THE SOURCE AND THE SENSE OF NATURAL AND ARTIFICIAL EVOLUTION FORMS

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ABSTRACT. A preferential sense of processes can be outlined at all the successive levels of existence, starting from cosmic systems, passing through biotic and social ones and up to cognitive and spiritual constructive systems. The status and role of some founding principles of a universal theory of evolution are studied, especially the principle of action and the derived principle of effectiveness. Cybernetics is conceived here as the general theory concerned with the study of efficiency conditions of action but also as the system of activities regarding the implementation of adequate instruments for social systems development orientation, coordination and control. From the main perspective of the paper, cybernetics is thought as a general theory of sistems with a finalist, oriented behavior. Within the class of sense oriented systems, especially the evolving sistems which can be described as developing sistems are studied. Social evolution itself can be natural, artificial and mixed, in its each component dimensions: biotic, mental, cognitive and spiritual. The natural and artificial co-existent, co-generative and co-functional forms of being are presented and their co-evolution is described. Socio-technical aspects of natural and artificial evolution are studied and instruments of social interaction and intervention, offered by the information technology, are considered.

Introduction

An ontological research perspective can reveal a preferential sense of processes, which can be studied at all the successive levels of existence. These ontological aspects are then detailed by various scientific and philosophical approaches and efficiently used in technical and social invention, such as in socio-cybernetic visions, activities and structures.

The preferential sense is present starting from cosmic systems, passing through biotic and social ones and up to cognitive and spiritual constructive systems. Cosmologic models emphasize a preferential sense in the entire existence when they are non-stationary models, such as those elaborated by Friedmann and Hubble or Lemaître and Eddington as well as in the case of some oscillating models [3].

Some later formulated non-stationary models as the explosive one (Friedmann), the pulsating model (de Sitter), the hesitating model and the up-down model (Tolman) are all grounded in the idea that the universe evolves and that in this evolution certain irreversible processes occur. The selected models also demonstrate that even in the case of a finite past, the future of the universe is infinite, as shown by Landsberg and Park.

The ontological and epistemological status and role of principles is studied and a model of structural analysis of the system of principles is proposed.

Cosmologic principles such as the "General Relativity Principle" combined with the "Equivalence Principle" (Einstein), as well as the "Perfect cosmologic principle" (J. Jeans), the "Universal Evolution Principle" (I. Prigogine), related with non-linear ireversible processes, and the "Anthropic Principle" (Teilhard de Chardin) all reflect the preferential sense manifested in the whole existence.

The preferential sense defines the very essence of biotic existence; it is an oriented evolution, generated by a specific causality: finality. Finality, defined with conceptual tools of the information theory, is a causal connection in which the set-up of

effect's succession is determined by information codifying models structurally integrated in the system of its causes [23], this model being structured before the effective action of the causes which generate, foster or stimulate their emergence and development. Socio-technical aspects of natural and artificial evolution are studied as cybernetic issues, and instruments of social interaction and intervention offered by the information technology are considered.

Finality – the presence of a sense in the evolution of existence – not necessarily implies the finitude of existence, as it not involves with necessity a preferential sense. It may be correlated with the open nature of systems, which make possible the universal property of structurality, manifested in its turn in the infinity property. The continuity of existence forms and the open feature of diverse fields of the world is expressed in a more general trait than preferentiality, namely in the oriented character of the evolution. Orientation, in its turn, can signify both spontaneous or even automated evolution; it not necessarily implies a preferential orientation.

We can use, in this context, the results of some scupulous studies made in some very specialized fields of the philosophy of science, like the philosophy of physics or even the philosophy of the quantic physics, as those undertaken by I. Isac, who examines the problem which he consider to be central for any ontological vision, that of the relation between the succesive levels of reality [6, 118], and who shows, taking account the need to describe the whole of reality levels, that besides a large self-consistency, the universal ontical scale „is governed by an *oriented coherence* [6, 125] (underscored by the quoted author). An „information flow is coherently transmitted from each level of reality to anorher in the entire physical world", he also adds.

At the biotic, social and technical levels of evolution, finality as self-organization and self-development appears not as a ring-shaped connection between different aspects of a system or between the evolution stages of a system, but it is an open evolution that can be modeled by specific methods. At the social and technological

levels, these forms of asymmetric evolution, even open, can be both anti-entropic and entropic [16], even if they are open processes.

The mental, intellectual and spiritual development of humankind also reveals a lot of asymmetric processes as shown in some neurological and psychological studies of certain important cognitive processes, for example, an obvious continuity as well as a permanent asymmetry between the structural and functional aspects of brain and mind development in learning, reflecting and creating processes.

A similar asymmetry can be found in the field of the present human action forms where new levels and types of activity can also be identified, in which the preparation, the informational, the cognitive, the formative and the conception levels tend to become increasingly extensive and intensive, while the executive segment of action tends to be reduced to simple gestures or even orders and directives, these being themselves often automated and delegated to machines.

At the social level of existence, natural and artificial forms of being now co-exist and co-evolve. These kinds of existence also are co-generative and co-functional. Some authors are even convinced that the so far experienced generations of artificial cognitive systems, techniques and agents are also steps in human evolution. Social evolution itself can be now natural, artificial and mixed, in its every component dimension: biotic, mental, cognitive and spiritual (moral, artistic, philosophical and technical).

The present paper proposes a certain renewal of the systemic research understanding and the cybernetic studies approaching, given the internal requirements that the treatment of the respective subjects involves. Thus cybernetics is here understood as the general theory of systems with a finalist or directed behavior. The general theory of systems with sense concerns the systems directed by a sense which can be determined or undetermined, determined from exterior or from within (self-determined), predetermined or not. The paper refers especially to evolutive systems which can be described as developing systems.

1. Principles in evolution

Evolution is a universal phenomenon. All domains of existence are characterized by evolution; they evolve according to some laws of evolution and are explained by particular theories of evolution, developed for each region of existence. But how can one explain the evolution of existence as a whole, only on the basis of specific knowledge, provided by these domains and updated by using the current scientific findings, therefore without using speculative principles?

An answer at hand, facilitated precisely by our positioning inside the systemic theory and the structural methodology, is the fact that we have a hierarchy of scientific theories, and these scientific results can be used in an integrated and at the same time, operational, manner. Thus the products of particular, local knowledge can be extrapolated to the totality of systems, by means of a system of principles with various degrees of generality, all of them scientifically grounded, by describing and explaining the increasingly complex systems that construct the world as a system of systems.

We have to outline here that the underlying principles of knowledge and action result not only from generalization, but also from understanding the essence of knowledge and practice, and the constructive principle functions as well in the process of building the system of principles, precisely from the inside of this system.

Through this method the systemic vision and the structural methodology are not just pointed at but also applied to larger systems and even to the study of the whole existence, being particularly useful for socio-cybernetics as complex activity of study, reflection, interaction and social intervention.

This perspective involves more principles already analyzed in the philosophical literature, for instance, the principles of continuity and differentiation, or the principles of homogeneity and analogy, as well as the structural principle and the principle of becoming, or the principles of action and construction, all these principles underlying at the same time the organization and the

evolution of existence, as well as the theoretical or practical activities.

The above-mentioned principles can be considered fundamental. They have general expressions which apply to more areas of existence. Such general expressions of the fundamental principles can be the systemic principle, the principle of connectivity, principles of retroactivity, of finality, of efficiency, of adaptation, of learning and of creativity.

The fundamental principles can also have particular expressions and forms identifiable within a certain area of existence; for instance, for the field of knowledge, the holistic principle, the principle of induction and the principle of deduction, the idealization principle, the principle of prediction and post-diction, the principle of verification, the hermeneutic principle, the principle of practical applicability.

For the same field, one can also identify specific principles, such as the principle of systemic analysis, the principle of structural analysis and of functional analysis, the principle of genetic analysis, the modeling principle, the principle of integration etc.

Materializations of certain fundamental principles such as the principle of continuity – important for the grounding of our paper – are also valid in the field of knowledge. Such expressions of the continuity principle in the field of knowledge are the principles of transition from the real to the possible, from phenomenon to essence, from the concrete to the abstract and the other way around, from analysis to synthesis, from comprehension to creation, or from learning to invention.

A similar analysis of the content and the validity of the principles can be made for other fields of existence and knowledge. The analytic scheme presented above shows that the principle is discussed in our paper, as it was in the earliest philosophical systems, as being an ambivalent principle: both a generating principle (the primordial source of the forms of existence) and a founding (explanatory) principle and therefore as being valid both on the ontic and the ontological level.

Just as the Constructive Principle participates in the building of the system of principles, the activity principle functions is related with all the other principles. The principles, therefore, not only condition and ground each other, but also achieve each other.

All the principles presented above are active principles, operating at the levels and in the fields mentioned and having decisive and constant effects on their existence and evolution. The existence as a whole, the society itself, our mind, are all structured and operate, in essence, according to these principles.

Consequently, the Principle of Action is particularly worth analyzing, from the perspective of our paper, and will make the object of a separate analysis of the way this principle operates at various levels and in various areas of existence. An important role will be assigned to the study of a derived principle, namely the principle of efficiency, and to the way it operates at the social levels of existence.

Cybernetics itself may be reconsidered, at this level, as representing the study of the conditions of growing the efficiency of action and the implementation of adequate instruments designed to orient, coordinate and control the development in the social systems.

The world of principles that the explanation of the structure and dynamics of existence is based on has itself a systemic character, fact demonstrable even from multiple perspectives. But what are principles if they are neither knowledge, nor assumptions and they are not postulates either?

The principles represent cognitive, evaluative, interpretative and practical syntheses which can ground and guide any type of theoretical or practical activities. Therefore, the principles are complex constructions of ideas, established through various methods and having a universal role.

G. Bruno and Leibniz highlighted both the plurality of the worlds and the connections among them. Descartes and La Mattrie have even formulated cybernetic explanations for the mode of organization and operation of the world system, thus integrating

the cosmic universe and the human universe in the succession of the regulatory and self-regulatory forms of organization.

Leibniz showed and demonstrated the existence of a relation of continuity between the human, the animal, the vegetal and the mineral levels of existence and even formulated a universal principle of continuity, stressing the role of this principle [7, 55–57] which guarantees, through its operation, among other things, the harmony of the above-mentioned systems of existence, and also eliminates the need to resort to chance or miracles to explain the phenomena.

This principle was considered a principle of principles or a meta-principle, along with the principle of reason; Leibniz was called the philosopher of the principles (E. Yakira, *A Principle of Reason or a Theory of Reason*, 2001), as he may have used the greatest number of principles to build his system and may have formulated most new principles. He was also credited, by the same author, with the attempt to work out a principle theory.

We can show, however, that the various principles do not integrate, without contradictions, in a system, and any system of principles, once established, claims the satisfaction of all the principles it contains. But reality, even if limited to the social reality, does not necessarily and constantly satisfy neither in the same spatial and temporal framework nor in different contexts, sets of specific principles or their necessary correlation with certain universally valid principles.

One of the motivations of the emergence and the development of the socio-cybernetics consists precisely in the necessity to scientifically ground the social evolution toward a development without a waste of resources and energy, through an increase of efficiency by resorting to universal mechanisms and principles of organization and activity, already experimented and perfected in nature and technology.

Our perspective is inspired by the mode of evolution and the efficiency models developed in the information technology. This superior, partially artificial, type of efficiency is explained by its

more recent grounding in knowledge-based technological systems and methods, and also in the understanding of the continuity between the various types of evolution and in the combination and the acceleration of the evolution types which turn out to be the most efficient.

2. Co-evolution of natural and artificial aspects of social systems

The systemic vision and the structural methodology, used in connection with the theory and the method of modeling, can integrate the discussion about the evolution of social system in the description of the successive forms and levels of world evolution, which derives from the organization and dynamics of the whole existence, on the condition that the social model stresses the particularity of human evolution and the characteristics of the dynamics of the various sub-systems of the social system and, if the case, even the finality of the evolution of the social ensemble.

At the same time, a model of the universe must be an integral, complete model which should include all the levels, domains and forms of existence in a global vision. Such a model can be and is going to be a strictly scientific model and therefore there is no need to become a philosophical model to be an authentic global model of the universe.

To be an integral and complete model, this scientific model of the universe must include the human universe as well, to be, therefore, self-inclusive. Thus a model of the universe can include cosmological models, models of the natural terrestrial existence, models of the social existence and dynamics, models of the mind and the consciousness, models of the historical evolution of the humankind.

We have proposed an integrative model of brain, mind, cognition, creation and spirit which aims to explain the fulfilling of an individual sense of existence. At the social level, the systemic and integrative visions, associated with the open multi-modeling

method, elaborated by M. Maliţa, allow the construction of an adequate social model: one global, but modular and evolutionary.

Such a model can be both scientific and effective if two kinds of requirements (structural and functional) are observed, such as modularity and adaptability. An adequate social model has to evolve together with the modeled reality field. This requirement is much more stringent when we know that human evolution is open in almost all its dimensions: biotic, social, technical, intellectual and spiritual.

The models developed to anticipate the evolution of these various dimensions, as the partial and global social models that integrate them, have to highlight not only quantitative, easier to deal with, aspects, but also qualitative aspects of the human existence and activity, which can account for their complexity, which can describe their characteristics and can suggest the sense of their evolution

Social evolution has some specific forms and levels and when it is not a spontaneous one, it uses some characteristic means, because it is a self-determined evolution and because society is mainly a system of activities and human activity is an instrument-mediated form of activity; these instruments can be of material, intellectual or spiritual nature.

Conditioned by specific economic mechanisms, by technical progresses in diverse cultural fields and by universal forms of knowledge, but generated mainly, by cognitive methods, creative techniques and permanently optimized conceptual models, social evolution leads today to the changing of the objectives, motivations and means of action. Consequently, not only the conditions of action, the process of action, but the whole system of social action is modified; it receives artificial aspects and produces a more and more artificial environment. In these conditions the agent of action itself can be artificial and inedite forms of action, among which some artificial, are appearing.

Artificial cognition is already born, at the elementary and the high level of cognition. Elements of artificial cognition are involved

in processes of knowledge discovery and acquisition in knowledge bases, stores and warehouses, in knowledge and research nets, in documents which circulate in knowledge flows, all these activities being supported by knowledge-based information systems and intellectual techniques. Similar techniques are used in information processing activities as well as in information structuring activities needed by specific fields of activity [23], [22]. Experimental activities, problem solving, conceptual modeling and even creative processes supporting in science and other cultural fields are activities performed today by artificial intelligent agents.

Artificial discovery is now described by computer scientists as being constituted not only from stored knowledge discovery in knowledge bases and warehouses or as theorem demonstration and knowledge verification by virtual experiments in physics or chemistry, but as new knowledge generation sustained by knowledge-based information systems and techniques used by collaborative knowledge groups in some artificial and even virtual environments.

Some new conceptual models have been developed in contemporary science and these models can be described by means of several new sets of traits and trends, as well as by means of many new forms of thinking as shown by [15], and the activity to identify and analyze these general features of today cognitive processes is one of cognitive sciences and cognitive philosophy competencies. New cultural fields such as informational aesthetics, computing ethics and digital politics are now contributing to the birth of artificial philosophy [18] too.

The changes we can nowadays identify in the general structure and dynamics of the cognitive process are in fact produced by modifications in the deep process of genesis of the new knowledge, namely at the level of the one of the poles of the cognitive process, that of the „subject" of knowledge, which now is, how we already have showed, an expanded and combined one, because it includes artificial cognitive agents and because the human subject itself evolves, from a cognitive point of view, as a

result of its interaction with new cognitive means (systems, agents and techniques) within a new cognitive environment, during some common cognitive activities, by which artificial agents gain some humanlike skills and by which human intellectual qualities are modified and enhanced by co-operation with populations of agents with some new features [21], so that we can consider a co-evolution of human and artificial intelligent agents in shared activities, conditions and environments [12].

Asymmetry phenomena which are not necessarily also preferential phenomena, can be detected in the whole area of natural-artificial co-evolution, as in the complex process of succession and continuity between scientific discovery and technical invention, a process in which the mental, technical and social aspects are correlated in singular complexes for each creative person, respectively for every specific field of activity, and the balance between intellectual invention and information techniques is permanently changing.

A Romanian representative of cybernetics, St. Odobleja, who created, in 1938, the first version of the generalized conception of cybernetics and demonstrated its multi- and inter-disciplinary character, in his work *Consonantal Psychology* (published in French and reviewed in America in 1941), considered cybernetics as theory, method and technique in a single body of knowledge and activity and even defined it, in a later paper, as a technique of artificial thinking; he anticipated that science would come to create ideas in labs. In his reflections about a science and art of invention, able to formulate some laws to produce the new, Odobleja asserted that a considerable part of creativity has a technical nature and it can be learned.

In his capital work, he explained that consonantal psychology is not a grammatical and verbal one. Thinking is not inferred from the succession and association of ideas, but the self-generation of ideas is explained, and the way in which they are created one by other, by a consonantal process, similar to other biotic and physical resonance phenomena [10, 188]. Odobleja outlines that in his

description of some common mechanisms and laws that operate in various domains of the existence, two principles are important, that of similitude and that of harmony (other names for the already mentioned principles of analogy and perfection).

A new cognition, action, interrelation and communication environment is nowadays born and new work groups and communities are developed in the virtual global environment of the web. The specific needs and the appropriate means to satisfy these needs that evolve in this e-world are virtual too and have all the chances to become universal human needs, which will be at the origin of the whole system of some foreseeable common values.

But at least for the time the evolution of different human organization and community forms has different evolution rhythms, duration and periodicity, and a common sense of evolution is hard to distinguish, both at the vision and practice level. The present globalization process is a general, but mainly a technological, economical and political phenomenon, and a less cultural and spiritual one, or it is precisely these two social fields that are essential for the human level of existence.

Our attempts to generate and control some new ways of the natural and the technical evolution to the benefit of human beings can be founded on more or less old but valuable principles of thinking and acting. Among these principles, we can consider, in conformity with the presented hierarchy of the clusters of principles, as a non-specific, but precursory one, the Bionic Principle, which can be accounted as promising for the mixed, natural-artificial evolution of social agents. These can be cognitive or practical agents, material or virtual ones, natural and artificial, etc. For a complex presentation of artificial agents see the section dedicated to this subject matter by M. Drăgănescu [5, 77–81].

Another, both philosophical and scientific, principle which can be considered is the Anthropic Principle, proposed by Teilhard de Cardin, who explain the "human phenomenon" as well as the universal evolution by the power of a final sense which directs the entire existence toward its crowning by human creation. The

explanatory and especially the anticipatory power of his own creation is revealed by his forecast of an era of universal co-operative spiritual human interaction, even materialized in a "substantial thinking envelope", so deeply realized today by the virtual global scientific community hosted on the net.

Human evolution can be analyzed at diverse levels of complexity and it shows today different kinds and degrees of possibilities from distinct perspectives. At the biotic level it is an open evolution as on the technical and spiritual levels, where human possibilities seem to be infinite, while from a psychological point of view, human evolution appears as being closed.

This partially pessimistic view on human behavior and its internal determination (motivation system), derives from a historical perspective on human nature, which has its own evolution, in its biotic, social and cultural dimensions, but its psychological (individual or social) dimension has, according to the consulted records, a very specific, pick to pick movement, in which the picks are connected only by breakneck descendent curves.

Observed from another perspective, the same reality can suggest optimistic de-codifications if we consider, like M. Drăgănescu, in the most recent version of his original, scientific and philosophical model of universe, that the world, even our mental world, can be intro-opened, like many other systems, in a world in which a third type of existence is „*to exist into itself*" [4, 192–193]. In his vision, maybe the main way to be is the activity of being and then of giving a sense to our being. This activity consists fundamentally in our orientation to the being (to the essence of being).

But, as M. Drăgănescu points out, a sense can be associated only with a finite and closed system; consequently, certain ortho-senses are proposed in his model, which promotes the multiverse cosmologic idea, formulated by M. Rees, but preceded by the idea of pluriverse, coined by G. Bruno. These ortho-senses are phenomenological and they cannot be described by fully scientific, mathematical means, as the evolution of the universe is not an automatic one. The human universe itself is not entirely predictable,

but a neccessary evolution to a society of consciousness can be postulated, in the same vision [4, 209], because the Perfection Principle is satisfied by a universe only if it is able to sustain a society of consciousness, possible after the realization of the information and then of the knowledge society.

A Creative Space Theory was formulated by Andrzej P. Wierzbicki, a theory subsequently developed together with Y. Nakamori, with the means of Computational Intelligence and with the aim to anticipate and maybe to hasten the coming of the Knowledge Civilization Age, by models of creative processes implementing. The scope of creative action is centered on knowledge creation by Wierbzbicki and Nakamory, who propose both micro- and macro-theories of knowledge creation.

At this point we have to remind another important contribution of St. Odobleja, who identified not only some general laws of creation (laws are the structure of explanation and then of the theory), but who proposed even a pedagogy of creation, on the basis of its "general cybernetics". He has even pointed to certain intensity, speed and frequency parameters of creation in the "little portative cerebral laborator", but also some maybe more important, spiritual requirements, such as to "run" for an ideal, to eliminate the fear of absurdity and to learn to meditate.

3. Natural and artificial cognitive evolution

If we center our attention on some cognitive aspects of human-artificial co-evolution, we can remark that nowadays a triple cognitive evolution is occurring. Human cognition is continued in its already sketched theoretical and methodological frameworks but with outstanding new results (new forms and levels of knowledge), generated by new cognitive models and integrated in unprecedented conceptual structures.

In the same time, artificial cognitive techniques, means and processes are conceived and used in a growing rhythm and with high efficiency. The previous two processes are not independent and a third, more and more powerful tendency is now evolving, by

their intertwined development, that of a human-artificial cognition, characterized by human initiative and aims, but by artificial methods, techniques and processes, that are used in an artificial intellectual environment, which is a technical and often virtual environment.

The accelerated rhythm and the crescent social importance of artificial agent's development is explainable by the start point of their evolution, that of the upper level of human evolution, the intellectual one. This fact may constitute the very foundation, even if not consciously understood and not explicitly evoked, of a belief expressed by some computer scientists according to which the observable stages in the evolution of artificial agents are also steps in human evolution.

Humans evolve *with* and *by* their artificial creations, like the growing set of artificial (cognitive agents), and then we have more than a common evolution: a co-evolution of human and artificial agents.

Are past and present models of knowledge development models able to describe and to explain the complex evolution of cognitive phenomenon?

Human brain, mind and knowledge were the real cognitive models till now and even if evolving knowledge models were built, these models were conditioned by the successive levels of understanding these fundamental structures, processes and activities. More, the human cognitive agents development, respectively the artificial cognitive agents evolution were represented as unilateral dependent and separate.

To understand, to project and to optimize their common evolution we have to continue our study on the present complex process of knowledge forms diversification, especially those of social knowledge, prospective knowledge and even self-cognition, if we want to built multi-agent systems, abuse-free human-artificial "social agents" interaction or even an artificial self for some of these agents, which will cooperate with humans in a common, more and more artificial environment.

Human-artificial cognitive agent's co-evolution, a research matter launched by us at an international conference, is a theme suggested by the study of artificial agents evolution, very differently understood and anticipated by diverse kinds of specialists, from technical or social branches of knowledge. This evolution is nowadays viewed in different ways: as a

– technically directed evolution; as

– evolution by simulation of the natural evolution of populations, that needs the generation and management of complex processes which involve ecosystems, mutations, viruses and selection; as

– self-structuring processes in ordered context: engineers will create just suitable conditions for a self-determined development of artificial activity and even life forms, or as a

– learning activity, realized by cultural processes, like in the case of children's education.

In this last case, artificial cognitive agents building also needs culture learning, values understanding, sharing and practicing, all these being difficult processes that can lead to failure even when undertaken by human individuals or communities.

Co-evolution of different kinds of human and artificial agents can be anticipated as being even more difficult. If the models till now used (the brain, mind or cognition) were less effective, what can be the model of artificial cognitive and active agents conceiving and building? Spirit, maybe? Which human and artificial needs must be induced and stimulated in humans and robots, to be able of a cultural conduct? As we see, not only the future and artificial, but even the present and human social agents have to be urgently formed and developed in the spirit of some durable and in the same time effective ways of thinking and doing.

As a more remote and ambitious, common, human and artificial project, the creation of new values, practical, intellectual and spiritual ones, namely a common cultural activity can be anticipated. As we already shown [16], artificial learning, artificial discovery sequences, invention procedures and other scientific

activities such as theorem demonstrating, virtual experiments and even ethical decision procedures and forms of artificial philosophy were implemented.

Applied by humans and machines, who can meet in the middle of the road between the natural and the artificial, these cognitive techniques can facilitate a common, faster evolution.

This evolution not necessarily supposes the development of artificial entities according to a human model, nor an evolution of humanity toward artificiality. The most important result of the contemporary cognitive and technical progresses is a maximal diversification of the ways of evolution. This represents, as a matter of fact, the confirmation of the older idea that a criteria of complexity and superiority of a system is done by the number of its alternatives of evolution.

None of all the evolutionary possibilities are then exluded: the development of humans toward an other species, as a variant of the natural evolution in artificial conditions; the guidance of this evolution by the means of genetical engineering, but on the basis of natural principles and structures, as it will be possible an evolution toward a lot of hibride beings, illustrated by some actual activities of correcting, completing or to replacing certain material and mental structures or functions in the natural process of aging or in illness cases.

Classes of attributes of artificial agent's such as a) sensing and acting, b) reasoning, c) learning and knowing, d) internal structure and e) diversity of their number, are distinguished by specialists in theory and methodology of intelligent agents, like Skolnicki and Arciszewski [21].

The same authors mention that individual agents act locally, cooperate, are sophisticated, they do not model other agents and do not show internal state, are trustful and acquire knowledge, have stable architecture and work in group. Swarm agents are locally acting too, they share resources, have less autonomy but are more competitively and more mobile. They also react more directly and

may discover roles in runtime, use fixed language and assume information to be true, but are less transparent and less reusable.

Human and artificial agents can be compared as intelligent agents. As shown by Skolnicki and Arciszewski [21], while human intelligent agents have initiative, are both subjects and objects of action, are social agents and are reflective, artificial intelligent agents are only reactive, pro-active and self-analytic. We can add that human agents are also omni-oriented and in(de)finitely perfectible, when artificial agents are only guidable and teachable.

By common activities in this new cognitive environment, human and artificial cognitive agents are gaining new common traits. Both types of cognitive agents are or will be, as we have already shown [11]:

1) individual entities (complex, specialized, autonomous or self-determined, even unpredictable ones), 2) open and even free conduct performing systems (with specific, flexible and heuristic mechanisms and procedures of decision), 3) cultural beings: the free conduct gives cultural value to the action of a human (natural) or artificial being, 4) systems open to education, not just to instruction, 5) entities with "lifegraphy", not just "stategraphy", 6) entities endowed with diverse or even multiple cognitive skills and techniques, 7) equipped not just with automatisms and intelligence, but with beliefs (cognitive, evaluative and affective complexes), 8) capable even of reflection (cultural life is a form of spiritual, not just of conscious activity), 9) components/members of some real (corporal or virtual) communities.

Then, at the social level of existence, natural and artificial forms of being now coexist and co-evolve. By such complex emerging processes, new social systems will appear and maybe a new biotechnical species will develop.

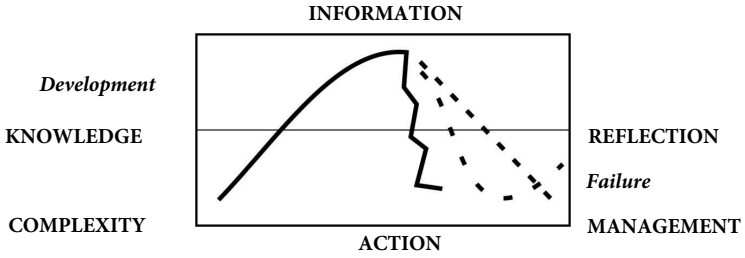
Some reflections, we hope not only of a conjunctural value, can be inspired by certain present technological, economical and even political course of events, which can be illustrated by some graphical representations.

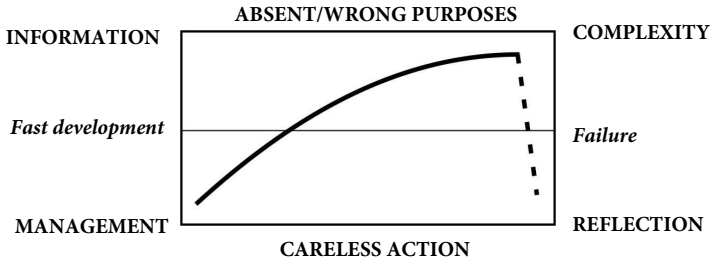
Thus, a few possible future dynamics of social systems can be anticipated depending on certain complex relations between complexity and information, knowledge and reflection as well as between invention and management (see the following figure).

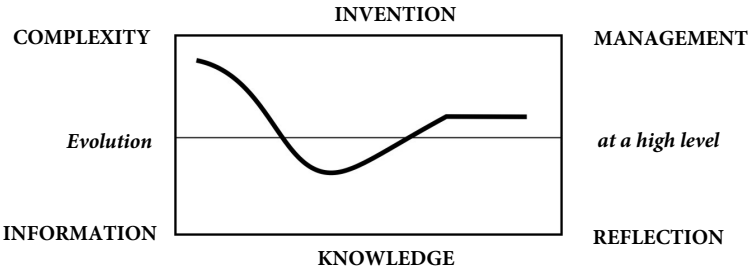
The possible future states of the social system can be anticipated by the study of the foreseeable next critical events and mainly of the necessary action ways imposed by the probable correlations between the complexity degree of the social organization and the levels of information about its structure and dynamics, 2) between our capacity to extend cognition by reflection, as well as 3) the measure of facilities created by invention implementing.

The selected possibilities, as all other veridical predictable evolution ways can be both successive and alternative. Some another, nowadays yet un-conceived evolution possibilities will faster and faster be generated. In our days too, we believe some events are possible only because they have happened.

We can outline here that all forms of social invention [16], not only the technical one, have always as their core the intellectual invention [15], and also that important present forms of joining cognitive and applicative aspects of invention are those of project management and invention management.







If the growth of the complexity degree will further be compensate in the society only by information acquisition, without a necessary reflective component of action, the peril of the absence of a sense of evolution may appear or a wrong set of objectives can be proposed. The acceleration of development toward unknown directions, performed by careless actions with regard to the social and natural environment, may be followed by a total failure.

The serious warning formulated by St. Lupasco in his famous book *The dynamic logics of the contradictory*, can be here reminded, because he anticipates in that work the future of human species, which will have a brilliant but short career, as an effect of the lack of concern to ensure the continuity of its own living conditions; he also appreciate, in accord with many other authors who ask for more "metabolic" technologies, that economy has to become a branch of biology.

On the other hand, complexity generated by structured information (knowledge) and guided by managerial activities strengthened by reflection, on the condition of return to a middle innovation level, based in its turn on a longer life-cycle of knowledge, should lead to a continuous and at a high level carried-on evolution.

References:

[1] Calude, C., Păun, Gh. *The Mathematical Model as a tool and as a point of view*, (In Romanian), Editura Ştiinţifică şi Enciclopedică, Bucharest, 1982.
[2] Constantinescu, P., *Synergy*, *Information and the Genesys of Systems* (In Romanian), Editura Tehnică, Bucharest, 1990.
[3] Dobrescu, R., Iordache, A. D. (Eds), *Complexity Modeling* (In Romanian), Editura Politehnica Press, Bucharest, 2007.
[4] Drăgănescu, M., *The society of consciousness* (In Romanian and English), Artificial Intelligence Research Institute, Romanian Academy, Bucharest, 2007.
[5] Drăgănescu, M., "The Society of Information and Cognition. The Vectors of the Society of Cognition", in Fl. Gh. Filip (Editor), *The Society of Information – Society of Cognition. Concepts*, *Solutions and Strategies for Romania*, p. 43–112, Editura Expert, Bucureşti, 2001.
[6] Isac, I., *Reference points and re-configurations in the philosophy of science*, (In Romanian), Editura Argonaut, Series Philosophy – Sociology – Psychology, Cluj-Napoca, 2007.
[7] Leibniz, G. W., "About the continuity principle", in G. W. Leibniz, *Philosophical Works*, (In Romanian), Editura Stiintifica, Bucharest, 1972.
[8] Maliţa, M. (Ed.), *Systems in Social Sciences*, (In Romanian), Editura Academiei R. S. R., Bucharest, 1977.
[9] Marcus, S. (Ed.) *Mathematical and Semiotic Models of the Social Development*, (In Romanian), Editura Academiei R.S.R., Bucharest, 1986.
[10] Odobleja, Şt., *Consonantal Psychology* (In Romanian, translated from French), Editura Ştiinţifică, Bucharest, 1982.
[11] Pană, Laura, "Artificial Intelligence and Moral Intelligence", in *TripleC: Cognition*, *Communication*, *Co-operation*, 4(2): 254–24, 2006.
[12] Pană, Laura**,** "Co-evolution of Human and Artificial Cognitive Agents", *International Conference on Computing and Philosophy*, University Institute de Technology of Laval and AAAI (American Association for Artificial Intelligence), Laval, France, May 3–5, 2006.

[13] Pană, Laura, (Ed.), *Cultural Models of the Knowledge Society from the Perspective of Technical Culture* (In Romanian), Editura Politehnica Press, Bucharest, 2006.
[14] Pană, Laura, "Finitude and Infinity in the Human Existence" In Romanian), *Revista de filosofie*, Tome XXXIX, nr. 2/1992, p. 481–490 and "Infinity and Absolute" (In Romanian), *Revista de filosofie*,Tome XLII, nr. 2/1995, p. 213–223.
[15] Pană, Laura, "Intellectics and Inventics", in *Kybernetes*, *The International Journal of Systems and Cybernetics*, Volume 35, Number 7/8, 2006, p. 1147–1164.
[16] Pană, Laura, *Knowledge Management and Intellectual Techniques – Intellectual Invention and Its Forms*, in Robert Trapl (Ed.), „CYBERNETIC AND SYSTEMS", volume 2, *Proceedings of the Eighteenth European Meeting on Cybernetics and Systems Research*, University of Vienna, Austria, 18–21 April 2006, pp. 422–427, Austrian Society for Cybernetic Studies.
[17] Pană, Laura, (Ed.), *Modeling of the evolution of value systems under the influence of the technical culture* (In Romanian), Editura *Politehnica* Press, Bucharest, 2004.
[18] Pană, Laura, 2004, "Philosophy of the artificial and the artificial philosophy", in Laura Pana, *Philosophy of Information and Information Technology*, (In Romanian), Editura *Politehnica* Press, Bucharest, pp. 249–324.
[19] Pană, Laura, *Social and Technological Prognosis*, (In Romanian), Editura Politehnica Press, Bucharest, 2005.
[20] Pană, Laura, "The Intelligent Environment as an Answer to the Complexity Problem", IUAES Congress: XV ICAES 2K3 „Humankind/Nature Interaction: Past, Present and Future", Florence (Italy), July 5th – 12th, 2003.
[21] Skolnicki, Z., Arciszevski, T. (2003), "Intelligent Agents in Design", in *The 15th International Conference on Design Theory and Methodology*, George Mason University, 2–6 September 2003, Chicago, Illinois.
[22] Trăuşan-Matu, St., Maraschi, D., Cerri, S., "Ontology-Centered Personalized Presentation of Knowledge Extracted from the Web", in S. Cerri, G. Guarderes (Eds.), *Intelligent Tutoring Systems 2002*, Springer, Lecture Notes in Computer Science, nr. 2363, p. 259–269, 2002.
[23] Trăuşan-Matu, St., Raibuleţ, C., Constantin, O., *Documents Processing with XML and PERL*, Editura MatrixRom, 2001.
[24] Tudosescu, I. "Finality and purpose", in I. Tudosescu, *Determinism and Science*, (In Romanian), Editura Ştiintifică, Bucharest, 1971.
[25] Wierbicki, A. P., Nakamori, Y., *Creative Space. Models of Creative Processes for the Knowledge Civilization Age*, Springer.