INFORMATICA 1/89

INFORMATIONAL LOGIC III

Descriptors: LOGIC INFORMATIONAL, RULES FORMATIONAL, AXIOMS INFORMATIONAL, INFORMATIONAL WELL-FORMED FORMULA (IWFF)

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In this part of the essay two main topics of the informational logic (IL) are discussed: formation rules which govern the structure of informationally well-formed formulae (iwffs) and informational axioms. In the continuation of this essay informational transformation rules of IL will be examined in a formal informational way.

Formation rules of IL have to answer the question how to construct initial informational formulae which will belong to the so-called class of iwffs. Within this question the so-called operational, operand, and parenthetic constituents and their compositions into iwffs are determined. In formatting a formula (iwff) several basic processes can be applied, for instance, beginning of formula formation, introducing of operands and operators in implicit and explicit forms into the context of an iwff, particularization and universalization of formulae, etc. Afterwards, formation rules of IL are exposed in a short and concise manner. At the end, the question can be put what could be the form of a non-informational formula.

Within the topic of informational axioms the following subjects are discussed: axiomatization of informational principles, how informational axioms can be generated, axioms of Informing, informational difference, informational circularity, informational spontaneity, informational arising, counter-information, counter-Informing, informational embedding, informational embedding of counter-information, informational differentiation, informational integration, informational particularization and universalization, informational structure and organization, informational parallelism, informational cyclicity, openness of informational axiomatization, influence of metaphysical beliefs on axiomatization, and axiomatic consequences of informational arising.

Informacijska logika III. V tem delu spisa se obravnavata dve glavni naslovni poglavji informacijske logike (IL): formacijska (oblikovalna) pravila, ki urejajo strukturo informacijsko dobro oblikovanih formul (iwff) in informacijski aksiomi. V nadaljevanju tega spisa se bodo na informacijsko formalen način preučevala še informacijska transformacijska pravila IL.

Formacijska pravila IL morajo odgovoriti na vprašanje, katere informacijske formule pripadajo t.i. razredu iwff. V okviru tega vprašanja se opredeljujejo operacijski, operandni in oklepajni konstituenti in njihove kompozicije v iwff. Pri oblikovanju informacijskih formul (iwff) se uporabljajo nekateri osnovni procesi, kot so npr. začenjanje oblikovanja formul, uvajanje operandov in operatorjev v implicitni in eksplicitni obliki v kontekst formul, stikanje operatorjev, partikulariziranje in univerzaliziranje formul itd. Oblikovalna pravila IL je mogoče opisati kratko in jedrnato. Vprašanje, ki ga je mogoče postaviti pri oblikovanju formul je, kakšna bi lahko bila oblika neinformacijske formule.

V okviru problematike informacijskih aksiomov pa se obravnavajo tale naslovna vprašanja: aksiomatizacija t.i. informacijskih principov, kako je mogoče generirati aksiome, aksiomi informiranja, informacijske diference, informacijske cirkularnosti, informacijske spontanosti, nadalje aksiomi informacijskega nastajanja, protiinformacije, protiinformiranja, informacijskega vmeščanja, informacijskega vmeščanja protiinformacije, informacijske diferenciacije, informacijske integracije, informacijske partikularizacije in univerzalizacije, informacijske strukture in organizacije, informacijskega paralelizma, informacijske cikličnosti ter še odprtost informacijske aksiomatizacije in aksiomatične posledice informacijskega nastajanja.

II. 2. FORMATION RULES OF INFORMATIONAL LOGIC

... in rejecting mental representations as the objects of belief one is not thereby rejecting the empirical hypothesis that the brain is an information processor and thus processes in a neural machine language.

Stephen Schiffer [11] 5

II.2.0. Introduction

In this section (II. 2.) we have to say clearly which kind of informational formula will belong to informational logic (IL). Thus, we shall deal with the question how to construct informational formulae which will belong to the legal form of informational formulae. The word legal will have the meaning of well-formed. We have to state precisely what is an expression composed of informational operands, informational operators, and parenthetic delimiters, in such a way that it will represent the so-called informational well-formed formula (iwff).

In the context of formation rules we must consider that an iwff has to be capable of representing any information, most abstract as well as most ordinary life information, simple as well as most complex one. In this respect, it seems senseful to put the following question: "Is it possible to state explicitly what will be the limits of formula formation or is it at all possible to set any fixed limits which would disable realization of any general principle of information?" Within this dilemmatic view of formation of an informational formula we shall develop some basic rules of formation, not saying that these rules are the only possible ones.

Already within the principles of information ([4] or [10] respectively) it was shown how informational formulae can be composed on the level of natural language. This experience tells us that informational formulae are in no way limited sequences of informational operands and informational operators in relation to spoken and written language. Relationships within information are objective (operand-characteristic) and subjective (operational) and can be changed from the operand to operational states and vice versa during an informational process. Thus, a local informational operator can be viewed as an operational variable in a wider informational observation. Due to this phenomenology of informational compositions of operands and operators, iwffs are, in general, not structurally limited in any particular way. Limitations can be determined in cases of particular informational theories, concerning, for instance, formal logical systems as traditional symbolic logic, modal logic, etc., which can be conceived as special projections (particularizations) of informational logic.

The next fact to be explicated is, that sets of objects of IL are generative, i.e. not limited (determined once and for ever) in advance. Only static theories deal with finite and strictly determined sets of objects and as such are understood to be the most informationally primitive (static) forms of IL. In this respect, the set of formation rules of IL will not be semantically limited and informational operators will be recruited depending on needs, goals, and applications, which arise during an informational process. Similar will hold for informational operands occurring in informational formulae. The principle of informational arising will govern the arising of concrete formation rules (concerning concrete informational operators). However, it will be possible to present the essential framework of the arising of formation rules within IL.

II.2.1. Informational Operands as Constituents of IWFFs

The nature of information is variable in its arising, changing, vanishing, and disappearing. An informational operand is such a sort of variable information. We have the following basic definition concerning an informational operand as iwff:

[Operands]^{DF1}:
Informational variable α, defined as informational operand, is iwff. This operand can represent various kinds of information belonging to an informational realm. Thus,

$$(\text{'}\alpha \text{ is informational operand'}) \Rightarrow (\text{'}\alpha \text{ is iwff'}) \quad \blacksquare$$

In many cases it is reasonable to separate informational entities as variable operands. So, one can set the following definition:

[Operands]^{DF2}:
A set of informational variables $\alpha, \beta, \ldots, \gamma$, in which $\alpha, \beta, \ldots, \gamma$ are defined as informational operands, is iwff. These variables of the set can represent various kinds of information belonging to given informational domains. It is:

$$(\text{'}\alpha, \beta, \ldots, \gamma \text{ are informational operands'}) \Rightarrow (\text{'}\alpha, \beta, \ldots, \gamma \text{ is iwff'}) \quad \blacksquare$$

In the last definition, the commas can be understood as informational operators, which connect operands into an informational set. The sequence $\alpha, \beta, \ldots, \gamma$ could as well be written in the following way:

$$\alpha \models_{comma} \beta \models_{comma} \cdots \models_{comma} \gamma$$

where $\models_{comma}$ is the set-connective informational operator representing the delimiter ",". A set of operands $\alpha, \beta, \ldots, \gamma$ can be represented by a resultant operand, say ξ, where

$$\xi = \alpha, \beta, \ldots, \gamma$$

In this case, the symbol '=' is the informational operator of representation. It has the meaning that ξ representatively informs $\alpha, \beta, \ldots, \gamma$ or

$$\xi \models_= \alpha, \beta, \ldots, \gamma$$

Let us set now the definition reverse to [Operands]^{DF1}:

[Operands]^{DF3}:
If α represents an iwff, then α is an informational operand:

('α is iwff') $\Rightarrow$
('α is informational operand') ■

This definition says that irrespective of how α is structured as iwff, in fact, it represents an informational operand (traditional variable). Or, in other words: irrespective of its structure, an iwff can always be used as informational operand or can be put under operation of an informational operator. Everything which is iwff can be operated or can become an operand in the structure of another, higher formula. In the iwff

$$\alpha, \beta, \ldots, \gamma$$

$\alpha, \beta, \ldots, \gamma$ are iwffs, so, each of these iwffs can have its own structure.

[Operands]^{DF4}:
If $\alpha, \beta, \ldots, \gamma$ are informational operands, then $\mathfrak{F}$ in $\mathfrak{F}(\alpha, \beta, \ldots, \gamma)$ is the so-called functional informational operand (fio) or implicit informational operator (iio). In an iwff, a fio performs as informational operand, however, it has the implicit operational property. In this respect, an informational operand can be a functional or a non-functional variable. Fios or iios will be marked by capital Gothic letters (for instance, $\mathfrak{A}$, $\mathfrak{B}$, $\mathfrak{C}$, etc. ■

In $\mathfrak{F}(\alpha, \beta, \ldots, \gamma)$, the operand variables $\alpha, \beta, \ldots, \gamma$ can be functional as well as non-functional. Some distinguished iios (or fios) are, for instance:

- $\mathfrak{A}$ general Informing, for instance, as Informing of the variable α,
- $\mathfrak{B}$ behavioral Informing or behavior of a being,
- $\mathfrak{C}$ counter-Informing of information,
- $\mathfrak{D}$ informational differentiation (which could be the synonym for counter-Informing),
- $\mathfrak{E}$ informational embedding (of counter-information or new information into source information),
- $\mathfrak{F}$ general implicit functional operator,
- $\mathfrak{I}$ Informing or informational integration,
- $\mathfrak{L}$ motor or behavioral Informing of a being,
- $\mathfrak{M}$ metaphysical Informing of a being,
- $\mathfrak{P}$ informational particularization (subscription of informational operators) and informational universalization (superscription of informational operators),
- $\mathfrak{S}$ sensory Informing of a being, etc.

Marking by Gothic letters does not mean that also capital Latin letters cannot be used (according to [Variables]^{DF1}) for the purpose of marking implicit operators within the operand expressions. In this sense, for the above list of markers of Informing, also the Latin letters A, B, C, D, E, F, I, L, M, P, S, etc. can be used, respectively. Gothic letters are introduced for better distinctness of implicit operators in the expression of operands.

II.2.2. Informational Operators as Constituents of IWFFs

In IL operators are understood to be variable. In general, informational operators, presented by the metasymbol $\models$, will belong to a generative, potentially unlimited set of informational operators. In contrast to the so-called implicit informational operators marked by capital Gothic letters, metaoperators belong to the so-called explicit informational operators, which will be marked by distinctive special symbols. The set of informational operators is generated by the two already mentioned informational procedures, called particularization and universalization of existing metaoperators or already particularized or universalized operators. The process of particularization or universalization can always begin from the most general informational operator $\models$, which as metasymbol represents the so-called general operational variable. In IL, on the level of informational operations, we regularly have to deal with operational variables rather than with operational constants. Informational operands, as well as informational operators, underlie the so-called principle of informational arising.

[Operators]^{DF42}:
The informational operator $\models$ is operational variable and is the sub-iwff. This operational variable represents various kinds of informational operators, which can be generated by particularization and universalization of $\models$, according to the needs, goals, application, and understanding of an informational formula, which is an iwff representing an informational form, process, or phenomenon. In the same way as does the operator $\models$, the particularized and universalized operators underlie the philosophy of their further (recurrent) particularization and universalization. Thus,

('$\models$ is operational variable') $\Rightarrow$
('$\models$ is sub-iwff')

('$\models_{part}$ is operational variable') $\Rightarrow$
('$\models_{part}$ is sub-iwff')

$(\text{'}\models^{univ}$ is operational variable') $\Rightarrow$ $(\text{'}\models^{univ}$ is sub-iwff')

where $\models_{part}$ is a particularized explicit operator and $\models^{univ}$ is a universalized explicit operator. Further, it is possible to mark

$$(\models_{part}) \equiv \mathfrak{P}_{\downarrow}(\models) \quad \text{and} \quad (\models^{univ}) \equiv \mathfrak{P}^{\uparrow}(\models)$$

where $\mathfrak{P}_{\downarrow}$ is the implicit informational operator of particularization and $\mathfrak{P}^{\uparrow}$ the implicit informational operator of universalization. ∎

In several cases it is reasonable to concentrate informational operators into (regular) functional compositions of operators. In such cases, the following definition can be adopted:

[Operators]^{DF43}:
A set (type) $\models$ of particularized and universalized operational variables or informational operators, marked for example as $\models_1, \models_2, \dots, \models_m$, is the basis from which these elements can be taken to construct the so-called operational concatenations in the following way:

(1) $\models_{con} \equiv \models_i$, where $\models_i \in \models$, is operational concatenation (OC);

(2) $\models_{con} \equiv (\models_{con}\models_j)$, where $\models_j \in \models$, is a recursive definition of OC.

If $\models_{con}$ is an OC, one can write instead of (1) and (2):

(1)* $(\models_i \in \models) \Rightarrow (\models_{con} \equiv \models_i)$

(2)* $((\models_j \in \models) \wedge (\text{'}\models_{con}$ marks OC')) $\Rightarrow (\models_{con}\models_j)$

Expression (2)* is a kind of informational modus (a particular form of the so-called modus informationis):

$$\frac{\models_j \in \models,\ (\text{'}\models_{con} \text{ denotes OC'})}{(\text{'}\models_{con}\models_j \text{ is OC'})}$$

∎

The consequence of [Operators]^{DF43} is that $\models_{con}$ is a word belonging to the set

$$\{\models_1, \models_2, \dots, \models_m\}^* \setminus \{\}$$

where {} denotes the empty set. $\models_{con}$ is a composition of informational operators in an arbitrary complex (interweaving) way. In a particular case, $\models_{con}$ can be the linear (usual, mathematical) composition of operators. The complex composition means a parallel (interweaving) activity of operators constituting $\models_{con}$. For instance, we shall allow the notation $\models^{\dashv}$ instead of $\models\dashv$, where in $\models^{\dashv}$ the relation of dominance $\models \Delta \dashv$ will be assumed. It is evident that among operators, constituting $\models_{con}$, additional dependencies (relations) can be determined.

[Operators]^{DF44}:
If $\models_{con}$ represents a sub-iwff, then $\models_{con}$ is an informational operator (or operational variable):

$(\text{'}\models_{con}$ is sub-iwff') $\Rightarrow$ $(\text{'}\models_{con}$ is an operational variable') ∎

This definition says that irrespective of how $\models_{con}$ as a sub-iwff is structured, in fact, it represents a composite (complex) operational variable in which its components (suboperators) are variables too. Formally, as a concatenation of operational variables, $\models_{con}$ functions as an operator composition. In regard to an iwff, a sub-iwff is in some way a reduced form of the iwff concept. This reduction is semantically presented as the prefix 'sub' in sub-iwff, which is a concatenation of informational operators and is marked by operator $\models_{con}$.

II.2.3. Parenthetic Delimiters and Parenthesizing of IWFFs

In fact, parenthetic delimiters can be understood as the delimiting informational operators within an iwff. Their function is to determine the so-called iwff's unities within a formula. A unity of an iwff can be used as operand of a higher operator structure. For parenthetic delimiters arbitrary symbols can be introduced, for instance, parentheses, brackets, etc. Besides parentheses, it is possible to introduce the so-called non-substantial delimiter, by which the so-called non-substantial part of an iwff will be marked. So, let us have the following definition:

[Delimiters]^{DF1}:
Irrespective of their choice, the parenthetic delimiters occurring in an iwff unite parts of the iwff or the whole iwff, with the intention to define the unit they delimit to be used for some operation over the unit. Parenthetic delimiters occur always in pairs, consisting of the beginning and the ending delimiter, and can be nested within other pairs of delimiters. Usually, parenthetic delimiters will be denoted by '(' for the beginning and by ')' for the ending delimiter. However, also other kinds of delimiters can be introduced, for instance, the pairs [,] and {, }, all of which can be understood as particularizations of the delimiter operators $\models_{beg}$ and $\models_{end}$, denoting the beginning and the ending parenthesis. ∎

[Delimiters]^{DF2}:
Parenthetic delimiters can be used in pairs in such a way, that they delimit an expression within an iwff, which is either an iwff or a sub-iwff. In this case the usual nesting principle of parenthesizing is valid. ∎

[Delimiters]^{DF3}:
A special, unary delimiter is in fact the symbol, marking the so-called non-substantial or self-comprehensive part of an iwff. This delimiter is composed of three consecutive dots, thus '...'. The three-dot delimiter is a legal symbol of an iwff. ■

[Delimiters]^{EX1}:
Considering the previous three definitions, the legal formulae or iwffs are, for instance:

$\ldots\alpha,\quad \alpha\ldots;\quad \alpha\ldots\beta,\quad \ldots(\ldots(\ldots))$

With the last formula we can even determine the positioning of parentheses in an iwff. Evidently, this formula can be rewritten as $\alpha(\beta(\gamma))$, where the entities α, β, and γ are understood as unsubstantial parts of the formula in question. ■

II.2.4. Some Basic Processes within the Formation of Formulae

So far, we have used the following basic processes in the formation of a formula:

(1) Introducing of informational operands as constituents of an arising formula, where the operand as a variable represents an iwff.

(2) Setting of informational operands into sets of variables, where distinct variables were separated by commas. Such a set of variables was declared to be the iwff.

(3) Introducing of explicit informational operators of the type $\models$ in an arising formula and concatenating them by other informational operators into a sub-iwff (OCs) within an iwff.

(4) Introducing of explicit informational operators and their operational concatenations (OCs) and concatenating them with operands and their informational sets, thus formatting an iwff.

(5) Introducing of implicit informational operators of the type $\mathfrak{F}$ (functional operands) into the operand parts of an arising formula and concatenating them (functionally) to an parenthesized informational set of operand variables.

(6) Introducing of explicit and implicit informational operators in a particularized and universalized way of their choice. Even if operational particularization and universalization are the basic formatting principles, they could be understood first of all as formula transformation principles (see subsection II.5).

(7) Formatting a complete formula (iwff) means to use rules (1)-(6) in an arising manner. In this respect an instantaneous formula can be always developed by further steps proceeding from one formational state to the other in a growing (enlarging) or a vanishing (reducing) manner.

II.2.5. Formation Rules of IL

In the previous definitions of the subsection II.2 we gave the rules for formation of an iwff in the following way: it was said what operands and operators constituting a formula are. Then it was said how operands and operators can be combined or concatenated into a formula. Also, the use of the so-called delimiters, which determine the units or subunits of a formula, was described. There were not any particular restraints for formula formation. In general, combining of operands, operators, and delimiters in the described way, leads to the formation of a formula. In such formatting processes, particularization and universalization of operators are still possible.

[Formatting of formulae]^{DF1}:
An informational well-formed formula (iwff) can be constructed by the use of the definitions [Operands]^{DF1} - [Operands]^{DF4}, [Operators]^{DF42} - [Operators]^{DF44}, and [Delimiters]^{DF1} - [Delimiters]^{DF3} by concatenating (combining) operands, operators, and delimiters according to the description in subsection II.2.5. With this procedure production of an iwff is assured. ■

[Formatting of formulae]^{DF2}:
Informational well-formed formulae, being constructed according to the previous definition, can be composed into the so-called informational system. In this system, distinct iwffs are separated by commas or/and can appear in different lines. Similarly as a single iwff can be marked by a symbol of operand, the informational system can be marked by a symbol of operand. Informational system performs as iwff. ■

Later on, discussing the transformation rules, we shall show how formulae can be decomposed into systems and how systems of formulae can be composed into formulae under certain circumstances. In this essay we have given several examples, which clarify and illustrate the principles of formula formatting.

II.2.6. What Could Be a Non-Informational Formula?

The first approach to the topical question could be in questioning what are already informational formulae. The answer to this counter-question is that all mathematical formulae certainly belong to the class of informational formulae. However, informational formulae are not necessarily mathematical, for mathematics does not deal with the creative component of information (Informing, arising, generating, functional changing, etc.). The semantics of informational operators and operands as variable subjects and objects is generative, while mathematically chosen objects are invariably determined.

The answer to the topical question is that anything we form out of informational operands, operators, and parenthetio delimiters is either iwff or sub-iwff. Certainly, there exist some unessential distinctions. For instance, if we take two informational variables, say α and β, we can form several compositions, such as

$$\alpha\beta, \quad \alpha, \beta, \quad \alpha(\beta), \quad (\alpha)\beta,$$

etc. The first case can be interpreted as informational concatenation of α and β, which is already known as operational concatenation of the type $\models_{con}$. In a similar way it is possible to determine the so-called operand concatenation and the concatenation of mixed operand and operator components. This is already performed in the case of iwff formation. The second case concerns the so-called informational set of components α and β. The third case can, in general, have two substantially different interpretations: α can be an implicit operator and β its argument, or the parentheses '(' and ')' are used simply as formula delimiters, where α is an explicit informational operator. In the fourth case we have to do with a similar case as in case three, etc. One can feel that any formula expression can have its informational sense, interpretation, understanding, and that it is not possible to say decisively what an informational formula cannot be.

The last statement is evidently only a consequence of the fact that there is not anything which could not be informational. This "all-embracing" principle governs not only the realm of the real information (metaphysics), but also its concept of self-formalization. In this respect, informational logic introduces a free, legal, and effective concept for dealing with cases concerning the generative, creative, or intelligent nature of information. It has to be said that the introduced semantics of IL is initial and has still to be elaborated and developed to the levels, where it would satisfy more properly the needs of a particular arising of information.

II. 3. INFORMATIONAL AXIOMS

... and in the end one is left with the no-theory theory of meaning, the deflationary thought that the question that now define the philosophy of meaning and intentionality all have false presuppositions.

Stephen Schiffer [11] 3

II.3.0. Axiomatization of Informational Principles

We shall now come to the point at which it will be possible to make an authentic self-experience how axiomatization of the so-called principles of information ([4] or [10]) opens the abyss of making these principles formalistic, i.e. to give them forms of iwffs. Again, the semantics of operands and operators will take its informational power. In fact, by axiomatization of informational principles, we are entering the abysmal domain of informational phenomenology. If somebody is in doubt whether this is or is not so as we have stated right now, let him simply follow the experiments and intentions of the subsequent informational axiomatization. The nature of the mentioned abyss is that it is practically inexhaustible, that axiomatization as an informational approach can generate an unlimited and unforeseeable set of axioms, where the end cannot be seen at all. It may sound surprisingly that informational axioms, although intuitively deduced from informational principles, can and will illuminate these principles in a refreshing, new, and theoretically elucidated way.

We are now coming to the point where we have to decide what can be an informational axiom. The basic association of ideas is that the so-called informational principles (discussed in [4] and also in [10]) have to be axiomatized. The first impression is that the main difficulty may lie in the principle of informational arising which concerns all informational entities, operands, as well as operators of a formula. Informational arising is the semantic property of operands and operators. Results of applying informational operators is the arisen information, for instance, counter-information. Simultaneously to the arisen information also Informing of information arises or new informational components are coming into existence. Evidently, these basic mechanisms of information have to be formally axiomatized. To enter into the discourse of informational arising a recurrent and informationally interwoven approach is necessary.

II.3.1. The Main Axiomatic Principles

II.3.1.0. How Axioms Can Be Generated

It is simply possible to follow principles of information [4] and make the list of axioms, which will be constructed in the next paragraphs. Thus, we shall have the following axioms concerning the subsequent informational entities: Informing and mutual Informing of information, informational difference, informational circularity, informational spontaneity, arising of information, counter-information, counter-Informing of information, informational embedding, informational embedding of counter-information, informational differentiation, informational integration, informational particularization and informational universalization, informational formula, informational structure and informational organization, informational parallelism, informational cyclicity, openness of informational axiomatization, informational axioms and metaphysical beliefs, and axiomatic consequences of informational arising.

II.3.1.1. Axioms of Informing of Information

If we say that α marks an informational entity, i.e. information, then it is supposed that this entity has the property of inward (own) and outward (concerning other information) informational development or Informing. For this informational property of Informing the operator variable or general metaoperator ⊨ was introduced. According to our previous discussion we can propose the following axioms:

[Axioms]^{DF1}:

(1) $(\text{'}\alpha \text{ is information'}) \Rightarrow ((\alpha \models) \vee (\dashv \alpha))$

(2) $(\text{'}\alpha \text{ is information'}) \Rightarrow ((\models \alpha) \vee (\alpha \dashv))$

(3) $((\alpha \models) \vee (\dashv \alpha) \vee (\models \alpha) \vee (\alpha \dashv)) \Rightarrow (\text{'}\mathfrak{I}_\alpha(\alpha) \text{ is coming into existence'})$

(4) $((\alpha \models) \vee (\dashv \alpha) \vee (\models \alpha) \vee (\alpha \dashv)) \Rightarrow ((\alpha \models \alpha) \vee (\alpha \dashv \alpha))$ ■

The comments to these axioms are the following:

(1) If α is information, then α informs in one (⊨) or another way (⫤).
(2) If α is information, then α is informed in one (⊨) or another way (⫤).
(3) If α informs and is informed in one or another way, then Informing of α over α itself ($\mathfrak{I}_\alpha(\alpha)$) is coming into existence.
(4) If α informs and is informed in one or another way, then α informs itself and/or is informed by itself.

[Axioms]^{DF2}:
[of Mutual Informing of Information]

(1) $(\text{'}\alpha \text{ and } \beta \text{ are informationally interwoven'}) \Rightarrow ((\alpha \models \beta) \vee (\beta \dashv \alpha) \vee (\beta \models \alpha) \vee (\alpha \dashv \beta))$

(2) $(\alpha \models \beta) \Rightarrow ((\alpha \models \beta) \vee (\beta \dashv \alpha) \vee (\beta \models \alpha) \vee (\alpha \dashv \beta))$

(3) $(\beta \dashv \alpha) \Rightarrow ((\alpha \models \beta) \vee (\beta \dashv \alpha) \vee (\beta \models \alpha) \vee (\alpha \dashv \beta))$

(4) $(\beta \models \alpha) \Rightarrow ((\alpha \models \beta) \vee (\beta \dashv \alpha) \vee (\beta \models \alpha) \vee (\alpha \dashv \beta))$

(5) $(\alpha \dashv \beta) \Rightarrow ((\alpha \models \beta) \vee (\beta \dashv \alpha) \vee (\beta \models \alpha) \vee (\alpha \dashv \beta))$

(6) $((\alpha \models \beta) \vee (\beta \dashv \alpha)) \Rightarrow ((\beta \models \alpha) \vee (\alpha \dashv \beta))$

etc. ■

The comment to these axioms is that the informational operators ⊨ and ⫤ have metaequivalent power and that in mutual Informing of information entities all possible cases of Informing of the involved information can be considered.

II.3.1.2. Axioms of Informational Difference

Informational difference concerning two informational items is the most natural informational property. This fact can be expressed by the following axioms:

[Axioms]^{DF3}:

(1) $((\text{'}\alpha \text{ is information'}) \wedge (\text{'}\beta \text{ is information'})) \Rightarrow (\alpha \neq \beta)$

(2) $((\alpha \models \beta) \vee (\beta \dashv \alpha)) \Rightarrow (\alpha \neq \beta)$

(3) $((\text{'}\alpha \text{ is datum'}) \wedge (\text{'}\beta \text{ is datum'})) \Rightarrow (\models_\pi (\alpha = \beta))$

(4) $((\text{'}\alpha \text{ is information'}) \wedge (\text{'}\beta \text{ is information'})) \Rightarrow (\not\models_\pi (\alpha = \beta))$

(5) $((\alpha \models) \vee (\models \alpha)) \Rightarrow (\llcorner\, \delta_\alpha(\alpha))$

(6) $((\dashv \alpha) \vee (\alpha \dashv)) \Rightarrow (\delta_\alpha(\alpha) \lrcorner)$

(7) $\delta_\alpha(\alpha) \equiv_\pi \omega(\alpha)$

In (5)-(7), $\delta_\alpha(\alpha)$ denotes the difference arising as Informing of α over itself and $\equiv_\pi$ marks the possible equivalence between informational difference and arising of counter-information from α. ■

For instance, a pure logical axiomatic conclusion would be that

$$(\alpha \neq \beta) \Rightarrow (\not\models_\pi (\alpha = \beta))$$

From (3) it is understood that only data can be equal. Thus, the equality between two informational items is possible in the realm of information, which represents information as data, that is on the informationally static basis. Sooner or later informational equality remains very unnatural and lifeless informational property.

[Axioms]^{DF4}:
If β is information and if α = β, then α is the marker for β. In this case α is the so-called marking information, which has the nature of information β whose marker it is. Formally,

$(('\beta \text{ is information'}) \wedge (\alpha = \beta)) \Rightarrow ('\alpha \text{ is the marker of } \beta')$ ■

II.3.1.3. Axioms of Informational Circularity

[Axioms]^{DF5}:

(1) $(\alpha \models) \Rightarrow (\alpha \models \alpha)$

(2) $(\alpha \models) \Rightarrow (\models \alpha)$

(3) $(\models \alpha) \Rightarrow (\alpha \models \alpha)$

(4) $(\models \alpha) \Rightarrow (\alpha \models)$

(5) $((\alpha \models) \wedge (\models \alpha)) \Rightarrow (\models \alpha \models)$

(6) $(\alpha \models \alpha) \Rightarrow ((\alpha \models) \vee (\models \alpha))$

etc. If α informs, then it informs itself (1). If α informs, then it is informed (2). If α is informed, then it is informed by itself (3). If α is informed, then it informs (4). If α informs and if α is informed, then it is informed that it informs (5). If α informs itself or if α is informed by itself, then it informs or it is informed (6). Etc. Evidently, axioms of these types can be generated infinitely. ■

[Axioms]^{DF6}:

(1) $(\alpha \models \beta) \Rightarrow ((\alpha \models) \wedge (\models \beta))$

(2) $(\alpha \models \beta) \Rightarrow_{\pi} (\beta \models \alpha)$

(3) $(\alpha \models \beta) \Rightarrow ((\alpha \models \beta) \models)$

(4) $(\alpha \models \beta) \Rightarrow_{\pi} ((\alpha \models \alpha) \wedge (\beta \models \beta) \wedge ((\alpha \models \beta) \models (\alpha \models \beta)))$

etc. If α informs β or β is informed by α, then α informs and β is informed (1). If α informs β or β is informed by α, then it is possible that β informs α or α is informed by β. If α informs β or β is informed by α, then this Informing informs. If α informs β or β is informed by α, then it is possible that α informs itself, β informs itself, and that this Informing informs itself. Etc. Evidently, axioms of these types can be generated indefinitely. ■

Obviously, it can be understood how information and Informing of information perform circularly. Circularity is the basic informational phenomenology.

II.3.1.4. Axioms of Informational Spontaneity

Synonyms of the adjective "spontaneous" may be unforeseeable, generative, and arising. Informational spontaneity is the property of unforeseeable arising of information and of Informing of information. Spontaneity concerns information as informational operand and Informing as informational operator. Spontaneous means to be capable to arise, to come into existence in a possibly unpredictable way. Spontaneity belongs to the most primitive properties of information. This yields the most simple form of the axioms concerning spontaneity.

[Axioms]^{DF7}:

(1) $('\alpha \text{ is information'}) \Rightarrow ((\alpha \models) \vee (\models \alpha))$

(2) $((\alpha \models) \vee (\models \alpha)) \Rightarrow ('\mathfrak{I}_{\alpha}(\alpha) \text{ is spontaneous'})$

(3) $((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\alpha \models \mathfrak{I}_{\alpha}(\alpha)) \vee (\mathfrak{I}_{\alpha}(\alpha) \models \alpha))$

(4) $((\alpha \models) \vee (\models \alpha)) \Rightarrow (\mathfrak{I}_{\alpha}(\alpha) \models \mathfrak{I}_{\alpha}(\alpha))$

(5) $('\mathfrak{I}_{\alpha}(\alpha) \text{ is Informing'}) \Rightarrow (\exists \alpha . ((\alpha \models) \vee (\models \alpha)))$

etc. If α is information, then α informs or is informed (1). Spontaneity in this axiom is hidden in semantics of the metaoperator ⊨. This fact is expressed in (2). If α informs or is informed, then Informing of α, $\mathfrak{I}_{\alpha}$, is an implicit functional operator over α, which is informed by α or informs α (3). If α informs or is informed, then Informing of α over α, $\mathfrak{I}_{\alpha}$, informs itself or is informed by itself. If $\mathfrak{I}_{\alpha}(\alpha)$ is Informing of α over α, then there exists such an α that (.) α informs or is informed (5). Etc. Obviously, axioms of informational spontaneity can be generated infinitely. ■

II.3.1.5. Axioms of Informational Arising

The principle of informational arising is the most basic principle of the theory we call informational logic. This principle hides several other, particular informational principles, for instance, the principles of spontaneity, circularity, Informing, counter-Informing, parallelism, etc. In this respect, this principle has an integrative, originating, and conceptual role in the development of informational theories. The principle that all informational is under the protection and influence of arising, which simultaneously is the synonym for coming into existence, changing and vanishing, guarantees the most possible dynamic nature of information, as it is understood by modern common sense. Of course, the question of new semantic power of informational operators and their operands arises: How can they be determined to surpass the traditional mathematical terminology? How can they be treated to overcome the rationalistic philosophical blockade? How can they exclude, for instance, the principle of truth as the only possible logical means? Several of these efforts have been already presented in the previous text of this essay.

[Axioms]^{DF8}:

(1) $((\alpha \models) \vee (\models \alpha)) \Rightarrow$
$('\mathfrak{I}_{\alpha}(\alpha) \text{ arises'}) \vee$
$('\mathfrak{I}_{\alpha}(\alpha) \text{ is coming into existence'}) \vee$
$('\mathfrak{I}_{\alpha}(\alpha) \text{ is generated'}) \vee$

$('\mathfrak{I}_\alpha(\alpha)$ is changing$') \vee$
$('\mathfrak{I}_\alpha(\alpha)$ is vanishing$') \vee \ldots$

(2) $((\mathfrak{I}_\alpha(\alpha) \models) \vee (\models \mathfrak{I}_\alpha(\alpha))) \Rightarrow$
$('\alpha$ arises$') \vee$
$('\alpha$ is coming into existence$') \vee$
$('\alpha$ is generated$') \vee$
$('\alpha$ is changing$') \vee$
$('\alpha$ is vanishing$') \vee \ldots$

These two axioms have to be treated as a unique, axiomatically interwoven system in which information α and its Informing $\mathfrak{I}_\alpha(\alpha)$ are mutually dependent. ■

The axiomatic question for the last axiom is where do the arising, coming into existence, generating, changing, vanishing, etc. of information and its Informing originate from. The answer to this question is given by the following axiom:

[Axioms]^{DF9}:

(1) $((\alpha \models) \vee (\models \alpha)) \Rightarrow (\alpha \models \mathfrak{I}_\alpha(\alpha))$

(2) $((\mathfrak{I}_\alpha(\alpha) \models) \vee (\models \mathfrak{I}_\alpha(\alpha))) \Rightarrow (\mathfrak{I}_\alpha(\alpha) \models \alpha)$

Without changing essentially the meaning of these axioms, they can be widened in the following manner:

(1) $((\alpha \models) \vee (\models \alpha)) \Rightarrow (\alpha \models \mathfrak{I}_\alpha(\alpha)) \vee (\mathfrak{I}_\alpha(\alpha) \models \alpha))$

(2) $((\mathfrak{I}_\alpha(\alpha) \models) \vee (\models \mathfrak{I}_\alpha(\alpha))) \Rightarrow (\alpha \models \mathfrak{I}_\alpha(\alpha)) \vee (\mathfrak{I}_\alpha(\alpha) \models \alpha))$

In this respect, the consequences of information and its Informing are the same. ■

[Axioms]^{EX1}:
Interpretation of the last axioms by means of the previous ones can be given through various particularizations of the metaoperator $\models$. If we introduce particularizations of $\models$

$\models_{ari}$ for 'arises from or causes the arising of'

$\models_{exi}$ for 'comes into existence from or causes the coming into existence of'

$\models_{gen}$ for 'is generated or generates'

$\models_{cha}$ for 'is changed or changes'

$\models_{van}$ for 'is vanished or vanishes'

then it is possible to express [Axioms]^{DF8} in the following way:

(1) $((\alpha \models) \vee (\models \alpha)) \Rightarrow$
$(\alpha \models_{ari} \mathfrak{I}_\alpha(\alpha) \models_{ari} \alpha) \vee$
$(\alpha \models_{exi} \mathfrak{I}_\alpha(\alpha) \models_{exi} \alpha) \vee$
$(\alpha \models_{gen} \mathfrak{I}_\alpha(\alpha) \models_{gen} \alpha) \vee$
$(\alpha \models_{cha} \mathfrak{I}_\alpha(\alpha) \models_{cha} \alpha) \vee$
$(\alpha \models_{van} \mathfrak{I}_\alpha(\alpha) \models_{van} \alpha) \vee \ldots$

(2) $((\mathfrak{I}_\alpha(\alpha) \models) \vee (\models \mathfrak{I}_\alpha(\alpha))) \Rightarrow$
$((\mathfrak{I}_\alpha(\alpha) \models_{ari} \alpha \models_{ari} \mathfrak{I}_\alpha(\alpha)) \vee$
$((\mathfrak{I}_\alpha(\alpha) \models_{exi} \alpha \models_{exi} \mathfrak{I}_\alpha(\alpha)) \vee$
$((\mathfrak{I}_\alpha(\alpha) \models_{gen} \alpha \models_{gen} \mathfrak{I}_\alpha(\alpha)) \vee$
$((\mathfrak{I}_\alpha(\alpha) \models_{cha} \alpha \models_{cha} \mathfrak{I}_\alpha(\alpha)) \vee$
$((\mathfrak{I}_\alpha(\alpha) \models_{van} \alpha \models_{van} \mathfrak{I}_\alpha(\alpha)) \vee \ldots$
■

In general, it has to be understood that the process of axiomatization of informational arising can be continued indefinitely.

II.3.1.6. Axioms of Counter-Information

Formation, appearance, or coming into existence of the so-called counter-information is a consequence of Informing of information. Counter-information is a result of the informational phenomenology of information. Counter-information arises from information, from information as activity over itself. Appearance of other information, which is not counter-informational, may be called sensory or outward information in respect to the so-called source information or information in question.

[Axioms]^{DF10}:
Let ω denote counter-information and let $\omega(\alpha)$ be counter-information which arises from information α. Let the meaning of operators $\llcorner$ and $\lrcorner$ be 'causes the appearance of' or 'comes into existence from', respectively. There is possible to set several axioms, for instance:

(1) $((\alpha \models) \vee (\models \alpha)) \Rightarrow (\alpha \llcorner \omega(\alpha))$
(2) $((\dashv \alpha) \vee (\alpha \dashv)) \Rightarrow (\omega(\alpha) \lrcorner \alpha)$
(3) $((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\alpha \models \omega(\alpha)) \wedge (\omega(\alpha) \models \alpha))$
(4) $((\dashv \alpha) \vee (\alpha \dashv)) \Rightarrow ((\omega(\alpha) \dashv \alpha) \wedge (\alpha \dashv \omega(\alpha)))$

etc. The axioms (1) and (2) are already particularized because counter-information $\omega(\alpha)$ appears as the consequence of information α. In the axioms (3) and (4) the most general operators $\models$ and $\dashv$ are used. ■

We have already shown some axiomatic constructions concerning counter-information in [Operators]^{DF24} and [Operators]^{EX5}. Evidently, axiomatic constructions concerning counter-information can be continued indefinitely.

II.3.1.7. Axioms of Counter-Informing of Information

Counter-Informing is a component of Informing by which information is producing its counter-information. This component is interwoven in the Informing of information. It acts upon information as a subject causing the appearance of counter-information. Similarly as information is informing, counter-information is counter-informing. The acceptance of counter-information by information depends on the so-called informational embedding of counter-information into the source information. Counter-Informing belongs to the most subtle processing components of information.

[Axioms]^{DF11}:
Let $\mathfrak{C}$ be counter-Informing and let $\mathfrak{C}(\alpha)$ denote counter-Informing which arises within the Informing of information α. It is possible, for example, to set the following axioms:

(1) $((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\alpha \mathrel{\llcorner} \mathfrak{C}(\alpha)) \wedge (\mathfrak{C}(\alpha) \models \omega(\alpha)))$

(2) $((\dashv \alpha) \vee (\alpha \dashv)) \Rightarrow ((\mathfrak{C}(\alpha) \mathrel{\lrcorner} \alpha) \wedge (\omega(\alpha) \dashv \mathfrak{C}(\alpha)))$

(3) $((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\alpha \models \mathfrak{C}(\alpha)) \wedge (\mathfrak{C}(\alpha) \models \alpha) \wedge (\mathfrak{C}(\alpha) \models \omega(\alpha)) \wedge (\omega(\alpha) \models \alpha))$

(4) $((\dashv \alpha) \vee (\alpha \dashv)) \Rightarrow ((\mathfrak{C}(\alpha) \dashv \alpha) \wedge (\alpha \dashv \mathfrak{C}(\alpha)) \wedge (\omega(\alpha) \dashv \mathfrak{C}(\alpha)) \wedge (\alpha \dashv \omega(\alpha)))$

etc. In the axioms (1) and (2), the operators $\llcorner$ and $\lrcorner$ can be understood as particularizations of the operators $\models$ and $\dashv$, respectively. ■

II.3.1.8. Axioms of Informational Embedding

Let, for instance, sensory or outward information σ arrive into informational domain of the so-called source information α. In this case, the perception of σ by α is possible only through Informing of σ, namely in the way that α is informed by σ. In this Informing, α is in no way a passive actor, because the state of being informed is in fact Informing within information in the presence of the outwardly appeared cause, i.e. information σ. The acceptance or perception of this Informing is called informational embedding, in general. The nature of informational embedding is to embed the arriving information into the source information. Evidently, embedding in this sense is a dynamic, unforeseeable Informing. Informational embedding explains and illuminates Informing of information from a particular point of understanding.

It is evident that Informing of the arriving information σ can only be informational, or that the acceptance or perception of σ by α can only be informationally particular. The only exception from this general principle can be observed within the so-called data processing, occurring in traditional, lifeless machines.

[Axioms]^{DF12}:
Let α be source information, σ arriving (sensory, outward) information, $\mathfrak{E}$ informational embedding, and ε information embedded into α by $\mathfrak{E}$. A series of axioms of informational embedding can be constructed:

(1) $(\sigma \models \alpha) \Rightarrow$ (('σ is embedded into α') ∧ ('α is embedded into σ'))

(2) $(\sigma \models \alpha) \Rightarrow ((\sigma, \alpha \mathrel{\llcorner} \mathfrak{E}) \wedge (\mathfrak{E} \mathrel{\llcorner} \varepsilon))$

(3) $(\alpha \dashv \sigma) \Rightarrow ((\mathfrak{E} \mathrel{\lrcorner} \alpha, \sigma) \wedge (\varepsilon \mathrel{\lrcorner} \mathfrak{E}))$

(4) $((\sigma \models \alpha) \mathrel{\llcorner} \mathfrak{E}, \varepsilon) \Rightarrow ((\mathfrak{E} \equiv \mathfrak{E}_{\sigma,\alpha}) \wedge (\varepsilon \equiv \mathfrak{E}_{\sigma,\alpha}(\sigma, \alpha))$

(5) $(\varepsilon, \mathfrak{E} \mathrel{\lrcorner} (\alpha \dashv \sigma)) \Rightarrow ((\mathfrak{E} \equiv \mathfrak{E}_{\alpha,\sigma}) \wedge (\varepsilon \equiv \mathfrak{E}_{\alpha,\sigma}(\sigma, \alpha))$

(6) $(\sigma \models \alpha) \Rightarrow ((\varepsilon \subset \alpha) \wedge (\sigma \not\subset \alpha))$

(7) $(\sigma \models \alpha) \Rightarrow (\varepsilon \therefore \sigma, \alpha)$

etc. It is evident that the so-called axioms of informational embedding can be constructed indefinitely, for instance, by using the principle of particularization, etc. ■

Let us comment the listed axioms. In general, if σ informs α, then an informational interaction between σ and α occurs in the form that σ and α are simultaneously embedded in each other. This fact is easily understood in the case of a living being, where sensory and, for instance, perceptual (or cortical) information influence each other. If σ informs α in one (2) or another way (3), then informational embedding $\mathfrak{E}$ arises from σ and α and information of embedding ε appears as a consequence of embedding as Informing. If σ informs α in one (4) or another way (5) and this Informing causes the appearance of embedding $\mathfrak{E}$ and information of embedding ε, then in one case (4) the embedding is equivalent to $\mathfrak{E}_{\sigma,\alpha}$ and information of embedding is equivalent to $\varepsilon_{\sigma,\alpha}$, and in another case (5) the embedding is equivalent to $\mathfrak{E}_{\alpha,\sigma}$ and information of embedding is equivalent to $\varepsilon_{\alpha,\sigma}$. If σ informs α (6), then ε becomes a part (⊂) of α, however σ is not a part (⊄) of α. Simultaneously, ε is similar to σ as well as α (7).

It is certainly possible to introduce the explicit informational operator of embedding, for instance $\models_{\mathfrak{E}}$, which could be even more comprehensible than its implicit (functional) counterpart, denoted by $\mathfrak{E}_{\alpha,\alpha}(\sigma)$. The meaning of this implicit case is 'σ is in the process to be embedded into α by α'.

II.3.1.9. Axioms of Informational Embedding of Counter-Information

In contrary to sensory information, counter-information is a product of information itself. It appears as a kind of inward sensory information, which has to be perceived by information itself. This self-perception is performed through the process of embedding $\mathfrak{E}$.

[Axioms]^{DF13}:
In this axiom we use the following symbols: α is information which informs, however, also informs in itself. ω is counter-information which comes into existence through self-Informing of information α. Further, $\mathfrak{C}$ denotes counter-Informing within α and $\mathfrak{E}$ denotes the process of embedding performed by α. The following axioms of informational embedding of counter-information are only a few of possible ones:

(1) $(\alpha \models \alpha) \quad \Rightarrow \quad ((\alpha \mathrel{\text{L}} \omega) \wedge (\alpha \models_{\mathfrak{E}} \omega))$

(2) $(\alpha \Dashv \alpha) \quad \Rightarrow \quad ((\omega \mathrel{\lrcorner} \alpha) \wedge (\omega \Dashv_{\mathfrak{E}} \alpha))$

(3) $(\alpha \models \alpha) \quad \Rightarrow \quad ((\alpha \models_{\mathfrak{C}} \omega) \wedge (\alpha \models_{\mathfrak{E}} \omega))$

(4) $(\alpha \Dashv \alpha v \quad \Rightarrow \quad ((\omega \Dashv_{\mathfrak{C}} \alpha) \wedge (\omega \Dashv_{\mathfrak{E}} \alpha))$

(5) $(\alpha \mathrel{\text{L}} \omega) \quad \Rightarrow$

$$((\alpha \models \mathfrak{C}_{\alpha}(\omega)) \wedge (\alpha \models \mathfrak{E}_{\alpha,\alpha}(\omega)))$$

(6) $(\omega \mathrel{\lrcorner} \alpha) \quad \Rightarrow$

$$((\mathfrak{C}_{\alpha}(\omega) \Dashv \alpha) \wedge (\mathfrak{E}_{\alpha,\alpha}(\omega) \Dashv \alpha))$$

etc. The axioms (3), (4), (5), and (6) bring the so-called cyclic (also circular) nature of information in the foreground, when information is understood as a cyclic process of counter-Informing and embedding of information. ■

The following comments to the last axioms are possible: If information α informs in itself in one (1) or another way (2), then, from α or by α, counter-information ω is coming into existence and this counter-information is embedded in α in one ($\models_{\mathfrak{E}}$) or another way ($\Dashv_{\mathfrak{E}}$). If information α informs in one (3) or another way (4), then α counter-informs counter-information ω in one ($\models_{\mathfrak{C}}$) or another way ($\Dashv_{\mathfrak{C}}$) and embeds counter-information ω in one ($\models_{\mathfrak{E}}$) or another way ($\Dashv_{\mathfrak{E}}$). If α causes the appearance of counter-information ω in one (5) or another way (6), then information α informs its own counter-Informing $\mathfrak{C}_{\alpha}(\omega)$ in one or another way and informs its own informational embedding $\mathfrak{E}_{\alpha,\alpha}(\omega)$ in one or another way. The last four axioms constitute the cyclic nature of arising informational entities.

II.3.1.10. Axioms of Informational Differentiation

Differentiation of information is an inherent property of information which informs and is informed. Differentiation is not only informational arising, but arising of informational difference in comparison to the present state or processing of an informational entity. Differentiation is a component of informational arising with the intention to arise differently to existing information. The consequence of this fact is that information arises differently. To enter into the discourse concerning informational differentiation, we can introduce two basic and general differential operators which govern the so-called explicit and implicit informational differentiation.

[Operators]^{DF45}:
The explicit informational operator of differentiation can be determined in the following way:

$(\models_{\mathfrak{D}} \vee \Dashv_{\mathfrak{D}}) \quad =_{Df}$ ('differentiates') $\vee$
('differentiate') $\vee$
('is_differentiated(_by)') $\vee$
('are_differentiated(_by)')

The implicit informational operator of differentiation can be determined as

$$\mathfrak{D}_{\alpha,\beta,\ldots,\gamma}(\xi, \eta, \ldots, \zeta)$$

with the following meaning: $\alpha, \beta, \ldots, \gamma$ differentiate $\xi, \eta, \ldots, \zeta$ or $\xi, \eta, \ldots, \zeta$ are differentiated by $\alpha, \beta, \ldots, \gamma$. ■

[Operators]^{EX14}:
To clear the meaning of the explicit informational operator of differentiation let us look at the following examples:

$\alpha \models_{\mathfrak{D}}$ information α differentiates (or α has the function of an informational differentiation);

$\models_{\mathfrak{D}} \alpha$ information α is differentiated;

$\alpha \models_{\mathfrak{D}} \beta$ information α differentiates information β or information β is differentiated by information α;

$\alpha, \beta, \ldots, \gamma \models_{\mathfrak{D}} \xi, \eta, \ldots, \zeta$

informational entities $\alpha, \beta, \ldots, \gamma$ differentiate informational entities $\xi, \eta, \ldots, \zeta$ or $\xi, \eta, \ldots, \zeta$ are differentiated by $\alpha, \beta, \ldots, \gamma$ etc.

This general case of informational differentiation ($\models_{\mathfrak{D}}$) can certainly be determined also for parallel, cyclical, and parallel-cyclical cases ($\Vdash_{\mathfrak{D}}$, $\vdash_{\mathfrak{D}}$, and $\Vvdash_{\mathfrak{D}}$). ■

[Axioms]^{DF14}:

(1) $((\alpha \models) \vee (\models \alpha)) \quad \Rightarrow \quad ((\alpha \models_{\mathfrak{D}}) \vee (\models_{\mathfrak{D}} \alpha))$

(2) $((\Dashv \alpha) \vee (\alpha \Dashv)) \quad \Rightarrow \quad ((\Dashv_{\mathfrak{D}} \alpha) \vee (\alpha \Dashv_{\mathfrak{D}}))$

(3) $(\alpha \models \alpha) \quad \Rightarrow \quad (\alpha \models_{\mathfrak{D}} \alpha)$

(4) $(\alpha \models \beta) \quad \Rightarrow \quad (\alpha, \beta \models_{\mathfrak{D}} \alpha, \beta)$

etc. The last axiom can be constructed from a more general one, namely from,

$$(\alpha \models \beta) \quad \Rightarrow \quad (\alpha, \beta \models \alpha, \beta)$$

by the non-uniform substitution of the second operator, i.e., by its particularization. ■

Through informational differentiation of information also several differences can be determined. These differences can be marked by special symbols. For instance,

$$\delta_{\alpha,\beta,\ldots,\gamma}(\xi, \eta, \ldots, \zeta) \quad \equiv \quad ((\alpha, \beta, \ldots, \gamma \models \xi, \eta, \ldots, \zeta) \vee (\xi, \eta, \ldots, \zeta \Dashv \alpha, \beta, \ldots, \gamma))$$

This formula shows the possibilities of conversion between implicit and explicit informational operators, where marking of a difference becomes equivalent to the result of an implicit operation. For instance,

$$\delta_{\alpha,\beta,\ldots,\gamma}(\xi, \eta, \ldots, \zeta) \quad \equiv \quad \mathfrak{D}_{\alpha,\beta,\ldots,\gamma}(\xi, \eta, \ldots, \zeta)$$

II.3.1.11. Axioms of Informational Integration

Integration of information is an inherent property of information which informs and is informed. By integration the incoming, arriving, and arising information is informationally integrated into source information or into information in question. Informational integration is a consequence of the appearing information which has to be integrated into an existing informational realm, otherwise it will be lost as informational noise. Similarly as in the case of differentiation, it is possible to introduce two basic and general operators of integration which govern the so-called explicit and implicit informational integration.

[Operators]^{DF46}:
One kind of the explicit informational operator of integration can be determined in the following way:

$$(\models_{\mathfrak{Z}} \vee \;\dashv_{\mathfrak{Z}}) \;=_{Df}\; (\text{'integrates'}) \vee (\text{'integrate'}) \vee (\text{'is\_integrated(\_by)'}) \vee (\text{'are\_integrated(\_by)'})$$

The primitive implicit informational operator of integration can be determined as

$$\mathfrak{Z}_{\alpha,\beta,\ldots,\gamma}(\xi, \eta, \ldots, \zeta)$$

with the following meaning: $\alpha, \beta, \ldots, \gamma$ integrate $\xi, \eta, \ldots, \zeta$ or $\xi, \eta, \ldots, \zeta$ are integrated by $\alpha, \beta, \ldots, \gamma$ into $\alpha, \beta, \ldots, \gamma$. Evidently, the operators $\models_{\mathfrak{Z}}$, $\dashv_{\mathfrak{Z}}$, and $\mathfrak{Z}$ integrate the given information into the integrating information itself. At this point a clear difference between differentiation and integration comes into the foreground.

Certainly, the complete implicit informational operator of integration can be determined in the following way:

$$\mathfrak{Z}_{[\lambda,\mu,\ldots,\nu]\alpha,\beta,\ldots,\gamma}(\xi, \eta, \ldots, \zeta)$$

The meaning of this implicit operator is as follows: informational entities $\alpha, \beta, \ldots, \gamma$ integrate informational entities $\xi, \eta, \ldots, \zeta$ into informational entities $\lambda, \mu, \ldots, \nu$. ■

[Operators]^{DF47}:
Now, we have to define an informational operator of location with the meaning "into", to enable the expression of this particular need, for instance, to be integrated "into" information. This operator has to be of explicit informational type, for difficulties of expressing the process concerning the "into" occur, for instance, by the use of the operator $\models_{\mathfrak{Z}}$. We have:

$$\mathbb{I} \;=_{Df}\; (\text{'into'})$$

Further, we can introduce the left to the right and the opposite version of this operator by

$$\mathbb{I}_{\rightarrow} \quad \text{and} \quad \mathbb{I}_{\leftarrow}$$

respectively. The proposed operator is general and introduces substantial semantics into our further discourse. ■

[Operator]^{RX15}:
In the explicit case the informational operator of integration $\models_{\mathfrak{Z}}$ the need has arisen to express into which informational entity information will be integrated. We have now the following possibility:

$$\alpha \models_{\mathfrak{Z}} \beta \;\mathbb{I}_{\rightarrow}\; \gamma \quad \text{or} \quad \gamma \;\mathbb{I}_{\leftarrow}\; \beta \dashv_{\mathfrak{Z}} \alpha$$

The meaning is the following: information α integrates information β in one or another way into information γ. By the operator $\mathbb{I}$ we can even capture the most subtle phenomenon of coming of information into existence. Thus, we can decompose the operator L to some degree by splitting its meaning into "coming_of' ($\models_{come}$) and 'into'. We can introduce the following implication:

$$(\mathsf{L}\ \alpha) \;\Rightarrow\; ((\models_{come}\ \alpha)\ \mathbb{I}\ \alpha) \qquad ■$$

At this point the question what is existence can arise. "Existence" has the meaning of information of existence or of *existing* information. Similarly, "coming" has the meaning of information which comes or of *coming* information. This kind of information is, for instance, counter-information or sensory information. Coming of information into existence is, for instance, embedding of the arisen counter-information into the existing information. Here, coming into existence concerns informational differentiation as well as informational integration. In other words, arising of information is nothing else but counter-Informing and embedding or differentiation and integration of information. These two types of Informing constitute the so-called informational cycle, which is the cycle of coming into existence: from the existing information arises the counter-information and is embedded again into the existing information, enlarging (or decreasing) its informational realm. This informational cycling is the fundamental process of any informational arising. Therefore, we can say that information informs (differentiates) and is informed (integrates) cyclically or, in a more general sense, circularly.

[Operators]^{RX16}:
Let us clear the meaning of the explicit informational operator of integration in composition with the informational operator 'into'. We can list the following examples:

$\alpha \models_{\mathfrak{Z}}$ or $(\alpha \models_{\mathfrak{Z}})\ \mathbb{I}\ \alpha$

information α integrates or information α integrates into itself;

$\models_{\mathfrak{Z}} \alpha$ or $(\models_{\mathfrak{Z}} \alpha)\ \mathbb{I}\ \alpha$

information α is integrated or information α is integrated into itself;

$\alpha \models_{\mathfrak{Z}} \beta$ or $(\alpha \models_{\mathfrak{Z}} \beta)\ \mathbb{I}\ \gamma$

information α integrates information β or information α integrates information β into information γ; the last formula can also be read as information β is integrated by information α into information γ;

$\alpha, \beta, \ldots, \gamma \models_{\mathfrak{J}} \xi, \eta, \ldots, \zeta$ or

$(\alpha, \beta, \ldots, \gamma \models_{\mathfrak{J}} \xi, \eta, \ldots, \zeta) \mathbf{I}$
$\lambda, \mu, \ldots, \nu$

informational entities $\alpha, \beta, \ldots, \gamma$ integrate informational entities $\xi, \eta, \ldots, \zeta$ or informational entities $\alpha, \beta, \ldots, \gamma$ integrate informational entities $\xi, \eta, \ldots, \zeta$ into informational entities $\lambda, \mu, \ldots, \nu$; the last formula can also be read as informational entities $\xi, \eta, \ldots, \zeta$ are integrated by informational entities $\alpha, \beta, \ldots, \gamma$ into informational entities $\lambda, \mu, \ldots, \nu$, etc.

These cases of informational integration, using the explicit operator $\models_{\mathfrak{J}}$, can certainly be determined also for parallel, cyclical, and parallel-cyclical cases ($\Vdash_{\mathfrak{J}}$, $\vdash_{\mathfrak{J}}$, and $\Vvdash_{\mathfrak{J}}$). ■

[Axioms]^{DF15}:

(1) $((\alpha \models) \lor (\models \alpha)) \Rightarrow ((\alpha \models_{\mathfrak{J}}) \lor (\models_{\mathfrak{J}} \alpha))$

(2) $((\dashv \alpha) \lor (\alpha \dashv)) \Rightarrow ((\dashv_{\mathfrak{J}} \alpha) \lor (\alpha \dashv_{\mathfrak{J}}))$

(3) $(\alpha \models \alpha) \Rightarrow ((\alpha \models_{\mathfrak{J}} \alpha) \mathbf{I} \alpha))$

(4) $(\alpha \models \beta) \Rightarrow ((\alpha, \beta \models_{\mathfrak{J}} \alpha, \beta) \mathbf{I} \alpha, \beta))$

etc. The last axiom could be constructed from a more general one, namely, from

$$(\alpha \models \beta) \Rightarrow ((\alpha, \beta \models \alpha, \beta) \models \alpha, \beta))$$

by the non-uniform substitution of operators (e.g. particularization of the second operator on the left side of implication). ■

[Axioms]^{EX2}:
The axiom (4) in the last definition can be decomposed in details in the following way:

$$\begin{aligned}(\alpha \models \beta) \Rightarrow\ & (((\alpha \models_{\mathfrak{J}} \alpha) \mathbf{I} \alpha) \lor \\ & ((\alpha \models_{\mathfrak{J}} \beta) \mathbf{I} \alpha) \lor \\ & ((\beta \models_{\mathfrak{J}} \alpha) \mathbf{I} \alpha) \lor \\ & ((\beta \models_{\mathfrak{J}} \beta) \mathbf{I} \alpha) \lor \\ & ((\alpha \models_{\mathfrak{J}} \alpha) \mathbf{I} \beta) \lor \\ & ((\alpha \models_{\mathfrak{J}} \beta) \mathbf{I} \beta) \lor \\ & ((\beta \models_{\mathfrak{J}} \alpha) \mathbf{I} \beta) \lor \\ & ((\beta \models_{\mathfrak{J}} \beta) \mathbf{I} \beta))\end{aligned}$$

This is the well-known principle of the iwff decomposition. The so-called parallel decomposition of the last case would be as follows:

$$\begin{aligned}(\alpha \models \beta) \Rightarrow\ & ((\alpha \Vdash_{\mathfrak{J}} \alpha) \mathbf{I} \alpha, (\alpha \Vdash_{\mathfrak{J}} \beta) \mathbf{I} \alpha, \\ & (\beta \Vdash_{\mathfrak{J}} \alpha) \mathbf{I} \alpha, (\beta \Vdash_{\mathfrak{J}} \beta) \mathbf{I} \alpha, \\ & (\alpha \Vdash_{\mathfrak{J}} \alpha) \mathbf{I} \beta, (\alpha \Vdash_{\mathfrak{J}} \beta) \mathbf{I} \beta, \\ & (\beta \Vdash_{\mathfrak{J}} \alpha) \mathbf{I} \beta, (\beta \Vdash_{\mathfrak{J}} \beta) \mathbf{I} \beta)\end{aligned}$$

This example is in fact the axiom of the parallel decomposition of the case $\alpha \models \beta$. ■

II.3.12. Axioms of Informational Particularization and Universalization

In informational logic iwffs can be particularized and universalized. This principle permits various substitutions of explicit operators, enabling specialization (particularization) and generalization (universalization) of informational formulae. Processes of informational particularization and universalization are the basic, i.e. axiomatic properties of an iwff. These processes could be included as well into the domain of the so-called transformation rules, for through their application, formulae are transformed from original semantic domains into other special or general ones.

[Axioms]^{DF16}:

(1) ('α is iwff') $\Rightarrow$ ('$\mathfrak{P}(\alpha)$ is iwff')

(2) ('$\models_{con}$ is sub-iwff') $\Rightarrow$ ('$\mathfrak{P}(\models_{con})$ is sub-iwff')

(3) $(\alpha \models \beta) \Rightarrow (\alpha\ \mathfrak{P}(\models)\ \beta)$

(4) $(\beta \dashv \alpha) \Rightarrow (\beta\ \mathfrak{P}(\dashv)\ \alpha)$

(5) $\mathfrak{P}(\alpha \models \beta) \Rightarrow (\mathfrak{P}(\alpha)\ \mathfrak{P}(\models)\ \mathfrak{P}(\beta))$

(6) $\mathfrak{P}(\beta \dashv \alpha) \Rightarrow (\mathfrak{P}(\beta)\ \mathfrak{P}(\dashv)\ \mathfrak{P}(\alpha))$

etc. In fact, particularization is an implicit informational operation. Further, the symbol $\mathfrak{P}$ can be used for particularization ($\mathfrak{P}_{\downarrow}$) as well as for universalization ($\mathfrak{P}^{\uparrow}$) of formulae. Particularization is always a non-uniform operation in regard to substitution of operators. By particularization and universalization new semantics of operators and formulae is generated. Particularization and universalization belong to the most essential principles of informational arising. ■

II.3.13. Axioms of Informational Formula

We have already determined the so-called formation rules of iwffs. However, this rules do not ensure the constructibility of a formula which has to interpret a natural or an artificial information. We would like to know, at least hypothetically, if we do not need to take care about the nature of information which has to be formalized or put into the form of an iwff. Thus, the following questions may sound quite naturally: What kind of information can be put into the form of an informational formula? How can information be put into an adequate form of a formula? Is this form in case of information a unique or a multiplex one?

[Axioms]^{DF17}:
Let α denote an arbitrarily complex information. Let informational formula be denoted as an informationally well-formed formula (iwff). Then the following basic axiom is adopted, concerning the possibility of forming an informational formula from given information:

$(\forall\alpha)$.(('α is information') $\Rightarrow$
(∃('iwff').
('α can be put into the form of an iwff')))

This axiom says: for each α, which is information, irrespective of its complexity and informational nature, there exists at least one iwff such that (.) information can be put into the form of this iwff.

$(\forall\alpha)$.(('α is information') $\Rightarrow$
(∃('iwff').
('iwff is an adequate interpretation of α')))

This axiom says: for each α, which is information, irrespective of its complexity and informational nature, there exists at least one iwff such that this iwff is an adequate interpretation of information in question. We can understand that formal interpretation of a given information is never unique and that it depends on informational circumstances. In general, there exist (indefinitely) many interpretations of a given information.

$(\forall\alpha)$.(('α is information') $\Rightarrow$
(∃('iwff').
('iwff interprets α by an informational system of one or several sequences of informational operands and operators')))

This axiom assures the constructibility of the iwff which interprets adequately the given information α.

These three axioms can be certainly expressed in a much more symbolically compact form, for instance:

$$(\forall\alpha).(((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\exists\varphi).((\alpha \models \varphi) \vee (\varphi \dashv_{ade} \alpha)) \vee (\exists\ \varphi_1, \varphi_2, \ldots, \varphi_n).(\varphi_1, \varphi_2, \ldots, \varphi_n \dashv \alpha)))$$

where φ symbolizes iwff, $\dashv_{ade}$ is informational operator of adequate interpretation, and each of the three conjuctive parts on the right side of implication concerns one of the three axioms. ■

II.3.14. Axioms of Informational Structure and Informational Organization

What are informational structure and informational organization and how do they reflect in informational axiomatization? To answer this question we have to consider the principle of informational structure and informational organization ([4] or [10]) as follows:

"Informational structure is a constitution of information, that is, a constitution of informational forms and informational processes that are composed as information. These forms and processes are informational components. The informational relations among informational components which determine a composite information constitute informational organization. In terms of informational epistemology, informational structure is closer to the form, whereas informational organization is closer to the process. Within information, informational forms and informational processes are informationally interwoven components. Informational components integrate information. Informational structure and informational organization are information by themselves."

What are forms and processes constituting a particular informational case? Speaking in the language of informational formulae, these forms and processes are informational operands and operators, where forms are, for instance, self-standing operands and processes are formally grouped (parenthesized) operands and operators. In this respect, informational structure appears as a more or less pure syntactic structure.

We suppose that given information always has a structure. This structure, which is observed as information concerning the structure of information in question, can always be interpreted through an iwff in a simple informational case or through an informational system of iwffs in a complex informational case. The structure of information is interpreted in iwffs by particular informational forms and processes, consisting of informational operands and operators. It is possible to list several axioms concerning the structure of information, for instance:

[Axioms]^{DF18}:

(1) $(\forall\alpha)$.(('α is information') $\Rightarrow$
((∃σ).('σ interprets the syntactic nature of information α')))

In this axiom, σ denotes information concerning the structure of information α.

(2) $(\forall\alpha)$.(('α is structured information') $\Rightarrow$
((∃φ).('α is interpreted by an adequately syntactically structured φ')))

In this and in the next axioms, φ marks the so-called iwff.

(3) $(\forall\alpha)$.(('α is information') $\Rightarrow$
((∃φ).('φ as information syntactically constitutes information α')))

(4) $(\forall\alpha)$.(('α is information') $\Rightarrow$
((∃φ).('φ interprets the syntactic structure of information α')))

etc. These axioms constitute the so-called structural hypothesis of information. This hypothesis, in fact, is the informational principle of structural constructibility of information and its adequate iwff. Here iwff is understood to be an informational system or any form of informationally connected iwffs. ■

The structure of information α is information which concerns the componential syntax of α.

This syntax is interpreted into the structure of iwff of α. Structural interpretation of α onto its iwff does not represent the sufficient condition for a completely adequate interpretation of α by its iwff. The second component, called informational organization of α, has to be considered when the iwff adequate to α is constructed.

While the structure of information predominantly concerns the so-called syntax or form of componential constitution of information, organization of information predominantly concerns the so-called semantics or componential processes, relations, and informational interweaving of informational processes. Among possible interweaving of informational forms and processes within information, the most important seems to be informational parallelism, which is the synonym for interweaving nature of informational forms and processes. It becomes evident that information, by its nature, is nothing else but extremely interwoven structure (topology, granularity) and organization (selectivity, relationship) of information.

[Axioms]^{DF19}:

(1) $(\forall\alpha)$.(('α is information') $\Rightarrow$ (($\exists\omega$).('ω interprets the semantic nature of information α')))

In this axiom, ω denotes information concerning the organization of information α.

(2) $(\forall\alpha)$.(('α is organized information') $\Rightarrow$ (($\exists\varphi$).(('α is interpreted by an adequately semantically organized φ') $\vee$ ('φ semantically interprets α as informational organization'))))

In this and in the next axioms, φ marks the so-called iwff.

(3) $(\forall\alpha)$.(('α is information') $\Rightarrow$ (($\exists\varphi$).('φ as information semantically constitutes information α')))

(4) $(\forall\alpha)$.(('α is information') $\Rightarrow$ (($\exists\varphi$).('φ interprets the semantic organization of information α')))

etc. ■

[Axioms]^{EX3}:

The axioms [Axioms]^{DF18} and [Axioms]^{DF19} can be interpreted in a more symbolically compact and instructive manner. Let us construct the following implications:

(1) ('α is information') $\Rightarrow$ $((\alpha \models) \vee (\models \alpha))$

(2) ('σ interprets the syntactic nature of information α') $\Rightarrow$ $(\sigma \models \mathfrak{S}(\alpha))$

Instead of the consequence in the last implication it could be

$\sigma \models_{int} \mathfrak{S}(\alpha)$ or, conventionally, $\sigma = \mathfrak{S}(\alpha)$

$\mathfrak{S}(\alpha)$ has the meaning of 'syntactical, i.e. structural nature of α', whereas the operator $\models_{int}$ has the meaning of Informing by interpretation.

(3) ('α is structured information') $\Rightarrow$ $((\alpha \models \sigma) \wedge (\sigma \subset \alpha))$

If information α is structured, then it informs (gives, transmits) information σ of its structure ($\sigma \subset \alpha$).

(4) ('α is interpreted by an adequately syntactically structured φ') $\Rightarrow$ $((\sigma \subset \alpha) \wedge (\sigma \subset \varphi) \wedge (\varphi \therefore_{syn} \alpha))$

The iwff φ informs structurally (syntactically) similar (analogous) to information α. The iwff φ informs structurally similar (by means of the operator $\therefore_{syn}$) to α.

(5) ('φ as information syntactically constitutes information α') $\Rightarrow$ $(((\sigma \subset \alpha) \Rightarrow (\sigma \subset \varphi)) \wedge (\exists(\varphi \models).(\varphi \models_{syn} \alpha)))$

The iwff φ in fact constitutes also the structure of information α. The operator of this syntactic constitution is $\models_{syn}$. There exists such Informing of φ that φ syntactically informs α.

(6) ('φ interprets the syntactic structure of information α') $\Rightarrow$ $((\sigma \subset \alpha) \Rightarrow (\varphi \models_{syn} \alpha))$

(7) ('ω interprets the semantic nature of information α') $\Rightarrow$ $(\omega \models \mathfrak{A}(\alpha))$

Instead of the consequence in the last implication it could be

$\omega \models_{int} \mathfrak{A}(\alpha)$ or, conventionally, $\omega = \mathfrak{A}(\alpha)$

$\mathfrak{A}(\alpha)$ has the meaning of "semantic, i.e. organizational nature of α".

(8) ('α is organized information') $\Rightarrow$ $((\alpha \models \omega) \wedge (\omega \subset \alpha))$

If information α is organized, then it informs (gives, transmits) information ω of its organization ($\omega \subset \alpha$).

(9) (('α is interpreted by an adequately semantically organized φ') $\vee$ ('φ semantically interprets α as informational organization')) $\Rightarrow$ $((\omega \subset \alpha) \wedge (\omega \subset \varphi) \wedge (\varphi \therefore_{sem} \alpha))$

The iwff φ informs organizationally (semantically) similar (analogous) to information α. The iwff φ informs organizationally similar (by means of the operator $\therefore_{sem}$) to α.

(10) ('φ as information semantically constitutes information α') $\Rightarrow$

$$(((\omega \subset \alpha) \Rightarrow (\omega \subset \varphi)) \wedge (\exists(\varphi \models).(\varphi \models_{sem} \alpha)))$$

The iwff φ in fact constitutes also the organization of information α. The operator of this syntactic constitution is $\models_{sem}$. There exists such Informing of φ that φ semantically informs α.

(11) ('φ interprets the semantic organization of information α') $\Rightarrow$

$$((\omega \subset \alpha) \Rightarrow (\varphi \models_{sem} \alpha))$$

Considering implications (1)-(11), [Axioms]$^{\mathrm{DF18}}$ and [Axioms]$^{\mathrm{DF19}}$ can be rewritten in the following manner:

(1) $(\forall\alpha).(((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\exists\sigma).(\sigma \models \mathfrak{S}(\alpha))))$

(2) $(\forall\alpha).(((\alpha \models \sigma) \wedge (\sigma \subset \alpha)) \Rightarrow ((\exists\varphi).((\sigma \subset \alpha) \wedge (\sigma \subset \varphi) \wedge (\varphi \therefore_{syn} \alpha))))$

(3) $(\forall\alpha).(((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\exists\varphi).(((\sigma \subset \alpha) \Rightarrow (\sigma \subset \varphi)) \wedge (\exists(\varphi \models).(\varphi \models_{syn} \alpha))))$

(4) $(\forall\alpha).(((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\exists\varphi).((\sigma \subset \alpha) \Rightarrow (\varphi \models_{syn} \alpha))))$

etc. Further, for [Axioms]$^{\mathrm{DF19}}$ there is:

(1) $(\forall\alpha).(((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\exists\omega).(\omega \models \mathfrak{O}(\alpha))))$

(2) $(\forall\alpha).(((\alpha \models \omega) \wedge (\omega \subset \alpha)) \Rightarrow ((\exists\varphi).((\omega \subset \alpha) \wedge (\omega \subset \varphi) \wedge (\varphi \therefore_{sem} \alpha)))))$

(3) $(\forall\alpha).(((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\exists\varphi).(((\omega \subset \alpha) \Rightarrow (\omega \subset \varphi)) \wedge (\exists(\varphi \models).(\varphi \models_{sem} \alpha)))))$

(4) $(\forall\alpha).(((\alpha \models) \vee (\models \alpha)) \Rightarrow ((\exists\varphi).(((\omega \subset \alpha) \Rightarrow (\omega \subset \varphi)) \wedge (\exists(\varphi \models).(\varphi \models_{sem} \alpha)))))$

etc. ■

The axioms [Axioms]$^{\mathrm{DF18}}$ and [Axioms]$^{\mathrm{DF19}}$ assure the existence of an adequate (informationally complete) interpretation of any information α onto its iwff φ in the sense of informational structure σ and informational organization ω. This leads to the fundamentally important axioms of constructibility of iwffs for arbitrarily occurring informational cases.

[Axioms]$^{\mathrm{DF20}}$:

The axioms which follow govern the interpretation of information α onto the structure σ and organization ω of an iwff (or of a system of iwffs) φ, which models α in the informationally complete way. The process of constructing iwff from given information can be expressed in the following manner:

$$\alpha \models \sigma, \quad \alpha \models \omega, \quad \sigma, \omega \models \varphi$$

The consequence of this system is $\alpha \models \varphi$. The construction of iwff φ from α is a parallel informational system which assures the so-called formalization of information α onto iwff φ. Thus, the last system can be particularized in the form

$$\alpha \Vdash \sigma, \quad \alpha \Vdash \omega, \quad \sigma, \omega \Vdash \varphi$$

The consequence of this system is $\alpha \Vdash \varphi$. Further particularization is possible:

$$\alpha \Vdash_{syn} \sigma, \quad \alpha \Vdash_{sem} \omega, \quad \sigma, \omega \Vdash_{form} \varphi$$

The consequence of this system is $\alpha \Vdash_{form} \varphi$. ■

II.3.15. Axioms of Informational Parallelism

Information is a parallel informational phenomenon in itself as well as in its interaction with other or outside information. It means that its forms and its processes appear, inform, change, vanish, etc. in a parallel manner. In this phenomenology, parallelism can be understood not only topologically and temporally, but also symbolically, abstractly, expressively. The basic question might be how information is performing parallel in itself. Why is informational interaction in fact always a parallel Informing? Thus, these conclusions (or beliefs) can be axiomatically framed in the following axioms:

[Axioms]$^{\mathrm{DF21}}$:

(1) ('α is information') $\Rightarrow$

$$(((\alpha \Vdash) \vee (\Vdash \alpha)) \vee ((\dashV \alpha) \vee (\alpha \dashV)))$$

If α is information, then it informs and is informed in parallel in one or another way. This fact can be expressed also in the form of parallel informational system, i.e.,

('α is information') $\Rightarrow$

$$(\alpha \Vdash, \Vdash \alpha, \dashV \alpha, \alpha \dashV)$$

(2) $(\forall\alpha).(('\alpha \text{ is information}') \Rightarrow (\exists(\mathfrak{C}_\alpha, \mathfrak{E}_\alpha).(\mathfrak{C}_\alpha \Vdash, \Vdash \mathfrak{C}_\alpha, \mathfrak{E}_\alpha \Vdash, \Vdash \mathfrak{E}_\alpha)))$

If α is information, then there exist counter-Informing caused by α, $\mathfrak{C}_\alpha$, and informational embedding of α, $\mathfrak{E}_\alpha$, which inform in parallel. This Informing of $\mathfrak{C}_\alpha$ and $\mathfrak{E}_\alpha$ is an immanent property of parallelism of information. As we have already recognized, counter-Informing and embedding of counter-information constitute the so-called basic informational cycle (informational cyclicity). It also follows from the last axiom that counter-Informing and informational embedding within information α perform as information.

(3) $(\forall\alpha).(('\alpha \text{ is information}') \Rightarrow (\exists(\mathfrak{C}_\alpha, \mathfrak{E}_\alpha).(\alpha \Vdash \mathfrak{C}_\alpha(\alpha), \alpha, \mathfrak{C}_\alpha(\alpha) \Vdash \mathfrak{E}_\alpha(\mathfrak{C}_\alpha(\alpha)))))$

where $\mathfrak{C}_\alpha(\alpha)$ is in fact counter-information ω produced by counter-Informing $\mathfrak{C}_\alpha$ and $\mathfrak{E}_\alpha(\mathfrak{C}_\alpha(\alpha))$ is the embedding of the produced counter-information ω into α.

(4) The most complex informational system of inward informational parallelism can be axiomatized by the following iwff:

$$(\forall\alpha).((\text{'}\alpha \text{ is information'}) \Rightarrow \\ ((\alpha, \mathfrak{I}_\alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha \VDash \alpha, \mathfrak{I}_\alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha) \vee \\ (\alpha, \mathfrak{I}_\alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha \Dashv \alpha, \mathfrak{I}_\alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha)))$$

The parallel decomposition of the first disjunctive iwff part on the right side of implication is

$$\begin{array}{lllll} \alpha \VDash \alpha, & \alpha \VDash \mathfrak{I}_\alpha, & \alpha \VDash \mathfrak{C}_\alpha, & \alpha \VDash \omega, & \alpha \VDash \mathfrak{E}_\alpha, \\ \mathfrak{I}_\alpha \VDash \alpha, & \mathfrak{I}_\alpha \VDash \mathfrak{I}_\alpha, & \mathfrak{I}_\alpha \VDash \mathfrak{C}_\alpha, & \mathfrak{I}_\alpha \VDash \omega, & \mathfrak{I}_\alpha \VDash \mathfrak{E}_\alpha, \\ \mathfrak{C}_\alpha \VDash \alpha; & \mathfrak{C}_\alpha \VDash \mathfrak{I}_\alpha, & \mathfrak{C}_\alpha \VDash \mathfrak{C}_\alpha, & \mathfrak{C}_\alpha \VDash \omega, & \mathfrak{C}_\alpha \VDash \mathfrak{E}_\alpha, \\ \omega \VDash \alpha, & \omega \VDash \mathfrak{I}_\alpha, & \omega \VDash \mathfrak{C}_\alpha, & \omega \VDash \omega, & \omega \VDash \mathfrak{E}_\alpha, \\ \mathfrak{E}_\alpha \VDash \alpha, & \mathfrak{E}_\alpha \VDash \mathfrak{I}_\alpha, & \mathfrak{E}_\alpha \VDash \mathfrak{C}_\alpha, & \mathfrak{E}_\alpha \VDash \omega, & \mathfrak{G}_\alpha \VDash \mathfrak{E}_\alpha \end{array}$$

(5) $(\alpha \models \beta) \Rightarrow (\alpha, \beta \VDash \alpha, \beta)$

etc. ■

II.3.16. Axioms of Informational Cyclicity

Information is a cyclic informational phenomenon in itself as well as in its interaction with other or outward information. It means that informational forms and informational processes appear, inform, change, vanish, etc. in a cyclic manner. Cyclicity of information can be viewed to be purely serial, parallel, or serial-parallel phenomenon. The last case seems to be the most obvious one. Within this phenomenology, cyclicity can be understood not only topologically and temporally, but also symbolically, abstractly, expressively. The basic question is how information performs cyclically in itself. Why informational interaction is in fact always a cyclic Informing? Let us frame these observations axiomatically in the following manner:

$[\text{Axioms}]^{DF22}$:

(1) $$(\text{'}\alpha \text{ is information'}) \Rightarrow \\ (((\alpha \vdash) \vee (\vdash \alpha)) \vee ((\alpha \Vdash) \vee (\Vdash \alpha)) \vee \\ ((\dashv \alpha) \vee (\alpha \dashv)) \vee ((\dashV \alpha) \vee (\alpha \dashV)))$$

If α is information, then it informs and is informed cyclically and parallel-cyclically in such or another way. This fact can be expressed also in the form of parallel-cyclical informational system, i.e., in a particular form:

$$(\text{'}\alpha \text{ is information'}) \Rightarrow \\ (\dashv \alpha, \alpha \dashv, \dashV \alpha, \alpha \dashV)$$

(2) $$(\forall\alpha).((\text{'}\alpha \text{ is information'}) \Rightarrow \\ ((\alpha \models \mathfrak{C}_\alpha) \wedge (\alpha, \mathfrak{C}_\alpha \models \omega) \wedge \\ (\alpha, \mathfrak{C}_\alpha, \omega \models \mathfrak{E}_\alpha) \wedge (\alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha \models \alpha)))$$

This axiom determines the so-called inward informational cycle. The formula can be universalized in the following manner:

(3) $$(\forall\alpha).((\text{'}\alpha \text{ is information'}) \Rightarrow \\ ((((\alpha \vdash \mathfrak{C}_\alpha) \vdash (\alpha, \mathfrak{C}_\alpha \vdash \omega)) \vdash \\ (\alpha, \mathfrak{C}_\alpha, \omega \vdash \mathfrak{E}_\alpha)) \vdash (\alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha \vdash \alpha)))$$

In this formula it is possible to observe distinct cycles, i.e., also cycles within cycles, where for the right side of implication there is

$$(((\text{cycle}_1 \vdash \text{cycle}_2) \vdash \text{cycle}_3) \vdash \text{cycle}_4)$$

In this expression there are three more cycles, namely cycle_5 between cycle_1 and cycle_2, cycle_6 between cycle_5 and cycle_3, and cycle_7 between cycle_6 and cycle_4. All these cycles can be understood as cyclically parallel, thus:

(4) $$(\forall\alpha).((\text{'}\alpha \text{ is information'}) \Rightarrow \\ (\alpha \Vdash \mathfrak{C}_\alpha, (\alpha, \mathfrak{C}_\alpha \Vdash \omega), (\alpha, \mathfrak{C}_\alpha, \omega \Vdash \mathfrak{E}_\alpha), \\ (\alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha \Vdash \alpha))$$

This cyclic parallelism can be captured in the most complex form by the iwff

(5) $$(\forall\alpha).((\text{'}\alpha \text{ is information'}) \Rightarrow \\ (\alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha \Vdash \alpha, \mathfrak{C}_\alpha, \omega, \mathfrak{E}_\alpha))$$

(6) To explain the nature of informational cycle, the following auxiliary axioms can be adopted:

$$(\mathfrak{C}_\alpha \Vdash \alpha)\ \boldsymbol{\iota}\ \omega \quad \text{and} \quad (\mathfrak{E}_\alpha \Vdash \omega)\ \boldsymbol{\iota}\ \alpha$$

with the meaning $\omega = \mathfrak{C}_\alpha(\alpha)$ and $\mathfrak{E}_\alpha(\omega) \subset \alpha$, respectively.

Obviously, axiomatization of informational cyclicity can be continued indefinitely. ■

II.3.17. Openness of Informational Axiomatization

But taking the methodologies as an end in themselves is ultimately limiting in the same sense as the analytic tendency to take the arguments as an end in themselves.

Terry Winograd [12] 255

The axioms determined show the possibilities of their indefinite axiomatic continuation. Beside the already existing axiomatic cases new axiomatic interpretations are possible which concern an axiomatic type. In a similar way it is possible to add new axiomatic types to the existing ones. The consequence of these possibilities is that an axiomatic system remains open for new axiomatic determinations. Finally, it is possible to conclude that informational axiomatization irrespective of the informational system involved remains open in the described sense. To clear this informational phenomenon to some extent, we can put several principled questions concerning the structure, organization, parallelism, etc. of information.

The axiomatic basis of informational logic remains open. Principles of informational particularization and universalization contribute to an additional and constructively senseful component of keeping the axiomatic basis open. In fact, informational logic in its axiomatic nature performs as regular information. Thus, the exposed axiomatization in this essay is informational.

II.3.18. Informational Axioms and Metaphysical Beliefs

We want to expand our ability as observers, within a context in which we are not detached but are engaged in the practices we ourselves observe.

Terry Winograd [12] 255

It cannot be disputable that the listed informational axioms arise from a particular metaphysical disposition from which they are thrown into a broader professional, scientific, and certainly also philosophical discourse. Whichever theory comes into existence, it begins its march as a scientific or philosophical literature and in fact represents nothing more than an authorial telling of a story. This storytelling, which concerns informational axioms and processes of axiomatization of diverse informational principles, grounds in epoch-making beliefs, i.e. in the metaphysical background constituting the philosophy of the so-called information era. Again, metaphysics has to be understood as a totality of information spontaneously arising in a living being and within its population.

The awareness that axiomatization of informational principles grounds in metaphysical beliefs lets the processes of axiomatization be generative, indefinitely predictable, and open for further development. Such kind of axiomatization certainly does not fit properly into the hardly predestined realms of traditional and emphasized rationalistic science. Does the time come when new, non-traditional, and also non-rationalistic approach in exact sciences is becoming an evident advantage in the research of unrevealed possibilities?

II.3.19. Some Axiomatic Consequences of Informational Arising

At the end of section II.3, in which we have discussed informational axioms, it seems necessary to stress again the arising (or at least variable) nature of informational operands, operators, and formulae. Such as they are, all of the listed axioms in this essay concern the arising principle of occurring informational entities. Thus, this informational nature is found not only in the semantics of explicit informational operators but also in implicit informational operators and informational operands. By themselves, axioms are arising structures of informational formulae. In this respect the axiomatic consequences of informational arising can find their continuation in any construction of iwff.

References of IL I, II, and III

[1] H. L. Dreyfus and S. E. Dreyfus: *Mind over Machine.* The Free Press, Macmillan, New York 1986.

[2] A. P. Zeleznikar: *On the Way to Information.* Informatica 11 (1987), No. 1, 4-11.

[3] A. P. Zeleznikar: *Information Determinations I.* Informatica 11 (1987), No. 2, 3-17.

[4] A. P. Železnikar: *Principles of Information.* Informatica 11 (1987), No. 3, 9-17. [Published also in Cybernetica 31 (1988), 99-122.]

[5] A. P. Železnikar: *Information Determinations II.* Informatica 11 (1987), No. 4, 8-25.

[6] A. P. Železnikar: *Problems of Rational Understanding of Information.* Informatica 12 (1988), No. 2, 31-46.

[7] L. A. Steen (Editor): *Mathematics Today.* Twelve Informal Essays. Springer-Verlag. New York (Third Printing, 1984).

[8] E. de Bono: *The Mechanisms of Mind.* Penguin Books, Harmondsworth, Middlesex, England (Reprinted 1977).

[9] G.W.F. Hegel: *The Science of Logic.* In Hegel's Logic, being Part One of the Philosophical Sciences (1830), translated by W. Wallace. Oxford, At the Clarendon Press, reprinted 1985.

[10] A.P. Zeleznikar: *Principles of Information.* Cybernetica 31 (1988) 99-122.

[11] S. Schiffer: *Symposium on Remnants of Meaning: 1. Overview of the Book.* Mind and Language 3 (1988), No. 1, 1-8 (Basil Blackwell).

[12] T. Winograd: *On Understanding Computers and Cognition: A New Foundation for Design (A response to the reviews).* Artificial Intelligence 31 (1987) 250-261.