



## **On the Nature of Consciousness. On Consciousness in Nature.**

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### **Abstract**

The study of consciousness has considerably increased in the last few years. Research has been mainly focused on its neurological aspects, but the intrinsic nature of consciousness is usually completely neglected. In this contribution, we present a new onto-epistemological general metamodel that we developed to interpret complex partly autonomous systems (like living systems). Our metamodel is not based on the usual space-time-energy framework of mainstream science, but involves two elemental categories: the domain of objects and the domain of relations. Furthermore, and most importantly, we show that the combination of these two aspects gives rise to the system as a holistic, self-referential and existential entity. We then use this onto-epistemology to interpret the nature of consciousness, which, in this model, is a meta-physical, meta-relational self-referential entity.

**Keywords:** consciousness, mind, ontology, epistemology, system dynamics

## **1 Introduction**

After having been a taboo in science for decades, the subject of consciousness has now become a tolerated – if not fashionable - subject of scientific research. But there is no consensus yet on a precise meaning of the term “consciousness”.

Most models refer either to the physical-neurological aspects or to the functional aspects of consciousness. In the first view, it is believed that consciousness can be reduced to the properties and organization of neurons in the brain. Some insights on the relation between the anatomy of the brain and consciousness have come, for instance, from the examination of injured neurological patients.

Secondly, in the cognitive sciences, several functionalities are often associated with the presence of consciousness; the most frequently mentioned are:

- the ability to discriminate, categorize, and react to environmental stimuli
- the integration of information by a cognitive system
- the reportability of mental states
- the ability for a system to access to its own internal states
- the focus of attention

- the deliberate control of behavior
- the difference between wakefulness and sleep

David Chalmers (Chalmers, 1996) qualifies the problems connected to these functional aspects of the mental activities – the cognitive consciousness - as the "easy problems". The "hard problem", on the other hand, the so-called phenomenal consciousness, is the problem of the subjective experience. There is general agreement that experience arises from a material (biological) basis, the brain, but numerous questions remain: why and how does it arise? Why are other organs not conscious? Why do some physical processes give rise to experience and others do not? What is their nature? What is the nature of the phenomenal subjective conscious state? What is the difference between quantifiable physical states and processes, and qualitative non-measurable subjective experiences (qualia)? All these questions are part of the “hard problem”.

The heart of the present communication is the idea that the difficulties met in understanding consciousness will not be solved within the empirico-analytical ontology and epistemology of mainstream science. We suggest instead that the usual space-time-energy framework of the physicalist sciences, the so-called c-g-s world (centimeter-gram-second and energy), be replaced by another set of basic categories: objects, relations and wholes.

On the methodological level, the usual confrontation between the results of concrete experiments and the predictions of mathematized theoretical models is not adequate to understand existential subjective entities like consciousness.

Before describing our metamodel and its application to the conscious state, we will briefly mention the main types of models that have been proposed in the literature.

## **2 Models of Consciousness Proposed in the Literature**

### **2.1 Background**

We base our presentation of the models found in the literature for the concept of consciousness on the categorization proposed by Chalmers (Vimal R. 2009)).

The metaphysics of consciousness can be divided into two broad categories:

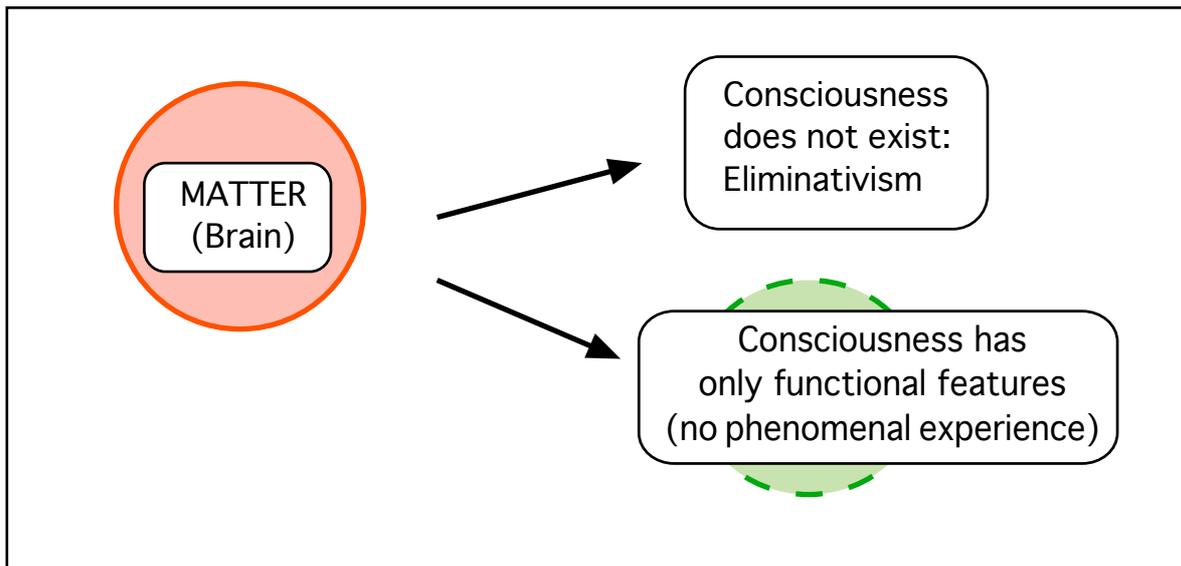
1. The reductionist-materialist views which consider that there are only physical processes in nature; no expansion of the physical ontology is needed.
2. The non-reductionist views, which consider that consciousness involves something irreducible to physics; the physical ontology therefore requires expansion or reconception.

Two features of consciousness have to be explained by a pertinent model:

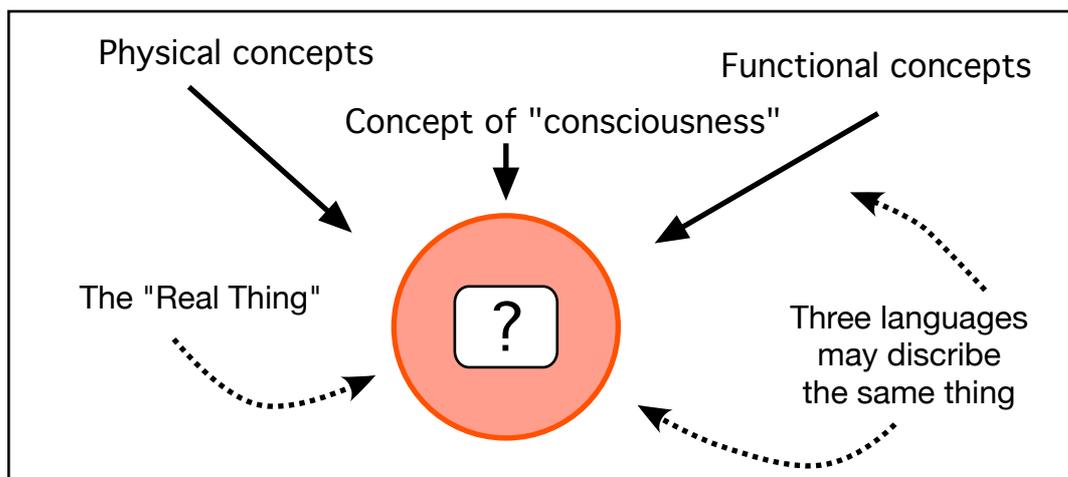
1. Its functions, i.e. the easy problems (for example discrimination of stimuli, report of information, monitoring of internal states, control of behavior, etc.)

# Three Materialist Views of Consciousness (Very Simplified Pictures)

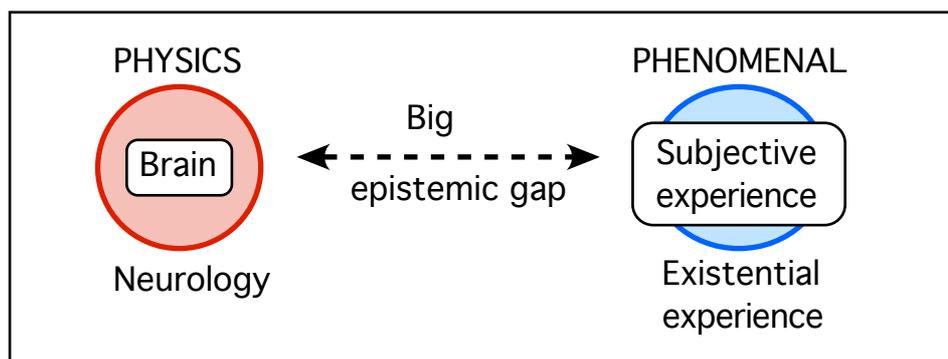
## TYPE A MATERIALISM: ELIMINATIVISM OR ANALYTIC FUNCTIONALISM



## TYPE B MATERIALISM: THREE TYPES OF CONCEPTS MAY APPLY TO THE SAME ENTITY



## TYPE C MATERIALISM: BIG EPISTEMIC GAP BETWEEN PHYSICS AND EXPERIENCE IS IN PRINCIPLE CLOSABLE



2. The associated experience, i.e. the hard problem (for example subjective experience, bodily sensations, mental imagery, emotional experience, occurring thoughts, etc.).

In the next section we present a very brief list of the main types of materialist-reductionist models and of non-reductive models (in which natural processes cannot be reduced to physics).

## 2.2 Three Materialist Views

According to D. Chalmers, materialist models can be divided into three types:

1. Type A Materialism. In this view, consciousness does exist but only in its functional, operational, capacities. There is no perceived feeling of “being there”. In addition to this “analytical functionalism” view, other more scientist authors claim that the subjective experienced feeling is only an illusion. This philosophical attitude is therefore called eliminativism. By the same token the “hard problem” is also eliminated!
2. Type B Materialism. Here the thesis is that although the phenomenal (subjective) states are necessarily identical with the physical states, the phenomenal concepts have no a priori connection with the physical or functional concepts. We may later discover empirically that these two sorts of concepts refer to the same thing: they are two different ways of talking about the same thing.
3. Type C Materialism. It is recognized that there is a deep epistemic gap between the physical (neurological) and phenomenal (subjective, existential) domains but it is in principle closable.

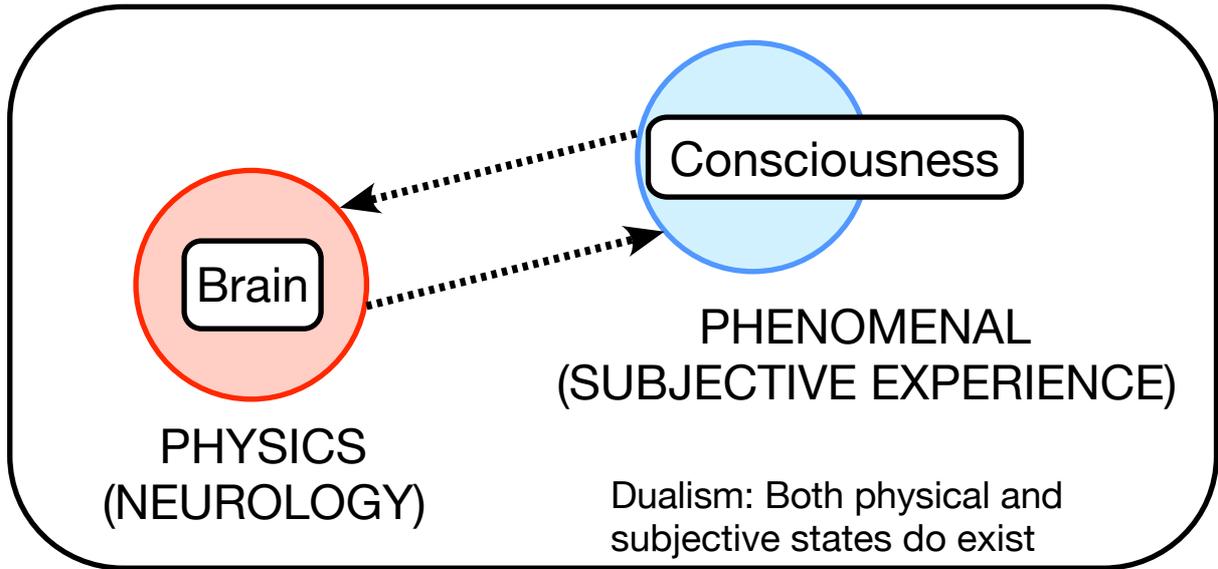
## 2.3 Three Non-Reductive Views

The non-reductive views require a modification or an expansion of the usual space-time-energy framework of the mainstream Newtonian science. It is assumed here that not only physical processes occur in nature but also events that cannot be reduced to material processes. Non-reductive views can be divided into three types:

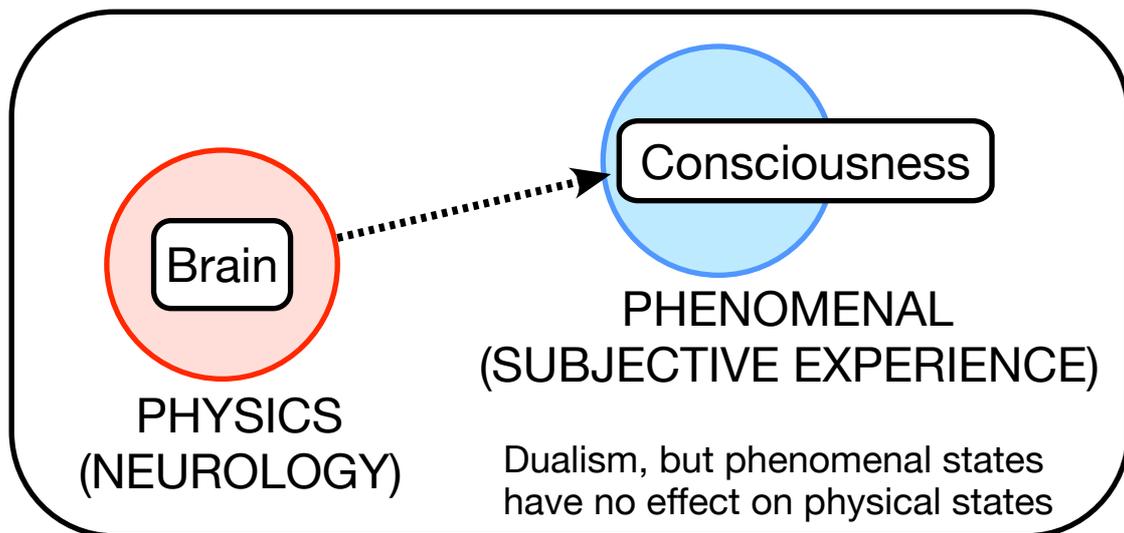
1. Type D Dualism. In this strong dualist model phenomenal (subjective) states do exist as well as physical states. Furthermore, this view is strongly interactionist in the sense that physical states can cause phenomenal states and phenomenal states can cause physical states.
2. Type E Dualism. According to this view, also called epiphenomenalism, phenomenal states do exist and are caused by physical states but they cannot influence the physical states. Phenomenal states are some sort of collateral effects of physical processes. Phenomenal properties are ontologically distinct from physical properties. Accordingly, consciousness, as a subjective experienced phenomenon, is irreducible (to physical processes).
3. Type F Monism, also called pan-proto-psychism, is the view that consciousness is constituted by the intrinsic properties of some fundamental

# Three Non-Reductionist Views of Consciousness

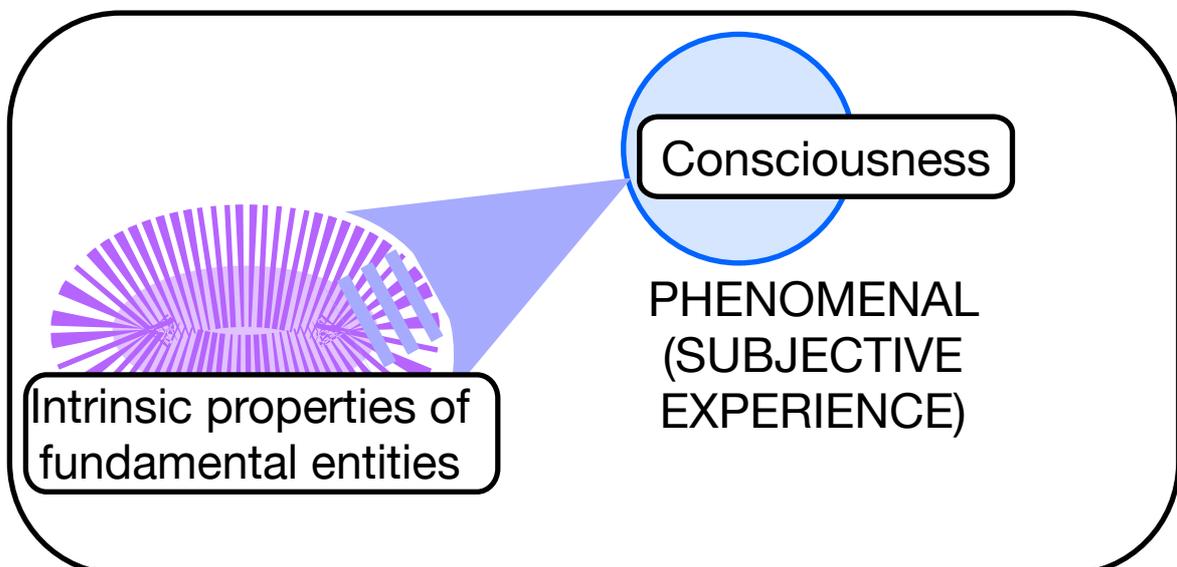
## D. TYPE D DUALISM: INTERACTIONISM



## E. TYPE E DUALISM: EPIPHENOMENALISM



## F. MONISM OR PAN-PROTO-PSYCHISM



pervasive entities. In this view, phenomenal or proto-phenomenal properties are located at the fundamental level of physical reality and, in a certain sense, underlie physical reality itself.

In summary, the models of consciousness proposed in the literature are based on two competitive ontologies: the first one believes that only physical processes occur in nature (materialism), the second one admits that some fundamental immaterial entities remain that are not reducible to physical processes (dualism, monism).

We will present in the next section the main features of our metamodel that not only distinguishes and integrates the physical and the relational aspects in nature but also includes a third dimension that is absent in the usual space-time-energy of the Newtonian paradigm, i.e. the irreducible existential dimension of the wholes (or systems) that emerge from interacting objects.

### **3 Main Features of a New Metamodel for Complex Autonomous Systems**

#### **3.1 Background**

The essential novelty of our work is the distinction between two worlds within nature: the world of objects (like in physics) and the world of relations (like in cybernetics). Indeed in the mainstream Newtonian mechanist view, there is only one world, the material world we apprehend through our senses, the so-called centimetre-gram-second (cgs) world, the place where everything happens. For many ordinary situations, this framework is largely sufficient. But when it comes to study complex and partly autonomous systems like living organisms or conscious beings, the mechanist epistemology is totally insufficient. As we shall see, our (apparently more complicated) way of interpreting complex systems simplifies the understanding a) of the logic of life and b) of the nature of consciousness.

The purpose of our metamodel, whose details can be found elsewhere (Schwarz, 1997a, 2004) is not to describe things like in mechanical sciences, i.e. pre-existing objects (atoms in physics, individuals in social sciences, etc.); but to describe systems, i.e. more or less complex entities defined as sets of several (at least two) interacting parts. Our metamodel is a general epistemological framework through which detailed models can be built for particular complex situations, as can be met for instance in ecology, in biology, in social sciences or in cognitive sciences. These systems are not only characterized by dense networks of interactions, feedback loops, emergence of new structures (chaotic, non linear systems) and temporary high sensitivity to noise; more fundamentally, we suspect that, in principle, they cannot be understood in the mechanist paradigm where it is supposed that the changes can be computed by a permanent set of invariant equations as can be done in astronomy for example. In complex systems, the equations themselves can change with the changes in the concrete system. In these cases we propose that a completely different approach be used.

As we can observe, the notion of “real” immaterial relation is hard to assimilate for people used to the physicalist point of view of the mechanist framework where only material things are real. Even more difficult to apprehend scientifically are the concepts of whole, of existence or of being, which are traditionally associated with religion and philosophy, or, in the best case, with the "soft" sciences. Whatever their names, science now needs meta-physical and meta-cybernetical notions that refer to a system as a whole and to its holistic, unitary and existential characteristics. We hope our metamodel is a useful step in this direction.

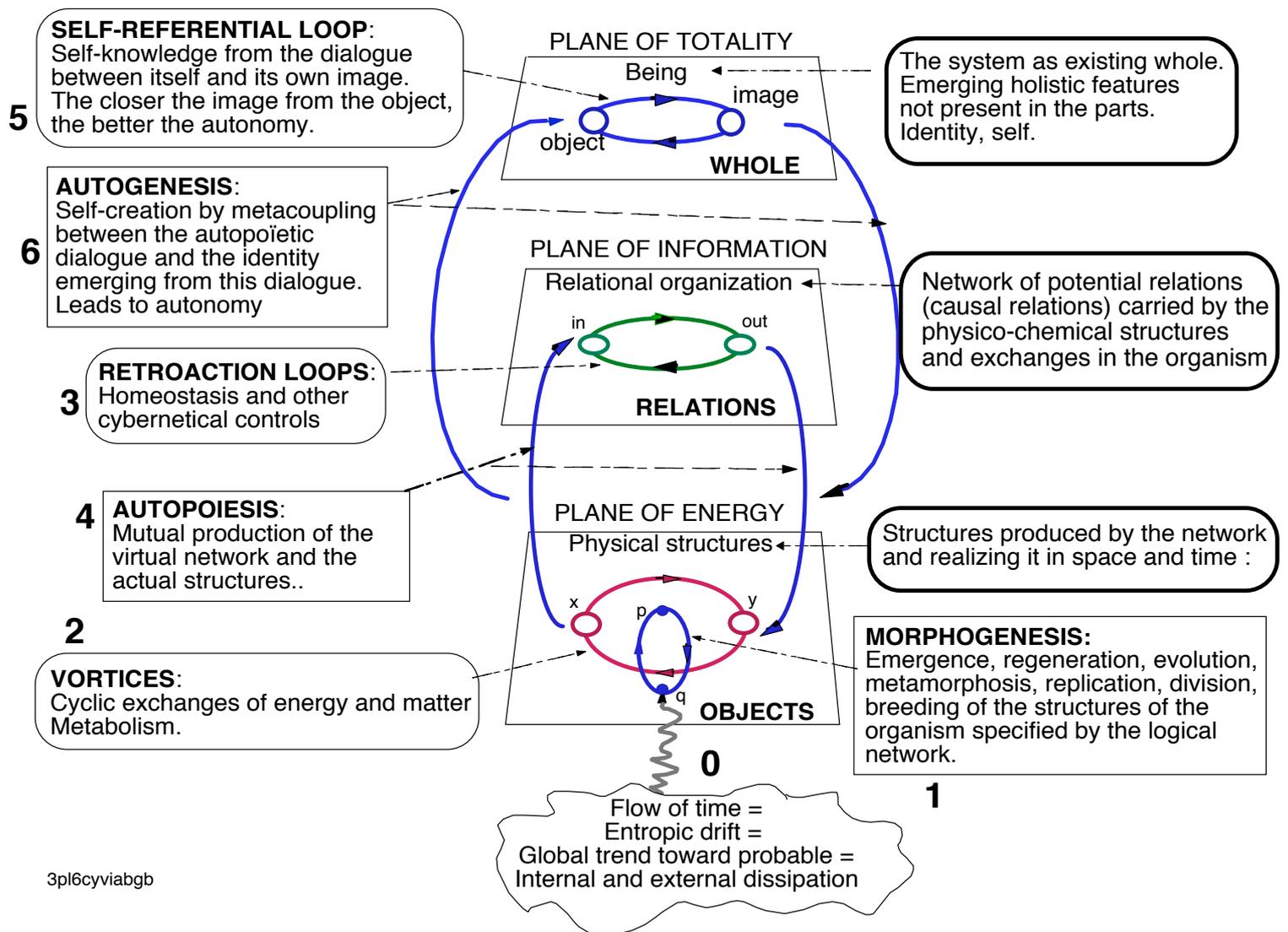
We think that consciousness cannot be understood clearly without a deep change in the onto-epistemological foundations of the framework used to interpret it. In our view, the "hard problem" is not a neurophysiological or a computationist scientific problem, but an ontological and epistemological problem. The accumulation of unsuccessful research in the fields of biology and of information science to clarify the nature of consciousness is an indication of the need of a new fundamental dimension.

As mentioned earlier we will not go into the details of our metamodel which has been exposed elsewhere but recall here only the points useful for its application to the problem of consciousness.

### **3.2 The Initial Ingredients of the Metamodel.**

Searching for the most common configuration of things when we observe nature, we start with a very simple and general configuration where two components are in relation (additional figures can be found on the Internet at Schwarz 1997b) that we call a system. It can represent either any pair of interacting objects or a subject observing an object. Drawing general conclusions from this trivial starting point, we propose that any existing situation is given by couples of interacting components, which constitute an existential whole, a "system".

As already mentioned, the usual Cartesian-Newtonian view of an objective "reality" whose evolution is determined by some eternal "laws", is replaced here by a holistic approach where what happens emerges from a deep ontological dialogue between two inseparable and nevertheless irreducible aspects: the physical world of the things, which we can perceive by our senses and which corresponds to the usual world of physics (energy plane in figure 1), and the cybernetical world of the network of potential relations immanent in the system (information plane in figure 1), one of which can be actualized during the next round in the dynamics of the system. This potential field can be symbolized, in the framework of a theory, by symbols or algorithms, like numbers, parameters, differential equations, logical constraints or geometrical figures. But one should not confuse the symbols of a theory, which are human-made artefacts, and the immanent potential relations existing within the system, which are part of nature. The system as an existing whole emerges from this permanent ontological dialogue between its real physical aspects and its immanent virtual potentialities. It is represented in figure 1 by a third plane called the plane of totality, which is the most important of the three planes since it is the plane of existence. The usual mechanist Cartesian approach with the movements on one hand and the invariant laws on the other, is a particularly trivial



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### Figure 1. Structure-Organization of Viable, Complex, Partly Autonomous Systems.

In this metamodel, the viability of complex dynamical systems evolving toward autonomy depends on the presence of six cycles.

Three cycles, one in each plane, are responsible for the stability of such systems:

- recycling of matter in the physical plane (vortices, loop no. 2)
- feedback loops in the cybernetical plane (retroactions, loop no 3)
- self-reference dialogue between the object and its image in the holistic plane (loop no. 5)

Three other cycles contribute to the perennity of such systems by giving them some plasticity or adaptativity in case of change in their environment:

- morphogenesis or self-organization (loop no 1 between the environment and the physical plane)
- autopoiesis or self-production (loop no. 4 between the system's structures in the physical plane and its immanent network of relations the cybernetical plane)
- autogenesis or self-creation (loop no. 6 between the autopoietic cycle and the holistic plane (the system's identity))

The effect of entropy is symbolized here in the input no.0

Autopoiesis (Zeleny 1981) is a kind of ontological loop between the structure of an organism and its network of internal potential relations. According to Varela and Maturana, autopoiesis is the logic of life.

Autogenesis is the ultimate cycle that represents the impact of the system as a whole on its own self-producing (autopoietic) dialogue. In other words autogenesis (self-creation) is what makes a system autonomous: it is able to create its own laws.

case of the general case depicted here, where the laws can change when the movements proceed.

### **3.3 The Structure-Organization of Viable Systems**

Starting from the primordial system and the basic epistemology indicated above in section 3.2., we were led to a detailed general structure–organization (see fig.1) for complex viable systems (see references given above for the details).

Broadly speaking, two types of systems exist in nature:

1. Systems whose dynamics obeys the second principle of thermodynamics, i.e. the drive toward increase of entropy; these systems evolve from order to disorder or uniformity. Most inorganic systems are of this type.
2. Systems (that, of course, also follow the second principle) whose dynamic is mainly driven by their internal organization; these (neguentropic) systems' survival is due to the presence of several kinds of closed loops which give them the ability to compensate the curse of the entropic trend toward disorganization, destructuration or destruction.

Systems, that have non-entropic dynamics and numerous feedback loops like self-organization, self-regulation, self-production (autopoiesis) or self-reference cannot be understood if we reduce them only to their trace in the usual space-time-energy framework as it is done in mainstream science. They have to be studied in the physical plane (plane of energy) together with their trace in the relational plane (plane of information), and their emerging holistic identity in the existential plane (plane of totality). We discuss in fig.1. the structure-organization of these viable systems. Living organisms and conscious cognitive beings are examples of such non-entropic viable systems.

## **4 Application of the Metamodel to the Problem of Consciousness**

The structure-organization of complex systems shown in figure 1 that we have called a metamodel has also much deeper implications in the ontological and epistemological levels. It implies that the usual physicalist framework of the mainstream sciences is not sufficient to interpret nature. If the Newtonian physicalist paradigm is adequate to make models of simple inorganic objects and processes, living organisms and conscious living beings cannot be fully understood by reducing them to a bunch of interacting pieces of matter in space and time.

### **4.1 Living Systems**

A plant or an animal is a coherent entity which is not only driven by the second principle of thermodynamics but has also an internal organization that allows these living organism to last and to survive even in an aggressive environment. Living systems, according to Varela and Maturana, are characterized by an internal logic called

autopoiesis, i.e. self-production (Zeleny, 1981). The autopoietic cycle can be seen in figure 1 as a loop (loop no. 4) between the organism as a concrete physico-biological structure and the network of its internal relations. The survival capacity of living organisms is due to this mutual production of the organism by its immanent network and of the network by the concrete organism and its metabolic processes. This example shows that autopoiesis, the logic of life, is much better understood if the physical structure of the system and its relational organization are placed in two different, distinct and inseparable ontological “worlds” as it is done here.

## 4.2 Conscious Systems

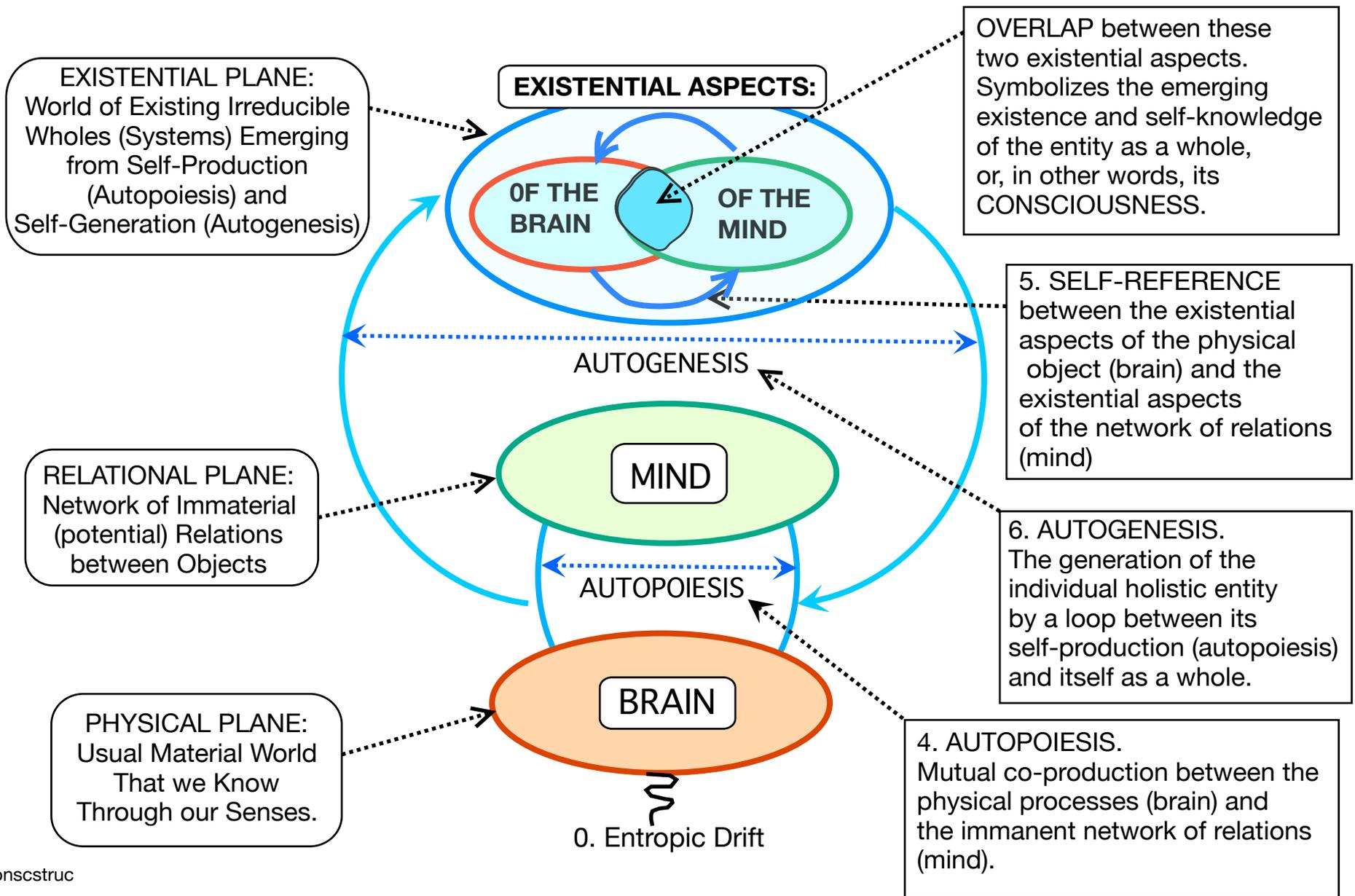
Let us now turn to consciousness and its nature.

As can be seen in figure 1, the self-production cycle of the living organism (autopoiesis, loop no. 4) is itself connected to the produced organism in the plane of totality, by another cycle called autogenesis (loop no. 6). Autogenesis, which can also be called self-creation, means that the system as a whole can intervene in its own production process, which is exactly what autonomy means: the capacity to determine its own laws.

The last important feature, which is crucial to prospect the nature of consciousness, is the organization present within the plane of totality, or existential plane. In a fashion similar to the loops found in the other two planes: recycling vortices in the physical plane, feedback loops in the information plane, what we find in the existential plane is a loop between an “object” and an “image”. The object represents the organism found in the physical plane and the image represents the immanent network found in the relational plane. To be more precise, the “object” in the plane of totality is not the object as a physical object but its existential dimension, its trace at the level of existence. In the same manner, the “image” in the existential plane is not the network of cybernetical feedback loops present in the relational plane, but represents the network as an existing part of what is, of its presence at the ontological level.

A closer study of the nature of consciousness can be done with the help of figure 2. On this figure, only the main features of the cognitive system that are useful to interpret consciousness have been reported.

1. The brain, obviously the concrete organic aspect of the cognitive system, is situated in the physical plane.
2. In the relational plane we find what we have called the mind. Usually this term is associated with thought, knowledge or purpose. Here, this word refers to the immaterial network of the potential relations within the brain. Incidentally, we suspect that the functioning of the brain, i.e. thinking, knowledge and intentions, is indeed strongly dependent on the internal network of potential – but actualisable – relations.
3. In the existential plane, we have here a more detailed picture than that of the preceding figure. We have again the existential aspects of the object - the organism - and of the image - the internal network - as well as the self-referential loop between these two entities. In addition, we have the overlap



**Figure 2. The most Important Features to Interpret Consciousness and its Nature.**

The general structure-organization for complex partly autonomous systems represented in figure 1. is applied here to the case of living conscious systems, like human beings. See more details in section 4.

between these two existential aspects, which means that the system exists as an emerging unitary whole where its originally physical and relational existential dimensions are now undistinguishable.

This overlap in the existential level between the concrete organ (the brain) and the immaterial network that rules its functioning (its “laws of movement”) means not only that the system is (partly) autonomous but also that it is self-knowing: there is a sort of continuous reflexivity between its actual state in the physical plane and the network in the information plane that determines its dynamics.

This reflexivity between the object (the brain) and the image (the mind) is precisely what we are looking for in this work: consciousness, i.e. self-knowledge.

## **5 Final Remarks.**

### **5.1 Summary of the Onto-Epistemological Metamodel**

In this paper we have presented a general metamodel constructed on a new ontology and a new epistemology based on three categories: objects, relations and existential wholes, instead of the usual space-time-energy framework of the Newtonian paradigm. This new metamodel, proposed to interpret complex autonomous systems, allows a new understanding of the elusive notions of life, identity and consciousness:

- The signature of living systems is a cycle called autopoiesis, or self-production, that generates the mutual production of the concrete organism (here the brain) and its internal immaterial network of relations (the mind).
- The creation of the organism’s existential identity is due to a loop called autogenesis connecting the autopoietic cycle to its product, the organism.
- The emergence of the individual’s consciousness is symbolized by the overlap produced by the self-referential loop between the existential dimension of the brain and the existential dimension of the mind.

### **5.2 Ultimate and Open Question.**

Is our (and other animal’s) consciousness a new feature of the world that appeared during the evolution of life on our planet or is it the manifestation of a more fundamental feature, or principle, of the world at a global scale?

As we have seen in this approach, the origin – and nature – of the phenomenal subjective consciousness is the existential self-reference between the material objects (here the brain) and the immaterial relations network (here the mind). In a more general perspective, it could be phrased as an ontological dialogue between the objects of physics and the laws of physics.

A question often raised by specialists of the Big Bang is to know if the laws of physics preceded the objects or if the objects and the laws appeared together. In the latter case, the logic would be similar to the self-reference described above for phenomenal

consciousness. In this case, consciousness would not be an accidental event in history, but the manifestation of a deeper feature of nature. More research is needed to clarify this basic question. Progress in this quest may help consciousness evolution.

## References

- Chalmers, David J. (1996). *The Conscious Mind: In Search of a Fundamental Theory*. Oxford University Press.
- Schwarz, E., (1997a), *Toward a Holistic Cybernetics. From Science through Epistemology to Being. Cybernetics and Human Knowing, Aalborg (DK), Vol.4.* pp 17-49.
- Schwarz, E., (1997b) <http://www.autogenesis.ch/Res1997.html>
- Schwarz, E., (2004), *Is Consciousness Reality or Illusion? A Non-Dualistic Interpretation of Consciousness. AIP Proceedings CASYS'03 - Sixth International Conference, Computing Anticipatory Systems, Liège (BE), August 11-16, 2003,* pp. 425-434
- Vidal, Ram L. P., (2009) *Meanings Attributed to the Term "Consciousness". Journal of Consciousness Studies,* May 2009, Vol. 16 pp. 9-27.
- Zeleny, M. edit (1981). *Autopoiesis. A Theory of Living Organization.* North Holland,