

Article

“Information”—from an Evolutionary Point of View

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Abstract: “Information” (=information including its processing, communication, *etc.*) is indispensable for the modern understanding of processes within cells, tissues, organs, the organism, but also between individuals and social structures. Is “information” the mathematically applicable substitute for the omnipotent and in all living entities identical *Vis Vitalis*, applicable also to machines? *Vis Vitalis* was falsified by evolutionary theory. Its explanatory power was not “saved” with an alternative hypothesis. So the causal explanation of what could be handled previously with *Vis Vitalis* remains a “grey area” in the landscape of sciences. “Information” seems to fill the gap between, e.g., body and mind. Therefore, an analysis of “information” from an evolutionary view can be helpful even for information sciences: there are gaps which cannot be bridged sufficiently, especially between the different evolutionary levels up to the “hierarchical structure” of a person as a social being. An analysis is presented: the meaning and the indispensable carriers of “information” have changed within the evolutionary processes. Options and restrictions for an evolution-oriented use of “information” are discussed and applied. Doing this it seems possible not only to bridge the gap between the layers within the biological, emotional, cognitive and intellectual hierarchical levels within a person, but between persons and machines too.

Keywords: information; evolution; extended view; *Vis Vitalis*; autopoiesis

1. Introduction: Is “information” the Substitute for “Vis Vitalis”

“Information”, (including processing of information, communication, *etc.*) is indispensable for the modern understanding of processes within cells, tissues, organs, the organism, and also between individuals and social structures [1]. It seems to allow the linkage between body and mind, materialistic and idealistic aspects without a proposal in which way, e.g., a special meaning can be attributed to a material structure. In the 19th century, we had a similar “comfortable” situation: it seemed acceptable that “Vis Vitalis + Physics + Chemistry” allowed a sufficient understanding of all expressions of life from amoeba to Einstein (without the topics which were restricted as research objects for priests). And this without any need to discuss: what is “behind” the different types of “powers”.

Vis Vitalis was and is falsified by evolutionary theory: it became obvious that there cannot be anything omnipotent and unchanged if everything is only to be understood within an evolutionary based changing world. However, its explanatory power was not “saved” neither with an alternative hypothesis (as “Popper” would allow) nor thanks to another theory. So the causal explanation of what could be handled previously with Vis Vitalis remains a “grey area” in the landscape of sciences [2].

Now “information”—of course not a power—deals with similar aspects: for special facets with great success:

However, there are gaps which e.g., the so interesting and relevant concept of the General System Theory could not bridge sufficiently: e.g., the different evolutionary levels to the “hierarchical structure” of a person as a biological and social being [3,4]! Why was this not possible?

“Information” is a term which is used with identical wording—and often identical formulas—for machines and humans. The use of the term is in any case in agreement with the definitions: “*Information is information and not energy or matter!*” (N. Wiener) and “*Information is a difference which makes a difference*” (G. Bateson).

Who makes the difference and thanks to what kind of ability? “Vis Vitalis” was a comfortable explanation for that, but finally incompatible with the given facts of evolution and therefore dismissed. So it is correct to ask: is this extremely general understanding of the “technical aspect” of “information” and its “identical” application from a machine to a person really in agreement with our understanding of its application with respect to its “historical/evolutionary” aspects and “aspects with respect to the complementarity”? Should we expect consequences in the technical applications within the evolutionary and complementarity related process even if we have phenomenological identical results?

We are in a situation similar to the one Einstein has been when he recognized the logic incompatibility between the two indispensable theories of Newton and Maxwell: the operational effects are identical from an empirical position: a changing of the position of physical entities in time and space. However, mechanics deals with processes (e.g., of movement) which emerged later in the evolutionary process than electromagnetism or gravitation (and their movements). Similar to the empirically identical “operational output” of the use of information (e.g., for feedback), but used on different “historic/evolutionary” levels and for different applications (e.g., to remember anything or to guide a process within an Euclidian grid). Einstein could handle “his” historical-operational problem with new epistemological tools [5]. Therefore, we should try to adapt his epistemological tools to save the given power (of “information-sciences”) and extend it with respect to the “historical” and the

“operational” understanding of “information” within the (evolutionary older) bodily systems of a human person and between human persons as social beings from an evolutionary point of view. This I have done for the so called Extended View for “evolution” (e.g., [6]). Now I will sketch this within this presentation for “information”.

“Evolution” and “Darwinism” seem to be nearly identical. However, the position of Darwin is limited on the evolution of species. We need a much wider view including social structures and inanimate systems, like machines or the World Wide Web (WWW). Therefore I use the model of the Extended View for our analysis. So biological evolution is just a subset within the ground set of the unique evolutionary process from Big Bang to recent societies.

2. Some Basics

2.1. The Extended View: Some Aspects

The “Extended View” is a model to deal with material and immaterial aspects of a person as a social being and its interactions with and its expectations towards its environments on a causal level [5]. Therefore the model must allow the bridging of unlinked gaps, e.g., between “body and mind”. This is possible with the help of a set of additional epistemological tools, e.g., thanks to the natural philosophy of Einstein [5]. A “basic assumption of the “Extended View” is: incompatibilities between different natural and non-natural scientific based disciplines are to expect because of the consequences of incompatibilities between the nature of their research objects. They can be caused by techniques to generalize research problems on special aspects with the inherent consequence to skip out other aspects which are not relevant for “classic” problems of a discipline—but maybe for “extended ones”. Einstein could confirm this with his Relativity Theories!

His problem was the incompatibility between the identical wording of the term “movement” in electromagnetism and mechanics. The term (and the related processes) is indispensable in both scientific fields but does not cover identical contents: both contents simplify on what is relevant for the changing of an object in its position in time and space for mechanics OR for electromagnetism. Einstein’s solution demonstrates a natural principle: what is relevant on one level can be irrelevant on another level and *vice versa*. The irrelevant is (nearly) neglected in nature and can be neglected in science. The classic example:

The differences between the diffraction of a beam of light passing the sun calculated with “Newton” and “Einstein” are significant. However, they are not relevant for human daily life. They are irrelevant for problems adequately to handle with mechanics (e.g., to calculate the need of fuel for a missile) but they are indispensable when dealing with atomic energy, GPS, WWW Therefore the content of the term “movement” can be and should be different depending on its scientific use for mechanics, electromagnetism and gravitation.

As the reason for that can be assumed: natural entities are evaluating actors! They (can) simplify what is constitutive for their precursors on older evolutionary levels and are unable to attribute meaning to what is emergent on “younger levels”.

2.2. Semantic Correctness—as Simple as Possible but not too Simple

Einstein developed a technique for his problem: to invent a general definition of movement that covers both terms [7]: the invention should be as simple as possible but not too simple: it should cover all the logic and empiric relevant. The Relativity Theories were created. I modified this technique for the “Extended View”. Now we will apply this technique on “information”.

I focus on a related aspect: we need terms to be able to communicate “differences, which make differences”. Therefore, we have to create a term and—if needed—related qualities if we can observe or conclude differences but are not able to communicate about them.

However, the creation of the term and the related quality is not enough within science about our world. We have to postulate characteristics which can be proved: are they “in agreement” to our given world, is there an increase of scientific power to expect to deal more appropriate with daily life problems? Only such inventions of terms can be accepted.

2.3. An “Ability to Deal with Information” in Complementarity to the “Ability to Deal with Energy”

If it is correct to explain the movement of matter with an “(unobservable) ability to deal with energy” (power, fields) then it is also correct to explain the attribution/shift of information to matter with an “ability to deal with information”.

For that “ability” we have introduced the term “discrimination ability” as complementary ability to “energy” as the expression of the potential of just one substance (a neutral evolution-based substance monistic position) and to attribute to the postulated ability characteristics which can be proved empirically and logically.

The proposal of such a quality is consistent with the rules of epistemology but maybe in conflict with social norms. Its abdication can cause ethical implications especially for medicine and Public Health [8]: it would exclude maybe relevant reasons for the understanding of diseases because of a qualitative or quantitative lack on the “ability to deal with information” (e.g., “Causally Unspecific Health effects” Kofler 2001 [9]) and options to improve the level of health.

We characterized this ability in such a way that empirical proving is possible. For further detailed information see the literature within the Stockholm-Project, (e.g., [9] or [10]) The Stockholm-Project is an initiative of the 1st I.M Moscow State Medical University and IAS-HE for the final proving and the adequate presentation of the Extended View to science and the public.

2.4. What Do You Prefer: A Machine Model or “Symbol Intentions” of Actors?

Is it enough to accept that information is all the time the result of a process thanks to the ability of the observer to attribute information/meaning to an observed matter?

You can answer: yes—if you deal just with machine models. Then, you accept an automatism between the perception, the attribution of information to the matter and the consequence that anything happens. This is a stimulus response model—sufficient to understand machines.

But any machine needs a planning person with the intention that the machines do something in regard to the intention of the creator. No machine can exist without a creator who knows that the

reaction of the stimulus will be the intended response. However, remember Bertalanffy: please no machine models for life and persons [11]!

We have to introduce intentionality and—for persons—free will. Can we handle this appropriate?

Again a critical look at Darwin and his evolutionary theory: nobody—even not Darwin—can know about the intentions of another entity. However, he can conclude on them from the observable results of their doing. He generalized the intentions of any living being on what is the fundamental prerequisite for any individual intention: to survive. So “survival” can be understood as a “symbol-intention”.

To be alive is indispensable to realize individual intentions. Individual intentions are in principle “individual” and cannot be fully grasped by an outside observer. Predictable are the agreements about the prerequisites which are common and constitutive to be a “member within a subset of entities”. All “members” will intend these “symbol-intentions” as prerequisite to be able to realize their individual intentions. This can be predicted by the outside observer.

Darwin was interested in a predictable general model for evolution. Therefore I cannot see any incompatibility between the assumptions of Darwin (who included the progress of immaterial aspects in his evolutionary understanding—e.g., the emotions of an earthworm [12]) if I attribute to any single entity intentionality—on the level which was reached by the entity: they are different between the earthworm and Mozart, but both have/had the fundamental intention to survive.

We have to see these differences with respect to the historic dimension and to (the progress in) the application of the autopoiesis of “natural principles”:

Inanimates up to photons have no genes, but are to understand as expressions of and precursors for an evolutionary process: consequently, we have to attribute to them intentionality too.

Therefore we have to extend our understanding of “information”. We have to attribute to the actors not only the ability to link information with matter, but to attribute “meaning” to information.

And if our actors are not omnipotent and ideal, then we have to assume that they attribute positive and negative valuations to meaning. This links our discussions with the natural principle of enforcement and inhibition. Sechenov and Pavlov have discovered them in physiological systems.

I have reported shortly that this principle can be understood as a natural principle which can be observed on any level of our world [13].

3. Evolution with Regards to “Information”

3.1. Implicit Restrictions

3.1.1. Implicit Contents of Terms Change

The use of any term is linked with implicit attributions to it. The comprehensiveness depends on the context of the sentence/problem which should be communicated: if you speak with a medical doctor about pollen of birch the term covers implicitly the ability of the pollen to react specifically with a specific cell system of an allergic person (even if such ability is not a matter of immunology!). The implicit comprehensiveness is narrow if I ask you about the definition of “information”. It is much wider when we discuss about the relevance of “information” for the understanding of the evolutionary process. In the second case we have to integrate that information can be applied on different evolutionary levels, maybe based on an ability to attribute and modify information to structure, *etc.*

Even in a scientific discussion we cannot repeat all these aspects and start with “Adam and Eve” (with one exception: if we are interested to analyze the prerequisites for information from the very early beginning and the related modifications up to the autopoiesis of virtual worlds and the www). The (scientific) discussion will only be fruitful if the partners grasp the essential but changing contents. It is obvious: the constructions about our world exclude often aspects and focus on a selected part.

3.1.2. Implicit Restrictions of the Empirically Experienced Energetical World

It is remarkable that the descendants of quanta are not observable with our sense organ up to the level of atoms. Observable is only the so called “light matter”. “Light matter” covers only 4% of the total energy of the universe—a fundamental restriction of “our world”.

And each further step of evolution is linked with a further restriction of the proportion of the energy of the new level in comparison to the total existing energy: so you can neglect the proportion of energy of persons in relation to the total amount of energy even when considering just the earth and even in relation to the total existing biomass on this planet.

However, not negligible are the evolutionary consequences on the increasing complexity, variability, *etc.*, of information, information carriers and the storage of information which are constitutive for the evolutionary steps—not only, e.g., for humans, but also for the future of our world.

3.2. Evolution Thanks to an Interaction between “Dealing with Information” and “Energy”: *Conclusive but Unpredictable*

You can see the process of evolution conclusive but not predictable if you accept to integrate (the ability to deal with) “information”: any actor is interested to increase its symbol-intentions within the restrictions of its environments and its options thanks to consents. Therefore, actors observe the environment and attribute/construct realizations—in the case of a starting point for evolution a new (emergent) option for realization: to see what anyone can see but to recognize an option for realization which was never recognized before”. This option will be realized and can be the starting point for an evolutionary progress. The starting point for this type of evolution is therefore the observation of the existing. The following step is the attempt to realize a new type of observable realization. If this is a win and is shared with enough others (WINWIN) then this extended evolutionary level can be the starting point for the next construction for an additional new type of realization.

3.3. Probability

Nearly all empirically researchable influences and prerequisites for the autopoiesis of an emergence can occur without a dominating conscious influence of the creator of the emergent. The actually given environmental situation, genetical options, available support thanks to consents, *etc.* So the empirist can come to the conclusion: “The occurrence of the emergent is the result of probability.” If you integrate the valuation of the perceived and assumed then you can assume that even the selection for one of the different possible chains of answers can be a random result—without any link between the assumed relevance of the prerequisites and the open possibilities even if you accept intentionality. Maybe this is enough to explain the survival of an individual. However, this cannot explain why this

individual will answer the same (or a similar) situation in the same way. This would not be to expect if there would be the need just for the correct follow up of a small number of steps for intended survival. The individual must have recognized that the used technique was the reason for survival.

Similar on much more basic levels: you have to attribute even to the cell options with choice for selection. Then, the cell must “recognize” that—maybe the random based—selection was helpful. This would make plausible that the same cell would use next time the identical option.

4. A “General Extended View” on Evolution with Focus on the Autopoiesis of More and More Complex Entities [14]

Evolutionary processes are usually illustrated as follow-ups of the occurrence of entities along a time scale, in the classical understanding just for living beings. A complex understanding of the “only one evolutionary process” deals also with the cosmic evolution, *etc.* up to the autopoiesis of life. You can say: evolution from “Big Bang to Big Mac”. However, the evolution of humans deals with additional aspects—obviously with new types of information.

Such aspects are integrated into the “Extended View” as hypothetic-deductive follow-ups of the attributed autopoietic processes—on four levels of abstractions.

Within this paper I just have the possibility to give a spotlight on the most general level: the General Extended View.

The General Extended View offers the sketch of a draft of a blueprint of the evolutionary process from the very early beginning up to now. It integrates not only energetically aspects. It also uses the potential of the precursors to deal with information to create emergent offers: they are used for new types of consents, an increasing efficiency and other wins for them.

We can illustrate this process with two focusses: One is the “traditional one” with focus on the autopoiesis of more and more complex entities. The other one is the autopoietic progress of “dealing with information”.

First the focus of the autopoiesis of entities [14].

- (a) There was a need to invent basic assumptions to deduce from them the oldest empirically observable entities according to the technique of Einstein (e.g., [7]).
- (b) Photons/quanta act as “if they would have the mass $h\nu$ ” (Einstein). They carry their information and are observable observers for other quanta as “if information would have a localization in an “Euclid-analogue frame”. They cause the field of gravitation: Einstein calls it “ghost-field” and compared it with a sign on the road—not from energy or matter—just to guide the photons the way for the geodetic line—a field for information. However, a sign is helpful only if you can read it!
- (c) Any mass, any atom is expressed on the level of physics as movement of quanta, but is observed by e.g., humans or a camera simplified as surface, form, structure: simplification as a natural principle we know from physiology [13]!
- (d) I focus your interest on (inorganic and organic) catalysts—for a better understanding of the increase of the level to deal with information: chemicals interact “usually” according to the law of mass action (Guldberg and Waage): any single reaction is just restricted by the laws of thermodynamics and the available molecules/ions in a solution but more or less probable. The

probability is getting higher as the mass of the potential “partners” gets higher. You can interpret this in that way that the probability of an interaction depends on the mass and the distance: the closer and heavier the higher the relevance for the application of the allowed interaction! The probability for a special option can be influenced extremely just by the presence of a component but without the integration of this component within the related chemical or physical interaction. If we attribute to any actor the ability to observe the environment (only on the reached evolutionary level), to evaluate the observed and to be able to modify the evaluation then it would be conclusive “to see what everybody has seen but to recognize what nobody has recognized before”—but just on the reached evolutionary level: The recognition of the connection between the presence of an entity and the linkage to a special chemical/physical interaction would be compatible with the actually given evolutionary level. It would allow the creation emergent new options—just on the basis of the former given—thanks to the integration of the new experience: to influence the action of others thanks to the use of a catalyst. Such an entity could increase the relevance of the stimulation thanks to approaching the catalyst and could stop thanks to moving away. It would be a stimulation of other molecules to provide selected realizations. Therefore this emergent new system would consist of entities with two different levels to deal with information: it is sufficient to attribute to the acting entities the level to deal with information on the evolutionary old level. However, it would be necessary and sufficient to attribute to the “guiding” entities which use the “gained knowledge”, how to use catalysts on a new level, which allows not only to discriminate different processes but to organize activities of others to processes too.

- (e) If such a “helmsman” is using this “knowledge”, then others act for the “helmsman” even without grasping the “hidden reason” for their stimulation—a basic for the understanding of life thanks to two different levels of the ability to deal with information. If the capacity to deal with information is restricted—which is a basic assumption within our model—then we have to expect with further progresses in the evolutionary process a situation in which the memory of the actors for the “recipes” for the organization of processes with catalysts will never be sufficient. Such actors need a stabile storage for information/carriers. Then the gained knowledge of the linkage of material structures with recallable information can be used again. There is a need for a persisting structure which can be modified. The crystal is stable and can be linked in consent with information. The determination of organic structures was used for the construction of organic catalysts (enzymes). The result of the combination of both we know: DNA. This proposal can be understood as answer to the problem which was presented by Nobel Laureate HJ. Muller to the scientific communities in classic papers in the 20s and 30s of the last century [15–17]. However, there is no conclusive or just plausible answer up to now: “Why is it possible that a chemical structure is determining the morphological structure of a totally different structure, e.g., the color of the eyes?” He assumed that there should be a special property.
- (f) The use of genomics and proteomics (e.g., to recall the recipe of the enzyme for cAMP) remains identical to stimulate the autopoiesis of the information carrier for identical structures in single cellular (e.g., amoeba), as well as in temporary and permanent multicellular up to humans. However, with the progress from single cellular to multicellular an additional information system—different from enzymes—was needed. Systems of hormones and the complexity of

genomic and proteomic interactions were differentiated throughout the evolutionary development of structures as basis, e.g., for taxia and phobia. Neurons allowed the organization information for more and more complex realizations for biological survival and persistence functions to realize, e.g., thanks to the linkage between the grid for movement and the grid for information.

- (g) The fundamental break of symmetry as starting point for higher living beings. The former focus (physical and biological persistence) as prerequisite is used to set a new focus on being accepted and accepting subjective relationships—From the focus on uniqueness and non-interchangeability thanks to observable energetical/material realized options to individuality and personality thanks to information-related constructions on the basis of meaning and values which cannot be observed but concluded from behavior, wordings, *etc.*
- (h) The new type of (information-related) relationship was the basis for the further differentiation of species (up to homo sapiens). K. Lorenz teaches us [18]: such higher living beings can be classified into different types of species not only by their morphology (incl. genetics) but also on the basis of their behavior.
- (i) With the discovery that the decision maker cannot be observed—just his outside body—new options for the next level of relationship with new types of terms, contents und values (information) were opened: to accept the existence of an unobservable cause, primarily of a deity and an immortal soul. Its oldest symbol: the soulbird in the cave of Lascaux, Dorgone, 15,000 B.C. This is the starting point of the creation of social structures (e.g., Durkheim [19]).
- (j) Worldwide humans created within the cultural evolution more and more types of information and information carriers. Any term (symbol, law) is a free invention of the human mind to deal more appropriate with our world and from another nature than the subject for what it stands (as Einstein teaches us).
- (k) I invite you to have a short view on the process of the storage of and dealing with information outside of the individual, e.g., books, libraries and in the World Wide Web. Here we are using fundamental agreements—the agreements between quanta/photons. We use their predictable persistence of modifications and attribute to them information we can select. We use their abilities to move themselves very quickly over long distances with the speed of light, make artificial interfaces to transform the language of the quanta via “younger” entities and their modifiability to produce effects which can be perceived by human sensory organs.

5. The Autopoietic Progress of “Dealing with Information”

5.1. The Relevance of Navigation, Plasticity, Organization of Follow Ups, Special Time Structures, Dosages, *etc.*

The integration of “information” (with its different aspects of application, *etc.*) demonstrates: even the understanding of the autopoiesis of (morphologically characterized) new species should integrate our interest in information- related principles and tools, e.g., to economize the use of resources (e.g., by feedback), or about the relevance of the positioning of (e.g., enzymes, technical tools, *etc.*). We know that eucariotes have, e.g., special (Rab-)Proteins on well-defined places within the Euclid grid

e.g., in a cell and are responsible for the precise cargo of, e.g., information carriers from one point to another. However, there is limited understanding “how a limited number of motor proteins carries the wide variety of synaptic cargo” [20]. This is connected with the basic question: in which way can we link the grid for movement within space and the grid of information/meaning? The language of the bees is an example how effective this can be used [21]. Dosage, e.g., of phosphorylation is another relevant topic: “Even if enzymes are understood as “words on quanta-basis of an unknown language”, we cannot understand why never too much or too less energy is offered (Nobel Laureate E. Krebs) [22].

Order and time structures (e.g., thanks to rhythmic) are fundamental for the understanding even for the basics of life (therefore, we call the level of discrimination ability which is the prerequisite for life “ability to organize”). The demands will increase dramatically for the survival and functioning of more complex higher living beings. There is no time to handle this within this paper—but we should keep it in mind as a relevant “information-related” topic for the understanding of evolution.

5.2. *The Problem of Interfaces between Languages*

This leads to the next question: How can communication take place, if the languages are more and more sophisticated and deal with in principle different meanings even for identical processes and phenomena?

We have to expect that information gets more and more complex within the evolutionary process even within living entities and their (sub)systems: within a cell, between cells, tissues and organs and within the organism and between structures of the brain. These processes must be at the same time different from the information processes according to their “historic/evolutionary nature” and therefore between different evolved entities without and with brain and especially between them and human persons. However, they have to be similar/identical with respect to the “classic operational principles” of genomic and proteomic interactions. However, they were differentiated throughout the evolutionary development of structures as basis, e.g., for taxia and phobia.

Neurons allowed the organization of information for more and more complex realizations for biological survival and persistence functions, e.g., thanks to the linkage between the grid for movement and the grid for information. The group around J. Frey could demonstrate this for different types of stress in mice [23–26].

5.3. *The Fundamental Break: From the Focus on Realization to the Focus on Constructions*

The next and fundamental break in symmetry in evolution is the change in the intentionality from physical/biological survival/persistence to the intention to be and to remain in a special relationship to another physically existing entity (e.g., thanks to affection) or (in a later step of evolution) to an assumed abstract entity (e.g., god, nation, science). What is so fundamental?

The discovery that the relationship to an object can be seen as an individual win causes the shift: Not the observable structure is in the focus of intention but the immaterial and individual attribution of a relationship—a meaning (e.g., love). Further on the realization is used to express meaning. This is a shift from the focus on the realized to the constructed: “To attribute to a process the message of an individual relationship”. We call this “sense orientation” and “final orientation”.

5.4. Is There a Need for an Additional Type of Storage for Information?

In the center of relationships are not anymore the form and its construction for life processes or their use for applications for self-intentions. We know the tools to store the related recallable information for structures: this is the genome. In the center of the intentions and for the orientation in the world of entities with emotion (and of cause with cognition, virtuality, *etc.*) are constructions and consents about it—and not energetical/material structures.

Therefore we should expect that the storage system for information (carriers) gets modified too. We propose to discuss that neuronal modules can be understood as “the genome-equivalent system for psycho-socio-cultural information”. They are indispensable to handle symbols, complex behavior, language, music, scripture, *etc.*

However, all fundamentally older information systems which are the prerequisites for, e.g., a person must remain fully in order: especially the principles of genomics and proteomic (and their evolutionary development like epigenetics) and also the physical and chemical properties of living entities. They are necessary for the characterization of a person as a social being, but not sufficient to explain intellectual, emotional and cognitive processes.

Arguments to postulate a “genome-analogue” system to store and recall meaningful information.

The genomic and proteomic prerequisites—remain in principle identical in any living entity, from amoeba to mice, from mice to cats and primates, from primates to Einstein and Mozart.

However, the attribution of meaning to matter/letters and “sounds”/words depends on the place of birth, education, *etc.*—not on genes and proteins. Genes and proteins are necessary but not sufficient for the understanding of the attributed memorization of words, *etc.* The Stone of Rosette demonstrates: the brain—with its modules and nets—enables us to conclude and to reactivate forgotten meanings attributed to structure!

6. Conclusions

Let me conclude with just some consequences:

- (1) Information is a term covering qualitatively very different contents.
- (2) “Information” is the result of a process thanks to an ability depending on evolution.
- (3) Information can be understood as an (unobservable) relationship between an existing actor and
 - (a) another existing actor on the basis of an attribution of information to an observed (existing) object (even between quanta, quarks);
 - (b) an attribution about priorities to an object (physics, chemistry, biochemistry, basic life);
 - (c) an assumption about the hoped for or assumed attribution of the observed object as subject of the „valuating actor” (emotion);
 - (d) an assumption about the relationship to an actor which is unobservable but assumed as existing (finality);
 - (e) effects within just theoretically assumed or to observations of “instruments” attributed interactions between existing entities (e.g., natural sciences).
- (4) effects within processes “outside of the really given world” but within the assumption of a predictability of reactions of others (virtuality).

- (5) The (evolutionary) level of the “observer” defines what kind of potential information can be observed and what can “never“ be observed because of the fact that the “observer” is too young to catch the information, or has a lower evolutionary level than needed to deal with such an information, *etc.*
- (6) Identical information carriers can have different meanings on different evolutionary levels.
- (7) We can use the predictable consequences of information on different evolutionary levels to create machines, including machines to deal with information, e.g., the telephone or the WWW.
- (8) Systemic approaches (e.g., feedback) can be understood as “technical natural principles”. They can be used on different levels to produce (nearly) identical phenomena, but related to intentions, demands, *etc.* of different evolutionary levels.

Conflicts of Interest

The author declares no conflict of interest.

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