

Informational Design of Conscious Entities

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Thesaural approach to entities' metaphysicalistic organization is shown within the design of an informational consciousness system.

Besides phenomenal, psychological, biological, quantum-mechanical, artificial, and other possible definitions of consciousness, the informational consciousness (IC) is outlined as a major autonomous subsystem necessary in any conscious system. It is impossible to imagine a kind of the beyond to the informational phenomenalism in brain, nature, cosmos, and artifact. IC is founded formally by its own informational axiomatism, formulas, formula systems, schemes, scheme systems, graphs, and other constructive means and, within this theory and implementation possibilities, remains clearly scientifically disciplined. More actually, IC systems can be designed by the proposed informational methodology and implemented within existing complex computer systems and informational nets.

Povzetek: članek opisuje informacijsko zasnovo zavestnih entitet.

1 Definitions of different sorts of consciousness

A precise and exhaustive definition of consciousness does not exist at all. Definitions can emerge according to the research of brain, mind, cognition, emotions, motivation, and other ingredients of the consciousness complex. There are loose attempts stating a few commonly accepted principles within the concept of consciousness. Definitional distinguishing among philosophical consciousness, artificial consciousness, phenomenal consciousness, psychological consciousness, biological consciousness, quantum-mechanical consciousness, informational consciousness, and other sorts of consciousness is possible.

Definitions of consciousness can substantially differ in different languages. The philosophical background dictates the inclination to such or another definition together with different views of research and the emerging science of consciousness. Let us make a short list of possible definitions explicitly concerning consciousness of such or another sort. In a way, major consciousness components like cognition and emotions should be incorporated in the rough forms of definition.

Instead with definitions we start with the assumptions of the following sort.

Assumption 1 *From the research point of view different sorts of consciousness can be distinguished:*

InC: individual (human, animal) consciousness,
BC: biological consciousness,
PhC: phenomenal consciousness,
PhiC: philosophical consciousness (phenomenology),
PsC: psychological consciousness,

SC: social consciousness,
LC: local consciousness,
GC: global consciousness,
CC: cosmological consciousness,
QtC: quantum-theoretical consciousness,
AC: artificial consciousness,
IC: informational consciousness,
AIC: artificial informational consciousness, etc.

These sorts of consciousness represent the majority of concepts known nowadays. □

Assumption 2 *Consciousness concerns an object or a complex of objects and emerges out of the subconscious or unconscious background, being the possible informational space. The substance of any sort of consciousness is informational and, within the informational, consciousness-like components can emerge being organized consciously.* □

This assumption does not deviate essentially from known definitions of consciousness. As an exception the *informational view* of consciousness may be understood which, however, seems to be evident.

Assumption 3 *Consciousness is generally regarded to be a conscious system with abilities or components representing conscious properties. One of the major system components is self-awareness or self-consciousness, the ability to perceive the component by itself. Perception as a conscious component perceives the relation between component and component environment.* □

To repeat: Informational consciousness seems to be the essential component or property of any consciousness system. We experience how the phenomenal consciousness — the consciousness in the living human brain — has its

evident informational roots, for instance, in pure linguistic experience, where memory performs as an associative storage of learned and experienced information. Phenomenology in philosophy performs as a literary information and, in this view, as informational phenomenology.

2 Informational consciousness system

Instead of consciousness a more appropriate term will be introduced, called *conscious system*. For a general denotation of an informational formula system, symbol Φ will be used. Conscious system is a formula system concerning consciousness as a particular informational entity, denoted by \mathfrak{z} . Thus, $\Phi[\mathfrak{z}]$ will symbolize the conscious system at the first glance, not expressed informonically yet. In general, it is adequate to use informational systems instead of properties like consciousness, subconsciousness, perception, cognition, emotions, and so on. A conscious system can unite such kind of subsystems organizationally. The system view of informational entities approaches also the understanding of informons and entropions as complex conscious and subconscious entities representing the named informational entities.

Assumption 4 Conscious system, denoted naively (primitively) by $\Phi[\mathfrak{z}]$, is a system of major subsystems, where \mathfrak{z} stands for consciousness, that is, $\mathfrak{z} \rightleftharpoons c_{\text{consciousness}}$, \mathfrak{s} subconsciousness for subconsciousness, $u_{\text{unconsciousness}}$ for unconsciousness, $c_{\text{cognition}}$ for cognition, e_{emotions} for emotions, $m_{\text{motivation}}$ for motivation, $h_{\text{homeostasis}}$ for homeostasis, b_{behavior} for behavior, etc. $\Phi[\mathfrak{z}]$ is meant to be a circular, component-distributed, serial-parallel system of components, tied informationally by common operands. \square

In the next step of theory development, the informonic view has to be considered to explicate the complex and holistic nature of a conscious system. An informon $\underline{\alpha}$ always appears together with its adequately named entropion $\overline{\alpha}$. They build the so-called α -informational space, denoted by $(\underline{\alpha}, \overline{\alpha})$. Or, consequently, recursively,

$$\begin{aligned} &\underline{\alpha}, \overline{\alpha} \text{ delivers } (\underline{\alpha}, \overline{\alpha}); \\ &(\underline{\alpha}, \overline{\alpha}), (\underline{\alpha}, \overline{\alpha}) \text{ delivers } ((\underline{\alpha}, \overline{\alpha}), (\underline{\alpha}, \overline{\alpha})); \\ &((\underline{\alpha}, \overline{\alpha}), (\underline{\alpha}, \overline{\alpha})), ((\underline{\alpha}, \overline{\alpha}), (\underline{\alpha}, \overline{\alpha})) \text{ delivers} \\ &(((\underline{\alpha}, \overline{\alpha}), (\underline{\alpha}, \overline{\alpha})), ((\underline{\alpha}, \overline{\alpha}), (\underline{\alpha}, \overline{\alpha}))); \dots \end{aligned}$$

This sort of informon-entropion recursion represents the holistic informational propagation of α -meaning through the informonic-entropic consciousness system, being defined by the next assumption.

Assumption 5 Consciousness system is an informonic-entropic organization, denoted complexly by $\Phi[(\mathfrak{z}, \overline{\mathfrak{z}})]$.

Such a system connects in an informational way, through common operands, the informonic-entropic spaces $(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})$ and $(\underline{\alpha}_i, \overline{\alpha}_i)$ in the form

$$\Phi[(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})] \rightleftharpoons \begin{pmatrix} (\underline{\mathfrak{z}}, \overline{\mathfrak{z}}); \\ (\underline{\alpha}_i, \overline{\alpha}_i); \\ i = 1, 2, \dots, n; \\ n < \infty \end{pmatrix}$$

Relation $n < \infty$ means that n is potentially not limited and rises with the informational development of the system. \square

Spaces $(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})$ and $(\underline{\alpha}_i, \overline{\alpha}_i)$ are informationally connected through common operands. Since each informon $\underline{\alpha}_i$ is a conscious entity, on the primitive formula level, $\alpha_i[\dots, \mathfrak{z}, \dots]$ holds. On the informonic level, there is, certainly, $\underline{\alpha}_i[\dots, \underline{\mathfrak{z}}, \dots]$ and, consequently, $\underline{\alpha}_i[\dots, \underline{\mathfrak{z}}, \dots]$.

3 Meaning of informational operands

One of the central notions of the informational and the conscious is the *meaning of informational entities*. One sort of understanding meaning comes from the use of natural language. Meaning is nothing more than the use of language within a community. In this way, meaning is the expression in language as such. The expression means that something comes to word where sequences of words appear.

Assumption 6 Meaning concerns operands occurring in a formula, formula scheme and formula graph, and formula system, system scheme and system graph. Meaning of an operand is determined by the informational context with other operands and operators in different informational expressions. Meaning is nothing else than the expression of an operand, in a contextual or explicit way. \square

In a formula $\varphi_{\triangleright}^{\nabla}[\alpha_1, \alpha_2, \dots, \alpha_i, \dots, \alpha_{n_{\varphi_{\triangleright}^{\nabla}}}]$, where $\triangleright \in \{\rightarrow, \leftarrow, \rightleftharpoons, (\rightarrow, \leftarrow)\}$ and $\nabla \in \{\lambda, \odot\}$, operand α_i is expressed contextually, within the formula between other operands. The scheme of this formula for $\triangleright = \rightarrow$ is

$$\begin{aligned} &\mathfrak{S}[\varphi_{\rightarrow}^{\nabla}[\alpha_1, \alpha_2, \dots, \alpha_i, \dots, \alpha_{n_{\varphi_{\rightarrow}^{\nabla}}}] \rightleftharpoons \\ &(\alpha_1 \models \alpha_2 \models \dots \models \alpha_i \models \dots \models \alpha_{n_{\varphi_{\rightarrow}^{\nabla}}} \models \alpha_1) \end{aligned}$$

From this scheme we see how α_i occurs in the context of other operands. Within this context, it has a specific meaning, so the conclusion can be made, what does it in fact mean. Option $\models \alpha_1$ in the scheme represents the circular case, where $\nabla = \odot$. In a circular situation, operand α_i in the scheme can be rotated to the initial position of the scheme, that is,

$$\begin{aligned} &\mathfrak{S}[\mu[\alpha_i]] \rightleftharpoons \\ &(\alpha_i \models \dots \models \alpha_{n_{\varphi_{\odot}}} \models \alpha_1 \models \alpha_2 \models \dots \models \alpha_i) \end{aligned}$$

where $\mu \equiv m_{\text{meaning}}$. This kind of the scheme can be grasped as an explicit circular definition, that is, the one among parallel meaning schemes pertaining to operand α_i . The unambiguous meaning $\mu[\alpha_i]$ can be obtained by parenthesizing this scheme, for instance, by formula

$$\mu[\alpha_i] \equiv \varphi_{1 \rightarrow}^{\circ} [\alpha_i, \dots, \alpha_{n_{\varphi_{\circ}^-}}, \alpha_1, \alpha_2, \dots, \alpha_i]$$

Formally, the schematic result obtained by the operand rotation procedure can be expressed directly, using the rotation operand \mathfrak{R} concerning operand α_i , in the form

$$\mathfrak{S}[\mu[\alpha_i]] \equiv \mathfrak{R}[\alpha_i] \left[\mathfrak{S} \left[\varphi_{\rightarrow}^{\circ} [\alpha_1, \alpha_2, \dots, \alpha_i, \dots, \alpha_{n_{\varphi_{\circ}^-}}] \right] \right]$$

Meaning $\mu[\alpha_i]$ is then a concrete parenthesizing of the scheme, that is,

$$\mu[\alpha_i] \equiv \mathfrak{P} \left[\mathfrak{R}[\alpha_i] \left[\mathfrak{S} \left[\varphi_{\rightarrow}^{\circ} [\alpha_1, \alpha_2, \dots, \alpha_i, \dots, \alpha_{n_{\varphi_{\circ}^-}}] \right] \right] \right]$$

where \mathfrak{P} is the operator of parenthesizing.

A direct, serial, or linear meaning of an informational operand α_1 is given by a serial, non-circular formula in the form $\varphi_{\triangleright} [\alpha_1, \alpha_2, \dots, \alpha_i, \dots, \alpha_{n_{\varphi_{\triangleright}}}]$ putting

$$\alpha_1 \equiv \varphi_{\triangleright} [\alpha_1, \alpha_2, \dots, \alpha_i, \dots, \alpha_{n_{\varphi_{\triangleright}}}]$$

For getting the meaning of formula system Φ 's operand α_{ij_i} , it would suffice to put at the relation

$$\varphi_{i \triangleright_i}^{\nabla_i} [\alpha_{ij_i}, \dots, \alpha_{in_{\varphi_{i \triangleright_i}^{\nabla_i}}}, \alpha_{i1}, \alpha_{i2}, \dots, \alpha_{i-1}] \in \Phi,$$

$\alpha_{ij_i} \equiv \Phi$. It is understood that system formulas

$$\varphi_{1 \triangleright_1}^{\nabla_1}, \varphi_{2 \triangleright_2}^{\nabla_2}, \dots, \varphi_{i \triangleright_i}^{\nabla_i}, \dots, \varphi_{n_{\Phi} \triangleright_{n_{\Phi}}}^{\nabla_{n_{\Phi}}} \in \Phi$$

are mutually informationally connected (dependent, impacted) through common operands. In this view the meaning of α_{ij_i} becomes as complex as possible, expressed by system formulas, interpreting its meaning in different possible, explicit and implicit ways.

4 How to make an informational entity conscious?

By an informational entity the meaning is understood belonging to the explicitly expressed entity's title, its name. For instance, entity α has the name α and simultaneously represents α 's meaning in the form of an informational formula $\alpha \equiv \alpha[\alpha_1, \alpha_2, \dots, \alpha_i, \dots, \alpha_{n_{\alpha}}]$, schematized by $\mathfrak{S}[\alpha] \equiv (\alpha_1 \models \alpha_2 \models \dots \models \alpha_i \models \alpha_{n_{\alpha}})$, where some operands α_i may equal to α . A complex meaning of α is

expressed by a formula system which could mean an explicit definition of operand α in the form

$$\alpha \equiv \left(\begin{array}{l} \alpha[\alpha_{11}, \alpha_{12}, \dots, \alpha_{1i_1}, \dots, \alpha_{1n_1}] ; \\ \alpha[\alpha_{21}, \alpha_{22}, \dots, \alpha_{2i_2}, \dots, \alpha_{2n_2}] ; \\ \vdots \\ \alpha[\alpha_{j1}, \alpha_{j2}, \dots, \alpha_{ji_j}, \dots, \alpha_{jn_j}] ; \\ \vdots \\ \alpha[\alpha_{m1}, \alpha_{m2}, \dots, \alpha_{mi_m}, \dots, \alpha_{mn_m}] \end{array} \right)$$

schematized by

$$\mathfrak{S}[\alpha] \equiv \left(\begin{array}{l} \alpha_{11} \models \alpha_{12} \models \dots \models \alpha_{1i_1} \models \dots \models \alpha_{1n_1} ; \\ \alpha_{21} \models \alpha_{22} \models \dots \models \alpha_{2i_2} \models \dots \models \alpha_{2n_2} ; \\ \vdots \\ \alpha_{j1} \models \alpha_{j2} \models \dots \models \alpha_{ji_j} \models \dots \models \alpha_{jn_j} ; \\ \vdots \\ \alpha_{m1} \models \alpha_{m2} \models \dots \models \alpha_{mi_m} \models \dots \models \alpha_{mn_m} \end{array} \right)$$

where some operands α_{ji_j} may equal α . System formulas $\alpha[\alpha_{j1}, \alpha_{j2}, \dots, \alpha_{ji_j}, \dots, \alpha_{jn_{j\alpha}}]$ of the meaning system α can be mutually connected also by other common operands than α , where $j = 1, 2, \dots, m$ and $i_j = 1, 2, \dots, n_j$.

Assumption 7 An informational entity, named by α , becomes primitively conscious if it is informationally connected with at least one conscious space $(\underline{\beta}, \overline{\beta})$ within a consciousness system $\Phi[(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})]$. The ability of consciousness is granted to α transitively, via the conscious organization of informon $\underline{\beta}$. Thus, entity α transits into informon $\underline{\alpha}$ and $(\underline{\alpha}, \overline{\alpha}) \in \Phi[(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})]$. \square

This kind of α 's conscious emergence does not need $\underline{\alpha}$'s own metaphysicalistic organization. So, $\underline{\alpha}$ cannot decide autonomously upon its own conscious development and is, in this respect, dependent on informational spaces of other system operands.

Assumption 8 An informational entity, named by α , becomes properly conscious if it is organized in the sense of initial informational metaphysicalism $\mathfrak{M}_{\triangleright}^{\circ}[\alpha]$ and, then, complexly developed to the informonic-entropic space $(\underline{\alpha}, \overline{\alpha})$. Through metaphysicalism, informon $\underline{\alpha}$ appropriates its own ability of consciousness, and the corresponding ability of subconsciousness, expressed entropically by $\overline{\alpha}$. This means that space $(\underline{\alpha}, \overline{\alpha})$ is complexly connected to spaces $(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})$ and $(\underline{\alpha_i}, \overline{\alpha_i})$, constituting the common consciousness system $\Phi[(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})]$, where $(\underline{\alpha}, \overline{\alpha}), (\underline{\mathfrak{z}}, \overline{\mathfrak{z}}), (\underline{\alpha_i}, \overline{\alpha_i}) \in \Phi[(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})]$. Consciousness space $(\underline{\mathfrak{z}}, \overline{\mathfrak{z}})$ is meant to be the central informonic-entropic space for the metaphysicalistically organized informational entity $\mathfrak{z} \equiv c_{\text{consciousness}}$. \square

Informonic solution for operand α becomes, according to the previous formula system, as complex as

$$\alpha \Leftrightarrow \left(\begin{array}{l} \underline{\alpha} [\underline{\alpha}_{11}, \underline{\alpha}_{12}, \dots, \underline{\alpha}_{1i_1}, \dots, \underline{\alpha}_{1n_1}] ; \\ \underline{\alpha} [\underline{\alpha}_{21}, \underline{\alpha}_{22}, \dots, \underline{\alpha}_{2i_2}, \dots, \underline{\alpha}_{2n_2}] ; \\ \vdots \\ \underline{\alpha} [\underline{\alpha}_{j1}, \underline{\alpha}_{j2}, \dots, \underline{\alpha}_{ji_j}, \dots, \underline{\alpha}_{jn_j}] ; \\ \vdots \\ \underline{\alpha} [\underline{\alpha}_{m1}, \underline{\alpha}_{m2}, \dots, \underline{\alpha}_{mi_m}, \dots, \underline{\alpha}_{mn_m}] \end{array} \right)$$

5 Informational organization of a language thesaurus

An exhaustive and adequately structured language thesaurus is the key means at the design and implementation of informational consciousness. It is a must for the design of *metaphysicalistically conceptualized artificial informational consciousness system* (MCAICS) being the major component of other possible concepts, theories, and implementations of consciousness systems.

In Fig. 1, the recursive graph of a more or less complete thesaurus of a natural language is presented [1]. This graph can be additionally meaningfully refined according to the design needs, and shows, at the first glance, a linear or serial, tree-like structure. However, the graph becomes circular as soon as, in a concrete case, the word (informational operand) appears, being used in a previous (higher) knot of the graph. Such a circular situation is regular and can concern any headword in the dictionary.

Let us look a case from thesaurus [1] in which the headword *attention* is presented in the following way¹:

attention n 1 a focusing of the mind on something <gave the problem careful *attention*>

syn application, concentration, consideration, debate, deliberation, heed, study

rel assiduity, diligence, industry, sedulity, sedulousness; notice, observation, regard, remark; absorption, engrossment, immersion, intentness

con absence, absentmindedness, abstraction, detachment, remoteness, withdrawal; disinterest, indifference, unconcern, unmindfulness

ant inattention

2 syn see NOTICE 1

rel awareness, consciousness, mindfulness, sensibility

con disregard, heedlessness, insensibility, unawareness, unconsciousness

¹The meaning of abbreviations, also in further examples, is the following:

syn synonym(s) **rel** related word(s)

ant antonym(s) **con** contrasted word(s)

idiom idiomatic equivalent(s)

|| use limited; if in doubt, see a dictionary

3 syn see COURTESY 1

rel deference, homage, honor, reverence, benignity; considerateness, consideration, kindness, solicitude
con neglect, negligence; aloofness, indifference, unconcern; discourtesy

notice n 1 a noting of or concerning oneself with something <take *notice* of the gathering clouds>

syn attention, cognizance, ear, head, mark

|| mind, note, observance, observation, regard, remark

rel care, concern, consideration, thought; apprehension, grasp, understanding

con disinterest, disregard, indifference, unconcern; carelessness, heedlessness, unmindfulness; insouciance, negligence, recklessness

2 syn see MEMORANDUM 2

3 syn see CRITICISM 1

Etc. One sees how by the use of thesaurus the meaning of the headword *attention* expands in a positive and negative sense. However, a thesaurus includes also other words used in the subscript language of informational operands and informational operators (verbs, adjectives, prepositions, etc.) Between two subscribed operands, an appropriately subscribed operator must be chosen, meaningfully corresponding to the context in which operands and operators occur. Thus, verbs or verbal phrases can be searched in a thesaurus too.

6 Where does a thesaurus meet informational metaphysicalism?

A thesaurus must not be understood as a headword-synonym dictionary but rather a much more complex interpretation of the headword meaning also in a contrasted, idiomatic, and other possibilities of positively and negatively related word meaning, concerning the headword [1]. In such a dictionary, synonyms, antonyms, related words, contrasted words, idiomatic equivalents, and other meaningfully relevant words and phrases to a headword can be searched. Then, in the second step of searching, again, all these categories of words and phrases can be searched to a found synonym, antonym, related word, contrasted word, idiomatic equivalent, and other meaningfully relevant word and phrase. This technique of the initial headword identification within a broader meaning can expand as deep as necessary, offering the sufficient informational complexity of the headword interpretation by sentences, concerning the searched thesaural entities. To this pure thesaural identification of a headword, sentences can be constructed, explaining or defining the headword meaning. In this way, a complex meaning of the headword can emerge expressing what the headword represents informationally in a context and what it does not represent at all.

A thesaurally represented headword α can come close to the concept of metaphysicalistic decomposition $\mathfrak{M}_{\alpha}^{\circ||}$ concerning the headword α , that is, $\mathfrak{M}_{\alpha}^{\circ||} [\alpha]$. Informational

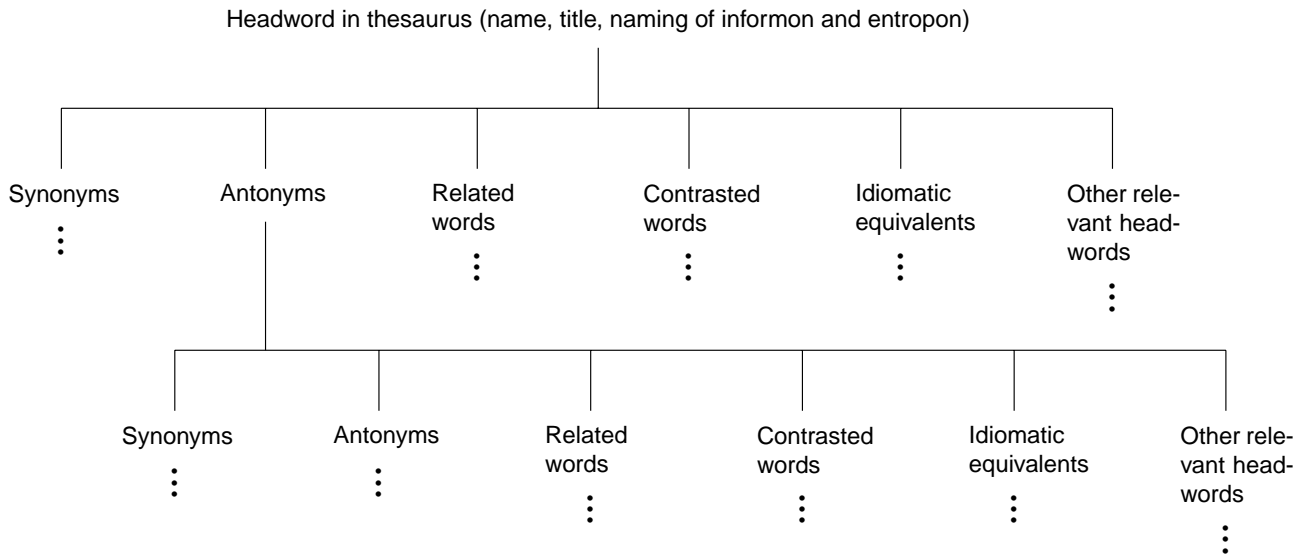


Figure 1: Recursive organization of thesaurus [1] for the design of thesaural-metaphysicalistic structure developing informon. Such a thesaurus is a must in conceptualizing and design of informational consciousness.

metaphysicalism is organized as informing, counterinforming, and informational embedding concerning an informational entity, in this case, the headword. Thesaural identification of a headword is structured

- by its synonyms and meaningly related words — a kind of positive identification in the sense of metaphysicalistic informing,
- by its antonyms and meaningly contrasted words — a kind of negative identification in the sense of metaphysicalistic counterinforming, and
- by a kind of meaningly idiomatic identification (an equalization) — in the sense of metaphysicalistic informational embedding (fixing the meaning).

Informational embedding can be grasped also as a kind of decision making upon the meaning, resulting from metaphysicalistic informing and counterinforming of the headword. To the metaphysicalistic-thesaural model belongs also the determination of concrete operators figuring in the metaphysicalistic organization which subscripts can be chosen by means of the thesaurus. The operand-operator identification in a metaphysicalistic model can be efficiently meaningly covered by words and word phrases obtained by the use of a thesaurus. Thesaural approach is in fact a complex approach to the problem of meaning concerning a headword and its identification up to the possible details of meaning or interpretation.

For each informational entity intending to inform in a conscious way, it is necessary to know what consciousness does mean in the most possible complex way of meaning expression. Therefore, the meaning of the concept “consciousness” must be developed in an informationally complex manner. What is needed is the informon $c_{\text{consciousness}}$, represented by its informational synonym \mathfrak{z} , and determined by the possible, informationally most complex form,

from the thesaural point of view. Further, within the metaphysicalistic model of an operand α , one has to distinguish meaningly relatively closely positioned operands, like informing \mathfrak{I}_α and to it corresponding informational entity i_α , counterinforming \mathfrak{C}_α and to it corresponding counterinformational entity c_α , and informational embedding \mathfrak{E}_α and to it corresponding informational embedding entity e_α . Informational embedding is a kind of decision making in the understanding of that which results from metaphysicalistic informing and the corresponding counterinforming within systemically organized entity’s metaphysicalism.

Let us show an experiment made on the basis of Tab. 1, where metaphysicalistic components are listed both in the sense of thesaural contents and metaphysicalistic meaning (semantics). The table proceeds from name α , being the informational identifier of metaphysicalistic decomposition in the left-most column. The following columns represent metaphysicalistic informing \mathfrak{I}_α (second column), metaphysicalistic informational entity i_α (third column), metaphysicalistic counterinforming \mathfrak{C}_α (fourth column), metaphysicalistic counterinformational entity c_α (fifth column), metaphysicalistic informational embedding \mathfrak{E}_α (sixth column), and metaphysicalistic informational embedding entity e_α (seventh column). All of the columns include metaphysicalistically appropriate, thesaural, and intentional contents, dedicated for the future development of metaphysicalistic organization, up to the complex informonic and entropic perplexity of occurring operands. Thus, the table becomes a significant reminder for the metaphysicalistic decomposition of the named operand α .

In the upper part of the table, the first column deals with the named operand, being for instance a noun or a noun phrase in a thesaurus, dictionary, or encyclopedia. The named operand will appear as a headword, idiom, or otherwise related word in thesaurus. After a time of de-

Name α ; Informational identifier	Metaphysicalistic informing \mathfrak{J}_α	Metaphysicalistic informational entity i_α	Metaphysicalistic counterinforming \mathfrak{C}_α	Metaphysicalistic counterintentional entity ϵ_α	Metaphysicalistic informational em- bedding \mathfrak{E}_α	Metaphysicalistic informational em- bedding entity ϵ_α
Noun; Noun phrase	α -intentional in- forming	α -intentional en- tity	α -counterinten- tional informing	α -counterinten- tional entity	Informing of α -inten- tional embedding	α -intentional embed- ding entity
Noun head- word in a thesaurus; Idiomatically named entity; Associatively, otherwise in- formationally related head- words in a thesaurus; α -named informon; ...	Participles corre- sponding to name synonyms, name related headwords, name-idiomatic meaning; Synonymizing name-related concepts; α -intentional informonic and entropic informing; ...	Noun synonyms; Related nouns; Synonyms of noun synonyms; Idioms in a thesaurus; Intentionally name-related words and concepts; α -intentional informons' and entropions' environment; ...	Participles corre- sponding to α - and i_α -anto- nyms, synonyms of antonyms, and antonyms of synonyms, to re- lated headwords and idioms con- cerning them; α -counterinten- tional entropic and informonic informing; ...	Antonyms; Contrasted words; Synonyms of antonyms; Idiomatic opposition; Counterintention- ally name-relat- ed words and concepts; α -counterinten- tional informons' and entropions' environment; ...	Informing of under- standing, to it cor- related headwords as participles; Generating mean- ing correspond- ing to name α , $\mu \alpha$], its intention $i_\alpha, \mu [i_\alpha]$, and its counterintention $\epsilon_\alpha, \mu [\epsilon_\alpha]$; α -intentional mean- ing, embedding in- formonic informing; ...	Understanding of synonyms, antonyms, synonyms of syno- nyms and antonyms, antonyms of syno- nyms and antonyms, and entities related to them, in different possible ways, and recursively to arbi- trary depths; Resulting informonic meaning of the α -named entity; ...
Conscious- ness, $\mathfrak{J} \rightleftharpoons$ $c_{\text{consciousness}}$; Informon \mathfrak{J}	Consciousness intending $\mathfrak{J}_\mathfrak{J}$; Intending to be conscious, $\mathfrak{J}_\mathfrak{J}$	Consciousness intention $i_\mathfrak{J}$; Intention to be conscious, $i_\mathfrak{J}$	Consciousness counterintending; Counterintending to be conscious, $\mathfrak{C}_\mathfrak{J}$	Consciousness counterintention; Counterintention to be conscious, $\epsilon_\mathfrak{J}$	Consciousness inten- tional embedding, constituting mean- ing to be conscious, $\mathfrak{E}_\mathfrak{J}$	Consciousness inten- tional embedment, constituting mean- ing to be conscious, $\epsilon_\mathfrak{J}$
Awareness; Self-con- sciousness; Mind; Intellect; Intelligence; Mentality; Affects; Disposition; Temper; Opinion; Personality; Spirit; Reason; Atmosphere; Intuition; ...	Being conscious; Being aware, aw- ake, cognizant, sensible, alive; Perceiving; Cognizing; Apprehending; Rationalizing; Observing; Controlling thought; Marking by thought, will, mind, design; Conceiving; Innovating; ...	Consciousness; Awareness, awak- eness, cogniza- nce, sensibility; Perception; Cognition; Apprehension; Rationalism; Observation; Control of thought; The thought-, will-, mind- design-marked: Concepts; Innovation; ...	Being subcon- scious, unaware, ignorant, insen- sible, unalive; Misperceiving; Dogmatizing; Misapprehending; Disregarding; Ignoring; Diversifying thought; Making obscure by thought, will, mind, design; Misconceiving; Scholasticizing; ...	Subconsciousness, unawareness, insensibility, unawakenedness; Misperception; Dogmatism; Misapprehension; Disregard; Ignorance; Diversity of thought; The thought-, will-, mind- design-obscured: Misconception; Scholasticism; ...	Conscious embedding; Cognizing; Emotionalizing; Attending; Being intelligent; Motivating; Being homeostatic; Behaving; Recognizing; Observing; Concentrating; Examining; Inferring; Comprehending; Conceptualizing; Designing; ...	Conscious embedding; Cognition; Emotions; Attention; Intelligence; Motivation; Homeostasis; Behavior; Recognition; Observation; Concentration; Examination Inference; Comprehension; Concepts; Design; ...

Table 1: A rough thesaural expansion of metaphysicalistic operand α , in the upper part of the table, interpreted by an example of consciousness \mathfrak{J} , in the lower part of the table.

velopment by decomposition, the initially named operand α will result into informon $\underline{\alpha}$, becoming a conscious entity through its complexity and informational perplexedness with other conscious entities, that is, through informons of a conscious system.

In the next six columns (2–7), the α -intentional and α -counterintentional (positively and negatively α -related) subjects come into the decompositional foreground. They mean that informing, counterinforming, and informational embedding of entities must follow the α -intentional and α -counterintentional platform, respectively. That concerns a definition process of the α -named operand, that is, what it is or what it represent, and what it is not or what it does not represent.

In the second column of the upper table part, metaphysicalistic informing \mathcal{I}_α as an α -intentional component is treated. It is expressed as participles corresponding to α -synonyms, α -related headwords, α -idioms meanings in a thesaurus, for instance. In this way, α -related concepts can be synonymized. This kind of intentional informing results gradually into α -informonic and α -entropic components, building up the informational space of α -informing.

Consequently, the third column of the upper table deals with metaphysicalistic informational entity i_α , through which the most substantial α -intentional platform is emerging. This happens intentionally by the inclusion of α -synonyms and whichever α -related concepts into the organization of i_α , that is, in entity's informational context. Gradually, such a gathering of α -intentional concepts leads to emerging of α -informon and α -entropion with α -specific intention.

Counterinforming in columns four and five is being characterized by an opposing informing to the α -intentional informing, searching for contraries and contrasts, also negations in regard to α -positive meaning. α -counterinforming brings in the foreground the possibility to say what does α -entity not mean, that is, its anti-definition. By this, the domain of meaning for an entity can be expressed in a negative way of α -understanding and α -interpretation. α -conterinforming is on the way to produce such an α -negative domain of meaning in the form of α -conterinformational entity c_α in column five.

In the fourth column of the upper part of the table, metaphysicalistic conterinforming \mathcal{C}_α as an α -counterintending component comes into the scope of discussion as an α -counterintending entity. The informing of this specific component dictates the searching and including of participles corresponding to α - and i_α -antonyms, α - and i_α -synonyms of antonyms, and α - and i_α -antonyms of synonyms to related headwords and idioms concerning them. Through complex counterinforming, α -counterinforming informons and entropions can come into informational existence, spreading the negative or opposing meaning of operand α .

The fifth column of the upper part of the table deals with conterinformational entity c_α as an α -counterintentional

component emerging as a consequence of otherwise informationally involved entities of the system. Here, the α -counterintentional nature comes to the informational surface. α -antonyms, α -contrasted words, and synonyms of α -antonyms pervade in entity's organization. α -idiomatic opposition comes into interpretation of operand α within the formula system represented by c_α . Counterintentionally α -related words, word phrases, sentences, paragraphs, and concepts come into the informational texture of c_α . This kind of phenomenalism results in c_α -informons and c_α -entropions (\underline{c}_α , \overline{c}_α , and others) constituting the counterinformational space of α .

Informational embedding filters, modulates, and unites α -intentionally the meaning of α -informing and α -counterinforming and performs as a kind of understanding of the α -named operand in a complex informational environment. By informational embedding, metaphysicalistic components inform as characteristic, initially determined components of a conscious system, following the cognitive-emotional paradigm together with other possible conscious constituents. The embedding entity is an α -intentional summary expressing positively and negatively informational properties of name α , that is, its meaning.

In the sixth column of the upper part of the table, dealing with metaphysicalistic α -informational embedding \mathcal{E}_α , participles corresponding to the field of understanding and interpretation, and to them correlated headwords or phrases, are considered. Here, the summarized α -meaning $\mu[\alpha]$ is being generated, taken into account both the α -intentional and α -counterintentional meaning, $\mu[i_\alpha]$ and $\mu[c_\alpha]$, respectively. In the form of informing of embedding, the informonic α -intentional meaning is coming into existence together with accompanying entropions of involved entities.

In the last, seventh column of the upper part of the table, metaphysicalistic informational embedding entity e_α is confronted with the α -intentional embedment of components resulting during the informing of α -intentionally and α -counterintentionally oriented informational environment. Here, different forms (formulas, formula systems corresponding to sentences, paragraphs, etc., respectively) of terminal understanding of synonyms, antonyms, synonyms of synonyms and antonyms, antonyms of synonyms and antonyms, entities related to all of them come into informational existence, recursively (circularly) to arbitrary depth of meaning. The result is the generated α -informonic and α -entropic meaning of the α -named entity in the left-most column of the table.

The lower, concrete part of Tab. 1, can be called the thesaurus constructed for the headword "consciousness", as needed in the design of initial and, later, informonic metaphysicalistic organization, \mathfrak{z} , in Fig. 2. The first step can be made by the use of an existing thesaurus (for instance, [1]) or dictionary, where some word meaning can be found. More adequate or professional approach is considering the cognitive-emotional paradigm in the informational study and design of conscious entities, using concepts and cat-

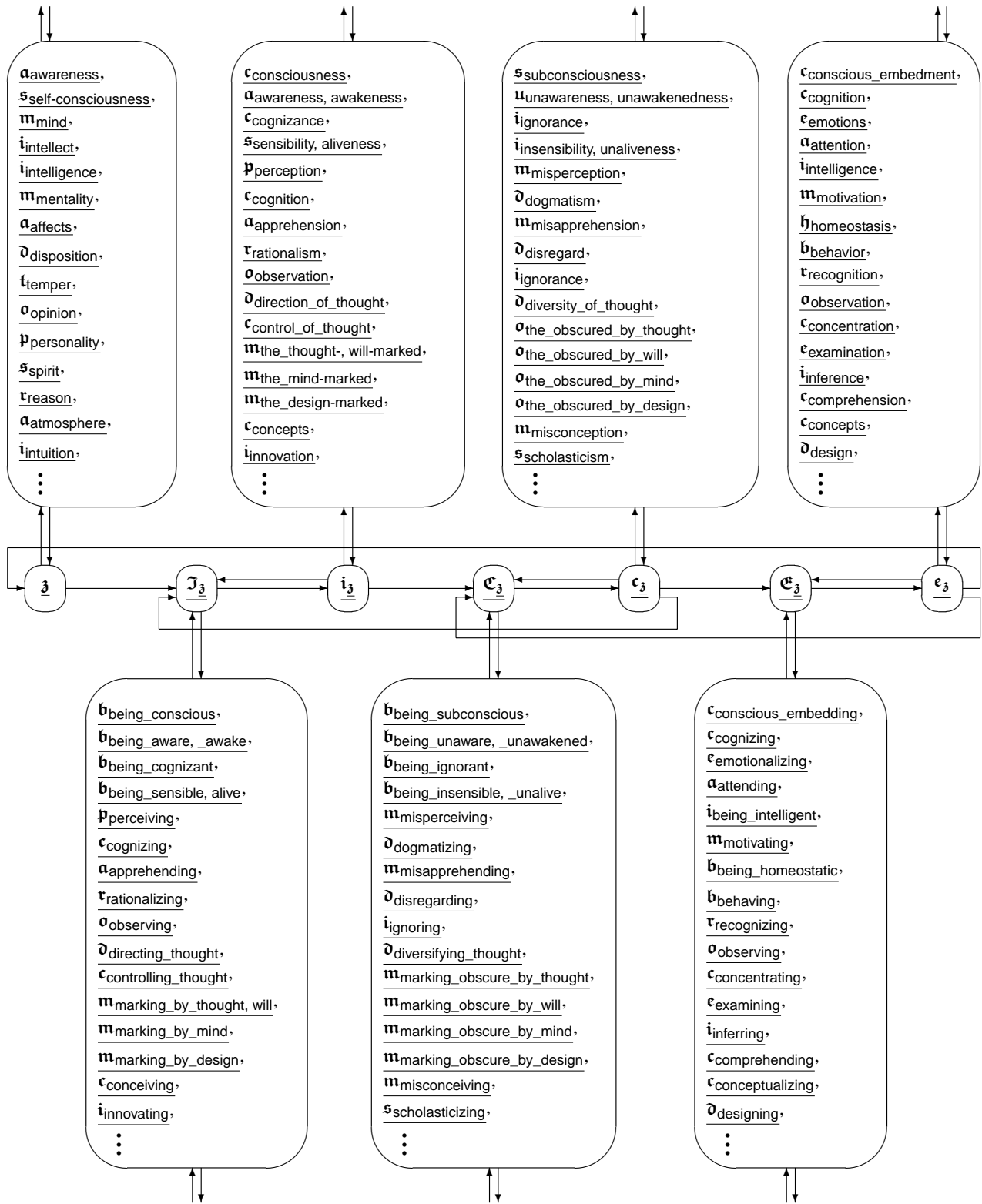


Figure 2: Informational formalization of the lower part of Tab. 1, representing the graph of consciousness \mathfrak{z} and its components in informonic form, showing how entity \mathfrak{z} becomes conscious. As seen from the graph, initial metaphysicalistic decomposition $\mathfrak{M}_{\rightarrow}^{\circ\parallel}[\mathfrak{z}]$ grows into the corresponding informonic complex.

alogs of cognitive and emotional components, as shown elsewhere [2, 4, 7, 9].

Some of hints to the meaning of “consciousness” can be

identified as

consciousness (in [6]) $n\ 1\ a$: the quality or state of being

aware esp. of something within oneself **b** : the state or fact of being conscious of an external object, state, or fact **c** : AWARENESS; *esp* : concern for some social or political case **2** : the state of being characterized by sensation, emotion, volition, and thought : MIND **3** : the totality of conscious states of an individual **4** : the normal state of conscious life **5** : the upper level of mental life of which the person is aware as contrasted with unconscious processes

aware (in [1]) *adj* marked by realization, perception, or knowledge often of something not generally realized, perceived, or known <aware of her own inner weakness>

syn alive, apprehensive, au courant, awake, cognizant, conscious, conversant, knowing, mindful, sensible, sentient, ware, witting

rel acquainted, appraised, informed; alert, heedful; impressionable, perceptive, receptive

con anesthetic, impassible, insensible, insensitive; ignorant, unknowing

ant unaware

conscious *adj* **1 syn** see AWARE

rel noticing, noting, observing, perceiving, remarking; vigilant, watchful

con forgetful, oblivious, unmindful; disregarding, ignoring, overlooking

ant unconscious

2 syn see SELF-CONSCIOUS

From nouns, adjectives, verbs, etc. in dictionaries and thesauri adequate operand names for metaphysicalistic operands can be chosen as shown in Tab. 1 and Fig. 2. Entering into recursive depth of dictionaries and thesauri, the complexity of operands and their mutual connection can rise up to the required degree and precision of concrete operand meanings.

The metaphysicalistic organization of operand \mathfrak{z} , that is, of $c_{\text{consciousness}}$, in the graph of Fig. 2, is informonized, that is, complexly informationally interweaved within a conscious system $\Phi[(\mathfrak{z}, \mathfrak{z})]$ discussed in Assumption 5. For the initial metaphysicalistic organization, the serial decomposition $\mathfrak{M}_{\rightarrow}^{\circ\parallel}[\mathfrak{z}]$ was taken and, then, informonically organized according to the operand suggestions in Tab. 1.

On the other hand, nothing was determined on the level of graph operators, which in the same way as operands can be determined by adequate subscripts fitting the operator position between concrete operands. Namely, the general operator \models , as an informational joker, can be in principle put between arbitrary operands. However, in a concrete situation, the operator is subscribed according to the used natural language, expressing a verb or a verbal phrase (in the last case by an operator composition, e.g., as the operator composition in $\alpha \models_{\alpha} \circ \models_{\beta} \beta$).

7 Methodology of the design of informational consciousness

In the preceding section several possible and essential methods of designing informational consciousness have been demonstrated. Systematically, the methods can be formulated as follows.

Method 1 [The naive expansion of consciousness.] *The most general, in fact, non-structural or naive way of making an informational entity α conscious is to include it in an existing conscious system $\Phi[(\mathfrak{z}, \mathfrak{z})]$ informonically, that is, $\alpha \in \Phi[(\mathfrak{z}, \mathfrak{z})]$, connecting it to informonic operands of system $\Phi[(\mathfrak{z}, \mathfrak{z})]$ through common operands.* □

This method needs additional explanation. Operand α , understood as a formula or formula system, is so far a rough informational entity determined as a usual informational formula (also as a single operand) or informational formula system. As such, it has not the property of being conscious, but is an unconscious entity yet. Such a case can happen in reading a sentence in a foreign language. Then, the unknown operands can be linked to the known translated operands and the similar is done with unknown operators. Thus, the sentence becomes linked to already conscious (common, that is, translated) operands in the context of meaningfully known entities. The sentence becomes understandable, that is consciously perceivable.

The second method intends to give a future conscious entity a primordial organization for the development into a proper self-content conscious informational entity, proceeding from the initial, thesaurally-metaphysicalistically organized structure. This method puts in the foreground the beginning of the design of an informational consciousness system when at least some key components must be developed first to the level of conscious informational behavior. One of such entities is without doubt the complex meaning of the headword ‘consciousness’.

Method 2 [The thesaural-metaphysicalistic expansion of consciousness.] A headword, $\mathfrak{h} \equiv \mathfrak{h}_{\text{headword}}$, of a complete informational thesaurus, denoted by $t_{\text{thesaurus}}$, with $\mathfrak{h} \in t_{\text{thesaurus}}$, is made conscious by its informonic expansion \mathfrak{h} through a consequent recursive use of $t_{\text{thesaurus}}$ in a metaphysicalistic way, that is, proceeding from the initial decomposition $\mathfrak{M}_{\triangleright}^{\circ\parallel}[\mathfrak{h}]$ to the informonic organization $\mathfrak{M}_{\triangleright}^{\circ\parallel}[\mathfrak{h}]$, building up the informational space $(\underline{\mathfrak{h}}, \overline{\mathfrak{h}}) \equiv (\mathfrak{M}_{\triangleright}^{\circ\parallel}[\underline{\mathfrak{h}}], \overline{\mathfrak{M}_{\triangleright}^{\circ\parallel}[\overline{\mathfrak{h}}]})$. □

What would the entroponic decomposition of entropion $\overline{\mathfrak{h}}$, $\mathfrak{M}_{\triangleright}^{\circ\parallel}[\overline{\mathfrak{h}}]$, and the informonic decomposition of entropion $\underline{\mathfrak{h}}$, $\mathfrak{M}_{\triangleright}^{\circ\parallel}[\underline{\mathfrak{h}}]$, mean at all? As already shown in Sect. 2,

$$(\mathfrak{M}_{\triangleright}^{\circ\parallel}[\underline{\mathfrak{h}}], \overline{\mathfrak{M}_{\triangleright}^{\circ\parallel}[\overline{\mathfrak{h}}]}) \text{ delivers } (\overline{(\mathfrak{M}_{\triangleright}^{\circ\parallel}[\underline{\mathfrak{h}}], \overline{\mathfrak{M}_{\triangleright}^{\circ\parallel}[\overline{\mathfrak{h}}]})}, \overline{(\mathfrak{M}_{\triangleright}^{\circ\parallel}[\underline{\mathfrak{h}}], \overline{\mathfrak{M}_{\triangleright}^{\circ\parallel}[\overline{\mathfrak{h}}]})})$$

as recursive expansion, to which the pointed-out entropic decomposition of entropion and informonic decomposition of entropion do not belong. In a general case of operand α ,

- *entropion of entropion*, an up to now not discussed entity $\bar{\alpha}$ or, more precisely, $(\bar{\alpha})$, could mean entropion $\bar{\alpha}$ developing (emerging, coming into unconsciousness, expanding it) in an entropic way, and
- *informon of entropion* is an up to now not discussed entity $\underline{\alpha}$, understood ambiguously as both $(\underline{\alpha})$ and $(\bar{\alpha})$; $(\bar{\alpha})$ could mean entropion $\bar{\alpha}$ developing (emerging, coming into consciousness in the very moment) informonically, and $(\underline{\alpha})$ could mean informon $\underline{\alpha}$ entropionizing in the very moment.

Thus, decomposition $\mathfrak{M}_{\triangleright}^{\circ\parallel} \left[\bar{h} \right]$ means entropion \bar{h} , which fragments in this very moment come into consciousness in a metaphysicalistic way, and decomposition $\mathfrak{M}_{\triangleright}^{\circ\parallel} \left[\underline{h} \right]$, which fragments in this very moment emerge unconsciously, that is, entropionically, in a metaphysicalistic way.

Consequence 1 [Determination of operator subscripts by means of a thesaural-metaphysicalistic approach.]

By the choice of headwords or headword phrases, denoted by h_1 and h_2 , where $h_1, h_2 \in \mathfrak{t}_{\text{thesaurus}}$, the operator subscript (verb or verb phrase) for $\models_{\text{subscript}} \in \mathfrak{t}_{\text{thesaurus}}$, in a basic or complex (interiorly parenthesized h_1 - and h_2 -transition $h_1 \models_{\text{subscript}} h_2$), depends on meaningfully context determined circumstances, where operator $\models_{\text{subscript}}$ must fit the operator composition $\models_{h_1\text{-subscript_dependent}} \circ \models_{h_2\text{-subscript_dependent}}$, that is,

$$(h_1 \models_{\text{subscript}} h_2) \Leftrightarrow (h_1 \models_{h_1\text{-subscript_dependent}} \circ \models_{h_2\text{-subscript_dependent}} h_2)$$

Operator subscript dependence is a matter of meaning within the natural language context, that is, the use of language. □

In Fig. 2, all the paths of the graph, representing operators, are informational jokers \models , with the general meaning of the verb “to inform”. They are not subscribed yet. For instance, the operator of informational concern \models_{Ψ} could be used in many cases. However, more specific operators from the thesaurus, appearing in headword definitions, can be chosen, e.g., $\models_{\text{be_conscious}}$, $\models_{\text{be_aware}}$, $\models_{\text{be_unconscious}}$, $\models_{\text{conceive}}$, $\models_{\text{perceive}}$, $\models_{\text{understand}}$, \models_{intend} , etc.

8 Conclusion

The design of a thesaurus belongs to the hard problems of linguistic study, being an innovative effort in the direction of a deeper understanding of language, of enlarging and spreading the word and phrase meaning.

It is important to comment where the informational approach to conscious agents could meet the Computing Research Repository (ACM) as an innovative research theory and practice on the way to informational consciousness. This paper shows how the subject concerns natural language processing [Computation and Language], combinatorics and graph theory [Discrete Mathematics], indexing (naming), dictionaries (thesauri), retrieval, content and analysis (meaning) [Information Retrieval], multiagent systems (informons), distributed artificial intelligence, intelligent agents, coordinated interactions, and practical applications [Multiagent Systems], connectionism and adaptive behavior [Neural and Evolutionary Computation], other not listed subject areas (consciousness) [Other], and robotics in the sense of informational consciousness [Robotics] [5]. Informational consciousness directly concerns cognitive psychology, cognitive science [2, 4], linguistics, and the philosophy of information [3] and mind.

This paper and [8] show how in English and German, respectively, it is possible to begin the design and programming of informational consciousness system by the use of language thesaurus. It becomes evident that particular thesauri have to be constructed concerning the consciousness related terms of a natural language. The process of translation could be hidden behind a bit more complex organization of informational conscious system: in the first phase, the first natural language is translated into the first (subscribed) informational language. In the second phase, the mapping of the first informational language into the second informational language takes place. This mapping can be determined in advance by approved rules between two languages. In the third phase, the obtained result in the second informational language is translated into the second natural language.

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²Readable also in PDF (Adobe Acrobat Reader), at the website <<http://www.artifco.org>>.