

## CREATIVITY AND INFRASYSTEMIC COMMUNICATION - AN AUTOPOIETIC SYSTEM APPROACH

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### Abstract

*Creativity* represents an intellectual function related equally to an individual "neurotic" and "psychic" condition. In support of such an idea, the author approaches *creativity* from the perspective of the *order-disorder (noise)* relation, known as fundamentally characterizing the living systems, also defined as *autopoietic systems*. From this perspective, the developments in brain neurobiology that allow consideration of the brain as a contradictory communication unit are reasons favouring this approach.

**Keywords:** *creativity, autopoietic systems, order, disorder, contradictory communication unit, complexity.*

Considering the notion of "creativity" and examining it from the perspective of a "logic of the contradictory", now visibly installing itself at the basis of a new episteme, we realized that, as a matter of fact, not long ago, *creativity* was considered and defined in a too "simple" manner, more exactly from the positions of a "binary logic" which excludes contradiction when, actually - as we shall try to demonstrate in the following -, this notion may be defined in a more "complex" way, from the perspective of a dialectic monism which, on the contrary, accepts the contradiction and integrates it.

Obviously, the general meaning of the notion of "creativity", given by its Latin etymon, is known, however its scientific sense remains quite large, depending on the opinion of the researchers on the motivations which generate this function, so characteristic to the human being. Therefore, possible attempts made at providing a certain ordering of the variety of definitions would classify the main meanings of the here discussed notion into two important categories: a) *creativity* springs from a "neurosis", being considered as resulting from the suppression and deviation of libido energy. More exactly, it is viewed as a compensation effect of one's individual impulses; b) *creativity*

is a normal process related to one's psychic health condition, carrying out one's desire to know and to learn, a result of individual's ceaseless aspiration to harmonize his being with the surrounding environment and to find intelligent solutions to all problems created in the process of adequacy.

The conclusion to be drawn is that, up to now, the analysts investigating the phenomenon of creativity apparently belong to one of these two classes of definitions: some of them start from the premise of the "abnormal", "neurotic" character of creativity, the others believing in its "normal" condition. However, as the present period of time is characterized by the attempts made at establishing bridges between contradictory aspects, more numerous people assert that the two different perspectives of both types of definitions contain valuable elements, even if neither of them can pretend to explain thoroughly and essentially the process of creativity. The only solution at hand remains, therefore, to find a middle path, capable of bringing together, in a dialectic approach, the two perspectives describing one and the same process.

To this end, heuristic, "complex" patterns should be applied, capable of reuniting the opposites, while evidencing the dialectic process which assures their equally complementary and antagonistic interaction within a coherent structure.

However, if considering that the heuristic patterns still recommended by epistemology should observe the principles of *completeness, exhaustiveness* and *simplicity* (the adequacy to the real being self-understood and accepted on the basis of certain empirical intuitions), one may assert that a cognitive pattern attempting at

reuniting opposite aspects appears, for a still traditional manner of thinking, as an authentic defy.

And yet, as we shall evidence in the following, such patterning attempts do exist, being justified by the fact that the research actually performs the inadequacy to the real world of the "simple patterns", insufficient by their very elaboration conditions for explaining the intrinsic *complexity* of the real world.

Giving up "simple" patterns represents an acute problem of the episteme of today, assuming a thorough modification of outlook, an authentic revolution in science. However, to understand the necessity and importance of such a change, one should examine, even briefly, the condition of the experimental and theoretical research of today.

This will give us the opportunity to observe the significant advances recorded in the experimental field, namely the newly-imagined, more and more sophisticated instruments and devices, permitting a profound exploration of nature. One should nevertheless accept the fact that, while the concrete experiments and investigations, supported by an ever-increasing development of the existing techniques and technologies, put into light an impressive variety of elements and combinations at the level of the objective, real world, the fundamental and deductive research - especially human sciences - is still characterized by a certain inertia, which makes them remain at the level of "simple patterning". Or, as time passes and research advances, one comes to realize that the living world is inconsistent, a feature that should be described as such. To investigate such a world one therefore needs instruments, especially "patterns", more and more "complex", capable of dealing with inconsistency and disorder as elements without which the dynamics of the living world cannot be explained, any longer.

At the same time, we realize that, even if continuously and busily filling the universe with more and more complicated instruments, the human being continues to remain a great mystery. The science of today is only at the beginning of a genuine endeavour of explaining the living structure, whereas the neurobiological and psychic mechanisms of an inspired discoverer

remain still cloudy. Apparently, we are experiencing a period of lucidity announcing the beginning of a new scientific paradigm, in which, challenged equally by our technical successes and failures, we slow down our rhythm, as if interested in finding out the responsible for such a phenomenon. Such a period might be similar to what we usually call "the crisis of the runner": worn out, in a certain moment, he comes to ask himself why he is running, whether his effort makes any sense, but, finally, he continues to run.

A beneficial doubt is characterizing the actual moment of science development, accompanied by some major - even if not new - questions: who are we, how are we thinking? We come to realize our smallness in the universe, its overwhelming sizes and we ask ourselves, in a more and more acute manner, whether our actions, the progress recorded in science are *in favour* or *against* nature.

Such questions are even more important as they are asked in a crucial moment, when humanity realizes that, for long centuries, man considered himself - undeservedly - as the absolute master of the universe. Confident in the force and prestige bestowed upon him by articulated language and by his self-reflexive thinking, he declared himself the supreme instance of nature, organizing the world, for a long time, according to his own pattern, more exactly according to his physical symmetry and order characterizing the logical processes of thinking. He set up an intelligible, yet cold world, based on symmetry, a deterministic order, a world born from narcissistic self-contemplation, in which the coldness of the mirror is still felt.

However, nowadays, the human being has acquired lucidity. Apparently, the two major revelations he experiences in this moment, which gradually modify the image he used to have about himself and about the universe are: a) *the subject of knowledge is always included in the object of knowledge*, while b), contrary to the opinions established since long times by anthropocentrism, the universe, nature, society, the individual represent *systems whose functioning involves "hazard", "noise" and "disorder"*.

In a classical deterministic universe, all is order, symmetry, trajectories that are clearly described and having non-contradictory

directions, order being the universal law inherent to the material world. In modern science, however, the situation appears as gradually changing: "The old universe – informs us Edgar Morin – was installed in the clear-cut concepts of Determinism, of Law, of the Being. The new universe overturns the concepts, transgresses them, and unravels them, forcing the combination of the most contradictory terms, yet without losing their contradictions, as in a sort of mystic communion". The same philosopher asks himself: "How could we have failed to understand that pure order is the most terrible folly ever possible, namely that of abstraction, the most tremendous death of all – the one which has never experienced life?" (Morin, 1977, p. 62).

And yet: how could one explain such a change of outlook, in favour of "disorder"?

Following the year 1900, the notion of "universal order" has suffered successive reformulations, which finally came to destabilize the classical conception of a balanced, symmetrical and deterministic reality.

At the level of the micro universe, by the introduction of indeterminacy and complementarity principles, quantic mechanics unveils an atomic "disorder" which raises a lot of questions.

Before this, Boltzmann, providing a mechanical explanation to the second principle of thermodynamics on the basis of molecular disorder, was to transform the principle of energy degradation in a principle of order degradation.

However, the fundamental question remains the following: is this "disorder" a still undiscovered "order" or is it, indeed, a real *disorder*, necessary and inherent to the physical world? Numerous researches, even if accepting – as already mentioned above – the partially subjective character of knowledge, still feel inclined to consider this disorder as consubstantial to both Bios and Physics.

In 1930, the observation made by Hubble that the light emitted by distant galaxies shifts towards red laid the foundations of the theory of universe expansion, starting from a huge initial explosion. Therefore, the order present in the galaxies of the universe might be a resultant of this initial *disorder*.

On the other side, starting with the sixth decade of the last century, more precisely with the investigations of Monod and Jacob, genetics launches the idea of the "bricoleur" hazard, namely the idea of a disordered, accidental mutation. Monod and Jacob state that "the logic of the living world" is subjected to aleatory and accidental events, the genetic program – more precisely, "necessity" – coexisting with its own "hazard", or – as a function of one's perspective! – being always "undermined" by the latter.

Later on, as early as 1960, von Foerster, discussing the "self-organizational" systems – which are exclusively "living" systems (*vs.* the *artificial* ones) – states that their order is actually built up on disorder (von Foerster, 1960). In 1966, it is the turn of von Neumann to assert that the difference between the artificial and natural automata is due to the fact that the latter ones operate with "noise", an unacceptable situation for the former (von Neumann, 1966). In 1970, Atlan makes mention of an "organizing hazard inside the living systems" (Atlan, 1970, 1972, 1974).

In this way, as time passes, the idea of a *creative disorder* manifested within the living systems is reinforced, a concept undermining the assurances of classical sciences. Nothing belonging to the living world seems possible in the absence of "disorder", "hazard", "noise", "mutation": the basis of an organization capable of creating *order* always assumes an interaction of the elements which, occurring in an initial turbulence, disequilibrium, excitement, are susceptible of establishing accidental links (*organization*), possibly leading to subsequent stabilization (*order*). Such self-organization appears as a leap from the "accidental" to the "necessary", the disordered interactions being gradually transformed into interrelations which, in their turn, once stabilized, will give birth to a complex and relatively stable system whose general properties cannot be identified at the level of the constituting elements (Cf. Morin, 1977).

The order of these systems emerges from a *poietic* (Gr. *poiein*) hazard. However, mention should be made of the fact that *creative disorder* does not remain a simple starting point, more and more distant as the system evolves, yet it is part of the very systemic synchronism,

representing an essential element both for maintaining order and for regenerating the system. As a sort of “retroactive loop” (Morin, 1977)<sup>1</sup> within the living systems, *disorder* generates *order* and reversely: in other words, in such systems, order challenges disorder which, destroying a previous order, actually and always lays the foundations of a new order, a.s.o.

More specifically, an autopoietic system is an open system, characterized by the tension between a *negative* and a *positive recursivity* (Morin, 1973). If the former one permits to the system to maintain its internal equilibrium (homeostasis) through retroaction upon the deviating tensions, in view of their levelling, the latter maintains active the forces generating poietic disorder, which actually assures the viability of the system, its perpetual renewal<sup>1</sup>), as, in their absence, the system may face the risk of degradation through an increased entropy and levelling of its internal temperature due to the uniformity generated by *negative recursivity*.

In this way, the complexity of the living world and, along with it, the necessity for some *complex modelling* - supported by the theoretical contributions of scientists such as Monod, Jacob, Prigogine, Atlan, Maturana, Morin etc. - may be explained.

Resuming the problem of the ratio between *creativity* and the *individual*, we shall begin by defining the former notion, if considering its belonging to the living world as an autopoietic system. This means that we shall be able to identify at the level of its cerebral processes the same “organizational loop” (*order – disorder – order*) (Cf. Morin, 1977). Yet, how would this be possible, once accepting that human personality and all its concrete or abstract realizations are the result of logical thinking, apparently based on order and rigour? Are we permitted to move down the “*sapiens*” from the so difficultly erected pedestal and to add to his image an aspect always considered as unfavourable? Is the *demens* component of human personality - as this is actually here under analysis - a simple waste always deeply suppressed in the primary layers of the encephalon by the neuronal specialization of the neocortex? This approach, accepted as such for a long time, is now viewed as debatable

from the perspective of self-organizational systems, the notion under discussion being nowadays considered an essential element which, together with the *sapiens* compound, provides the complete equation of one’s individuality.

The main sources of “noise” for the self-organizational system represented by a person are formed, on one side, by the very morphology of the encephalon and, on the other, by the “information” coming from the outside world, which actually disturbs the genetic information of an individual, causing regress (Cf. Changeux, 1983).

Along the development of human species phylogenesis, the brain has gradually increased its volume and weight, successive layers being added to it. In this way, neurophysiologists and biologists could evidence, in the morphology of the brain, three well-established levels, corresponding to an equal number of evolutive stages. The first is the *paleocephalon* (the cerebral body), belonging to the reptilian age of mammals – the center of the procreative, predatory, defence of the territory, gregarious etc. instincts, then the *mesencephalon* (the associative cortex), formed simultaneously with the cerebral development of the first mammals – the center of affective manifestations -, and the *neocortex* – the center of logical operations. These morphological layers of the encephalon are connected among them through some axonal terminations which cross them, disappearing at the level of the subcortical centers, towards the thalamus or even up to the motion areas from the spinal marrow<sup>2</sup>.

All these morphological details about the encephalon show that it forms a “polycentric system” (Cf. Morin, 1973), each of the layers submersed to the neocortex being dominated by it, up to their gradual inclusion, along with its fantastic development. However, this does not mean that they have completely lost their initiative. Connected among them by the mentioned axonal terminations, all the three layers of the encephalon occur in a perpetual tension, a perpetual *contradictory communication*. The analytical centers of the neocortex are permanently endangered by the invasion of affective and instinctual manifestations, which

represent a continuous source of "noise" for the processes of logical thinking.

Or, it is exactly this polycentrism present at the basis of cerebral morphogenesis that convinces us to believe that, unlike the traditional views, the brain is a *system with a weak control over its processes* (Cf. Morin, 1973). Its morphological polycentrism determines a low ranking of the components, which are simultaneously *complementary, competing and antagonistic*; accordingly, this weak ranking leaves space for "noise" and "disorder", which explains the instability of the nervous processes and the continuous modification of the systemic individual behaviour. The uniqueness and hyper-complexity of the human being lie exactly in this gathering in a *contradictory communication whole* of these levels of the brain.

As known, beyond the logical thinking of an individual there occurs a whole series of reactions, propensity, impulses which connect him to an ancestral, atavistic world, namely the world of primary living. This ancestral background transforms the individual into a human being subjected to ecstasy and terror, to devastating love and hatred, a being dominated by his own thoughts, capable of uncontrolled transfers from the imaginary to the real world - all these characterized by a much more powerful amplitude of the feeling, comparatively with the other mammals: his dreams are not stereotypical, genetically programmed (as the dreams of predators), his erotic impulses are extremely intense, sometimes related only to pure pleasure, whereas the defence or aggressive reactions are sometimes wholly abnormal, up to crime and even to genocide, and his fears induce uncontrolled panic, with catastrophic effects.

The pressure of instincts and of affectivity upon the analytical nervous centers of the cortex is therefore, even by the constitution and functioning of the encephalon, extremely intense. The equilibrium between the *sapiens* and *demens* parts of the human personality is always precarious, highly unstable, in great danger, an irreversible slipping towards the *demens* component being always possible. The danger is the higher the more - by the very formation and cerebral organization of the individual - the *demens* part may gradually invest the centers of

logical thinking, yet manifesting, apparently, as a *sapiens*, and rationalizing the destructive impulses (Morin, 1973).

However, paradoxically, it is exactly this control "within a hair breadth of death" of the cerebral processes, generated by an insufficient ranking of the encephalon components, that determines the force and superiority of the human automaton, comparatively with all the other artificial devices.

Unlike the artificial ones, natural automata operate - as already mentioned - with "noise" and "error". If, inside a computer, any "noise" leads irreversibly to blockage of the system, if not to its total degradation, in self-organizational systems, "disorder", "noise", "accident" do not always produce their irreversible degradation but, on the contrary, they may contribute to its renewal, generating a *autopoiesis* movement. More than that, if accepting that both the species and the individual have their origin in more or less significant genetic accidents, one should also embrace the idea according to which any mutation and changes in the living world are funded on *disorder*, interpreted as a "source of complexity" (Morin, 1973, p. 129).

Related to genetics, we shall examine in the following the other source of "creative noise", which contributes to the hyper-complex cerebral organization of an individual. This is the *external information*, coming from the environment and determining, as already mentioned, regression of *genetic information*.

Therefore, to the extent to which, by birth, the individual possesses an inborn genetic programme, any sensation, any impulse from the environment appears initially as "noise" factors for such a programme. Until acquiring some cultural competence, the information received from the outside world represents a blockage of genetic information. Any habit is, thus - from this perspective - a *loss* and even a "désapprentissage" (fr.). No one knows precisely how this phenomenon is developed, however, even if the individual possesses, since birth, large neuronal groups specialized for a certain function, in time, with the advance of age, this cerebral redundancy gets reduced through the atrophy and death of a great number of neurons, along with specification of others<sup>3</sup>. At the same

time, stabilization of the connections with other neuronal centers and poly-qualification of the neuronal cells occurs (Changeux, 1974, 1983).

The genetic neuronal fund, which may face any requirement transmitted by the environment, is gradually reduced in processing of external information. A "cultural imprint" is thus formed, established inside a "genetic outer cover" (Changeux, 1983), eliminating all superfine elements of the neuronal network, while also stabilizing a *heuristic competence* of the mature individual. Initially perceived as "noise", the external information will finally lead specialization of the neuronal links and, consequently, to a higher "order" of the system (Changeux, 1983, p. 269).

All these observations permit the conclusion that the center of human spirituality, the brain, represents a hyper-complex system permanently under the assault of disorder, in whose absence it cannot function. The attack is a double-sided one, namely, on one hand disorder is inherent to the morphology of the brain while, on the other, it results from the tensions created between the genetic inheritance and the cultural imprint created through the interaction with the environment.

The *heuristic competence* of an individual is therefore built upon the concentration and reordering of these impulses, received either from the cerebral body and the associative cortex, or from the sensors and contact with the outer world.

The weak ranking of the cerebral subassemblies, the cerebral polycentrism supported by the vertical or lateral contacts established by dendritic ramifications and axonal terminations provoke a highly tensioned equilibrium of the cerebral processes. The source of *creativity* – a most prestigious feature of the "sapiens" – lies exactly in this hesitating equilibrium between "order" and "disorder".

Unlike the artificial automaton, which can operate exclusively with discrete, well-defined units, the natural automaton may also make use of imprecise elements, fragments of images, of "pre-categorially" sensations – if one accepts the term –, elements from which it acquires, nevertheless, coherence and permits the formulations of ordered enunciations. It may

function through successive trials, therefore with "error", and it is liable to corrections<sup>4</sup>. In wakefulness, almost as in the paradoxical sleep, our brain creates fantastic structures, fragments of thoughts, images, sensations, words, as if the dream would be continuing in reality, as well<sup>5</sup>, the background "noise" giving sometimes birth to ideas – when the analogical encounter we use to call "revelation" takes actually place. *Novelty, invention* are generated by processes of logical nature, as well as by accidental situations: "The source of wakeful creativity – asserts the same E. Morin – occurs within an accidental, infinite and multifactorial game of combinations controlled by obsessional elements of variable intensity, when, unexpectedly, the heuristic «competence» ascertains and transforms into a message, idea or formula what had been previously perceived exclusively as diffuse noise (*bruissement*)" (Morin, 1973, p. 138). For completing the definition, one should add that the *idea*, once formulated, changes completely the whole system of heuristic competence, producing its new organization. Any information enters a system of information, certain relations and ratios with the other components of the system, being capable of modifying, by its simple presence, their whole organization and, therefore, the whole system.

To conclude with, *creativity* is characteristic to autopoietic systems – which we all know – its origin lying – an idea which we only presume – in the dialectic and poietic opposition between *order* and *disorder* which defines these system in a fundamental manner.

Therefore, as an epigenetic result of the neuronal processes, *creativity* finds, in its turn, a complex definition, accepted both by those believing in its "neurotic" origin and by those considering it an effect of the "psychic condition" of an individual. This observation can be still refined if underlying that, indeed, *creativity* is a result of one's psychic health state, on condition of considering the notion of "psychic health" as relative, once known that it actually expresses a precarious equilibrium between the *sapiens* and *demens* components of the human psychic state.

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## Endnotes

1. *Positive recursivity* is the one maintaining the self-generating force of the system. It assumes amplification of the "accident", acceleration of a process deviating by itself and for itself. In a certain

- given moment of time within a living system, deviation gets intensified by itself and for itself, being gradually transformed into a tendency, up to finally destroying the order of the system, and changing it, temporarily, into a poietic disorder (once accepted that the interactions it induces will lead to a new organization and, subsequently, to another, relatively stable order). Examples of *positive retroaction*: the explosion caused by the deviations produced in the nucleus of a star, decomposition, initially slow, then more and more rapid, of a corpse, the panic gradually spread among the people of a crowd (Morin, 1977) and, why not, the idea dazzlingly sprung from fragments of thoughts.
2. Mention should be also made here of the fact that, at the level of the six layers of the neocortex, each of these axonal inputs and outputs gets branched, establishing synaptic contacts with the dendritic spines of the pyramidal cells, which transmit the information and the impulses vertically, as well as with the dendrites of the star-shaped neurons, which transmit, in their turn, the information and the impulses horizontally, establishing contacts with other cellular bodies. The connections of the encephalon are extremely complex and, up to now, hardly elucidated (think only that an exhaustive inventory of the cortical synapses would require - depending on the performance of the computer - between 3, 000 up to 30, 000 years of investigations).
  3. With the advance of age, the individual loses an immense number of neurons and neuronal connections, which simply die, with no possibility of being regenerated. Some call this situation an authentic "neuronal hecatomb" (Changeux, 1983).
  4. It brings together, in a unique yet contradictory assembly, the analogical and the digital, an impossible combination for an artificial automaton.
  5. Apparently, involved here are some inhibiting mechanisms which permit day-dreaming, while performing other actions.