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Representation, interrelation and intersubjectivity: Evolution below and beyond objective knowledge

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Abstract

It is recalled that, within the framework of the logic of *the one* and *the multiple*, there are two rationalities: an objective or representative rationality in which each constituent is relative to another or represented by another and a non-objective rationality which is such that *the one* without being divided is immanent in each constituent. Evolution structures the universe, continues through knowledge and, beyond this, thanks to *intersubjectivity*. It is shown that it is governed by the two rationalities which cooperate. Through objective rationality, the constituents of *the multiple* interact with each other and thus become more complex. At each stage of the complexification, an *indetermination* appears as to the direction of evolution. Non-objective rationality, through the immanence of *the undivided one* in each constituent, delocalizes on the scale of the universe the complexifications which are initiated locally.

By objective rationality alone, it is not possible to justify the sense of evolution. It is thanks to non-objective rationality that this evolution becomes creative through the *interrelation* of constituents, which can be extended to the scale of the universe. There is no break in the course of evolution passing through knowledge and continuing beyond, so that the interrelation effect plays a role throughout the whole extent of evolution. It is suggested that the interrelation, in the early stages of evolution before the onset of biological life, can be compared to quantum coherence. Beyond that, when humans acquire self-awareness and become subject, it becomes *intersubjectivity* which opens up responsibility as well as creativity.

Representative or *objective time* is distinguished from *creative time* which is that of evolution, but also that of thought by becoming subjective.

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Représentation, interrelation et intersubjectivité :

L'évolution en-deçà et au-delà de la connaissance objective

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Résumé

Il est rappelé que, dans le cadre de la logique de l'*un* et du *multiple*, il existe deux rationalités: une rationalité objective ou représentative dans laquelle chaque constituant est relatif à un autre ou représenté par un autre et une rationalité non-objective qui est telle que l'*un* sans se diviser est immanent à chaque constituant. L'évolution structure l'univers, se poursuit par la connaissance et au-delà de celle-ci grâce à l'intersubjectivité. Il est montré qu'elle est gouvernée par les deux rationalités qui coopèrent. Par la rationalité objective, les constituants du multiple interagissent les uns avec les autres et, ainsi, se complexifient. A chaque stade de la complexification, une indétermination apparaît quant à l'orientation de l'évolution. La rationalité non-objective, par la présence de l'*un* non divisé en chaque constituant, globalise à l'échelle de l'univers les complexifications qui sont initiées localement.

Par la rationalité objective seule, il n'est pas possible de justifier le sens de l'évolution. C'est grâce à la rationalité non-objective que cette évolution devient créatrice par l'*interrelation* des constituants, qui peut être étendue jusqu'à l'échelle de l'univers. Il n'y a pas de rupture dans le cours de l'évolution passant par la connaissance et se poursuivant au-delà, si bien que l'effet d'interrelation joue un rôle sur toute l'étendue de l'évolution. Il est suggéré que l'interrelation, dans les premiers stades de l'évolution avant l'apparition de la vie biologique, peut se comparer à la cohérence quantique. Au-delà, lorsque l'humain acquiert une conscience de soi et devient sujet, elle devient *intersubjectivité* qui ouvre à la responsabilité en même temps qu'à la créativité.

Le temps représentatif ou objectif est distingué du temps créatif qui est celui de l'évolution, mais aussi celui de la pensée en devenant subjectif.

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1- Introduction

In two previous studies [1, 2] we have distinguished, by referring to the logic of *the one* and *the multiple*, *objective reason* from *non-objective reason*. The objective reason is based on the affinity which exists between the components of *the multiple*. Each component interacts with another so that one projects itself onto the other, that is to say, one can be represented by the other and vice versa. The elements of *the multiple* or of the diverse interact thanks to their common origin, direct or indirect, in *the one* which can only be conceived as asymptotic, in the sense that it cannot be achieved objectively. *The one* is divided among the components of *the multiple*. The process of evolution is established through the interaction between these components, which represent each other and become more complex at each stage of this process. This is interpreted, at least in its early stages, by successive symmetry breakings from an original symmetry which cannot be objectified but which can be conceived as that of something presenting no differential difference in itself. These local symmetry breakings come from an *indetermination* as to the product, then complexified, from the interaction between two components that will occur. This indetermination results in an unpredictable character of the evolution which however can be described by objective rationality *a posteriori*. In other words, evolution takes place in a time that it gives birth to itself, in which it self-represents itself in a story.

In the logic of *the one* and *the multiple*, *the one* is also conceived as being immanent to the different components of the multiple without being divided. It is by this immanence of *the undivided one*, which thus correlates the parts of the multiple, that a rationality, different from objective rationality, is established that we have qualified as non-objective [1]. We have shown that objective reason can be compared to Kant's theoretical reason [2, 3] and that non-objective reason is close to the practical reason of the same philosopher [2, 4]. *The one*, which is not divided, presents itself as the *moral law* in practical reason, while in non-objective reason it is considered to be (non-objective) *Life* which is the source of creation and cannot be reduced to objective biological life. Life manifests itself in a time of which it is itself the source. The distinction between objective reason and non-objective reason is, moreover, close to that between algorithmic reason and non-algorithmic reason, in the sense that the former is the basis of computer programs, while the latter cannot be computerized for computer calculations.

At first, we will see that evolution, if it can be described by objective reason *a posteriori*, presents a character of indetermination in each of its stages when it is considered at a local level, without integrating the possibility of a relationship with the whole universe. After having observed that there is no break in the process of evolution from the beginning to knowledge, made possible by the human neural network, we will deduce that the human mind can acquire an adequate representation of the outside world and its evolution. We will then show that objective rationality alone cannot account for evolution, the creative characteristic of which can only be explained by the cooperative nature of the two reasons, objective and non-objective. From the necessity of the collective in the process of evolution we will be led to suggest that there is a relationship between the *interrelation* of the elements of the multiple in the universe and *intersubjectivity* [5]. Finally, we will distinguish objective, *representative time* (represented

by space and vice versa) from *creative time, in itself*, which is that of creation in the evolution of the outside world and in thought.

2- Representativeness in objective knowledge and evolution.

Kant built his theory of knowledge based on the process of representation [3]. Very schematically we can summarize the representativeness of Kant in the following way: by the senses, that is to say by the sensitivity, the man is in contact with the external world that he represents to himself by various impressions which constitute the variety of phenomena. Through intuition, phenomena become representations that have an affinity for each other while becoming detached from the outside world. The imagination structures the representations given by intuition through their affinity, and also representations of representations, and so on. Understanding, by categories (quantity, quality, causality...), which are concepts from which laws proceed, plays the role of legislator to order the sequences woven by the imagination. These concepts are linked together by a more general idea or concept. This activity of the understanding, which is spontaneous, is represented by the "*I think*" from which results a self-awareness, on which is based the unity of the representation of the object. The final representation will be validated as objective knowledge if it leads to a *possible experience*, that is to say, if it can be confronted with the reality of the outside world.

Before moving on to representativeness in evolution, two important points must be underlined. For Kant, space and time are a priori representations. "Space is a necessary representation, a priori, which serves as the foundation for all external intuitions" [6] and also for "external phenomena" [6]. At the same time, time is a necessary representation "under which all intuitions can take place in us" [7], it is the *form* "of the intuition of ourselves and our inner state" [8]. Kant's time must be distinguished from objective time as it appears to be represented by space and vice versa. We will return, in section-4, to the distinction between objective time and time as conceived by Kant, which is subjective or non-objective in nature.

Representativeness did not start with the man endowed with a mind supported by a complex neural network. The beginning of the universe to which we have access objectively (that is, as we can represent it) by our nature, inaugurates in itself the process of representation. Ultimately, the universe can be regarded as having no differential deviation, as being undifferentiated like the *supreme emptiness* of thinkers in ancient China [9]. This original state corresponds to an absolutely total symmetry. The big bang corresponds to the emergence of time and space, one being represented by the other and vice versa, concomitantly with that of energy in the form of mass and radiation. This event brings differentiation to the universe thanks to this concomitance and to the limit speed of energy radiation ($c \approx 300,000 \text{ km / s}$). We logically conceive that the universe retains in its entirety the total original symmetry, but that locally in space-time this symmetry is lowered. A possible representation of the universe then becomes that of Einstein's general relativity, from which arises, among other things, the curvature of space-time by localized masses.

At the first moments, the universe which spreads out in its space-time in self-expansion preserves its symmetry of origin, as we already underlined. It remains in total indetermination

as it can be realized in states in indefinite number. We can describe the evolution in the first times by the simplified process which we schematize in the following way: different elements, in the form of particles or quantum fields, still undetermined, that is to say that can be realized in a large number of states, appear. Because of their common origin in the asymptotic *one*, these different elements interact to give birth to new components, which can themselves be produced in several states, each one being an entanglement of the states of the interacting elements. Through all of these new states, the original symmetry is preserved. One of the elements becomes represented in the space subtended by the states of the other and vice versa.

The energy aspect plays an important role. On the one hand, the interacting elements, which we consider, are in thermal contact with the rest of the universe which at first is at a very high temperature insofar as it contains energy with a very high density. With expansion this temperature will gradually decrease. On the other hand, the following situation, which we schematize by simplifying it, becomes possible: to each entangled state or group of entangled states, resulting from the interaction, corresponds a minimum or energy well, so that in the space of representation of one of the elements, subtended by the states of the other, appears energy barriers separating wells. Then, the component, which results from the interaction of the elements, to pass from one entangled state or group of states to another will have to cross an energy barrier (in the absence of the possibility of crossing the barrier by tunnel effect). Two limiting cases can arise: either the thermal energy (kT , k , Boltzmann constant and T , temperature) is much higher than the height of the barrier, then the complex system goes from one entangled state to another in an instant very short, so its state is the superposition of the different entangled states so that the original symmetry remains; either the thermal energy is much lower than the height of the barrier and the complex system is trapped for a very long time in one of the potential wells which, by itself, no longer represents the original symmetry, there has a breaking of symmetry. Then the component is realized in one of the entangled states without it being possible to predict which one. There is an *indetermination* as to the realization or the partial objectification of the component.

In the first moments of the evolution of the universe in which there is a very high energy density, the original symmetry remains in expanding space and time. It then breaks locally with the appearance of the first particles or quantum fields which interact thanks to forces which diversify with elementary particles of various natures. It is conceivable that the global symmetry is preserved in the early stages of evolution, despite the breakings of local symmetry, thanks to a homogeneous distribution in space-time of the different energy wells or entangled states resulting from the interaction between elements, each with equal probability. However, it does not seem that in our world of *matter* symmetry is preserved, precisely because of the non-observation (until now) of *antimatter*. With the auto-expansion of the universe, the temperature decreases so much that the height of the barriers allowing the entangled states and the components which correspond to them to be trapped in the wells of energy, i.e. be stabilized, gradually lowers. New species of components are born, such as atoms.

Several conclusions can be drawn from this short, very schematic and simplified description of the first period of evolution. (1) The original symmetry can be *represented* by an indefinite number of possible states which are superimposed and correspond to quantum fields.

(2) Because of the origin of all these states in *the asymptotic one*, the quantum fields interact with each other and become entangled with each other so that one is represented by the other and vice versa. (3) The components resulting from successive interactions become more and more complex by integrating in themselves contributions of the elements or original states. (4) The energy relief coming from interactions and the energy density of the universe play an essential role in the objectification of complex components (by reducing the superposition of the set of elementary states representing the symmetry which thus becomes lowered or broken). (5) At each stage of this sequence of interactions, which causes one thing to be represented by another, an *indetermination* appears, due to the superposition of several possible entangled states.

This representation of evolution implicitly based on quantum physics is only relevant for the first period of existence of the universe (<300,000 years). It shows that the beginning of the universe consists in the representation of one thing by another thanks to the interaction between the one and the other, interaction coming from the common origin of the multiple things in *the one* that we can only reach asymptotically and therefore cannot be objectified. The constituents of the multiple become more complex with evolution in a structure whose state is an increasingly complex combination of elementary states which are superimposed in the original universe. On our planet Earth, which remains in relation to the rest of the universe by different radiations and by gravitation, matter - in the gaseous, liquid or solid state - diversifies into inorganic components and other more structured organic, mainly constituted carbon and hydrogen. From this organic matter arise structures organized in space, but also in time. Living matter emerges, being itself, like inert matter, governed by objective rationality, that is to say biological.

The evolution continues, in particular, in the neural network of living beings, to a more complex state in the human brain. It remains effective for a longer time in man because his neurons, which are in *interaction* with each other, are in a state of organization which retains a certain degree of *indetermination*. Thus, the process of representation between increasingly complex components can be maintained in the neural system. While evolving by itself, the internal organization of man, mainly at the level of the brain, remains in relation to the outside world thanks to the different senses, sight, hearing, touch etc., to which are associated the organs of sensitivity, the eye, the ear, the skin, etc. The signals picked up by these organs are guided towards the neural system with which they interact and which, thanks to this interaction, will be able to represent in itself the outside world: the outside world becomes *represented* inside living beings.

The evolution continues, always through the process of *representation*, in knowledge. For Kant, objective knowledge, or theoretical knowledge, is a *representation* which is established by successive syntheses of *representations* from sensitivity, thanks to the different faculties of the human mind, intuition, imagination, understanding and the reason; as described above. But, although he admits a connection between nature and the intellect, Kant limits the relevance of the process of representation to its effectuation in the mind, by placing the *subject* at the center, a *subject* which synthesizes knowledge of an objective nature. Its representation by the faculties of the mind, validated by the confrontation with possible experience, does not

include the different successive compositions or syntheses which arise from the process of representation in the evolving universe. We can ask ourselves the question: if Kant had conceived the evolution, would he have limited the process of representation to the intellectual activity of the subject?

It is, however, remarkable that the characteristics of representation in the mind are very similar to those discovered in evolution. There is a homology between the two types of representation, and that is why the knowledge constructed through the faculties of the mind can be representative of nature. In this regard, we pay attention to the *indetermination* that appears at each stage of evolution as to its orientation. Comparable indetermination is present at several stages in the development of knowledge. According to the decomposition of the process of knowledge, that is to say of thought, according to Kant, the imagination entangles representations of phenomena, which have an affinity for each other, and representations of representations to different degrees of sequences, to lead to several representative structures or images: there is *indetermination*. The understanding selects, among all its representations of the imagination, the one(s) which will be (will be) conform(s) to the categories which are concepts, like quantity, quality, causality, etc. Finally, the selection of the understanding will be passed through the sieve of the proper reason, that is to say will have to agree with *a priori* principles or ideas emanating from the subject endowed with self-awareness. It emerges from this process of objective thinking that the indeterminations that are present at the different stages are lifted by *the one* who constitutes the subject; this means that this lifting of indetermination is not ultimately objective in nature.

The notion of self-awareness deserves an insight that can be given to us by Levinas in "Totality and infinity", precisely with regard to objectivity [10]. The subject becomes aware of the object, that is to say, to objectify, by detaching himself from its representation, by externalizing it, by putting himself "at a distance from his own being". For Levinas this is possible thanks to the communication that can be established with *the other, infinitely other*, by face to face with the *face* of the other and by the *word*. It's completely non-objective communication. As the philosopher indicates, this relation of the *infinity* of the subject to the *infinity* of the other, as he describes it, is, in a way, an explanation of the last paragraphs of Descartes' "Fourth Meditation" [11]. Descartes acquires the certainty of self-awareness by itself "because of the presence of the infinite in finite thought which, without this presence, would ignore its finitude" [12] or its objectivity. The infinity of Levinas or of Descartes, can be considered as being a figure of the *one* on which non-objective rationality is based which, itself, is the foundation of objective rationality.

If the goal of reflection is to give a representation of nature or of the outside world, the indetermination to which the work of thought would lead can be partially reduced by confrontation with experience. But rationally objective thinking can develop independently of possible experience, as in the mind of theoretical mathematicians, imagining, for example, different geometries which apparently are not representative of the outside world, although they may have the power to being, insofar as the mind has an affinity with the world which is external to it, as we have already pointed out. During the development by the mind of rationally objective theories, that is to say being constructed according to the process of representation, it happens

that at certain stages, and sometimes at the final stage, there are several solutions as rational as possible as each other: there is undecidability as to the solution to this indetermination which is inherent in representativeness both in the mind and in the course of evolution. This state of affairs manifests the *incompleteness* of objective rationality.

3- Interrelation between elements of the multiple and intersubjectivity.

The course of evolution, by successive entanglements or complexifications up to its current stage, does not seem to us to be limited by the framework of objective rationality or representativeness. A posteriori, it is possible to describe the course of evolution by objective rationality, that is to say, by science. Thus, thermodynamics has been applied, as far as possible, to a self-expanding universe open to no exterior, in order to justify a posteriori the evolution of the universe, but facing several problems not yet resolved. It seems generally accepted that the entropy of the global universe increases with time (warning: this time is maybe non-objective, see section 4) or evolution. This means that a few moments ($\sim 10^{-4}$ seconds) after the big bang the entropy of the universe was extremely small. Currently, there are no clear justifications for this weak initial entropy by the theories of relativity and quantum mechanics including the big-bang model [13]. Another fact, difficult to justify a priori, is that over time, entropy increases in the universe in a totally inhomogeneous way: it locally retains a very large deficit, hence the evolution in which we are implied, while globally it seems to undergo an increase. Furthermore, in relation to this evolution, the models of explanation by chance and natural selection, applicable from the stage where biological life is present, do not seem completely satisfactory: indeed, it appears more and more that evolution in the living domain does not involve individuals taken in isolation, but involves processes that take place inside colonies formed by individuals (bacteria, viruses, etc.) of the same species or different species.

Objective reason at the stage of knowledge expands its power, as we have emphasized, thanks to the tension towards *the one* which is discovered in the *self-awareness of the subject who thinks*, not in the sense of Kant for whom the “*I think*” is a representation [3], but in the sense of Descartes for whom to think is to be [14] (see also previous section). However, we can agree with Kant, in that theoretical reason finds its foundation in practical reason [3, 4], like objective reason in non-objective reason. In other words, *the one* who is divided into inert matter and living matter (biologically), on which objective or representative reason is based, tends, it seems, towards an undivided unity. This tension is manifest in man, who, for Kant, is “the connecting core” between the sensitive and the supersensible in an absolute whole [15].

For this philosopher, unity is concretized by the *moral law* to which man must obey freely in order to reach his *destination* which is one [4]. For a phenomenologist, like Michel Henry [16], *the one* which does not divide, while spreading among all humans, is the Life which we qualify as non-objective, which is not the biological life coming, as such, from the divided *one*. Kant’s *moral law* or freely consented duty, like Michel Henry’s Life, translates into *love* between humans inhabited by the *undivided one* [1, 2]. It is, indeed, the *undivided one* prevalent among living beings that allows *intersubjectivity*. These two visions, of Kant and of Michel

Henry, are not in contradiction with that of Levinas, for which reason is based on ethics: goodness, justice, hospitality... [17]. It is important to distinguish non-objective Life from biological life. The latter (biological), like the properties of complex components, isolated or associated with each other, emerged in the course of evolution. But, detached from its emergence on earth and considered at a determined stage of evolution, this life is the object of rational studies involving representativeness within the framework of the science of biology. Non-objective or non-representative Life, which is itself out of time and space, represented one by the other, is inserted, in contrast, in space-time. This is made possible by the indetermination that arises at each stage of evolution, evolution continuing until knowledge and even beyond. By the choice that indetermination allows, Life manifests itself in a time which is that of creation and which develops like the course of evolution.

For Darwin and his successors, the evolution in the field of life is explained by genetic mutations that happen to certain individuals, among them, those who have a chance of survival, are those who will adapt best to their environment. Darwin's scientific work consists of insightful and thorough observations which give an overview of evolution without resulting in real rationality. From our point of view, on the one hand, the mutations which happen by chance materialize the indetermination which opens the door to evolution, on the other hand, if the individuals who adapt to the environment are those who have mutated, this means that this environment has changed itself, otherwise those who would have the best chance of survival would be those who would not have mutated since already adapted to this environment. So we can deduce that there is a concomitance between the change of the environment and the mutation of the individual. But this concomitance is certainly not entirely coincidental, it reveals a collective element. We can then ask the question of the origin of this change in the environment. It is likely that this change it is not due, itself, only to biological type mutations, but more generally to causes which also apply to the material and inert world. If, as we will develop further, there is a certain coherence in the universe, and not only contingency, we can think that there is a correlation, probably weak, between an isolated genetic mutation and the change of the environment. We note, moreover, that this collective aspect of the evolution in populations of bacteria or viruses has been clearly highlighted by biologists [18]. In other words, evolution would result from a cooperativity between the liftings of *indetermination* and from an *interrelation* between individuals or components in the universe, and not from the liftings of indetermination, which would all happen by chance and isolated [19] (this does not exclude that random and isolated lifts of indetermination have existed or exist, but they do not contribute as a whole to evolution). It is not obvious that this *interrelation* is *representative* in nature, that is to say, has emerged from *the divided one* which is recomposed. We suggest that it is rather of a non-objective nature, comes from *the undivided one*, that is to say a manifestation of the non-objective Life. This implies that evolution results from a cooperation between *the divided one*, which is recomposed, and *the undivided one* immanent in the universe.

Non-objective Life is close to Bergson's "life (or vital) impulse", which "consists in a requirement of creation" [20]. It can be compared to the vital breath (*qi*) or to the "animating" power (*shen*) of ancient Chinese thinkers [21, 22]. As we have just emphasized, Life does not manifest itself by increasing by isolated transformations, such as for example mutations, but

results from a collective transformation involving a large number of liftings of indetermination thanks to the interrelation between them.

The manifestation of Life results in creations whose succession spreads on a time which is that of the history of the universe. It follows that Life itself has been immanent in the universe since its beginning, before biological life had emerged. So, the question arises of its manifestation in non-living matter since the beginning of evolution. In other words, how does non-objective Life manifest itself in the physics of matter insofar as it inevitably became involved in evolution when only non-living matter still exists? The question comes back to this: how can *the one* be multiple while manifesting itself *not divided* by the multiple? We can answer that *the originary one*, already multiple in itself, is a superposition of elementary states, not objectified, in indefinite number which are unified by their interrelation, that is to say by the *coherence* which is a characteristic of *the one*; then, *the one* can manifest itself as *undivided* if a trace of this coherence persists when the elements are objectified concomitantly with space and time which represent each other.

This trace of the *originary coherence*, that is to say of the undivided one and of the non-objective Life, which accompanies objectification, is reminiscent of the phenomenon of entanglement, undoubtedly highlighted in recent years, that is a direct consequence of quantum mechanics. In order to explain the relationship that can exist between the quantum coherence from which entanglement stems, and the coherence resulting from *the one*, we simply describe the phenomenon of entanglement in the case of two particles in the same coherent state. Quantum coherence implies that when the two particles separate by making them, for example, move away from each other, they remain in the same quantum state which is the superposition of elementary states. If we make a measurement on one of them, that is to say if we reduce the indetermination coming from the superposition of the elementary states, then, from the determined or objectified state of one of the particles we obtain information on the state of the other particle, state which is thus itself partially determined or objectified. This information, which is obtained on the state of the second particle after the measurement on the first, comes only from the coherence which unites the two particles, that is to say from the conservation of the entanglement of their states. It is not obtained by an exchange of information which would propagate from the first to the second at the speed of light. The partial determination of the state of the second particle is absolutely independent of the distance between the two particles and it occurs instantaneously following the measurement on the first.

The comparison between quantum coherence in the two-particle system and the coherence that characterizes *the one* present in the multiple seems to us deserves to be explored. The entanglement which is postulated between the superposed states of the different constituents of the multiple in indefinite number must be compared to the entanglement between the states of the two interacting particles, which persists when these particles separate. The objectivation which arises from the lifting of indetermination by a breaking of local symmetry is comparable to the measurement applied to one of the two particles, which determines the state of the latter. The consequence which can be deduced from this comparison would then be that the lifting of local indetermination would result in a partially delocalized lifting of indetermination of superposed coherent states. This lifting of localized

indetermination is undoubtedly imperceptible, given the indefinite number of coherent states which are superposed, but which can be decisive. In our opinion, this partial delocalization of objectivation by breaking of symmetry is a manifestation of the *undivided one*, that is to say, of non-objective Life in non-living matter.

Coherence, which is the basis of quantum mechanics for extremely more limited systems, cannot be divided, like *the undivided one* or non-objective Life; at the *foundation* of quantum mechanics for isolated systems, it is, according to our hypothesis, extended over the universe without being fragmented, while not being of a nature totally identical to this quantum coherence which would be the reduction of it by materialization. It implies that the transformations which have the power to lead to objective biological life, even if they are initially localized, can have a certain degree of delocalization, that is to say imply a collection of constituents. Thus, we find, thanks to coherence, which is the manifestation of *the one* at the origin of the universe, in the logic of *the one* and *the multiple*, the cooperativeness that we required to account for the creative aspect of evolution. Faced with this hypothesis, it can be objected that coherence is immediately destroyed by the process of decoherence, given the vastness of the universe. However, this objection does not seem obvious to us insofar as, on the one hand, the universe keeps its unity by having no exterior to itself and, on the other hand, the form of coherence to the scale of the universe cannot be fully described by quantum coherence, as we suggested above. At this stage of our research, we specify that we limit our reflection to objective rationality and to non-objective rationality (the latter being concerned with coherence) without prejudging the nature of *the one*.

As we have already pointed out, there is no break in the process of evolution from the beginning to knowledge and even beyond. Evolution accord with objective rationality a posteriori, but is not predictable because of the indetermination that arises in each of its stages. We have just suggested that it is creative thanks to coherence, which characterizes *the undivided one* at the origin and which inhabits the universe in evolution. This coherence manifests itself by an imperceptible delocalization of a lifting of local indetermination on a set of constituents. It seems reasonable to suppose that the interrelation between the constituents is reinforced, when these become more and more complex by being constructed of a multitude of elements according to a self-organization where coherence has its share, as in the living matter, more particularly between constituents of the same nature.

At its recent or current stage, evolution takes place more particularly among humans who, with many abilities, have acquired through complexification, to which can be attributed a degree of coherence, the awareness of acting and thinking. In addition, the humans become provided with self-awareness, that is an awareness of being inhabited by Life, in which the freedom (made possible by ever-present indetermination) is inherent. Thanks to this self-awareness, they become subjects who themselves participate in the evolution which remains creative, open to the unpredictable, that is to say to *the other*. The collective character, which we have highlighted in the past evolution, is essential at the human stage. As Levinas, who was interested in the relationship between time and *the other*, has shown, creation can only come

from intersubjectivity [5]. The time of evolution becomes the time of human history. The human community is then, to a large extent, responsible for evolution. This responsibility should not consist in enclosing oneself in past history and, on the basis of this alone, in determining the future, but in opening oneself, through intersubjectivity, to unpredictable novelty, to that which is *all other*.

4- Representative time and creative time.

In the previous sections it appeared that there are two different times: an objective or representative time, represented by the space with which it subtends the space-time; and creative, unrepresentative time. This second time can be said *in itself* in that it is the creation itself, more precisely, in the terms of Kant's transcendental aesthetics [3], that it is the "form" (which is not representation) of this creation. It separates the present from the accomplished past and the still undetermined future. In other words, creation unfolds a time which is its "form". Obviously, this time can be projected onto representative time in order to give a measure of it, but this measured time is not itself creative time, but simply its projection on, or its representation in, space-time . Two points must be considered in order to better define this creative time: the relation of the time of creation to *the one*; the relationship between the internal time, as Kant sees it, and the external time of creation in the universe.

In the previous section we insisted on the observation that the creative nature of evolution does not come from isolated mutations, without correlation between them, but rather from correlated transformations. The self-temporalizing creation, as we have described, is due to the infiltration of Life, which is the direct manifestation of *the one*, in the cracks of the objective world. These cracks figure the indeterminations which follow one another over time. This interrelational nature of creative evolution, which is a manifestation of *the one*, is the reason why creative time is the time of *the one* who inserts himself into matter by infiltrating through its cracks. It therefore appears that the time of creation, *in itself*, results from the cooperation of the non-objective with the objective.

This time *in itself* is distinguished from objective time which is represented by space (and vice versa) to which it is, for simplicity, proportional with a coefficient which is the speed of light ($c \approx 300,000 \text{ km / s}$ in the vacuum) , and to which it is linked, in a more complex way, by Einstein's theory of relativity. This reciprocal representation of time by space at the foundation of science, and more specifically of physics, removes all character *in itself* at this time.

The ideas which have just been exposed do not in themselves reflect reality, they come from the human mind, but they are not disconnected from it insofar as the human mind comes from the evolution itself and that, as we noted in section-2, there is a homology between the internal processes of the brain and the processes of external evolution. The relationship between the constituents of the multiple of the outside world is homologous to that which exists between representations and then between images in the mind. Thus, is justified the power of the human mind to represent the objective rationality of the outside world itself. The representative time internal to humans, and perhaps to animals more generally, is that of the biological life which

is perceived through its various processes, time which is in direct correspondence with the time of space-time, that is to say, with the time of classical physics, both, the time of biology and the time of physics, being ultimately the same.

The correspondence between external creative time and internal creative time is a little more difficult to discern. As we already noted in section-2, time is for Kant, the *form* "of the intuition of ourselves and of our inner state" [8], that is, of consciousness that we have of *ourselves*. But it is right to be *in itself*, as Descartes had the intuition by declaring "I think, I am", in the sense that to think is to be *self-aware* and not to represent oneself. The thought process has a certain homology with external evolution in that it develops to become creative through the indetermination which is inherent in the thought process itself (see, for example reference [13]). Thanks, on the one hand, to this homology between creative evolution and creative thought, in other words, between the time of evolution and the time of thought, and, on the other hand, to the direct participation of thought of evolution, we can conceive that self-awareness justifies the character *in itself*, not representative, of the creative time of evolution.

From the above, it appears that non-objective rationality cooperates with objective rationality in the creative evolution, that is to say, in the creation of an objective world governed by objective reason. However, the creative nature of the evolution of the objective world gives it an unpredictable nature which is directly related to the indetermination inherent in the birth process of the universe. So, if science is the science of nature, we cannot eliminate creative time from it. It is the recent proposal by physicist Nicolas Gisin to include this creative time in physics [23]. This idea of the involvement of creative time in physics follows the development, at the beginning of the 20th century, of a new mathematics, called intuitionist, in which, the time, of a creative nature, is included [24]. The main initiator of this new mathematics is the mathematician L. E. J. Brouwer who considered that mathematics is a creation of the human mind, taking place in (creative) time [24]. The unpredictability is pretty obvious in quantum physics, in which the indetermination is inherent. Gisin insists that unpredictability also characterizes classical mechanics because of the "hypersensitivity to initial conditions" of most dynamical systems which, then, exhibit chaotic behavior [23].

5- Discussion and Conclusion.

In this article the ideas are developed within the framework of the logic of *the one and the multiple*. The rationality that governs the self-organization of our universe and of our knowledge is based on the interconnection of the constituents of *the multiple*, whose origin and source lie in *the one* in which they meet. This interconnection is established in two ways, either by the division of *the one* of which each of the parts inhabits each of the constituents, respectively, or by the immanence of *the undivided one* into each of these constituents. In the first case, it manifests itself through the interaction of the components; in the second case, it is the presence of *the undivided one* in each of them which unites these constituents. By the interaction of two constituents, one of the two is represented by the other and vice versa. By the immanence of *the one*, each constituent keeps within himself the memory of the state of origin in which he was unified with the others.

The interaction between the constituents, the origin of which is found in *the asymptotic one*, justifies objective or representative reason in the sense that things cannot be achieved *in themselves*, but only by reciprocal representation of one by the other. Objective reason structures the reflection which leads to scientific knowledge; moreover, it justifies, a posteriori, the evolution of the universe. As we have argued, there is no break between the process of evolution and that of objective knowledge which is itself representative. At each stage of evolution, and even of reflection, an indetermination arises as to the direction that will be taken. This is the reason why evolution can only be objectively justified a posteriori. Indetermination is the cause of the incompleteness of objective rationality.

The immanence of *the one* in the different constituents does not result from objective rationality, it is other. Furthermore, it is logically inconceivable that *the undivided one* has emerged in the course of evolution; he must be present in the universe, by himself, from the beginning. This means that by its presence *the undivided one* participates in evolution from its first stages, from the stage where the universe can be described by physics. We have suggested that *the undivided one* can represent itself at the origin, by reducing itself, as by being in a totally *coherent state* which is a superposition of elementary states, in indefinite number, in coherence with each other in the mean of quantum mechanics, that is to say entangled with each other. In this hypothesis, coherence is not destroyed by the dispersion of the elements in space-time which is itself developed by this dispersion itself. It follows that a lifting of indetermination by a breaking of local symmetry, according to the process of representation, is imperceptibly delocalized thanks to the coherence of the many states which are superposed. As we have pointed out, this reveals the cooperative nature between *the divided one*, at the base of the representation process, and *the undivided one*, manifested by a coherence that can extend over the entire universe. In our opinion, it is thanks to this coherence, which is a property of *the undivided one*, that the evolution can become creative and not be totally subject to the representation on which objective reason is based. However, two remarks should be added. (1) We expect that, given the indefinite number of elementary states that are superposed at the origin, the delocalization of the lifting of indetermination is barely perceptible and is limited in space, but is decisive in the end; (2) We can consider that coherence is not limited to our world, but can encompass many galaxies.

The suggestion of participation in the evolution of *the undivided one* under the form of coherence, which *after reduction* is comparable to quantum coherence, brings us to another suggestion. As we have just noted, *the undivided one* co-operates with *the divided one* in evolution. This means that there would be a complementarity between both, that is a complementarity between non-objective rationality and objective rationality. Now, non-objective rationality is, according to what precedes, in relation to quantum theory, while objective, that is to say representative, rationality is at the foundation of the theory of relativity. So, the relationship between quantum theory, in its *foundation*, and the theory of relativity is it not a relationship of complementarity, like the relationship between non-objective rationality and objective rationality and like, ultimately, that between *the undivided one* and *the divided one*? This last suggestion requires clarification: as evolution, the science, even hard, as is physics, is rationally objective only a posteriori; it progresses, in its foundations, through

creation which manifests itself through the discovery of new principles, thanks to the non-objective rationality.

In the course of evolution, the constituents of the multiple become more and more complex, like the processes of representation themselves. From a stage, some become endowed with a biological life which can be described by objective rationality and whose emergence is objectively justified only a posteriori after the implication of the coherence coming from *the undivided one* who creates novelty. With the emergence of biological life, it is preferable to describe the evolution basing oneself on the characteristic of (collective) interrelation of the constituents rather than starting directly from the coherence which is the apparent cause of it.

The creativity that manifests itself, without prejudice to objective a posteriori rationality, stems from the involvement of *the undivided one* in the course of the universe made possible by the indeterminations that arise in the dynamics of it. The creative character comes precisely from the *otherness* of *the undivided one* relatively to the world into which this fits. Creativity appears in the form of coherence, comparable, by reducing it, to the quantum coherence which manifests itself at the beginning of the universe. Non-objective Life, which represents *the undivided one* and whose essence is to grow more and more, plays a fundamental role in the evolution of living species which is described by the models of Darwin and his successors. The creative tendency in all living species cannot be justified simply by objective rationality, it stems from the collective characteristic which is brought to the process of evolution by the coherence and, apparently in a different way, by the non-objective Life.

We have distinguished objective or representative time from creative time. Representative time, which is the time of objective rationality, is represented by space and vice versa. Creative time, on the other hand, is in itself, it is creation itself, or more exactly the "form" of this creation. These two times are not disconnected from each other, in the same way that non-objective rationality is not disconnected from objective rationality. The creative time of the external world is connected to the subjective time, which is that of creative thought, by the homology which exists between the process of the evolution of the external world and that of thought, these two processes being involved in that of generalized evolution.

The cooperation between non-objective rationality and objective rationality, or the entanglement of the two, leads in evolution to man endowed, not only with a consciousness of acting and thinking, but also with a *consciousness of oneself*. Thus, man is a *subject* who becomes charged with a responsibility in evolution itself, remaining open to Life, that is to say to true creativity. This charge will be exercised by promoting an ecology open to indetermination, in order to make room for innovation for the benefit of all. Life will especially develop through intersubjectivity that is a source of creation through openness to *others*. Evolution then merges with human history when it is creation.

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