Informational Theory of Consciousness

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Keywords: consciousness: arising, artificialism, causalism, circularism, components, concrete formal structure and organization, decomposition, distributivism, emerging, externalism, gestaltism, informational graph, informing, internalism, metaphysicalism, non-computability, parallelism, serialism, spontaneism, phenomenalism, star-gestaltism, understanding

Edited by: Vladimir A. Fomichov

Received: April 15, 1997 **Revised:** June 17, 1997 **Accepted:** June 24, 1997

What is consciousness from a philosopher's, cognitivist's, physicist's, and informatician's point of view? Physicists attempt to tackle the problem by theoretical means of quantum theory [20, 10, 16, 30, 17, 14], philosophers by a debate on qualia [4, 23], cognitivists claim description and explanation [2, 21], for example. Informaticians develop a theory of the informational based on the new ground of informational arising [33, 34, 36, 37, 40, 42, 43, 44, 45]. This theory together with its formalism seems to meet the requirements for consciousness description, development, emerging, vanishing, modeling, and non-computability, although the principles of informational arising must be thought and elaborated to the new possible and necessary details.

The paper presents two basic metaphisicalistically organized concepts of consciousness: the general (Fig. 2) and the standard one (Fig. 3). On this ground, an initial informational shell of the generalized and standardized metaphysicalism of consciousness system $\mathfrak{z}$ *in Fig. 7 is presented. The shell can be filled with concrete consciousness components (e.g., intention, experience, memory, understanding, etc.), functioning as operand markers in the scheme; they can be further and additionally (in parallel) decomposed in the form of their own and arbitrarily complex informational systems.*

1 Introduction

Informational theory of consciousness[1] is an attempt towards a structure, organization, and formalism of consciousness from the informational point of view. What does this view concern, which scientific disciplines are involved, and what kind of formalistic approach could be used for description of consciousness phenomena?

In [16] (p. 194), Penrose divides the field of physics in two essential theories: the classical and the quantum one. The classical theory is deterministic, *so the future is always completely fixed by the past.* Principles of quantum theory are, on contrary, uncertainty, indeterminism, and mystery in behavior of physical particles.

In informatics (e.g., in the sense of the German term *die Informatik* or *das Informationelle* [47, 49]) also views of theoretical and practical understanding of objects can be recognized: the computational and the non-computational ones, respectively. Like physics, the field of informatics unites both views, and informational theory introduces (legalizes) uncertainty, indeterminism, and mystery as the unknown-yet in behavior of informational entities, however leaves computability to remain where it is consistent and necessary. More precisely, the theory introduces the principle of non-computability (in its widest meaning) as the most essential property of the informational so that the theoretical treatment of non-computable

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informational phenomena becomes possible. In this way a new theoretical approach is emerging—coming into the scientific discourse.

Phenomenalism of consciousness is a good example upon which the informational theory can be proved. From the cognitivistic point of view, consciousness is an assembly of informational concepts from various disciplines concerning brains and mind as biological and cognitivistic entities, respectively. On the other side, quantum theory is on the way to build a new theory for conscious phenomena in the living organisms [10].

Another push for using informational theory in consciousness research is given in [10] by objective reduction, *which is to be a non-computational process instead of merely a random one* [16, 17], and from the consciousness research in general [1]. It is another question what the contemporary mathematics can offer to the problem of non-computability as such, and how could it incorporate the study of consciousness into its own abstract scientific realm (world).

But because of its non-computability principles (that is, informational nature), informational theory does not fit the standard mathematical axiomatism [13] although trials similar to the traditional axiomatics of mathematics have been studied for the sake of the axiomatic analogy [40, 42]. The new theory allows, for instance, to take into consideration phenomena of spontaneity and circularity of informational entities, as the most basic properties of the entity informing [33, 34, 36, 37]. Within these principles the theory anticipates several other and particular forms of informing of entities like intentionality, coming of new information into existence, and informational embedding of arriving and emerging information into the corpus of informational entity. These preliminary studies call to approve the informational theory in the field of cognitive phenomena [44, 47, 49].

The phenomenon of consciousness concerns several fundamental concepts of spontaneous circular informing of entities which are serialism and parallelism in any complex and perplexed form, and the accompanying theory notions of informational transition, frame, gestalt, star gestalt, and graph [43, 45, 48]. These notions can become powerful tools of informational decomposition of entities for mastering the informational consciousness problems [50], as it will be presented through this paper.

2 Terminology of the Consciousness Hard and Soft Problem

How to face consciousness as an evident physical phenomenon, on the one side, and how to express this phenomenon by informational (also linguistic, symbolic, intentional) means, on the other side?

In quantum theory concerning consciousness, several terms came into the conscious foreground:

- —attraction;
- —coherence, interference;
- —collapse;
- —contraction;
- —non-computability, uncertainty;
- —objective reduction OR; and
- —orchestrated space-time selections.

In cognitive science specific consciousness concerning terms are:

- —awareness, attention, observing;
- —intention, coherence, content;
- —qualia, perception;
- —experience, learning, memory, recall;
- —emotion, understanding;
- —sentience, intuition;
- —thematic fields, nonconscious effects;
- —introspection, the self, mind; and
- —uncertainty, subjective aspect.

In the study of the human prefrontal cortical functions [8, 9] several models are presented, based on the theories of:

- —attentional control [24, 25, 26]:
  - — contention scheduler;
  - — supervisory attention system (SAS);
- —working memory [7, 31];
- —temporal processing model [6];
- —behavioral/anatomical theory [29];
- —problem solving [15];
- —somatic marker theory [5, 32]; and
- —action framework [22].

The above models explicate similarities and they all operate over extended time domains and resemble the so-called controlled attentional processes. They suggest information stored elsewhere

in the cerebral cortex (manipulating the brain distributively) which constitutes the main function of the prefrontal cortex. For instance, working memory, attention, or serial encoding, each appears as an informational operator coordinating the activation of stored information [9].

In the theory of the informational there are the following general counterterms:

- —informational arising as a metaphor for:
  - — collapse (ceasing) of informing of informational items (operands as well as operators);
  - — emerging of new informational items (e.g., on the basis of counterinforming, coming of information into existence);
  - — changing of existing (informing) of informational items;
  - — informational spontaneity in the framework of an entity's intentionality;
  - — non-computability of operands (entities) and operators (their relations);
- —informational embedding as a basic property of informing: connecting the arisen and arrived information to the existing information;
- —causalism (possibilities of displacement of parenthesis pairs in formula systems; informational gestalts, especially star gestalts);
- —circularity in the form of serialism, parallelism, with perplexed causal loops;
- —metaphysicalism as a synonym for individual circular coherence;
- —serialism as a synonym for causation;
- —parallelism (formula systems, informational graphs);
- —spontaneity as arising, non-determinism, accidental events, non-predictiveness, etc.;
- —vanishing (dying of informational systems as a consequence of dying of biological organization [18], collapse of physical systems);
- —informational transition; and
- —informational graph as a representative of the most complex parallelism.

These three disciplinary views—the physical, the cognitive, and the informational—constitute an essential ground for the future scientific investigation of the consciousness phenomenalism. Certainly, several other disciplines are and will be involved, especially those studying the phenomena of the brain and the mind.

3 Basic Formalism for Informational Consciousness Study

3.1 Introduction to the Study of Natural and Artificial Consciousness Phenomenalism

A cognitivist can think about consciousness in terms of his/her own observation of his/her own states of awareness in the form of the consciousness phenomenalism. Consciousness appears as a complex informational entity with a number of components being operationally joined into a system of informing entities.

Informational consciousness is a particular phenomenon of the informational, and informational formalism as studied in some recent papers of the author [33, 34, 36, 37, 40, 42, 43, 44, 45, 48] fits the consciousness phenomenalism in the best possible way. What is more important also in this study is the formalistic approach to the phenomenalism of informational consciousness entities. By this approach a systematic understanding of informational entities on both the abstract and the complex level becomes constructively (modeling-likely) and functionally transparent. Formalization brings to the surface several verbally hidden problems in the domain of informational hardness and softness, which can specifically concern the study of consciousness phenomenalism. The formalism brings also to the view the possibilities of structural and organizational artificialness, that is, conceptualization and modeling of arbitrarily complex conscious systems. In this respect, models of natural consciousness, as understood by the contemporary science, seem to appear below the various and arbitrarily powerful (complex) possibilities of the artificial consciousness systems.

3.2 A Formalism for Expression of Consciousness Phenomenalism

Informational formalism presented in [36, 37, 40, 42, 43, 44, 45, 48] is a visible candidate for the study of the most pretentious problems of consciousness, being a system of coherently and infer-

entially acting informational components. Both informational operands and informational operators belong, if necessary, to the category of uncertainly and non-computably informing entities. In this respect, they cannot be exactly and efficiently processed and modeled by nowadays computer programs. For this purpose, an informational machine, using informational programs, would be necessary [41], performing as an informing entity (computing device) by itself. This initial comment for the reader is necessary to stay aware that informational operands and operators together with their formulas are, by their nature, informationally arising (changing, emerging, vanishing) entities. This fact cannot be slighted by the fame of the tremendous power of the today computing system nets.

3.2.1 The Most Fundamental Axioms of Consciousness

It is easy to identify how the fundamental axioms of the informational [40] meet the axioms of consciousness. For instance, that consciousness informs out of itself (to the exterior), that it is informed into itself (to its interior) from the exterior, and, its most characteristic feature, that it informs (in) itself and is informed by (in) itself (consciousness circularity). For a consciousness system, marker $\mathfrak{z}$ (or, systematically, $\mathfrak{z}_0$)[2] will be used.

The general informational axiom[3] says that consciousness $\mathfrak{z}$ informs, otherwise it could not be observed by consciousness. This sentence hides three elementary axioms.

Axiom 1 (Consciousness Informing) *Consciousness $\mathfrak{z}$ informs. Formally and graphically,*

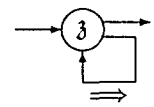
$$\mathfrak{z} \models \quad \textit{and} \quad (\mathfrak{z})\longrightarrow$$

respectively. Here, $\models$ is an operator of consciousness informing and $\longrightarrow$ (an arrow of an arbitrary length and form) is the graphical representation of operator $\models$, respectively. □

A kind of the consequence of this axiom is an implication which origins in the meaning of the verb 'inform'. Namely, if something informs, there must exist something which is informed by the something's informing. By the first of the classical mathematical axioms[4] it would mean that the following implication is reasonable:

$$(\mathfrak{z} \models) \Longrightarrow ((\models \mathfrak{z}) \Longrightarrow (\mathfrak{z} \models))$$

This axiomatic implication [13] is explicitly circular in respect to $\mathfrak{z} \models$ and implicitly circular to $\models \mathfrak{z}$. The informational graph for this axiomatic implication is evidently



Thus, also,

$$(\models \mathfrak{z}) \Longrightarrow ((\mathfrak{z} \models) \Longrightarrow (\models \mathfrak{z}))$$

The second consciousness axiom can now be formulated.

Axiom 2 (Consciousness Observing) *Consciousness $\mathfrak{z}$ is consciously informed or, simply, $\mathfrak{z}$ observes. Formally and graphically,*

$$\models \mathfrak{z} \quad \textit{and} \quad \longrightarrow(\mathfrak{z}) \quad \textit{or} \quad (\mathfrak{z})\xrightarrow{\models \text{observe}}$$

respectively. $\mathfrak{z}$ is observingly open, that is, for observing something (the empty left place of $\models$). □

Explicitly, the following consequence of Ax. 2 is possible.

Consequence 1 *Formula $\models \mathfrak{z}$, where $\mathfrak{z}$ has the observing position, can be expressed explicitly in an operator particularized form,*

$$\mathfrak{z} \models_{\text{observe}}$$

[2]Symbol $\mathfrak{z}$ for consciousness was chosen as the last letter in the Fraktur alphabet, to be clearly distinguished from any other letter symbol. In Slovene, consciousness is translated as zavest.

[3]Informational axioms, presented in this paper, meet the principles of the objectivist epistemology (Ayn Rand [19]). Informational axioms identify a primary fact of the reality, consisting of the three axiomatic parts: informational externalism, internalism, and metaphysicalism. Out of these axioms the axiom of informational phenomenalism follows, as a central fact of informing of things, entities, events, phenomena, etc. In this way, existence, identity, and consciousness of entities and phenomena come into the foreground.

[4]The first (meta)mathematical axiom ([13], p. 66) has the form

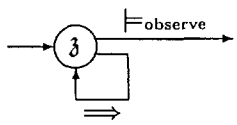
$$A \longrightarrow (B \longrightarrow A)$$

In the discussed informational case we insert $\mathfrak{z} \models$ for A, $\models \mathfrak{z}$ for B and informational implication $\Longrightarrow$ for mathematical implication $\longrightarrow$.

Thus, logically,

$$(\models \mathfrak{z}) \Longrightarrow (\mathfrak{z} \models_{\text{observe}});$$
$$(\mathfrak{z} \models_{\text{observe}}) \Longrightarrow (\models \mathfrak{z})$$

and graphically,

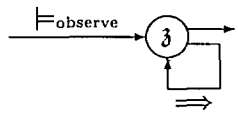


respectively.

Simultaneously, as a consequence of Ax. 1, there is logically,

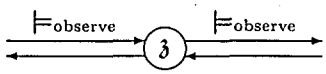
$$(\mathfrak{z} \models) \Longrightarrow (\models_{\text{observe}} \mathfrak{z});$$
$$(\models_{\text{observe}} \mathfrak{z}) \Longrightarrow (\mathfrak{z} \models)$$

and graphically,



respectively. □

Consequence 2 (Bidirectionality of the consciousness informing-observing phenomenalism) *According to Cons. 1, the following basic informational graph for consciousness* $\mathfrak{z}$ *is coming in the foreground:*



The dualism (in the form of the informational bidirectionality) of informing and observing of consciousness $\mathfrak{z}$ *will become still more evident in the circular and metaphysicalistic organization of consciousness.* □

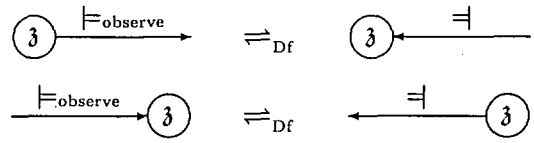
The following is evident: if consciousness informs (something), it must be observed (by something); if consciousness observes (something), it must be informed (by something). In case of an arbitrary informational entity instead of consciousness, the *must* will be replaced by the *can*.

Informationally, the informing and the observing are antisymmetric phenomena. For the sake of formalistic symmetry the following definition is senseful.

Definition 1 *Let the operator* $\models_{\text{observe}}$ *be replaced by the counter-directional operator* $=\!|$. *Then,*

$$(\mathfrak{z} \models_{\text{observe}}) \rightleftharpoons_{\text{Df}} (\mathfrak{z} =\!|);$$
$$(\models_{\text{observe}} \mathfrak{z}) \rightleftharpoons_{\text{Df}} (=\!| \mathfrak{z})$$

The particularized (observing) operator $\models_{\text{observe}}$ *is replaced by the right-left (informing, called also alternative) operator* $=\!|$. *Graphically, the following definitional equivalence is introduced:*



Operator $\models_{\text{observe}}$ *and* $=\!|$ *is a particularization of operator* $\models$. □

The informing and observing of consciousness can concern the consciousness itself, where consciousness informs itself and is informed by itself, or where consciousness observes itself and is being observed by itself. The following axiom is a consequence of the preceding axioms.

Axiom 3 (Consciousness Void Informational Circularity) *Consciousness* $\mathfrak{z}$ *consciously informs itself and is consciously informed by itself or, simply, consciousness observes itself. Formally and graphically, there is,*

$$\mathfrak{z} \models \mathfrak{z} \qquad \textit{and} \qquad$$ 

respectively. This formula constitutes the so-called void or pure consciousness (e.g., [27]*).* □

According to the general informational theory [33, 36], this axiom could be called the void consciousness metaphysicalism[5]. Void consciousness is an informational artifact existing only as a meditation process in eastern philosophy [27]. On the other hand, $\mathfrak{z} \models \mathfrak{z}$ is the initial situation, in which the so-called general (circular-serial, circular-parallel) or more specific (general metaphysicalistic or standardized metaphysicalistic) informational decomposition can be started.

[5] A general concept of consciousness metaphysicalism will be discussed later. Metaphysicalism means a loosely determined (organizational invariance, according to [3], interpreted also as a void consciousness, according to [46], p. 406) structure and organization of an informational entity.

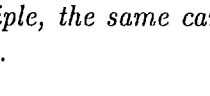
In such a decomposition, inner components of consciousness come to the surface in a circular serial and/or circular parallel manner. The so-called *pure* or *void* consciousness which appears as the final state of the extremely skilled and disciplinary meditation in Eastern philosophies (see the discussion in [46]) becomes, in an informational decomposition process, the beginning situation from which the complexity of consciousness develops. A similar situation happens in a living embryo when after the development of neurons (still in the condition of tabula rasa) the synaptic-dendritic connection among neurons begin to emerge, as a consequence of circumstances, learning, and experience events, disturbances, and pressures of the life.

Informational phenomenalism of consciousness is the most general principle of possible consciousness informing, emerging of its structure and organization, determination of its inner and outer structural decomposition. In its formalistic, conceptual, and constructive sense, this phenomenalism must preserve at least: the coming potentiality of consciousness evolution, the conscious and unconscious development, the surpassing of the instantaneous transparent horizons, and the intervening beyond the disciplinarily traced scientific and ideological frames of reference and understanding.

Within this perspective, consciousness phenomenalism unites its externalism, internalism, and metaphysicalism as stated in Axs. 1–3. In this respect, consciousness remains open to the impactingness and to the impactedness of itself and its environment.

Axiom 4 (Phenomenalistic Nature of Consciousness) *Formalistically, the consciousness phenomenalism is best described by the basic parallel system of the form*

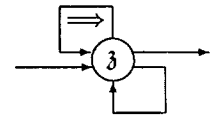
$$\mathfrak{z} \rightleftharpoons \begin{pmatrix} \mathfrak{z} \models; \\ \models \mathfrak{z} \end{pmatrix} \quad \textit{and} \quad$$



where the following informational implication of consciousness

$$\begin{pmatrix} \mathfrak{z} \models; \\ \models \mathfrak{z} \end{pmatrix} \Longrightarrow (\mathfrak{z} \models;\ \models \mathfrak{z};\ \mathfrak{z} \models \mathfrak{z})$$

must be considered. This implication increases the circularity in the sense of the sense of the informational graph of the form



Evidently, informational phenomenalism of consciousness includes [38] its externalism, internalism, and metaphysicalism. Thus,

$$\mathfrak{z} \models,\ \models \mathfrak{z},\ \mathfrak{z} \models \mathfrak{z} \subset \begin{pmatrix} \mathfrak{z} \models; \\ \models \mathfrak{z} \end{pmatrix}$$

is true. □

In the next definition we have to clear up the potentiality of operators $\models$ and $\rightleftharpoons$ also in the so-called trivial cases.

Definition 2 (General Meaning of Operator $\models$ and Operator $\rightleftharpoons$ in a Trivial Case) *Additional explanation of formulas $\mathfrak{z} \models \mathfrak{z}$ and $\mathfrak{z} \rightleftharpoons \mathfrak{z}$ is the following:*

$\mathfrak{z} \models \mathfrak{z}$: *Besides that what is said in Ax. 3, $\mathfrak{z}$ on the left is the informer of $\mathfrak{z}$ on the right of operator $\models$. The left and the right $\mathfrak{z}$ can be developed by the essentially different serial, parallel, and circular $\mathfrak{z}$'s decompositions. That what remains is that the left $\mathfrak{z}$ part informs (impacts) the right one $\mathfrak{z}$-part. Both parts remain constituents of $\mathfrak{z}$ as an integrated entity—which may be marked by $\mathfrak{z}$. The last concerns already the next situation, that is $\mathfrak{z} \rightleftharpoons \mathfrak{z}$.*

$\mathfrak{z} \rightleftharpoons \mathfrak{z}$: *Operator $\rightleftharpoons$ is understood to be a particularization of the general operator $\models$ (informational joker) and expresses the meaning of the left denotation (designator, marker) in concern to the right formula system. Usually, the left $\mathfrak{z}$ marks the right formula complexly developed (decomposed) to an arbitrary serial, parallel, and/or circular complexity. In principle, the same can certainly hold for the left $\mathfrak{z}$.*

Difference: *Between formulas $\mathfrak{z} \models \mathfrak{z}$ and $\mathfrak{z} \rightleftharpoons \mathfrak{z}$ is the difference in informing and meaning. The first formula is in principle a beginning of the possible informational decomposition, where in formula $\mathfrak{z} \models_{\mathfrak{z}} \circ \models_{\mathfrak{z}} \mathfrak{z}$ (as an operator composition) the left part $\mathfrak{z} \models_{\mathfrak{z}}$ as well as the right part $\models_{\mathfrak{z}} \mathfrak{z}$ can be entirely differently decomposed. In formula $\mathfrak{z} \rightleftharpoons \mathfrak{z}$, the left*

part is used as a designator of the arbitrarily complex right part and as a shortcut in other complex formula systems.

The presented difference is essential for comprehension of informationally conceptualized symbolism, denotations and formula systems. □

3.2.2 General and Metaphysicalistic Circular Serial Decomposition of Consciousness

On the other hand, that what concerns the study of consciousness is the possibility of consciousness decomposition, in a circular and spontaneous manner, and in a serial and parallel form. Consciousness $\mathfrak{z}$ as a general entity is decomposed into its circular-serial components, marked by $\mathfrak{z}0$, $\mathfrak{z}1$, $\ldots$, $\mathfrak{z}n$, where $\mathfrak{z}0$ simultaneously marks the general entity $\mathfrak{z}$. A consciousness component is denoted by $\mathfrak{z}j$, where $0 \leq j \leq n$. Such a decomposition possesses $n+1$ components.

This sort of a general decomposition is an informational function [39] of the initial general circular position $\mathfrak{z} \models \mathfrak{z}$ or shortly $\mathfrak{z}$, marked by ${}^{n+1}_{i_j}\Delta^{\circlearrowleft}_{\rightarrow}$. Another sort of decomposition of $\mathfrak{z}$ is the so-called metaphysicalistic decomposition ${}^{n+1}_{i_j}\mathsf{M}^{\circlearrowleft}_{\rightarrow}$ constituted by the three characteristic (metaphysicalistic) parts: intentional informing, intentional counterinforming, and intentional embedding. The term 'intention' is a joker (metaphor) for characteristic coherence (components) of consciousness like experience, qualia, emotion, memory, introspection, observing, etc. Thus,

$$ {}^{n+1}_{i_j}\Delta^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}) \quad \text{and} \quad {}^{n+1}_{i_j}\mathsf{M}^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}) $$

mean the following:

- $n+1$ is the length (number of binary operators of type $\models$) of circular decomposition and, simultaneously, the number of occurring loop operands;
- j is the subscript of a concrete operand, the one of $\mathfrak{z}$'s components, $\mathfrak{z}j$, thus, $0 \leq j \leq n$;
- i_j is a case of causal possibilities in the interval $1 \leq i_j \leq \frac{1}{n+2}\binom{2n+2}{n+1}$;
- $\circlearrowleft$ is the symbol of circular structure;
- $\rightarrow$ marks the serial structure; and
- $\mathfrak{z}$ in this context, represents a circularly ordered sequence of operands, according to the circularly running subscript j, $\mathfrak{z}j, \mathfrak{z}j{+}1, \cdots, \mathfrak{z}n{-}1, \mathfrak{z}n, \mathfrak{z}0, \mathfrak{z}1, \cdots, \mathfrak{z}j{-}1$.

Circular serial decompositions deliver circular serial formulas and informationally coherent consciousness formula systems. According to the form of circular formulas [43, 44, 48, 50, 47, 49] obtained by the circular serial decomposition, for the case of consciousness $\mathfrak{z}0$, there is,

$$
\begin{aligned}
&{}^{n+1}_{i_0}\Delta^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}0) \rightleftharpoons {}^{n+1}_{i_0}\mathfrak{z}0^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}0, \mathfrak{z}1, \mathfrak{z}2, \cdots, \mathfrak{z}n);\\
&{}^{n+1}_{i_1}\Delta^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}1) \rightleftharpoons {}^{n+1}_{i_1}\mathfrak{z}1^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}1, \mathfrak{z}2, \cdots, \mathfrak{z}n, \mathfrak{z}0);\\
&\quad\vdots\\
&{}^{n+1}_{i_j}\Delta^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}j) \rightleftharpoons {}^{n+1}_{i_j}\mathfrak{z}j^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}j, \mathfrak{z}j{+}1, \cdots, \mathfrak{z}n, \mathfrak{z}0, \cdots, \mathfrak{z}j{-}1);\\
&\quad\vdots\\
&{}^{n+1}_{i_n}\Delta^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}n) \rightleftharpoons {}^{n+1}_{i_n}\mathfrak{z}n^{\circlearrowleft}_{\rightarrow}(\mathfrak{z}n, \mathfrak{z}0, \mathfrak{z}1, \cdots, \mathfrak{z}n{-}1);\\
&1 \leq i_0, i_1, \ldots, i_j, \ldots, i_{n-1}, i_n \leq \tfrac{1}{n+2}\tbinom{2n+2}{n+1}
\end{aligned}
$$

From the decomposition scheme, it is evident that the number of all possible circular-serial decompositions of length $n+1$, considering the rotation of the occurring operands in a cycle, for the described situation, is

$$ {}^{\circlearrowleft}N^{\circlearrowleft}_{\rightarrow} = \frac{n+1}{n+2}\binom{2n+2}{n+1} $$

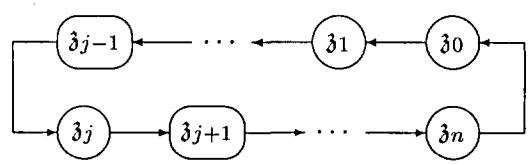


Figure 1: *A generalized circular graph (which fits the serial as well as the parallel case) of consciously informing components $\mathfrak{z}j$, if $0 \leq j \leq n$. In fact, the single (main) loop of the graph, without additional feedbacks (subloops including some successive operands of the main loop), concerns all of the circularly involved operands, $\mathfrak{z}0, \ldots, \mathfrak{z}n$.*

In [48], Fig. 28, the details for the structure of an informational function ${}^{n+1}_{i_j}\varphi^{\circlearrowleft}_{\rightarrow}$, corresponding to the circular structure of a consciousness component ${}^{n+1}_{i_j}\mathfrak{z}j^{\circlearrowleft}_{\rightarrow}$, are presented where, certainly, $0 \leq j \leq n$. The graph, presenting roughly the listed $n+1$ decompositions is shown in Fig. 1. One of the possible circular serial interpretation

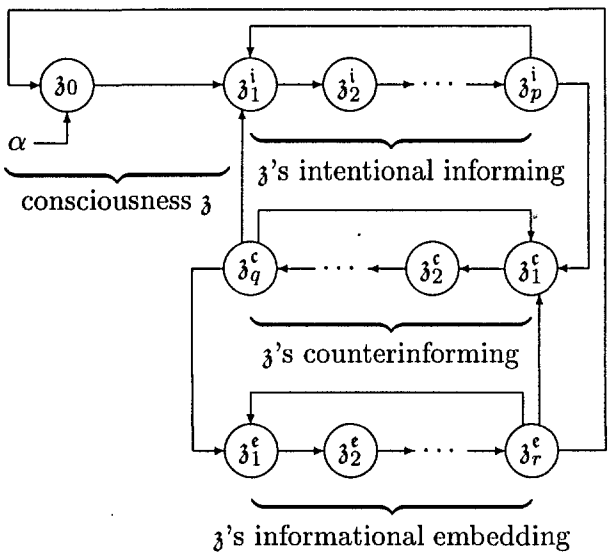


Figure 2: *A generalized metaphysicalism of consciousness $\mathfrak{z}_0$ (marked, in general, by symbol $\mathfrak{z}$) with consciousness-intrinsic informing, counterinforming and informational embedding, concerning something exterior or interior, denoted by α. In this scheme, there are six metaphysicalistically characteristic feedbacks, connecting several components: $\mathfrak{z}_r^e$ with $\mathfrak{z}_0$, $\mathfrak{z}_q^c$ with $\mathfrak{z}_1^i$, $\mathfrak{z}_r^e$ with $\mathfrak{z}_1^c$, $\mathfrak{z}_p^i$ with $\mathfrak{z}_1^i$, $\mathfrak{z}_q^c$ with $\mathfrak{z}_1^c$, and $\mathfrak{z}_r^e$ with $\mathfrak{z}_1^e$.*

of the graph in Fig. 1 is, for instance, the first formula of existing $\frac{1}{n+2}\binom{2n+2}{n+1}$ formulas, the general decomposition ${}^{n+1}_{i_j\rightarrow}\Delta^{\circlearrowright}(\mathfrak{z}_j)$, concerning operand $\mathfrak{z}_j$, that is,

$$(\cdots((((\cdots(\mathfrak{z}_j \models \mathfrak{z}_{j+1}) \models \cdots \mathfrak{z}_{n-1}) \models \mathfrak{z}_n) \models \mathfrak{z}_0) \models \mathfrak{z}_1) \models \cdots \mathfrak{z}_{j-2}) \models \mathfrak{z}_{j-1}$$

In principle, the metaphysicalistic structure meets the presented general circular scheme. The difference to the general circular case lies in a loose form of the metaphysicalistically invariant organization, by which some specific, meaningly (semantically, pragmatically) founded informational details (operands, feedbacks) come into the foreground. In this respect, the metaphysicalistic scheme possesses intrinsically characteristic parts (structure with feedbacks) of a consciousness loop, as shown in Fig. 2. For this scheme there exist six circular decompositions, expressed by a unique system of circular formulas. An example of such a unique system is, for instance,

$$\begin{pmatrix} (\cdots((((\cdots((\mathfrak{z}_0 \models \mathfrak{z}_1^i) \models \mathfrak{z}_2^i) \models \cdots \mathfrak{z}_p^i) \\ \qquad \models \mathfrak{z}_1^c) \models \mathfrak{z}_2^c) \models \cdots \mathfrak{z}_q^c) \\ \qquad \models \mathfrak{z}_1^e) \models \mathfrak{z}_2^e) \models \cdots \mathfrak{z}_r^e) \\ \qquad \models \mathfrak{z}_0; \\ (\cdots((((\cdots(\mathfrak{z}_1^i \models \mathfrak{z}_2^i) \models \cdots \mathfrak{z}_p^i) \models \\ \qquad \mathfrak{z}_1^c) \models \mathfrak{z}_2^c) \models \cdots \mathfrak{z}_q^c) \models \mathfrak{z}_1^i; \\ (\cdots((((\cdots(\mathfrak{z}_1^c \models \mathfrak{z}_2^c) \models \cdots \mathfrak{z}_q^c) \models \\ \qquad \mathfrak{z}_1^e) \models \mathfrak{z}_2^e) \models \cdots \mathfrak{z}_r^e) \models \mathfrak{z}_1^c; \\ (\cdots(\mathfrak{z}_1^i \models \mathfrak{z}_2^i) \models \cdots \mathfrak{z}_p^i) \models \mathfrak{z}_1^i; \\ (\cdots(\mathfrak{z}_1^c \models \mathfrak{z}_2^c) \models \cdots \mathfrak{z}_q^c) \models \mathfrak{z}_1^c; \\ (\cdots(\mathfrak{z}_1^e \models \mathfrak{z}_2^e) \models \cdots \mathfrak{z}_r^e) \models \mathfrak{z}_1^e \end{pmatrix}$$

Later we shall see how all the circular causal possibilities are determined by the graph, and how this situation is described formally by the parallel formula system consisting of primitive informational transitions only.

The basic standardized scheme of consciousness metaphysicalism can now be discussed in a greater detail in the next paragraph.

3.2.3 The Standardized Fundamental Organization of Consciousness Metaphysicalism

Consciousness as a natural phenomenalism is not only an extremely appropriate case of informational philosophy, but fits astonishingly suitable the presented informational formalism also. It explicitly shows the most characteristic properties of informational emerging (arising in the process of informing, counterinforming, and informational embedding), in the spirit of coming of the new information into existence, its changing and disappearing. Informational arising brings new and again new informational objects into the appearance of consciousness, its specific informationally concerning objects. In this respect, consciousness is much more an evident entity within the informational phenomenalism as it could be some other physical entity, e.g. a thing, where a thing's emerging, changing, and vanishing might be not so evident as it is a case of consciousness. On the other hand, it should be said that the informational phenomenalism can meet biological systems in their evolutionary development and in reactions as consequences of intrinsic and extrinsic physical, biological, and informational disturbances. Within this ascertainment lies the per-

spective of the use of the new informational formalism in the fields of biology, sociology, psychology, and other intelligently structured phenomena [44].

The organizational invariance[6] of a consciousness informational system fits the requirements characteristic for the metaphysicalism of informational entities [36, 37, 40, 44, 47]. An adequate term for this kind of organization within the informational theory is the *standardized fundamental organization of metaphysicalism*, which applies for consciousness too. The details of consciousness come into the foreground when a specific case is studied and then decomposed to the possible details. Within this context, some specific components must (in an organizationally invariant sense) belong to a specific section of the fundamental metaphysicalistic scheme. Indeed, specific artificial decompositions are possible, in which consciousness components can appear in different sections. Such cases occur in the process of parallel decomposition (parallelization), when different parallel loops for consciousness come into existence.

The graph in Fig. 3 shows such a standardized situation. Within this scheme, each component (an informing and its entity) can be further decomposed, where an informing should preserve the attributes of informing, and to it belonging entity should appear as a consequence of this informing. Because of the circular structure of the system, causality is circular too, and in this view, informings and their entities become informationally depended on all in the loop informing entities.

How could the scheme in Fig. 3 be interpreted for a concrete case of consciousness? Which entities could occupy the determined parts as consciousness components? At the first glance, one could say that, for instance, consciousness concerns understanding [44], by which the intentional part of consciousness includes intending, sensing, and observing as being conscious; the counterinforming part includes the being unconscious and conceiving; this part is responsible for the essential emerging of information from the unconscious and for the emerging of concepts from the unconscious background; the informational-embedding

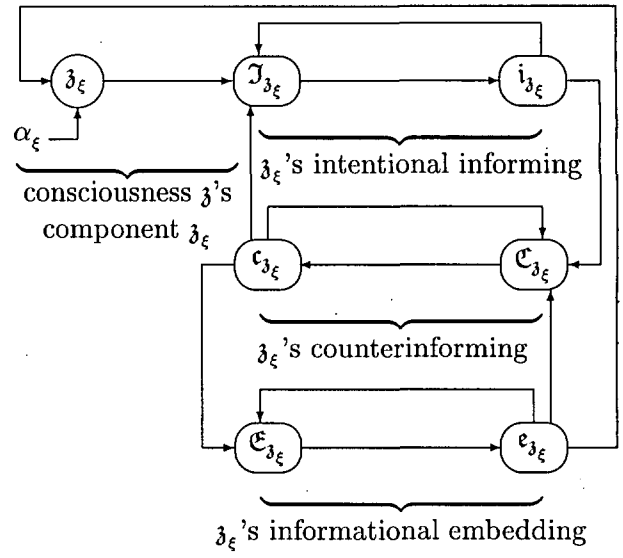


Figure 3: *A standardized metaphysicalistic organization of consciousness components* $\mathfrak{z}_\xi$, *where* $\mathfrak{z}_\xi$ *applies to components* $\mathfrak{z}_j$, $0 \leq j \leq n$, *in Fig. 1, as well as to* $\mathfrak{z}_\xi \in \{\mathfrak{z}_1^{\mathfrak{i}}, \cdots, \mathfrak{z}_p^{\mathfrak{i}}; \mathfrak{z}_1^{\mathfrak{c}}, \cdots, \mathfrak{z}_q^{\mathfrak{c}}; \mathfrak{z}_1^{\mathfrak{e}}, \cdots, \mathfrak{z}_r^{\mathfrak{e}}\}$ *in Fig. 2. In this scheme, each metaphysicalistic part is divided into informing* $(\mathfrak{I}, \mathfrak{C}, \mathfrak{E})$ *of the part, and informational entity, that is, operand* $(\mathfrak{i}, \mathfrak{c}, \mathfrak{e})$, *to which the informing belongs.*

part decides upon the contents which should be incorporated into the subject of the instantaneous consciousness: such components could be signifying (recognizing of importance of something), making sense (bringing the sense of a certain consciousness into the foreground), perceiving (making an interpretation as unavoidable and necessary), concluding (generating inferential processes with specific goals), and lastly, generating meaning of a conscious process as an informational result in a global and particular sense.

The described pragmatic case of understanding meets consciousness as small and particular case only. Consciousness has many other and very different and controversial components, and its own parallel cycles, on the conscious and unconscious (subconscious) level. The most exhaustive, but still not sufficiently integrated presentation in this direction will be described in [50].

If each consciousness component is organized metaphysically, and the same applies for a consciousness system as a whole too, then the question arises, how it would be possible to identify the system's integral intentionality, its in-

[6]The term *organizational invariance* was introduced by Chalmers [3], and has been discussed and additionally interpreted in [46] by the author.

tentional counterinforming, and intentional embedding? It becomes evident that these informational functions are distributed over the consciousness components, and can be comprehended simply as nothing else than *distributed* intentionality, its counterinforming and embedding. In this respect, consciousness appears as a distributed system in regard of its basic properties of informing. It comes up the evidence that, formally, the consciousness system as an informational system could be expressed by means of distributed operands. What could such an operand mean and how could it be expressed formally and efficiently?

To grasp consciousness as an integratively as well as componently distributed entity (a complex informational operand), we can introduce the equational (equivalence) denotation

$$\mathfrak{z}_\xi \rightleftharpoons \|\mathfrak{z}_\xi\rangle$$

Denotation $\|\mathfrak{z}_\xi\rangle$ reminds someone on the symbol of a state vector (quantum state), e.g. $|\psi\rangle$, in Hilbert space. Although, a certain affinity between denotations $\|\mathfrak{z}_\xi\rangle$ and $|\psi\rangle$ could be possible, the difference is essential. The parallelism symbol $\|$ in $\|\mathfrak{z}_\xi\rangle$ denotes the parallel structure of $\mathfrak{z}$, where its components inform in parallel (concurrently and simultaneously), although they can be informationally circularly and/or serially connected. Symbol $\|$ represents the distributivity of an informational entity in a parallel (componentially-coexistent) manner.

In Hilbert space, $|x\rangle + |y\rangle$ is a vector (resultant) composed of vectors $|x\rangle$ and $|y\rangle$, where '+' is the composition (combination) operator. In informational theory, in $\|\alpha\rangle \models \|\beta\rangle$, symbol $\models$ is the composition operator, and $\|\alpha\rangle$ and $\|\beta\rangle$ are components of the basic informational transition. Transition $\|\alpha\rangle \models \|\beta\rangle$ is a new informational entity (an autonomous operand), $\|\alpha \models \beta\rangle$, in regard to its constituting entities (operands) $\|\alpha\rangle$ and $\|\beta\rangle$. The notional parallelism between a Hilbert space and an informational space could be developed also in the direction of the scalar product $(|a\rangle, |b\rangle)$ (a sum of sums of products) and a vector length (norm) $\||a\rangle\|$. In informational theory, notation (α, β) means coexistent entities α and β, for which, by this sort of notation, their interaction is not determined. A sort of informational distributive law is

$$(\alpha, \beta \models \gamma) \rightleftharpoons \begin{pmatrix} \alpha \models \gamma; \\ \beta \models \gamma \end{pmatrix}$$

while this law in a Hilbert space is $(x, y + z) = (x, y) + (x, z)$.

Evidently, informational coexistence formula (α, β) is not an adequate equivalent to the Hilbertian product (x, y), which is a scalar measure. One of the possible informational measures could be the meaning μ of an informational entity. Thus, for instance,

$$\mu(\alpha, \beta)$$

can be defined as a function (informational Being-of [39]) concerning entities α and β. The definition [39] delivers, evidently, the circular system

$$\mu(\alpha, \beta) \rightleftharpoons \begin{pmatrix} \mu \models_{\text{of}} \alpha, \beta; \\ \alpha, \beta \models \mu; \\ (\mu \models_{\text{of}} \alpha, \beta) \subset \mu; \\ (\alpha, \beta \models \mu) \subset_{\text{of}} \mu \end{pmatrix}$$

It can be easily seen how a multivariable function

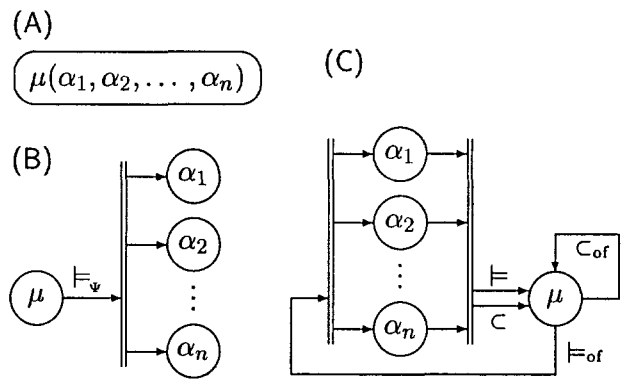


Figure 4: *Informational graph for the case of meaning μ as a multivariable informational function:* (A) *for $\mu(\alpha_1, \alpha_2, \ldots, \alpha_n)$;* (B) *for the functional transition $\mu \models_\Psi \alpha_1, \alpha_2, \ldots, \alpha_n$; and* (C) *for the definition of informational function $\mu(\alpha_1, \alpha_2, \ldots, \alpha_n)$.*

of meaning would be formally expressed and how it would look like graphically. Fig. 4 shows the situation for the three equivalent cases which can be used within an informational graph. Case (C) presents all the details which must be considered. Usually, in a graph presentation, case (B) is applied which delivers the possible causal diversity considering different paths within a graph, especially when exploring cases of star gestalts [43].

Meaning as an entity of consciousness appears often in the form of informational function of an

informational function, to an arbitrary depth, as presented in Fig. 5. Thus,

$$\mu(\alpha_1(\alpha_2 \dots (\alpha_{n-1}(\alpha_n)) \dots))$$

In this context, to the Hilbertian norm corresponding meaning μ of an informational entity $\mathfrak{z}$ would mean to decompose the function $\mu(\mathfrak{z})$ as an informational interpretation of $\mathfrak{z}$. In principle, there are at least two possibilities for the place of meaning $\mu(\mathfrak{z})$. It can, for example, appear in a metaphysicalistic environment (decomposition) of $\mathfrak{z}$. In a different case, it can appear as an autonomous informational formula system informing in parallel to $\mathfrak{z}$. All this should suffice to give the reader an outlook on possibilities of construction of informational space, with essentially different meaning and structure in comparison to Hilbert space.

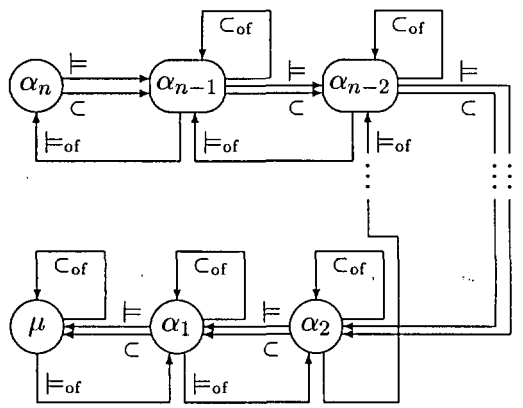


Figure 5: *Informational graph for the function* $\mu(\alpha_1(\alpha_2 \dots (\alpha_{n-2}(\alpha_{n-1}(\alpha_n))) \dots))$, *where* $\subset$ *and* $\subset_{of}$ *represent complex operators of informational Being-in [38].*

Meaning belongs to the central notions of informational embedding and, in case of consciousness, it is indispensable within various components of consciousness. As soon as meaning appears in a consciousness informational loop it becomes, directly or indirectly, impacted by the components of the loop. On the other hand, it may certainly impact the development of consciousness components. For instance, the informing of component α_n in Fig. 5, as a main circular operator, can be described by the formula

$$\begin{aligned}&((\dots(((((\dots((\alpha_n \subset \alpha_{n-1}) \subset \alpha_{n-2}) \subset \dots \alpha_2) \subset \alpha_1)\\ &\subset \boxed{\mu}) \models_{of}\\ &\alpha_1) \models_{of} \alpha_2) \models_{of} \dots \alpha_{n-2}) \models_{of} \alpha_{n-1}) \models_{of} \alpha_n\end{aligned}$$

Meaning μ can appear in a consciousness component loop. But, it can be treated also as a parallel formula concerning consciousness components. In this way, it can have its own metaphysicalistic structure, e.g., in the sense,

$$\mu(\mathfrak{z}_0, \mathfrak{z}_1, \dots, \mathfrak{z}_n) \quad \text{or/and}$$
$$\mu(\mathfrak{z}_0(\mathfrak{z}_1(\dots \mathfrak{z}_{n-1}(\mathfrak{z}_n(\mu)) \dots)))$$

In case of $\mu(\mathfrak{z}_0(\mathfrak{z}_1(\dots \mathfrak{z}_{n-1}(\mathfrak{z}_n(\mu)) \dots)))$ consciousness components as arguments of function μ are ordered. The situation of the loop is shown in Fig. 6. Here, μ figures as the main operand. But, according to the *operand rotation principle* for a loop, each of the occurring operands can take the place of the main operand. Thus,

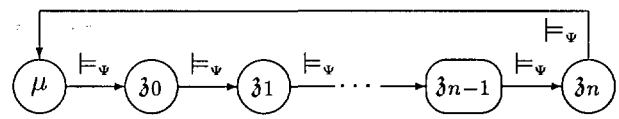


Figure 6: *Informational graph for the circular function formula* $\mu(\mathfrak{z}_0(\mathfrak{z}_1(\dots \mathfrak{z}_{n-1}(\mathfrak{z}_n(\mu)) \dots)))$, *where* $\models_\Psi$ *denotes the function operator.*

$$\mathfrak{z}_j(\mathfrak{z}_{j+1}(\dots \mathfrak{z}_{n-1}(\mathfrak{z}_n(\mu(\mathfrak{z}_0(\mathfrak{z}_1(\dots \mathfrak{z}_{j-1}(\mathfrak{z}_j) \dots)))))) \dots))$$

In a loop, each loop operand can be expressed by the remaining loop operands. This applies for common loop formulas as well as function formulas, which are nothing else than particular formula expressions.

3.2.4 Metaphysicalistic General and Standardized Circular Parallel Decomposition of Consciousness

Parallel decomposition belongs to the typical reductionistic reasoning with a various possibilities effect in the framework of a case, phenomenon, or problem generalization. As already recognized, this sort of decomposition enables the construction of a graph in which more precise and detailed causal circumstances are blurred, unexpressed, uncertain, or simply unknown sufficiently. In this

manner, a parallel decomposition embraces several and probable many certain possibilities. It enables them, as it could be seen, by the magnitude of numbers $N_{\rightarrow}^{\circlearrowleft}$ and ${}^{\circlearrowleft}N_{\rightarrow}^{\circlearrowleft}$.

There are different ways of a parallel circular decomposition of consciousness entities. The well-known method pertains to a system of parallel circular formulas, by which various components of a consciousness system are described in parallel. On the basis of such a system it is possible to draw an informational graph being circled in a complete way [48]. It means that each operand of the graph belongs to one or more loops, that loops are mutually connected (possess common operands), and that isolated operands can exist only for the sake of a distinguished (additional) input or output operand of the system.

On the other hand, the question emerges, if the description of a completely circled graph is possible by non-circled informational formulas. The answer to this question is positive, and one of the possibilities is to use the basic transition formulas, that is those of the form $\mathfrak{z}_i \models \mathfrak{z}_j$. A parallel system consisting of such primitive transitions is called the primitive parallel system (a system of primitive transitions) and denoted by ${}^{n+1}\mathfrak{z}_{j\,\parallel}^{\circlearrowleft'}$ [48] for a single circular loop or by $\mathfrak{z}_{j\,\parallel}^{\circlearrowleft'}$ in case of several loops. Several loops, the number of which is k, can be exactly considered by an arithmetic function f as the fore superscript, that is,

$${}^{f}\mathfrak{z}_{j\,\parallel}^{\circlearrowleft'}, \text{ where } f = \prod_{i=1}^{k} \frac{1}{\ell_i + 1}\binom{2\ell_i}{\ell_i}$$

Here, ℓ_i denotes the loop length. Thus, f is the number of all possible causal situations within the primitive parallel system ${}^{f}\mathfrak{z}_{j\,\parallel}^{\circlearrowleft'}$.

Similar as in case of circular serial decomposition, for the primitive circular parallel decomposition of a single loop there is

$${}^{n+1}\Delta_{\parallel}^{\circlearrowleft'}(\mathfrak{z}) \quad \text{and} \quad {}^{n+1}\mathsf{M}_{\parallel}^{\circlearrowleft'}(\mathfrak{z})$$

in a general and metaphysicalistic case, respectively. A multiloop metaphysicalistic decomposition is denoted by ${}^{n+1}\mathsf{M}_{\parallel}^{\circlearrowleft'}(\mathfrak{z})$. A multiloop occurrence is a consequence of shorter loops within the main loop, as shown, for example, in Figs. 2 and 3.

The graph in Fig. 2 realizes the general primitive parallel circular consciousness system of the form

$${}^{f_{\mu_g}}\mathfrak{z}_{\parallel}^{\circlearrowleft'} \rightleftharpoons$$

$$\begin{pmatrix} \alpha \models \mathfrak{z}_0; & & & \\ \mathfrak{z}_0 \models \mathfrak{z}_1^{\mathsf{i}}; & \mathfrak{z}_1^{\mathsf{i}} \models \mathfrak{z}_2^{\mathsf{i}}; & \cdots & \mathfrak{z}_{p-1}^{\mathsf{i}} \models \mathfrak{z}_p^{\mathsf{i}}; \\ \mathfrak{z}_p^{\mathsf{i}} \models \mathfrak{z}_1^{\mathsf{c}}; & \mathfrak{z}_1^{\mathsf{c}} \models \mathfrak{z}_2^{\mathsf{c}}; & \cdots & \mathfrak{z}_{q-1}^{\mathsf{c}} \models \mathfrak{z}_q^{\mathsf{c}}; \\ \mathfrak{z}_q^{\mathsf{c}} \models \mathfrak{z}_1^{\mathsf{e}}; & \mathfrak{z}_1^{\mathsf{e}} \models \mathfrak{z}_2^{\mathsf{e}}; & \cdots & \mathfrak{z}_{r-1}^{\mathsf{e}} \models \mathfrak{z}_r^{\mathsf{e}}; \\ \mathfrak{z}_r^{\mathsf{e}} \models \mathfrak{z}_1^{\mathsf{e}}; & & & \\ \mathfrak{z}_q^{\mathsf{c}} \models \mathfrak{z}_1^{\mathsf{i}}; & \mathfrak{z}_r^{\mathsf{e}} \models \mathfrak{z}_1^{\mathsf{c}}; & & \\ \mathfrak{z}_r^{\mathsf{e}} \models \mathfrak{z}_0; & \mathfrak{z}_p^{\mathsf{i}} \models \mathfrak{z}_1^{\mathsf{i}}; & \mathfrak{z}_q^{\mathsf{c}} \models \mathfrak{z}_1^{\mathsf{c}}; & \end{pmatrix};$$

$$f_{\mu_g} = \prod_{i=1}^{6} \frac{1}{\ell_i + 1}\binom{2\ell_i}{\ell_i}$$

where $\ell_1 = p + q + r + 2$, $\ell_2 = p + q$; $\ell_3 = q + r$, $\ell_4 = p$, $\ell_5 = q$, and $\ell_6 = r$. Subscript μ_g denotes the general metaphysicalistic case. In the first row of the array there is an exterior connection (of α) to the component $\mathfrak{z}_0$. In the second, third, fourth, and the fifth row the main loop resides. In the sixth row the feedbacks of the two middle-sized loops reside, and their remaining elements are already within the main loop. In the last row of the array the feedbacks of the three short-sized loops are located, and their remaining elements appear in the main loop. Later the reader will see how f_{μ_g} is related to the different serial loops which cover entirely the graph in Fig. 2.

Similarly, it can be shown how the graph in Fig. 3 is completely described by the standardized primitive parallel circular consciousness system of the form

$${}^{f_{\mu_s}}\mathfrak{z}_{\parallel}^{\circlearrowleft'} \rightleftharpoons \begin{pmatrix} \alpha_\xi \models \mathfrak{z}_\xi; & & & \\ \mathfrak{z}_\xi \models \mathfrak{I}_{\mathfrak{z}_\xi}; & \mathfrak{I}_{\mathfrak{z}_\xi} \models \mathfrak{i}_{\mathfrak{z}_\xi}; & & \\ \mathfrak{i}_{\mathfrak{z}_\xi} \models \mathfrak{C}_{\mathfrak{z}_\xi}; & \mathfrak{C}_{\mathfrak{z}_\xi} \models \mathfrak{c}_{\mathfrak{z}_\xi}; & & \\ \mathfrak{c}_{\mathfrak{z}_\xi} \models \mathfrak{E}_{\mathfrak{z}_\xi}; & \mathfrak{E}_{\mathfrak{z}_\xi} \models \mathfrak{e}_{\mathfrak{z}_\xi}; & & \\ \mathfrak{e}_{\mathfrak{z}_\xi} \models \mathfrak{z}_\xi; & & & \\ \mathfrak{c}_{\mathfrak{z}_\xi} \models \mathfrak{I}_{\mathfrak{z}_\xi}; & \mathfrak{e}_{\mathfrak{z}_\xi} \models \mathfrak{C}_{\mathfrak{z}_\xi}; & & \\ \mathfrak{i}_{\mathfrak{z}_\xi} \models \mathfrak{I}_{\mathfrak{z}_\xi}; & \mathfrak{c}_{\mathfrak{z}_\xi} \models \mathfrak{C}_{\mathfrak{z}_\xi}; & \mathfrak{e}_{\mathfrak{z}_\xi} \models \mathfrak{E}_{\mathfrak{z}_\xi} & \end{pmatrix};$$

$$f_{\mu_s} = \tfrac{1}{8}\tbinom{14}{7} \cdot \left(\tfrac{1}{5}\tbinom{8}{4}\right)^2 \cdot \left(\tfrac{1}{3}\tbinom{4}{2}\right)^3 = 429 \cdot 14^2 \cdot 2^3 = 672\,672$$

Subscript μ_s denotes the standardized metaphysicalistic case. In the first row of the array there is an exterior connection (of α) to the component $\mathfrak{z}_\xi$. In the second, third, fourth, and the fifth row the main loop of the length 7 resides. In the sixth row the feedbacks of the two middle-sized loops

of length 4 reside, and their remaining elements are already within the main loop. In the last row of the array the feedbacks of the three short-sized loops of length 2 are located, and their remaining elements appear in the main loop. Later the reader will learn how f_{μ_s} is related to the different serial loops which cover entirely the graph in Fig. 3.

3.2.5 Parallelism and Serialism of Consciousness Informational Graphs

Looking into an informational graph, the first impression is that it represents a serially looped structure. Serialism is the informing property which comes up at the first glance. However, such a naïveté is not only misleading but also concealing. The concealment lies in the causally hidden situations on one side, and on the various parallel informing not only of the occurring operands but also of any causally structured entity, that is, of any parenthesized formula within a formula. However, certainly, an informational graph does not eliminate all these situations: it does not determine them specifically at all. In this respect, an informational graph leaves open concrete causal situations and offers a kind of overlook of all different possibilities of concrete informing.

To a certain extent, we have already experienced how an informational graph can be functionally covered by a parallel system of different circular serial formulas and, simultaneously, by a parallel system of primitive informational transitions. In case of more than one loop, we have always to do with a situation of formula parallelism. But also in case of a single non-trivial loop (a loop of the length greater than 1), the situation can be interpreted by parallel transitions. Thus, parallelism of an informational system is ubiquitous. Serialism—as we stated—is graphically evident and experientially present in the common way of human understanding of time phenomena.

Informational graph, representing a system, is a serial-parallel mixture of informational situations, described by informational formulas. Consciousness is evidently one of the best examples of such a view, knowledge, and epistemology. We owe the covering of graphs in Figs. 2 and 3 by parallel systems of circular serial formulas.

Evidently, the graph in Fig. 2 can be covered entirely by the six loops, expressed in the form

$$
{}_{1}^{f}\!\circlearrowright\!\mathfrak{z}0 \rightleftharpoons
$$

$$
\left(\begin{array}{l}
(\cdots(((\cdots(((\cdots((\mathfrak{z}0 \models \mathfrak{z}_1^{\mathfrak{i}}) \models \mathfrak{z}_2^{\mathfrak{i}}) \models \cdots \mathfrak{z}_p^{\mathfrak{i}}) \\
\qquad\qquad\qquad\qquad \models \mathfrak{z}_1^{\mathfrak{c}}) \models \mathfrak{z}_2^{\mathfrak{c}}) \models \cdots \mathfrak{z}_q^{\mathfrak{c}}) \\
\qquad\qquad\qquad\qquad \models \mathfrak{z}_1^{\mathfrak{e}}) \models \mathfrak{z}_2^{\mathfrak{e}}) \models \cdots \mathfrak{z}_r^{\mathfrak{e}}) \\
\qquad\qquad\qquad \models \mathfrak{z}0; \\
(\cdots(((\cdots(\mathfrak{z}_1^{\mathfrak{i}} \models \mathfrak{z}_2^{\mathfrak{i}}) \models \cdots \mathfrak{z}_p^{\mathfrak{i}}) \models \\
\qquad\qquad \mathfrak{z}_1^{\mathfrak{c}}) \models \mathfrak{z}_2^{\mathfrak{c}}) \models \cdots \mathfrak{z}_q^{\mathfrak{c}}) \models \mathfrak{z}_1^{\mathfrak{i}}; \\
(\cdots(((\cdots(\mathfrak{z}_1^{\mathfrak{c}} \models \mathfrak{z}_2^{\mathfrak{c}}) \models \cdots \mathfrak{z}_q^{\mathfrak{c}}) \models \\
\qquad\qquad \mathfrak{z}_1^{\mathfrak{e}}) \models \mathfrak{z}_2^{\mathfrak{e}}) \models \cdots \mathfrak{z}_r^{\mathfrak{e}}) \models \mathfrak{z}_1^{\mathfrak{c}}; \\
(\cdots(\mathfrak{z}_1^{\mathfrak{i}} \models \mathfrak{z}_2^{\mathfrak{i}}) \models \cdots \mathfrak{z}_p^{\mathfrak{i}}) \models \mathfrak{z}_1^{\mathfrak{i}}; \\
(\cdots(\mathfrak{z}_1^{\mathfrak{c}} \models \mathfrak{z}_2^{\mathfrak{c}}) \models \cdots \mathfrak{z}_q^{\mathfrak{c}}) \models \mathfrak{z}_1^{\mathfrak{c}}; \\
(\cdots(\mathfrak{z}_1^{\mathfrak{e}} \models \mathfrak{z}_2^{\mathfrak{e}}) \models \cdots \mathfrak{z}_r^{\mathfrak{e}}) \models \mathfrak{z}_1^{\mathfrak{e}}
\end{array}\right)
$$

This system describes a single distinguished situation (the fore subscript 1, where the parenthesis pairs are strictly positioned from the left to the right in each circular formula), and still many other situations remain unutilized. The number of all possible systems of such a kind is

$$
\frac{1}{p+q+r+3}\binom{2(p+q+r+2)}{p+q+r+2}\cdot
\frac{1}{p+q+1}\binom{2(p+q)}{p+q}\cdot\frac{1}{q+r+1}\binom{2(q+r)}{q+r}\cdot
\frac{1}{p+1}\binom{2p}{p}\cdot\frac{1}{q+1}\binom{2q}{q}\cdot\frac{1}{r+1}\binom{2r}{r}
$$

This situation does not consider the so-called rotation principle for operands in a loop. The factor to the upper product would yield

$$(p+q+r+2)(p+q)(q+r)pqr$$

additionally. The number of possibilities increases rapidly by the number of binary operators between operands.

In the second, standardized case (Fig. 3), the graph covering loops are

$$
{}_{672\,672}^{f}\!\circlearrowright\!\mathfrak{z}0 \rightleftharpoons
$$

$$
\left(\begin{array}{l}
\mathfrak{z}\xi \models (\mathfrak{I}_{\mathfrak{z}\xi} \models (\mathfrak{i}_{\mathfrak{z}\xi} \models (\mathfrak{C}_{\mathfrak{z}\xi} \models (\mathfrak{c}_{\mathfrak{z}\xi} \models \\
\qquad (\mathfrak{E}_{\mathfrak{z}\xi} \models (\mathfrak{e}_{\mathfrak{z}\xi} \models \mathfrak{z}\xi)))))); \\
\mathfrak{I}_{\mathfrak{z}\xi} \models (\mathfrak{i}_{\mathfrak{z}\xi} \models (\mathfrak{C}_{\mathfrak{z}\xi} \models (\mathfrak{c}_{\mathfrak{z}\xi} \models \mathfrak{I}_{\mathfrak{z}\xi}))); \\
\mathfrak{C}_{\mathfrak{z}\xi} \models (\mathfrak{c}_{\mathfrak{z}\xi} \models (\mathfrak{E}_{\mathfrak{z}\xi} \models (\mathfrak{e}_{\mathfrak{z}\xi} \models \mathfrak{C}_{\mathfrak{z}\xi}))); \\
\mathfrak{I}_{\mathfrak{z}\xi} \models (\mathfrak{i}_{\mathfrak{z}\xi} \models \mathfrak{I}_{\mathfrak{z}\xi}); \mathfrak{C}_{\mathfrak{z}\xi} \models (\mathfrak{c}_{\mathfrak{z}\xi} \models \mathfrak{C}_{\mathfrak{z}\xi}); \\
\mathfrak{E}_{\mathfrak{z}\xi} \models (\mathfrak{e}_{\mathfrak{z}\xi} \models \mathfrak{E}_{\mathfrak{z}\xi})
\end{array}\right)
$$

This system describes a single distinguished situation (the fore subscript 672 672, where the parenthesis pairs are strictly positioned from the right

to the left in each circular formula), but still 672 671 other situations remain unutilized. Considering the rotation principle for operands in a loop, the factor to the upper product would yield 896, that is, 602 714 112 possibilities. The reader can realize how already simple graphical schemes offer a tremendous number of possible cases.

3.2.6 Gestaltism of Consciousness

Informational—and within it the consciousness—gestaltism [43] can be described in the following straightforward manner: a simple formula has its representation in the adequate informational graph. However, such a graph, constructed by the neglecting of all parentheses pairs, represents all possible formulas in which the parenthesis pairs are displaced in the well-formed manner. Now, the graph can be described in its whole by a primitive parallel system of basic transitions. But, the other possibility is to express the circular-serial nature of a graph by serial formulas with differently displaced parenthesis pairs.

Gestalts, coming fore, are the so-called (simple, common) gestalt, Γ, circular gestalt, $\Gamma^{\circlearrowright}$, and star gestalt, Γ^{*} [48]. The circular gestalt is based on the operand rotation principle being valid for a loop. The star gestalt considers arbitrary movings along the arrows in a graph and, on this basis, the forming of the well-formed circular formulas, also in cases of repeated moving along the same parts of a graph path. Because of arbitrary looping, the star gestaltism explicates the possibility of the potential infinity.

In case of a simple formula, gestaltism seems to be a trivial approach. But in case of a complex informational consciousness system, e.g., like in Fig. 7, to the gestalts attributed numbers of possible cases, $N_{\rightarrow}$, $N_{\rightarrow}^{\circlearrowright}$, ${}^{\circlearrowright}N_{\rightarrow}^{\circlearrowright}$ (see also Sec. 3.2.2) and ${}^{\circlearrowright}N_{\rightarrow}^{\circlearrowright^{*}}$ ($\longrightarrow \infty$), become relevant for the evaluation of informational possibilities.

In case of the graph in Fig. 7, the evaluation of the number of all possible combinations of parenthesis pairs in the occurring loops can be evaluated. One has to consider systematically all the horizontal and all the vertical loops (considering the feedbacks being visible in the graph) and form the products

$$N_{\rightarrow}^{\circlearrowright} = \prod_{\forall i} \frac{1}{\ell_i + 1} \binom{2\ell_i}{\ell_i}$$

for a simple circularity and

$${}^{\circlearrowright}N_{\rightarrow}^{\circlearrowright} = \prod_{\forall i} \frac{\ell_i}{\ell_i + 1} \binom{2\ell_i}{\ell_i}$$

in case of operand-rotating circularity, where $\ell_i \geq 2$ is a loop length.

4 On the Way to a Concrete Formal Structure and Organization of Informational Consciousness

A concrete formal structure and organization of informational consciousness can be achieved step by step, studying and considering realistic, scientific, and experiential observations and result in various and interdisciplinary fields. An initial archive of such a knowledge is collected in [50], where also certain problems of consciousness bidirectionality are presented.

4.1 An Initial Decomposition of Consciousness Structure and Organization

In the very beginning one can grasp consciousness as an "empty" (abstractly, as-such) structured and organized informational shell which can be filled by concrete experiences, step by step. The approach of building up the concept of consciousness structure and organization follows some axiomatic and experiential principles of consciousness decomposition in several basic aspects:

- natural (physical, biological, physiological);
- artificial (constructive, conceptual, imaginable);
- scientific (logical, formalistic, systemic);
- epistemological (experiential, conceptual, cognitive);
- phenomenal (philological, philosophical, psychological);
- abstract (apart from things having the property, qualia-like, mathesis-like, universal); and

– informational (joining the preceding items by its own principles and formalism).

To overview the situation of the emerging consciousness shell, as the most appropriate approach, the methodology of graph presentation comes fore, simultaneously using the possibilities of description by parallel and serial circular formulas of different kinds: transition primitives (an operational connection from one to the other operand), serial transitions, and mixed circularly structured serial-parallel formulas. Such an approach can guarantee the necessary and emerging complexity, satisfying the conceptual circumstances and the possibilities to improve and widen them to a more complete form of structure and organization.

4.2 Informational Decomposition of Consciousness

In the beginning of this investigation—construction of the consciousness shell—we have in mind a consciousness machine, realized by *general* informational means (principles, formalism) which include:

– conceptualism of informational externalism, internalism, metaphysicalism, and phenomenalism;

– informational arising as a metaphor for: spontaneity [based, e.g., on the quantum-physical spontaneous symmetry breaking (SSB) [20, 30, 14]]; emerging, changing, and vanishing (evanescing) of entities and their components, structure and organization; computability and non-computability; uncertainty, unforeseeability, unpredictability;

– informational serialism, parallelism and circularism, together with formalistically based causalism;

– decomposition principles, being within the informational axioms and rules of procedure;

– informational causalism emerging as the informational gestaltism and star-gestasltism, spontaneously and circularly;

– informational distributivism of entities in various other entities and ditributiveness of informational components within an entity itself (constituting a kind of informational space, e.g., in the sense of Hilbert space [28]).

4.3 General (Concrete) and Standard Decomposition of Consciousness

The *concrete* informational means—the filling of the consciousness shell by concrete experiences—of the present investigation will include:

– informational entities being components of consciousness metaphysicalism in a *distributive* form;

– *intention* of the object becoming conscious, where intention characterizes, identifies, stabilizes, generates and makes the object inertial as the present, the transitional, the emerging or the diminishing (evanescing) state of consciousness; intention—as any other component of consciousness—is distributed through the metaphysicalistic parts of informing (intending), counterinforming (counterintending) and informational embedding (intentional embedding);

– *memorizing* as a fundamental identity of consciousness of something is presumably present in a form of informational circularity, on the very local level of basic components, and informs circularly on different informational compositions of components, as the identity essential and developing informational loops; in this sense, memory distributivity is evident and it presents the most substantial property of consciousness;

– *experience* as a concretized subject (e.g., behavior) is based on the *learned* and *memorized* affairs; *adaptation* of behavior depends on learned, memorized, and experienced and impacts these three components informationally;

– *understanding* appears as an integrating component of consciousness; it performs upon the consciousness components, interviews and impacts them, in an understanding way of informing them and being informed by them; in this way, understanding produces meaning, concerning different complexes of the conscious affairs; understanding belongs

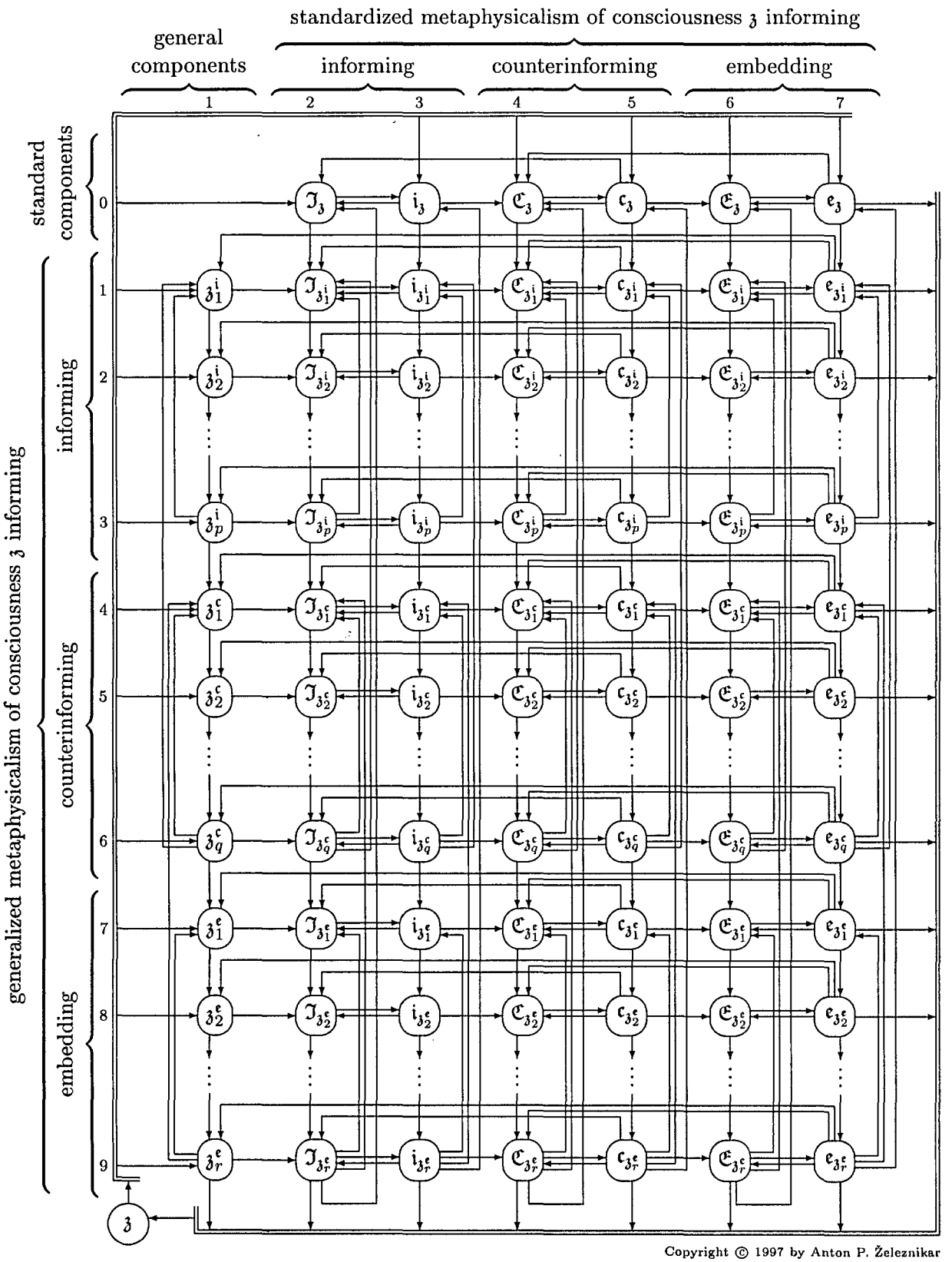


Figure 7: *An initial informational shell of the generalized and standardized metaphysicalism of consciousness system ʒ.*

to the most extensive and sophisticated components of consciousness;

- *emotions* impact consciousness on different informational levels and places; they are informationally distributed within consciousness intention, experience, memory, understanding, etc.;

- *sensing* is a component which connects consciousness with its environment; the question is where to place the sensing subsystem in the column 1 of the general components in Fig. 7, to consider the most appropriate neighbor general components, being intensively dependent on the informing of sensing; sensing concerns—in its distributed form—the conscious as well as the unconscious;

- *subconscious* and *unconscious* components are substantial parts of the counterinformational segments in Fig. 7 when conscious entities emerge by coming of the subconscious and unconscious into the conscious; in general, both components can be distributed within the system in Fig. 7;

- consciousness *conceptualism* originating in memory, learned experience, understanding and produced meaning can develop its own spontaneous way deriving its feedback influence on the constituting components; concepts generate knowledge as an informational archive of experience; the developing conceptualism concerning something informs distributively on different organizational levels and parts of consciousness;

- *consciousness abstraction of informational abstractions* is also a way by which the scheme in Fig. 7 has been constructed; this kind of abstraction is recursive and leads to the multidimensional concept of consciousness within the *informational space*, as the most sophisticated (abstract) concept of consciousness formalization;

etc. There are many other generally recognized concrete components which can be considered in a complex model of consciousness. The question is how to model a consciousness shell which would include the general informational principles as well as the concrete—general and particular—components.

4.4 A Complete Description of the Graph in Fig. 7 Using the Primitive Parallelism

We have already seen that circular structures—especially those using informational metaphysicalism—can offer an appropriate background for an efficient and complex modeling of consciousness informing. What we could present in the form of an informational graph is a kind of "two-dimensional" metaphysicalism, built on the basis of the generalized and standardized metaphysicalism, discussed in Fig. 2 and Fig. 3, respectively. Such a metaphysicalism has to be captured also formally when using informational "vectors", introduced in Sec. 3.2.3. In this respect, additional rules of informational space have to be introduced. To give the reader a motivation, let us look at the graph in Fig. 7.

In this graph, initially, consciousness $\mathfrak{z}$ is determined by the two main loops. The first loop is constituted by the row 0 and its metaphysically generalized extension downwards the graph. The second loop consists of column 1 and its standardized extension rightward the graph. Row 0 is a standardized metaphysicalistic decomposition of $\mathfrak{z}$ (e.g., in the sense of Fig. 3), while column 1 is a generalized metaphysicalistic decomposition of $\mathfrak{z}$. As it is evident, $\mathfrak{z}$ has simultaneously (in parallel) two different "vectored" structures, where the generalized structure (column 1) explicates an additional parallelism (of the second degree), realized by the direct standardized metaphysicalisms of the general components. The new informational formalism has to be designed in such a manner that it could uniquely capture the complexity of the informational graph. The graph in Fig. 7, as a whole, is nothing else than a complex informational "vector" representing consciousness $\mathfrak{z}$, and possessing—in the framework of possible individual operators' decompositions by the parallel informing systems—a potentially infinite number of causal possibilities (e.g., a product of numbers ${}^{\circ}N^{\circ}_{\rightarrow}$ for all possible loops).

The easiest way of a formally exact description of $\mathfrak{z}$ in Fig. 7 would be the primitive parallel system of the graph, consisting of all possible primitive transitions, that is, from one operand to the

next operand in the arrow direction. Such a formal system can be written in a transparent way because of the formal periodicity not only of rows and columns but also of their feedbacks. Thus, for ${}^{f\mu gs}\mathfrak{z}_{\parallel}^{\circlearrowleft'}$ (compare Sec. 3.2.4), there is,

$(\mathfrak{k} = \mathfrak{i}) \Longrightarrow (\mathfrak{j} = 1, 2, \ldots, p)$; [*Superscript-*
$(\mathfrak{k} = \mathfrak{c}) \Longrightarrow (\mathfrak{j} = 1, 2, \ldots, q)$; *subscript*
$(\mathfrak{k} = \mathfrak{e}) \Longrightarrow (\mathfrak{j} = 1, 2, \ldots, r)$; *implications*]

[*$\mathfrak{z}$'s outputs and inputs to the loop matrix*]

$\mathfrak{z} \models \mathfrak{z}_{\mathfrak{j}}^{\mathfrak{k}}, \mathfrak{I}_{\mathfrak{z}}, \mathfrak{i}_{\mathfrak{z}}, \mathfrak{C}_{\mathfrak{z}}, \mathfrak{c}_{\mathfrak{z}}, \mathfrak{E}_{\mathfrak{z}}, \mathfrak{e}_{\mathfrak{z}}$;
$\mathfrak{e}_{\mathfrak{z}}, \mathfrak{e}_{\mathfrak{z}_{\mathfrak{j}}^{\mathfrak{k}}}, \mathfrak{z}_{\mathfrak{r}}^{\mathfrak{e}}, \mathfrak{I}_{\mathfrak{z}_{\mathfrak{r}}^{\mathfrak{e}}}, \mathfrak{i}_{\mathfrak{z}_{\mathfrak{r}}^{\mathfrak{e}}}, \mathfrak{C}_{\mathfrak{z}_{\mathfrak{r}}^{\mathfrak{e}}}, \mathfrak{c}_{\mathfrak{z}_{\mathfrak{r}}^{\mathfrak{e}}}, \mathfrak{E}_{\mathfrak{z}_{\mathfrak{r}}^{\mathfrak{e}}} \models \mathfrak{z}$;

[*Horizontal loops*]

$\mathfrak{I}_{\mathfrak{z}} \models \mathfrak{i}_{\mathfrak{z}}$; $\mathfrak{i}_{\mathfrak{z}} \models \mathfrak{C}_{\mathfrak{z}}$; $\mathfrak{C}_{\mathfrak{z}} \models \mathfrak{c}_{\mathfrak{z}}$; $\mathfrak{c}_{\mathfrak{z}} \models \mathfrak{E}_{\mathfrak{z}}$; [*Row 0*]
$\mathfrak{E}_{\mathfrak{z}} \models \mathfrak{e}_{\mathfrak{z}}$; | $\mathfrak{i}_{\mathfrak{z}} \models \mathfrak{I}_{\mathfrak{z}}$; $\mathfrak{c}_{\mathfrak{z}} \models \mathfrak{C}_{\mathfrak{z}}$; |*fdbs 0*|
$\mathfrak{e}_{\mathfrak{z}} \models \mathfrak{E}_{\mathfrak{z}}$; $\mathfrak{c}_{\mathfrak{z}} \models \mathfrak{I}_{\mathfrak{z}}$; $\mathfrak{e}_{\mathfrak{z}} \models \mathfrak{C}_{\mathfrak{z}}$;|

$\mathfrak{z}_1^{\mathfrak{i}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{i}}}$; [*Row 1*]
$\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{i}}}$; | $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{i}}}$; |*fdbs 1*|
$\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{z}_1^{\mathfrak{i}}$;|

$\mathfrak{z}_2^{\mathfrak{i}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{i}}}$; [*Row 2*]
$\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{i}}}$; | $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{i}}}$; |*fdbs 2*|
$\mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{i}}} \models \mathfrak{z}_2^{\mathfrak{i}}$;|

$\vdots \quad \vdots \quad \vdots \quad \vdots$

$\mathfrak{z}_p^{\mathfrak{i}} \models \mathfrak{I}_{\mathfrak{z}_p^{\mathfrak{i}}}$; $\mathfrak{I}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{i}_{\mathfrak{z}_p^{\mathfrak{i}}}$; $\mathfrak{i}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_p^{\mathfrak{i}}}$; $\mathfrak{C}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{c}_{\mathfrak{z}_p^{\mathfrak{i}}}$; [*Row 3*]
$\mathfrak{c}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_p^{\mathfrak{i}}}$; $\mathfrak{E}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{e}_{\mathfrak{z}_p^{\mathfrak{i}}}$; | $\mathfrak{e}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_p^{\mathfrak{i}}}$; $\mathfrak{c}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_p^{\mathfrak{i}}}$; |*fdbs 3*|
$\mathfrak{i}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_p^{\mathfrak{i}}}$; $\mathfrak{e}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_p^{\mathfrak{i}}}$; $\mathfrak{c}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_p^{\mathfrak{i}}}$; $\mathfrak{e}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{z}_p^{\mathfrak{c}}$;|

$\mathfrak{z}_1^{\mathfrak{c}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{c}}}$; [*Row 4*]
$\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{c}}}$; | $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{c}}}$; |*fdbs 4*|
$\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{z}_1^{\mathfrak{c}}$;|

$\mathfrak{z}_2^{\mathfrak{c}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{c}}}$; [*Row 5*]
$\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{c}}}$; | $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{c}}}$; |*fdbs 5*|
$\mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{c}}} \models \mathfrak{z}_2^{\mathfrak{c}}$;|

$\vdots \quad \vdots \quad \vdots \quad \vdots$

$\mathfrak{z}_q^{\mathfrak{c}} \models \mathfrak{I}_{\mathfrak{z}_q^{\mathfrak{c}}}$; $\mathfrak{I}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{i}_{\mathfrak{z}_q^{\mathfrak{c}}}$; $\mathfrak{i}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_q^{\mathfrak{c}}}$; $\mathfrak{C}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{c}_{\mathfrak{z}_q^{\mathfrak{c}}}$; [*Row 6*]
$\mathfrak{c}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_q^{\mathfrak{c}}}$; $\mathfrak{E}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{e}_{\mathfrak{z}_q^{\mathfrak{c}}}$; | $\mathfrak{e}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_q^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_q^{\mathfrak{c}}}$; |*fdbs 6*|
$\mathfrak{i}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_q^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_q^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_q^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{z}_q^{\mathfrak{c}}$;|

$\mathfrak{z}_1^{\mathfrak{e}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{e}}}$; [*Row 7*]
$\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{e}}}$; | $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{e}}}$; |*fdbs 7*|
$\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{z}_1^{\mathfrak{e}}$;|

$\mathfrak{z}_2^{\mathfrak{e}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{e}}}$; [*Row 8*]
$\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{e}}}$; | $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{e}}}$; |*fdbs 8*|
$\mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{e}}} \models \mathfrak{z}_2^{\mathfrak{e}}$;|

$\vdots \quad \vdots \quad \vdots \quad \vdots$

$\mathfrak{z}_r^{\mathfrak{e}} \models \mathfrak{I}_{\mathfrak{z}_r^{\mathfrak{e}}}$; $\mathfrak{I}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{i}_{\mathfrak{z}_r^{\mathfrak{e}}}$; $\mathfrak{i}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_r^{\mathfrak{e}}}$; $\mathfrak{C}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{c}_{\mathfrak{z}_r^{\mathfrak{e}}}$; [*Row 9*]
$\mathfrak{c}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_r^{\mathfrak{e}}}$; $\mathfrak{E}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{e}_{\mathfrak{z}_r^{\mathfrak{e}}}$; | $\mathfrak{e}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_r^{\mathfrak{e}}}$; $\mathfrak{c}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_r^{\mathfrak{e}}}$; |*fdbs 9*|
$\mathfrak{i}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_r^{\mathfrak{e}}}$; $\mathfrak{e}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_r^{\mathfrak{e}}}$; $\mathfrak{c}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_r^{\mathfrak{e}}}$; $\mathfrak{e}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{z}_r^{\mathfrak{e}}$;|

[*Vertical loops*]

$\mathfrak{z}_1^{\mathfrak{i}} \models \mathfrak{z}_2^{\mathfrak{i}}$; $\mathfrak{z}_2^{\mathfrak{i}} \models \mathfrak{z}_3^{\mathfrak{i}}$; $\cdots$ $\mathfrak{z}_{p-1}^{\mathfrak{i}} \models \mathfrak{z}_p^{\mathfrak{i}}$; [*Col. 1*]
$\mathfrak{z}_p^{\mathfrak{i}} \models \mathfrak{z}_1^{\mathfrak{c}}$; $\mathfrak{z}_1^{\mathfrak{c}} \models \mathfrak{z}_2^{\mathfrak{c}}$; $\cdots$ $\mathfrak{z}_{q-1}^{\mathfrak{c}} \models \mathfrak{z}_q^{\mathfrak{c}}$;
$\mathfrak{z}_q^{\mathfrak{c}} \models \mathfrak{z}_1^{\mathfrak{e}}$; $\mathfrak{z}_1^{\mathfrak{e}} \models \mathfrak{z}_2^{\mathfrak{e}}$; $\cdots$ $\mathfrak{z}_{r-1}^{\mathfrak{e}} \models \mathfrak{z}_r^{\mathfrak{e}}$;
| $\mathfrak{z}_p^{\mathfrak{i}} \models \mathfrak{z}_1^{\mathfrak{i}}$; $\mathfrak{z}_q^{\mathfrak{c}} \models \mathfrak{z}_1^{\mathfrak{c}}$; $\mathfrak{z}_r^{\mathfrak{e}} \models \mathfrak{z}_1^{\mathfrak{e}}$; $\mathfrak{z}_q^{\mathfrak{c}} \models \mathfrak{z}_1^{\mathfrak{i}}$; |*fdbs 1*|
$\mathfrak{z}_r^{\mathfrak{e}} \models \mathfrak{z}_1^{\mathfrak{c}}$;|

$\mathfrak{I}_{\mathfrak{z}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\cdots$ $\mathfrak{I}_{\mathfrak{z}_{p-1}^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{i}}}$; [*Col. 2*]
$\mathfrak{I}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\cdots$ $\mathfrak{I}_{\mathfrak{z}_{q-1}^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_q^{\mathfrak{c}}}$;
$\mathfrak{I}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\cdots$ $\mathfrak{I}_{\mathfrak{z}_{r-1}^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_r^{\mathfrak{e}}}$;
| $\mathfrak{I}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{I}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{I}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{I}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{i}}}$; |*fdbs 2*|
$\mathfrak{I}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{I}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{I}_{\mathfrak{z}}$;|

$\mathfrak{i}_{\mathfrak{z}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\cdots$ $\mathfrak{i}_{\mathfrak{z}_{p-1}^{\mathfrak{i}}} \models \mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{i}}}$; [*Col. 3*]
$\mathfrak{i}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\cdots$ $\mathfrak{i}_{\mathfrak{z}_{q-1}^{\mathfrak{c}}} \models \mathfrak{i}_{\mathfrak{z}_q^{\mathfrak{c}}}$;
$\mathfrak{i}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{i}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\cdots$ $\mathfrak{i}_{\mathfrak{z}_{r-1}^{\mathfrak{e}}} \models \mathfrak{i}_{\mathfrak{z}_r^{\mathfrak{e}}}$;
| $\mathfrak{i}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{i}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{i}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{i}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{i}}}$; |*fdbs 3*|
$\mathfrak{i}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{i}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{i}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{i}_{\mathfrak{z}}$;|

$\mathfrak{C}_{\mathfrak{z}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\cdots$ $\mathfrak{C}_{\mathfrak{z}_{p-1}^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{i}}}$; [*Col. 4*]
$\mathfrak{C}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\cdots$ $\mathfrak{C}_{\mathfrak{z}_{q-1}^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_q^{\mathfrak{c}}}$;
$\mathfrak{C}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\cdots$ $\mathfrak{C}_{\mathfrak{z}_{r-1}^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_r^{\mathfrak{e}}}$;
| $\mathfrak{C}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{C}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{C}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{C}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{i}}}$; |*fdbs 4*|
$\mathfrak{C}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{C}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{C}_{\mathfrak{z}}$;|

$\mathfrak{c}_{\mathfrak{z}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\cdots$ $\mathfrak{c}_{\mathfrak{z}_{p-1}^{\mathfrak{i}}} \models \mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{i}}}$; [*Col. 5*]
$\mathfrak{c}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\cdots$ $\mathfrak{c}_{\mathfrak{z}_{q-1}^{\mathfrak{c}}} \models \mathfrak{c}_{\mathfrak{z}_q^{\mathfrak{c}}}$;
$\mathfrak{c}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{c}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\cdots$ $\mathfrak{c}_{\mathfrak{z}_{r-1}^{\mathfrak{e}}} \models \mathfrak{c}_{\mathfrak{z}_r^{\mathfrak{e}}}$;
| $\mathfrak{c}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{c}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{c}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{i}}}$; |*fdbs 5*|
$\mathfrak{c}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{c}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{c}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{c}_{\mathfrak{z}}$;|

$\mathfrak{E}_{\mathfrak{z}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\cdots$ $\mathfrak{E}_{\mathfrak{z}_{p-1}^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{i}}}$; [*Col. 6*]
$\mathfrak{E}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\cdots$ $\mathfrak{E}_{\mathfrak{z}_{q-1}^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_q^{\mathfrak{c}}}$;
$\mathfrak{E}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\cdots$ $\mathfrak{E}_{\mathfrak{z}_{r-1}^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_r^{\mathfrak{e}}}$;
| $\mathfrak{E}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{E}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{E}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{E}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{i}}}$; |*fdbs 6*|
$\mathfrak{E}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{E}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{E}_{\mathfrak{z}}$;|

$\mathfrak{e}_{\mathfrak{z}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{i}}} \models \mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{i}}}$; $\cdots$ $\mathfrak{e}_{\mathfrak{z}_{p-1}^{\mathfrak{i}}} \models \mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{i}}}$; [*Col. 7*]
$\mathfrak{e}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{c}}} \models \mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{c}}}$; $\cdots$ $\mathfrak{e}_{\mathfrak{z}_{q-1}^{\mathfrak{c}}} \models \mathfrak{e}_{\mathfrak{z}_q^{\mathfrak{c}}}$;
$\mathfrak{e}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{e}}} \models \mathfrak{e}_{\mathfrak{z}_2^{\mathfrak{e}}}$; $\cdots$ $\mathfrak{e}_{\mathfrak{z}_{r-1}^{\mathfrak{e}}} \models \mathfrak{e}_{\mathfrak{z}_r^{\mathfrak{e}}}$;
| $\mathfrak{e}_{\mathfrak{z}_p^{\mathfrak{i}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{i}}}$; $\mathfrak{e}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{e}}}$; $\mathfrak{e}_{\mathfrak{z}_q^{\mathfrak{c}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{i}}}$; |*fdbs 7*|
$\mathfrak{e}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{e}_{\mathfrak{z}_1^{\mathfrak{c}}}$; $\mathfrak{e}_{\mathfrak{z}_r^{\mathfrak{e}}} \models \mathfrak{e}_{\mathfrak{z}}$;|

But, in a real case, not all of the possible situations take place. The extreme situation would be a single case in the framework of the consciousness

graph in Fig. 7, describing all the different loops, each by a single circular informational formula, and in this way covering the entire graph.

4.5 General Circularism of the Standard Metaphysicalistic Components

It is important to bring to the attention the general circularity of the standardized metaphysicalistic components $\mathfrak{I}_\mathfrak{z}$, $\mathfrak{i}_\mathfrak{z}$, $\mathfrak{C}_\mathfrak{z}$, $\mathfrak{c}_\mathfrak{z}$, $\mathfrak{E}_\mathfrak{z}$, and $\mathfrak{e}_\mathfrak{z}$ of consciousness $\mathfrak{z}$ in Row 0 of Fig. 7. Each of these components is a complete general metaphysicalism consisting of the adequate standard components of the general metaphysicalistic operands $\mathfrak{z}^{\mathfrak{i}}_1, \mathfrak{z}^{\mathfrak{i}}_2, \dots, \mathfrak{z}^{\mathfrak{i}}_p, \mathfrak{z}^{\mathfrak{c}}_1, \mathfrak{z}^{\mathfrak{c}}_2, \dots, \mathfrak{z}^{\mathfrak{c}}_q, \mathfrak{z}^{\mathfrak{e}}_1, \mathfrak{z}^{\mathfrak{e}}_2, \dots, \mathfrak{z}^{\mathfrak{e}}_r$. Thus, the standardized informing $\mathfrak{I}_\mathfrak{z}$ is vertically (Col. 2) general-metaphysicalistically constituted by the informings $\mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_2}, \dots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_p}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_2}, \dots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_q}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_2}, \dots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_r}$, etc., respectively. A similar general metaphysicalism which holds for consciousness $\mathfrak{z}$ in respect to its general components $\mathfrak{z}^{\mathfrak{i}}_1, \mathfrak{z}^{\mathfrak{i}}_2, \dots, \mathfrak{z}^{\mathfrak{i}}_p, \mathfrak{z}^{\mathfrak{c}}_1, \mathfrak{z}^{\mathfrak{c}}_2, \dots, \mathfrak{z}^{\mathfrak{c}}_q, \mathfrak{z}^{\mathfrak{e}}_1, \mathfrak{z}^{\mathfrak{e}}_2, \dots, \mathfrak{z}^{\mathfrak{e}}_r$, holds for the consciousness informing $\mathfrak{I}_\mathfrak{z}$ in respect to the informings of the general components $\mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_2}, \dots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_p}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_2}, \dots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_q}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_2}, \dots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_r}$, etc. Thus, a characteristic six-loop vertical metaphysicalism for informing $\mathfrak{I}_\mathfrak{z}$ is (without the rotation of operands)

$$((((\cdots(((\cdots((\mathfrak{I}_\mathfrak{z} \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_1}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_p}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_q}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_1}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_r}) \models \mathfrak{I}_\mathfrak{z};$$

$$(\cdots(((\cdots(\mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_1} \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_p}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_q}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_1};$$
$$(\cdots(((\cdots(\mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1} \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_p}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_1}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_q}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1};$$

$$(\cdots(\mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_1} \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_p}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_1};$$
$$(\cdots(\mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1} \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_q}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1};$$
$$(\cdots(\mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_1} \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_2}) \models \cdots \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_r}) \models \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_1}$$

Similar six-loop vertical systems can be written for the consciousness components $\mathfrak{i}_\mathfrak{z}$, $\mathfrak{C}_\mathfrak{z}$, $\mathfrak{c}_\mathfrak{z}$, $\mathfrak{E}_\mathfrak{z}$, and $\mathfrak{e}_\mathfrak{z}$. Usually, a system with different parenthesis pair positioning as the last one will be required. In parallel, on some other place, the principle of operand rotation in a loop can be considered. However, such additional formula systems do not change the graph in Fig. 7. This means, that by applying the rotation principle, a formula system would describe more than an informational graph might show at the first glance.

4.6 Standard Circularism of the general Metaphysicalistic Components

From the graph in Fig. 7 it is evident that all the general components $\mathfrak{z}^{\mathfrak{i}}_1, \mathfrak{z}^{\mathfrak{i}}_2, \dots, \mathfrak{z}^{\mathfrak{i}}_p, \mathfrak{z}^{\mathfrak{c}}_1, \mathfrak{z}^{\mathfrak{c}}_2, \dots, \mathfrak{z}^{\mathfrak{c}}_q, \mathfrak{z}^{\mathfrak{e}}_1, \mathfrak{z}^{\mathfrak{e}}_2, \dots, \mathfrak{z}^{\mathfrak{e}}_r$ of consciousness $\mathfrak{z}$ are structured in the standardized form.

5 Informational Investigations and Experiments Concerning Consciousness

5.1 Possibilities of Informational Investigations and Experiments Concerning Consciousness

Informational investigations and experiments concerning consciousness, also in the spirit of the scheme in Fig. 7, are possible in many directions and fields of research. The most evident direction is an informational formalization of meaningly dense texts after which the informational graph can be constructed. Experiments as such can then be performed by "moving" along the graph arrows. By abstraction, and in a multimedia environment, experiments of various kinds are possible, concerning text, voice, and image. For the last two, an informational machine [41] would be necessary. A special account to such experiments and investigation could be taken in the field of scientific research.

A preliminary study of Heideggerian understanding and interpretation (in English [35] and in German [48, 49]) as informational phenomenalism showed how various language experiments can generate reasonable philosophical sentences which additionally interpret the existing authorized philosophical text. Such experiments bring new understanding and the widening of the semantic contents and meaning of groups of sentences, paragraphs, and texts [49]. Thus, for instance, from original German sentences, interesting interpretative sentences can be generated by moving along the arrows within a text graph[7].

[7]Several such sentences in German, proceeding from the eight Heidegger's sentences [11], are shown in [49].

The scheme in Fig. 7 can be taken as it is, without additional decompositions in the graph itself. The connection with exterior and interior operands can be described by separate parallel formula systems. Also, additional informational interpretations can be described separately, and can become as complex as necessary. In this way, the resulting graph becomes more and more complex, exceeding the complexity of the scheme in Fig. 7 substantially. This techniques points to the possibility to make an initial organizational scheme as transparent as possible and, afterwards, develop it in a further way by the parallel formula systems. Each time a parallel system is added, the graph becomes more complex. In this respect, a computer supported system for a systematic graph drawing and its presentation (on the screen and/or paper) would be of extreme importance.

5.2 A Possible Choice and Disributiveness of General Components of Consciousness

A concrete model of consciousness can proceed from the general case, considering the first column of the graph in Fig. 7. The dilemmas, concerning the generalized informing, counterinforming and embedding can be resolved by the three possible approaches:

1. for operands $\mathfrak{z}^{\mathfrak{i}}_1, \mathfrak{z}^{\mathfrak{i}}_2, \ldots, \mathfrak{z}^{\mathfrak{i}}_p, \mathfrak{z}^{\mathfrak{c}}_1, \mathfrak{z}^{\mathfrak{c}}_2, \ldots, \mathfrak{z}^{\mathfrak{c}}_q, \mathfrak{z}^{\mathfrak{e}}_1, \mathfrak{z}^{\mathfrak{e}}_2, \ldots, \mathfrak{z}^{\mathfrak{e}}_r$, there is possible to insert different concrete operands discussed in Sec. 4; these operands can be additionally determined by parallel formula systems outside of the scheme in Fig. 7;

2. the enumerated operands can appear in a distributed manner and in the standardized form; for instance, intention of a consciousness subject can appear as an informing part (superscript i), as an appropriate counterinforming part (superscript c), and as a corresponding informational embedding part (superscript e); and

3. operands can occur in a mixed mode according to items 1 and 2.

Let us list in short the concrete operands and their informational markers being candidates for operands $\mathfrak{z}^{\mathfrak{i}}_1, \mathfrak{z}^{\mathfrak{i}}_2, \ldots, \mathfrak{z}^{\mathfrak{i}}_p, \mathfrak{z}^{\mathfrak{c}}_1, \mathfrak{z}^{\mathfrak{c}}_2, \ldots, \mathfrak{z}^{\mathfrak{c}}_q, \mathfrak{z}^{\mathfrak{e}}_1, \mathfrak{z}^{\mathfrak{e}}_2, \ldots, \mathfrak{z}^{\mathfrak{e}}_r$. We have:

α's intention	—	$\mathfrak{i}_{\text{intention}}(\alpha)$;
α's experience	—	$\mathfrak{e}_{\text{experience}}(\alpha)$;
α's emotions	—	$\mathfrak{e}_{\text{emotions}}(\alpha)$;
α's qualia	—	$\mathfrak{q}_{\text{qualia}}(\alpha)$;
α's abstraction	—	$\mathfrak{a}_{\text{abstraction}}(\alpha)$;
α's concepts	—	$\mathfrak{c}_{\text{concepts}}(\alpha)$;
α's percepts	—	$\mathfrak{p}_{\text{percepts}}(\alpha)$;
α's sensations	—	$\mathfrak{s}_{\text{sensations}}(\alpha)$;
α's understanding	—	$\mathfrak{u}_{\text{understanding}}(\alpha)$;
α's subconsciousness	—	$\mathfrak{s}_{\text{subconsciousness}}(\alpha)$;
α's unconsciousness	—	$\mathfrak{u}_{\text{unconsciousness}}(\alpha)$;
α's meaning	—	$\mathfrak{m}_{\text{meaning}}(\alpha)$;
α's structure	—	$\mathfrak{s}_{\text{structure}}(\alpha)$;
α's organization	—	$\mathfrak{o}_{\text{organization}}(\alpha)$;
α's self-consciousness	—	$\mathfrak{s}_{\text{self-consciousness}}(\alpha)$;
α's identity	—	$\mathfrak{i}_{\text{identity}}(\alpha)$;
α's memories	—	$\mathfrak{m}_{\text{memories}}(\alpha)$;
α's behavior	—	$\mathfrak{b}_{\text{behavior}}(\alpha)$;
α's existents	—	$\mathfrak{e}_{\text{existents}}(\alpha)$;
α's references	—	$\mathfrak{r}_{\text{references}}(\alpha)$;
α's interpretation	—	$\mathfrak{i}_{\text{interpretation}}(\alpha)$;
α's causation	—	$\mathfrak{c}_{\text{causation}}(\alpha)$;
α's phenomenology	—	$\mathfrak{p}_{\text{phenomenology}}(\alpha)$;
α's reduction	—	$\mathfrak{r}_{\text{reduction}}(\alpha)$;
α's truth	—	$\mathfrak{t}_{\text{truth}}(\alpha)$

etc., where α marks something which might belong to any consciousness component or to something, which the component might functionally

---

One of them is, for instance, the following: Verstehen ist nicht etwas anderes in der Auslegung, das nicht die Kenntnisnahme des Verstandenen, sondern die Ausarbeitung der Möglichkeiten im Seinkönnen ist für Sein des Daseins, erschlossen im Rückschlag, von Möglichkeiten des Entwerfens des Verstehens. This sentence follows from the informational graph, presented in [48], Fig. 12, or from the informational formulas as particular situations of the graph. The informational formula for this sentence is [49]

$$\left(\begin{pmatrix}(V \not\boxminus \mathfrak{e}_{\text{etwas}}(\mathfrak{a}_{\text{andere}} \subset A)) \not\boxminus \\ \begin{pmatrix}K(V_{\text{Verstandene}}) \boxminus_{\text{sondern}} \\ A_{\text{Ausarbeitung}}(M \subset S_{\text{Seinkönnen}})\end{pmatrix}\end{pmatrix} \boxminus_{\text{sondern}}\right.$$
$$(S(D \boxminus_{\text{erschließen}} R))(M(E(V)))$$

In the last formula, some symbols are abbreviated as: V–Verstehen; $\not\boxminus$–ist nicht; $\boxminus$–ist (sein); $\subset$–ist in; A–Auslegung; K–Kenntnisnahme, S–Sein; D–Dasein; R–Rückschlag; M–Möglichkeiten; and E–Entwerfen. An English translation (for philosophical terminology see Heidegger [12]) of the obtained German sentence would be, for example, the following: Understanding is not something other that does not take cognizance of understanding, but is the working-out of possibilities within the potentiality-of-Being for Dasen's Being, being disclosed in the counter-thrust of possibilities of understanding's projecting.

concern. Thus, this list can cause the feeling what the concrete components of consciousness could be, and how could they be informationally interrelated in the most complex and circularly perplexed way. On this way, it becomes clear that experiments, using such a complex organization, cannot be effectively performed by conscious man and, instead, an informational machine [41] is the tool needed.

5.3 The Problem of Pure Consciousness

The problem of *pure* or *void consciousness* was presented in [27] (Shear 1996), and discussed in the informational sense in [46]. Now, it can be shown in more detail what the problem of pure consciousness could mean in the light of the scheme in Fig. 7.

The extreme case of pure consciousness can be conceptualized by different possibilities. To be consciously pure or void means to be concentrating on consciousness as such, excluding other informational components from the process of consciousness. Such a state of concentration is achieved, for example, by meditative training in the Eastern thought. In case of a consciousness model it means to minimize the informational impact of consciousness components and environmental sensation, especially of dealing with concrete intention of something, and perverting the intention (concentration) to consciousness itself as a conscious something.

Using the model in Fig. 7, the goal to achieve a consciously pure consciousness can be informationally implemented by the reduction of the distributive dimensionality of consciousness, e.g., through the transition from the two metaphysicalistic dimensions—the general and the standard one—to the one of them. This means that the problem of consciousness informing becomes simpler and more superficial as in case of several metaphysicalistic dimensions. The scheme in Fig. 7, as it is drawn, seems to be isolated from the environment. But, this is in fact not true since each informational component (operand) can have its own input and output operator to a kind of environment—the interior and/or exterior one. However, for the pure consciousness it is relevant to be excluded from any exterior informational impact (disturbance), and concentrating merely onto the perceiving of consciousness as such. The additional condition for such a situation is, for example,

$$
\begin{aligned}
&\alpha \not\models \mathfrak{c}_{\text{consciousness}}; \mathfrak{c}_{\text{consciousness}} \not\models \alpha;\\
&\mathfrak{c}_{\text{consciousness}} \in\\
&\quad \{\mathfrak{z}, \mathfrak{z}^{\mathfrak{i}}_1, \mathfrak{z}^{\mathfrak{i}}_2, \ldots, \mathfrak{z}^{\mathfrak{i}}_p, \mathfrak{z}^{\mathfrak{c}}_1, \mathfrak{z}^{\mathfrak{c}}_2, \ldots, \mathfrak{z}^{\mathfrak{c}}_q, \mathfrak{z}^{\mathfrak{e}}_1, \mathfrak{z}^{\mathfrak{e}}_2, \ldots, \mathfrak{z}^{\mathfrak{e}}_r,\\
&\quad\ \mathfrak{I}_{\mathfrak{z}}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_2}, \ldots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{i}}_p}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_2}, \ldots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{c}}_q},\\
&\qquad \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_1}, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_2}, \ldots, \mathfrak{I}_{\mathfrak{z}^{\mathfrak{e}}_r},\\
&\quad\ \mathfrak{i}_{\mathfrak{z}}, \mathfrak{i}_{\mathfrak{z}^{\mathfrak{i}}_1}, \mathfrak{i}_{\mathfrak{z}^{\mathfrak{i}}_2}, \ldots, \mathfrak{i}_{\mathfrak{z}^{\mathfrak{i}}_p}, \mathfrak{i}_{\mathfrak{z}^{\mathfrak{c}}_1}, \mathfrak{i}_{\mathfrak{z}^{\mathfrak{c}}_2}, \ldots, \mathfrak{i}_{\mathfrak{z}^{\mathfrak{c}}_q},\\
&\qquad \mathfrak{i}_{\mathfrak{z}^{\mathfrak{e}}_1}, \mathfrak{i}_{\mathfrak{z}^{\mathfrak{e}}_2}, \ldots, \mathfrak{i}_{\mathfrak{z}^{\mathfrak{e}}_r},\\
&\quad\ \mathfrak{C}_{\mathfrak{z}}, \mathfrak{C}_{\mathfrak{z}^{\mathfrak{i}}_1}, \mathfrak{C}_{\mathfrak{z}^{\mathfrak{i}}_2}, \ldots, \mathfrak{C}_{\mathfrak{z}^{\mathfrak{i}}_p}, \mathfrak{C}_{\mathfrak{z}^{\mathfrak{c}}_1}, \mathfrak{C}_{\mathfrak{z}^{\mathfrak{c}}_2}, \ldots, \mathfrak{C}_{\mathfrak{z}^{\mathfrak{c}}_q},\\
&\qquad \mathfrak{C}_{\mathfrak{z}^{\mathfrak{e}}_1}, \mathfrak{C}_{\mathfrak{z}^{\mathfrak{e}}_2}, \ldots, \mathfrak{C}_{\mathfrak{z}^{\mathfrak{e}}_r},\\
&\quad\ \mathfrak{c}_{\mathfrak{z}}, \mathfrak{c}_{\mathfrak{z}^{\mathfrak{i}}_1}, \mathfrak{c}_{\mathfrak{z}^{\mathfrak{i}}_2}, \ldots, \mathfrak{c}_{\mathfrak{z}^{\mathfrak{i}}_p}, \mathfrak{c}_{\mathfrak{z}^{\mathfrak{c}}_1}, \mathfrak{c}_{\mathfrak{z}^{\mathfrak{c}}_2}, \ldots, \mathfrak{c}_{\mathfrak{z}^{\mathfrak{c}}_q},\\
&\qquad \mathfrak{c}_{\mathfrak{z}^{\mathfrak{e}}_1}, \mathfrak{c}_{\mathfrak{z}^{\mathfrak{e}}_2}, \ldots, \mathfrak{c}_{\mathfrak{z}^{\mathfrak{e}}_r},\\
&\quad\ \mathfrak{E}_{\mathfrak{z}}, \mathfrak{E}_{\mathfrak{z}^{\mathfrak{i}}_1}, \mathfrak{E}_{\mathfrak{z}^{\mathfrak{i}}_2}, \ldots, \mathfrak{E}_{\mathfrak{z}^{\mathfrak{i}}_p}, \mathfrak{E}_{\mathfrak{z}^{\mathfrak{c}}_1}, \mathfrak{E}_{\mathfrak{z}^{\mathfrak{c}}_2}, \ldots, \mathfrak{E}_{\mathfrak{z}^{\mathfrak{c}}_q},\\
&\qquad \mathfrak{E}_{\mathfrak{z}^{\mathfrak{e}}_1}, \mathfrak{E}_{\mathfrak{z}^{\mathfrak{e}}_2}, \ldots, \mathfrak{E}_{\mathfrak{z}^{\mathfrak{e}}_r},\\
&\quad\ \mathfrak{e}_{\mathfrak{z}}, \mathfrak{e}_{\mathfrak{z}^{\mathfrak{i}}_1}, \mathfrak{e}_{\mathfrak{z}^{\mathfrak{i}}_2}, \ldots, \mathfrak{e}_{\mathfrak{z}^{\mathfrak{i}}_p}, \mathfrak{e}_{\mathfrak{z}^{\mathfrak{c}}_1}, \mathfrak{e}_{\mathfrak{z}^{\mathfrak{c}}_2}, \ldots, \mathfrak{e}_{\mathfrak{z}^{\mathfrak{c}}_q},\\
&\qquad \mathfrak{e}_{\mathfrak{z}^{\mathfrak{e}}_1}, \mathfrak{e}_{\mathfrak{z}^{\mathfrak{e}}_2}, \ldots, \mathfrak{e}_{\mathfrak{z}^{\mathfrak{e}}_r}\}
\end{aligned}
$$

where α presents an exterior operand, and $\not\models$ is the operator of non-informing.

Further, the organization of consciousness has to be simplified as much as possible. In the first step, the general components $\mathfrak{z}^{\mathfrak{i}}_1, \mathfrak{z}^{\mathfrak{i}}_2, \ldots, \mathfrak{z}^{\mathfrak{i}}_p, \mathfrak{z}^{\mathfrak{c}}_1, \mathfrak{z}^{\mathfrak{c}}_2, \ldots, \mathfrak{z}^{\mathfrak{c}}_q, \mathfrak{z}^{\mathfrak{e}}_1, \mathfrak{z}^{\mathfrak{e}}_2, \ldots, \mathfrak{z}^{\mathfrak{e}}_r$ can be omitted in the context of consciousness. By such an omission, only the Row 0 in Fig. 7 remains, with the basic intention to examine the consciousness $\mathfrak{z}$ as the only relevant phenomenon.

6 Conclusion

Besides a possible scientific interpretation, the theory presented in this paper has also its own horizons of the possible consciousness artificialness, that is, numerous possibilities of an adequate consciousness constructibility in regard to the concepts in different fields of scientific research. What follows from such a view is the possibility of modeling and experimenting, with the straightforward as well as controversy structures and organization of informational consciousness [44]. Within this context, organization has to be understood as a complex circular and metaphysicalistic perplexed consciousness structure as, for example, presented in Fig. 7. On the other side, arbitrary other schemes of consciousness become possible which do not have any metaphysicalistic organization, but are by their nature com-

plexly circular (e.g., an unconscious functionalism of consciousness).

By the scheme in Fig. 7, a paragon of the so-called *organizational invariance* [3] is given, which could be expanded over several dimensions (potential infinity), where metaphysicalistic components are and emerge in a metaphysicalistic way ad infinitum. Potentially infinite depth of metaphysicalism brings to the surface the concept of an infinitely dimensional informational space, being defined on the basis of a new mathematical (mathesis-like) scope. Such a formalization can lead to a conceptually new type of machine, being able to inform as a complex informational entity [41].

A meticulous reader will observe that the theory of consciousness, as exposed in this paper, roots in the general informational theory, by which the phenomenalism of informing of entities can be efficiently formalized. Within this view, the theory can be built up in the sense of a positivistic and objective epistemology [19], with the firm informational axiomatic background and formalistic rules of theoretical procedure. The initial cognition of informational phenomenalism can be directly transferred to the concepts of consciousness, being in accordance with scientific results in different fields of research, methodology, and practice.

It must be stressed that the formation of the informational concept—and through it the consciousness concept—is straightforward in the basic axiomatic direction, together with the rules of informational deduction, induction, and the other rules in the domain of the so-called modi informationis [48], which concern the informational inference. In this way, some new forms of abstraction are introduced, especially those concerning the basic phenomenalistic properties—informational externalism, internalism, metaphysicalism, and phenomenalism. The four initial axioms open the realm of the entire theory together with the simplest syntax for the informational formula formation. Thus, the concept of abstraction of informational abstraction can seize to an arbitrary depth, complexity and perplexity. This feature of the informational concept abstraction can best be recognized in the case of consciousness where all the possible theoretical and formalistic resources have to be taken into consideration, with the goal to overcome the usual scientific reductionism.

The concept of consciousness coincides to a substantial philosophical depth with the concepts of being (Sein) and identity (Seiendes). Phenomena of consciousness root in the awareness of the internal and external world. The informational concept follows this consciousness aspect in every concern. Existing of things means to have the faculty of informing for the others (spectators), for the thing itself (in the sense of the external impacting of the thing interior), and for the inner (metaphysicalistic) informing of the thing (its characteristic physicalism). In this way, the informational of something covers simultaneously the physicalism and phenomenalism of something.

Each significant theory—and informational and consciousness theory in particular—must be able to identify the nature of its objects (e.g., consciousness operands and operators) by the epistemologically objective concepts. Informational definitions help to introduce the necessary terminology, for instance terms as operand, operator, transition, serialism, parallelism, circularism, metaphysicalism, causality, gestaltism, etc. By a definition, a concept is clearly distinguished from all other concepts, and can be communicated in terms of other concepts. Informationally, concepts can be embedded in other concepts and itself, giving the theory the necessary circularism, perplexity and multi-plasticity.

Formalization (mathematization) of consciousness concepts is the conditio sine qua non for a future theory development (a higher form of formalization) and its application. The higher form of formalization calls for the development of a new sort of multidimensional space—the informational space—the formalism for a more dense, concentrated, and efficient expression of higher forms of circularism and parallelism, especially in the depth-embedded metaphysicalism. On the other hand, the rigorous and precise formalization of consciousness (informational) concepts could substantially contribute to the transparency of the design (engineering) of a new type of machine [41]—the informational machine. Experiments with consciousness problems and tasks, supported by such a machine, would lead to the recognition in which way a machine could essentially surpass the living consciousness, and enable a real breakthrough in the domain of informational phenom-

ena in the field of literature, voice and image, and in the last consequence to the experiments in the field of conscious thought.

It becomes more and more evident in which direction the research of consciousness as informational phenomenalism has to proceed. *In which way different scientific disciplines can profit by the new theory and how can they impact it?* remains an actual open question.

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