

OCTOBER 2023

INFORMATION COSMOLOGY AND CONSCIOUSNESS

On the nature of consciousness

This issue is an submission to an essay prize on “Is consciousness fundamental?” which is part of a research project on Panpsychism lead by Philip Goff. The main statement of this essay is that consciousness is universal and fundament because it is equal to information potential which is present in all living, material and immaterial objects.

Concept Relativity

Systems Ontology

The laws of information dynamics

Systems Cosmology

Consciousness is information potential

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Guide into the October 2023 Issue

This issue of “The Human Capacity” - magazine for the imagination – describes a theory on consciousness. Consciousness is a substance called information potential associated with all living and intelligent beings and all material objects, microscopic, macroscopic and of the cosmos itself. This statement is the result of a philosophical exercise in which metaphysics, physics, information theory and philosophy of the mind are merged into a new cosmology. I will first introduce a new physical theory called Concept Relativity. The theory of Concept Relativity defines the concept of an Information Universe. An Information Universe is a metaphysical object that has two different conceptual representations: that of a black hole and that of a universe. The theory assumes information is an ontological category, creating thereby a mathematical (meta)world without physical concepts. Mind and reality are unified by the concept of information and quantized by information of the concept.

Because all objects are systems of information a general information theory must become a systems ontology. From Thermodynamics, and Quantum gravity I will deduce 5 fundamental principles that ‘moves’ information in our systems ontology. These five meta-laws of Information Dynamics are built around a key concept called: Information Potential. Applying these meta-laws on our Information Universe results in a new type of cosmology: A Systems Cosmology. It is a qualitative representation of a symmetric, scale-invariant hierarchy of systems of information.

Finally, I will interpret consciousness as information potential so it ‘becomes’ an omnipresent characteristic of being that pervades all objects of the universe and the universe itself.

Keywords: Systems theory, Ontology, Relativity, Information, Consciousness, Cosmology, Multiverse, Reality, Emergent properties

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Information, cosmology, and consciousness

1. Concept Relativity

Since Darwin, many physicists consider metaphysics obsolete. It is in my view one of the main reasons physics hasn't been able to develop a unified theory of Quantum mechanics and Relativity Theory. John Wheeler wrote in 1970 a famous article [1] on the strategy how such a theory should be developed. I fully agree with Wheeler's assumption, that unification will be found by 'It from bit'. The cause of all matter must be found in information. But it is not enough to affirm that all things are informational. Unification can only be achieved if we also change the 'bit' into a 'metaphysical it'. Information must be substantialized metaphysically. And additionally, as a consequence, all thing in the world are conceptual representations build by some thinker/observer. All conceptuality is relative, which is a generalization of the relational interpretation of quantum mechanics.

1.1 The Information Universe Hypothesis

My starting point, 40 years ago, was a bold idea called the Information Universe Hypothesis (IUH). The idea was released by the fact that within the interior of a black hole, the radial space coordinate becomes 'time-like', and time becomes 'space-like'. As a physics student I took this conceptual hybrid for granted and just 'did the math'. As a philosophy student the concept puzzled me deeply. How can something look like time, but not being time? Should we not skip this conceptual hybrid and think of time-like as just being time? What would be the consequences of this 'conceptual flipping'? How would the internal world of a black hole change if we switch time and space? My first assumption was that there should exist something that stays invariant under flipping concepts. My second assumption was, the conceptual flipping image must result in something we could understand, something like our universe. Therefore, my starting hypothesis was that the black hole interior must also have a conceptual appearance of a universe. Because the black hole and the universe appearances must be consistent with each other, there must exist a mapping of concepts. There has to exist a concept transformation that connects both representations. This process of concept flipping is not just a mind game, it is real. The stuff that stays invariant under swapping concepts is a real thing that I will call an 'Information Universe'. So, generalizing this basic idea the Information Universe Hypothesis states that all universes are black holes and all black holes are universes.

If we observe the Information Universe "from the outside" conceptual continuity predicts a black hole interior with a singularity in the middle that will destroy all matter. Yet another kind of thinker situated inside the interior of that same Black Hole sees a completely different thing; the thinker sees a universe. both thinkers cannot communicate because they live in different conceptualized worlds. The second thinker does not see the universe of the first observer, which lays *before* his Big Bang.

The physical theory of Concept Relativity concerns the nature of reality and the relationship between reality and the human thinker. It is a successor to General Relativity theory. In Einstein's relativity theory a concept like space and time can be bent, shortened, or even become time-like, but they remain the same concept, while in Concept Relativity concepts transform into other concepts. This kind of transformation can only be meaningful if there exists something behind these concepts that remains unchangeable and invariant. That is where philosophy is needed. We need a nonphysical theory that describes a metaphysics (what is behind things?) and a cognitive theory (how can we know something?). The 'thing' that stays invariant cannot be a physical concept because all conceptuality belongs to a representation thought by a thinker. Concepts are the 'things' that change in a concept transformation. So, what can stay unchanged in a concept transformation? The obvious candidate is bare mathematics. The 'unchangeable thing' is a meta-world of pure abstract mathematical objects and relations which is not directly visible or accessible but will only take shape through conceptual representations by intelligent beings which add 'conceptuality' to mathematics. These conceptual representations are, as in Plato's cave parable, a kind of reflection of a true, purely mathematical reality. The conceptual representations represent a specific physical interpretation of a mathematical 'reality' which is created by interaction of thinker and its reality.

Mathematical variables or structures have no physical dimension. The meta world is without physics. I will therefore call it a metaphysics, in de direct sense of the word 'meta' (= behind) physics. Mathematics becomes metaphysics. There are physicists that will probably consider the idea that mathematics is metaphysics, an extra reality 'too much', philosophers will find it 'too less' because mathematics is almost

empty of conceptuality. But is it quite logic. Numbers are fundamentally empty of conceptual content. Mathematics counts emptiness. A metaphysics that serves Concept Relativity must be empty of concepts.

There is yet another modern concept that is without physical dimension: information. There cannot be two different substances without a physical dimension, because there is no means to differentiate. And if there is, it cannot be metaphysics. Therefore, using Ockhams razor, they are the same. The pure abstract mathematical world is informational in nature. Math tells us about pure information. What information is hidden, what information is present and how information flows. This information only becomes 'visible' in a conceptualized form, stored within the data of an entity, or activated in a force or interaction. That is why I called the invariant object behind all Concept Transformations an Information Universe (IU).

The metaphysical conception of information does not match the common conception of information, which is often perceived as knowledge or meaning we extract from data nor does it match Shannon's definition of information, which is used in physics. Shannon's information is a sum of possible states (degrees of freedom). Although both are numerical 'in nature', Shannon's definition lacks a metaphysical interpretation which is needed to manage information within an Information Universe on a theoretical level. In my view 'number' is being an entity, an object . Mathematics is metaphysics. The information we 'count' or calculate, is never the number-object itself, the metaphysical object, because that object has no physical dimension. This metaphysical reality is not real in the physical sense, i.e., we can never contact directly that informational object. We need an interaction or communication within a physical process, we need a 'hook', to retrieve information. The perception we use to communicate information is always (concept)relative.

But (flipping the perspective) we could as well say that this metaphysical reality is the only real thing. All Concept Representations are just reflections, images, pictures, expressions of a real, unreachable world. Information, the essence of that reality, is present in every physical interaction, and hidden in many possible states precisely because it has no properties other than number. Nevertheless, we cannot reduce reality to just mathematics. Nevertheless, we cannot reduce reality to just mathematics. The Mathematical Universe Hypothesis of physicist Max Tegmark [2] states that our physical world is an abstract mathematical structure. I do not agree. The reality of Tegmark is pure abstract conceptualization. The essential problem of this approach is that it reduces all conceptualization to abstract concepts. It loses contact both with the human mind and reality. In my view the reality can only be 'seen' (i.e., interacted with) by representing concepts. We need both. Math and conceptuality. We need metaphysics *and* physics.

1.2. What is a universal constant?

To perform Concept Transformations, we will need to organize physical concepts into structures that can be transformed by some transformation. A transformation always acts on a complete set of concepts. For instance, if you change time into inverted space, space will change into inverted time and the concept of force becomes angular momentum. A way to organize concepts into structures, is to apply mathematical group theory to concepts. This technique is called Concept Mechanics and is beyond the scope of this article. Here, we are concerned how it is possible to change time into space without becoming completely disoriented? The key to this question is the concept of a universal (property) constant. A universal constant is a strange concept. It is a constant and it is universal. But something that is a constant of reality must be of the same nature as mathematical number (which is a 'universal' constant of the mind). But a mathematical number has no physical dimension, a universal constant like c, the velocity of light, has. It is a speed! How is that possible? A photon always moves with the velocity c. But without variation, there is no differential power. And without differential power there exist no concept. A universal constant 'misses' variation. A universal constant therefore reduces the conceptual richness. If a photon could think, it would not understand speed. A photon does not experience a change in speed. The photon's 'mental world' has one dimension less than that of man. There is a conceptual reduction.

The existence of a universal constants makes it possible to eliminate the physical dimension of physical variables, like velocity. By dividing the variable by its corresponding universal constant, we create an informational concept. Universal constants are by their nature also the most logical physical units to express a variable. Physicists use the dimensionless quantity $\beta = v/c$ to simplify the calculation. But deconceptualization is much more than just nondimensionalization. It is more than just a rule of convenience. Dividing the concept by its universal constant is the way to make a physical dimension

disappear and let a new metaphysical (pure mathematical) dimension 'appear'. By dividing speed by its universal constant, the property speed is deconceptualized into an information object and a pure mathematical value that has a 'reality of its own'. The universal constant connects physics of concepts with the metaphysics of number.

1.3. Postulates of Concept Relativity

Form this observation we can postulate the basics of Concept Relativity.

Postulate 1 of Concept Relativity. Mathematical, informational structures build an Information Universe. They constitute the metaphysics of our reality.

Postulate 2 of Concept Relativity. All concepts in physics have a corresponding universal constant.

Postulate 3 of Concept Relativity. Every universe is constituted by a set of universal constants that are direct expressions of the concepts we use to represent reality.

The universal constant can be used as an instrument of deconceptualization but also as an instrument of reconceptualization. The retrieved concept created from an informational dimension does not have to be the same physical dimension as the original concept. The conceptualization we use is always relative to the thinker that conceptualizes. An 'other thinker' can conceptualize an Information Universe in a different form.

Concept Relativity causes a remarkable shift of our perception of the universe. Until now physicists believe that the discovery of the constant of Planck (h) and the constant of Einstein (c) are scientific additions to understand the reality of the microscopic and macroscopic world. To me, it is just the other way around, Planck length, Planck time, the Planck mass, and the speed of light are universal constants of length, time, mass, and velocity and are the sole reason we are capable to use concepts of length, time, and mass at all. They define conceptuality. They are therefore deeply related to the realm of thought and our conceptual representation of the universe.

This kind of idealism will be a difficult hurdle to take for realists. Yet it is the heart of Concept Relativity. If we want to understand the world, we cannot ignore our thinking. We are no invisible observers. We make reality with our concepts. And universal constants are nothing more than expressions of those rational constants.

1.4 The Horizon Concept Transformation

Based on the Schwarzschild metric of a black hole I propose a definition of the Horizon Concept Transformation (CT_{Ho}) that change a black into a universe and vice versa: CT_{HO} $(r/r_P) = t_{P'}/t'$. In this formula r/r_P and $t_{P'}/t'$ are informational dimensions without any physics. Radial space dimension is divided bij its corresponding universal constant Planck length. Inverse time is divided the inverse Planck Time of the image representation, which is constant but does not need to be of the same value as the Planck time in our conceptualization of the universe.

This Horizon Concept Transformation interchanges and inverts time and one space dimension. The radial axis originating in the center of the black hole becomes inverted time. The event horizon of the black hole acts as a mirror plane, hence the name 'Horizon Concept Transformation. The universe concept representation of the black hole interior starts at time t' = 0 located on the Schwarzschild horizon 'flowing' inwards. The Big Bang origin of our universe Concept Representation is situated at the horizon of a black hole. The center of the black hole (the singularity) is mapped on t' = ∞. Time itself will flow according to inverted space (1/r). In short, the Black Hole Horizon Concept Transformation turns the black hole 'inside out' , 'backwards forward' and is 'conceptually twisted'.

The theory creates a new view on fundamental issues in physics, like dark energy, the acceleration of de universal expansion, the nature of Quantum Mechanics entanglement and the unification of Quantum Mechanics and Relativity theory, but they fall outside the scope of this article. Of fundamental importance, here, is the prediction of Concept Relativity that our universe is an open entity and part of a multiverse that connect all kinds of universes. The big bang of our universe coexists with a creation of a black hole within our parent universe. And all black holes within our universe are (proto) universes which are fundamentally

open entities. There exists a permanent flow of mass/energy/information from outside to inside, from the parent universe to the child universes which is essential to start universal evolution.

2. Systems Ontology

The Information Universe is the substance of our reality. All objects in the universe are conceptual representations of this metaphysical entity of pure information. Therefore, all objects that exist can considered to be systems of information. A system has a boundary, an internal structure, and an external environment. In systems theory it is widespread practice to model objects as systems of information using all kinds of mathematical techniques. Informational systems are easily digitalized and stored in computers, after which calculations are performed. Usually, we do not think of metaphysics during this process. But in Concept Relativity information is a metaphysical substance. The deepest nature of all things is information, that must 'appear' and be measured by a conceptualization of the object. It is this conceptualization that is modelled and digitalized, and not the metaphysical information itself. Only when the informational object is given physical properties, we, thinking observers, can interact with it. So, the systems approach is not only a useful tool, according to Concept Relativity it should be reinterpreted as a systems ontology.

2.1. Information Potential

Before we can explore the characteristics of a systems ontology we need to speak of information. In physics the concept of information is linked to entropy by the Boltzmann statistical interpretation of entropy of a Thermodynamics system. Entropy equals hidden information enclosed in microstates of a system. We calculate degrees of freedom. We 'measure' disorder. But information is also used to measure the degree of order or organization. Sometimes the term 'negentropy' is (wrongly) used. Concept Relativity considers information to be a metaphysical substance. To Concept Relativity all reality is an appearance of information, in which hidden information becomes 'visible'. The present definition is originated in the theory of communication and not metaphysics. We therefore need a refinement of information that contains hidden and visible information.

Clearly order and disorder both have an informational dimension. I shall demonstrate the relation between both types of information in an example. Let us look at the outcome of a throw of 1000 coins . This statistical system has 2^{1000} possible states. The entropy of the system $S = k \log W = 1000\ S0$. If we set the constant S0 to 1, the degrees of freedom are 1000, and the hidden information is 1000. But what is the amount of ordered information presently stored and visible in this statistical system? Obviously that amount is zero. There is no organization present in the chaotic process of throwing 1000 coins. Let us now 'connect' 2 coins by an unknown interaction which forces the 2 coins to become both either 'heads' or 'tails'. We lose a degree of freedom, but we gain a binding where information is 'stored' into. This storage can be visualized as a permanent 'exchange' of information between the 2 coins that 'tell' each other what the state of the other is, so that they can match the others state. By this binding the system gains organization, it gains information content. Hidden information is transformed into ordered, 'visible' information stored in an interaction. I write the word 'visible' with quotes because we never actually see information. We only see a conceptualized form of it. When all coins are connected this way the entropy of the system would become 0 and the stored information will become 1000.

Information enclosed in order or disorder of a system are communicating vessels. The information content which is stored in interactions is a measure of order and complexity. It measures the number of bindings. On the other side, informational entropy measures the amount of hidden information, chaos, and disorder. It measures the degrees of freedom of a system. All real systems have an amount of organization (Information content or ordered information or visible information) and an amount of 'freedom' or disorganization (entropy or hidden information). I will call the sum of both the Information Potential of a system.

Information Potential characterizes a system and tells something about the potential amount of order and/or disorder the system can gain. Order and chaos, or organization and disorganization, each have their own quantity of information. If a system has no visible structure, like a throw of coins, or a gas or a black hole, the variable of information content will be zero and the information potential will be equal to the entropy of the system. But if there are no degrees of freedom in a system, then too the system contains information, but this information is stored in bindings between the elements of the system that creates a

structure or organization. The information potential is equal to the information content of the structure of the system. The information potential, the sum of information content and informational entropy, is a fixed characteristic of any system. The information potential of a system is metaphysical 'property' of a system and can be denoted by a number (without any physical dimension).

2.2. The Composition of a system

Let us now explore the ontological characteristics of a system. The systems ontology analyses systems from a purely informational viewpoint. It uses the systems terminology to create a general theory of information, that in turn will give us a general theory of systems . What is a system? A system is an object constituted of elements that are related with each other. There are three basic concepts in this definition: an element(object), a relation (between element(objects)) and a system(object). I will call this concept group is a trinity and name it the System Trinity,

Each element of the System Trinity can become a perspective and reflect the System Trinity by its own set of concepts which again are trinities. The concept of 'system' has three conceptual characteristics: entity, structure and set, defining a unity of a connected multiplicity. The characteristics of an element(object) are entity, identity and a concept called 'information potential' defining the complete interaction potential of an elementary object. And thirdly, the relation is a long-term bound of exchanging information. It has the characteristics: binding, exchange, and information content (of the relation). I will discuss the relationship between information potential and information content shortly.

These 'decompositions' expands our vocabulary and give us new perspectives on a system. The binding perspective of the relation trinity binds things. It is a connection. The bound concept unites. And the binding scales things up. It creates a system, which is something 'bigger' than the connecting parts. The single element itself becomes a 'bigger thing' by the binding. In the exchange perspective of interaction, we point out another characteristic of an interaction. An interaction changes the objects (and/or subjects) that interact. That change is always an exchange. Something is carried from one to the other and vice versa. All communication between objects is an exchange of information. Interaction has a metaphysical dimension by stating that the exchanged information is equal to the information content of relation that will sum up to the information content of the system. all exchanges change the connecting parties.

The change of the connected element entities is conceptualized into a transformation of identity. I will discuss the concept of identify later. The information potential of an entity 'determines' all the possible interactions within a system. Partly this information is 'hidden'. It is not realized potential. Partly this information is 'visible' within the actual interactions of a system. This stored Information is the information content of the system. Information is never destroyed and has only two forms: actual in relations and potential in elements of the system. Both forms of information express the metaphysical dimension of the system. All information is discrete. It is a natural number. It is countable and it is counted in bits of information.

From the perspective of the system, we count the number of elements (the cardinality of the system). The elements are an enumeration and belong to a set, which has no other characteristic then the name 'elements belonging to the system'. So, this set is not the extension of a predicate. There is no predicate. The elements of the set are 'beings' gathered together. All systems have a structure, i.e., an enumeration of all active interactions between all elements of the system. The structure organizes the set of elements. Set and structure are complementary and form a system entity.

Of great importance is the intrinsic symmetry between element object and system object. Every object has two perspectives; it can be studied as a system objects, looking into its inside structure, or it can be studied as an element object looking at its outside environment.

Note, this systems ontology fits the Quantum Mechanics picture of interactions. According to the standard model (vector) bosons are the carriers of interactions connected with the four forces of nature. Each interaction has its own carrier. Bosons are even spin particles; they are discrete, countable quanta. They quantize the mechanics. Because bosons have even spin, they can share the same quantum state, which is essential to be an intermediate. We can pile up information in an intermediate, i.e., the strength of an

interaction increases. The information in physical relations of a system is always conceptualized into quanta of a physical dimension.

3. Information Dynamics

Let us now investigate how systems of information change from a purely informational, metaphysical point of view. First of all, we have to ascertain that information within systems ontology moves. It is not static but dynamic. The dynamics is reflected in the dynamics of our universe representation. I will present in the next sections five meta-laws of Information Dynamics (ID). I will not use the term 'law' but instead use meta-law. The meta-law of ID are no real laws because they cannot be tested directly by physical experiments. They are metaphysical/mathematical in nature or if you like, they are 'laws' of thought. They express themselves in real systems through physical interactions and relations. The laws of physics and the structure of our universe are a conceptualization of the dynamics of these information processes. The meta-laws are named:

conservation of information (ID1),

movement of information (ID2) ,

the information boundary (ID3) ,

emergence (ID4),

hierarchy symmetry (ID5).

The first two meta-laws of ID resemble laws of Thermodynamics. The third and fourth meta-law are complementary laws and create a hierarchy of systems. The last meta-law is a corollary caused by the symmetry of an Information Universe. I will discuss them consecutively. After that I will present a new type of cosmology, a systems cosmology, based on the meta-laws of Information Dynamics.

3.1. Conservation of information

The first law of Thermodynamics is the law of conservation of energy. It has a metaphysical counterpart in the meta-law of conservation of information. According to Noether theorem a law of conservation is related to a symmetry. The conservation of energy is connected to the symmetry of time displacement. Likewise, the meta-law of conservation of information is connected to the symmetry of conceptual connectivity, which is named 'causality.' We interpret reality by chains of concepts. All 'movement' in our universe is a chain of cause and effect (mostly plotted in a time flow). The effect-concept becomes a cause-concept to another effect-concept. Causes and effects are a series of concepts that are 'connected.' The chain of causality has translation symmetry due to its repetitive character. It precisely this symmetry that establishes the conservation of information. Within the chain the information, as it jumps van link to link, does not change in amount. During a causal process, the quantity of information does not change. It is conserved.

The conservation of information was a central topic in a debate between Stephen Hawking and Leonard Susskind/Gerard 't Hooft on 'conservation of information' in a black hole [2]. Hawking claimed information is destroyed in a black hole. Susskind and 't Hooft refuted this idea because it would undermine causality and reversibility. We need conservation of information to maintain causal bounds. The battle was won by Suskind/'t Hooft in which 't Hooft introduced his holographic principle which I will discuss later (ID3).

3.2. Movement of information

Movement is determined by laws of Physics. The laws of Quantum mechanics, General Relativity and Classical Mechanics are time symmetric. If we reverse the direction of time the laws stay the same. On the contrary, the laws of Thermodynamic 'movement' is asymmetric in time. The famous second law of Thermodynamics states that entropy will always increase in closed systems. If we reverse time the Thermodynamics process will not be the same. If we watch the film of a broken teapot backwards, we see a different film. Another asymmetric process is evolution. The universal picture is a growing chain of complexities, from quarks, tot atom, to living cells and intelligent beings. This process is not time reversible. One of the great puzzles in physics was, how are these two asymmetric processes related to the symmetry of physical laws?

Until now the solution was twofold. Firstly, Boltzmann himself, one of the founders of Thermodynamics, gave a statistical interpretation based on symmetric mechanical laws of elementary objects. Secondly, the

theory of dynamic systems showed that complex macroscopic structures can evolve form microscopic elements if systems are far out of equilibrium. Our Big Bang Universe is such an unstable system. In the 1970s Prigogine [4] was one of the pioneering scientists that studied systems far from equilibrium and found that complex macroscopic order arises from a steady flow of energy between the system and its environment. These systems evolve and organize themselves. Nowadays they are called self-organizing systems. Still, self-organization is considered to be a spontaneous order created by some external cause. It is therefore considered a 'secondary' process, requiring a disturbed equilibrium. Evolution is not in conflict with the second law of Thermodynamics. Systems only decrease in entropy if the entropy of the surrounding environment increases equally or more. Eventually, which is the mainstream thought of physicists, on a bigger scale, all evolution, including human intelligence is just a temporally perturbation that will fade away as time goes on. The end of our universe will be a heath death, or a big Crunch, or something else, we do not know. But what we do know: humans are irrelevant in this process.

According to Concept Relativity there is a firm relation between man and universe: mind and reality are conceptual expressions of information. According to the Information Universe hypothesis our universe is an open entity, a child universe that is in permanent contact with its parent universe. So, one of the main assumptions of modern cosmologies – that the universe has no outside, - is refuted by Concept Relativity. Because our universe is open, an increase of complexity, i.e., evolution will be natural process due to instability caused by the flow of matter/energy between our universe and our parent universe. But Concept Relativity will go one step further. It states there is a fundamental symmetry between evolution in open systems and disintegration in closed systems. There is not one but there are two laws at work: entropy (disorder) increases in closed systems; *information content increases in open systems*.

In systems inf information both laws are at work because there do not exist completely open or completely closed systems. Every system (every object) is (partly) open (connected to the outside world) and (partly) closed (confined by some boundary). Both meta-laws of movement of information are active in the movement of all systems, even the biggest system we call 'universe'.

The second meta-law of movement, - open systems evolve to more complex systems, - is a well known fact from human experience. It is called learning. We believe that people who keep an open mind are better off than people who close their mind. In Darwin's theory of biological evolution openness is inherent to the process of adaption to a changing environment. These processes are representations of the universal meta-law of movement in openness. The information movement meta-law of openness will change our perspective on the universe dramatically: evolution of complex systems becomes a lawful necessity in an open universe. Until now the growth of complexity has been conceived as spontaneous order caused by some external agent. Concept Relativity tells us it is not a spontaneous process; it is a lawful process. Which means, just as we did with the second meta-law of Thermodynamics (the heath death) we could extrapolate the development of the universe on basis of a 'meta-law of evolution' connected to the openness meta-law of Information Dynamics.

I am aware this change of perspective may be quite disturbing. We normally do not think of atoms, molecules, stars, galaxies as 'evolving systems.' Evolution was 'confined' to biological, living systems and intelligent beings (cultural evolution). The rest is 'dead matter' that obeys the laws of physics. Material systems do not self organize. But according to Information Dynamics they do. All systems are subjected to the meta-laws of movement of information. The organization depends on the degree of openness and the flow of information between the system and its environment. There is no fundamental difference between matter and live from an informational point of view. The two movement meta-laws underpin universal evolution. For instance, consider a system of molecules. If this is a closed system, we would be incredibly surprised if this system would change into a car. But if we accept it may be an open system, influences from outside can change this system into a car. That is what we do in our car factories. The impact of the outside world changes the internal structure of a system dramatically. Of course, a car is a product of man, it is not a self-organizing system. So how does self-organization work? If intelligence (a thinking consciousness) is a product of self-organization, how does this intelligence come into existence by evolution?

3.3. The Information boundary

Quantum gravity has given us two astonishing ideas: The Bekenstein-Hawking entropy of a Black Hole and the holographic principle put forward by Gerard 't Hooft [4]. I will generalize both ideas from quantum gravity into a meta-law of Information Dynamics, the information boundary, which is valid for all informational systems.

Bekenstein and Hawking proved that the amount of information of a Black hole is finite and is equal to the surface of the black hole measured in Planck units. A black hole is also a system of information. From an informational perspective there is no difference between a black hole and a molecule or a cell. So, when a black hole has a theoretical information boundary, I will postulate that all informational systems will have an information boundary. By definition, information potential is the sum of the information visibly stored in relations within the system and the hidden information, representing some degree of freedom. There is no third category. Therefore, the information boundary must be equal to the information potential of the information system (ID3).

Secondly, all informational objects have borders that isolate them form the surrounding environment. Like the Bekenstein-Hawking maximum, all system objects have a maximum amount of information. The surface of an entity is the (only!) means of communication. By its surface, a system expresses itself. I will call the surface expression of an entity its identity. An entity (element or system) communicates by means of its surface/identity. i.e., all information is retrieved by means of this surface/identity. But that same surface also restricts the flow of information. The surface of entities in an expression of the information content of the entity. To outer world there is no more. We cannot know more than what the surfaces expresses.

Every surface, membrane, skin of any other kind of border are information mirrors of the internal structure of self-organizing systems. Identity is the hologram of an informational object. I should point out, there are two layers of meaning, physics and metaphysics. The idea of a hologram or identity involves conceptual content, properties whereas information is just number. We cannot project a volume bit of information onto a surface bit of information. We always need appearances, which uses information. These appearances have different forms and are sometimes difficult to compare.

The information content of a system, the visible information stored in the order of a system, is always smaller or equal then the information potential of the system. A Complete System is by definition a system that has an information content equal to its information potential. I.e., a complete system is a system that has realized its complete potential. There are no degrees of freedom anymore. The entropic or hidden information has become zero. All information is actively present within interactions, which are presented on the surface of the system.

Note, systems, depending on their size, are built by different forces: gravity, electromagnetism, the weak and the strong force. So, it is not only gravity (which determines the information boundary of a black hole) that determines the information boundary. It depends on the types of interaction that builds the system. The size of the system restricts the possible mix of interactions that builds a system. Within some given size we can assume that the nature of the relations that build the system cannot change fundamentally, i.e., its surface is fixed. Due to the meta-law of openness, system of a specific size will grow in information content, expressing that information on the surface. I.e., the communications will grow and intensify.

Focusing on only the openness meta-law we achieve a rudimental model of evolution of informational systems. Entities of some size start off interacting with each other relatively short termed. Increasing in number, entities become elements of a system. The short-term interaction has changed into a long-term relation. First loosely connected, but gradually gaining order and information content. Hidden information which was enclosed in degrees of freedom gets realized and becomes 'visible' in relations between elements of the system. Information increases, entropy decreases. Information is expressed in the surface interface of the system. Because the size is fixed, increasing information content will reach eventually a maximum, the information bound of a system. As IS becomes equal to □S the surface expresses the maximum information. The system next, becomes a stable entity in a higher system level and starts of as an element in a system with again maximal disorder. The process now repeats.

3.4. Emergence

When a system completes its potential, when it reaches its maximum information boundary (ID3), the movement of information (ID2) does not stop; evolution does not end. Evolution will proceed on a higher system level. A new system level emerges based on the complete system. The meta-law of emergence (ID4) states that the system level of complexity that emerges will have a unique irreducible property that characterizes the new system level and its evolution. This emerging property does not come out of nothing. It is 'caused' by a quantitative growth of information. The meta-law of emergence transforms quantity into quality. When universal evolution performs this process of emergence repeatedly, a hierarchy of systems is created.

The transformation from quantity into quality corresponds with a transformation of a system into an element. A complete system is a stable system; The stability is the result of tight relations within the system. The system 'behaves' as if it is an elementary object. And it is. A complete system is both system and element. Complete systems are the building bricks of higher system levels. The complete system is an elementary object with an information potential which will be get realized by interacting with other emerged entities or with its surrounding world. Objects that are at these 'crossroads' of evolution are universal object constants. They are constants of evolutions. Object constants have a dual concept representation: an element Concept Representation and a system Concept Representation. Object constants are universal constants, comparable with universal (property) constants like the velocity of light, or the Planck angular momentum, but they are objects, no properties. The object constants are building brick of the structure of the universe. All over the universe the same building bricks are formed, driven by the movement meta-law of openness. The information upper boundary of a system creates borders, barriers which become thresholds to next system levels. Constants of evolution are 'knots of transitions.'

What are the object constants of our universe? Massive elementary particles are systems of energy (massless particles). Systems of quarks/fermions become atoms. System of atoms become molecules. Systems of molecules become a cell. Systems of cells become intelligent beings. Each object constant has it characteristic emerging properties. Inertial mass and charge emerge out of pure energy as temperature of the universe drops below a threshold. Live is an emerging property of complete molecular systems. It is built out of 'dead' matter. Intelligence and though are caused by awareness of an intelligent self. It transcends the processes of life. These four properties, energy, matter, live, intelligence should correspond to system levels of object constants.

All hierarchical levels are systems of information. They are fundamentally the same. Although various kinds of properties emerge, they are all based on information. The metaphysics is identical. All objects, (systems and elements) interact and relate. Information is stored in interactions and relations. Information increases by movement meta-laws. From this view point each hierarchical level represents a reality. So, the human perspective, based on intelligence is just one of many realities. Our universe consists of multiple irreducible worlds or realities. An atom has its own reality, just as a cell or a planet. Concept Relativity expresses, as Thomas Nagel [6] did, there is not just one world of (only) matter, there are many worlds of irreducible beings, all levels of a universal holistic entity. And, as we shall see, there are worlds beyond what we know of.

3.5. Hierarchy Symmetry

The Horizon Concept Transformation is the cause of the 5th meta law of Information Dynamics. Inverted radial space dimension becomes time and inverted time becomes a space dimension. Because both representations apply on the same Information Universe there must exist a symmetry between the macroscopic and the microscopic world. It is called Hierarchy symmetry. In the very first moment of creation, a black hole is a very compact (almost point-like) entity, which is also the starting point of a corresponding universe. Micro and macroworld are united and deeply intertwined. When the universe starts to expand the original unity of the microscopic and macroscopic world will be preserved. This preservation must be expressed into universal physical laws and universal physical constants. But as these constants are the basis of structural organization, this preservation must also be expressed in a symmetry on levels of structures or an entanglement of micro and macro processes.

According to Big Bang theory the universe started off as a point like ball of energetic spacetime that rapidly expanded. As the universes expands information thresholds (ID3) are passed. With the passing of each threshold new structures emerge (ID4). Systems of energetic particles transform into elementary particles. Systems of elementary particles transform into atoms. Systems of atoms transform into molecules. System of molecules transform into living cells. System of cells transform into intelligent beings. Each threshold is a specific point in spacetime that divides the universe in layers of space and time and worlds of operation and being. And according to ID5 each microscopic threshold must have a macroscopic counterpart. We find that within the universe more complex galactic structures appear; within galaxy stars appear; within star system planets appear; on planets a biosphere appears; within the biosphere social communities arise.

4. Systems Cosmology

Based on the five meta-laws of Information Dynamics, a new type of cosmology, a systems cosmology, is build. A systems cosmology describes the structure of spacetime, just like modern cosmologies, but it takes a qualitative approach that focusses on the emergence of universal qualities, entities, and system levels. These qualities correspond to specific interactions, which build systems realizing their information potential. When an open Information Universe evolves, effectuating a movement of information, gradually a bigger part of the universal Information potential is realized. In this universal unfolding process, spacetime is structured into hierarchical levels of objects.

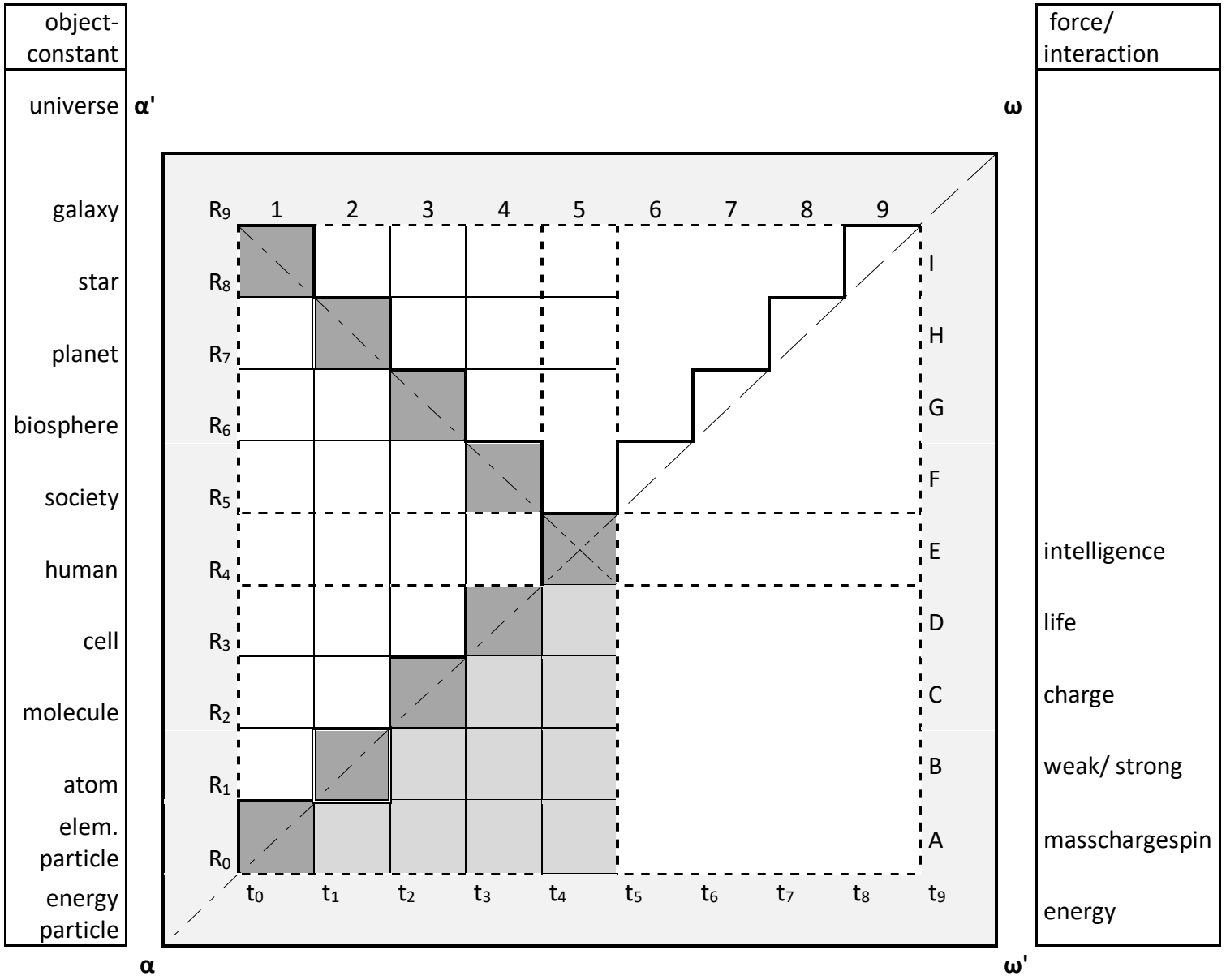
In figure 1 I have depicted a Cosmic Board model (CB model) of a systems cosmology. As the model looks like a chess board, I used chess board conventions to denote squares of the board. The CB model shows entities and properties that appear due to information dynamics in an open Information Universe. It divides the area of cosmic spacetime into compartments (squares) of realities that are due to the information boundary (ID 3) restricted to specific scales of time and space.

The x and y axis of this grid show R (radius of the object constant) and t (the first time moment of emergence of the 0bject-constan) on a logarithmic scale. A systems cosmology deals with huge differences in scale. To enhance readability, the variables t_h and R_h (h = 1,..,8) are exponent variables of time and radius.

Property rows (ranks) A to I will be called worlds of becoming which are space scale related structures connected with an emerging property. Each world of becoming has a unique quality, irreducibly emerged from the lower level (ID 4) by transformation of a system into an element (the entity Concept Transformation). Columns (files) 1 to 9 are called worlds of being. They are time epochs of a series of object-constants that function on all scales.

New object-constants emerge at spacetime coordinates (t_1, R_1), (t_2, R_2), (t_3, R_3) , (t_4, R_4) and (t_5, R_5). The lines of the cosmological grid are planes of transformation where new properties emerge and systems become elements on a higher hierarchical level. A1, B2, C3, D4 and E5 are called natural realities of these object-constants. Each reality unfolds the potential of the 0bject-constan that is associated to the emerging property of the 0bject-constan. Each being realizes its information potential, (be)coming into existence, within the cosmological spacetime square which is the cross section of a row of becoming and a column of being.

The CB model shows four quadrants, created by the dual concept pairs past-future and micro-macro cosmos. In the middle we find a central ‘cross of squares’ formed by present time and normal (human) scale. Past and future are united in the ‘present’ column (E). Micro and Macro world are united in the ‘normal spatial scale’ (of humans) (5). E5 is the cross-section of row 5 and column E. It is the human universe. It is the mirror ‘point’ of the Human Concept Transformation (which I haven’t discuss here). The mirror point of Horizon Concept Transformation is (t_0, r_0).



LEGENDA

Natural reality of a universal object constant, co-evolution of micro and macro object-constant

area of hierarchy enrichment

Energy area without time space and mass concepts

Increasing mean information content per object constant within a system of object constants

System upper border of natural world of an object constant = maximum information potential

universal horizon of micro object-constant

Increasing information content of macroscopic entities is defined by R - phi

quadrant demarcation (past/present/future - micro/normal/macro)

(t_h,R_h) Emergence of an object-constant at time t_h with radius R_h

(x_h,y_h) Emergence of an object-constant at time $t_h = 10^{Xh}$ with radius $R_h = 10^{Yh}$ using exponential variables

In the CB model hierarchy symmetry is depicted by coevolution of elementary particles (A1) with galaxies (I1), atoms (B2) with stars (H2), molecules (C3) with planets (G3), life (D4) with the biosphere (F4). The universal evolution of microscopic object-constants creates a series of systems, each build on its predecessor. The macroscopic evolution creates smaller, more complex systems within the bigger system. The micro and macroscopic universal evolution are linked structures like a double helix of a DNA molecules. Stars are the 'factories' where 'atoms' are built, which form later new types of stars. Planets become the 'factories' of molecules, the domain of chemistry, and the surface of the planet (the biosphere) becomes the factory of cellular life. This intertwining of microscopic and macroscopic processes is fundamentally caused by the hierarchy symmetry of an Information Universe. Micro and macro properties affect each other continuously. Both structures evolve simultaneously. On the lowest and highest level, we find the unification of Quantum Mechanics and General Relativity. The unification of Quantum Mechanics and General Relativity, I propose, will be a concept symmetry of General Relativity and Quantum Mechanics which entangles the biggest (spacetime) and the smallest (the standard model) objective levels. When the universe expands corresponding microscopic and macroscopic levels occur likewise entangled.

Processes, activities, and scientific disciplines, all may be classified within the CB model. They are positioned within a square of the board. Especially I like to point out processes of 'hierarchy enrichment' . When a new object-constant appears in the universe, a new natural reality unfolds which will affect all lower levels of becoming. An intelligent being is not only an intelligent being, it is also a living being and a material being. The emergence of intelligence will enrich the living dimension and material dimension by intelligent applications. Bodily movement becomes sport, instincts become feelings, eating becomes the art of cooking, reproduction becomes sex. These activities are located in the area of 'hierarchy enrichment'. Hierarchical enrichment is not solely a 'human thing'. all object constants transform lower level properties in a way we cannot deduce from these lower levels themselves. Cellular life has enlarged the molecular potential and changed the molecular content of the planet: the oxygen in our atmosphere is created by the 'invention' of photo synthesis of cells. The living cell enriches chemical processing in a way no single molecule could ever 'explore'. We normally do not call it technology but is an analog process.

5. Consciousness

Where does consciousness fits in this new (human) cosmology? According to the Systems Cosmology human intelligence is an emergent property of a specific system level in a systems cosmology. Many assume consciousness is also an emergent property, but I will argue that the concept of consciousness is not emergent but has the same 'nature' as information potential.

Human consciousness appears in intelligence, just like animal consciousness appears in the emergent property of live. In this appearance consciousness transforms into awareness or becoming. Like information consciousness itself is empty and inaccessible. Awareness (of thought, feelings, words, presence) expresses consciousness but is not identical to consciousness itself. Like information consciousness can appear in many different states, corresponding to different types of being, corresponding to different realities.

Of course, consciousness is also a thought. We need a word to discuss it. We intelligent beings cannot handle things without conceptualizing them. And of course, this though can neurologically be situated in some area of the brain. But we must not confuse this representation of consciousness by a thought with the thing itself.

The metaphysical thing has many names, but it is all the same. Some will call it, I, myself. I am conscient. Again this 'I' is as illusive as information. The Self always escapes the thought. We can reflect on who I am, but soon you discover that consciousness is in de reflection on de reflection of who I am. No, it is on the reflection of the reflection on de reflection of who I am. And so on. Trying to pinpoint consciousness is like trying to divide a finite number by zero, nothing: it creates an infinite sequence.

Consciousness is the same as the unity of being a self. Consciousness is self being. But the word 'self' has a specific connotation as we use often use it in the term self consciousness. We say humans are self consciousness, where animals only are consciousness. In my view the 'self' is the representation of the cosmological property that emerges with humans: intelligence. The self is identical to being intelligent. The

self of animals is being alive. An atom's self is being massive. So self consciousness is not an exclusive human property. In a sense, typical to the system levels property, all things are self conscious.

Here too, we can expand the self in a duality between physics en metaphysics. We can distinct between the Self as such and the Self as a becoming. The self becoming is an identity. The things we put in our Self are experiences, words, concepts; these appearances build an identity. And by creating an identity we are becoming aware (of something). Consciousness is expressed in what we aware of. The self being (of an entity) is expressed in self-image is a becoming. The body I have, the feelings I feel, the thoughts I have, are phenomena of becoming representing a being.

Consciousness is self being. Awareness is self becoming. Awareness, presence, presupposes (a localization in) time and space. These are concepts of the mind. They are 'constants' of mind and universe. But time and space are according to Concept Relativity emergent as well. Time and space are created in de Big Bang. They are part of physics; consciousness is part of metaphysics of the mind.

Consciousness can best consider to be a potence like information potential. It is a metaphysical container of all possible becoming. This potential is not a static vessel, it is force that motivates the movement of all things. It forces the appearance of a physical reality, even the cosmos itself. For humans this movement if often 'conceptualized' as a will. Why do we want things. Why do human 'move'. We move because we are open systems, we are open to the world. The metalaws of movement of information forces us to act, as it forces living beings to live, as it forces material bodies to act (their heaviness).

All objects or entities are containers of information potential. They are self defined by their being and identified by their becoming. These containers are 'analyzed' as systems of information. The concrete appearances of the system, the elements, and the relations between those elements, is realized information, a fractional appearance of its information potential. Or in other words, they are appearances of becoming realizing a possible state of being. The realization of an Information potential effectuates interactions and relationships. Information potential represents all possible interactions of the entity. Information potential is interaction potential. Consciousness changes being into becoming when people interact.

Awareness is connected to experiences like feelings. These internalized feelings always correspond to interactions or relations. There is no fundamental difference between the interaction of an atom and the interaction of a human being. Both are part of a system of information, where composites relate to each other. So, an atom has experiences like a human being. Its spectrum of possible relations is of course limited: gravitation and electrical force. But let us not be misguided by the idea that these forces of nature are fundamental different then human interaction. We think the paths of movement of atoms is lawful and determined and we humans have free will. But that is relative. It depends on your position. Would we be an atom, we would not 'feel' this determination. And human interaction is quite determined if we take the stand of higher level consciousness.

Yes, there will exist higher levels of consciousness because this is the inevitable way of evolution. The meta-law of information predicts higher levels of beings, more complex systems, which will gain higher levels of consciousness. Levels, we humans cannot conceive. Because consciousness is omnipresent, it is in present, past and in the future. The degree of consciousness depends on the complexity of the system. When societies increase in complexity, they can become complete systems. If societies reach a complete unity, a new self will occur, that has, just as all smaller things a consciousness. A new cosmological property will occur. A new kind of reality will develop we human can never perceive, just like an atom that cannot perceive what it is to be intelligent.

It may be clear that this conception of consciousness is not at all in line with the Western tradition. Consciousness is since Descartes, linked to the mind. 'I think therefore I am' has created a bond of equality between though and being, thereby reducing all beings that are not intelligent to some 'lower' kind of beings and creating a fundamental dualism between mind and matter that has shaped the history of Western philosophy for centuries. Man's reason, his mind, is given an almost divine nature, which is above nature and matter. Human reason is the instrument by which to know the laws of God. Mighty Nature lost its divinity and became an appendage: a physical world open to man for discovery. The 'subordination' of

nature to reason has led, among other things, to a shameless exploitation of natural life and the material wealth of raw materials. Technology gave expression to the idea of making the environment into a product of man to be formed. It should be noted that Eastern philosophical tradition (like the Veda's) took a completely different stand, which associated consciousness with being (and not with intelligent being) which is much more in coherence with my position.

Appendix. The future of mankind

Systems Ontology, Information Dynamics and the CB cosmological model create a conceptual framework which has many aspects that can be studied by all disciplines of science. It unifies all sciences by a cosmological overall vision. Many questions arise. But they are united by one theme: the universe and who we are within that universe. The systems cosmology is an evolution cosmology that incorporates humans. It places the human existence in a cosmological process of movement of information and a sequence of qualitative changes due to this evolution. Evolution is a universal process of moving information that started at the very first moment of the universe and can be extrapolated to the future. The systems cosmology tells us where we – humans came from, who we are and where we are going to.

Notice, the meta-law of emergence sharpens the distinction between cosmological levels by stating that each level is characterized by a distinct and unique property. We descend from animals but we are no longer animals. Mind transcends live. Just as Live transcends matter. Just as matter transcends energy. And information dynamics is the common cause that makes it all happen. We are all systems of information. To unleash the potential of an intelligent mind we firstly should eradicate the Darwinian struggle for live in which many humans are still trapped. There is no need for it. Intelligence transcends this struggle. If humans would recognize who they are, they would stop killing each other, end famine, and organize housing and care for everyone. After fulfilling these basic needs of living our mind can really start flourishing and unfold its potential.

What will we do? No doubt, humans will transform the Earth, with respect to energy, matter, and nature . It is the unavoidable course of (cultural) evolution. But we first have to redefine our relationship to nature. Earth and nature are no longer our enemies. They are a part of us, we evolved from them. And they are a source of human inspiration. The earth is no longer something we can exploit, like we did for the last three centuries, resulting in climate change and diminishing biodiversity. No, in fact, with the emergence of intelligence, earth, plants, and animals also become in a sense 'human' (cosmological enrichment). By looking at matter and nature with intelligent eyes, a manner of looking no animal or plant can ever see its own world, they become part of the human reality. They become human. Real intelligence will bring about respect and care for all our living companions and the earthly matter.

So, what is intelligence? What will change on the cosmic system level of intelligence? What characterizes intelligent species? Thought. Thought is the new DNA. It relates men in ever bigger communities. Thought that expresses itself in a community or society becomes part of a universal evolution. Technology is socialized thought. We are technology. From the first throwing stone, the first sentence, the control of fire, to the Hubble Telescope, from tax systems, laws, and culture, it is all human technology: a product of the mind realized in a social context. The social community is a system of intelligent beings which are related by stories. Human intelligence is all about inventing concepts and telling stories . These stories create the natural reality of humans.

Some people fear technology of today. They fear AI, gen and nanotechnology will destroy humanity. But if we are technology, how could it destroy humanity? What we should fear is the misuse of technology for personal profit that increases inequality and that deprives people of potential. We should fear the misuse of technology by states to control peoples mental expression. We should fear the degradation of humanity when we reduce human intelligence to a computer. We should fear economic powers that monopolizes technology. We should fear technology in the hands of (nearly) 'animals'. which is like giving a box of matches to class of small children. Technological development is human development. It expresses wat we are. It should be a topic of political debate and democratic decision making.

Earth is our home planet. Even more, we are born out of the Earth. It fills our genes and memes. And we are not alone. There exist many other planets that produce intelligent beings. Our Systems cosmology predicts

we are not alone in the universe. Intelligence is a stage of universal evolution. It is the result of a lawful, informational process and not some coincidental miracle. If our universe is capable of 'producing' intelligence around our sun, it will produce intelligence everywhere in the universe where open systems evolve.

What lays ahead, spoken cosmologically? This is unknown territory to scientists. It involves a paradigmatic change of mind. The mind of the scientist is analytic and tends to see the whole as composite and reduce it into is constituents. The scientist looks always 'down' and 'back'. Whereas the philosophic and religious mind look 'up' and 'forward'. Spirituality tends to see the whole as a part and magnifies it into greater wholes. Ultimately, both mindsets exist in one mind. Inevitably, we must also inspect the prominent story of the future of humankind our systems cosmology is telling us. What happens when we climb up along the universal systems hierarchy (the right half of the CB model)? Human individual development co-evolutes with society and culture. Gradually human relations will intensify and become more complex. A society could eventually achieve system completeness realizing its full potential. These societies, no doubt, incorporate the complete biosphere of a planet. A complete world state system will be created unifying all things that live . Evolution will step up to the next level in our systems hierarchy. The social biological system becomes an elementary entity (t5,R5) with a new quality, which I will denote 'planetary intelligence', which we, human beings, will never understand, simply because this quality is beyond understanding. Evolution will start over on a higher level: eventually stellar entities organize themselves into galactic societies and reach maximal information capacity at some point (t9,R9). Galactic intelligence emerges and a new reality of galactic entities is created. The last foreseeable level will be a universal conscious entity which will operates on a supra universal system level we are not aware of (ω).

Of course, there is no guarantee what soever of such an evolutionary destination. Nearly closed systems will decay. The future of man, and even the future of the universe could well become that of a dinosaur: extinct, nonexistent. We do not know what the information potential of humankind nor that of our universe is. What we do know is when a universe loses its openness the information movement meta-law of closedness will take over and the universe will start to implode, complexity will fall apart and finally it will die. But then again, in a multiverse, there are many universes. If our universe will not become conscious, other universes may be capable to reach this unthinkable state of complexity. After that, my imagination stops. But I am convinced reality will not stop.

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