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FORM, FUNCTION AND VALUE
 IN THE EMERGING AND SELF-ORGANIZING
 PROCESSES OF THE NATURAL EVOLUTION

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1. Agency and Autocatalysis

In the history of scientific thought many models have been conceived in order to attempt an explanation of the mysterious process of continuous autopoiesis of every living system. Just as Kepler renewed the cognitive ideal of astronomy, breaking the circle that had led from Tolomeo to Copernicus, Prigogine and other scholars, starting in the 1970s, have contributed to breaking the circle of sufficient reason by creating a new mathematical language capable of rendering intelligible the irreversible processes and events that traditional physics had itself saved through phenomenological approximations. In recent decades, Prigogine's insights, the pioneering work of the Dutch physicist Lorentz, the study of chaotic systems, and research in the field of biological complexity theory have gradually led to precise theoretical developments that now make clearer and more visible the intricate network of relationships between dynamics, non-equilibrium thermodynamics, systems biology and information theory [cf. Prigogine & Stengers 1979/1999; Nicolis & Prigogine 1989]. When we find ourselves, for example, in front of phenomena not of pure order or pure randomness, but phenomena pertaining to forms of high organization, we actually find ourselves in an intermediate situation between the complete absence of constraints and the maximum of redundancy.

The optimum organization should therefore be seen as a real compromise between maximum variability and maximum specificity [cf.

Kauffman 1993]. A compromise which can only be articulated according to a dynamic dimension that transforms itself over time in the presence of a deep structure underlying the surface message [cf. Prigogine 1996/2014].

In *Investigations* [Kauffman 2000] and other subsequent works [cf. Kauffman & Clayton 2006; Longo *et al.* 2012], Kauffman faces these intrepid questions and finally identifies the core of the current theory of biological complexity in the key concept of autonomous agent, i.e. the basic unit of a general biology independent of the support, defined as «a self-reproductive system capable of performing at least one thermodynamic work cycle» [Kauffman 2000, 7].

An autonomous agent is a physical system that can act to its own advantage in an environment. A first intuition then is that an autonomous agent must be moved away from thermodynamic equilibrium because work cycles cannot occur at that state: the concept of agent is, in fact, itself a concept of non equilibrium.

In the beginning, it is also clear that the American scholar's objective is to highlight how the definitional circle of this notion is virtuous and therefore harbinger of a new understanding of the concept of "organization" in itself. In short, dissecting this definition will lead us into mysterious territory. Partly, the enigma concerns the answer to a precise question: what is the appropriate mathematical form to describe an autonomous agent? Is it a number, and therefore a scalar? Is it a list of numbers, and therefore a vector? A tensor? According to Kauffman, the answer is negative because the autonomous agent is a relational concept.

Living cells, in fact, inevitably appear as organized wholes. A cell is not a single type of molecule that replicates itself, but a rich web of molecular events through which that whole propagates «approximate reductions of itself» [Kauffman 2000, 43]. Then there is the metabolism, there is the activity of understanding, translation and innovation of different languages that interact incessantly with each other such as, for example, that of DNA, that of the various RNAs and finally that of proteins where the code itself is mediated by activation enzymes (aminoacyltransferases) that load on the appropriate tRNA molecules the correct amino acids in order to translate the code, a code that is able to create the aminoacyltransferase enzymes themselves. Moreover, in the

cell there is the “rustling” of energy that flows simultaneously inside, and through, what we could define as main and secondary labyrinthine pathways that connect the degradation of high energy sources to the synthesis of products that require the addition of free energy. Living cells connect endoergonic and exoergonic reactions in order to produce high concentrations of many molecular species. The link between exoergonic and endoergonic reactions is therefore essential in the definition of an autonomous agent, «that mysterious concentration of matter, energy, information, and that extra something we call life» [Kauffman 2000, 64].

In summary, Kauffman argues that autocatalysis and molecular reproduction are necessary for life, but not yet sufficient [cf. Kauffman 2003]. Life possesses deeper realities, and even more mysterious than the autocatalysis that Ghadiri and colleagues have been exploring [cf. Lee *et al.* 1997].

Well, keeping as theoretical reference the Carnot cycle and Boltzmann’s entropy, Kauffman and other scholars [cf. Hordijk & Steel 2017; Filisetti *et al.* 2012] in an attempt to probe the mysterious essence of life have recently successfully simulated the system of differential equations that correspond to the dynamics of the network of reactions of a virtual molecular agent [cf. Gillespie *et al.* 2014].

The main conclusion we draw from the simulation is that autonomous agents, by coupling one or more autocatalytic and work cycles, constitute a perfectly plausible form, although new, of an open, unbalanced chemical reaction network. Perhaps, behind the mysterious entanglement of self-organization and natural selection there is not only an additional relationship between matter, energy and information, but, as Kauffman guess, a new conception of information is emerging, a conception within which information appears as a “quality” able to generate and regulate the entire system (coextensive relationship linked to a continuous dialectical game among parts), transforming it into a living system and therefore into a cognitive system [cf. Wallace 2014].

We are referring here to the fascinating opportunity to make possible the dialogue between the mystery of the complexity of the living species and the notion of the genesis of meaning [cf. Carsetti 2012; Kauffman 2014]. The bios, in fact, in my opinion, going beyond the

merely quantitative measurement (syntactic level) of the information that is attacked through a binary logic (extensional logic), can be interpreted as an emerging phenomenon intrinsically connected to forms of cognition and intentionality (semantic level) [cf. Di Bernardo 2016], also allowing the review of some enlightening philosophical insights in modern times about the teleological principle of self-organization of living organisms.

2. Know-how, natural selection and self-organization

In the introductory part of *The Metaphysics of Morals*, masterpiece of 1797, Kant gives a definition of what is meant of Life: «Life is called the faculty that a living being has to act in accordance with its representations» [Kant 1797/2006, 21, my translation].

At first it seems that this sentence refers only to subjects endowed with consciousness but if we revisit this definition in the light of Kauffman's theory of autonomous agents, some original aspects certainly emerge. For example, more than two hundred years after the brilliant words of Kant, systemic biology can only recognize the great eighteenth-century philosopher as having merited one of the main characteristics of life: cognition. But that is not all, it will soon become clear how in living organisms cognition is deeply linked to the fundamental notion of intentionality.

The autonomous agents fill the gap that separates the merely physical from that new realm of the merely physical where all living beings attribute themselves a purpose. Semantics comes into play with a purpose; at the molecular level, in fact, according to Kauffman autonomous agents are able to distinguish and select external entities by virtue of a simple chemistry that hosts symbols and signs. To an external entity, therefore, will correspond a modification of the internal state of the agent itself, a modification, that is, that will allow the latter to act in one way rather than another.

Put in these terms and in agreement with the American biochemist, know-how is another way of seeing the catalytic closures that propagate itself, the work tasks, the perception, the recording and the actions that we today recognize as intrinsic to the activities of autonomous agents.

Know-how, in fact, is not outside the processes of self-organization: know-how is the propagating organization itself [Kant 1797/2006, 153-154]. From this point of view, therefore, with autonomous agents also a glimmer of an ethical question arises because the facts are enunciated by the know-that, but the know-how as it preceded the know-that.

In fact, although aware of Hume's injunction, Kauffman believes that in the perspective of the autonomous agent the disgusting-delicious dichotomy is primary, inevitable and, for that agent, of the utmost importance. Without attributing a consciousness to *E. coli* we cannot, therefore, fail to perceive that the rudiments of value are present once autonomous agents exist [Kant 1797/2006, 154-155]. Let us return for a moment to the definition formulated by Kant. Life, understood as the faculty of acting in accordance with its own representations, not only tells us that all living beings are cognitive systems, but also tells us that these organisms act according to internal models creating always new meanings. A representation, in fact, can be read, from a phenomenological point of view, as a re-representation of something. In the term representation, therefore, the internal/external difference and thus the directionality towards the external reality perceived through modifications of the internal state to which it is possible to respond through simple actions is implicit. This tension towards exteriority, only intuited by Kant, in my opinion can be defined as intentionality not related to consciousness or internal purpose [cf. Kauffman 2008; 2016], that is to say as that process strictly connected with the gratuitousness of molecular interactions, whereby meanings¹ develop and, once embodied in actions, operate also allowing autonomous agents to modify to their own advantage the environment in which they live in order to reproduce themselves. Let us think for a moment of the humble *E. coli* swimming against the current in a glucose gradient. According to Kauffman, the bacterium is an autocatalytic system able to reproduce and therefore to act by carrying out one or more cycles of thermodynamic work, but it is also a cognitive system able to create always new meanings and, subsequently, to transmit them through unconscious actions [cf. Kauffman *et al.* 2008].

Bacteria and amoebas, in fact, as we well know, already manifest

¹ At this level we see that in a natural autopoietic system what is self-organizing is the function itself with its meaning [cf. Atlan & Louzoun 2007].

a learning we could say Pavlovian to use Dennet's words; these organisms, in fact, are endowed with receptors that adapt themselves on a constant level of a certain ligand signal and that perceive a change from the present level: here, then, is the outline in biology of a primitive (naturally unconscious) form of representation. Here, therefore, even if we cannot yet speak of the association between a more or less arbitrary conditioned stimulus and an unconditional stimulus, it is possible to infer that these organisms are in all respects endowed with that four billion year old faculty that Kauffman defines as know-how, intentionality not related to consciousness.

3. Function, value and meaning

Therefore, at this point the genius of Kant's intuition appears clearly: life is called the faculty that a being has to act in accordance with his own representations [Kant 1797/2006]. In this definition, however, one aspect remains to be clarified. What is meant by the term "action"? Is it possible to distinguish between the actions of an autonomous agent and the mere events that take place within and around him? In an attempt to give an initial answer to this question, Kauffman [cf. Kauffman 2000] argues that the fundamental difference between what is living and what is not lies in the ability to act (agency), that is, in that process that allows the meaning to manifest itself over time. In fact, according to the American biologist, "the meaning derives from the agency" and it can be studied in nature by referring first of all to the minimum autonomous molecular agents that perform at least one thermodynamic work cycle and that have a receptor for food and poison and are also able to approach the first and move away from the second. Going back to the example of the bacterium, we can infer, according to Kauffman, that a greater quantity of glucose molecules, revealed by a receptor while the bacterium swims or orients itself in the gradient, represents a sign of greater concentration of glucose along the gradient of this sugar. That is a sign "interpreted" by the bacterium through "its oriented movement" in the same gradient.

In the meaning of Peirce [cf. Peirce 1932/1969], then, we could say that glucose acquires a meaning for the bacterium thanks to the recep-

tor of the sign for the bacterium, glucose, and by virtue of its actions: to go up the glucose gradient. The bacterium is the receiver. And in this case it was natural selection that built the molecular systems to achieve it. Without agency there can be no meaning. This is the thesis of Kauffman, interpreter of Peirce. Therefore, whatever the level of evolution in which we intend to recognize it, with the agency not only the meaning emerges in the universe, but also the values, behaviors and purposes. In fact, the evolution by natural selection acting on heritable variants contributes in a decisive way to the genealogical unfolding of the distinction between causal-functional and causal-collateral aspects of organisms². Thus, in the ability of the bacterium to fulfill the biological function of “obtaining food”, without attributing any consciousness to it, it is possible to discern from an external observer the evolutionary beginning of the choice and therefore of the behavior, value and purpose or semiosis, where a sign acquires a meaning a posteriori and in a given context of observation [cf. Kull 2009; Ruiz-Mirazo *et al.* 2017].

The meaning has therefore appeared in the universe with life itself because, according to Kauffman, natural selection has assembled the propagating organization of structures and processes that have led to swim along the glucose gradient for valid selective reasons, glucose has a value for the bacterium. And since obtaining food is the function of this organized behavior, assembled by natural selection acting on the most suitable variants, obtaining food is the purpose of the activity and is the doing or the action of the bacterium [cf. Vattay *et al.* 2015].

In almost agreement with this perspective Freeman showed, among others, how human beings have evolved from simpler creatures and certain behaviors of these older forms are precursors of our intentional behavior which is rich and varied. According to Freeman, the evolution

² In biology, for example, the “heart pumping blood” function is distinguished from other non-functional causal consequences such as “heart noises” by the fact that the organization of processes and structures we call heart was born by virtue of natural selection for its ability to pump blood. Therefore, the heart is ontologically emerging because the very existence of its specific organization of structures and processes in the universe has been constructed by heritable variation and natural selection, which cannot be reduced to physics, where neither signs, nor interpretations, nor errors are logically possible because only events occur.

has given us the ability to grasp intentionality in others without the need to define it. If we see a targeted behavior, we recognize it almost instantly. In zoological literature there are many examples of intelligent behaviour manifested by other vertebrates and also by invertebrates such as octopus, bee and lobster. Darwin, for example, discovered clear evidence of intentional behaviour in earthworms [cf. Freeman 2000].

Of course we can only assume all this by observing the autonomous agent in action. Unity, wholeness and purpose, therefore, constitute, at Freeman's eyes, the basic conditions for the existence of a biological subject carrying meaning. Meanings, therefore, are transmitted through intentionality, that is, through that process by which living organisms change themselves by acting and learning from the consequences of their actions: when an autonomous agent grasps a meaning, in fact, it is pushed towards new behaviours [cf. Di Bernardo 2014].

Well, depending on the complexity of the autonomous agents, there will be different capacities of meaning processing, that is, different channels of communication [cf. Dougherty & Bittner 2010; Emmeche & Kull 2010]. This being so, therefore, according to the perspective outlined before, it is clear that autonomous agents constitute that mysterious place in physics where physics opens up to semantics; however, in my opinion, it is necessary to distinguish in the scale of living beings the actions of simple autonomous agents, such as amoebas and bacteria or more complex ones such as tigers and chimpanzees, from those of *Homo Sapiens*, that is, the only known species so far capable of good and evil.

4. *The preconditions of ethics*

With the *Homo Sapiens*, the most profoundly teleonomic nervous system that has ever existed in the history of our biosphere makes its appearance on earth: only at this level, then, the nature becoming aware of itself actually able to transform actions, that carry meaning, into freely desired acts. In order to fully understand the scope of these considerations it seems appropriate to invoke again the help of Kant who, in *The Metaphysics of Morals*, distinguishes with great insight the term "action" (*Handlung*) from that of "act" (*That*). The action (*Handlung*)

constitutes a change brought about by the subject, that is, by any living being; the act (*that*), instead, is the material content of the action, that is, that of which the subject is the creator [Kant 1797/2006, 47].

According to Kant, therefore, only man performs acts because only man, as the only self-aware being, is able to responsibly recognize an action as an expression of his own subjectivity. At this point, then, we can return to Kantian definition of life. By virtue of the distinction now outlined, it is clear that, at the eyes of the great German philosopher, the faculty to act (*handeln*) in conformity with one's own representations is not only human, but extends to all living systems, that is, to all those cognitive systems which, acting to one's own advantage, are able to reproduce themselves. Well, this brilliant intuition of Kant allows us to reflect also on another relevant question raised by Kauffman. We are referring to the original idea that rudiments of semantics, intentionality, value and ethics are born with autonomous agents and therefore are intrinsically correlated to the notion of life. Such suggestions also allow us to revisit, in the ethical field, Hume's classic criticism that it is not possible to deduce "having to be" from "being" [cf. Hume 1739/2008]. Criticism that laid the foundations of modern ethics, from Kant to utilitarianism, to the present day. Was the English philosopher right? If, according to Kauffman, neither biology nor agency are reducible to physics and if it is true that with minimal molecular agents such as bacteria and amoebas the value enters the universe, then with them the meaning and "having to be" enter the universe. According to the American biochemist, this "having to be" fruit of the agency is not reducible to the language of naked facts, to what "is" of the physical world: the "having to be" is also emerging and not reducible to statements limited to "being" (a teleonomic language is needed to describe it). Although Hume was right in arguing that we cannot deduce "having to be" from "being", at the same time he was also wrong because today we know that values, meaning, actions and "having to be" are real parts of the inventory of the universe: "having to be", in fact, is central to much of man's action and moral reasoning.

Therefore, this approach allows us to dig further into the agent theory as divided by Kauffman. According to the perspective now brought to light, in fact, autonomous agents are surely constructing actors who

always create new meanings, through the realization of unpredictable actions (know-how), but as Freeman denotes all this is possible only because life is essentially assimilation and intentionality [cf. Freeman 2008]: the bios, therefore, at the end of this review, appears as the result of a trans-finished series of adjustments that constitute and unpredictably modify parts of the game itself. So, from these considerations, in my opinion, it is possible to infer that life is not only syntactic language (or a pure system of fixed programs on the edge) and cognition (and, in general, learning), but also appears as a co-evolutive phenomenon in which information is continuously transformed giving birth to a dialectical process of creation and assimilation of new meanings, too: therefore, in agreement with Kauffman and Freeman, the construction of a new semantics becomes more and more urgent, a kind of semantics that is not only of an interpretative type but of a generative type [cf. Di Bernardo 2015].

5. Development of the moral sense and emergence of symbolic thought

According to this new interpretation which can also be found in other works [cf. Sanyal *et al.* 2012], life in general presents itself as an amalgam of the cooperative and simultaneous work carried out by molecules that can be considered as actual components of a dance; we are referring here to the highly orchestrated game in which DNA, RNA and proteins come to play at the same time the roles of actors and interpreters of a mysterious plot [cf. Gerstein *et al.* 2012].

In fact, today we know that the membrane as a result of the calculations made at the level of the cell develops combinations of proteins able to modulate the expression of DNA at the surface level. In this way, it allows the emergence of potentialities never known before, giving the DNA the opportunity to outline new forms of expression at a functional level [cf. O’Nuallain 2008].

From this complex interweaving a new unity of function and meaning emerges. In fact, there is no longer only a machine of inheritance on the one hand and on the other hand an external meaning enclosed, for example, in a simple selective procedure that is given at the environmental level [cf. Jablonka & Lamb 2014].

Now the eyes of the scientist find themselves in front of a complex interweaving within which the meaning comes to operate as an immanent guide for what concerns the primary expression of life while the observer himself comes to be determined by the function in action [cf. Carsetti 2019]. Today we know that the high number of proteins produced in human cells, and the increased complexity that characterizes our systems, depend on the junk DNA that in the new systemic vision becomes fundamental [cf. Li *et al.* 2011].

Recently, in fact, the completion of the genomic sequences of other organisms (dog, chimpanzee, mouse) has allowed to compare them with the human one (comparative genomics) and it has been discovered that intron sequences contain important information for the functioning of our about 22000 genes. In fact, it is not so much the number of genes as the way in which their functioning is regulated to make man man, dog dog and chimpanzee chimpanzee. However, it should be pointed out that for the systemic vision, we are delineating here, is considered a form of reductionism or materialistic monism, even if of a refined kind, the idea that function is a linear process that emerges from the quantitative complexity of interactions between the many components of the system. This is the position, for example, of Crick, and in part also that of Kandel, who, not distinguishing between surface information and depth information, actually reduce the formal causation due to efficient cause, thus inverting the effect (biomolecular syntax) with the cause (biological meaning) [cf. Crick 1958; Kandel 1976]. Moreover, for them the concept of information cannot be separated from that of material support also reducing “quality” to “quantity” and the temporality that brings new functions [cf. Prigogine 1996/2014] to mere linear spatiality [cf. Boniolo 2003].

However, it should be specified here that the concept of biological meaning adopted by Atlan, Carsetti and Freeman implies the notion of intentional causation, where the notion of “intentionality” [cf. Freeman 1999] refers not only to consciousness, but to agency – the ability of every living system to act (by changing itself and the environment around it) for achieving a precise goal: self-preservation. The concept of meaning here is understood as *forma formans*, i.e. as a process of “production of forms” and is applied in several disciplinary fields. As

the meaning of words is connected with a universe of highly dynamic functions and functional processes that operate synthesis, cancellations, integrations (a universe that we can only describe in terms of symbolic dynamics), in the same way, at the level of systems biology, assimilated *schemata* are continuously revealed and constructed and made available for selection, through the coordinated information that penetrates from external reality (at the mathematical level the non-standard models that interpret these processes despite the different disciplinary fields are practically the same) [cf. Longo & Montévil 2014].

Finally, all this intertwines with the mechanisms of internal selection along a “journey” in the regions of intentionality. In other words and in the more general sense, meaning is a relational property of reality by virtue of which an inanimate object changes its state and a living being feels at its level of sensitivity that the message received provides information that is important for its main purposes such as, for example, that of survival. In short, the meaning of a message is the information (in the sense of modification of properties and behaviour) that the message itself produces in the receiver. Therefore, it can be said that meaning becomes an essential aspect of the omnipresent activity in the universe, “emerges” when life appears [cf. Del Re 2006]. In fact, in the living the ability to attribute meaning to messages that come from outside is a condition for preserving identity. It is indeed a sufficient condition, if necessary physical conditions such as the availability of energy in the right form are met. Seen in this perspective, meaning had to emerge progressively in the history of life [cf. Del Re 1992].

For the primordial bacteria many events must have been indifferent and just few answers were enough to be themselves, i.e. to play their part in their environment. When man appeared, the complexification of the universe produced a being capable of constantly questioning the sense of things and events. Trying to understand the world around him, himself, and his own intuition of something that goes beyond the sensitive is a characteristic of the individual of the species *Homo Sapiens*. At this level, complicated messages are transferred with conventional signs such as those used to represent words. When the signs used are single objects or signs that put a person with realities not directly accessible to the five senses they are symbols.

In the world of men, symbols are everywhere, from the equations of physics to the pillars of cathedrals. Since human beings have appeared in the universe, therefore, the fundamental distinction between sense and meaning has taken on value. According to Frege, the “sense” (*Sinn*) of a word is its function in a context, while the “meaning” (*Bedeutung*) is what it “designates”. But there is more and we can see it considering the use of the word “sense” in a question that highlights its intensional aspect. The question is: is it the same to talk about the meaning of life instead of the sense of life? It is clear that we are alluding to what a man’s life represents in the context of his existential and spiritual life, and not to the definition of life, so the word “sense” seems more correct. On the other hand, when the context is man’s relationship with things (extensional or reference level) the concepts of sense and meaning belong to the same perspective. However, one thing is sure: from human biological information emerge unthinkable qualities for other living beings known until now. Man performs “conscious” acts that imply an incalculable degree of complexity: here the biological meaning that at the microscopic level forms the deep processes of self-organization, at the mesoscopic level regulates the sophisticated and stratified information flows that modulate the interaction between endless populations of neurons, thus laying the foundations for the emergence of the self-consciousness [cf. Freeman 2008].

However, it must be stressed that at the level of biological life, thought is not only the result of simple abstraction. On the contrary, it appears to be linked to a precise linguistic mediation, to the interval of well-defined schematism operating on a symbolic level according to a dialectic that involves a multiplicity of factors inextricably linked to each other. To think is not to guess or even simply to order. On the contrary, it is to concretely realize the conditions for an *embodiment*, that is an incarnation on a primarily biological and neural level. An *embodiment* that binds together, for example, thinking about the movement of a body in space and seeing the contours of a neurogeometry at the level of the visual cortex [cf. Petitot 2013]. The mind therefore presents itself as a real articulated distributed and stratified process of spontaneous self-organization, which has as reference the neural connections. To the extent that they are characterized by processes of self-organization, the

cognitive processes are based, therefore, on the gradual construction of an “I-subject” characterized by a progressive work of abstraction, unification and emergence that leads, on the one hand, to the partial creation and interpretation of external reality and, on the other, to the constitution of that same subject as a cognitive subject.³

Since the dawn of civilization the ability of the human being to give meaning to things has been one of the peculiarities that has distinguished our species as being able to produce symbols. Without unity the cognitive process would be impossible because the assimilation of information from the outside implies a unifying subject: transforming the flow of information into something endowed with meaning, in fact, requires the existence of a system of determinations and constraints at the neural level that determine its meaning. The living person is therefore an autopoietic system which organizes itself and at the same time “in-forms” the world: by giving meaning to the world itself, it endows itself with meaning. This explains how it is possible in evolutionary and genealogical terms the passage from consciousness to self-consciousness: it is the cognitive process that, emerging as a process of self-organization, allows the construction of an “I-subject”. In order to explain, therefore, the development of protomnemonic activity (the basis of autobiographical memory) the presence of this subject which is self-knowledge in the moment in which it self-constitutes itself is necessary [cf. Cusinato 2018].

According to this vision, the holistic perspective becomes decisive: in the interpretation of consciousness as a dynamic operator capable of creating order, in fact, suddenly appears a purpose (an ordered totality) incompatible with any vitalistic theory but, at the same time, regulated by a mysterious coupled game of constraints (invariance) and possibilities (the becoming of multiplicity). Therefore, the idea of hierarchical organization demands in itself a finality in so far as it is not possible to separate the structure from its meaning. In the dynamic system precisely

³ Although in a minimal form some more complex animals manifest glimmers of consciousness proportional to their brain structure, only in the human being does consciousness take the form of awareness, i.e. it presents itself as self-consciousness + moral consciousness (conscience) despite the fact that the preconditions of morality already appear with life itself and then develop through genealogy.

within such a multi-level approach, it is possible to trace the preconscious unity of the self, that is, the responsible agent who continuously tries to catch up with the consciously performed actions. According to Freeman, for example, intentionality (deep informational level or semantic aspect of *bios*) is intrinsic to the dynamics of the process of self-organization of every living system and guarantees its unity, gratuitousness and original dimension, as well as independence from matter [cf. Freeman 2000].

From this point of view the very recent results related to this new frontier closely connected with the emergence of a real conceptual revolution at the level of the analysis of that particular *entanglement* of information, biological self-organization, causality and teleonomy show the need to develop a new, non-reductionist naturalistic approach to the problem of the preconditions of ethics able to take into account keeping well distinct the reference planes, not only of the unfolding of the natural forms of human cognition, but also of the genesis of the intentional structures (not referred to consciousness) in autonomous non-human agents, understood as building actors capable of creating always new meanings through the realization of unpredictable actions (know-how) [cf. Kauffman 2016]. We are referring here, in agreement with Kauffman, to the idea that rudiments of semantics, intentionality and value arise with biological systems and are therefore intrinsically related to the same notion of life [cf. Kauffman, 2019]. In fact, the mind, as emergence, intends to grasp in genealogical terms the paths and modalities that determine the selective and coupled action expressed by the meaning, the modalities, in particular, related to the disclosure of the above mentioned semantic apparatus at surface level. It is not a question of discovering new “territories” [cf. Putnam 1975] but to become matrix and arc for their autonomous emergence according to increasing levels of complexity. There is not a random autonomous process already in place (“thing- in-itself”) and an activity of selection and synthesis by means of possible “cutting out”, through, in particular, the use of reference procedures understood as a mode of simple regimentation [cf. Carsetti 2014]. In fact, in agreement with Carsetti, such procedures are functional to the construction of new incompressibility: meaning, as *forma formans*, gives the possibility to realize a holistic anchorage; it is, exactly, what allows the categorial to emerge as “arborization”.

Hence, the opportunity within the theory of complexity to redefine a conception of nature as an evolutionary process of growth of information that allows us to lay the foundations of a meta-biology [cf. Di Bernardo 2019] capable of rethinking the boundaries and the relationship between “being” and “having to be” within a new vision of time no longer understood as repetition and rediscovery, but as the generation and creativity of new structures and new symbolic *schemata* (or systems).

According to this systemic genealogical approach capable of going beyond the mere differentiation of specialist knowledge and, at the same time, of keeping together the procedures and principles, the specificity of the disciplines and the complex language of each area of study must be included in a work of analysis and translation that can finally lead to a synthesis based on the continuous dialogue between different and complementary souls’ knowledge. An example of this is the concept of “integration” which, placed alongside that of plasticity, manages to give account of a broad identity to the notion of intentionality, even if it not all carried out under the sign of conscious rationality. In fact, the idea of integration, proper to an adequate epistemology of complexity, makes it possible to contrast the chaotic image of the centerless mind, proposed by some neuroscientific theories, with the emergence of a unity in diversity compatible with the philosophical position that it is possible to naturalize consciousness and, at the same time, recognize it as a subjective pole as the cornerstone of our conceptions of the world, i.e. the expression of a unitary and continuous subject over time. In this systemic vision, therefore, the notion of plasticity confers uniqueness and irreducibility to the subject who thinks in a continuous circularity between what is invariant (genetic level) and what is constantly becoming (epigenetic level). From this point of view, it is possible to read Kauffman’s proposal to elaborate a precise notion of agency (theory of action) associated with a specific molecular semantics proper to each living being on which it is possible to build an emerging theory of value (beyond the subject-object dichotomy) based on a non-reductionist naturalistic approach. On this line of research, as I have shown recalling the works of Del Re and Freeman, the analysis and development of a specific evolutionary conception of meaning (historical reality “in

itself” and “for me”) as “intentionality not referred to consciousness” and “selective response” that allows to explain in genealogical terms the emergence of ethics and moral sense in human beings has recently come to fruition. Therefore, the development of moral sense would reside in the same evolutionary process of unfolding conditions (molecular semantics) that allow life to emerge as an agency and as a functional closure [cf. Montévil & Mossio 2015] of integrated and self-organizing tasks (Kantian whole). Such conditions when are mediated by symbolic language and thought, i.e. the emergence of a narrative identity as a meeting point between the descriptive and the prescriptive, between what can and must be done, between action and ethics are then translated into ethical attitudes at the human level: the story is exactly what weaves and brings together the fragments of life, emotion and experience that we accumulate as conscious intentional agents in search of the ultimate sense of existence.

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Keywords

Genealogy of Morality; Non-Reductionist Naturalism; Biosemiotics; Intentionality; Autonomous Agents; the Evolution of Meaning; Post-Neo-Darwinism

Abstract

Keeping S.A. Kauffman's agency theory and W.J. Freeman's neurobiology of meaning as a projection period, the contribution through the use of a specific epistemological approach linked to the theory of biological complexity examines the opportunity of interpreting life and cognition as emerging phenomena such as hierarchical levels of self-organization in continuous co-evolution. At this level the relationship between form, function and value becomes a generative biological information of always new dialectical processes of organizational closure. From this point of view, the hypothesis to investigate is that rudiments of semantics, intentionality and value arise with autonomous agents and therefore are intrinsically related to the notion of life itself.

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