

Informon—An emergent conscious component

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This article deals with a conscious entity being the building block of conscious systems. Such an informational entity is called informon, with its local and global function. The idea of informon as a conscious unit roots in the property of a sufficient complexity and learning capabilities, realized by different sorts of informational interpretation, formalism, general and metaphysicalistic decomposition concerning informon.

Emotional and cognitive informons show the complexity, intention, and capability of consciously, sub-consciously, and self-consciously autonomous entities informing within a conscious system.

1 Understanding informon α

Consciousness seems to be an informational phenomenon emerging within an individual (physical, biological, phenomenal) brain. This kind of conscious informing is grasped as an instantaneous informational process of temporary active attention concerning definite matters in informationally complex ways, coming into the foreground out of possible conscious background with conscious potentialities. The search for an realizable concept of consciousness concerns the possibility of design leading to something which could be called artificial, machine-like, or robotic consciousness.

To be conscious means to be involved informationally in a matter (entity, problem, process, event) of awareness, in an instantaneous way, in a moment of attention informationally concerning a distinct matter, that is, by an immediate concern that is spontaneous and transitory simultaneously, being a form of an informational event, happening as a matter of individual experience. This state of conscious possibility and possible experience concerning a determined or verbally named matter α is symbolized and informationally formalized by the notion of informon $\underline{\alpha}$, published for the first time in German [9] and described before in [8].

To be more clear let's take the example of an emotion. In English, up to 2,500 names or name phrases for emotions can be distinguished. In Slovene, we can probably identify some hundreds names marking emotional states¹. Taking a concrete emotion, for instance,

named anger, informationally formalized by $\underline{\mathbf{a}}_{\text{anger}}$, we search for the meaning of this word in English. Using dictionaries, thesauri, encyclopedias, and our own imagination concerning anger, we can write a dissertation on anger. The meaning of anger is now determined by a collection of anger explaining sentences, paragraphs, psychological sketches, and the like. We understand that the collected meaning is in no way a final result and can be continued, refined, advanced, etc. The acquired meaning given by the linguistic collection concerning anger we call anger informon or informon, concerning anger, denoting it symbolically by $\underline{\mathbf{a}}_{\text{anger}}$.

What do we have in mind by the obtained result of the concept? The name $\underline{\mathbf{a}}_{\text{anger}}$, a pure marker or basic informational operand concerning the English word **anger**, is now expanded or informationally propagated within the language to a meaning of anger, the still emerging informon denoted by $\underline{\mathbf{a}}_{\text{anger}}$. In the complexity of language, this meaning is expressed by meanings of other emotional, cognitive, and other sorts of informons. The complexity becomes interweaved—informonically perplexed. In general, for such a situation, we can introduce the informon notations named α in a formula-dependent way,

$$\underline{\Phi}_{\underline{\alpha}} \Rightarrow \underline{\varphi}_{\underline{\alpha}}[\alpha, \underline{\alpha}_1, \underline{\alpha}_2, \dots, \underline{\alpha}_i, \dots]$$

or, in a formula-system way,

$$\underline{\Phi}_{\underline{\alpha}} \Rightarrow (\alpha; \underline{\alpha}_1; \underline{\alpha}_2; \dots; \underline{\alpha}_i; \dots)$$

The third possibility would be to express the informational dependence of operands by the so-called informon Slovene term.

¹I believe that a study of this sort was not made until now. I tried something in this direction by translating known English terms for emotions, however, it happens that many distinguished English terms fell into the domain of one and the same

mational concerning of the form

$$\underline{\Phi}_{\alpha} \Rightarrow \alpha [\alpha, \underline{\alpha}_1, \underline{\alpha}_2, \dots, \underline{\alpha}_i, \dots]$$

The first expression is something we know as mathematical expression of a function or formula $\underline{\varphi}_{\alpha}$ depending on its operands (variables) $\alpha, \underline{\alpha}_1, \underline{\alpha}_2, \dots, \underline{\alpha}_i, \dots$. In case of an informational formula, parenthesis-like floor delimiters '[' and ']' are used instead of '(' and ')', respectively. The last parenthesis pair is used for delimiting subformulas occurring in informational formulas and, simultaneously, delimiting or enclosing the operands (elements) of a formula system $\underline{\Phi}_{\alpha}$ as shown in the second expression. In the third expression, informon α concerns informationally in a complex manner the name α and informons $\underline{\alpha}_1, \underline{\alpha}_2, \dots, \underline{\alpha}_i, \dots$ emerged during a system informing. It is essentially to stress that operands $\alpha, \underline{\alpha}_1, \underline{\alpha}_2, \dots, \underline{\alpha}_i, \dots$ certainly possess common operands and, in this way, become circularly structured, that is, inform circularly in one or another way. Detailed meanings of such expressions can be found in the study [8] and elsewhere in its references.

Let us show the examples of the discussed three informonic system notations $\underline{\Phi}_{\alpha}$. Let the emotion of anger, $\mathbf{a}_{\text{anger}}$, inform dominantly in a situation within the conscious system, together with cognition concerning anger and some other involved emotions. All of these components are informonic (complex and consciously structured by themselves) and build up the informonic system of anger as the dominant intention. In the formula dependent way it means, according to the first kind of expression,

$$\underline{\Phi}_{\mathbf{a}_{\text{anger}}} \Rightarrow \underline{\varphi}_{\mathbf{a}_{\text{anger}}} \left[\mathbf{a}_{\text{anger}}, \underline{\mathbf{c}}_{\text{cognition}} [\mathbf{a}_{\text{anger}}], \dots, \underline{\mathbf{r}}_{\text{rage}} [\mathbf{a}_{\text{anger}}], \underline{\mathbf{s}}_{\text{sadness}} [\mathbf{a}_{\text{anger}}], \underline{\mathbf{d}}_{\text{depression}} [\mathbf{a}_{\text{anger}}] \right]$$

In this expression components of the informonic formula $\underline{\varphi}_{\mathbf{a}_{\text{anger}}}$ are linked by operators. In the second formula system expression, components are linked through common operands, that is,

$$\underline{\Phi}_{\mathbf{a}_{\text{anger}}} \Rightarrow \left(\mathbf{a}_{\text{anger}}, \underline{\mathbf{c}}_{\text{cognition}} [\mathbf{a}_{\text{anger}}], \dots, \underline{\mathbf{r}}_{\text{rage}} [\mathbf{a}_{\text{anger}}], \underline{\mathbf{s}}_{\text{sadness}} [\mathbf{a}_{\text{anger}}], \underline{\mathbf{d}}_{\text{depression}} [\mathbf{a}_{\text{anger}}] \right)$$

In the third, informational-concerning expression,

$$\underline{\Phi}_{\mathbf{a}_{\text{anger}}} \Rightarrow \mathbf{a}_{\text{anger}} \left[\underline{\mathbf{c}}_{\text{cognition}} [\mathbf{a}_{\text{anger}}], \dots, \underline{\mathbf{r}}_{\text{rage}} [\mathbf{a}_{\text{anger}}], \underline{\mathbf{s}}_{\text{sadness}} [\mathbf{a}_{\text{anger}}], \underline{\mathbf{d}}_{\text{depression}} [\mathbf{a}_{\text{anger}}] \right]$$

the system becomes circularly perplexed according to the dominating informon $\mathbf{a}_{\text{anger}}$. It becomes evident that the three systems marked by $\underline{\Phi}_{\mathbf{a}_{\text{anger}}}$ represent nothing other than the actual informon $\mathbf{a}_{\text{anger}}$ within a complex conscious system.

2 Consciousness versus complexity, learning versus time, and decomposition versus emerging of informon

The main problem of informon concept is the implementation of its autonomous conscious function. In principle, each informational entity represented by an informational operand has the property to function consciously per se, to possess the conscious capability within its own informational organization. The hypothesis of the necessary complexity [2], exponential process of learning [3], and informational organization of emerging [8], offers a smart and believable approach to make informational entities intentionally conscious in an artificial way, that is, outside a natural biologically founded consciousness.

Fig. 1 shows the learning versus time exponentialism (a) and the emerging of consciousness versus component complexity (b) being necessary for the occurrence of a conscious system. The learning curve \curvearrowright in (a) shows how the state of a skill mastering advances through learning versus time from the knowledge of a beginner. In this part of the curve the acquiring of knowledge has an exponential nature when the beginner grasps a lot of new knowledge and begins to use it as his or her own experience. In a point of development, the critical knowledge is reached putting the beginner near the threshold of becoming the master of the learned skill. Finally, the skill mastering is reached, characterizing the skill of a professional, which then can be still improved in an advanced manner. The point of critical knowledge is a kind of the donkey bridge and, when crossed, the way to the professional side becomes open. One of the best examples of the learning curve is the exponential acceleration in computer technology, where complexity of components and their speed of operation advance exponentially through time. It is understood, that the critical knowledge of the complex technology is already reached, so the advancement to an artificial conscious system becomes possible through the next decades.

The step curve \curvearrowleft in (b) is crucial for the occurrence of consciousness or conscious system. Human brain is an example of neuron and synapse complexity being sufficient for the real occurrence of consciousness in man. In primitive biological systems, the unconscious nervous activity takes care for the functioning of the necessary conditions of life. At some complexity of the neuronal system, intelligence can be observed being a manifest of the species successfully fitting to the environment. The state of the beginning of intelligence can be observed in machines using the technology of artificial intelligence (house equipment, today expert systems, and the like). As we see in Fig. 1 (b), this kind of intelligence is still far under the complexity

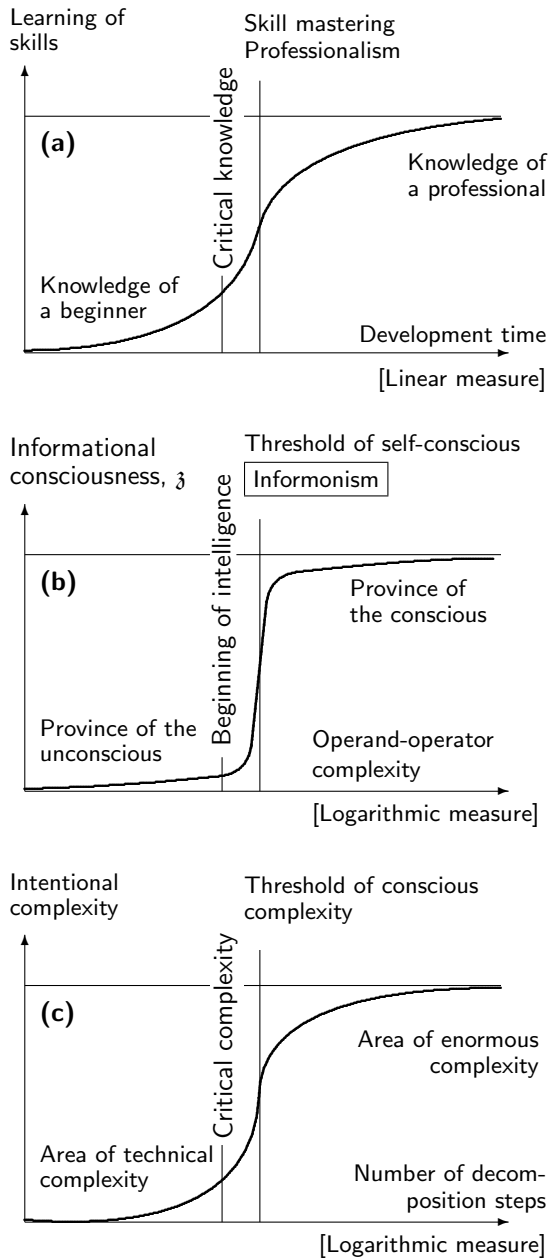


Figure 1: (a) The exponential acceleration of an entity’s knowledge through learning versus development time (Kurzweil [3] p. 34, the learning curve \mathcal{L}). (b) The step curve \mathcal{I} of emerging of informational consciousness versus operand-operator complexity (Buttazzo [2]). (c) The complexity acceleration versus the number of informational decomposition steps (Δ , \mathfrak{M} , \mathfrak{J} , and other sorts of decomposition).

needed for the most primitive form of consciousness. When complexity raises, a kind of jump to the conscious ability occurs. In man, some 10^{15} synapses and 10^{12} neurons constitute the conscious function being already substantially above the limit of consciousness occurrence.

Finally, the third curve (c) shows how a part of intentional complexity depends on the number of decomposition steps. The point of critical complexity, critical knowledge (a), and the beginning of intelligence (b) coincide. This coincidence is the condition for an informational system to become conscious, as the step curve (b) shows. The transition from unconscious to conscious happens along the “step” in curve (b). The other part of complexity might be conditioned by the number of physical components available for the machine in which a conscious system is embedded.

By the acquiring and emerging of knowledge the complexity of conscious system raises. Vice versa, the enlarged complexity accelerates the acquiring of knowledge. Under artificial or machine-like circumstances, artificial consciousness can widely surpass a biological consciousness in the brain. A silicon or quantum-technology brain will substantially surpass the biological brain in complexity, speed, interior and exterior communication (informational connectivity), and in (unforgettable) memory, being capable to accumulate everything happened to a conscious system in the past.

Functional and componetial complexity, building up the intentional informational complexity, remains one of the major requirements in the design and implementation of artificial consciousness. The informon as a component of conscious system needs the complexity in itself and in its environment.

3 To verbal and formal etymology of the word informon, informoron, and cognitron

For a physicist or an electronic engineer, the comparison between the electron concept and the informon concept may be instructive. For instance, electron is in no way a static, definite, or even transparent notion. On the contrary, electron is a dynamic phenomenon imagined in the brain of a physicist constructing the atom theory. It is not only a particle with mass and charge, but a moving particle within the atom organization and outside of the atom as an electrically charged particle. The invisible trajectories of electron within an atom concept exist just as a logical predisposition of the atomic model. Mainly, electron is characterized by its charge, mass, and the dynamics originating in the charge moving along an electro-magnetic field. The point of this story concerning electron is that its definition is in no way as simple as it would be seen at the first glance. The origin of the word electron is Greek and means amber.

Can we expect a simple story of an informon etymology after all? There will be several additions determining informon’s nature in the world of informational. The word informon is a fusion of the Latin *informo*

Informing complexity	Name	Local informon	Global informon	Local informoron	Local cogniton
Operand's informing	α	$\underline{\alpha} \Rightarrow (\alpha; \underline{\mathcal{I}}_{\alpha}; \underline{\mathcal{C}}_{\alpha}; \underline{\mathcal{E}}_{\alpha})$ $\underline{\alpha} \Rightarrow (\alpha; \widehat{\alpha}; \widetilde{\alpha})$	$\widehat{\alpha} \Rightarrow (\alpha; \widehat{\underline{\mathcal{I}}}_{\alpha}; \widehat{\underline{\mathcal{C}}}_{\alpha}; \widehat{\underline{\mathcal{E}}}_{\alpha})$	$\widetilde{\alpha} \Rightarrow (\underline{\mathcal{I}}_{\alpha}; \underline{\mathcal{C}}_{\alpha})$	$\widetilde{\widetilde{\alpha}} \Rightarrow \underline{\mathcal{E}}_{\alpha}$
Intentional informing	\mathcal{I}_{α}	$\underline{\mathcal{I}}_{\alpha} \Rightarrow (\mathcal{I}_{\alpha}; \underline{\mathcal{I}}_{\mathcal{I}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{I}_{\alpha}}; \underline{\mathcal{E}}_{\mathcal{I}_{\alpha}})$	$\widehat{\underline{\mathcal{I}}}_{\alpha} \Rightarrow (\mathcal{I}_{\alpha}; \widehat{\underline{\mathcal{I}}}_{\mathcal{I}_{\alpha}}; \widehat{\underline{\mathcal{C}}}_{\mathcal{I}_{\alpha}}; \widehat{\underline{\mathcal{E}}}_{\mathcal{I}_{\alpha}})$	$\widetilde{\underline{\mathcal{I}}}_{\alpha} \Rightarrow (\underline{\mathcal{I}}_{\mathcal{I}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{I}_{\alpha}})$	$\widetilde{\widetilde{\underline{\mathcal{I}}}_{\alpha}} \Rightarrow \underline{\mathcal{E}}_{\mathcal{I}_{\alpha}}$
Counter-informing	\mathcal{C}_{α}	$\underline{\mathcal{C}}_{\alpha} \Rightarrow (\mathcal{C}_{\alpha}; \underline{\mathcal{I}}_{\mathcal{C}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{C}_{\alpha}}; \underline{\mathcal{E}}_{\mathcal{C}_{\alpha}})$	$\widehat{\underline{\mathcal{C}}}_{\alpha} \Rightarrow (\mathcal{C}_{\alpha}; \widehat{\underline{\mathcal{I}}}_{\mathcal{C}_{\alpha}}; \widehat{\underline{\mathcal{C}}}_{\mathcal{C}_{\alpha}}; \widehat{\underline{\mathcal{E}}}_{\mathcal{C}_{\alpha}})$	$\widetilde{\underline{\mathcal{C}}}_{\alpha} \Rightarrow (\underline{\mathcal{I}}_{\mathcal{C}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{C}_{\alpha}})$	$\widetilde{\widetilde{\underline{\mathcal{C}}}_{\alpha}} \Rightarrow \underline{\mathcal{E}}_{\mathcal{C}_{\alpha}}$
Informational embedding	\mathcal{E}_{α}	$\underline{\mathcal{E}}_{\alpha} \Rightarrow (\mathcal{E}_{\alpha}; \underline{\mathcal{I}}_{\mathcal{E}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{E}_{\alpha}}; \underline{\mathcal{E}}_{\mathcal{E}_{\alpha}})$	$\widehat{\underline{\mathcal{E}}}_{\alpha} \Rightarrow (\mathcal{E}_{\alpha}; \widehat{\underline{\mathcal{I}}}_{\mathcal{E}_{\alpha}}; \widehat{\underline{\mathcal{C}}}_{\mathcal{E}_{\alpha}}; \widehat{\underline{\mathcal{E}}}_{\mathcal{E}_{\alpha}})$	$\widetilde{\underline{\mathcal{E}}}_{\alpha} \Rightarrow (\underline{\mathcal{I}}_{\mathcal{E}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{E}_{\alpha}})$	$\widetilde{\widetilde{\underline{\mathcal{E}}}_{\alpha}} \Rightarrow \underline{\mathcal{E}}_{\mathcal{E}_{\alpha}}$

Table 1: This table shows, how the initial (sublocal) components α , \mathcal{I}_{α} , \mathcal{C}_{α} , and \mathcal{E}_{α} of informon $\underline{\alpha}$ become local informons $\underline{\alpha}$, $\underline{\mathcal{I}}_{\alpha}$, $\underline{\mathcal{C}}_{\alpha}$, and $\underline{\mathcal{E}}_{\alpha}$ and, in this sense, perform as individual informons by themselves. The similar is shown for the global informon.

Nouns	Information, α	Informon, $\underline{\alpha}$	Informoron, $\widetilde{\alpha}$	Cogniton, $\widetilde{\widetilde{\alpha}}$
Adjectives	informational	informonic	informoronic	cognitonic
Adverbs	informationally	informonically	informoronically	cognitonically
Verbs	to inform	to informonize	to informoronize	to cognitonize
Participles	informing	informonizing	informoronizing	cognitonizing

Table 2: An overview of meaning concerning the words information, informon, informoron, and cogniton and their English derivations.

and the Greek *on* (being, entity). Translated into English, the meaning of *informon* is informational being or Being of the informational. Informational entity is the most general term to which the term informon belongs. It comes fore as the intentionally extremely complex entity connecting, interweaving, and in this manner including other informational entities and, in this way, informing and being informed consciously by itself. Informational entities, as they occur in conscious systems, are conscious, self-conscious, and sub-conscious as informational units. In this respect, informon brings a new meaning into the discourse of conscious structuring and organization, and understanding of its informational constitution. A conscious system—biological or artificial—can be imagined as an informonic organization, possessing initially a basic shell structure, complexly connected to various and numerous other entities in a circular way, ensuring the conscious maintaining and development of the involved informational entities.

Etymologically, it can be useful to structure the in-

formon into a more detail. For instance, it could be quite appropriate to distinguish the so-called informing-counterinforming subsystem and cognitive subsystem in the initial and further developed informon organization. For such a purpose, two new terms can be coined: *informoron* and *cogniton*, respectively. In this texture, informon $\underline{\alpha}$ is an informational fusion of the informon's name α , informon's informoron $\widetilde{\alpha}$, and informoron's cogniton $\widetilde{\widetilde{\alpha}}$, that is, a formula system $\underline{\alpha} \Rightarrow (\alpha; \widetilde{\alpha}; \widetilde{\widetilde{\alpha}})$.

The informon comparison table Tab. 1 can be useful: it forces us to rethink the recursive definitions of informon and make the introduced symbolism transparent for the common use in the future. According to the table, in a concrete case, the informon $\underline{\alpha}$ components are informonically constituted as $\underline{\mathcal{I}}_{\alpha} \Rightarrow (\mathcal{I}_{\alpha}; \underline{\mathcal{I}}_{\mathcal{I}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{I}_{\alpha}}; \underline{\mathcal{E}}_{\mathcal{I}_{\alpha}})$ (informon's informing), $\underline{\mathcal{C}}_{\alpha} \Rightarrow (\mathcal{C}_{\alpha}; \underline{\mathcal{I}}_{\mathcal{C}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{C}_{\alpha}}; \underline{\mathcal{E}}_{\mathcal{C}_{\alpha}})$ (informon's counterinforming), and $\underline{\mathcal{E}}_{\alpha} \Rightarrow (\mathcal{E}_{\alpha}; \underline{\mathcal{I}}_{\mathcal{E}_{\alpha}}; \underline{\mathcal{C}}_{\mathcal{E}_{\alpha}}; \underline{\mathcal{E}}_{\mathcal{E}_{\alpha}})$ (informon's informa-

tional embedding, called also cogniton). Evidently, the informon definition is recursive and can reach any reasonable informational depth of a situation decomposition.

In a similar way, this happens to the initially local components α , \mathcal{I}_α , \mathcal{C}_α , and \mathcal{E}_α (being named operands only), which in the framework of the global informon $\hat{\underline{\alpha}}$ become global informons $\hat{\underline{\alpha}}$, $\hat{\underline{\mathcal{I}}}_\alpha$, $\hat{\underline{\mathcal{C}}}_\alpha$, and $\hat{\underline{\mathcal{E}}}_\alpha$ as presented in Tab. 1.

Adequately to the local informorons and local cognitons in Tab. 1, global informorons can be defined in the form

$$\begin{aligned} \hat{\underline{\alpha}} &= (\hat{\underline{\mathcal{I}}}_\alpha; \hat{\underline{\mathcal{C}}}_\alpha); & \hat{\underline{\mathcal{I}}}_\alpha &= (\hat{\underline{\mathcal{I}}}_{\hat{\underline{\mathcal{I}}}_\alpha}; \hat{\underline{\mathcal{C}}}_{\hat{\underline{\mathcal{I}}}_\alpha}); \\ \hat{\underline{\mathcal{C}}}_\alpha &= (\hat{\underline{\mathcal{I}}}_{\hat{\underline{\mathcal{C}}}_\alpha}; \hat{\underline{\mathcal{C}}}_{\hat{\underline{\mathcal{C}}}_\alpha}); & \hat{\underline{\mathcal{E}}}_\alpha &= (\hat{\underline{\mathcal{I}}}_{\hat{\underline{\mathcal{E}}}_\alpha}; \hat{\underline{\mathcal{C}}}_{\hat{\underline{\mathcal{E}}}_\alpha}) \end{aligned}$$

and global cognitons in the form

$$\hat{\underline{\hat{\underline{\alpha}}}} = \hat{\underline{\hat{\underline{\mathcal{E}}}_\alpha}}; \quad \hat{\underline{\hat{\underline{\mathcal{I}}}_\alpha}} = \hat{\underline{\hat{\underline{\mathcal{E}}}_{\hat{\underline{\mathcal{I}}}_\alpha}}}; \quad \hat{\underline{\hat{\underline{\mathcal{C}}}_\alpha}} = \hat{\underline{\hat{\underline{\mathcal{E}}}_{\hat{\underline{\mathcal{C}}}_\alpha}}}; \quad \hat{\underline{\hat{\underline{\mathcal{E}}}_\alpha}} = \hat{\underline{\hat{\underline{\mathcal{E}}}_{\hat{\underline{\mathcal{E}}}_\alpha}}$$

Global cognitons leave the question “What do they represent?” open. They certainly include a global understanding of the name (title, topic) α , its derivatives, and subnames, acquired through the informational decomposition propagation in global circumstances, for instance, including the meaning of α in different languages and image presentations and processing [5]. Such a sort of cogniton can emerge probably on a natural and an artificial level of consciousness, when the meaning material is assembled and systematically ordered and treated in a nervous system [6] and an informational machine.

To keep in mind the introduced symbols the following list with supplementary explanations could be helpful:

α	Name of entity, operand
$\underline{\alpha}$	Informon, as consciously organized complex entity in <i>local</i> or individual environment
$\tilde{\underline{\alpha}}$	Informoron, a complex component of informon, a subsystem of intentional and counterinformational part
$\hat{\underline{\alpha}}$	Cogniton, a complex component of informon, a subsystem representing the cognitive part
$\hat{\underline{\hat{\underline{\alpha}}}}$	Global informon, as consciously organized complex entity in <i>global</i> environment, expanding over local or individual informational borders
$\hat{\underline{\hat{\underline{\tilde{\underline{\alpha}}}}}}$	Global informoron, a complex component of global informon, a subsystem of intentional and counterinformational part
$\hat{\underline{\hat{\underline{\hat{\underline{\hat{\underline{\alpha}}}}}}}}$	Global cogniton, a complex component of global informon, a subsystem representing the cognitive part

Into the etymological view of informon additional words can enter, as shown in Tab. 2. The meaning of adjectives, adverbs, verbs, and participles must be understood in a pragmatic commonsense of the English language. For instance, informonic means to have an

informational organization of informon. To informonize means to make an informational entity informon-like. Informoronic means to have an interior organization of informing and counterinforming simultaneously, etc.

4 Understanding consciousness in an innovative way

Usually, references concerning the topics of consciousness or mind root in some kind of traditional philosophy, for instance, such as Chalmers’ conscious mind. In the last couple of years, questions touching problems of an artificial consciousness implementation come to the foreground (e.g., Buttazzo, 2001 [2]). The characteristic of references is a typical reductionism rooting on one side in an abstract philosophical discourse and, on the other side, in a too small number of properties pertaining to conscious systems. To such a conceptualism, usually a hierarchical organization of consciousness is studied and being disputed, rooting in the structure of brain and its functional locations.

For instance, the main question of the traditional consciousness studies remains if and when the design and implementation of an artificially conscious system would be possible. So, the experienced properties of conscious mind are rather very abstract concepts of unity, representation, supervenience, being in relation with, complexity, learning, and the like. A descriptive and exact formalism of conscious phenomena is practically not known, with few exceptions found in an exhaustive formalistic study of artificial consciousness in [8]. In this ongoing research some of the characteristic concepts or properties of conscious systems—biological or artificial—are systematically listed in Tab. 3.

The right column of the table is dedicated to the innovative philosophy, formalism, and methodology, all being relevant for the future artificial consciousness implementation. As the reader might observe, a substantial number of criteria for conscious system is identified—some of them by an entirely new approaches, for instance, how to generate, acquire, embed the meaning of solutions as a sort of results coming up in conscious systems. So, we can discuss some items of the table additionally and complementarily.

The main point of this paper is to discuss the constitution of informon and show its functional (structural, organizational) sufficiency to operate or inform consciously, that is, as an independent conscious subsystem, coming into the conscious foreground upon the inner and environmental impulses, and putting it into the background, when other, for a particular informon relevant impulses, force other informons into the conscious foreground.

The concept of informonic consciousness does not

Item	Commonplace mind philosophy	Informational consciousness philosophy
(1)	Properties of conscious mind	Properties of informational consciousness
(2)	Unity of consciousness	l. systematism, informational formula systems
(3)	Consciousness representation: language, image, sound, etc.	l. operands (α), i. operators (\models), i. formulas (φ), i.f. systems ($\varphi^{\circ\parallel}, \Phi$)
(4)	Being in relation with other components	l. causality captured by i. formulas, common operands
(5)	Complexity of brain (neurons), mind	Complexity of i. formula systems: operands, operators
(6)	Phenomenal intentionality: in cognition, emotions, sensory domain	l. intentionality in meaning, goals, aims, i. stability, i. perseverance, i. orientation, ideology
(7)	Conscious spontaneity, occasioning, happening, being	l. unforeseeability, unpredictability, emergence of the informationally unexpected, possible
(8)	Direct and circular causality	l. causal relationship of i. entities
(9)	Conscious entity, event, process, experience	l. entity is: i. operand, i. operator, i. formula, i. formula system, emergence of meaning, understanding, expressed formally, generated by i. decomposition
(10)	Parallelism of conscious events, processes, experiences	l. parallelism of operands, operators, formulas, formula systems, represented formally
(11)	Conscious serialism, consequentialness, with simultaneous conscious parallelism of events	Non-circular and circular serial, reverse serial, biserial, split biserial i. formulas ($\varphi_{\triangleright}^{\nabla}$), and uniform and non-uniform i. formula systems ($\varphi_{\triangleright}^{\nabla\parallel}, \Phi$), where $\nabla \in \{\lambda, \circ\}$ and $\triangleright \in \{\rightarrow, \leftarrow, \rightleftarrows, (\rightarrow, \leftarrow)\}$
(12)	Conscious emergentism, experiential happening	l. arising of entities causally, unforeseeably, occasionally, happening accidentally, environmentally dependent
(13)	Conscious structure and organization, embodied in the brain architecture and its properties, depending on it	l. structure and organization, expressed by i. entities, informing continuously in an intentional, emotional, and cognitive way
(14)	Metaphysics of consciousness, the inner organization of conscious systems	l. metaphysicalism, with m. shell $\mathfrak{M}_{\triangleright}^{\circ\parallel}[\alpha]$, where $\alpha \in \{\beta, \varphi_{\triangleright}^{\nabla}, \varphi_{\triangleright}^{\nabla\parallel}, \Phi\}$; β marks a primitive operand
(15)	Conscious ontogenesis	l. heaping, accumulating, enlarging of complexity, entity relatedness, causality, meaning
(16)	Conscious solving of problems	Producing of i. entity specific meaning, informationally fused in the solution f. systems
(17)	Events: conscious, sub-conscious, self-conscious, and not being conscious	Informing entities are operands, operators, formulas, and f. systems, representing conscious and other events, processes, and experiences
(18)	Conscious counterfactual relations	Counterinforming of i. entities, in decomposition $\mathfrak{M}_{\triangleright}^{\circ\parallel}[\alpha]$, with counterinforming components \mathfrak{C}_{α} and c_{α}
(19)	Conscious components, as subsystems of c.s., e.g., cognitive, emotional, attentional, behavioral, metastatic, etc.	Informons, informing in parallel: $\underline{\alpha}_i \equiv (\alpha_i; \underline{\mathcal{I}}_{\alpha_i}; \underline{\mathcal{C}}_{\alpha_i}; \underline{\mathcal{E}}_{\alpha_i})$, where $i = 1, 2, \dots$; α_i is the name, $\widetilde{\underline{\alpha}}_i \equiv (\underline{\mathcal{I}}_{\alpha_i}; \underline{\mathcal{C}}_{\alpha_i})$ is informoron, and $\widetilde{\underline{\alpha}}_i \equiv \underline{\mathcal{E}}_{\alpha_i}$ is cogniton
(20)	Biological, individual consciousness	Artificial, computational, i. individual consciousness \mathfrak{z}
(21)	Physical embodiment of consciousness	l. embodiment in i. machines, robots, local and global webs, informationally accessible archives
(22)	Brains	l. machines, global web computing systems
(23)	Conscious system	Informonic systems, systems of informing informons
(24)	Formalism: exact, physicalistic, scientific, mathematical	l. formalism: embodied in i. axiomatism, informons, by operands, operators, formulas, and f. systems
(25)	Methodology: scientific and experimental	l. methodology: decomposition (Δ, \mathfrak{M}), parenthesizing (\mathfrak{P}), schematizing (\mathfrak{S}), gestaltizing (Γ), rotation of operands (\mathfrak{R}), i. axiomatism, inferentialism
(26)	Authenticity of consciousness	Intentional i. emergentism, individualism, creativity, objectivism
(27)	Qualia	Individual, unique, sensory and metaphysical experience
(28)	Pure consciousness	Artificial consciousness as informon \mathfrak{z} , concentrating on consciousness name \mathfrak{z} as such

Agenda: c. — conscious, f. — formula, i. — informational, m. — metaphysicalistic, s. — system

Table 3: A correspondence concerning the commonplace concepts and the informational concepts of consciousness. For details see [8].

reflect the physical and biological organization of the human brain with a specific and hierarchically structured architecture impacting and conditioning the information-functional specificity of human mind. It concentrates on informational possibility of conscious phenomena as they appear to an individual consciousness and can freely inform within a machine.

5 A concise definition of informon

5.1 The hypothetic background

Formal informational definition of informon needs a complex and environmentally perplexed determination of a formula system. Informon as an informational entity needs its verbal and formal definition. Verbally a lot concerning informon was said. What we need is a unique symbolism for informon $\underline{\alpha}$ rooting in its name α .

The name α , representing for instance a word, notion, concept, existent, the imagined, etc., carries an intention of its meaning. The intentional means something which is already informonic in structure, organization, and propagation of α 's meaning through and into informational environment (space):

- Structure of that which emerges out of the initial name α is informonic, e.g., basically metaphysicalistic in such or another way.
- Organization of the emerged is spontaneous and emergent in the propagation of the α 's meaning. We usually say that the meaning of α arises in complexity, however in an intentionally consistent (predominant) way.
- The propagation of α 's meaning comes into being by informational decomposition of that what emerged through previous processes of decomposition. Decomposition itself depends of the intentionality (meaning) of the name α , beginning from the initial shell of informon $\underline{\alpha}$, where the initial intention of the meaning is being captured.
- Decomposition of something is informational propagation of something's meaning through the informational space.

Hypothesis 1 (COMPLEXITY AND INITIAL SHELL) *An informational entity (operand, formula, or formula system) is said to inform consciously, if and only if*

1. *it possesses a sufficient amount of complexity, that is, sufficiently large or larger number of informational components (operands, formulas, formula systems), and*

2. *has an initial informonic structure of organization, that is, an informonic shell, from which the complexity can start according to the intention, given by the entity's name, e.g., α . An example of such a simple initial shell is informational metaphysicalism (decomposition) $\mathfrak{M}[\alpha]$. \square*

Complexity is comprehended as substance (e.g., being material, brain-like) and spiritual (e.g., mental, phenomenal, mind-like, informational, informonic). Complexity emerges intentionally, as a consequence of intention in orientation, materialization, informational decomposition, meaning the propagation of informational intention in the complex informational space.

Hypothesis 2 (LEARNING AND DECOMPOSITION) *A conscious entity develops, that is, enlarges and advances its organization by*

- *learning, happening through the sensory system of the conscious system (e.g., nervous system including memory), and*
- *informational decomposition, meaning interpretation, deduced from intentional name and its semantic derivatives. \square*

An informonic shell has, by definition, its intentionally informing part concerning the informon's name. Complexity, intentionality, learning, and decomposition are all emergent informational phenomena, being structured and organized spontaneously in a serial, biserial, parallel, and circular way of informing.

5.2 Definitions and a consequence concerning informon

We need a couple of definitions determining the concept of informon gradually, from the initial determination to its conscious informational function. The necessary conditions are, certainly: intentionality (informon's name α), complexity (in local and global informational circumstances), emerging of complexity by decomposition processes and, finally, the constitution of an informonic conscious system.

Definition 1 (LOCAL AND GLOBAL FORMULA SYSTEM) *Informon is a complex and perplexed local or global formula system, denoted by $\underline{\alpha}$ or $\hat{\alpha}$, respectively, with the operand name (argument) α , possessing a conscious structure of informational organization. \square*

Definition 2 (LOCAL AND GLOBAL INFORMON OF INFORMONS) *A local informon $\underline{\alpha}$ informs in an informationally localized area, e.g., in an individual brain or machine and its sensory environment. A global informon $\hat{\alpha}$ is meant to inform in a global area up to the cosmological dimensions and, in this respect, represents an informonic system of other, informationally involved informonic systems. Both local and global informon are systems of informons. \square*

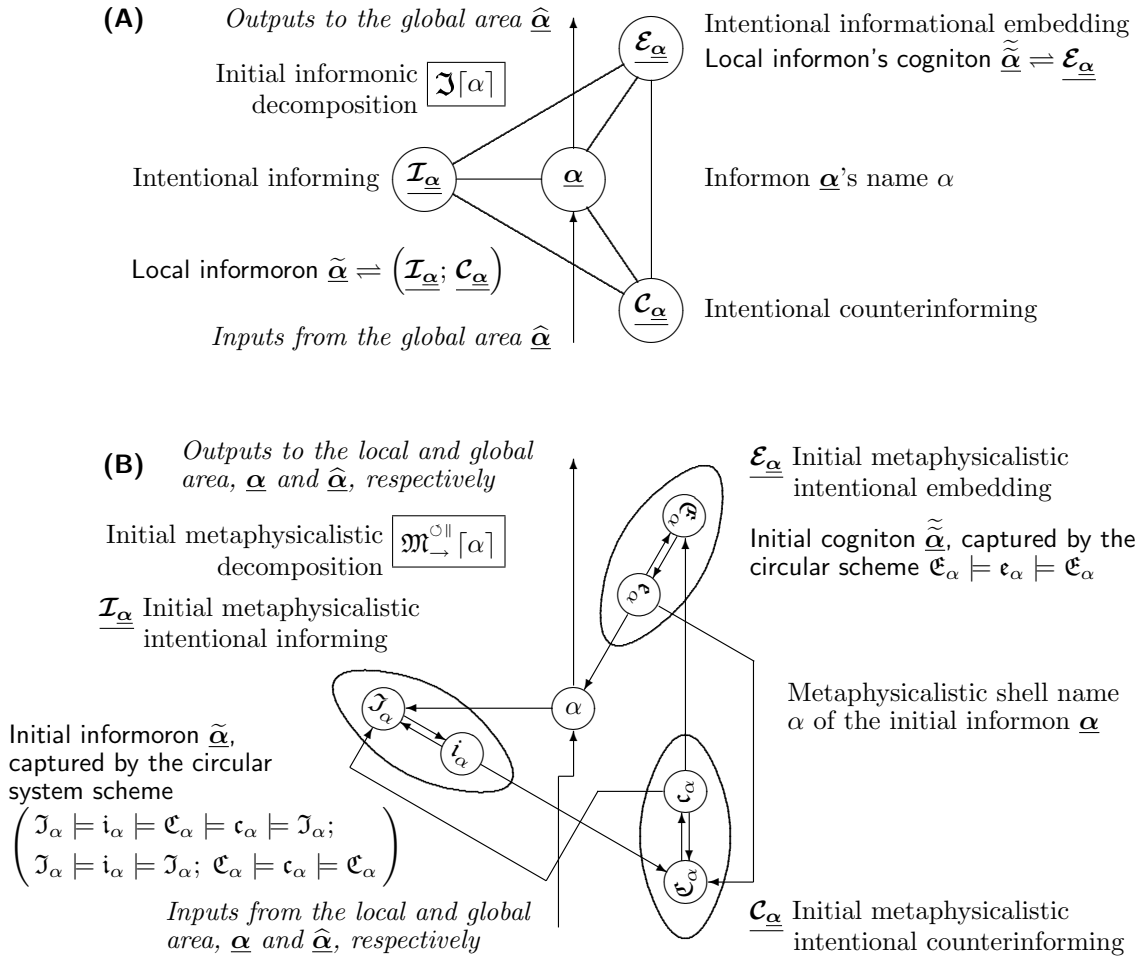


Figure 2: **(A)** The possible graph structure presents a maximal biserial form, called also the bicircular informational supervenience of informing, counterinforming, and informational embedding [8]. **(B)** Serial metaphysicalistic decomposition of α is an example of the initial shell of informon, developing into the local and global informonic area.

Definition 3 (GENERAL INITIAL INFORMONIC DECOMPOSITION $\mathfrak{J}_{\triangleright}^{\circ\parallel}[\alpha]$) Initial informonic decomposition of operand (name) α , called informonic shell, is, in its most general form, a circular biserial formula system, expressed schematically by

$$\mathfrak{S}[\mathfrak{J}_{\triangleright}^{\circ\parallel}[\alpha]] \equiv \begin{pmatrix} \alpha \models \underline{\mathcal{I}}_{\alpha} \models \underline{\mathcal{C}}_{\alpha} \models \underline{\mathcal{E}}_{\alpha} \models \alpha; \\ \alpha \models \underline{\mathcal{I}}_{\alpha} \models \underline{\mathcal{C}}_{\alpha} \models \underline{\mathcal{E}}_{\alpha} \models \alpha; \\ \alpha \models \underline{\mathcal{C}}_{\alpha} \models \underline{\mathcal{I}}_{\alpha} \models \underline{\mathcal{E}}_{\alpha} \models \alpha; \\ \alpha \models \underline{\mathcal{C}}_{\alpha} \models \underline{\mathcal{I}}_{\alpha} \models \underline{\mathcal{E}}_{\alpha} \models \alpha; \\ \alpha \models \underline{\mathcal{E}}_{\alpha} \models \underline{\mathcal{C}}_{\alpha} \models \underline{\mathcal{I}}_{\alpha} \models \alpha; \\ \alpha \models \underline{\mathcal{E}}_{\alpha} \models \underline{\mathcal{C}}_{\alpha} \models \underline{\mathcal{I}}_{\alpha} \models \alpha \end{pmatrix}$$

where $\triangleright \in \{\rightarrow, \leftarrow, \rightleftarrows, (\rightarrow, \leftarrow)\}$. The corresponding graph of this schema is presented in Fig. 2A. \square

The scheme $\mathfrak{S}[\mathfrak{J}_{\triangleright}^{\circ\parallel}[\alpha]]$ covers the graph in Fig. 2A. We see how by considering this graph many different formula schemes can be formed. The graph corre-

sponds exactly to the primitive formula system

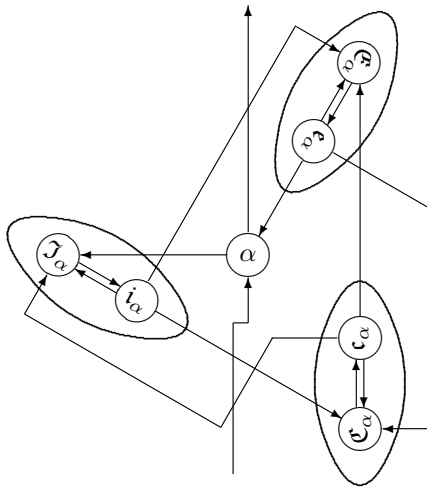
$$\mathfrak{J}_{\triangleright}^{\circ\parallel'}[\alpha] \equiv \begin{pmatrix} \alpha \models \underline{\mathcal{I}}_{\alpha}; \alpha \models \underline{\mathcal{C}}_{\alpha}; \alpha \models \underline{\mathcal{E}}_{\alpha}; \\ \alpha \models \underline{\mathcal{I}}_{\alpha}; \alpha \models \underline{\mathcal{C}}_{\alpha}; \alpha \models \underline{\mathcal{E}}_{\alpha}; \\ \underline{\mathcal{I}}_{\alpha} \models \underline{\mathcal{C}}_{\alpha}; \underline{\mathcal{C}}_{\alpha} \models \underline{\mathcal{E}}_{\alpha}; \underline{\mathcal{E}}_{\alpha} \models \underline{\mathcal{I}}_{\alpha}; \\ \underline{\mathcal{I}}_{\alpha} \models \underline{\mathcal{C}}_{\alpha}; \underline{\mathcal{C}}_{\alpha} \models \underline{\mathcal{E}}_{\alpha}; \underline{\mathcal{E}}_{\alpha} \models \underline{\mathcal{I}}_{\alpha} \end{pmatrix}$$

As expressed by the general form of informonic decomposition $\mathfrak{J}_{\triangleright}^{\circ\parallel'}[\alpha]$, particular cases are the following: serial informonic decomposition $\mathfrak{J}_{\rightarrow}^{\circ\parallel'}[\alpha]$, reverse serial informonic decomposition $\mathfrak{J}_{\leftarrow}^{\circ\parallel'}[\alpha]$, (proper) biserial informonic decomposition $\mathfrak{J}_{\rightleftarrows}^{\circ\parallel'}[\alpha]$, and split biserial informonic decomposition $\mathfrak{J}_{\rightarrow, \leftarrow}^{\circ\parallel'}[\alpha]$.

The informonic organization presented in Fig. 2A is understood as the maximal form of basic (initial) informonic structure. Also, connections between the components of the graph are multitudinous and biserial. What is the minimum form of informon still guaran-

tying the development from an initial informonic state to the conscious informing? The only condition of the informonic graph could be that all the components are circularly linked, thus, some of the connections sketched in Fig. 2A may not occur. Different forms of informational metaphysicalism satisfy this criterion [7, 8, 9]. The simplest form would be the initial serial loop with $\alpha, \mathcal{I}_\alpha, \mathcal{C}_\alpha,$ and $\mathcal{E}_\alpha,$ that is, a circular causality concerning all the informon's components.

The graph in Fig. 2B shows the initial metaphysicalistic variant of informonic structure marked by $\mathfrak{M}_-^{\text{oll}}$. One can see how informonic components $\alpha, \mathcal{I}_\alpha, \mathcal{C}_\alpha,$ and \mathcal{E}_α are configured and connected within the graph. By a slightly modified graph to Fig. 2B, of the form



an intentionally stronger controlled initial cogniton is obtained. Intention i_α informs the cognitive informing \mathcal{E}_α being directly involved into the emergence of the resulting cognition e_α . The graph is structured in a stronger way than the graph $\mathfrak{G}[\mathfrak{M}_-^{\text{oll}}[\alpha]]$ in Fig. 2B. The primitive initial informon for the stronger graph, as presented above, can be expressed transparently by the system of subsystems of basic transitions corresponding to informonic componetns, that is,

$$\alpha' \equiv \left(\alpha; \begin{pmatrix} \alpha \models \mathcal{I}_\alpha; \\ \mathcal{I}_\alpha \models i_\alpha; \\ \mathcal{I}_\alpha \models i_\alpha; \\ i_\alpha \models \mathcal{C}_\alpha; \\ i_\alpha \models \mathcal{E}_\alpha; \\ \mathcal{C}_\alpha \models \mathcal{I}_\alpha \end{pmatrix}; \begin{pmatrix} i_\alpha \models \mathcal{E}_\alpha; \\ \mathcal{E}_\alpha \models \mathcal{C}_\alpha; \\ \mathcal{E}_\alpha \models \mathcal{C}_\alpha; \\ \mathcal{C}_\alpha \models \mathcal{E}_\alpha; \\ \mathcal{E}_\alpha \models \mathcal{C}_\alpha \end{pmatrix}; \begin{pmatrix} \mathcal{C}_\alpha \models \mathcal{E}_\alpha; \\ \mathcal{E}_\alpha \models e_\alpha; \\ \mathcal{E}_\alpha \models e_\alpha; \\ e_\alpha \models \mathcal{C}_\alpha; \\ i_\alpha \models \mathcal{E}_\alpha; \\ e_\alpha \models \alpha \end{pmatrix} \right)$$

representing, transparently,

$$\alpha' \equiv \left(\alpha; \mathcal{I}'_\alpha; \mathcal{C}'_\alpha; \mathcal{E}'_\alpha \right)$$

Definition 4 (CONSCIOUS SYSTEM) A conscious system \mathfrak{z} is a system of informonic components $\mathfrak{z}_i, i = 1, 2, \dots,$ where some of the components, corresponding to a situation and time, represent the contents being currently in the conscious foreground (attention). \square

Consequence 1 (CONSCIOUSNESS OF INFORMONS) An informational entity (formula system) named β informs consciously if and only if it is initially structured in an intentional way according to Defs. 1–4, and if it, through sufficient number of decomposition steps, became structured and informationally organized to a sufficient degree of complexity. In this case, the named entity β has reached the informonic, that is, conscious organization $\underline{\beta}$. \square

Proof 1 Although the proof of Cons. 1 is evident, its proving interpretation might be truly useful. How did the initial name β expand or arrive to informon $\underline{\beta}$? At the beginning, the first step toward the informonizing of β is the initial, the so-called informonic shell decomposition of β , marked by $\mathfrak{J}[\beta]$ (see, for instance, Fig. 2A or Fig. 2B). By the initial decomposition $\mathfrak{J}[\beta]$, the initial informon $\underline{\beta} \equiv \mathfrak{J}[\beta]$ is coming into existence. This decomposition gives to $\underline{\beta}$ the necessary intentionally informing, intentionally counterinforming (emotional), and intentionally embedding (cognitive) organization of the shell. In the next procedures of decomposition, the inner components of the initial informon will propagate and expand into the environmental, intentionally related tissue of the informational space. Thus, the complexity of $\underline{\beta}$ will rise and, gradually, will reach the complexity, being necessary for $\underline{\beta}$'s conscious behavior. Defs. 1–4 concerning $\underline{\beta}$ will gradually, by decompositions considering the $\underline{\beta}$'s intention, structure and organize in a complex way the informon $\underline{\beta}$ for its conscious function.

To stress, decomposition considers learning and, with $\underline{\beta}$ as the meaning structure and organization of intentional meaning concerning the name β , the acquired knowledge is accumulated as the $\underline{\beta}$'s experience up to the moment, when in a situation, $\underline{\beta}$ enters into the occurring conscious domain. Virtually, this proves the value of the consequence. \square

5.3 A new philosophy with informonic consciousness

Informon is an informational unit being in the foreground of the instantaneous consciousness. Consciousness is nothing else than a momentary happening among informons, some of them coming to the conscious surface (attention). In a time interval, consciousness is understood to be a system of actively informing informons, that come into conscious existence, that emerge from the unconscious background of consciousness into the conscious existence; they emerge as momentary conscious entities, out of the subconscious domain, where they inform, and depend emergently and crucially on the temporary sensory situation. Consciousness is an informonic theater in which informons play their informational roles for the observing and informationally acting conscious system. In this view, conscious system happens as a momentary

sequence of groups of informons marching through the time of conscious experience. Consciousness is experienced as a column of informon groups in the understanding of past, present, and future situations. In this sort of grasping, consciousness is just an informon by itself and to itself. The consciousness informon \mathfrak{z} understands currently active informons $\mathfrak{z}_1, \mathfrak{z}_2, \dots$ and specific informons $\mathfrak{z}_1, \mathfrak{z}_2, \dots$ understand (are aware of) consciousness \mathfrak{z} .

Each informon is a conscious entity per se. As such, an informon consciously grasps other informons and itself. For instance, $\underline{\mathfrak{a}}_{\text{anger}}$ grasps consciously itself and other, the informon informationally accompanying informons as, for instance, $\underline{\mathfrak{s}}_{\text{sadness}}, \underline{\mathfrak{e}}_{\text{embarrassment}}, \underline{\mathfrak{s}}_{\text{surprise}}, \underline{\mathfrak{h}}_{\text{hate}}, \underline{\mathfrak{p}}_{\text{plot}}$, etc. In such an angry conscious happening, the informational interplay of the listed and other informons takes place. Thus, anger or any other emotional or cognitive conscious components can pull into the conscious orchestration several other emotional and cognitive components. In a moment of conscious happening, a distinct orchestra of informons plays its informational prelude into the next conscious happening.

The distinction to the common understanding of consciousness is in the ability of conscious informing of each single informon together with other informons. Consciousness \mathfrak{z} is just a specific informon $\underline{\mathfrak{c}}_{\text{consciousness}}$ and nothing more. In the framework of this understanding, informon $\underline{\alpha}$ means a specific name α , propagated into the possible meaning of α , concerning intentionally and attentionally the entire conscious system. As we know, $\underline{\alpha}$ is constituted by system complexity, α -intentionality, learning or informedness coming from other informons, and the own ability of decomposition or interpretation accelerating the complexity of the momentary conscious situation.

Now, let's say the said about a conscious system again by other words, with the aim, to acquire the additional clarity in informonic understanding of consciousness. The informonic concept does not stress so much the so-called hierarchically organized system being characteristic for the functioning of the human brain (informational machine). Intentionalities of complexly linked informons make the spontaneous and circular informing of the current conscious matter possible.

Consciousness about something emerges as an informational overlapping of informons, being currently relevant for a specific situation and time. A conscious event is constituted by the currently informing informons, as they occur spontaneously in a distinct time interval. The consciousness about something consists of yet consciously informing informons, transiting from a current situation to the next situation, where the next informons are coming to the conscious surface, that is, in the conscious foreground. In such a happening of conscious events, the hierarchy of the infor-

mationally relevant is not so much in the game as the informons' intentions and their interweavedness with current situations and time.

This kind of conscious mind comes fore as a spontaneous sequence of conscious events, that is, informons, depending on interior and exterior circumstances, occurring randomly but, certainly, in an intentionally unforeseeable and unpredictable way. Each individual consciousness about something confronts itself with a spontaneous stream of conscious, sub-conscious, self-conscious, and unconscious events, with an existing and entirely new experience, with learned and just learning facts, objectivities, irrationalities, beliefs, attention, cognition, and emotions. Such a conscious happening is offered through an informational overlapping and time-transiting of informons, constituting the feeling, unwinding, and revealing of consciousness about something.

6 Substructuring informon schematically, graphically, and meaningly

Capturing the inner organization of informon, its syntactic (formula-like) and semantic (parenthesis-setting) structuring, can be useful for informational decompositions, starting from the beginning informon's shell components. Decomposition of a current informon development of the form $\underline{\alpha}$ into a more sophisticated and more complex form of the emerging entity, now in a new form $\underline{\alpha}$, hides the basic informon's intentional orientation, given to it by the initial meaning, at that time an informon's pure shell form $\underline{\alpha} = (\alpha; \underline{\mathcal{I}}_{\alpha}; \underline{\mathcal{C}}_{\alpha}; \underline{\mathcal{E}}_{\alpha})$, characterized intentionally by the meaning of its name α .

The emerging of informon is reflected in the initial (starting) pure informon's shell, at that time an $\mathfrak{I}[\alpha]$, and, after some decompositional steps, advanced to a more developed meaning of α , then $\underline{\alpha}$ and, finally, to the currently developed form $\underline{\alpha}$, in which the maximal amount of meaning was gathered (accumulated) up to now. This meaning, $\underline{\alpha}$, is the semantic representation of the name α , structured schematically out of the graphical representation $\mathfrak{G}[\underline{\alpha}]$. Informational schemes form a formula scheme system $\mathfrak{S}[\Phi]$, which can finally be parenthesized, $\mathfrak{P}[\mathfrak{S}[\Phi]]$, so the final and precise form of meaning concerning α is obtained, however, merely up to now.

New and new decompositions of the obtained informon's situation are only parts of an infinitesimal procedure, approaching to a more and more precise meaning of α , however never reaching a final or exact meaning, but coming near to a virtually final meaning as close as possible [7].

In this respect, an informon reflects informationally

to some extent the slogan *One in all and all in one* (OA&AO). An informon propagates into the informational space gathering a specific (intentional) meaning concerning the informon’s name. Using the graph of an informon, $\mathfrak{G}[\underline{\alpha}]$, the OA&AO problem can be made more transparent. First, let’s remind that a system graph $\mathfrak{G}[\Phi]$ is equivalently described by the primitive system Φ' . This yields $\mathfrak{G}[\Phi] \equiv \Phi'$. Second, we introduce a relation of graphical inclusion, \prec , with the meaning,

$$(\mathfrak{G}[\underline{\alpha}_1] \prec \mathfrak{G}[\underline{\alpha}_2]) \equiv (\underline{\alpha}'_1 \subset \underline{\alpha}'_2)$$

This means that all the primitive transitions of system $\underline{\alpha}'_1$ enter into the primitive system $\underline{\alpha}'_2$. Precisely, by a primitive transition $\alpha \models \beta$, the operand α , the subscribed operator \models (e.g., $\models_{\text{subscript}}$), and the operand β is meant.

The way from system $\Phi \equiv (\varphi_1, \varphi_2, \dots, \varphi_{n_\Phi})$ to the corresponding graph $\mathfrak{G}[\Phi]$, that is, to Φ' , leads via the de-parenthesizing of system formulas ($\mathfrak{S}[\Phi]$) and, then, via the primitive partition of formula schemes into primitive system Φ' . An original formula $\varphi_i \in \Phi$ of length ℓ_{φ_i} (number of operators in φ_i), has been dissolved in the formula scheme $\mathfrak{S}[\varphi_i]$ and definitively lost in the possibility of $\frac{1}{\ell_{\varphi_i}} \binom{2\ell_{\varphi_i}}{\ell_{\varphi_i}}$ differently parenthesized formulas. Further, in the transition from the system scheme $\mathfrak{S}[\Phi]$ to Φ' , the formula schemes are definitively lost. From a primitive system Φ' (graph $\mathfrak{G}[\Phi]$), $\prod_{i=1}^{n_\Phi} \frac{1}{\ell_{\varphi_i}} \binom{2\ell_{\varphi_i}}{\ell_{\varphi_i}}$ different formula systems can be derived for each reasonable n_Φ (a complete overlapping which covers the graph).

Let’s mark the informing all (cosmos) by $\mathfrak{a}_{\text{all}}$, a part of the all by $\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]$, and the informational shell encircling the part of the all by $\mathfrak{s}_{\text{shell}}[\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]]$. Using the language of graphs, the following can be said:

$$\begin{aligned} \mathfrak{G}[\underline{\alpha}] &\prec \mathfrak{G}[\mathfrak{a}_{\text{all}}]; \\ \mathfrak{G}[\underline{\alpha}] &\prec \mathfrak{G}[\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]]; \mathfrak{G}[\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]] \prec \mathfrak{G}[\mathfrak{a}_{\text{all}}]; \\ \mathfrak{G}[\underline{\alpha}] &\prec \mathfrak{G}[\mathfrak{s}_{\text{shell}}[\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]]]; \\ &\mathfrak{G}[\mathfrak{s}_{\text{shell}}[\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]]] \prec \mathfrak{G}[\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]] \end{aligned}$$

The interpretation of this situation is presented topologically [7] in Fig. 3. Namely, expressed by the corresponding primitive formula systems, there is

$$\begin{aligned} \underline{\alpha}' &\subset \mathfrak{a}'_{\text{all}}; \\ \underline{\alpha}' &\subset \mathfrak{p}'_{\text{part}}[\mathfrak{a}_{\text{all}}]; \mathfrak{p}'_{\text{part}}[\mathfrak{a}_{\text{all}}] \subset \mathfrak{a}'_{\text{all}}; \\ \underline{\alpha}' &\subset \mathfrak{s}'_{\text{shell}}[\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]]; \\ &\mathfrak{s}'_{\text{shell}}[\mathfrak{p}_{\text{part}}[\mathfrak{a}_{\text{all}}]] \subset \mathfrak{p}'_{\text{part}}[\mathfrak{a}_{\text{all}}] \end{aligned}$$

This set-theoretical presentation helps to make the graphical situation in Fig. 3 definitely transparent.

The meaning of something means to have an informational expression for something called the informational solution on something. For instance, in

searching a solution of something α , the at-hand solution is a sort of decomposition, in general, $\Delta[\alpha]$. However, out of a formula φ or formula system Φ in which α occurs, the solution concerning α can be explicitly expressed. Let \mathfrak{P} mark the formula parenthesizing (setting of parenthesis pairs), \mathfrak{R} the operand rotation in a circular formula, \mathfrak{S} the schematizing (deleting the parenthesis pairs) of a formula, and $\varphi_{\triangleright}^{\circ}[\alpha_1, \dots, \alpha_{i-1}, \alpha_i, \alpha_{i+1}, \dots, \alpha_n]$ a circular formula. In this case it is possible to solve formula $\varphi_{\triangleright}^{\circ}[\alpha_1, \dots, \alpha_{i-1}, \alpha_i, \alpha_{i+1}, \dots, \alpha_n]$ on each of its operands $\alpha_1, \dots, \alpha_{i-1}, \alpha_i, \alpha_{i+1}, \dots, \alpha_n$, that is, to get n different solutions, expressing the meaning of each particular operand. Then, for a solution, using the operand rotation principle, there is

$$\begin{aligned} &\varphi_{\triangleright}^{\circ}[\alpha_i, \alpha_{i+1}, \dots, \alpha_n, \alpha_1, \dots, \alpha_{i-1}] \equiv \\ &\mathfrak{P}\left[\mathfrak{R}\left[\mathfrak{S}\left[\varphi_{\triangleright}^{\circ}[\alpha_1, \dots, \alpha_{i-1}, \alpha_i, \alpha_{i+1}, \dots, \alpha_n]\right]\right]\right]; \\ &i = 1, 2, \dots, n \end{aligned}$$

It is understood that the solution upon operand α_1 is already $\varphi_{\triangleright}^{\circ}[\alpha_1, \dots, \alpha_{i-1}, \alpha_i, \alpha_{i+1}, \dots, \alpha_n]$, obtained by an operand α_1 decomposition, for instance, etc.

A solution upon an operand can be obtained from a complex formula system taking into account all its formulas. That what comes out of such a consideration are informons $\underline{\alpha}'_1, \dots, \underline{\alpha}'_{i-1}, \underline{\alpha}'_i, \underline{\alpha}'_{i+1}, \dots, \underline{\alpha}'_n$.

7 The pure informon

The pure informon, $\mathfrak{i}_{\text{informon}}$, is the searching, propagating, and determining the meaning of the newly coined and introduced word *informon* in the informational space. By the acquired meaning, the concept of informon is fortified and made familiar and understood in communities of researchers, scientists, and publicists. For instance, the new word can enter into an English or other dictionary and be regularly explained together with its etymology.

Additionally, the concept of informon can be grasped formally by informational formalism. In fact, at the beginning, we concentrate on a name (phrase, named informational entity) marking it by α . What will be the informon named α and how will it develop informationally? According to the discussed definitions, initially,

$$\mathfrak{i}_{\text{informon}}[\alpha] \equiv \begin{pmatrix} \mathfrak{i}_{\text{informon}}[\alpha]; \\ \mathcal{I}_{\mathfrak{i}_{\text{informon}}[\alpha]}; \\ \mathcal{C}_{\mathfrak{i}_{\text{informon}}[\alpha]}; \\ \mathcal{E}_{\mathfrak{i}_{\text{informon}}[\alpha]} \end{pmatrix}$$

In general, an initially decomposed informon, e.g., $\mathfrak{I}[\mathfrak{i}_{\text{informon}}[\alpha]]$, attains the required complexity through the linkage to other informons. For the informonic components of the pure informon there is,

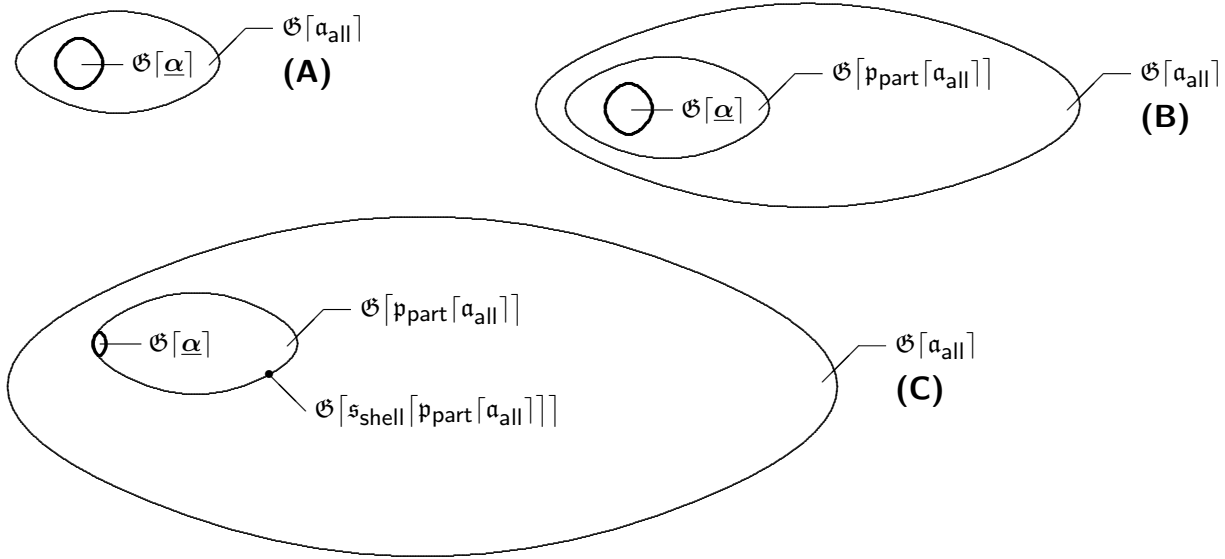


Figure 3: The solution as an informon’s meaning, that is, the up-to-the-minute developed informon—the one—represented graphically: **(A)** The informon as a possibility of the all. **(B)** The informon as a possibility of a part of the all. **(C)** The informon as a possibility of a shell surrounding a part of the all.

evidently, in case of intentional component,

$$\underline{\mathcal{I}_{i_{\text{informon}}[\alpha]}} \rightleftharpoons \begin{pmatrix} \underline{\mathcal{I}_{i_{\text{informon}}[\alpha]}}; \\ \underline{\mathcal{I}_{\mathcal{I}_{i_{\text{informon}}[\alpha]}}}; \\ \underline{\mathcal{C}_{\mathcal{I}_{i_{\text{informon}}[\alpha]}}}; \\ \underline{\mathcal{E}_{\mathcal{I}_{i_{\text{informon}}[\alpha]}}}; \end{pmatrix}$$

in case of counter-intentional component,

$$\underline{\mathcal{C}_{i_{\text{informon}}[\alpha]}} \rightleftharpoons \begin{pmatrix} \underline{\mathcal{C}_{i_{\text{informon}}[\alpha]}}; \\ \underline{\mathcal{I}_{\mathcal{C}_{i_{\text{informon}}[\alpha]}}}; \\ \underline{\mathcal{C}_{\mathcal{C}_{i_{\text{informon}}[\alpha]}}}; \\ \underline{\mathcal{E}_{\mathcal{C}_{i_{\text{informon}}[\alpha]}}}; \end{pmatrix}$$

and in case of cognitive component,

$$\underline{\mathcal{E}_{i_{\text{informon}}[\alpha]}} \rightleftharpoons \begin{pmatrix} \underline{\mathcal{E}_{i_{\text{informon}}[\alpha]}}; \\ \underline{\mathcal{I}_{\mathcal{E}_{i_{\text{informon}}[\alpha]}}}; \\ \underline{\mathcal{C}_{\mathcal{E}_{i_{\text{informon}}[\alpha]}}}; \\ \underline{\mathcal{E}_{\mathcal{E}_{i_{\text{informon}}[\alpha]}}}; \end{pmatrix}$$

The next, being extremely interesting, is the intentional contents of each of informonic components. Beside the informons’ names, the informing of intentional contents concerns informons and their components. The general properties of each informon and its components are the following:

1. the existence of the name- α -specific intention $i_{\text{intention}}[\alpha]$, the name- α -specific counter-intention

$\mathcal{C}_{\text{counter-intention}}[\alpha]$, and the name- α -specific intentional cognition $i_{\text{intentional_cognition}}[\alpha]$;

2. the development of the name- α -specific intentional complexity $\mathcal{C}_{\text{complexity}}[i_{\text{intention}}[\alpha]]$, the name- α -specific counter-intentional complexity $\mathcal{C}_{\text{complexity}}[\mathcal{C}_{\text{counter-intention}}[\alpha]]$, and the name- α -specific complexity of intentional cognition $\mathcal{C}_{\text{complexity}}[i_{\text{intentional_cognition}}[\alpha]]$; and
3. the emerging of the name- α -specific intentional decomposition $\mathfrak{I}[i_{\text{intention}}[\alpha]]$, the name- α -specific counter-intentional decomposition $\mathfrak{I}[\mathcal{C}_{\text{counter-intention}}[\alpha]]$, and the name- α -specific complexity of intentional cognition $\mathfrak{I}[i_{\text{intentional_cognition}}[\alpha]]$.

Within this circle of emergence, the intention is refined, stepping into greater details, and complexity is enlarged, being more and more interweaved into the informational space. The consequence is the enriching of meaning concerning the informon’s name α , that is, the name-specific intentionality $i_{\text{intention}}[\alpha]$. For an informon $\underline{\alpha} \rightleftharpoons (\alpha; \underline{\mathcal{I}}_{\alpha}; \underline{\mathcal{C}}_{\alpha}; \underline{\mathcal{E}}_{\alpha})$, there is, evidently,

$$\underline{\mathcal{I}}_{\alpha} \rightleftharpoons \left(i_{\text{intention}}[\alpha]; \mathcal{C}_{\text{complexity}}[i_{\text{intention}}[\alpha]]; \mathfrak{I}[i_{\text{intention}}[\alpha]]; \dots \right)$$

$$\underline{\mathcal{C}}_{\alpha} \rightleftharpoons \left(\mathcal{C}_{\text{counter-intention}}[\alpha]; \mathcal{C}_{\text{complexity}}[\mathcal{C}_{\text{counter-intention}}[\alpha]]; \mathfrak{I}[\mathcal{C}_{\text{counter-intention}}[\alpha]]; \dots \right)$$

$$\underline{\mathcal{E}}_{\alpha} \rightleftharpoons \left(i_{\text{intentional_cognition}}[\alpha]; \mathcal{C}_{\text{complexity}}[i_{\text{intentional_cognition}}[\alpha]]; \mathfrak{I}[i_{\text{intentional_cognition}}[\alpha]]; \dots \right)$$

8 Conclusion

The concept of informon calls for a different, in some way new understanding of consciousness or, precisely, conscious system. It comes close to that what a conscious observer experiences on the own consciousness, its happening in a time slice and in the sequence of conscious time slices. It enables a straightforward reasoning in the direction of artificially conscious systems constituted by informons. Informon seems to be finally just an informational entity depending on complexity, intention, learning, and decomposition concerning meaning of the intentional name. The required complexity seems to be a problem of future technological development, and the remaining necessary requirements are already in the visible scope of mastering them philosophically and technically.

After all, a meme [1] seems to be nothing else than a specific self-replicating informonic entity² in individual brains which breaks down the reasonable immunity of conscious systems against an informational excess, exaggeration, plethora, or surfeit. By the philosophy of informon, a concrete meme can be studied as an authentically conscious sort of informon, in an innovative general and meaning-specific way. E.g., totalitarian memes have informed as politically local informons.

Regarding the building block of conscious system, called informon, it might be reasonable to understand it as a consequence of macroscopic quantum nature of consciousness—which is pointed out in Peruš [5], as well as in Raković [6], from where it follows that informons might be related to quantum eigenstates of the conscious macroquantum system. The whole story should be then related closely to quantum algebra, and naturally explains the non-local (holistic) aspect of consciousness.

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²An informon informs in a self-replicating way by informational decomposition considering the informon's intention.