An Overview of Academician Mihai Drăgănescu's Conceptual Contributions to Information Science

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Science, as well as other domains of the human culture and civilization, benefits in its becoming from two important categories of personalities, which I would generically call "creators" and "catalysts", respectively.

Creators, be they discoverers or innovators, greater or lesser, are those who, by the power of thought, widen or deepen the knowledge, open new ways for investigation, produce or improve technologies; in short, they generate knowledge. Development of knowledge is not discontinuous, it builds on the common scientific creation and, even when the memorable findings seem to be cognitive breakthroughs, one can find their elements of continuity, their sources of inspiration and analogies in the works of other contemporary or preceding creators. Most often, the important creators manage to generate *schools of thinking*, in that more and more new researchers follow the ways they have opened. Usually, history records only the pioneers, being somehow unfair with the other creators.

Catalysts are decision makers at a social group level and who, by their initiatives, insure the premises of the creators' activities, most often with no clear expectations or even with no clear goal of the creation activity. Catalysts are *visionaries* in the most proper sense of the word and, furthermore, they are people of an exemplary morality, altruist beyond the usual limit. When a scientific creation activity is supported by economic or military reasons and the expected results and benefits are predictable, it is more difficult to call the involved decision makers "catalysts", in the sense considered here. Undoubtedly, they are valuable decision agents, intelligent managers of the immediate needs of the society they represent, and their contribution to the science development is important. Still, history rarely mentions them in its gallery of "contributors".

Without being a rule, in many cases, catalysts are or have been, in their turn, creators and school shapers in the same domain. Many creators have remained anonymous acknowledged and their creations were lost only because they did not meet the proper catalysts at the proper moment.

Academician Mihai Drăgănescu, outstanding personality of the contemporary science and culture, is an exceptional creator and an authentic catalyst. His work and activity, seen from the two perspectives mentioned above, are extremely vast, partially reflected in his more than 30 monographs, more than 300 scientific papers published in national and international journals, in hundreds of appearances in the press, on radio and at television. The ways opened by academician Drăgănescu's scientific creation are followed by numerous researchers, many of them being acknowledged as leading personalities in Romania and abroad. Research projects of national importance have been coordinated, initiated or supported by Professor Mihai Drăgănescu and they all left their mark on the scientific and technical development of Romania. Numerous educational, research and development institutions and organizations, together with professional forums, created by his initiative or being under his direction, prove a way of thinking beyond the present.

Below, I will focus on his conceptual creation in the information science. Before proceeding with this difficult task, I must ascertain (by following the notional parallelism creator – catalyst) that his more than 35-year long managerial activity in informatics has many conceptual aspects. Starting with his participation to the creation of the national program (1967) for introduction of informatics in Romania at a large scale and later to the defining of the concept of National Informatics System (1970) and of the frame project for implementing this concept (1976-1980, see [10]), continuing with his restless plea for the fundamental research in informatics and his permanent guidance and encouragement offered to the talented young researchers in the new domains (as artificial intelligence, robotics or functional electronics were in the '70s) and

ending with his constant concern for raising the awareness of the civil society about the informatics imperatives (for which the many papers and radio and television interviews are evidence), all of these are the measure of the "informatics catalyst" that academician Drăgănescu has been.

The phrase "*information era*", used more and more often lately, is connected with the name of Professor Drăgănescu and it defines the present evolutionary stage of mankind, in which information is treated as an infrastructural element, indispensable for the functioning and progress of the human society [3, 5, 6, 8, 9, 13, 20]. Whether it is regarded as a cognitive object or as an object of mechanical processing, as an instrument or as a weapon of the economic and military power, as a commodity or as a knowledge generating process, information is present in the definition and constituency of anything we speak or think about in the information era. In academician Drăgănescu's view, information era has already three stages: *the informatics society* (*pre-information*), *the information society* and *the knowledge society* (*post-information*) and these preview the forth one: *the consciousness society* [45]. How can the fundamental mutations produced by information in the human existence and knowledge be understood and explained? Professor Drăgănescu unambiguously states that the understanding of information with the structural science methods is partial, reduced to its perceptual, subjective manifestation. Information is objective, a-temporal and a-spatial, with a profound existence and computability, outside which subjectivity, affectivity, creativity and any other manifestation form of the mind (as information processor) cannot be explained. A new theory of information is necessary – says Professor Drăgănescu – subsumed by an integrative science that should combine the structural and phenomenological knowledge. The general theory of information proposed by academician Drăgănescu has its roots in, and cannot be detached from his structural-phenomenological theory of orthoexistence. In 1984, in the *Science and civilization* volume ([16], pp. 201–220), Professor Drăgănescu brings into discussion the *sense/reference* dichotomy as a key element in determining the relation between natural intelligence (NI) and artificial intelligence (AI), which he opposes in the treatment and interpretation of information. Even since its appearance, artificial intelligence has justified its approach through two types of discourses: the cognitive discourse, constructed mainly on the hope that the realization of artificial intelligence systems will help for a better understanding of the human mind, and the technological discourse according to which the realisation of computers able to fulfil tasks that are usually associated with the intelligent human behaviour would bring into existence some extremely valuable machines. The antinomy NI/AI, expressed in a period of full expansion of the artificial intelligence domain, represents an extremely clear critique of the AI objectives (to tend towards NI) and a preview of the AI stagnation after the '90s, as a consequence of the structural science inability to account for the essential differences between the two types of intelligence. We have to mention that the AI stagnation, acknowledged today and foreseen by academician Drăgănescu more than 25 years ago [4, 7, 11, 12, 14, 15, 17, 20], is concerned with the cognitive component, the hope of understanding the mind mysteries, lagging behind the exceptional technological advances in the telecommunication and information industry. From a technological perspective, AI has made great progress transferring a great number of applications satisfying the functional criterion mentioned above (the fulfilment of tasks which are usually associated with the intelligent human behaviour) from the laboratory research domain to industry.

The inequality NI ≠ AI is justified by academician Drăgănescu as being inevitable as long as NI has access both to sense and significance, while AI can only access a formal representation of the significance. In his critical analysis of Frege's theory about the sense/significance distinction (originally, „Sinn/Bedeutung"), Drăgănescu justifies its incapacity to explain the disparities between AI and NI in that Frege's sense is especially a structural sense (according to the structural-phenomenological theory), while in fact it should also include the phenomenological underlying layer. The semantic theory of science, developed by Mario Bunge, also

cannot explain the distinction between NI and AI, but, according to professor Drăgănescu, „…din punctul nostru de vedere, *înțelesul* (meaning) este compus din *sens* (sens fenomenologic) şi *semnificație*. Iar semnificația are cele două componente puse în evidență de M. Bunge (n.n.: semnificație de context şi semnificație de referință)…În felul acesta ne-am îndepărtat de Frege, dar principala desfacere a înțelesului în sens şi semnificație îşi are totuşi originea în semantica incipientă a lui Frege. Într-o asemenea viziune am dezvoltat unele aspecte legate de relația dintre formal şi neformal”[1], says Prof. Drăgănescu ([16], p. 214).

In 1984, at the International Conference “Artificial Intelligence and Information-Control Systems of Robots” [18], a first draft of *the general theory of information* (GTI) is presented, deepening the ideas presented in the study *Spre o teorie generală a informației* (Towards a general theory of information) ((Institutul Central pentru Conducere şi Informatică, May, 1983)) and in the volume *Ştiință şi civilizație* (Science and civilization)[16]. The coexistence of the formal and non-formal in the generalized definition of information is asserted under the form of the quadruple $<S, C, R, \Delta>$ where:

- *S* represents the structural information, in its syntactic form;
- *C* represents the Bunge contextual significance, part of the formal meaning;
- R represents the Bunge referential significance, part of the formal meaning;
- Δ represents the phenomenological sense (non-formal, profound sense).

In Drăgănescu’s view, the distinction between NI and AI is given by the nature of the information characterizing the two types of intelligence. While NI has access to all the four components of information in the general sense, AI information (AII) is characterized like AII = $<S, C, R,>$, called reduced information.

The non-formal aspect that characterizes information (taking into account the above generalization) is a defining attribute of intelligence, be it natural or artificial, and from this perspective Professor Drăgănescu distinguishes between the structural heuristic and creativity, as cognitive mechanisms for advancement beyond a certain level of knowledge (in this context, generation of new information). The heuristics used in AI are informal, in the sense that they cannot be (rigorously) motivated in the frame of a fully formalized theory, but they are not non-formal because they are described and implemented in a formal context (e.g. a programming language) by an algorithm or a succession of formal, algorithmically interpretable rules. NI also uses (structural) heuristics, but its specific creativity cannot be explained only by structural transformations of the pre-existent information; therefore, by terminological extension. Drăgănescu introduces the concept of phenomenological heuristic as a referential of the transformations of the profound senses of the information. By assigning phenomenological sense only to the living, GTI entails the AI incapacity (in the present understanding) to create. In the context of GTI, creation “implies a conscious control of formal heuristics and phenomenological heuristics, an iterative interaction between these two types of heuristics, in order to obtain the new phenomenological sense and the corresponding significant structure that satisfy a tendency, a desire, an expectation” ([18], p. 28). The invocation of consciousness in the above quotation is fundamental for the GTI development. This explains why, for example, the biological cell does not produce creation: “a biological cell does not have creation because it does not have consciousness” (idem, p. 28). The consciousness problem, foreseen in the papers of the middle ’80’s, will be revived at the beginning of the ’90’s from a much larger perspective [22], as a fundamental problem of an integrative science, able to answer the provocations of the informational era foreseen stage: the knowledge society [23, 28, 45].

[1] “… from our point of view, *meaning* is composed of *sense* (phenomenological sense) and *significance*. The latter has two components highlighted by Mario Bunge (o.n.: *context significance* and *reference significance*) …Thus we distanced ourselves from Frege, but the main division of *meaning* into *sense* and *significance* has its origin in Frege’s early semantics. From this perspective we have developed some aspects connected with the relation between formal and non-formal”.

In 1985, Professor Drăgănescu publishes the volume *Ortofizica* (Orthophysics) [19], a milestone of its creation, that embeds and harmonizes the previous results of the fundamental research in Informatics, Electronics and Philosophy Science in a masterpiece about which the great Noica was saying he "doesn't know any other philosophical synthesis in the contemporary culture as comprehensive and impressive as this work. We are talking about an exceptional accomplishment of our culture and – we hope we are not mistaking – of the 20th century culture… And if by any chance this work will not impose itself in the 20th century culture, we should be allowed to believe that it would amaze and impress deeply the unwarned thinkers from the 21st century"[2] (C. Noica: *Referat asupra lucrării ORTOFIZICA de Mihai Drăgănescu,* review addressed to *Editura Ştiinţifică şi Encilopedică*, supporting the volume's publication).

Chapter 10 (*Componentele semantice ale informaţiei*[3]) and chapter 11 (*Elemente pentru o teorie generală a informaţiei*[4]) from *Ortofizica*, extremely relevant for the present study, uniformly represents the GTI's frame standing on which academician Drăgănescu's nowadays research in defining an integrative theory of information (part of an even more recent Theory of the Integrative Science [46], developed in collaboration with Professor Menas Kafatos) is based.

Through the semantic components of information, Drăgănescu brings into discussion the traditional semantic domain, linguistic semantics and the logics associated to it. Natural language, the most common means of human communication and mind act, which fascinated the thinkers from all centuries, is considered by Chomsky[36] a *mental organ*, while Drăgănescu shows, more precisely and rightly, that „ar trebui considerat un *procesor mental*, adică un procesor informaţional natural, specific"[5] ([19], p. 372). Formal semantics, „privind limbajul ca extras, rupt de minte, caută să explice *înţelesul* propoziţiilor, uneori prin formula lor logică, legată de condiţiile de adevăr, însă de regulă trebuie să recurgă şi la o sferă extralingvistică, redusă uneori la un set de componente semantice primare din care să derive înţelesurile propoziţiilor şi cuvintelor. O semantică lingvistică formală se poate dezvolta şi pe baza unui înţeles bazat pe relaţia dintre structurile lingvistice şi acţiune, dar şi această semantică se loveşte de limitări inevitabile prin însăşi legarea limbii numai de acţiune… În realitate, limbajul natural nu poate fi rupt de mintea omului"[6] (ibidem). The cognitive paradigm of artificial intelligence in natural language modeling is close to the mental processor model invoked by Drăgănescu, although the processings are completely different: „un text într-un calculator produce o procesare informaţională de tip informatic, în timp ce într-o minte produce o procesare informaţională de tip mental"[7] (op. cit., p. 373).

In the general theory of information proposed by Drăgănescu, the subject is the fundamental element in the "mental processor" type of language modeling: „un dispozitiv care conţine un procesor informaţional de o anumită complexitate, interacţionând activ cu mediul înconjurător, interpretându-l şi, eventual, acţionând asupra lui. Un procesor informatic pasiv care la un semnal la intrare

[2] Originally, „nu cunoaşte nici o sinteză filozofică atât de cuprinzătoare şi de impresionantă ca lucrarea de faţă, în cultura contemporană. Este vorba de o excepţională reuşită a culturii noastre şi – sperăm să nu ne înşelăm – a culturii veacului XX… Iar dacă prin imposibil ea nu s-ar impune în cultura veacului XX, să ne fie îngăduit a crede că ea va uimi şi impresiona adânc pe gânditorii nepreveniţi din veacul XXI"

[3] Semantic components of information.

[4] Elements for a general theory of information.

[5] "it should be considered a *mental processor*, i.e. a natural, specific informational processor".

[6] "concerned with language as an excerpt, separated from the mind, is trying to explain the *meaning* of the sentences, sometimes through their logical formula, connected to the truth conditions, but most of the time it has to refer to an extra-linguistic range too, sometimes reduced to a set of primary semantic components from which the meanings of the words and sentences must be derived. A formal linguistic semantics can develop also on the basis of the relation between linguistic structures and action, but this semantics also faces inevitable limitations by putting language only in connection to action… In reality, natural language cannot be separated from the human mind".

[7] "in a computer, a text produces an informatics information processing, while in a mind it produces a mental information processing".

răspunde cu unul la ieşire nu este un subiect dacă nu învaţă din interacţiunea cu mediul, dacă nu construieşte cunoaştere şi dacă nu acţionează în mediu. În caz contrar este un subiect… Nu orice procesor este subiect"[8] (ibidem). The informatics subject specific to artificial intelligence and the naturally human mental subject are fundamentally different. Professor Drăgănescu asserts the NI ≠ AI inequality, without denying the possibility of a future alive artificial intelligence (AAI) that could transform it into equality. From this perspective, Drăgănescu proposes a refinement of the mental subject into naturally HUMAN or ANIMAL mental subject and alive artificial mental subject. In relation to the procedural subjects distinction, Drăgănescu classifies the processors into formal and formally-non-formal, the latter being refined into mental processors and social processors. But he also stipulates: „Nu trebuie să rămânem cu impresia că punând accentul pe procesoare, omul este redus la un procesor sau societatea este redusă la un procesor. Omul nu procesează numai ca să trăiască, să reproducă specia, ci şi ca să se îmbogăţească din punct de vedere cultural şi spiritual, pentru a reprezenta în mod conştient însăşi existenţa şi pentru a crea. Procesorul mintal face parte din om, ca o parte esenţială, însă omul nu se reduce numai la el."[9] (op. cit. 375).

Based on the considerations from Science and civilization about the distinction between sense (the non-formal meaning) and signification (the formal meaning), fundamental for GTI, Drăgănescu defines the semantics of the mental subject as a composite semantics of (phenomenological) sense and signification, while the semantics of the informatics subject is a (formal) semantics of signification (op. cit. p. 376).

By taking up the subject of the semantic internal dynamic of the mental processor, the investigation deepens the foregoing investigation of the heuristic processing and, above all, of the phenomenological heuristics (opposed, as we have seen, to the formal AI heuristics), defining the creation as the process whereby new structures and senses are generated. According to the nature of the new structures and senses (formal or formally-non-formal), the creation is classified as being of the third rank (creation trough AI formal heuristics) and of the second rank respectively (the effect of the phenomenological heuristics). Proper creation presupposes the controlled and sentient conjunction of a sequence of formal and non-formal heuristics. All intelligent information processors discussed before are generalized to the notion of psyche, a conceptual construct that adds to Drăgănescu's processor and meaning a privileged meaning called ego. Although defined by the same triplet <Π, I, E >[10], the nature of the definitional components makes the distinction between a mental psyche and an informatics psyche. The notion of informatics psyche, a by-product of Drăgănescu's theory, is reduced, in the AI context, to the characterization of introspective intelligent systems, capable of creation and which also have the knowledge of what they know and, especially, of what they do not know. Awareness of the "cognoscible" (be it asserted or inferred) at the level of an artificial intelligent system is, in principle, much easier to be realized in an algorithmic manner than the modeling of the "incognoscible", of the cognitive limits of the informatics processor. In other words, to create an informatics ego able to understand that it does not understand and, thus, that it cannot solve a certain problem is one of the biggest challenges of AI. The consciousness society, foreseen by Professor Drăgănescu as the successor of the knowledge society, will

[8] "a device containing an informational processor of a certain complexity, actively interacting with the environment, interpreting it and, if necessary, acting upon it. A passive informatics processor which answers an input signal with an output signal is not a subject unless it is able to learn from its interaction with the environment, unless it constructs knowledge and unless it acts in the environment. Otherwise, it is a subject… Not any processor is a subject."

[9] We don't have to have the impression that by laying stress on processors, the human is reduced to a processor or the society is reduced to a processor. Men do not process only for surviving and for reproducing the species, but also for his/her cultural and spiritual enrichment, for representing the existence in a sentient manner and for creating. The mental processor is an essential part of the human being but man is not reduced to it.

[10] Π = processor, I = meaning, E =ego

have, on its list of difficult technological problems, the creation of an informatics self aware of its own cognitive limitations.

Outlining the general theory of information, Professor Drăgănescu brings arguments for the necessity of a multidisciplinary and cross-disciplinary approach, identifying apparently distinct perspectives, in fact methodological cutouts of the same object of study (op.cit.p. 423):

- the philosophy of information;
- information science;
- information technology;
- information industry;
- the economy of information;
- the relation between culture and information;
- information society (including problems of social intelligence and of democracy of information);
- creation (information generation).

Even since the end of the '70s Drăgănescu's works have emanated a discontent about the explanatory power of contemporary sciences, highly specialized and inevitably leading to methodological and terminological individuations, to ontological and gnoseological (primarily epistemological) partisanships, which is clearly stated in Ortophysics:

"Atacarea multidisciplinară a unei probleme a devenit esențială în epoca noastră, dar ea nu se va dovedi suficientă dacă nu vom găsi şi factorii integratori, respectiv dacă nu vom găsi contopirea multidisciplinarității într-o unitate, fie că este cazul înțelegerii unei realități date, complexe, fie acela al construcției unor obiective care să servească omul şi societatea. Integrarea multidisciplinară a ştiinței ne duce, în mod îndreptățit, cu gândul la **unitatea ştiinței**, problemă atât de dezbătută, dar fără soluție în prezent."[11] (op.cit. p. 423)

Professor Drăgănescu clearly states that one of the integrating factors is, without any doubt, information and by developing a general theory, which could include all the perspectives mentioned above and even others, we can advance to an integrating theory of information and, further on, of science [28].

In the book Functional Electronics, Drăgănescu's perspective on information (section 2.4. A sketch for a general theory of information, pp. 84-89) is discussed in parallel with Shannon's classical theory of information and, respectively, with the algorithmic information theory elaborated by Gregory Chaitin and widely influenced by A.N. Kolmogorov's and R. Solomonoff's works. The extra components of Drăgănescu's information (the phenomenological information and meaning, subsuming Bunge's sense and the phenomenological sense) are considered by the Romanian scholar indispensable integrating elements for understanding information manifestations and its creation. The general approach is then particularized to the technological perspective of different kinds of information processors previously discussed, putting them in correspondence with syntactic and, respectively, semantic automata. With the help of these constructs simple organisms (living bodies, having no nervous system, equalized with biological automata with phenomenological senses[12]), complex organisms (living bodies having a nervous system, equalized with semantic automata, but having no ego-consciousness) and arhemes (complex organisms endowed with consciousness, the man[13] being their typical representative) are modeled.

[11] The multidisciplinary approach to a problem has become essential nowadays, but it will not prove sufficient unless we also find integrating factors, namely merging multidisciplinary into unity, either when understanding a given complex reality, or when constructing some objectives for the benefit of man and society. The multidisciplinary integration of science righteously makes us think at the **unity of science**, a widely discussed matter, with no solution for the moment.

[12] See, for instance, chapter 9.9. "A theory of the cell as an abstract organism" from *Functional Electronics*, pp. 393-407.

[13] An arheme more complex than man is the society, called *social arheme* in the book; if AI mimesis tries to equalize the arheme represented by man with the intelligent agent having an informatics *ego*, then, according to Drăgănescu's theory, the social arheme should correspond to the virtual communities of intelligent agents having informatics consciousness and arhemes proper;

The information society has come to fruition due to the appearance of the Internet and the generalized access to information and electronic services available on the web. In 1970 Professor Drăgănescu foresaw, as a condition of the information society, the necessity for interconnecting computers into a network accessible for home users as well, a structure meant „to finally serve each citizen, with computation power and auxiliary memories, for their auto-education, for relations with the social structures from an economical, cultural, medical, judicial, social, etc. perspective, for expressing desires and aspirations and their frequent contributions when being consulted or when voting for public and political matters. Man will find himself/herself not only in an ecological and social environment, but also in an informatics one, which will change his/her way of life." [1]. All foreknowledge in the above quote has fulfilled and in nowadays terminology of information society/ knowledge society we use the prefix e- (standing for electronic) to name them: e-learning, e-culture, e-entertainment, e-health, e-commerce, e-poll, e-government and so on. Only few people could imagine, at the end of the '70s, what was to happen in the next 20 years, thanks to the Internet.

The appearance of the web opened the possibility for moving to a new stage of the information era. The huge amount of information available on the web is meant for human usage and this is the very essence of the conceptual limitation of the web content. People have a limited ability to process information. Nobody can read the whole content of the web. Moreover, there are estimations according to which even for a specialized domain, reading all the web publications takes more than the biological time available for people. The big shift of paradigm brought about by the semantic web consists in the fact that the information on the Internet is associated with an explicit semantics, thus the informational content of the web becomes accessible not only to people, but also to the software projections of the human creativity: the intelligent agents. Professor Drăgănescu brings arguments in favour of the position that the intelligent agents represent one of the essential technological vectors of the knowledge society [29], they have the responsibility to monitor the information of interest for the human factor they represent. The intelligent agents, personalized reflections of men in the ceaseless fight with the more and more condensed time are ordered to analyze the available information, to synthesize it in a "digestible" amount, to deliver it at appropriate times, to make decisions more and more frequently. In the context of the nowadays exposure to information, this unavoidable transfer of responsibility cannot be attained in the absence of a conceptual leap in the definition of information, of sense and meaning. Explaining them, so that the information meant for the human receptor should become accessible for intelligent agents as well, is the aim of the semantic web. In the knowledge society, people and their software representatives (avatars) need equal opportunities. For the knowledge society the semantic web will represent the essential functional condition, without which the web will get suffocated by its own omniscience. The semantic web is for the knowledge society [26, 27, 30, 33] what the Internet was for the information society [24, 25]. Besides this technological, infrastructural aspect, Professor Drăgănescu adds some more defining elements [31, 32, 34, 35]:

- It is a society of science (and of technology), in all its domains.
- It is a society of learning (to define it only as a society of learning has limitations; learning is subordinated to knowledge).
- It is a durable and sustainable society (only through science and technology it is possible to reach this stage of society).
- It is a society that relies on the information (and communication) technology that involves all domains and allows for creating the knowledge society.
- It is a society with a new economy in which knowledge becomes an essential economical factor, with an organization based on knowledge and with a management of knowledge that involves new forms of organizing the institutional activities.
- It is a humanist culture knowledge society, including the preparation for a society of

this would be another big technological challenge for the consciousness society.

consciousness through fathomization of fundamental knowledge.

Professor Drăgănescu's latest researches in the domain of consciousness society naturally build on the previous studies on the knowledge society and have started in the research program "Structural-Phenomenological Modeling", a program that he supervises at the Research Institute for Artificial Intelligence. This fundamental research program that started in 2001 has a follow-up under the name "Researches in the Integrating Structural-Phenomenological Science and the Consciousness Society". A first series of studies [37, 38] have been dedicated to the definition of new notions and to the extension of the classical theory of categories and functors, motivated by the necessity of covering in the structural-phenomenological modeling not only the formal aspects, but also the (formal-unformal) phenomenological ones. Thus, besides introducing the phenomenological categories and the associated functors, in [37] the problem of defining the topology of a phenomenological category is posed for the first time. In the new types of phenomenological topological spaces, the concept of vicinity is generalized from the usual metrics to a "distance" that is functorially defined [38]. The phenomenological/integrating mathematics introduced in [37] and [38], elaborated in collaboration with professor Menas Kafatos, the dean of the Faculty of Computational Sciences and Informatics at George Mason University in the USA, is the conceptual instrument with which the two collaborators try to investigate the mind, the individual and social consciousness, opening the way towards the understanding of the concept of consciousness society. A thought-provoking study on the cognitive science is [39]: it is about the insufficient character of the structural sciences for explaining the consciousness and the necessity of an integrating cognitive science, in which information (in Drăgănescu's sense) must be the sine-qua-non element of any attempt to explain cognition. The success of such an intercession would naturally lead to creating an artificial consciousness, opening the ways for the consciousness society: "the Society of Consciousness will not be possible without artificial consciousness" ([40], p. 2).

Some recent researches in the networks domain as structures for representing dependencies and interactions between conceptualizations of our cognitive universe [41, 42] are analyzed by Drăgănescu and Kafatos in [43], from a structural-phenomenological perspective. The two authors propose a combination of the categories theory and the theory of the new networks as a more powerful instrument for scientific analysis of the universe [44] and of the mind.

Professor Drăgănescu's studies on The Consciousness Society, recently published in a comprehensive volume [45], contains, in a dense and visionary text, Drăgănescu's view on the future society:

"Societatea conştiinţei se va naşte din societatea cunoaşterii, astfel încât **suportul asigurat de societatea cunoaşterii**, cu vectorii care au constituit-o şi o menţin, poate fi considerat ca unul din vectorii societăţii conştiinţei. Pe lângă tehnologiile preluate din societatea cunoaşterii, cum sunt internetul, inteligenţa artificială, nanotehnologia, vectori tehnologici specifici societăţii conştiinţei vor putea fi tehnologiile conştiinţei artificiale şi ale biotehnologiei pentru transformarea speciei umane, intenetul conştient, tehnologii pentru acţiune la mare distanţă în spaţiul interplanetar al universului, precum şi tehnologii pentru acţiune în realitatea profundă, pentru a produce fenomene de comunicare fenomenologică prin substratul existenţei profunde (care în mod normal se va face prin viteză infinită) sau efecte fenomenologic-structurale producând consecinţe energetice sau asupra substanţei în realitatea spaţio-temporală.

Societatea conştiinţei va avea şi vectori funcţionali, cum ar fi cunoaşterea (de cea mai mare importanţă fiind cunoaşterea fundamentală asupra existenţei), spiritualitatea, managementul şi ecanomia (societăţii conştiinţei), educaţia (nu numai a omului, ci a tot ceea ce este conştiinţă în vederea continuităţii cu trecutul bun al omenirii), cultura (cu aceeaşi observaţie ca în cazul anterior) ş.a.

Poate este prea devreme pentru a desprinde exhaustiv vectorii societății conştiinței, dar cei menționați mai înainte par plauzibili. Important este faptul de a gândi asupra lor, pentru ca activitatea în societatea cunoaşterii să-i aibă în vedere de la bun început, cu atât mai mult cu cât tehnologia se dezvoltă atât de rapid înspre tehnologiile societății conştiinței, aparent de la sine, conform unor legități proprii, încât a nu acționa în viziunea cuprinzătoare a vectorilor societății conştiinței, încă din societatea cunoaşterii, ar putea fi extrem de dăunător pentru viitor.

Societatea conştiinței se pregăteşte de pe acum… Cunoaşterea şi conştiința sunt marile resurse ale viitorului, pe care să sperăm că vom şti să le folosim."[14] [45].

Concluding Remarks

My attempt to present a fragment of Professor Drăgănescu's creation and scientific activity is inevitably incomplete, and the selection of the conceptual contributions I mentioned is certainly subjective. I do not doubt that another expositor, with another specialization, will find in Drăgănescu's work in information science new conceptual aspects, many themes for scientific and philosophical reflection. Just like a really important book reveals new meanings at each reading, Professor Drăgănescu's extensive work reveals novel, surprising aspects at each analysis.

At the beginning of my professional activity, I had the chance to have Mihai Drăgănescu, a scholar fearless of the time vicissitude, as director of the National Institute for R&D in Informatics, ICI-Bucharest. I have come to know him as both a creator and a catalytic agent of advanced research. The researches that had already started in the domain of AI (in the group coordinated by Ioan Georgescu) and of robotics (in the group coordinated by dr. Adrian Davidoviciu) were strongly encouraged and led by Professor Drăgănescu. Alongside with other colleagues from the same generation (I would mention here Gh. Tecuci, M. Bărbuceanu, Ş. Voinea) and with those who came to ICI in the next years (Şt. Trăuşan-Matu, Adina Florea), young at that time, scientists of repute today, we all benefited from the competitive and intellectual emulation atmosphere created by Professor Drăgănescu. The group of young aspirant researchers mentioned above and some already experienced researchers (Dan Mânduțianu, Sanda Ionescu-Mânduțianu, Radu Bercaru) have gained experience in the laboratory that was wisely and elegantly led by dr. Margareta Drăghici, under Professor Drăgănescu's permanent "protective wing". The lack of trust and even the hostility that characterized the way in which the AI research was seen at that time could have dissolved or even destroyed the prospective

[14] The consciousness society will emerge from the knowledge society, thus the **support ensured by the knowledge society**, with the vectors that created it and upheld it, can be considered one of the vectors of the consciousness society. Besides the technologies taken over from the knowledge society, such as the Internet, the artificial intelligence, nanotechnology, technological vectors specific to the consciousness society could be the technologies of artificial consciousness and of biotechnology for transforming the human race, the conscious Internet, technologies for action at great distance in the interplanetary space of the universe, and also technologies for action in the profound reality, to produce phenomena of phenomenological communication through the substratum of profound existence (which will normally be made at infinite speed) or phenomenological-structural effects with energetic consequences or on the substance in the spatial-temporal reality.
The consciousness society will also have functional vectors, such as knowledge (the most important being the fundamental knowledge of existence), spirituality, management and economy (of the consciousness society), education (not only of man, but of whatever is consciousness in line with the good past of mankind), culture (with the same remark as before) and others.
It may be too early to exhaustively identify the vectors of the consciousness society, but the ones mentioned above seem plausible. What is important is to think about them, so that the activity in the consciousness society to take them into consideration from its early beginning, especially that the technology develops so fast towards the technologies of the consciousness society, apparently by itself, according to its own laws, so that in the comprehensive vision of the vectors of the consciousness society not to act could be extremely detrimental to the future.
The consciousness society is preparing now… The knowledge and the consciousness are the great resources of the future, which we hope we will know how to use.

young researchers's enthusiasm, if it has not been for the open sustaining of this "technology of the future" [14] by Professor Mihai Drăgănescu. I think I am not mistaken when I say that many of the professional trajectories of the young graduates hired at ICI at the end of the '70s and beginning of the '80s, who went towards research in AI, would have been different if not for the clairvoyance and direct involvement in this domain of the general director of that time, Mihai Drăgănescu.

It has been said many times that the work of a great creator must be separated and analyzed independently from the man behind it. There are famous examples of authentic creators (writers, artists, scientists) who were condemned because of their beliefs, behaviours or actions (having no connections with their work) against the authorities, the moral norms or even the course of history. If history is the one that judges in such cases, when the authentic creation belongs to a man of exemplary morality, to that MAN should our unconditioned admiration go. We can be sure that history will make us justice. Such a MAN is Academician Mihai Drăgănescu, our contemporary into the future.

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