), following the international recognition of the work of the scientist Ștefan Odobleja, the creator of Cybernetics: 1. "Demonstration de phonoscopie", the year 1937, 2. "Psychologie consonantiste", period 1938–1939, 3. Year 1972 – the autobiography of the mathematician Norbert Wiener, 4. "Cybernetics and Consonantist Psychology", the year 1975, 5. "Diversity and Unity in Cybernetics", the year 1978.

Keywords: cybernetics, computational models, computer science, informatics, Ștefan Odobleja, Grigore Moisil.
Received 5 May 2021

Tell future generations that Cybernetics was created in Romania (1938-1939), that Romania developed a Romanian informatics (after 1953) and built its own electronic computer (CIFA-1, 1957)!

Motto: "*The Informatics/Computer Science restores not only the unity between the pure and the applied mathematical sciences, the concrete technique and the abstract mathematics, but also that between the natural sciences, the human being and the society. It restores the concepts of the abstract and the formal and makes peace between arts and science not only in the scientists' conscience but also in their philosophy as well*." **Grigore C. Moisil**, Computer Pioneer Award and the father of Romanian Computer Science.

"*Knowledge is the bridge that connects us with all those who have ever lived before us. From civilization to civilization and from life to life, we contribute to the individual stories that become our collective history. No matter how well we keep the information about the past, the words in these stories are just "information" until we make sense of them. The way we apply what we know about our past becomes the wisdom of the present.*" **Gregg Braden**.

"*Understanding the evolution of concepts and theories in all fields and sciences, understanding the history of fields and sciences, consolidates the treasure of universal knowledge and helps us to develop them.*" **Marin Vlada (2019)**.

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INTRODUCTION: PRIORITIES IN CYBERNETICS, COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE

Science develops through the set of research, concepts, theories, methods and techniques that become valid and contribute to science complex problems studying and solving. Sometimes, over time, some of the theories, methods or techniques become obsolete and, through the appearance of more efficient and effective ones, disappear or are updated. Such examples are in mathematics, computer science, biology, medicine etc. The role of scientists is to contribute to these efforts to develop science. Globally, every nation has some fundamental contributions in the development of science, at various times when scientists, researchers, engineers, etc. are inventors or have priorities in developing theories, methods, or techniques. In this sense, Romania can also be proud of such people, even if in some situations the international recognition came later or maybe with great difficulties. Thus, a conclusive example is the case of Dr. *Ștefan Odobleja* (1902–1978), a forerunner of Generalized Cybernetics, who, only in 1978, at the Fourth Congress of the World Organization for General Systems and Cybernetics in Amsterdam, was recognized for his primacy (1938–1939) over the mathematician Norbert Wiener (1894–1964), who founded cybernetics (1948). The president of the congress, *J. Rose*, decided to award the gold medal "*Norbert Wiener*" – 30 years of cybernetics to the President of Romania (Vlada 2020).

About the beginnings and development of the world and Romanian informatics

- **The year 1938**: Inventive machine – "*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*." (Ștefan Odobleja, *Consonantist Psychology*, 1938–1939, Paris);
- **The year 1973**: Informatics – "*The Informatics/Computer Science restores not only the unity between the pure and the applied mathematical sciences, between the concrete technique and the abstract mathematics, but also that between the natural sciences, the human being and the society. It restores the concepts of the abstract and the formal and makes peace between arts and science not only in the scientists' conscience but in their philosophy as well*." (Grigore C. Moisil);
- **The year 2015**: Computational models – "*All important computational models came from simulating the activity of the nervous system. The automata models of the 1940s, the Turing machine of the 1930s, and the electronic computer produced by John von Neumann and his team in 1948 focused on the upper nervous system. In my 1964 book, Finite grammars and automata there is a large chapter on the neural system, as modelled by finite automata and regular grammars by S.C. Kleene.*" (Marcus, 2015);
- **The year 2017**: Molecular computer – "*Define a molecular computer as one molecule which transforms, by random chemical reactions mediated by a collection of enzymes, into a predictable other molecule, such that the output molecule can be conceived as the result of a computation encoded in the initial molecule*." (Buliga, 2015).

In 1978, as a student of the Faculty of Mathematics in Bucharest, Department of Informatics, I participated in the conference held by professors Solomon Marcus, Cristian Calude (newly assistant), and Ionel Ţevi – researcher at the Institute of Mathematics with the topic "Gabriel Sudan – The first example of position recursive which is not primitive recursive". The results of the research were published in C. Calude, S. Marcus, I. Ţevi, The First Example of A Recursive Function Which Is Not Primitive Recursive, Historia Mathematica, 6 (1979), pp. 380–384. Many years later, in 2017, I remembered this event-episode when writing an article in the ICVL 2017 volume: "*History of Informatics. From recursivity to the Turing universal machine and Horn clauses*", then in 2018 on the occasion of the elaboration of vol. I and II of "*History of Romanian Informatics*" (ROINFO project 2018–2022). Prof. Cristian Calude – came from New Zealand, was present at the launch of vol. I and II, which took place in the Spiru Haret amphitheater at the Faculty of Mathematics and Informatics, 26 Sept. 2019. In the presentation made on this occasion, C. Calude referred to this episode and confirmed the aspects related to those researches from 1974–1978. Sergiu Rudeanu[1] (1935–2019) was also paid homage, for his contribution to the development of pseudo Boolean programming, which today underlies quantum computers. Solomon Marcus, in the book "*From Romanian mathematical thinking*", Scientific and Encyclopaedic Publishing House, 1975, writes about these researches related to the recursive function G. Sudan (Marcus 1975).

The Pioneers in Computer Science/Informatics: *David Hilbert, Wilhelm Acherman, Alonzo Church, Kurt Gödel, Alan Turing, John von Neumann, Norbert Wiener, Noam Chomsky.*

Fig. 1 The Pioneers in Computing (Computer Science /Informatics)[2]

[1] http://mvlada.blogspot.com/2019/07/in-memoriam-prof-dr-sergiu-rudeanu.html

[2] https://museums.fandom.com/wiki/Pioneers_of_Computing

Worldwide, the American mathematician – of Hungarian origin, *John von Neumann* (1903–1957) is the author of the structure of the modern computer through *Von Neumann architecture*, through the technical report *First Draft of a Report on the EDVAC* from 1945, architecture that was based on the work of the British mathematician Alan Mathison Turing (1912–1954), (https://en.wikipedia.org/wiki/Alan_Turing) – this was acknowledged by Neumann, who described the so-called abstract Turing machine) – "*On Computable Numbers, with an Application to the Entscheidungsproblem (decision problem*)", Proceedings of the London Mathematical Society, 2 42: 230–65, 1936. In 1943, Turing built, for the benefit of the British army, Colossus – the first digital electronic computer for decryption of German codes, and in the period 1945–1946 contributed to the prototype of the computer machine "*Automatic Computing Engine*", made physically later, in 1950. In 1946 Turing presented a work that represents the first detailed design of a computer with a stored program. Today, this architecture is recognized and valid.

The construction of the modern computer was preceded by research and scientific papers on the construction of a computing machine to perform calculations, but also operations with symbols. This is how the "decision[3] procedure" arose from the computability theory and computational complexity theory. Decision problems usually arise in mathematical questions of decision-making, i.e. the problem of the existence of an effective method for determining the existence of an object or its membership in a set; some of the most important problems in mathematics are undecidable. The field of computational complexity classifies decision problems determined by how difficult they are to solve. "Difficult" in this sense is described in terms of the computational resources required for the most efficient algorithm for a given problem. Meanwhile, the field of recursive theory classifies undecidable decision problems according to the degree of Turing, which is a measure of the non-computability inherent in any solution. The origin of the decision problem dates back to the mathematician *Gottfried Leibniz*, who in the seventeenth century, after building a mechanical calculating machine, dreamed of building a machine that could manipulate symbols to determine the truth value of a mathematical statement. He realized that the first step should be a formal language, and much of his later work was directed toward that goal. In 1928, *David Hilbert* and *Wilhelm Ackermann* put the issue in the form presented above. Following his "program", Hilbert asked three questions at an international conference in 1928, the third of which became known as "Hilbert's Entscheidungsproblem" (Hilbert's decision problem). In 1929, Moses Schönfinkel published an article on the particular cases of the decision problem, which were prepared by Paul Bernays. Even in 1930, Hilbert believed that there were no unsolvable problems (Păun 2016).

NORBERT WIENER'S CYBERNETICS (1894–1964) VS. CYBERNETICS OF ȘTEFAN ODOBLEJA (1902–1978)

The mathematician *Norbert Wiener*[4] is considered the founder of cybernetics, the basic principles being described in his work "*Cybernetics or Control and*

[3] https://en.wikipedia.org/wiki/Decision_problem

[4] https://en.wikipedia.org/wiki/Norbert_Wiener

Communication in the Animal and the Machine" (1948), even if 10 years previously the Romanian Dr. *Ştefan Odobleja*– military doctor, published in French the fundamental work in 2 volumes, "Consonantist Psychology" (1938–1939), in which he defined the bases of a new science, Cybernetics, which will propel the construction of the modern computer and developing a new science: Computer science. Odobleja established the fundamental ideas of Cybernetics[5] – the 9 universal laws, the most important referring to feedback. *Norbert Wiener* is regarded as one of the first to theorize that all intelligent behaviour was the result of feedback mechanisms, which could be simulated by machines and was an important early step toward the development of modern artificial intelligence. Wiener's name frequently appears in the context of computer development, where he made important contributions to solving differential equations (1940). His World War II preoccupation with directing artillery fire led Wiener to develop a communication and transmission system for cybernetics. Thus, the birth of cybernetics took place in 1943, and in 1947 Wiener reached an agreement with other scientists to use the term "*cybernetics*" – a Greek term (κυβερνήτης – helmsman). It is a term that includes the regulation and linking of systems in the field of static mechanics, technology, and systems in the world of living organisms.

STAGES IN THE EMERGENCE AND DEVELOPMENT OF ROMANIAN INFORMATICS

Following studies and research within the ROINFO 2018–2022 project (*Romanian Informatics*) conclusions have been reached that must be known by the scientific world. These conclusions refer to the emergence and development of Informatics in the world and in Romania. The role of some nations in the emergence and development of Informatics worldwide is highlighted, through the joint efforts of scientists – *pioneers of Computing* (Computer Science and Computer): mathematicians, physicists, engineers, cyberneticists, economists, psychologists, etc. From the conclusions of the ROINFO project, some facts unknown until today in the history of world informatics have been reached. For example, Romania can be proud of a "*Romanian Informatics*" because the scientists from 1953–1970 contributed to the development of researches regarding the construction of the modern computer, managing to build their own Romanian computers. Between 1953 and 1954, Romania ranks third in the world, after the USA and USSR, in the research activity on the Theory of switching circuits – according to the number of articles (*Grigore C. Moisil*). Romania was the eighth country in the world designing and building an electronic computer (1957) and the eleventh country in the world, which built an electronic computer with transistors (1963). Therefore, comparing the scientific results and the contributions of scientists in the development of Informatics and computers, the priorities of some researchers and scientists, worldwide or nationally, can be highlighted. These priorities refer to Cybernetics – the science of systems, without which Informatics and the construction of computers would not have been possible. There is also evidence and results on some concepts and aspects regarding the vision of

[5] http://mvlada.blogspot.com/2019/10/stefan-odobleja-precursor-al.html

some scientists for the emergence and development of Artificial Intelligence – a complex field for building intelligent machines and systems that simulate intelligent human behaviour in solving complex decision-making problems.

Romania can be proud of the contribution of the Romanian scientists – mathematicians and engineers, in several fields of scientific research, on the fundamentals of calculability theory, the fundamentals of cybernetics, the algebraic theory of automatic mechanisms, mathematical logic applied to building and using the first electronic computers in Romania. A key role was played by acad. *Grigore C. Moisil* (1906–1973), considered the founder of the Romanian computer science, together with the engineers who built and developed the Romanian computer industry. Also, today, it is known that the new science Cybernetics was born in Romania, in 1938 and 1939, when Dr. *Ştefan Odobleja* – military doctor, published in French the fundamental work in 2 volumes, "*Consonantist Psychology*". He defined the foundations of a new science, Cybernetics, which will propel the construction of the modern computer and the development of a new science: Computer Science, which will contribute to the development of Artificial Intelligence. Odobleja established the fundamental ideas of Cybernetics (the 9 universal laws), the most important referring to feedback.

Romania in those years, before and after World War II, was connected to the scientific and technical activity on the emergence of new sciences: Cybernetics and Informatics, through the scientific efforts of the world community, to the construction of computer systems. In the '60s, Romania was considered among the first countries in the world (after the USA, England, USSR, Germany, France, Japan, Austria, Holland, Italy, and Denmark) regarding research and efforts to build the electronic computer. The Romanian school of mathematics developed under the influence of Romanian mathematicians who defended their doctorates with prestigious mathematicians from France, Germany, and Italy. For example, the mathematician *Gabriel Sudan* (1899–1977) published in 1927 (before *W. Ackermann*, 1928), the first non–primitive recursive function (Vlada 2019).

Fig. 2 The Pioneers in Romanian Informatics[6]

[6] https://museums.fandom.com/wiki/Pioneers_of_Computing

● **Gabriel Sudan (1899–1977) and the study of recursive functions** – "After a careful examination of all the articles and books of Prof. *Sudan, Cristian Calude* turns his attention to the article *Sur le nombre transfini* ω^{ω}, published in the Bulletin Mathématique de la Société Roumaine des Sciences, vol. 30, 1927, fasc. 1, pp. 11–30" (S. Marcus, From Romanian mathematical thinking, Scientific and Encyclopedic Publishing House, Bucharest, 1975) (Marcus 1975, Filip 2018).

● **Cybernetics was born in Romania – Cybernetics of Stefan Odobleja (1902–1978)** – "I coveted my whole life for the comfort of big cities, but fate, more prudent than me, protected me from this danger. I can believe that the realization of this psychology with a pronounced character of cybernetics is also due to the fact that its author lived his life in the province, closer to nature. The training in nature and the permanent contact with nature and its realities put me in the optimal conditions to reflect on my thinking and at the same time they imprinted on me an independent, personal and realistic attitude." (Dr. *Ştefan Odobleja*.)

● **Grigore C. Moisil (1906–1978) – the founder of Romanian informatics and of the algebraic theory of automatic mechanisms** – *Grigore C. Moisil* receives – post-mortem, in 1996, Computer Pioneer Award (Computer Pioneer Award[7] – IEEE Computer Society) – the only Romanian who received this medal "For the development of polyvalent logical switching circuits, the Romanian School of Computing, and support of the first Romanian computers".

● **The mathematician Tiberiu Popoviciu and the Romanian computer DACCIC** – Tiberiu Popoviciu (1906–1975), a visionary scientist, was a personality with important achievements in founding computer science in Romania in the '50s, both in terms of hardware and software. Notably, Tiberiu Popoviciu is the author of the first monograph in Romania on numerical analysis and approximation theory, 1937. We briefly list the following steps/arguments on the contribution of acad. *T. Popoviciu*[8] at the founding of Romanian informatics ("Tiberiu Popoviciu" Institute of Computing Cluj-Napoca, Romanian Academy).

● **Engineer Victor Toma (1922–2008), the pioneer of the construction of Romanian computers** – Thanks to Eng. Victor Toma and under his direct guidance, a series of electronic computers were made on tubes starting with CIFA-1 (April 1957), CIFA-2 (1959), CIFA-3 (1960), CIFA-4 (1962) and then on transistors CET-500 (1964) and CET-501 (1966). The CIFA-101 (1962) and CIFA-102 (1963) computers were also made in the section led by Victor Toma.

● **Wilhelm Löwenfeld and Iosif Kaufmann, creators of the MECIPT computer in Timisoara** – "*Willy Löwenfeld was without a doubt the soul of MECIPT (Electronic Computing Machine of the Timişoara Polytechnic Institute). We cannot deny the merits of Iosif Kaufmann as a brain of MECIPT,*

[7] https://www.computer.org/profiles/grigore-moisil

[8] https://ictp.acad.ro/ro/tiberiu-popoviciu-unul-din-fondatorii-informatic

but without Willy the computer certainly would not have appeared. Out of extraordinary vitality, with a perseverance that I always took as a model without success, Löwenfeld managed to coordinate the few resources existing for the completion of the project in a way many nowadays project managers could envy him for. In 1961, as a fourth-year student at the Faculty of Electrical Engineering in Timisoara, I was approached by Willy Löwenfeld, one of the two creators of MECIPT – a project that was already talked about, but not out loudly. Willy brought me to the computer under construction and I started to work with Iosif Kaufmann, in the form of a student circle, fashionable at that time. It was the moment when, after the initial impulses of Grigore C. Moisil, I decided that I wanted to work in the field of computers at any cost." (Vasile Baltac, 2008.)

● **Solomon Marcus (1925–2016), the mathematician of frontier and interdisciplinarity** – Academician *Solomon Marcus*, a renowned scientist with a solid international career, developed over 65 years, the Romanian mathematician and computer scientist whose name is quoted in major international encyclopaedias, has published over 50 volumes and 400 scientific articles, in various fields: mathematical analysis, mathematical linguistics, theoretical informatics, mathematical poetics, semiotics, history and philosophy of science, mathematical models in the natural sciences, history and philosophy of science and in the socio-humanistic sciences.

● **The mathematician Sergiu Rudeanu (1930–2019) and the structures of discrete mathematics** – Prof. Dr. *Dragoș Vaida*: "Sergiu Rudeanu was a mathematician who fully deserves the international recognition and echo, from which you had something to learn, not how to make your life easy, but certainly how to make a solid, unitary, coherent work, to which you could look with gratitude even later". Cristian S. Calude and Marian Gheorghe (Fundamenta Informaticae, vol. 131/2014): "Research activity of Sergiu Rudeanu[9] in lattice theory, algebra of logics, universal and Boolean algebras (see pseudo-Boolean programming, a subject he has initiated with P. L. Hammer), automata theory and graph theory is internationally well-known and appreciated. A very good lecturer, who devoted time and energy to write many textbooks, Prof. Rudeanu was also an excellent supervisor. The Mathematics Genealogy Project lists his 12 PhD students (including well-known researchers as D. Simovici, A. Iorgulescu and S. Istrail) and 13 descendants".

The volumes "History of Romanian informatics. Appearance, development and impact", MATRIXROM Publishing House, 2019–2020:

● Volume I (*Computing – International Context*), contains Chapter 1: 1. The International Context to the Emergence and Evolution of Computers.

● Volume II (*Computing – National Context*) contains chapter 2: 2 The national context on the foundation of Romanian informatics.

[9] http://www.genealogy.math.ndsu.nodak.edu/id.php?id= 60012

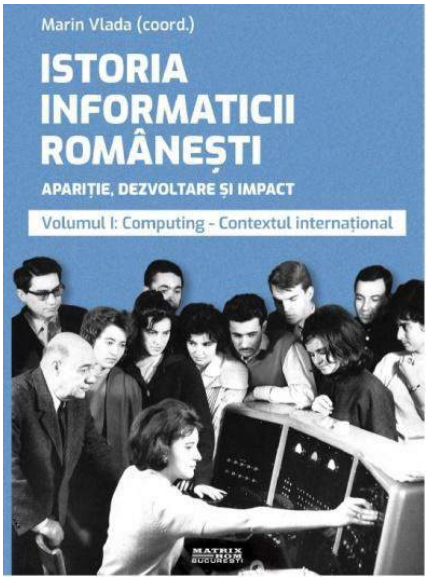

Fig. 3 Volumes I and II "History of Romanian informatics. Appearance, development and impact"

● Volume III (*Computing: Emergence and Development*) further includes 4 chapters (chapters 3–6): 3. The development of the computer industry in Romania; 4. Grigore C. Moisil – Computer Pioneer, founder of informatics in Romania; 5. Solomon Marcus, a life dedicated to mathematics and informatics: 6. The pioneers of Romanian informatics – University of Bucharest.

● Volume IV (*Computing: Development and impact*) further includes 4 chapters (chapters 7–10): 7. The pioneers of Romanian informatics – People and institutions; 8. Development and impact of informatics in Romania; 9. Computer Science and Cybernetics at the Academy of Economic Studies (ASE); 10. The history of computerization in the Romanian pre-university environment 1985–2018.

● Volume V (*Computing: Development*) further includes 2 chapters (chapters 11–12): 11. Development of the IT / IT field in Romania (Higher Education in Informatics and IT, CCUB, the first informatics unit established in Romania, Examples of software products developed by CCUB, High school and high school computer science, Emergence and evolution of IT companies / companies in Romania, Production of books and publications on informatics and IT, Contributions to the development of Romanian informatics: INFO–IAȘI and ROSYCS, Informatics methods and systems, studies and researches – evolution and impact); 12. Scientific events and IT / IT events in Romania (Pioneering scientific events in the field of informatics / IT, Pioneering scientific events in the field of informatics / IT, other programs and projects – Professional Development of Teachers).

Fig. 4 Volumes III, IV and V "History of Romanian informatics. Appearance, development and impact"

Now it can be stated that, in fact, the objectives of the ROINFO project continue some previous approaches regarding the history of informatics in Romania. The first approach is made by acad. *Grigore C. Moisil* through the article "*Activity of the Computing Center of the University of Bucharest – CCUB*", AMC no. 13–14, 1970, Technical Publishing House[10]. The second approach is made by the Vietnamese *Pham GiaDuc*[11], "*The History of the Establishment and Development of Computer Science in the R. S. România*", 1972. The third approach is *Marius Guran's* book, Monograph of Informatics in Romania, Historical Landmarks, AGIR Publishing House Bucharest, 2012, 705 pages. After the conception and elaboration of the first 2 volumes of the ROINFO project, important conclusions were drawn by understanding the phenomenon of Romanian informatics. Thus, the two papers highlighted the important efforts and contributions of scientists, professors, researchers, engineers etc., on the emergence and development of informatics in Romania. Therefore, the phrase "*Romanian informatics*" is argued by examples, studies, achievements, initiatives and actions.

These aspects were described in the Preface to Volume III (Vlada 2021):

1. **Research on recursive functions, logic and theory of demonstration** – In 1927, the Romanian mathematician Gabriel Sudan (1899–1977), with his doctorate at David Hilbert, gave the first example of a non-primitive recursive function, before Wilhelm Ackermann (1928). Between 1934–1942, at the University of Iași, the mathematician Grigore C. Moisil (1906–1973) dealt with "Logic and the theory of demonstration" and aiming to "learn mathematics from the beginning", he studied at the "wonderful library" of the Mathematical Seminar from Iași, the book by Hilbert and Ackermann, but also the 3 volumes "Principia Mathematica" by Russel and Whitehead. Professor Moisil learned about Lukasiewicz's multi-valued logics in the

[10] http://c3.cniv.ro/?q=2018/restituiri

[11] http://c3.cniv.ro/?q=2018/duc

spring of 1935, when T. Kotarbinski, a professor at the University of Warsaw, gave 3 public lectures and a short lecture at the Mathematical Seminar on Lukasiewicz's writing without parentheses.

2. **Cybernetics was born in Romania (1938–1939)** – Today it is known that, 10 years before the book of the American mathematician Norbert Wiener (1894–1964) "Cybernetics: Or Control and Communication in the Animal and the Machine", the Romanian Dr. Ștefan Odobleja (1902–1978) – military doctor (post-mortem member of the Romanian Academy, 1990), published in 2 volumes "Consonantist Psychology", 1938–1939, at the Publishing House "Maloine", Paris, in French (totalling over 800 pages), in which he establishes general laws, which he applies to both the sciences of inert nature and the sciences of the living world, psychology and economic and social phenomena. Dr. Ștefan Odobleja makes a description of the psychological functions using a general scheme of a cybernetic system, where the sense organs, which receive information from the environment, represent the inputs (INPUT), and the muscles are considered the outputs (OUTPUT). They take "*steps beyond the boundaries of psychology*" moving from man to other complex systems (communities, social organizations, etc.), inventing a new science: Cybernetics.
3. **Fundamentals of models for computing and development in the field of computing** – In the period 1953–1954, Romania ranked third in the world, after the USA and the USSR, in the research activity on "Theory of switching circuits" – after number of articles (Gr. C. Moisil, CCUB Activity, AMC magazine, Technical Publishing House, no. 13–14, 1970). Programs for the national computer and management system, regarding the endowment with computer technology in the period 1971–1980 (1967, 1971, 1972).
4. **Making Romanian computers** – Between 1955 and 1957, Romania designed and built its first electronic digital computer (1957, CIFA 1 computer), by a team led by Victor Toma, at the Institute of Atomic Physics (IFA) – Măgurele, Bucharest.
5. **Development of computers in the world** – Romania was the eighth country in the world to design and build an electronic computer (1957) and the eleventh country in the world to build an electronic computer with transistors (1963).

CYBERNETICS WAS BORN IN ROMANIA (1938–1939)

Stages in the international recognition of the work of the scientist Ștefan Odobleja, the creator of Cybernetics (Vlada 2021):

1. "Demonstration de phonoscopie", the year 1937, Dr. *Ștefan Odobleja* presents a scientific paper at the ninth (IX) *International Congress of Military Medicine and Pharmacy*, Bucharest. The paper is received with great interest by Dr. W.S. Bairbridge, head of the American delegation. On this occasion, Dr. Ștefan Odobleja distributed to the participants in the Congress a leaflet in French announcing the publication of the paper: "Consonantist Psychology" (1938–1939). Coincidentally

or not, the two American military doctors (Dr. Wiliam Seman Bainbridge – chief physician of the seventh American Fleet in the Mediterranean, and Dr. Rosenblueth), later – after 1940, were included in the research team of the American mathematician Norbert Wiener – today, considered the father of cybernetics.

2. "Consonantist Psychology", period 1938–1939 – Dr. Ștefan Odobleja (1902–1978), publishes in 2 volumes "Consonantist Psychology", 1938 and 1939, at the "Maloine" Publishing House, Paris, in French, totaling over 800 of pages), in which he establishes general laws, which he applies both to the sciences of inert nature and to the sciences of the living world, psychology and economics, and social phenomena. "Consonantist psychology has revealed the importance of dual, binary and dichotomous mechanisms both in psychology and beyond, in all sciences. He suggested and applied it as another essential for the mechanization of thought, along with circularity. Instead of logic based on 3, he proposed and sketched a logic based on 2", says Dr. Stefan Odobleja. Thus, he came to define the 9 universal laws, among them being the law of reversibility / vicious circle, feedback. The 2 volumes represent the concepts and studies for a new science: Cybernetics.

3. The year 1972 – Since 1972, when Ștefan Odobleja read the autobiography of the mathematician Norbert Wiener, he devoted himself to demonstrating the idea that the origin of cybernetics lies in psychology and that "Cybernetics was born in Romania in 1938" through his work in 2 volumes "Consonantist Psychology" from 1938–1939. In this sense, in order to mark his partnership, he published a special work, which appeared in the very year of his death: "Consonantist and cybernetic psychology", with a substantial preface by Mihai Golu: Ștefan Odobleja, Consonantist and cybernetic psychology, Scrisul Românesc Publishing House, Craiova, 1978.

4. "Cybernetics and consonantist psychology", the year 1975 – Scientific communication at The Third International Congress of Cybernetics and Systems, Bucharest, Romania, August 25–29, 1975 (ASE Bucharest). The paper appeared in Proceedings of the Congress (editors J. Rose – UJ and C. Bilciu–Romania), Vol. II, section 5 (Communications, Education, and Informatics), SPRINGER-VERLAG Berlin, Heidelberg, New York. The author presents the connection between the basic concepts of cybernetics and the ideas presented in detail in the volume "Consonantist Psychology", Paris, 1938–1939. Consonantist psychology views the brain as a thinking machine; it proceeds to the analysis of thinking in a mechanical, modern way and separates distinctly the two primordial categories (psychological and dynamic question). Thus, Dr. Ștefan Odobleja can be considered a forerunner of Artificial Intelligence.

5. "Diversity and unity in Cybernetics", the year 1978 – Scientific communication at the IV International Congress of Cybernetics in Amsterdam – Netherlands (August 21–25, 1978), which was presented by Dr. Stelian Bajureanu – Dr. Stefan Odobleja is ill in bed, and obtains international recognition as a forerunner of cybernetics. B. H. Rudall of the University of Wales, who chaired the session, said: "Dr. Odobleja's work was very well received. A great interest and

appreciation was expressed *towards Consonantist Psychology*". The convention was dedicated to the celebration of Norbert Wiener. After the presentation of Odobleja's work, "40 years of cybernetics" were chanted, although "30 years of cybernetics" and Norbert Wiener, who did not receive the Nobel Prize, were also celebrated.

Fig. 5 September 26, 2019, Meeting of Romanian computer scientists, launching volumes I and II, Amphitheater S. Haret, Faculty of Mathematics and Computer Science[12]

CONCLUSIONS

"*Any science that does not dissolve in practical applications is a crippled and useless science. The great inventions were made by scientists who were at the same time scholars. With simple incursions, not much can be done. It must be attacked on a broad front. Only in such a way will it be possible to produce a more important breakthrough in the enemy front of the unknown*." Dr. *Ștefan Odobleja* (1902-1978), Father of general cybernetics, post-mortem member of the Romanian Academy.

"*The value of scientific work is judged by the influence it exerts on the evolution of science. There are also clogged roads in science, rivers that instead of flowing into rivers and thus into seas and oceans, fail in a small lake or simply in a puddle*" Acad. *Solomon Marcus* (1925–2016). "*Calculus, in all its generality, is one of the fundamental human skills; we are born with this predisposition. It took a historic effort to perform a molecular analysis of human calculus in its irreducible components, an effort that culminated in the result of the British Alan Turing 80 years ago, in what science refers to as the Turing machine. It prefaced the*

[12] https://1.bp.blogspot.com/-ETUGQgfQr5c/X3gr4_we8mI/AAAAAAAAUBI/_zfKZxKfWx8PvVu5A3RZN_ry4GSer3v3ACNcBGAsYHQ/s960/26%2Bspt%2B2029%2Bamf%2BS%2BHaret%2Blansarea%2Bvol%2BI%s2B-II.jpg

electronic program-based computer developed by John von Neumann and his team in 1948. Inadmissibly, this itinerary, which makes the transition from traditional, numerical to qualitative computing, with entities of an abstract, unspecified nature, is missing from the program school." Acad. Solomon Marcus (1925–2016).

ACKNOWLEDGEMENTS

We thank Mr. Eng. *Ștefan Odobleja* jr., the president of the "Ștefan Odobleja" Foundation, the son of the scientist *Ștefan Odobleja*, because he provided us with documents and works about the monumental activity of his father.

In his vast work "*Consonantist Psychology*" (the term/concept of consonance – without consonance, did not exist in the dictionary in 1938), Dr. *Ștefan Odobleja* uses nine (9) universal laws (*equivalence, equilibrium, compensation, reaction, oscillation, reversibility-feedback, inertia, consonance, transformation*) based on the resonance phenomenon (this term existed in 1939, resonance, see resonance, source: Scriban – 1939). He is the first who applied the law of feedback (the law of reversibility) in nature and in society, to as many scientific fields as possible: *philosophy, biology, psychology, sociology, political economy, mathematics, and even medicine (psychoneurology, psychophysiology, psychopathology, interpsychology*); this approach helps us understand more easily the interrelationships between biological, psychological and social factors, the connections between psychic and somatic, in the practice of psychosomatic medicine. The consonantist psychosomatic phrase helps us to better understand the psychosomatopsychic circuit expressed in psychophysiological and clinical terms, in the work of *Ștefan Odobleja*.

REFERENCES:

BDM, SoftSolutions, *IEEE Computer Society's Web Programming Competition Unsung Heroes, CHC61 Competition*: Team number 718293 (BDM SoftSolutions), http://www.bdmsoft.com/ieeecontest/life.php

Baltac, Vasile. http://evocari.blogspot.com/2008/07/wili-loewenfeld-primul-pionier-al.html Filip, Florin Gheorghe. Civilizaţia Românească (coord. Victor Spinei) – *Ştiinţa şi tehnologia informaţiei în România*: Editura Academiei Române Bucureşti, 2018: 119–121

Ghinea, Cornelia. *Ștefan Odobleja*. *Omul, militarul, medicul:* Buletinul arhivelor militare, Anul XVII, Nr. 3(65), 2014, http://www.universitateaeuropeana dragan.ro/admin/documente/1291024277.pdf

Păun, Gheorghe, *Moisil 110*: Editura Tiparg, Curtea de Argeş, 2016

Marcus, Solomon. *Din gândirea matematică românească*, Ed. Științifică și Enciclopedică, 1975

Vlada, Marin (coord.). *Istoria informaticii românesti. Apariţie, dezvoltare şi impact. Oameni, instituţii, concepte, teorii şi tehnologii*, vol. I, II, III, IV: Editura MATRIXROM, 2019–2021

Vlada, Marin and Adăscăliței, Adrian. *Ştefan Odobleja*: *A Scientific Visionary, precursor of Cybernetics and Artificial Intelligence*, Proceedings of the 12th International Conference On Virtual Learning (ICVL 2017): Editura Universității din București, 2017

Vlada, Marin and Adăscăliței, Adrian. *History of Informatics. From recursivity to the Turing universal machine and Horn clauses*, Proceedings of the 12th International Conference On Virtual Learning (ICVL 2017): Editura Universității din București, 2017

Vlada, Marin. *Priorities in Cybernetics, Computer Science and Artificial Intelligence. About the beginnings of world and Romanian Informatics*: ICVL 2020, http://c3.icvl.eu/papers2020/1.pdf, http://www.c3.icvl.eu/2020/priorities

Vlada, Marin. *ROINFO 2018–2020 Project "Romanian Informatics", 60 years of Romanian Informatics:* ICVL 2020, http://c3.icvl.eu/papers2020/2.pdf

Vlada, Marin. *ROINFO project "Romanian Informatics" – Conclusions*, 2020, http://c3.icvl.eu/2020/roinfo-conclusions

Vlada, Marin (coord.), *ROINFO project "Romanian Informatics"*, https://sites.google.com/view/roinfo/, 2020

IMAGES:

The Pioneers in Computing (Computer Science /Informatics), in https://museums.fandom.com/wiki/Pioneers_of_Computing, last accessed 13.07.2021.

The Pioneers in Romanian Informatics in http://c3.icvl.eu/2020/roinfo-0, last accessed 13.07.2021.

Meeting of Romanian computer scientists, launching volumes I and II, Amphitheater S. Haret, Faculty of Mathematics and Computer Science, in https://1.bp.blogspot.com/-ETUGQgfQr5c/X3gr4_we8mI/AAAAAAAAUBI/_zfKZxKfWx8PvVu5A3RZN_ry4GSer3v3ACNcBGAsYHQ/s960/26%2Bspt%2B2029%2Bamf%2BS%2BHaret%2Blansarea%2Bvol%2BI%2B-II.jpg , last accessed 13.07.2021.

ROMANIAN SCIENTISTS – ȘTEFAN ODOBLEJA

DR. ȘTEFAN ODOBLEJA'S WILL TO YOUNG PEOPLE

NATALIA ODOBLEJA* AND ȘTEFAN ODOBLEJA JR.

Abstract: Dr. Ștefan Odobleja (13.10.1902 – 4.09.1978), military doctor, inventor of cybernetics, post-mortem member of the Romanian Academy, is the author of the monumental work in two volumes entitled "Consonantal Psychology" (1938–1939) which laid the foundations of a new "Consonantal Psychology" revealed the importance of dual, binary and dichotomous mechanisms both in psychology and beyond, in all sciences. He suggested and applied as another essential method for the mechanization of thought, along with circularity (feedback). Instead of logic based on 3, Dr. Ștefan Odobleja proposed and sketched a logic based on 2, being a forerunner of Computer Science and Artificial Intelligence. After 1972, when he read the autobiography of Norbert Wiener – considered the founder of modern cybernetics, Odobleja fought for the international recognition of the foundation of cybernetics through the 9 universal laws that he studied and defined, Odobleja's cybernetics being explained as in the two volumes "Consonantal Psychology". In addition to these studies, Odobleja left many studies on the sciences, organization and use of the human mind and even a will for young people. In this article we will see how current are these tips that the scientist Odobleja describes, advice addressed especially to young people. They are classified into: The need for Creation, The need for learning, The need for organization of mind, The need for diversified work, The need for discipline of the senses and imagination, the use of experiments, The need for classification, comparison, analysis and synthesis, The need for living logic.

Keywords: young, need, creation, learning, mind, classification.
Received 8 June 2021

Motto: "Let's purify our thinking. Let us get used to thinking real, in images, thinking without words, undressing our ideas of verbalism and prolixity. To give them a concrete, metaphorical character, to bring them back to the senses. Let's reject all obscure, confusing, vague ideas or clarify them. Let's only manipulate clear, precise, concrete and concretizable ideas, well defined, reducible to sensations and senses". Dr. **Ștefan Odobleja**[1] (1902–1978), creator of generalized cybernetics, post-mortem member of the Romanian Academy

1. THE NEED FOR CREATION

To create, we must feel and elaborate to the maximum. In order to create, you need intensity: a vigorous, solid and precise spirit. It takes depth and penetration, divinatory and inventive intelligence, sagacity, a spirit of synthesis, great strength of intuition. It takes, on the other hand, a lot of finesse, discernment and analysis, aptitude for meticulous work.

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To create, you need amplitude: a great wealth of elaborate material. Memory richness: complex, broad, encyclopedic spirit. The great inventions were made by scientists who were, at the same time, scholars. With simple incursions not much can be done. It must be attacked on a broad front. Only in this way can an important breach be made in the enemy's enemy front.

To create you need duration, perseverance, fixity, patience, a fixed idea pursued with perseverance, passion, obsession, lasting and tenacious concentration. Genius is only long-suffering.

We must keep the ideas and let them mature; the greater their gestation, the more perfect they are. Nothing important can be achieved without patience. To produce something beyond the common, we must also work and think infinitely more than others. Before inventing something in science or even in art, a lot must be invented in personal hygiene.

To create, you need a good memory, extensive knowledge, encyclopedic knowledge.

Scientific, philosophical, artistic or technical creation requires, first of all, updating with the present, with what is already acquired, known, expressed or invented. It demands the exhaustion of the assimilation of everything that has taken place in the respective field: a vast culture, a specialized, concrete and well-classified erudition. It is therefore necessary to thoroughly examine all the

works that have appeared on the subject we are concerned with. Let's not waste time discovering gunpowder or what is already known.

Psychology and Logic represent the foundation of all human knowledge and the backbone of all sciences. Indeed, knowledge presupposes not only a thing to be known, but also a knowing mind, an instrument of knowledge, and logic is the science of knowledge, the science of intellectual mechanisms, the normative science of methods of knowledge.

Research and observation methods, methods of thinking as well as methods of exposition are the tools with which we determine the contours and physiognomy of sciences and these methods, which are applied everywhere, are part of Logic. That is why logical theory cannot be indifferent to any Science, nor can it neglect it. For a good method is a good tool, while a rudimentary method is a rudimentary tool.

2. THE NEED FOR LEARNING

We must learn using the method of rediscovery. Let's learn each thing from several authors: let's consult as many books as possible for each problem. Let's use creative games, intelligence games (word families, derivations, synonyms, analogies, poetic exercises). Let's get used to contemplation and meditation.

Let us inform ourselves in the specific spirit of the creation we are preparing for: the scientist must observe and classify, the philosopher must contact the sciences, systematize them, the artist must feel and express, the technician must experiment and combine real objects.

Let's avoid skepticism, let's cultivate optimism. Science, philosophy, art, technique are not exhausted at all; there are always discoveries to be made. Everyone must hope that he will have the right chance. In every new fact a great truth must be assumed.

The love for research will be cultivated by reading the history of discoveries, the lives of illustrious scientists, autobiographies of philosophers, scientists or artists. Curiosity will be cultivated through problems and expectations.

Let it be known, moreover, that all truths have gone through the phase of stupidity; there is no way to suddenly produce perfect truths.

We must be optimistic; we must believe in our strengths and possibilities. If you have an intelligence slightly above average, you can always have self-confidence.

Let's work progressively; let's start with personal observations and ideas. Reading, let's work out. Let us always anticipate and anticipate reading; to read only to confirm or refute one's own ideas. Let's start with a little reading and the easiest, to avoid bluff inhibition. Let's read, if possible, in the order of the evolution of that science.

During the reading, let us doubt everything and everything. Let us doubt all the previous truths; to doubt everything that has been said or written in the matter. Let's read in a critical, difficult and distrustful spirit. Let's doubt the author's ability, despite his eventual celebrity. Let's not admit anything as an absolute, let's

accept everything in reserve. Let us not be fascinated, the idolatry of masters is a great obstacle to progress. Let's put the truth above any authority or celebrity.

Let's change, redo, reclassify everything we read. Let's try to offer everything in the clearest and most focused way. Let's look for novelty and originality; to reduce to more general classes or laws, to relate to other things, to explain in a different way.

… If the creation demands the renunciation of a number of pleasures and amusements, it offers in compensation, its own pleasures.

Let's abandon the other problems; only one big problem will be worked on.

Let's focus as much as possible on our study, focusing entirely on what we do at a given time. Great attention leads to great inventions. Let's avoid dilettantism and superficiality.

Let's dismantle the theme, let's attack each of its parts separately, through successive concentrations. To separate, to differentiate, to individualize, to specialize, to distinguish each problem. Let's avoid amalgam, mixing, shapeless mass. Let's open subchapters at every step. Let's isolate in separate chapters: history, bibliography, criticism, applications, discussions. Let's avoid sprinkling criticism, discussions, hypotheses and facts at every step; it is better for them to be separated.

… There is a great need for the memory to be materialized, depositing it on paper, in files, in files, which will thus replace it, substituting itself. It's an economy and an amplification at the same time.

… When reading, when making observations, etc. the creator to get used to omitting everything unrelated to his work. To create a selective, unilateral, limited, specialized perception. Always ask yourself: what should be kept in mind? In what order of importance?

… We must insist for a long time on the rare books, exceptionally well written and thought out, and even resume their reading.

Let's write down everything that deserves to be remembered: observations, experiences, events, ideas, readings. Let's write down all the details, all the results, all the subtleties. Let's note the successes as well as the failures. Let's note the rare elements, as well as the frequent ones, especially at the beginning when it is difficult to guess in which direction what is important will be found. Let's use memotechnics. Let's use general files, memos, forms, summaries, books, libraries. Let's note (materialize, fix) the sensations with the help of recording devices: photography, cinematography, phonography, compass, electrical measuring devices, mechanical recording devices, scales, chemical detectors.

3. THE NEED TO ORGANIZE THE MIND

Let's write down our ideas through the images that compose them. Let's even note the events, through literary sketches, or through their musical expressions (these notes will, themselves, be useful for artists).

Let us seek to delve into the deep depths of ideas; to retain them exclusively, in their simplest, purest and most concrete form. Let's learn to look for ideas, to discover them under the shell of words; to know how to peel them. Let's learn to undress ideas and detach them from form and language. Let's only record or write down classes and laws. Let's extract the essence, let's not copy the texts of the books.

Let's think without speaking; let's get used to it. But, because it is necessary to record the fruit of one's own thinking, this recording must at least be kept to a minimum. Very abbreviated notes will be taken (by signs, drawings, synoptic diagrams, sketches or transcripts), which only slightly impede the course of thought. A little later (after the moments of inspiration) these notes will be developed, which will suggest the rest of the thinking. Sometimes it is useful to delete any recording, for 5–30 minutes, to give the thought the freedom to take off. After that, the products will be recapitulated and registered.

Let's purify our thinking. Let us get used to thinking real, in images, thinking without words, undressing our ideas of verbalism and prolixity. To give them a concrete, metaphorical character, to bring them back to the senses. Let's reject all obscure, confusing, vague ideas or clarify them. Let's only manipulate clear, precise, concrete and concretizable ideas, well defined, reducible to sensations and senses.

Let's always exemplify. To set an example for ourselves is to give our thinking a solid foundation. To exemplify while expressing ideas is to make oneself understood.

Let's focus our ideas; to work with pure and focused ideas. Let's express them in the same way; readers will only gain. Science is enormous while time is short and life is complex. Therefore, prolixity, digressions, uselessness, nothingness will be combated, in writing as well as in thinking.

Think of synoptic tables; this means removing the heavy burden of the imperfections of a language (conjunctions, prepositions, inflections, articles, genres, pronouns, and the countless multitude of synonyms). Let's avoid digressions and uselessness.

… It is preferable to think without using words; to think in direct sensory images or representations.

4. THE NEED FOR DIVERSIFIED WORK

Let's react against excesses, fatigue, overwork. Let's apply the rules of aesthetics; to learn to drift, to have fun, to relax.

We mention among the appropriate derivatives and entertainments: manual work, walking, walking, cycling, traveling, horseback riding, swimming, gymnastics, sports, games, friction, massage, poetry, literature, humorous readings, music, dance.

Creative activity – like all our actions, in fact – must be cyclical, oscillating rhythmic, constantly oscillating between the various antitheses of which our

intellectual and physical functions are composed. Intelligence is a myriapod whose steps must alternate successively. We must, therefore, specialize the moments, differentiate them, always vary them. Creative work is not a block; it is reducible to many phases, the succession of which must be cyclical.

We have to work cyclically. Let's resume a few times. Let's go back to the work often until the results are perfect.

Let's alternate work and rest, exercise and relaxation, stimulation and calm, creation and recreation, concentration and distraction.

Let's alternate learning with elaboration, observation with meditation, reading with its resumption, perception with reflection, sensations with thinking, formation of apperception with creation, incubation with hatching, gestation with birth, preparation with inspiration, prelude with "intuition", facts with hypotheses. Reading excites productivity, and productivity demands control through new readings. Thus, reading builds and builds, but it is also reading that verifies and destroys or confirms and reassures.

Let's alternate the elaboration of the various chapters (parts) of the paper. Let's alternate its conception and expression, ideation and eloquence, meditation and writing, background and form, conception and style.

Let's alternate theory with practice, speculation with application, science with art. Any science that does not turn into practical applications is a crippled, lame and useless science.

Let us alternate synthesis and analysis, classification and division, definition and description, generalities and details, theses and antitheses, fusion and discrimination, similarity and differentiation, far vision and close vision. Let's build, destroy and rebuild a few times.

Let's work at a steady pace; studiousness, constancy, patience. Let's use especially the morning and evening work.

Let's read in order of difficulty, complexity, confusion and inaccuracy. Let's start with what is clear, easy, simple.

Let's start with building the skeleton of a plan, which we will cover in time. Gradually the outline of this plan will be replaced by another (better, more complete and more appropriate).

Let's write and formulate our ideas; we are inspired by writing. Let's present our ideas in a scientific society; the criticisms that will be expressed there will guide us and, at the same time, will stimulate us. Let's get involved in the fight for ideas. Let's talk and talk to someone; the conversation is a real collaboration.

5. THE NEED TO DISCIPLINE THE SENSES AND IMAGINATION, TO USE EXPERIMENTS

Let's discipline our senses and imagination. Let us educate our will to think; without voluntary activity the efficiency of the creative imagination will be very low.

Let's be careful; not to lose our moral balance. In practical life, let's not give up salutary common sense. Let us avoid being deceived by our own ideas; let's stay on the middle line.

Let's challenge the experimental approach; let's experiment. Let's ask the studied phenomenon (or object) all the possible questions, applying all kinds of imaginable techniques. Let's learn the experimental technique; there are a lot of books on this today. Let us never limit ourselves to a single experience; it would mean exposing ourselves to a definite error. Hundreds must be made. Let's repeat a few times the experiences whose results are simple, constant, easy to decipher.

Let's try to inventory new techniques, making new approaches. Let's not resign ourselves to the usual experiences, trivialized or already used in that field. A trivial experience is an exhausted experience; it can only offer a trivial truth and nothing original. So let's try to adapt new techniques. To this end, we should consult all experiments performed in other branches of science (physics, etc.). reviewing them yields useful suggestions. Let's classify the known techniques, in order to be able to invent new ones.

When we want to study a science, we must compare and bring it closer to all other sciences: physical, psychological, psychological, etc. Every restricted branch of a science must be sought in all other branches of that science (and in all other branches of other sciences) phenomena, laws, classes, and analogous, equivalent, or related notions.

In each field, let's read a few treatises, with the preconceived idea of finding similarities with the particular science we are concerned with. Let's insist until they are found, because they certainly exist. There will be a rich harvest of valid scientific ideas. Then there is nothing left to do but to gradually filter out the similarities until we catch their unifying thread, which is most often a common cause or law.

In each subject, in each chapter, in each problem, after consulting several authors, they must be placed in parallel in a comparative synoptic table.

Dictionaries will be used frequently; each word will be searched for all its synonyms. That word should be followed in translation into a foreign language; also to be followed in retranslation. Thus, new synonyms and new meanings will be found, which are just as many new ideas, especially for the particular field of research. Each new word evokes a lot of collateral ideas.

6. THE NEED FOR CLASSIFICATION, COMPARISON, ANALYSIS AND SYNTHESIS

Everything that is done will be done in series; it will be learned, thought about, classified, compared, criticized, defined, divided, synthesized or analyzed in series. All chapters and notions will be divided on the same day; only divisions will be made during this time. Another day each notion will be defined; nothing but definitions. Another day, again, only laws will be studied.

The readings will be done in series; on the same day, all the authors will be consulted on a certain problem (limited and circumscribed) in the subject that

concerns us. It will then be repeated, the same for each of the other issues or chapters. The idea must be "hatched."

It must never be abandoned; it must always be kept at the forefront of thinking. It must always be carried with us; she must accompany us everywhere, on a journey as at home, in society or in solitude; night and day, in a dream or in a dream. As long as the research lasts, let's be obsessed with this fixed idea. Let us always remain absorbed and meditative. Let's always enjoy this idea and be passionate about it.

The affective states will be harmonized with the intellectual processes and vice versa. It will cause, on the one hand, the feeling appropriate to the process we want to carry out. On the other hand, the presence of various feelings will be exploited by working in accordance with the case; will take advantage of moments of exaltation and optimism to criticize others and create hypotheses; moments of pessimism and depression (bitterness, disappointment and hesitation) will be used to self-criticize, to check, to control oneself.

Let's look for the ambiance, the closeness, the contact, the knowledge, the friendship of the great creators. Let's try to imitate them, to understand them, to contaminate ourselves with their virtuosity, sensitivity and intelligence.

Theme catalogs will be organized, with divisions and subdivisions. Prior to any particular training, the general plan will be reviewed. The general plan will be frequently agreed with the new stage of knowledge. It will often be resynthesized; the works will be reclassified in the sense of the new views. The general plan of each cited work will be studied; the general plans will be collected and compared. After that it will be necessary to decide the best one. Classifications will be collected; it will seek to unify them. The points of view will be collected and will be systematized according to their practical importance. The methods will be classified; not to advance at random. A work plan must be drawn up together with the work plan. The time must be well set, ie classified.

7. THE NEED FOR LIVING LOGIC

Formal logic – the classic logic of yesterday and today – is compared to real, true logic, in the same relationship in which a stuffed bird is to a living and true one. Indeed, apart from the feathers and the external appearance, beyond that it lacks almost everything, it lacks the entrails, it lacks feeling and movement, it lacks life.

Adherents of formal logic claim that they are engaged in the study of truths. But how will you be able to know the truth if you ignore the thinking that produces it? Who would dare to claim that he has studied flour thoroughly, if he does not also know the mill that grinds the wheat from which it comes?

The truth interests us not only as a product, but also as a production and even more as a production than as a product. Since truth is the product of thought, we are interested in thinking at least as much as its product, even more so. A study of truth that ignores truth-producing thinking would be nonsense. The

methods of obtaining the truth are more important than the methods of trying and recognizing it.

To answer the question, "how is truth born and how can we obtain it," is more important than answering the question, "what is and how is truth." A pattern is worth more than a print, because by owning a pattern we can have with its help, hundreds and thousands of prints. Likewise, the knowledge of thought is worth more than the knowledge of the truth, because by mastering the secrets of thought you can produce many and precious truths. The production of truths interests us more than the truths produced. Just as the creation of literary works is more valuable than their evaluation by literary critics. Consequently, static, inert logic must give way to another dynamic and genetic one. The logic of the product must be complemented by a logic of production, the science of truth must be included and subordinated to the science of thought.

If the old logic put the main emphasis on ideas or thoughts, the logic of the future will consider it first and foremost the ideation or thinking. Instead of ideas that stand, ideas that move. Instead of pressed and dried ideas, fixed with a bold in the logical insectarium, the logic of the future puts living ideas, in full motion and in full logical evolution. We will not be satisfied only with the cataloging of the different figures resulting from the association of ideas, but we will seek to decipher the determining cause of the association and the intimate mechanism by which those logical figures are formed. We will not limit ourselves to fixed and immobilized ideas in fixed patterns and forms, but we will follow especially the mobile ideas, the mobility of ideas and the laws of this mobility. Having exhausted the study of forms, we shall now turn to the study of the formation of forms.

In the old logic, the principles had only the mission to be inscribed on its frontispiece. They were talked about once and for all, at first, in an introductory chapter. Furthermore, nothing reminded them. Today we ask logical principles not to stand, but to activate, work and process, to energize, to collaborate, to lead, to initiate, to attract and repel, to pull and push, to implode and to inhibit., to organize the whole logic, to penetrate everywhere and do everything. The principles make the concept, they build the judgment and the syllogism and also through their action the classification and the division take place like all the other logical processes. Principles are the natural laws present at the origin of all logical facts.

The logic until today was bookish: it studied the preserved thought, the thought put on paper in the form of sentences and phrases. In its place, a real logic is required today, to study fresh thinking, unmummified thinking and not yet buried in the sarcophagus of papers.

The logic of today was a verbal, indirect logic. She studied ideas and thinking through the words she expressed, the ideas translated into words. Instead, we propose an ideational, direct, non-verbalist logic, studying thinking directly on thinking and ideas directly on ideas.

The logic of today was a posthumous logic: it studies thinking more or less later after it has been thought. She proceeded to examine the thought — that is, something alive — waiting for it to die first and then for an autopsy. Dissecting the

corpses of ideas, she claimed to know everything about ideas. Dissecting the earthly remnants of thought, she claimed to know all its secrets, which was exaggerated, because the most interesting secret – life – escaped these post-mortem investigations. Instead of this kind of logic, we envisage a live logic, which would study thinking in full swing and ideas and truths in the nascent state in the process of being constituted.

The old logic floated in the air like a stray balloon, unbound by no one and nothing, isolated in time and space, detached from the chain of causality and disparate from the rest of science. Instead of such a logic – monstrous and absurd flying tree without roots.

REFERENCES:

Odobleja Jr., Ștefan. *The destiny of a visionary: dr. Ștefan Odobleja*. Bucharest: Publicitaria Publishing House, 2017.

THE PHENOMENON OF CYBERNETICS AND THE DECIPHERING OF ITS APPEARANCE. CYBERNETICS WAS BORN IN ROMANIA (1938) – CONSONANTAL PSYCHOLOGY, THE FIRST CYBERNETICS IN THE UNIVERSAL SCIENTIFIC LITERATURE[1]

ȘTEFAN ODOBLEJA

Abstract. The author's analysis after 40 years (1938–1978). The history of Cybernetics needs to be revised. Between Massachusetts Institute of Technology (MIT) and Mehedinți-Romania (Origins of Cybernetics). It is generally accepted that Cybernetics was born in Massachusetts–USA and appeared in 1948, when the homonym book by Norbert Wiener was published. I consider that, in reality, it was not born in Massachusetts, but in Mehedinti and appeared in 1938, when the book "Consonantal Psychology", 2 vols887 pages, was published by Librairie Maloine Publishing House, Paris – the work of a Romanian physician from the Mehedinți County. There are still too many paradoxical and inaccurate opinions about the origin and genesis of Cybernetics. We must be aware that these are not without negative consequences. This science was not born in unusual, extravagant and spectacular ways and means, but in normal and usual ways. It is not the result of alleged discussions or quarrels between scientists, but rather the product of sustained study, of complete self-analysis, of thorough documentation and, above all, of deep thinking about thinking.

Motto:

"*Meetings led by Dr. W. Rosenblueth – a neurophysiologist, attended by engineers and mathematicians, physiologists and neurophysiologists, psychologists, communication and computing engineers, were held at Harvard in the United States from 1938–1946. Participants discussed aspects that were provided to the manufacturers of electronic computing machines, information, data, landmarks, models, principles and indications for the making of computing and thinking machines*." Dr. Ștefan Odobleja, 1978 Conference

"*As for Cybernetics, Dr. Rosenblueth has undeniable ownership over the mathematician Wiener, and Harvard Medical School has priority over the Massachusetts Institute of Technology. The initiative belonged to the doctors, not to the engineers and even less so to the mathematicians, even tough later the engineers and their assistants, the mathematicians took an important advance over the doctors, overcoming them and overshadowing them. In fact, Cybernetics had been expounded in 884 pages in "Consonantal Psychology" by Dr. Stefan Odobleja, published in Paris, 1938–1939.*" Dr. Ștefan Odobleja, 1978 Conference

"*The History of Cybernetics Must Be Revised!*" Dr. Ștefan Odobleja (1902–1978), creator of generalized cybernetics, post-mortem member of the Romanian Academy" Dr. Ștefan Odobleja, 1978.

[1] This article is edited by Marin Vlada, PhD Assoc. prof., University of Bucharest, full member of CRIFST – Romanian Academy. It is based on Odobleja, Ștefan. "Psihologia consonantistă" [Consonantal Psychology], 1978, Conference delivered in 1978 at the Teacher Training Centre from Drobeta-Turnu Severin, first broadcast on 20 December 1980, by Iulius Ţundrea as part of the radio series entitled "Fonoteca de Aur – Oameni de știință" [Golden Sound Library – Scientists], in the Sound Archive of the The *Romanian Radio Broadcasting Compan*y. Excerpts from the Conference were published on the website of the "Ștefan Odobleja" Foundation, https://odobleja.ro/category/evenimente/arhiva/

INTRODUCTION: CONSONANTAL PSYCHOLOGY VS. CYBERNETICS

Today, the concepts studied by Cybernetics – Systems Science, include, but are not limited to: knowledge, thinking, learning, storage and memorization, inputs and outputs, adaptation, command and control, social control, operations and processing, regulation and processing, convergence, communication, optimization and efficiency, effectiveness and connectivity, etc. These concepts (objects of study in other disciplines, such as computers and automation, medicine, biology, engineering etc.) are extracted from the context and processes of the human body or specific organs. Between 1925 and 1938, Dr. Ștefan Odobleja – Romanian military doctor, began to study and research the processes in the human body that are coordinated by the human brain, based on psychology and living / real logics, eventually creating a new science, starting from the concepts of consonance and resonance: Cybernetics, which he coined Consonantal Psychology. Therefore, if Dr. Ștefan Odobleja had not elaborated the 2 volumes of *Consonantal Psychology* (Paris, 1938–1939) and if the American mathematician Norbert Wiener had not elaborated the book *Cybernetics: Or Control and Communication in the Animal and the Machine* (Paris, 1948), coining the name of Cybernetics, there would be no electronic computers (computer systems), the thinking machines (expert-intelligent systems) envisaged by Odobleja, nor Informatics or Artificial Intelligence.

"*Ștefan Odobleja – post-mortem member, November 13, 1990. Through the work entitled Consonantist Psychology, published in 1938, he made public the first version of the generalized cybernetic conception and demonstrated its multi and interdisciplinary character*" Romanian Academy – Division of Information Science and Technology[2].

Today, we have a duty to Ștefan Odobleja, to highlight the truth about science and the evolution of science (CYBERNETICS is a multi-interdisciplinary science – see transdisciplinarity, Jean Piaget, 1970; Basarab Nicolescu, 1996). In our opinion, we say that the mathematicians of yesterday or today (except for some – who attended other courses, eg neuroscience) have no way to understand Odobleja. Conceptually, Odobleja studied which processes and phenomena, and for this he used as tools consonance and resonance, but to model and find practical implementation solutions, it takes the work and results of mathematicians, computer scientists, physicists, chemists, etc., these are two successive stages. Therefore, Odobleja was not disadvantaged because he did not know higher mathematics (for mathematics and for all sciences, he described many objects, structures, mathematical operations in a separate chapter, in terms of consonance and resonance, – it is a pleasure how this description is conducted!). He did not need mathematics, because he was in another phase of reasoning on understanding processes. Mathematicians could not invent feedback as Odobleja did, because they did not participate in describing and understanding the processes.

Psychology was the starting point for the emergence of Cybernetics. Psychology offers the widest, most varied and most complete study material for a

[2] Academia Română/Romanian Academy, https://acad.ro/.../sectia14_informatica/sti/info_sectie.htm.

science of leadership – for cybernetics. The cybernetics tree has its deep roots in Psychology and Logics. All the fundamental ideas of cybernetics – including feedback and binary – come from Psychology. Among other evidence is the fact that, for its important chapters, Cybernetics has preserved the concepts and terminology of Psychology. Leadership, initially studied in humans under the name of Psychology, was extended and later researched in animals, giving birth to Animal Psychology. Cybernetics comes to extend it even further – first to machines and then to other sectors of knowledge and practice (Odobleja, 1978).

We give as examples two exceptional world achievements which specialists from almost all sciences have worked on:

- 15 years of research to complete the DNA sequencing (1995–2004), the Human Genome Project – https://www.genome.gov/human-genome-project. At least 3 Romanians worked on this project, one being Sorin Istrail – doctoral student of Solomon Marcus – https://www.brown.edu/Research/Istrail_Lab/sorin.php
- Also, since 2013, the Human Brain Project, https://www.human brainproject.eu/en/

Recently, in 2020, an article[3] was published by Badea, Mocanu, Pasarescu, 1"Applications of Non-Standard Analysis in Topoi to Mathematical Neuroscience and Artificial Intelligence: Infons, Energons, Receptons (I)", which includes reference to Odobleja's works, among others.

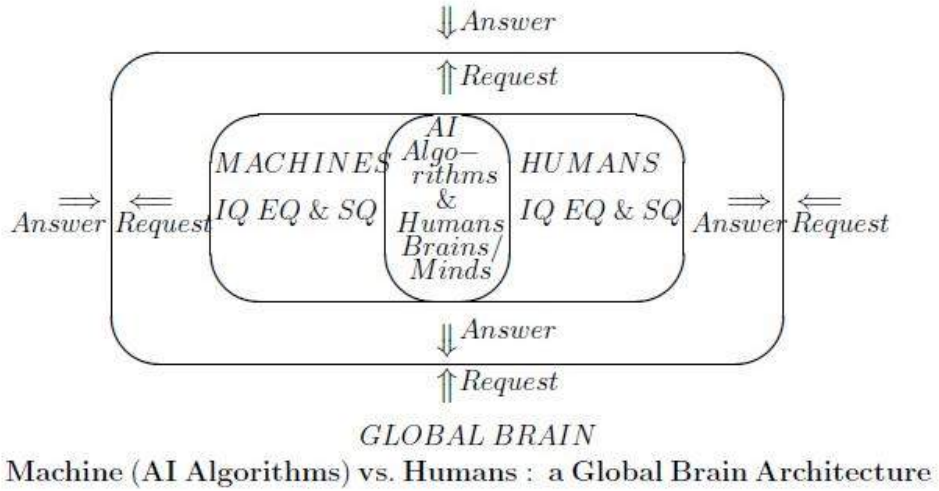

Figure 1. Global Brain Architecture (Badea, Mocanu, Pasarescu 2020)

"The Architecture of Global Brain generated by Machine (Artificial Intelligence Algorithms) – Human Beings interactions are inspired by Norbert Wiener's Cybernetic Communication principles"[4] *([45]), and have a possible graphical representation as below (M-Hemisphere, H-Hemisphere, corpus AIH,*

[3] https://www.preprints.org/manuscript/202001.0102/v2

[4] N. Wiener, Cybernetics: On Control and Communication in the Animal and the Machine, Paris,(Hermann and Cie) and Camb.Mass. (MIT Press), 1948.

analogous to the left hemisphere, right hemisphere and corpus callosum of the human brain). Based on Stefan Odoblejas vision[5] *([27]) on analogy and models of mental psychology, a Global Brain should attain at least the psychological functions of the human brain. Therefore: Request-Answer is a Cybernetic model to create Bio-Technological Feedback between Global Brain entities at the Knowledge Frontier. In the figure above the membrane of the Global Brain is in fact an invisible Knowledge Frontier towards Global Consciousness, continuously in activity inside the System and above it*." (Badea, Mocanu, Pasarescu 2020).

The following text[6] is authored by scientist Dr. Ștefan Odobleja, who fought a continuous struggle – after 1966, until September 1978 – when he deceased, for the international recognition of the fact that Cybernetics was born in Romania, between 1925–1939. The text contains references indicated by Odobleja in the form (p., no.), where "no" represents the number of pages from the original 884 page volumes printed in French in 1938–1939. These studies and research were carried out within the ROINFO project "Romanian Informatics" – Romanian Committee of History and Philosophy of Science and Technology, Romanian Academy, with the support of the "Ștefan Odobleja" Foundation, Drobeta-Turnu Severin.

CONSONANTAL PSYCHOLOGY, THE FIRST CYBERNETICS IN THE UNIVERSAL SCIENTIFIC LITERATURE

Consonantal Psychology is, through its conceptual content, the first cybernetics in the universal scientific literature. It is generally accepted that Cybernetics was born in Massachusetts in 1948 when the homonym book by Norbert Wiener was published. I consider that, in reality, it was not born in Massachusetts, but in Mehedinți, in 1938, when the book "*Consonantal Psychology*", 2 vols., 884 pages, was published by Librairie Maloine Publishing House, Paris – the work of a Romanian doctor from the Mehedinți County (Romania).

The history of Cybernetics needs to be revised. There are still too many paradoxical and inaccurate opinions about the origin and genesis of Cybernetics. We must be aware that these are not without negative consequences. This science was not born in unusual, extravagant and spectacular ways and means, but in normal and usual ways. It is not the result of alleged discussions or quarrels between scientists, but rather the product of sustained study, of complete self-analysis, of thorough documentation and, above all of deep thinking about thinking. Once it is well established that Consonantist Psychology is undoubtedly a cybernetics, it necessarily follows that this is, through its conceptual content, the

[5] S. Odobleja. *Introducere în logica rezonanței* [Introduction to the Logic of Resonance], București: Editura Scrisul Românesc, 1984 (in Romanian).

[6] Liceul "Ștefan Odobleja"/ "Ștefan Odobleja" High School from Drobeta-Turnu Severin, *Centenar Ștefan Odobleja, O viață – un destin* [Ștefan Odobleja Centenary, A life – a destiny], Craiova: Editura Radical, 2002, cf also the website of the "Ștefan Odobleja" Foundation, https://odobleja.ro/.

first cybernetics in the universal scientific literature. Let us not forget that what justifies the existence of Cybernetics as a science in its own right are precisely the ideas that constitute its essence and not the flatus vocis term coined 10 years later for it.

According to the author, Cybernetics was born between 1925 and 1933, in Romania, as a result of an attempt to reform, on physical and mechanistic bases, followed by a vast extrapolation, combined with a great generalization, as well as a practical and theoretical application. The emergence of Cybernetics is due to the assimilation of Physics and technology by Psychology, followed by a reverse operation, the assimilation of Psychology by technology, by Physics and by Mathematics. Cybernetics preserves, even today, the rather distinctive mark of its logical-psychological origin. The change of optics proposed by the author was received by some with resistance (reserve) which is explainable. In order to defend the old positions, our opponents take advantage especially of the multitude of definitions of Cybernetics, which determined the author to undertake a more in-depth study that just appeared in Romanian at the "Scrisul Românesc" Publishing House, Craiova, Romania, entitled *Consonantal psychology and cybernetics* [in original: *Psihologia consonantistă și cibernetica*]. Whatever one may say, the truth is that the foundations of Cybernetics were laid in 1938 by a Romanian physician. And no matter how many evasions are undertaken, in the end, it will have to be acknowledged that Cybernetics was born in 1938, in Romania, not in 1948, in America.

In 1938 – and many years before this date – the Romanian author worked on Cybernetics without knowing it, just as Mr. Jourdain, from "The Gentleman Bourgeois", had written prose all his life without knowing it. Those too attached to words could challenge Consonantist Psychology's right to be called and considered a cybernetics, on the grounds that it did not then give itself that name. They forget that Norbert Wiener himself worked on cybernetics for almost 10 years without knowing it, given that this word was coined by him only when he was writing his book for print. The Americans – Wiener in particular – have the priority of having noticed – before the Europeans busy with massacring one another – the value of this new science, which was not new until 1938, not in 1948, not in 1942, as the American mathematician Norbert Wiener stated, emphatically and with unfair bias towards oneself.

The Americans have the merit of having understood and of having observed the indisputable reality that was hidden beyond the screen of utopian and fantastic appearances. They were captivated by the theses of that Romanian psychology and. at the same time, contaminated by the optimism that radiated from it. These brave and inventive Americans have the merit of having immediately proceeded to the application in practice of the project of technicalization of thinking, one of the main preoccupations of Consonantal Psychology. Mathematician Norbert Wiener became the main disciple and propagandist of this new kind of psychology that broke the established barriers, spreading, beyond the borders of psychology, in the fields of all sciences, including that of technology. We also owe him the name

"Cybernetics". Thanks to him, the ideas of Consonantal Psychology became universally known and unanimously accepted. The seed sown in 1938 bore rich fruit. Not only through the advent of computers (computing and thinking machines) and the invention of many other types of machines imitated by Psychology and Physiology. Not only in applied technique, but also in theory: information theory, communication theory, storage theory (memorization), command theory, decision theory, prediction theory, adjustment and self-regulation theory, automata theory, automation theory, goal (achievement) theory, optimization theory, efficiency theory, recognition and discrimination theory, detection theory, coding and decoding theory, composition theory, algorithm theory, programming theory and other theories springing from Psychology and whose roots are deeply embedded in Psychology in general and in Physiological Psychology in particular.

New sciences have emerged, such as psycho-cybernetics, neuro-cybernetics, cybernetic physiology, psychosomatics, resonance psychology. A "cybernetic" variant has appeared in almost all scientific disciplines. Multidisciplinary sciences and interdisciplinary sciences have emerged. Methods of interdisciplinary collaboration have emerged, the analogy and the modelling method. And, in spite of the assertions — otherwise sporadic and isolated — that Consonantal Psychology is now obsolete, we have a firm and well-grounded belief that a few more sciences of epoch-making importance will spring from this miraculous seed. We refrain from naming them, because we do not want to diminish the emotion and joy of surprise when they appear "soon".

WHERE WAS CYBERNETICS BORN?

1. At the National Institute of Cardiology in Mexico?

It is true that Norbert Wiener's work, "Cybernetics," was written in Mexico by his friend, advisor, and collaborator, neurophysiologist Dr. Arturo Rosenblueth (2.33). În the same place and at the same time, in the last half of 1947, the name "Cybernetics" appeared (2.19). And the collaboration between the two and a good part of their research in this field, between 1943 and 1948, after Dr. Rosenblueth left the USA, took place in Mexico, as well (2.33). We could also add that Mexico was the city of origin of Freymann, the publisher from Paris who proposed to Wiener to write his book (2.33) and who edited it as a topical edition, in French, in 1948. However, one must not mistake the book "Cybernetics" or the name "Cybernetics" for the "Science of Cybernetics", which appeared before that the respective book and name appeared, a fact that was also pointed out by Norbert Wiener (2.19). Nor does he claim that this science originated in Mexico, nor that it arose from research conducted there.

2. At the Princeton Meeting from 1944?

Norbert Wiener considers that Cybernetics was born at Princeton at the end of the winter of 1943–1944. on the occasion of a meeting initiated there by himself and mathematician Dr. Joseph Neumann (2.22): "I consider this conference as the birthplace of a new science: Cybernetics or the theory of communication and

control in the machine and in the living organism"[7] (4.25 The meeting had been initiated – we are told, after Wiener had come to look at the nervous system as a calculating machine (4,254) Is this a novelty indeed? Hadn't the nervous system – the brain – been looked at as a machine at physicians' meetings between 1938–1944? Hadn't Dr. Rosenblueth had this idea since 1938, before Wiener? Hadn't it been recorded in writing in the joint article dated 1943, authored by not only Wiener, but also Rosenblueth and Bigelow?[8]

Attendance at the meeting was mixed, as was the case with previous meetings (in 1938–1943) of Harvard physicians led by Dr. Rosenblueth: "engineers, psychologists, philosophers, acousticians, doctors, mathematicians, neurophysiologists, philosophers, and other interested people"[9]. Neurophysiologist Rosenblueth was absent, but two of America's most illustrious neurophysiologists were present at the meeting: Dr. Mc. Culloch and Dr. Lorente. The stated goal was for specialists from different disciplines to arrive at unitary conceptions and a common language (2.23: 4.2.54) but the main goal, real and immediate, was to build such computing machines that could mimic the functioning of the brain (of mind and thinking) and to be genuine thinking machines. We must say that the decision to make this kind of machine – the future electronic computing machines, was not taken then, at Princeton: this initiative had been taken long before 1943. As such, at that time, people were already working on ENIAC and EDVAC machines at the University of Pennsylvania[10] (2.22).

At the Princeton meeting: "The physiologists gave a joint presentation of cybernetic problems from their point of view, similarly, the computer-machine designers presented their methods and objectives"[11] (2:23). But beyond the appearance of equality and reciprocity, the truth is that at that meeting, as at the previous Rosenblueth meetings at Vandebilt-Hall (2.5), and moreover, as at the previous meetings in 1946 in New York (2.30), doctors, neurophysiologists and psychologists provided computer-machine builders with information, data, benchmarks, models, principles, and guidelines for making advanced computing and thinking machines. By claiming that Cybernetics was born in March 1944 at Princeton, Norbert Wiener diminished the role of the engineers (Aiken, Bush, Coldstine etc.) who had already been working to obtain Artificial Intelligence (2,22) characteristic of and defining for Cybernetics, especially in its early stages. He overlooks the crucial role of Harvard physicians' meetings presided by neurophysiologist Dr. Rosenblueth.

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[7] Wiener, Norbert, *I Am A Mathematician: The Later Life of a Prodigy*, The MIT Press, Cambridge, Massachusetts, 1956, p. 269.

[8] Rosenblueth, Arturo, Wiener, Robert, Bigelow, Julian, "Behaviour, Purpose and Teleology", *Philosophy of Science*, 10 (1), 1943, pp. 18–24, https://courses.media.mit.edu/2004spring/mas966/rosenblueth_1943.pdf.

[9] Jerison, David, Singer, I.M., Strook, Daniel W. (eds.), *The Legacy of Norbert Wiener: A Centennial Symposium*, Cambridge, Massachusetts, 1994, p. 19.

[10] ENIAC – the Electronic Numerical Integrator and Computer, EDVAC – the Electronic Discrete Variable Automatic Computer.

[11] Wiener, Norbert. *Cybernetics: Or Control and Communication in the Animal and the Machine*, Paris, (Hermann and Cie) and Camb. Mass. (MIT Press), 1948. p. 23.

That the Princeton meeting was initiated by mathematicians is explicable, hence the augmentation of their contribution, to the detriment of that of other more fundamental categories for Cybernetics. It is also explicable that the mission of psychologists was revised and removed at the meetings from 1946, when the initiative no longer belonged to mathematician Wiener, but to some neurophysiologists (2.25–26). The attempt to remove his former advisor and somewhat guide Cybernetics is also explicable: the meeting at Princeton took place immediately after Dr. Rosenblueth left the United States and after the cessation of the monthly meetings he presided over. The meeting at Princeton was to continue and replace these meetings at Harvard, and Norbert Wiener was taking the lead, replacing Dr. Rosenbluteth in his role as head of cybernetic work. As justification, Norbert Wiener invokes the reason that memory (living and non-living), binary and feedback were recognized at Princeton. However, memory and binary are also included in the recommendations to engineers in 1941, and by 1944 they had already been incorporated into electronic computing machines that were at an advanced stage, close to being put into practice. As for feedback, leaving aside the fact that it had been made public since 1938, we mention that Wiener (with Bigelow) had been acquainted with it since 1942, and in 1943 he had described it in the well-known article jointly signed by the three authors (Rosenblueth, Wiener & Bigelow). Making feedback debut at Princeton was tantamount to owning it as personal property, thus removing not only the 1938 initiator of this process (note: Stefan Odobleja), but also his two friends, members of his joint work triumvirate as has been the case with other triumvirates in human history).

He removes Dr. Rosenblueth, who indeed had not participated in Wiener's "discovery" of feedback, but had collaborated as the author of the 1943 article on feedback (2.14); he had also presented by himslef those common ideas a year before the joint article (2.19); he had contributed to the verification and confirmation of the concept (2.14); and had given his endorsement as a neurophysiologist to the "Discovery" that Wiener had made in psychology – neurophysiology — without him, only with Bigelow — but, in his domain of specialization, which Rosenblueth could speak about without Wiener (2.19); however, Wiener could not have spoken at all or with great difficulty about these issues without Rosenbleuth, without the coverage and endorsement of the neurophysiologist. What is more, we believe that it is more than likely that Dr. Rosenblueth, as a neurophysiologist and psychologist, knew the source and true origin of Wienian feedback, a source which, in our opinion, also inspired him when he became a methodologist, a logician and unifier of sciences , a mechanistic and mechanizing psychologist, etc., and even though he may not have noticed that value of feedback, even though Wiener has the merit of having noticed it before his master, it is no less true that Dr. Rosenblueth is the one who co-opted him to jointly and equally exploit this mine. The fact that Wiener discovered a vein as he could only read a book well was a merit of his, but a merit that could not justify forgetting and removing his partner in and predecessor to this deed and discovery. However, Wiener's gesture was rather reckless when he made a disputed acquisition.

Wiener removed not only Dr. Rosenblueth from Cybernetics, but also Julian Bigelow, the young man who had at least equal merit to his own. In fact, we believe that his merits are incomparably greater as he noticedthe existence of feedback in 1942. Note that Dr. Rosenblueth had been working on Cybernetics since 1938, without about it; note that mathematician Wiener had also worked on Cybernetics, although disguised and still uncioned as such. So not only Wiener, but Dr. Rosenblueth as well (2.21) and they didn't give up until they monopolized it. Wiener emphasizes, however, the importance of the cyclical process in the discovery of which he considers to have had a meritorious contribution and a personal contribution made independently from Dr. Rosenblueth. He takes the moment of that discovery as the date of the birth of Cybernetics. In 1942 he discovered that process and at the same time he claims that "Cybernetics" was born. Starting approximately from the year 1942, Cybernetics started to develop in several directions (2.14). Therefore, Cybernetics was not born in 1944 at Princeton, but it was born before the fall of 1942 and more precisely in 1942, at the Massachusetts Institute of Technology (MIT), as the result of the research of a mathematician (Wiener) and an engineer, later proved to also be a mathematician (Bigelow). But as Wiener subsequently continued his research on his own or rather with the help of other collaborators, Bigelow's role in the founding of Cybernetics faded more and more. However, here we are interested in the birthplace of Cybernetics, which most people, together with Wiener, consider to have been at the Massachusetts Institute of Technology. Indeed, there Wiener developed a remarkable activity to impose his cybernetic ideas, which, however, did not belong exclusively to him, did not belong to him entirely, he did not issue them and he did not launch them, as he did he says verbatim: "... These ideas were floating in the air at the time and I do not want to claim my exclusive priority in formulating them" (2.4), and two lines below he states that "these ideas of his come from the study of the nervous system, therefore: from neurophysiology and psychology" as shown in his book[12].

3. Does it all start at Harvard Medical School – Harvard University?

It is unjustly admitted today that Cybernetics is the integral and pioneering work of mathematician Norbert Wiener of the Massachusetts Institute of Technology (MIT). This misconception must be rectified: on the one hand, in the sense that, quantitatively, the neurophysiologist Dr. Rosenblueth of Harvard Medical School – Harvard University had a large percentage of contribution to this work (in any case, greater than attributed to him today), on the other hand, in the sense that, chronologically, the neurophysiologist became a cybernetician before the mathematician and that he is in fact Wiener's initiator in this field. It turns out that in Cybernetics, Dr. Rosenblueth has undeniable priority over mathematician Wiener, and Harvard Medical School has priority over the Massachusetts Institute of Technology. The initiative belonged to the doctors, not to the engineers and even less so to the mathematicians, even though later the engineers and their assistants, the mathematicians, took an important advance over the doctors, overcoming them and overshadowing them.

[12] Wiener, Nobert, *Cibernetica sau știința comenzii*, Bucuresti, Editura Științifică, 1966.

"*It all started at Harvard Medical School*" (Mircea Grigorescu, p. 19). Indeed, the monthly meetings presided by Dr. Rosenblueth, a neurophysiologist, psychologist, and methodologist, inaugurated by him around 1943 and continued until his departure for Mexico (January 1944) were meetings on cybernetic issues. Those meetings acquired a cybernetic character only after mathematician Norbert Wiener began to participate in them, relatively late, and after the co-optation and acceptance of computer engineers or of physicist Vallarta, who did not attended them from the beginning, but who had come to these meetings before Wiener, which is very explicable, given the purpose pursued since the beginning: mechanical thinking and the mechanization of thinking. Those meetings had belonged to Cybernetics through their topics, ideas and trends ever since they had been initiated by neurophysiologist Dr. Arturo Rosenblueth, consequently from the very beginning, when the participants were only doctors, evidence of their preoccupations outside the medical field, the generally scientific, methodological and psychological interests of these physicians, (and we are not yet told everything and in fact the essential is eluded, as a result and continuation, by virtue of inertia, of the secret imposed during the war on everything related to the mechanization of thought).

From the very beginning of his book, Norbert Wiener informs us that his work "Cybernetics" "represents the outcome, after more than a decade, of a program of work undertaken jointly with Dr. Arturo Rosenblueth, then of the Harvard Medical School"[13] (2.5). Hence, if Cybernetics is the fruit of that long collaboration between a doctor and a mathematician, it means that it was not born instantly, so to speak, in the few hours, or even days, during the Princeton meeting, rather it was born more painstakingly, after years and years of research and discussion. If research for Cybernetics began in 1938, then how can we say that Cybernetics was born only in 1942? Was Norbert Wiener not mistaken, we wonder, when he implied that Cybernetics was born in 1942, that is: at the Institute where he worked and due to his discovery?

His collaboration with the doctor had accomplished nothing in the four years of endeavor? But he himself tells us that before 1942 (some time in 1941), in collaboration with the neurophysiologist, recommendations were made to engineers (2.9), which aimed at a revolutionary improvement of computing machines with a thinking machine, which was the most cybernetic idea of all the ideas of Cybernetics. And this cybernetic idea, this cybernetic technical goal before being proposed to construction engineers had of course been thought about for a long time. And, probably thought about not only in secret, between the two of them, but also in the debates at the monthly doctors' meetings. Our belief is that this idea sprouted in doctors and was tackled by them, among themselves, before resorting to the opinions and contribution of Norbert Wiener, before deciding to expand the membership of their study circle to turn it into a mixed circle. Only after the doctors had exhausted their resources, only then did

[13] Wiener, Norbert, *Cybernetics: Or Control and Communication in the Animal and the Machine*, Paris, (Hermann and Cie) and Camb. Mass. (MIT Press), 1948, p. 3.

they partially decline their competence, only then were they forced to resort to the help of Massachusetts engineers. In support of this view is the fact that a physiologist was also one of the first mechanizers of logic between 1938 and 1943, Dr. Mc Culloch (2.21), who at that time worked on authentic and efficient Cybernetics and did it independently of Norbert Wiener, independently of Dr. Rosenblueth and with less discursive but more palpable results, which makes us broaden the ranks of the beginners in the field and say that Cybernetics began at Harvard, and not only there, but simultaneously at other Faculties of Medicine from the USA and other countries.

Through the insight and dynamism of Dr. Rosenblueth, the Harvard Medical School was an important reception and amplifier station for Cybernetics. But Cybernetics was not born there and then, in 1938, when the neurophysiologist took over: it had been born for a long time, elsewhere, far from Harvard University and far from America. At Harvard everything was carried on, but it didn't start there in the first place. To give credit to the opinion that it began at Harvard, there should be evidence that it began there long before 1937. However, the existing evidence argues against Harvard's priority in the matter, not to say that it advocates even in favour of Harvard's taking over the matter. Numerous pieces of evidence attest to the fact that in 1938, at Harvard, Cybernetics appeared as a surprise and that in 1942 it was only at its first probing, at its first beginnings, with an obvious lag behind the stage of maturity that had been reached in another academic centre that we will talk about in what follows.

4. At the Faculty of Medicine of the University of Bucharest?

By the time Harvard doctors began discussing Cybernetics at their monthly meetings and banquets, Cybernetics had already appeared as "Consonantal Psychology" and had already been discussed in an 884–page book written in the most international language of the year 1938 and made available for the scientific world by a prestigious publishing house in Paris (Maloine). Thus, we emphasize the fact that, in the summer of 1937, when the book was being published, its author's research had been completed, and *Cybernetics* had been established. It had been emerging in Romania more than ten years before it began to become a topic for discussions among Harvard doctors. Consequently, until proven otherwise, we consider that it all started at the Faculty of Medicine of the University of Bucharest" not at that the Medical School of Harvard University. We refer, of course, to the general Cybernetics theory, which substantiated and preceded the appearance of other specialized branches, including the technical one. We refer to the initial and pioneering Cybernetics, to the Cybernetics of Harvard physicians between 1938 and 1944 – which also became Cybernetics for Harvard engineers, and for physicists, mathematicians and psychologists at the Massachusetts Institute of Technology. We are referring – not to forget – to the beginnings of Cybernetics and the beginnings of the cyber era. It is easy to understand that for the generation that moulded and completed its intellectual structure in support of the Wienerian version, with its legendary ppeal, the proposed change in perspective is uncomfortable and difficult to achieve. They

cling to the argument of "unanimous recognition" to hold on to the old positions without taking into account the fact that the recognition has ceased to be unanimous in favor of their favorite.

It has been insinuated that in Romania there was a lack of modernly equipped laboratories; that such labs were only available at Harvard, Massachusetts, and in America in general, including Mexico; that only Norbert Wiener and Dr. Rosenblueth could benefit from these material endowments, and that only they could produce cybernetic science. The argument seems plausible: it is perfectly valid for the most superb and spectacular technical cybernetics among the daughters of general Cybernetics theory. However, this argument is worthless when it is applied to the initial Cybernetics, to Mother Cybernetics, General Cybernetics, generators of derived and specialized cybernetics. This was a theory about the brain and physics, about thinking and machines, about natural thinking and artificial thinking. It started from psychology, physiology and the physics of thought and, for this, the small portable brain laboratory, which analyzed itself, afterwards applying the conclusions obtained beyond it, was sufficient or, in any case, more useful and indispensable than the big and the luxurious laboratories run by billionaires.

It has been said, and it would have been better if hadn't been said, that the authorship of Cybernetics belongs to Robert Wiener because he experimented with Dr. Rosenblueth. But firstly we must say that those very questionable and insignificant experiments wanted to prove a predetermined conclusion, which they failed to prove. They can be classified as worthless, if not negative, pseudo-experiments. Secondly, those experiments were conducted in Mexico and their purpose was not scientific, but of personal interest, namely: to justify the vacation and study leave. Thirdly, and most importantly, those alleged experiments were performed in the summer of 1945 (2.24–25) and in the summer of 1946 (2.27–28), that is 3 and 4 years after Cybernetics was born (in 1942) at the Massachusetts Institute of Technology-MIT (2.19), 7 and 8 years, respectively, after Cybernetics was born at Harvard Medical School, 7 and 8 years respectively after Cybernetics was extensively described in the 884–page volume entitled "Consonantal Psychology" authored by Dr. Ștefan Odobleja and published in Paris. Those experiments were suggested and determined by Cybernetics 8 years after it was born, but it was not from those experiments that Cybernetics was born. Relying on them to establish Wiener's paternity in Cybernetics is at least colossal naivety.

It has also been insistently pointed out that Cybernetics was born in America and that the paternity belongs to Norbert Wiener, because only he, there, benefited from the existence of a large and select team, only he had at his disposal numerous collaborators and huge resources. It is true that Norbert Wiener took advantage of the role and expertise of his many collaborators (Rosenblueth, Bigelow, Pitts, Lewin, Shannon, etc.). The valuable study community also participated in the monthly meetings at Harvard, as well as in the meetings of 1944 and 1946, with their reports and discussions. Rosenblueth and Wiener exploited and used this important human capital with good and constructive results. They made an

important contribution to the development of Cybernetics, but not to its birth, because meetings and teamwork began only after 1938, that is, after Cybernetics was born and published in print. It is not just a simple coincidence that the history of Romanian cybernetics came to an end and put an end to research by publishing its research results in a book, between 1938 and 1939.

In fact, without denying the efficiency of research work in teams, we want to warn against its overestimation. Thus, the great physiologist Rosenblueth and the great child prodigy Norbert Wiener collaborated for 4 years and for 4 years studied the feedback book (bad for them if they did not know about it) without perceiving it, despite the 70 figures that stood before their eyes. They could not even read it, much less discover iy, with all their team, with all their doctors at Harvard, with all their engineers at the Institute of Technology, with all their prolonged discussions, and the secret supper which ended their monthly meeting.

We consider, that in certain special cases, as, for example, in the work of synthesis and elaboration, which involved a great concentration of thought, quietly meditating by oneself is incomparably more fruitful than discussions and disputes in the noise and "stir" of team meetings. Theoretical Cybernetics, being a work of self-analysis and thinking, of synthesis and unification, was predestined to be born in quiet and isolation, as the work of a sole thinker, not as the work of teams in the hustle and bustle of a restaurant. We mention here that our opponents do not have the courage to attack us directly and head-on; they attack us indirectly, insidiously and from behind, publishing an avalanche of articles praising Norbert Wiener, in all magazines (which are welcoming and unhesitationantly at their disposal), taking care to praise him for what I did not have (scholarships, laboratories, libraries, teams, etc.). Overturning the argument of our opponents, we will say that, if – with all the laboratories, information, teams and their material resources, despite having on their desk an authentic and complete Cybernetics, despite having 10 more years (1938–1948) – they could only produce that failure of theoretical Cybernetics of 1948, then Norbert Wiener's cohorts of scientists fit the saying "*parturiunt montes, nascetur ridiculus mus*" only too well.

The tactics of our opponents is to unreservedly praise Norbert Wiener, with the adoration suitable for a demigod, while keeping complete silence on our contribution, and passing an encomium on him in a purely churchly style, avoiding predictions, cultivating vague and hermetic statements, just like their master, our camouflaged opponents skillfully resort to probabilism: only Wiener had (the means to do), only Wiener was (able to do), only Wiener could (do), with the implication that I could not do Cybernetics. All the better if I couldn't do it, but I still did it.

I have tried in the above to refute by logical arguments some of my opponents' insinuations, sophisms and probabilistic arguments. But, ultimately, the strongest argument is my book, factual evidence, more convincing than any other argument for those of good faith. As for the others… I wish them only well!

CONCLUSIONS

Cybernetics deals not only with the control of the being, but also with the control of the mind – with the "control of control"[14]. The mind is a specialized function in controlling the being. A function of the brain that controls not only the body of the being, but also controls itself; perfecting its activity, increasing its efficiency, researching itself, analyzing its functioning mechanisms, choosing and developing the most efficient methods of research, processing and making the most of past experience. The control of the mind, the control of thinking, the control of research, the control of knowledge, the control of science – all these are part of control in general and therefore of Cybernetics. In its capacity as the science of the control of the mind, Cybernetics acquires and incorporates the entire methodology. In a narrower sense, Cybernetics contains from the methodology only the part with which it has particularly contributed to – the part it has brought innovations and its own apparatus to, such as the following issues: the affinity between sciences, the multidisciplinary approach, the collaboration between and combination of sciences, the borrowings between them, the mutual influences, the extensions and generalizations, the analogies and modelling, the univocal and reciprocal proliferations, the mergers, the syntheses, the unifications, the interdisciplinary sciences.

- Cybernetics is not only the study of rudimentary control such as automatons or reflexes, rather, it is the study of specialized control – intelligent control. Unilaterally and exaggeratedly insisting on Regulatory Cybernetics, we are tempted to forget that Cybernetics is also a study of intelligence. On the other hand, Cybernetics is not only a study of artificial intelligence, but it is also a study of natural intelligence. Artificial intelligent control is closely linked to natural intelligent control, both genetically and structurally – as concerns their origin as well as their essence.
- It is important to point out that Cybernetics was not born from the study of lower rudimentary control, but it was born from the study of higher control – natural intelligence – in the pursuit of artificial intelligence. It was born at the level of intelligence, not at the level of feedback or regulation. It appeared at the highest level. It was not built on a bottom-up aproach, but on a top-down approach. As paradoxical as it may seem, the truth is that, despite the fact that automatic regulation had appeared earlier in science, both in technology and in biology, nonetheless feedback came after the projects on organizing thinking; Regulatory Cybernetics came after Intelligence Cybernetics. Neither Watt's regulator, nor homeostasis, nor the gyroscope, nor the psychology of behavior and reflexes could give rise to a generalized theory of control, to a cybernetics. They tried to claim it later, belatedly, post-factum.

[14] See Von Foerster, Heinz. *Cybernetics of cybernetics: or, the control of control and the communication of communication*. 1974, Urbana-Champaign, IL: Biological Computer Laboratory.

- Cybernetics is not only a normative, applied science, but it is also a theoretical, fundamental, descriptive and explanatory science of control. The two distinct application sectors especially developed by Cybernetics so far are:
  a) the *methodology – thinking technique* – to stimulate, develop, accelerate, improve knowledge, research and thinking, tokens of natural control,
  b) the *control technology – artificial thinking technique* – to synthetically and artificiallly create new controls, anticipating and building self–controlling aggregates / machines, substitutes for natural control.
- The applicative character of Cybernetics prevails in what concerns its utilitarian importance and in any case it overshadows its complementary and obligatory character as a theoretical, fundamental science. There were many who sought to free themselves from the inherent "theoretical ballast". In reality, Cybernetics is a unitary construction that cannot be deprived of its theoretical foundations.

Therefore, Cybernetics is the theoretical and applied science of simple and complex controls, in animals and humans, in beings and machines, in individuals and society, in the body and mind – with all the theoretical and practical conclusions that follow from this.

1 August 1978, Ștefan Odobleja, Romania, Drobeta-Turnu Severin

REFERENCES:

Academia Română/ Romanian Academy, "Secția de Știința și Tehnologia Informației" [Division of Information Science and Technology], https://acad.ro/.../sectia14_informatica/sti/info_sectie.htm.

Badea, I.R. Mocanu, C. Pasarescu, O. "Applications of Non-Standard Analysis in Topoi to Mathematical Neuroscience and Artificial Intelligence: Infons, Energons, Receptons (I)". In *preprints.org*, Preprints 2020, https://www.preprints.org/manuscript/202001.0102/v2.

Fundația "Ștefan Odobleja"/ "Ștefan Odobleja" Foundation from Drobeta-Turnu Severin, "Fenomenul ciberneticii și descifrarea apariției ei (I–III)" [The Phenomenon of Cybernetics and the Deciphering of its Appearance], text processed by Vlada, Marin from The Romanian Committee of History and Philosophy of Science, Romanian Academy, as part of the Project entitled ROINFO "Romanian Informatics", https://odobleja.ro/category/evenimente/arhiva/

Grigorescu, Mircea, "Omul și cibernetica", *România Literară*, September 4, 1975, p. 19

Human Brain Project, https://www.humanbrainproject.eu/en/

Human Genome Project – https://www.genome.gov/human-genome-project

Istrail, Sorin, Brown University, Rhode Island, USA, https://www.brown.edu/Research/Istrail_Lab/sorin.php

Jerison, David, Singer, I.M., Strook, Daniel W. (eds.), *The Legacy of Norbert Wiener: A Centennial Symposium*, Cambridge, Massachusetts, 1994.

Liceul "Ștefan Odobleja"/ "Ștefan Odobleja" High School in Drobeta-Turnu Severin, *Centenar Ștefan Odobleja, O viață – un destin* [Ștefan Odobleja Centenary, A life – a destiny], Craiova: Editura Radical, 2002, Site Ștefan Odobleja, https://odobleja.ro/

Nicolescu, Basarab 1996 *La transdisciplinarité (manifeste)*, Éditions du Rocher, Monaco.

Odobleja, Ștefan. *Cibernetica generalizată. Masa rotundă Lugoj (26–27 iunie 1982)* [Generalized Cybernetics. Round Table Lugoj (26–27 June 1982)], Lugoj: Editura Nagard, 1982 (în Romanian).

Odobleja, Ștefan. "Cybernetics and consonantal psychology*",* In *Proceedings of The Third International Congress of Cybernetics and Systems, Bucharest, Romania, August 25–29, 1975*, Springer Verlag, 1977, Vol. II, p. 1211.

Odobleja, Ștefan. "Diversity and Unity in Cybernetics*",* In *Proceedings of The Fourth International Congress of Cybernetics and Systems, Amsterdam – Netherlands, 21–25 august 1978*, Springer Science & Business Media, 2012.

Odobleja, Ștefan. *Introducere în logica rezonanței* [Introduction to the Logic of Resonance] , București: Editura Scrisul Românesc, 1984 (in Romanian)

Odobleja, Ștefan. *Psihologia consonantistă și cibernetica* [Consonantal Psychology and Cybernetics], Craiova: Scrisul Românesc, 1978 (in Romanian).

Odobleja, Ştefan. "Psihologia consonantistă" [Consonantal Psychology], 1978, Conference delivered in 1978 at the TeacherTraining Centre from Drobeta-Turnu Severin, first broadcast on 20 December 1980, by Iulius Ţundrea as part of the radio series entitled "Fonoteca de Aur – Oameni de ştiinţă" [Golden Sound Library – Scientists], in the Sound Archive of the The *Romanian Radio Broadcasting Compan*y.

Odobleja, Ștefan. *Psychologie consonantiste*, Paris: Librarie Maloine, vol. I, II, 884 pages 1938–1939 (in French)

Piaget, Jean, 1970, *Psychologie et épistémologie*, Gonthiers Denoël, coll. Médiations, Paris

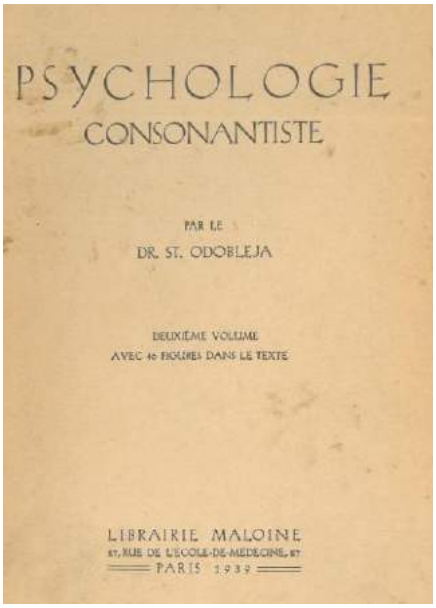
Rosenblueth, Arturo, Wiener, Robert, Bigelow, Julian, "Behaviour, Purpose and Teleology", *Philosophy of Science*, 10 (1), 1943, pp. 18–24, https://courses.media.mit.edu/2004spring/mas966/rosenblueth_1943.pdf.

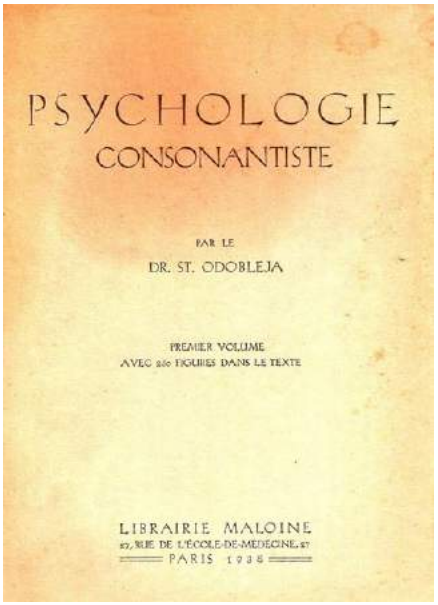
Von Foerster, Heinz, *Cybernetics of cybernetics: or, the control of control and the communication of communication,* 1974, Urbana-Champaign, IL: Biological Computer Laboratory.

Wiener, Norbert. *Cybernetics: Or Control and Communication in the Animal and the Machine*, Paris, (Hermann and Cie) and Camb. Mass. (MIT Press), 1948.

Wiener, Norbert, *I Am A Mathematician: The Later Life of a Prodigy*, The MIT Press, Cambridge, Massachusetts, 1956, p. 269.

ANNEX


PSYCHOLOGIE
CONSONANTISTE
PAR LE
DR. ST. ODOBLEJA
DEUXIÈME VOLUME
AVEC 16 FIGURES DANS LE TEXTE
LIBRAIRIE MALOINE
27, RUE DE L'ÉCOLE-DE-MÉDECINE, 27
PARIS 1939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PAR LE
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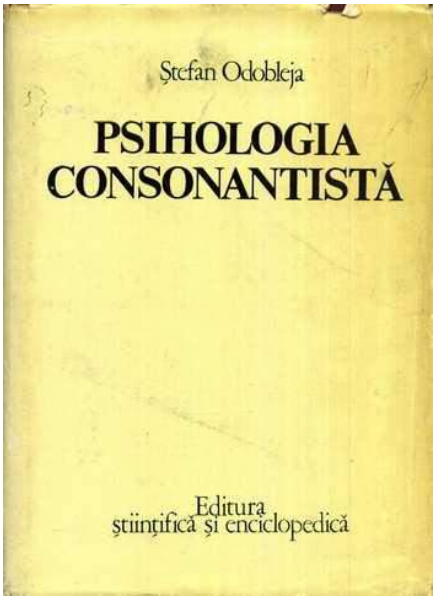
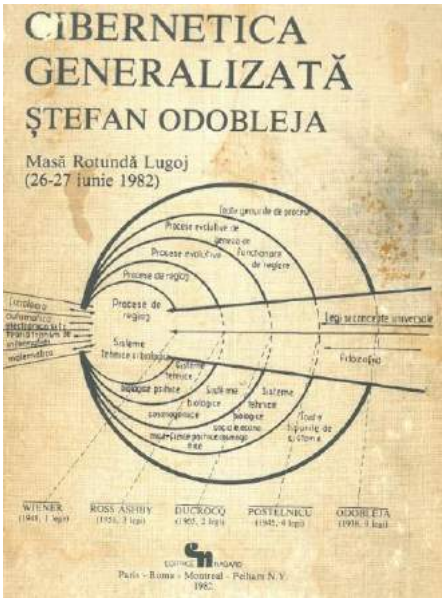

Ștefan Odobleja
PSIHOLOGIA CONSONANTISTĂ
Editura științifică și enciclopedică


CIBERNETICA GENERALIZATĂ
ȘTEFAN ODOBLEJA
Masă Rotundă Lugoj
(26-27 iunie 1982)
WIENER
ROSS ASHBY
DUCROCQ
POSTELNICU
ODOBLEȚA

IN MEMORIAM

MARIN VLADA
12 JUNE 1953 – 21 SEPTEMBER 2021

IN MEMORIAM

Our colleague Marin Vlada passed away on 21th of September 2021 at the age of only 68 years. Too early!

He was Associated Professor to the Faculty of Mathematics and Informatics of Bucharest University, full member of CRIFST/ Division of History of Science, Editorial Secretary of *NOESIS Journal* https://noesis.crifst.ro/editorial-board/, member of the Editorial Board of *Studies and Communications Journal* https://studii.crifst.ro/index.php

He delivered all his energy and soul to promote and to study fruitful applications of informatics in Education (e-Learning) by the CNIV, later ICVL, nineteen editions he organized yearly. Since the last October, the conference was called "Marin Vlada" *International Conference of Virtual Learning*.

He made a tremendous effort to bring into light the *History of Romanian Informatics* (Project ROINFO). He knew how to gather a team of distinguished Romanian computer scientists who participated into the project of writing the *History of Romanian Informatics*. In its five volumes (2018–2021) written up today, Project ROINFO is a valuable comprehensive frame-work of reference in the field, and it will generate new research. The entire work is crossed by Marin Vlada's vivid active untired spirit whose thought goes deep and far away into the future of the Romanian history of sciences to which Informatics is capable to apply to. Moreover, the whole plan he conceived for the *History of Romanian Informatics* has three outstanding qualities: (i) the plan is not a story, but it accords itself naturally with the principles of *History of Sciences* (Aldo Mieli, George Sarton, Petre Sergescu, René Taton); (ii) the plan is not a simple geography of ideas or/and computer scientists or/and schools and achievements, but it gives definitions and criteria to recognize historical facts and events based on documents and on those who lived the events by directly taking part into the creation of the institutions which made possible Romanian Informatics to be as it actually is today; (iii) the plan respects a still much ignored desideratum formulated in 2004 by Solomon Marcus: *the history of Romanian science cannot be written as before: let the truth to speak*[1].

[1] Solomon Marcus' words are <it will be definitely necessary to overcome the facts level and to carry out a critical view rather unusual so far in the way the history of Romanian science has been written>. This follows by Solomon Marcus' conception of history as <a proposal for a more comprehensive way than that in which the condition of a science in a certain country is usually understood, because we have considered the entire scientific, educational, social, historical, cultural and political context in which the Romanian mathematics developed during the 20th century>. Marin Vlada applies word by word this principle in the conception of the *History of Romanian Informatics*.

Since 2017, Marin Vlada fought with a great enthusiastic dedication to rise into contemporary sunshine light a clouded peak moment of Romanian Science: Ştefan Odobleja's work and its signification for Cybernetics and Informatics. Particularly, he collaborated by his computer competence and knowledge to the actual form of the site www.odobleja.ro – a wonderful useful source for Odobleja's works and life, source offered by "Ştefan Odobleja Foundation". We all have to acknowledge both to Ştefan Odobleja Jr. (President of the Foundation) and to Marin Vlada (the historian of Romanian informatics in its deepest roots). Last but not least, since the spring of 2021, Marin Vlada dedicated all his powers to support the project initiated by Ştefan Odobleja Jr. to edit Ştefan Odobleja's unpublished manuscripts on Logic (over one thousand pages).

In all those projects, Marin Vlada knew to challenge both his colleagues and a great number of Romanian computer scientists to participate into his projects and to do valuable research on computer science and on its history, as well as on the history of Romanian science, for the benefit of all. He inspired many of us to work on the ideas he enthusiastically professed. He inspires us by a single phrase

<Tell future generations that Cybernetics was created in Romania (Ştefan Odobleja, 1938–1939), that Romania developed a Romanian informatics (Grigore Moisil, after 1953) and built its own electronic computer (Victor Toma, CIFA-1, 1957)!>

Marin Vlada always is reminding us His cray "Tell future generations" is more actually today than ever. Dear call to us for never get lost and tempted in this huge world so little understood. Marin Vlada gives us the key of Romanian toil. With this vivid call let us open the door to lighten afterwards the history of Romanian informatics and the history of Romanian science in its secret places (like Dr. Ştefan Odobleja) gift to us by God, spring from the Romanian soul given as gift to the world. Marin Vlada left us a heritage to fruitful it and to go on with the research on the issues he opened. ***Let us remember him through his written works and through his words***. The reader and those interested in the themes approached by Marin Vlada or those who are wishing to know Marin Vlada, will find most of his works at the links which follows.

http://c3.cniv.ro/?q=2020/vlada (CNIV: Despre Marin Vlada), http://c3.icvl.eu/ (site ICVL 2010–2030)

https://scholar.google.com/citations?view_op=list_works&hl=fr&hl=fr&user=oyZyaAIAAAAJ&pagesize=80 (80 articles)

https://www.cugetliber.ro/stiri-cultura-educatie-de-elev-nu-te-apropii-interzicand-telefonul-si-obligandu-l-sa-memoreze-abstract-288876 (interview with Marin Vlada, in Romanian)

http://c3.cniv.ro/articole2020/1.pdf (Marin Vlada CNIV XVIII 2020)

https://www.edumanager.ro/prof-dr-marin-vlada-universitatea-din-bucuresti-trebuie-sa-fim-mandri-de-eforturile-si-contributiile-oamenilor-de-stiinta-romani-in-aparitia-si-dezvoltarea-informaticii/ (interview with Marin Vlada, December 2020)

http://www.crifst.ro/biblioteca/autori/marin-vlada (Istoria Informaticii Româneşti, 5 volume) https://www.todaysoftmag.ro/article/3169/proiectul-roinfo-2018-2020-romanian-informatics-si-promovarea-istoriei-informaticii-romanesti?fbclid=IwAR30AS-A1zX2l4QVqOK8h2WQyH1GWixR-aPtpGc7xZ0MgNfePDMWDUVEPk0

http://c3.icvl.eu/papers2017/icvl/documente/pdf/section1/section1_paper2.pdf (ICVL XII 2017, M. Vlada, A. Adăscăliței: Ștefan Odobleja: A Scientific Visionary, precursor of Cybernetics and Artificial Intelligence)

https://www.crifst.ro/biblioteca/volume/o-istorie-ce-trebuie-cunoscut%C4%83-centrul-de-calcul-al-universit%C4%83%C8%9Bii-din-bucure%C8%99ti (M Vlada, I. Văduva: O istorie ce trebuie cunoscută: Centrul de Calcul al Universității din București (CCUB), prima unitate de informatică înființată în România; Matrix ROM Bucureşti, 2021)

https://studii.crifst.ro/2020.php (Studii şi Comunicări, vol. XIII/2020, p 113–135, M Vlada: Viața și opera lui Ștefan Odobleja – inventatorul ciberneticii, precursor al inteligenței artificiale și al informaticii)

https://www.edumanager.ro/manuscrisele-lui-stefan-odobleja-actuale-si-azi-de-la-studiile-medicale-stiinta-razboiului-si-filozofie-la-logica-vie-reala/ (M. Vlada, July 2021, in Romanian)

https://sites.google.com/view/roinfo/home (ROINFO PROJECT 2018–2022, Romanian and English)

https://studii.crifst.ro/doc/2021/2021_07.pdf (D. Şerban: in memoriam Professor Marin Vlada)

Marcus, Solomon: Mathematics in Romania, Cub Press 22 Baia Mare, 2004; p.1

Editor,
Cătălin Ioniță