Informational Frames and Gestalts

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This article deals with two characteristic and widely useful notions, called the informational frame (of representation) and the informational gestalt. A preliminary discussion of both notions was already presented in [17]. Informational framing is nothing else than a part of informational gestaltism by which various causal possibilities of formulas come into existence. Although a frame is everything which can be put in a frame within a well-formed informational formula, the concatenation of frames must preserve the so-called possibility of a frame to be a part of a well-formed formula. On the other hand, the gestalt structure represents a parallel array of informational formulas, that is, an informational system of causally different formulas proceeding from a given formula. To this, circular gestalting can induce the reversely circular properties, so different forms of gestalts become possible. The most complex and free gestalt called star gestalt is a consequence of an initial circular formula and its graph, where operator transitions from one to the next operand are possible in an arbitrary manner of repeated looping.

1 Introduction

Both the notion of informational frame and informational gestalt[1] have been introduced in a superficial form, in connection with the informational Being-of [17] as a phenomenon of informational functionalism. In this article, both informational frame and informational gestalt will be tackled in a more fundamental manner using some particular means of informational formalism to make them informationally accessible and formally effective.

An informational frame is everything which can be framed within an informational formula, from a single parenthesis $\boxed{)}$, operand $\boxed{\alpha}$ or operator $\boxed{\models}$ to an arbitrarily complex part of the formula, say $\boxed{) \models \alpha}$. In a similar way, the principle of framing can be applied to elements of a demarked formula [12], for example, $\boxed{.}$ or to any complex part of the demarked formula, e.g. $\boxed{. \models \alpha}$. A gestalt of any informational formula is everything formally, especially causally, hidden behind the structure of the formula which represents an arbitrarily complex informational entity. We could say that the gestaltistic nature of a serial formula comes in the foreground when this formula is roughly sketched by the corresponding informational graph (a graphical scheme of operand circles and operator arrows) in which no parenthesis pairs or demarcation points of a formula are considered. Therefore, the gestalt of an informational entity remains the hidden other, formally, the adequately transformed formula system concerning the original operands and operators in an unchanged

[1] This paper is a private author's work and no part of it may be used, reproduced or translated in any manner whatsoever without written permission except in the case of brief quotations embodied in critical articles.

order within a formula, describing the entity in question. In general, an informational entity can appear (be understood, interpreted, grasped) as a gestalt of different possible entities (various formulas), strictly corresponding to the initial order of the operand-operator structure of the entity in question leaving parenthesizing or demarcation completely open.

As the reader will see, the informational frame (of representation [4]) can be any part of an informational formula (system) and, in this respect, the frame does not follow a structurally limited and traditionally organized syntactic formalism. The concept of the informational frame shows also how traditional syntactic schemes can be managed in a natural frame-appearing form leaving open the concatenation of frames in, certainly, a regular form. Any part of the formula means that the formula can be broken off at any place and that a part of it does not necessarily represent an operand or operator structure.

On the other hand, an informational gestalt will represent the possibility of the variety or, the whole variety or the whole variety of an operand, formula or formula system in a structural sense, where different structures (possible formulas to a given formula) can be forecasted automatically to some determined extent.

2 Two Cases of Informational Enframing

The usefulness of framing was demonstrated for a verbal case concerning the predicate of existing of something in [18]. Framing of the informational entities can become an effective and transparent aid in transforming linguistic forms (especially, sentences) into informational ones (e.g., cognitively relevant internal states, representations) and vice versa.

2.1 Enframing of a Sentence and Its Translation

Let us take an example of framing a sentence ([5] p. 161) in German, its formal transcription, and retranslation into English. The enframed original German sentence is

$$\boxed{\boxed{\boxed{\textit{Die Rede}\ \boxed{\textit{ist mit}}_{\phi_1}\ \textit{Befindlichkeit}}\ \ \boxed{\textit{und}}\ \textit{Verstehen}}\ \ \boxed{\textit{existenzial gleichursprünglich}}_{\phi_1}}$$

The dot at the end of the sentence will be replaced by the semicolon at the end of a formula, when the formula appears in a parallel informational system. In the last frame the main operator composition (verbally, *ist existenzial gleichursprünglich mit*) is split within the two frames marked consecutively by ϕ_1 and, to this, still verbally transposed. In this sense, the substitutional enframed German sentence, also suitable for formal translation, becomes

$$\boxed{\boxed{\textit{Die Rede}\ \boxed{\textit{ist existenzial gleichursprünglich mit}}_{\phi_1}\ \textit{Befindlichkeit}}\ \ \boxed{\textit{und}}\ \textit{Verstehen}}\ .$$

Let us introduce the following marks for the operands and operators in the given two sentences: $\mathfrak{r}$ for 'Rede' (discourse δ), $\mathfrak{b}$ for 'Befindlichkeit' (state-of-mind σ) and $\mathfrak{v}$ for 'Verstehen' (understanding v) as operands, and $\models_{\text{ex}}$ for 'ist existenzial' ('is existential' or 'informs existentially', operator $\models_{\text{exist}}$), $\models_{\text{gl-ur}}$ for 'ist gleichursprünglich' ('is equiprimordial' or 'informs equiprimordially', operator $\models_{\text{eq-prim}}$) and $\models_{\text{mit}}$ for 'ist mit' ('is with' or 'informs with', operator $\models_{\text{with}}$) as operators. An interpretation of the first enframed form is

$$(\mathfrak{r} \models_{\text{mit}} \mathfrak{b}, \mathfrak{v}) \models_{\text{ex}} \circ \models_{\text{gl-ur}}$$

where

$$(\mathfrak{r} \models_{\text{mit}} \mathfrak{b}, \mathfrak{v}) \equiv \begin{pmatrix} \mathfrak{r} \models_{\text{mit}} \mathfrak{b}; \\ \mathfrak{r} \models_{\text{mit}} \mathfrak{v} \end{pmatrix}$$

when the German 'und' ('and') was interpreted by comma (a short form) and by semicolon (a long form) within a parallel system of two formulas. Both kinds of expression are equivalent (informational operator $\equiv$).

The second form of the sentence enframing (frame-informational interpretation) delivers, formally,

$$\mathfrak{r}\ (\models_{\text{ex}} \circ \models_{\text{gl-ur}}) \circ \models_{\text{mit}}\ \mathfrak{b}, \mathfrak{v}$$

being a parallel system (as shown in the preceding case) in regard to Befindlichkeit $\mathfrak{b}$ and Verstehen $\mathfrak{v}$.

The first formula is externalistically open via the operator composition $\models_{\text{ex}} \circ \models_{\text{gl-ur}}$ while in the second formula this composition is brought into a formula interior operator composition with $\models_{\text{mit}}$, that is, $(\models_{\text{ex}} \circ \models_{\text{gl-ur}}) \circ \models_{\text{mit}}$.

Let us take the second form of the enframing of the German sentence (the last formula) with the English-adequate operand and operator markers, that is,

$$\rho\ (\models_{\text{exist}} \circ \models_{\text{eq-prim}}) \circ \models_{\text{with}}\ \sigma, v$$

Considering this formula, the English translation of the German sentence becomes (in an adequately enframed form)

$$\boxed{\begin{array}{c}\boxed{\begin{array}{l}\textit{Discourse}\\ \boxed{\textit{is existentially equiprimordial with}}_{\phi_1}\\ \textit{state-of-mind}\end{array}}\\ \boxed{\textit{and}}\ \textit{understanding}\end{array}}\ .$$

This sentence appears in the English translation of [5], that is in [6] (p. 203). A 'weaker' (so-called literal) translation would follow the first form of the German sentence enframing, that is,

$$\boxed{\begin{array}{l}\boxed{\begin{array}{c}\boxed{\textit{Discourse}\ \boxed{\textit{is with}}_{\phi_1}\ \textit{state-of-mind}}\\ \boxed{\textit{and}}\ \textit{understanding}\end{array}}\\ \boxed{\textit{existentially equiprimordial}}_{\phi_1}\end{array}}\ .$$

Another scheme of framing for the discussed sentence, depending upon an intuitive understanding, could take the enframing form

$$\boxed{\begin{array}{l}\boxed{\textit{Discourse}}\\ \boxed{\textit{is existentially equiprimordial with}}_{\phi_1}\\ \boxed{\textit{state-of-mind}\ \boxed{\textit{and}}\ \textit{understanding}}\end{array}}\ .$$

In the parallel approach, as formally expressed, the $\boxed{\text{and}}$ disappears and so two parallel sentences are coming to the surface, that is,

$$\boxed{\begin{array}{l}\textit{Discourse}\\ \boxed{\textit{is existentially equiprimordial with}}_{\phi_1}\\ \textit{state-of-mind}\end{array}}\ .$$

$$\boxed{\begin{array}{l}\textit{Discourse}\\ \boxed{\textit{is existentially equiprimordial with}}_{\phi_2}\\ \textit{understanding}\end{array}}\ .$$

Now, a dot appears at the end of each of the two enframed sentences. In the formal case, we have got the possibility with the comma between σ and v, or the semicolon between the two formulas. It is to stress that substantial differences can exist between the operators subscripted by ϕ_1 and ϕ_2 because the first one concerns internally the state-of-mind while the second one pertains internally to understanding. Here, the informational character of an equally marked operator in different contexts comes to the worth. Namely, in an informational transition of the form $\alpha \models \beta$, where α is the informer and β is the observer, operator $\models$ is to be understood as operator composition $\models_\alpha \circ \models_\beta$, where $\models_\alpha$ has to be decomposed according to the α's informingness and $\models_\beta$ according to the β's informedness.

The demonstrated translation of the German sentence into informational formula was only that which could be called the first informational approximation. Introducing the concept of the so-called informational graph it is possible to give several kinds of interpretation of an informational formula. In Fig. 1 an informational graph of the widening of this approximation is presented

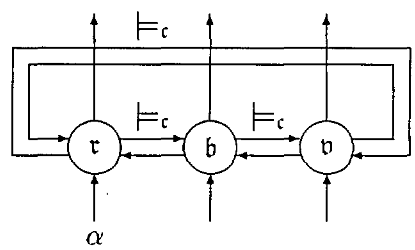


Figure 1: *A graphical interpretation of the bidirectionally and circularly (5-loop) structured parallel decomposed system* $\mathfrak{r}$ *concerning the input entity* α.

where the semantic scope of the word 'gleichursprünglich' (equiprimordial) is taken into consideration. Let us mark the operator composition

$(\models_{\text{ex}} \circ \models_{\text{gl-ur}}) \circ \models_{\text{mit}}$ corresponding to 'ist existenzial gleichursprünglich mit' by operator $\models_{c}$. By this operator the arrows between entities $\mathfrak{r}, \mathfrak{b}, \mathfrak{v}$ in Fig. 1 are marked. The vertical input and output arrows are unmarked and represent the general operator $\models$.

Which is the parallel informational system describing the graph in Fig. 1? If discourse (die Rede) $\mathfrak{r}$ concerns an entity α, that is $\mathfrak{r}(\alpha)$, the so-called $\mathfrak{r}$-solution of the system graphically presented is

$$\mathfrak{r}(\alpha) \rightleftharpoons \begin{pmatrix} \alpha \models \mathfrak{r};\ \models \mathfrak{b}, \mathfrak{v}; \\ \mathfrak{r}, \mathfrak{b}, \mathfrak{v} \models; \\ \mathfrak{r} \models_c \mathfrak{b};\ \mathfrak{b} \models_c \mathfrak{v};\ \mathfrak{v} \models_c \mathfrak{r}; \\ \mathfrak{r} \models_c \mathfrak{v};\ \mathfrak{v} \models_c \mathfrak{b};\ \mathfrak{b} \models_c \mathfrak{r} \end{pmatrix}$$

In the first row of the parallel array the input paths are located and in the second row the output paths. The third and the fourth row represent the main two loops (the left and the right one) of the graph. These two loops, joined, hide three more elementary loops existing between operands $\mathfrak{r}$ and $\mathfrak{b}$, $\mathfrak{b}$ and $\mathfrak{v}$, and $\mathfrak{v}$ and $\mathfrak{r}$. Thus, one of the so-called serial type solutions (a specific one) for $\mathfrak{r}(\alpha)$ can be expressed as

$$\mathfrak{r}^1(\alpha) \rightleftharpoons \begin{pmatrix} \alpha \models \mathfrak{r};\ \models \mathfrak{b}, \mathfrak{v}; \\ \mathfrak{r}, \mathfrak{b}, \mathfrak{v} \models; \\ \mathfrak{r} \models_c (\mathfrak{b} \models_c (\mathfrak{v} \models_c \mathfrak{r})); \\ \mathfrak{r} \models_c (\mathfrak{v} \models_c (\mathfrak{b} \models_c \mathfrak{r})); \\ \mathfrak{r} \models_c (\mathfrak{b} \models_c \mathfrak{r});\ \mathfrak{b} \models_c (\mathfrak{v} \models_c \mathfrak{b}); \\ \mathfrak{v} \models_c (\mathfrak{r} \models_c \mathfrak{v}) \end{pmatrix}$$

This solution formula system considers the input and output structure of the graph in Fig. 1 in the first and the second row, two long-size (bidirectional) loops in the third and fourth row, and three short loops in the last two rows, respectively.

The discussed examples of the natural text translation into informational formulas, and vice versa, demonstrate the hidden (intuitive) importance of the informational framing. As a consequence, framing concerns the so-called gestalting, where as the gestalt of a serially structured formula the parallel system of all possible formulas is meant, emerged from an initial formula by all possible displacements of the parenthesis pairs.

2.2 Sentential Paradigm and Possible Frames and a Gestalt

The ideas for the subsequent example of using informational frames and a gestalt go back to Fodor [2, 3] being sketched in a condensed form in Churchland ([1], pp. 385–388). We will study this particular case on the basis of the graph presented in Fig. 2. This graph is an exact representation of the parallel formula system (as a free-standing system without a specific marker) consisting of primitive transitions (from an operand to another), which is,

$$\begin{pmatrix} \sigma \models \iota; & & & \\ \iota \models \mathfrak{J}_\iota; & \mathfrak{J}_\iota \models \mathfrak{i}_\iota; & \mathfrak{i}_\iota \models \mathfrak{C}_\iota; & \mathfrak{C}_\iota \models \gamma_\iota; \\ & \gamma_\iota \models \mathfrak{E}_\iota; & \mathfrak{E}_\iota \models \rho_\iota; & \rho_\iota \models \mathfrak{c}_\iota; \\ \mathfrak{c}_\iota \models \iota; & \gamma_\iota \models \mathfrak{J}_\iota; & \mathfrak{c}_\iota \models \mathfrak{C}_\iota; & \mathfrak{c}_\iota \models \mathfrak{E}_\iota; \\ & \mathfrak{i}_\iota \models \mathfrak{J}_\iota; & \gamma_\iota \models \mathfrak{C}_\iota; & \rho_\iota \models \mathfrak{E}_\iota \end{pmatrix}$$

This array includes three types of transitions: the input, forward, and backward ones. In the first row, the only input transition informs the internal state about the sentence. In the second and third row seven forward transitions are listed. In the last two rows, seven backward (feedback) transitions appear, enabling a complex cycling of the system when the input sentence is identified in a processing way by the arising representation ρ_ι and content $\mathfrak{c}_\iota$.

On the basis of this graph we will present a solution for content $\mathfrak{c}_\iota$ and some possible, for the discussion relevant frames. The gestalt and possible interpretations of content $\mathfrak{c}_\iota$ will be presented (and discussed later on).

The concept of sentential attitudes α_σ belongs to the autonomy of human being; on the other side, the logical inference defends co-evolution and interdependence, that is, informing of entities, in informational terms. Beliefs, desires, thoughts, intentions, etc. inform between a being's internalism and externalism and play a crucial role in causation of living behavior. Sentential attitudes approach the nature of the so-called representations and of the rules that govern the transitions between representations. All this sounds informationally familiar where sentential attitudes and representations may function as distinguished informational entities.

There exists an interplay of the sentential attitudes and representations, a parallel and serial informing among entities. The theory postulates that sentential attitudes can also play a role in nonconscious processes and, in this way, can be involved in cognitive processes, e.g. in the form

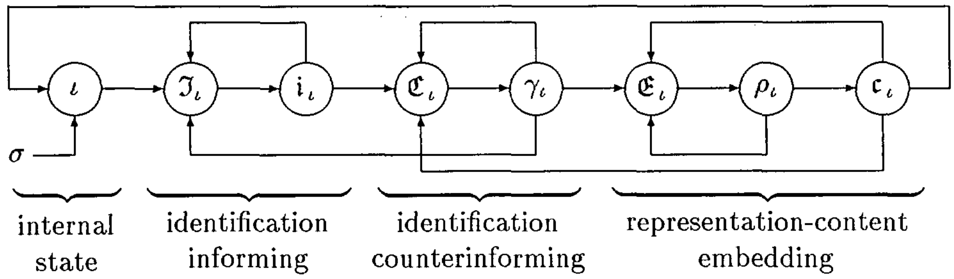


Figure 2: *A sententially paradigmatic, metaphysicalistically (7-tuple-loop) structured internal state system ι giving the input sentence(s) σ the sentence(s) representation $\rho_\iota(\sigma)$ and sentence(s) internal content (understanding with meaning) $\mathfrak{c}_\iota(\sigma)$.*

of inductive and deductive logic and decision making (the theory of internal states).

Let operand σ denote a sentence or a set of sentences, and operand ρ a representation or a set of representations. Transitions of sentences $\sigma_i \models \sigma_j$ and representations $\rho_i \models \rho_j$ have the standard informational form, where

$$(\sigma_i \models \sigma_j) \Longrightarrow (\rho_i \models \rho_j)$$

Other entities are the sentential attitude,

$$\alpha_\sigma(\sigma_1, \ldots, \sigma_n) \rightleftharpoons \begin{pmatrix} \sigma \rightleftharpoons (\sigma_1, \ldots, \sigma_n); \\ \iota \rightleftharpoons (\iota_1, \ldots, \iota_n); \\ \mathfrak{i}_\iota(\mathfrak{c}(\iota) \longleftrightarrow \sigma); \\ \rho_\iota \rightleftharpoons (\rho_1, \ldots, \rho_n); \\ \mathfrak{c}_\iota \rightleftharpoons \mathfrak{c}_\iota(\iota_1), \ldots, \mathfrak{c}_\iota(\iota_n) \end{pmatrix}$$

and the internal state ι. Cognitively relevant internal states can be comprehended as $\iota \rightleftharpoons \iota_1, \ldots, \iota_m$. An internal state ι has, in general, a content $\mathfrak{c}(\iota)$ (or in a short form, $\mathfrak{c}_\iota$), thus, $\mathfrak{c}_\iota \rightleftharpoons \mathfrak{c}_\iota(\iota_1), \ldots, \mathfrak{c}_\iota(\iota_n)$, where content components can be identified via sentences, that is,

$$\mathfrak{c}_\iota(\iota_1) \rightleftharpoons \sigma_1; \ldots; \mathfrak{c}_\iota(\iota_m) \rightleftharpoons \sigma_m$$

In this case, operator '$\rightleftharpoons$' can be replaced by operator $\models_{\text{identically}}$ which reads 'informs identically' (that is, circularly between the $\rightleftharpoons$-involved operands). Such an operator is bidirectional (constituting a loop, graphically), that is,

$$\mathfrak{c}_\iota(\iota_i) \models_{\text{identically}} \sigma_i; \; \sigma_i \models_{\text{identically}} \mathfrak{c}_\iota(\iota_i)$$

The identification, $\mathfrak{i}_\iota(\mathfrak{c}_\iota(\iota_i) \longleftrightarrow \sigma_i)$, is possible by virtue of the isomorphism (operator '$\longleftrightarrow$') between ι_i and σ_i.

Let us discuss the solution for content $\mathfrak{c}_\iota(\sigma)$ on the basis of the graph in Fig. 2, where

$$\mathfrak{c}_\iota(\sigma) \rightleftharpoons$$
$$\begin{pmatrix} \sigma \models \iota; \\ \iota \models \boxed{(}\mathfrak{I}_\iota \models \boxed{(}\mathfrak{i}_\iota \models \boxed{(}\mathfrak{C}_\iota \models \boxed{(}\gamma_\iota \models \\ \quad \boxed{(}\mathfrak{E}_\iota \models \boxed{(}\rho_\iota \models \boxed{(}\mathfrak{c}_\iota \models \iota \boxed{))))))}; \\ \mathfrak{I}_\iota \models (\mathfrak{i}_\iota \models (\mathfrak{C}_\iota \models (\gamma_\iota \models \mathfrak{I}_\iota))); \\ \boxed{(}(\mathfrak{C}_\iota \models \gamma_\iota) \models \mathfrak{E}_\iota \boxed{) \models^* (}\rho_\iota \models (\mathfrak{c}_\iota \models \mathfrak{C}_\iota)\boxed{)}; \\ \mathfrak{E}_\iota \models (\rho_\iota \models (\mathfrak{c}_\iota \models \mathfrak{E}_\iota)); \\ \boxed{\mathfrak{I}_\iota \models (\mathfrak{i}_\iota \models \mathfrak{I}_\iota); \; \mathfrak{C}_\iota \models (\gamma_\iota \models \mathfrak{C}_\iota);} \\ \mathfrak{E}_\iota \models (\rho_\iota \models \mathfrak{E}_\iota) \end{pmatrix}$$

The same solution is, in the demarked form,

$$\mathfrak{c}_\iota(\sigma) \,.\!\rightleftharpoons.$$
$$\begin{array}{l} \sigma \models \iota; \\ \iota \models \boxed{.}\mathfrak{I}_\iota \models \boxed{.}\mathfrak{i}_\iota \models \boxed{.}\mathfrak{C}_\iota \models \boxed{.}\gamma_\iota \models \\ \quad \boxed{.}\mathfrak{E}_\iota \models \boxed{.}\rho_\iota \models \boxed{.}\mathfrak{c}_\iota \models \iota; \\ \mathfrak{I}_\iota \models .\mathfrak{i}_\iota \models .\mathfrak{C}_\iota \models .\gamma_\iota \models \mathfrak{I}_\iota; \\ \mathfrak{C}_\iota \models \gamma_\iota . \models \mathfrak{E}_\iota \boxed{. \models^* .} \rho_\iota \models .\mathfrak{c}_\iota \models \mathfrak{C}_\iota; \\ \mathfrak{E}_\iota \models .\rho_\iota \models .\mathfrak{c}_\iota \models \mathfrak{E}_\iota; \\ \boxed{\mathfrak{I}_\iota \models .\mathfrak{i}_\iota \models \mathfrak{I}_\iota; \; \mathfrak{C}_\iota \models .\gamma_\iota \models \mathfrak{C}_\iota;} \\ \mathfrak{E}_\iota \models .\rho_\iota \models \mathfrak{E}_\iota \end{array}$$

In the third and fourth line, there is the circular formula describing a causal situation of the longest loop. In the remaining rows, systematically all loops are formalized, so that the entire graph in Fig. 2 is systematically covered. The reader can compare the parenthesized, and equivalent to the demarked formula systems, for one particular situation of the graph. In the next section, the demarked formula system will be discussed in detail.

The gestalt of a circular formula is determined by Definition 19. How many formulas does the content gestalt $\Gamma(\mathfrak{c}_\iota(\sigma))$ include? The first row delivers only one formula, $\sigma \models \iota$. The length of the formula in the second and the third row is $\ell_{2,3} = 8$ (the number of the formula's binary operators). Thus, $N_{2,3} = \frac{1}{9}\binom{16}{8} = 1430$. For the next lines there is: $N_4 = \frac{1}{5}\binom{8}{4} = 14, N_5 = \frac{1}{6}\binom{10}{5} = 42, N_6 = \frac{1}{4}\binom{6}{3} = 5, N_7 = \frac{2}{3}\binom{4}{2} = 4$, and $N_8 = \frac{1}{3}\binom{4}{2} = 2$. The sum is 1498 formulas in the gestalt of the discussed formula system.

3 The Role of the Demarcation Point Replacing a Pair of Parentheses in an Informational Formula

Let us introduce the demarcation (delimiting, separating) point [12] in the context of an informational formula replacing a pair of parentheses. Let us list some characteristic examples of parenthesized formulas to get the feeling how the demarking points are uniquely set instead of parentheses pairs in such a way that the parenthesized formula can be reconstructed, uniquely. Let have the following examples for parenthesized and equivalently demarked formulas, respectively:

(α);	α;
$(\alpha) \models (\beta)$;	$\alpha \models \beta$;
$(\alpha \models \beta) \models$;	$\alpha \models \beta \,.\! \models$;
$((\alpha) \models (\beta)) \models$;	$\alpha \models \beta \,.\! \models$;
$\models (\alpha \models \beta)$;	$\models .\, \alpha \models \beta$;
$\models ((\alpha) \models (\beta))$;	$\models .\, \alpha \models \beta$;
$(\alpha) \models (\beta \models \gamma)$;	$\alpha \models .\, \beta \models \gamma$;
$(\alpha \models \beta) \models (\gamma)$;	$\alpha \models \beta \,.\! \models \gamma$;
$\alpha_1 \models (\alpha_2 \models (\alpha_3 \models \alpha_4))$;	$\alpha_1 \models .\, \alpha_2 \models .\, \alpha_3 \models .\, \alpha_4$;
$((\alpha_1 \models \alpha_2) \models \alpha_3) \models \alpha_4$;	$\alpha_1 \models \alpha_2 \,.\! \models \alpha_3 \,.\! \models \alpha_4$;
$(\alpha_1 \models \alpha_2) \models (\alpha_3 \models \alpha_4)$;	$\alpha_1 \models \alpha_2 \,.\! \models .\, \alpha_3 \models \alpha_4$

The question is whether simple rules can be set for the mastering of a unique reading of a demarcated formula. Must it be read from the left to the right or can the reading be performed uniquely also in the opposite direction? In demarked formulas, the direction of formula reading is essential (from the left to the right or vice versa) and must remain the same as the direction in which demarcation points have been set when replacing particular parenthesis pairs. One must keep the same direction in which demarcation points have been set.

The rules of a unique replacement of parenthesis pairs by demarcation points (one point replacing the pair) in an informational formula are the following:

1. Before conversion, all superfluous parenthesis pairs in an informational formula have to be eliminated (crossed out).

2. Any left parentheses, $((\cdots($, at the beginning, as well as any right parentheses, $))\cdots)$, at the end of an informational formula (if any), are ignored and crossed out (within the final result).

3. Each left parenthesis, '('—and to it corresponding right part ')'—staying directly after an informational operator, $\models$ (or a particularized operator), is replaced by the demarcation point, '.'. E.g., $\models$ (____) is replaced by $\models$.____ (with one point only).

4. Each right parenthesis, ')'—and to it corresponding left part '('—staying directly before an informational operator, $\models$ (or a particularized operator), is replaced by the demarcation point, '.'. E.g., (____) $\models$ is replaced by ____ . $\models$ (with one point only).

5. All remaining parentheses, if any, with exception of those used in functional forms (e.g., $\varphi(\xi)$), in an informational formula, irrespective of the the left or the right type, are ignored and crossed out.

6. By the procedure following the previous rules, all proper parenthesis pairs in a formula are removed and uniquely replaced by demarcation points.

7. Semicolon ';' and comma ',' are in regard to demarking a formula exceptional operators which remain as they are. By semicolons separated formulas are in parallel informing formulas of a system and the formula parallelism remains preserved in both parenthesized and demarked formulas.

On the other hand, the rules of a unique replacement of demarcation points by parenthesis pairs (one parenthesis pair replacing one demarcation point) in an informational formula are the following:

1. The first point on the left side of operator in a formula is replaced by the parenthesis pair at the beginning of formula (left parenthesis), and at the place of the point (right parenthesis).
2. The first point on the right side of operator is replaced by the parenthesis pair with the left parenthesis '(' at the place of the point and with the right parenthesis ')' at the place of the first point at the left side of operator (lying right of the discussed operator).
3. After parenthesizing by rule 1 or rule 2, the next point is already within a parenthesis pair. Satisfying rule 1, the left parenthesis is set behind the existing left parentheses and the right one at the place of the point. Satisfying rule 2, the right parenthesis is set before the existing right parenthesis and the left one at the place of the point.
4. In the way of rules 1, 2, and 3, all the points can be uniquely replaced by parentheses pairs.

4 The Basic Notion of the Informational Frame within an Informational Entity

Informational frame is a very basic notion which, as a special case, functions between two informational operands irrespective of the parentheses pairs, which are disposed within an informational formula. Informational frame is everything which can be enframed in an informational formula. Enframing means simply to put a frame around certain consequent elements in an informational formula.

In this section we must answer the question what does such a regular, or irregular, structure, named informational frame represent. We shall see how the introduced notion of frame deviates from any other, traditionally fortified constituents of mathematical formulas. This strange notion originates from a fully legal style of formula writing in metamathematics—using the so-called demarcation point (quadratic dot '.')—introduced in Principia mathematica by Whitehead and Russel [12].

An informational frame is a formula or anything which can be put into the frame within a formula. Thus, one has to investigate which characteristic frames can occur within a formula or even a formula system, where the system is comprehended as a complex formula structure.

4.1 Possibilities of Informational Frames

To get an intuitive insight of the possibilities of occurring informational frames we have to look into the formula structure and detach all possible typical frames. This insight can begin with looking into a complex formula and mark or list the characteristic frames. As we shall learn, some frames will be senseful, being informational entities by themselves, the other will be artificial and corresponding to specific views and analyses. In this context harmonious and disharmonious frames will be treated and classified down to necessary details.

In principle, any part of a formula can constitute the so-called informational frame. The problem is how to choose a sufficiently complex formula in which all possible forms of informational frames do occur.

We can begin to write formulas from the left to the right and observe how structurally different frames come into existence. So, let us make a trial beginning with an operand:

$$\begin{array}{ll}
\alpha & \alpha \\
\alpha \models & \alpha \models \\
\alpha \models (& \alpha \models . \\
\alpha \models (\beta & \alpha \models . \beta \\
\alpha \models (\beta \models & \alpha \models . \beta \models \\
\alpha \models (\beta \models (& \alpha \models . \beta \models . \\
\alpha \models (\beta \models (\gamma & \alpha \models . \beta \models . \gamma \\
\vdots & \vdots
\end{array}$$

In the right column, formulas with demarcation points instead of left parentheses are listed.

In a similar manner, we can write formulas from the right to the left and observe how structurally different frames come into existence. So, let us make a trial ending with an operand:

$$
\begin{array}{rr}
\alpha & \alpha \\
\models \alpha & \models \alpha \\
) \models \alpha & . \models \alpha \\
\beta) \models \alpha & \beta . \models \alpha \\
\models \beta) \models \alpha & \models \beta . \models \alpha \\
) \models \beta) \models \alpha & . \models \beta . \models \alpha \\
\gamma) \models \beta) \models \alpha & \gamma . \models \beta . \models \alpha \\
\vdots & \vdots
\end{array}
$$

Within the listed parenthesized or demarked frames arbitrary parts can be chosen as frames. Some of them are operand frames, that is, informationally regular formulas or subformulas. Other frames are the so-called operator frames, which can be put between two operands, or, in case of parenthesized formulas, at the beginning and the end of formulas or inside of them, representing the so-called parenthesis frames [17].

4.2 Informational Operand Frames

Definition 1 [Operand Frame] *An informational operand frame is nothing else than an enframed informational formula which is either a marker, an autonomous formula, in a formula occurring subformula, or a formula system. An informational operand is, by definition, an informationally well-structured formula of formula system.* □

By inspection, it can be clearly recognized which syntactic structures in a formula perform as operands. And not only this: the semantic character of operands can be recognized to the extent of their decomposition which takes place in a serial extension or in one or more parallel, that is, additional interpretations. Operand frames need not to be treated separately because the notion of the informational formula is fundamental and firmly informationally determined.

4.3 Informational Operator Frames

Informational operator frames are twofold. The most primitive operator frames are informational operators as they are (or appear) by themselves. For a complex and, to some extent unusual, concept of operator frame we introduce a new definition. The sense of the introduction of the notion of the operator frame is to identify a direct informational connection between two operands in an informational formula.

Definition 2 [Operator Frame of a Parenthesized Formula] *Operator frame in a parenthesized formula is the part between arbitrary two operands, and to this operand-intermediate part belonging left-parenthesis and right-parentheses frames.* □

Example 1 [Some Operator Frames of a Parenthesized Formula] Let the metaphysicalistic parenthesized informational formula

$$
((((\alpha \models \mathcal{I}_\alpha) \models \iota_\alpha) \models \mathcal{C}_\alpha) \models \gamma_\alpha) \models^* (\mathcal{E}_\alpha \models (\varepsilon_\alpha \models \alpha))
$$

be given. Let us have examples of the following three parenthesized frames

$$
\boxed{((((} \, \alpha \, \boxed{\begin{array}{l} \models \mathcal{I}_\alpha) \models \iota_\alpha) \models \mathcal{C}_\alpha) \\ \qquad \models \gamma_\alpha) \models^* (\mathcal{E}_\alpha \models (\varepsilon \models \end{array}} \, \alpha \, \boxed{))} \, ;
$$

$$
\boxed{((((} \, \alpha \, \boxed{\begin{array}{l} \models \mathcal{I}_\alpha) \models \iota_\alpha) \models \mathcal{C}_\alpha) \\ \qquad \models \gamma_\alpha) \models^* (\mathcal{E}_\alpha \models (\end{array}} \, \varepsilon_\alpha \models \alpha \, \boxed{))} \, ;
$$

$$
(\, \boxed{(((} \, \alpha \models \mathcal{I}_\alpha \, \boxed{) \models \iota_\alpha) \models \mathcal{C}_\alpha) \models} \, \gamma_\alpha) \models^* (\mathcal{E}_\alpha \models (\varepsilon_\alpha \models \alpha))
$$

between operands α at the beginning and α at the end, α at the beginning and ε_α, and $\mathcal{I}_\alpha$ and γ_α, respectively. In the first two cases, the operator frame is an entity of three parts, namely, the left, middle and the right one, the third case has a two-part operator frame. □

The last example shows how parenthesized frames can become badly transparent and mutually dependent.

Definition 3 [Operator Frame in a Demarked Formula] *Operator frame in a demarked formula is the part between arbitrary two operands.* □

Example 2 [Some Operator Frames of a Demarked Formula] Let the formula in Example 1 be expressed in the demarked form, that is,

$$
\alpha \models \mathcal{I}_\alpha . \models \iota_\alpha . \models \mathcal{C}_\alpha . \models \gamma_\alpha . \models . \mathcal{E}_\alpha \models . \varepsilon_\alpha \models \alpha
$$

The enframed examples, discussed in Example 1, become evidently,

$$\alpha \boxed{\models \mathcal{I}_\alpha . \models \iota_\alpha . \models \mathcal{C}_\alpha . \models \gamma_\alpha . \models . \mathcal{E}_\alpha \models . \varepsilon_\alpha \models} \alpha;$$

$$\alpha \boxed{\models \mathcal{I}_\alpha . \models \iota_\alpha . \models \mathcal{C}_\alpha . \models \gamma_\alpha . \models .} \mathcal{E}_\alpha \models . \varepsilon \models \alpha;$$

$$\alpha \models \mathcal{I}_\alpha \boxed{. \models \iota_\alpha . \models \mathcal{C}_\alpha . \models} \gamma_\alpha . \models . \mathcal{E}_\alpha \models . \varepsilon_\alpha \models \alpha$$

Each case, irrespective of the operator frame structure (and position), possesses only one demarked frame. □

4.4 Harmonious Informational Frames

We have to determine harmonious and disharmonious parenthesized and demarked informational frames. Which are the various possible frame forms and in which manner do they appear as parenthesized and demarked frames? Which are the advantages of frames in one or the other form?

At the first glance, it seems that harmonious frames always appear in one piece, that is, they are not split within a formula. We shall see how this principle can have different consequences comparing the parenthesized and the demarked frames.

4.4.1 Harmonious Parenthesized Frames

Parenthesized frames in formulas of Example 1 are all harmonious. A frame, although split in two or three parts, is harmonious if it is functionally closed.

Definition 4 [Harmonious Parenthesized Frame] *A split, or unsplit, parenthesized frame is harmonious if it is functionally closed. The functional closeness of a parenthesized frame means that after concatenation of its parts the resulting frame presents a well-formed formula, that is, an operand frame. In the procedure of frame concatenation the empty parenthesized parts of the form () are replaced by an empty part (informational nothing), λ. At such places, the rule $() \leftarrow \lambda$ is applied. Also, the outmost parenthesis pair can be omitted.* □

The concatenation of frame parts in Example 1 gives

$$\boxed{((((} \boxed{\models \mathcal{I}_\alpha) \models \iota_\alpha) \models \mathcal{C}_\alpha) \models \gamma_\alpha) \models^* (\mathcal{E}_\alpha \models (\varepsilon \models} \boxed{))};$$

$$\boxed{((((} \boxed{\models \mathcal{I}_\alpha) \models \iota_\alpha) \models \mathcal{C}_\alpha) \models \gamma_\alpha) \models^* (\mathcal{E}_\alpha \models (} \boxed{))};$$

$$\boxed{(((} \boxed{) \models \iota_\alpha) \models \mathcal{C}_\alpha) \models}$$

which results in three well-formed formulas, that is,

$$((((\models \mathcal{I}_\alpha) \models \iota_\alpha) \models \mathcal{C}_\alpha) \models \gamma_\alpha) \models^* (\mathcal{E}_\alpha \models (\varepsilon \models));$$
$$((((\models \mathcal{I}_\alpha) \models \iota_\alpha) \models \mathcal{C}_\alpha) \models \gamma_\alpha) \models^* (\mathcal{E}_\alpha \models);$$
$$((\models \iota_\alpha) \models \mathcal{C}_\alpha) \models$$

One can see how the concatenated frame-harmonious structures are reduced in respect of the 'goal' entities, so that they preserve the necessary formula well-formedness.

Example 3 [Split Parenthesized Frames] Split parenthesized frames can be harmonious and disharmonious. They are divided in at least two parts and each part of a split harmonious frame is disharmonious. But the parts of a harmonious frame can be concatenated into a unique (well-formed) frame formula. For instance, the split frames in parenthesized formulas

$$\boxed{\boxed{((} \alpha \boxed{\models \beta) \models \gamma)}} \models \delta;$$

$$\boxed{\boxed{((\alpha \models} \beta \boxed{) \models \gamma)}} \models \delta;$$

$$\boxed{\boxed{((\alpha \models \beta) \models} \gamma \boxed{)}} \models \delta$$

are all harmonious. On the other hand, the frame parts are all disharmonious, that is,

$$\boxed{((}\,; \quad \boxed{\models \beta) \models \gamma)}\,; \quad \boxed{((\alpha \models}\,; \quad \boxed{) \models \gamma)}\,;$$
$$\boxed{((\alpha \models \beta) \models}\,; \quad \boxed{)}$$

The reader can recognize the disharmonious structures of the listed frames by himself/herself. □

4.4.2 Harmonious Demarked Frames

What is the difference between a harmonious parenthesized and demarked frame in concern to a frame splitting?

Definition 5 [Harmonious Demarked Frame] *An unsplit demarked frame is harmonious if it is functionally closed. The functional closeness of a demarked frame means that the frame itself presents a demarked well-formed formula.* □

Because the demarcation point replaces the parenthesis pair, the split harmonious frames in case of parenthesized formulas appear as unique frames in cases of demarked formulas. This is quite true for Example 2, where the demarked harmonious frames are

$$\boxed{\models \mathcal{I}_\alpha \,.\! \models \iota_\alpha \,.\! \models \mathcal{C}_\alpha \,.\! \models \gamma_\alpha \,.\, \models\!.\, \mathcal{E}_\alpha \models\!.\, \varepsilon_\alpha \models};$$

$$\boxed{\models \mathcal{I}_\alpha \,.\! \models \iota_\alpha \,.\! \models \mathcal{C}_\alpha \,.\! \models \gamma_\alpha \,.\, \models\!.};$$

$$\boxed{.\!\models \iota_\alpha \,.\! \models \mathcal{C}_\alpha \,.\! \models}$$

The rightmost operator combination $. \subset .$ in the second frame means $. \subset ()$, so, it can be reduced into $. \subset$ for the sake of simplicity. Similarly, the leftmost operator combination $. \subset$ in the third frame can be replaced by operator $\subset$ to keep the frame in a common form.

4.4.3 A Syntax Comparison between Harmonious Parenthesized and Harmonious Demarked Frames

How can harmonious parenthesized frames be recognized at once? The answer is: by stating that they represent well-formed formulas. The correct form of a formula can be proved by the usual syntax analysis, taking into account the general, context-free grammar for well-formed informational formulas. It is instructive to determine such grammars for parenthesized and demarked informational formulas.

Designing a syntax, one can consider that a formula or formula system is nothing other than an operand. It means that the initial (starting) grammatical variable in a formula development (generation) is the operand, symbolized grammatically (and as a terminal) by o. A general context-free grammar for the parenthesized formula systems can be constructed by the following items (syntax categories and terminals): o as operand; $\models$ as operator; $\circ$ as a separator in an operator composition; semicolon ';' as the operator of formula parallelism; comma ',' as the operator of alternativeness; and '(' and ')' as parenthesis pair. A preliminary context-free grammar is a construct $G = (N, T, R, o)$, where $N = \{o, \models\}$ is the alphabet of nonterminals, $T = \{\text{'('}, \text{')'}, \circ, \text{';'}, \text{','}, o, \models\}$ denotes the terminal alphabet, R is a set of context-free rules (see below) and o marks the initial symbol. The set of rules is determined by two syntax rules, which are

$$\begin{array}{lcl} o & \leftarrow & o \models \mid\; \models o \mid o \models o \mid (o) \mid o;o \mid o,o \\ \models & \leftarrow & \models \circ \models \mid (\models) \end{array}$$

In case of formula systems using the demarcation points instead of the parenthesis pairs, the demarked grammar is $G^\bullet = (N, T^\bullet, R^\bullet, o)$, the alphabet of terminals is $T^\bullet = \{\text{'.'} \circ, \text{';'}, \text{','}, o, \models\}$ and the rules of $R^\bullet$ are

$$\begin{array}{lcl} o & \leftarrow & o \models \mid\; \models o \mid o \models o \mid .o \mid o. \mid o;o \mid o,o \\ \models & \leftarrow & \models \circ \models \mid .\!\models \mid\; \models\!. \end{array}$$

Rules with demarcation point in the second line (operator composition case) can be used only in such a way that the point is inside of an operator composition. For example, in an operator generation process, there is

$$\models \twoheadrightarrow \models\circ\models \twoheadrightarrow \models .\circ\models \twoheadrightarrow \models\circ\models .\circ\models \twoheadrightarrow \models\circ\models .\circ. \models \twoheadrightarrow \models\circ\models .\circ. \models\circ\models$$

where the end result would correspond to the operator composition $(\models \circ \models) \circ (\models \circ \models)$. Symbol $\twoheadrightarrow$ represents the derivation (generation) step.

4.5 Disharmonious Informational Frames

The concept of the disharmonious informational frame (DIF) enables the treatment of arbitrary formula parts which do not fit harmonious informational frames. DIFs, in this way, contribute to the possibility to treat arbitrary parts of formulas as entities which may, in special cases, be of essential interest.

Definition 6 [Disharmonious Frame] *An informational frame is disharmonious if it is a part of a well-formed formula or formula system but it does not represent a well-formed formula by itself.* □

Disharmonious frames are parenthesized incompletely within a parenthesized formula and demarked within a demarked formula.

4.5.1 Disharmonious Parenthesized Frames

In a parenthesized formula, disharmonious parenthesized frames are the most arbitrary (enframed) entities. They can be parts of harmonious frames on one side, on the other side they can embrace any imaginable sequence of adequately serried operands, operators and parentheses, which do not constitute a harmonious frame. So, both types of frames exclude each other.

Definition 7 [Disharmonious Parenthesized Frame] *An informational frame is a disharmonious parenthesized frame if it is a part of a well-formed parenthesized formula or formula system but it does not represent a well-formed parenthesized formula by itself.* □

By this definition, a disharmonious parenthesized frame is not an arbitrary sequence of operands, operators and parentheses, but is an arbitrary sequence of the mentioned entities which constitute a part of a well-formed parenthesized formula or formula system. For example, frames $\boxed{(}$, $\boxed{)}$, $\boxed{(\models}$, $\boxed{\models)}$, $\boxed{\models(\models}$, etc. are disharmonious parenthesized frames because they can be completed to the harmonious parenthesized frames.

4.5.2 Disharmonious Demarked Frames

In a demarked formula, disharmonious demarked frames are enframed entities being arbitrary parts of the formula. They can represent parts of demarked harmonious frames and, in this way, can include any imaginable sequence of adequately composed operands, operators and demarcation points, which in this sequence appear in a harmonious frame. Demarked harmonious, and demarked disharmonious frames, exclude each other.

Definition 8 [Disharmonious Demarked Frame] *An informational frame is a disharmonious demarked frame if it is a part of a well-formed demarked formula or formula system but it does not represent a well-formed demarked formula by itself.* □

By this definition, a disharmonious demarked frame is not an arbitrary sequence of operands, operators and demarcation points, but is an arbitrary sequence of the mentioned entities which constitute a part of a well-formed demarked formula or formula system. E.g., frames $\boxed{.}$, $\boxed{.\models}$, $\boxed{\models .}$, $\boxed{\models . \models}$, $\boxed{. \models .}$, etc. are disharmonious demarked frames because they can be completed to the harmonious demarked frames.

4.5.3 A Comparison between Disharmonious Parenthesized and Disharmonious Demarked Frames

The comparison between disharmonious parenthesized and disharmonious demarked frames concerns the so-called of the frame's left and right edge development (see Subsubsection 5.6.1 and Table 1). In designing a frame (harmonious as well as disharmonious one), the designer (designing entity) proceeds from that part of the frame which already exists, developing the frame at its edges in such a way that the emerging disharmonious frame will become a part of a possible harmonious frame or of well-formed formula. Syntax rules for generation of disharmonious parenthesized and disharmonious demarked frames differ, of course, essentially between the parenthesized and the demarked case.

4.6 Functional Frames

Functional frames are characteristic in such a way that they can be clearly recognized in comparison with other formula frames. Informational function as an informational operand has the form $\varphi(\alpha)$, where the left parenthesis appears between two operands (the only possible case for such an appearance), and the right parenthesis appears at the end of argument α. There are not demarked functional frames, but within a function and its argument formulas can be expressed in the demarked form.

4.6.1 Harmonious Functional Frames

Functional frames are parenthesized structures which occur as such (roughly parenthesized) also in cases using demarcation points.

Definition 9 [Harmonious Functional Frame] *Harmonious functional frames have the general forms*

$$\boxed{(\varphi)(\alpha)},\ \boxed{(\varphi)}\boxed{(\alpha)},\ (\boxed{\varphi})(\boxed{\alpha}),\ (\varphi)\boxed{(\alpha)},$$
$$(\varphi)(\boxed{\alpha}),\ \boxed{(\varphi)}(\alpha),\ (\boxed{\varphi})(\alpha),\ \boxed{\boxed{(\boxed{\varphi})}\boxed{(\boxed{\alpha})}}$$

where, in principle, both φ and α are complex informational formulas, so, they must be parenthesized as (φ) and (α), respectively. A common form of informational functionalism is $\varphi(\alpha)$, where φ stands for a marker (a single operand name). Thus,

$$\boxed{\varphi(\alpha)},\ \boxed{\varphi(\boxed{\alpha})},\ \text{and}\ \boxed{\varphi\boxed{(\alpha)}}$$

where α is an argument formula and φ is a function representative informing upon the argument [17]. □

The following comment could be useful: frames $\boxed{\alpha}$ and $\boxed{(\alpha)}$ are harmonious and can appear as such also outside a functional context. On the other side, the possibility of framing both the function entity φ, and the function argument α, makes them visible for further informational investigation.

4.6.2 Disharmonious Functional Frames

A disharmonious functional frame offers an especially characteristically visible case which explicitly concerns the syntactic structure pertaining solely to the concept of informational function.

Definition 10 [Disharmonious Functional Frame] *Characteristic disharmonious functional frames take the general forms as*

$$\boxed{)(},\ \boxed{\varphi)(},\ \boxed{\varphi)(\alpha},\ \boxed{)(\alpha},\ \boxed{(\varphi)(},\ \boxed{\models)(},\ \boxed{)(\models},$$
$$\boxed{\models)(\models},\ \boxed{\varphi)(\models},\ \boxed{\varphi)(\models (},\ \boxed{)\models)(\models (}$$

etc. □

As stressed, combination ')(' is the most significant mark of the presence of an informational function which can be searched in the left and the right direction of the mark.

4.7 Frames Concerning the Operator Composition

Operator composition belongs to distinguished operator structure. It enables to join several operators systematically into one resulting operator. Similarly, as a function, operator composition can be treated as an autonomous framing problem. Harmonious and disharmonious framings of operator compositions can be studied and clarified.

4.7.1 Harmonious Frames for Operator Compositions

An operator composition is a structure consisting of operators $\models$ (differently particularized), operator separators '$\circ$' (uniquely determined) and parenthesis pairs.

Definition 11 [Harmonious Parenthesized Frame of Operator Composition] *Harmonious parenthesized frames of an operator composition can take the general forms*

$$\boxed{\models\circ\models},\ \boxed{(\models\circ\models)},\ \boxed{(\models\circ\models)\circ\models},\ \boxed{\models\circ(\models\circ\models)}$$

etc. They must satisfy the operator syntax described in Subsection 4.4.3. □

In a similar way, frames for the demarked operator compositions can be determined.

Definition 12 [Harmonious Demarked Frame of Operator Composition] *Harmonious demarked frames of an operator composition can take the general forms*

$$\boxed{\models\circ\models},\ \boxed{\models\circ.\models\circ\models},\ \boxed{\models\circ\models.\circ\models},$$
$$\boxed{\models\circ\models.\circ.\models\circ\models}$$

etc. They must satisfy the operator syntax described in Subsection 4.4.3. □

In a syntactically regular way, harmonious operator composition frames can be arbitrarily adequately nested.

4.7.2 Disharmonious Frames for Operator Compositions

Which are the main forms of disharmonious parenthesized and demarked operator composition frames? At least, a harmonious operator composition frame must begin and end by an operator $\models$ (which, obviously, follows from the previous definition). A general answer is given in the form of the following two definitions for a parenthesized and demarked case, respectively.

Definition 13 [Disharmonious Parenthesized Frame of Operator Composition] *Disharmonious parenthesized frames of an operator composition can take the general forms*

$$\boxed{\circ},\ \boxed{)\circ},\ \boxed{\circ(},\ \boxed{)\circ(},\ \boxed{\models)\circ},\ \boxed{\circ(\models},$$
$$\boxed{\models)\circ(\models},\ \boxed{\circ\models)\circ(\models\circ},\ \boxed{\circ\models)\circ(\models\circ\models}$$

etc. □

On the other hand, frames of disharmonious demarked operator compositions are determined in the following manner.

Definition 14 [Disharmonious Demarked Frame of Operator Composition] *Disharmonious demarked frames of an operator composition can take the general forms*

$$\boxed{\circ},\ \boxed{.\circ},\ \boxed{\circ.},\ \boxed{.\circ.},\ \boxed{\circ\models.\circ},\ \boxed{\circ.\models\circ},$$
$$\boxed{\circ\models.\circ.\models\circ},\ \boxed{\models\circ\models.\circ.\models\circ},$$
$$\boxed{\circ\models.\circ.\models\circ\models.}$$

etc. □

5 A Frame-analytical Comprehension of Informational Transition and Possible Frame Concatenation

5.1 Operator Frame

Informational operator is that entity which appears between two informational operands, forming the so-called basic informational transition, irrespective of the complexity of operands. On the other hand, the operator can be understood as an arbitrarily complex entity, composed of many other entities, that is, operators, operands, and parenthesis pairs, which do not constitute a well-formed formula. In such a sense, operator can be comprehended as a the most essential informational frame—the operator frame—which has to be studied carefully, and exhaustively.

(a)	Left operand	Operator	Right operand		
(b)	Left operand	Left operator	Separator	Right operator	Right operand

Figure 3: *Frame sequences for transition of type* (a) $\alpha \models \beta$ *and* (b) $\alpha \models \circ \models \beta$.

Informational transition, of the form (a) $\alpha \models \beta$, or, operator-compositionally, in the form (b) $\alpha \models \circ \models \beta$ can be comprehended by the general schemes in Fig. 3, respectively. How can informational frames be consistently (well-formedly) joined together?

Let us start with the following frame structures concerning the transition $\alpha \models \beta$. There are, evidently, some possible frame configurations:

$$\alpha\,\boxed{\models}\,\beta; \qquad \alpha\,\boxed{\models_\alpha \circ \models_\beta}\,\beta;$$
$$\alpha\,\boxed{\models_\alpha}\,\boxed{\circ}\,\boxed{\models_\beta}\,\beta; \qquad \boxed{\alpha \models_\alpha}\,\circ\,\boxed{\models_\beta\,\beta};$$
$$\boxed{\alpha \models_\alpha}\,\boxed{\circ}\,\boxed{\models_\beta\,\beta}; \qquad \boxed{\alpha}\,\boxed{\models_\alpha}\,\boxed{\circ}\,\boxed{\models_\beta}\,\boxed{\beta}$$

Let us study particular framings of informational transition.

5.2 Frame Concatenation and Frame Parallelism

Under certain circumstances, informational frames can be concatenated into new frames and can be stacked in a parallel manner within frames and, then, the stacked frames concatenated, etc.

Definition 15 [Frame Concatenation] *Two frames ϕ_α, and ϕ_β, can be concatenated building up a frame ϕ, that is, $\phi \rightleftharpoons \phi_\alpha\phi_\beta$, if both ϕ_α, and ϕ_β, are parts of a well-formed formula, and such is ϕ.* □

Definition 16 [Frame Parallelism and Concatenation] *Frames ϕ_α and ϕ_β, being arrays of frames*

$\phi_{\alpha,1}, \phi_{\alpha,2}, \cdots, \phi_{\alpha,k}$ and $\phi_{\beta,1}, \phi_{\beta,2}, \cdots, \phi_{\beta,k}$, respectively, can be concatenated into frame array ϕ with frame components $\phi_1, \phi_2, \cdots, \phi_k$ in such a way, that $\phi \rightleftharpoons \phi_\alpha \phi_\beta$, where

$$\boxed{\begin{array}{c}\boxed{\phi_1}\\ \boxed{\phi_2}\\ \vdots \\ \boxed{\phi_k}\end{array}} \rightleftharpoons \boxed{\begin{array}{c}\boxed{\phi_{\alpha,1}}\\ \boxed{\phi_{\alpha,2}}\\ \vdots \\ \boxed{\phi_{\alpha,k}}\end{array}}\boxed{\begin{array}{c}\boxed{\phi_{\beta,1}}\\ \boxed{\phi_{\beta,2}}\\ \vdots \\ \boxed{\phi_{\beta,k}}\end{array}} \quad \text{that is,} \quad \boxed{\begin{array}{cc}\boxed{\phi_{\alpha,1}}\boxed{\phi_{\beta,1}}\\ \boxed{\phi_{\alpha,2}}\boxed{\phi_{\beta,2}}\\ \vdots \\ \boxed{\phi_{\alpha,k}}\boxed{\phi_{\beta,k}}\end{array}}$$

(and $\phi_i \rightleftharpoons \phi_{\alpha,i}\phi_{\beta,i}$ for $i = 1, 2, \cdots, k$). □

5.3 Framing the Transition $\alpha \models \beta$

In the framed transition $\alpha \boxed{\models} \beta$, the question what could an operator $\models$ represent, and which is the degree of its complexity in a serial and parallel sense, comes to the surface. Initially, $\models$ is an arbitrarily structured operator and its structure has now to be clarified.

Evidently, the serial parenthesized decomposition of a transition $\alpha \boxed{\models} \beta$ can have the form

$$\boxed{(\cdots((}\ \alpha \boxed{\begin{array}{l}\models \alpha_1) \models \alpha_2) \models \cdots \alpha_m) \models^* \\ (\beta_1 \models (\beta_2 \models \cdots (\beta_n \models\end{array}} \beta \boxed{)\cdots))}$$

The complex operator frame is split into three parts and one can understand how a symbol $\models$ between operands can become as complex as possible. Operator $\models^*$ is the main operator and signals the transition decomposition process is never ended. Simultaneously, it marks, how the α-part of length $\ell_\alpha = m$ of the operator belongs to α and how the β-part of length $\ell_\beta = n$ belongs to β. Thus, the length of decomposed transition is $\ell_{\alpha\models\beta} = m+n+1$. The transition gestalt includes (see Subsection 6.3)

$$N_{\alpha\models\beta} = \frac{1}{m+n+2}\binom{2m+2n+2}{m+n+1}$$

possible decompositions of transition $\alpha \models \beta$ of length $\ell_\alpha + \ell_\beta + 1$.

The demarked form of the discussed operator decomposition of transition has a compact shape, with only one (unsplit) frame, that is,

$$\alpha \boxed{\begin{array}{l}\models \alpha_1 \,.\!\models \alpha_2 \,.\!\models \cdots \alpha_m \,.\!\models . \\ \beta_1 \models .\beta_2 \models . \cdots \models .\beta_n \models\end{array}} \beta$$

where the care of parenthesis pairs is left over the the mechanism of the demarcation point.

The next enframing shows a clear separation between the left, and the right, part of transition $\alpha \models \beta$ in regard of the main operator $\models^*$. There is

$$\boxed{\boxed{(\cdots((}_{\phi_{\alpha,l}}\ \alpha \boxed{\begin{array}{l}\models \alpha_1) \models \alpha_2)\\ \models \cdots \alpha_m)\end{array}}_{\phi_{\alpha,r}}}_{\phi_\alpha} \models^*$$
$$\boxed{\boxed{\begin{array}{l}(\beta_1 \models (\beta_2 \models \\ \cdots (\beta_n \models\end{array}}_{\phi_{\beta,l}}\ \beta \boxed{)\cdots))}_{\phi_{\beta,r}}}_{\phi_\beta}$$

where ϕ_α is a harmonious left frame and ϕ_β a harmonious right frame. Within these frames, frame pairs and $(\phi_{\alpha,l}, \phi_{\alpha,r})$ and $(\phi_{\beta,l}, \phi_{\beta,r})$ are disharmonious. Additionally, the main operator does not belong explicitly either to operand α or to operand β. It stays between both of them and can be decomposed in a further way in the left, and the right, direction.

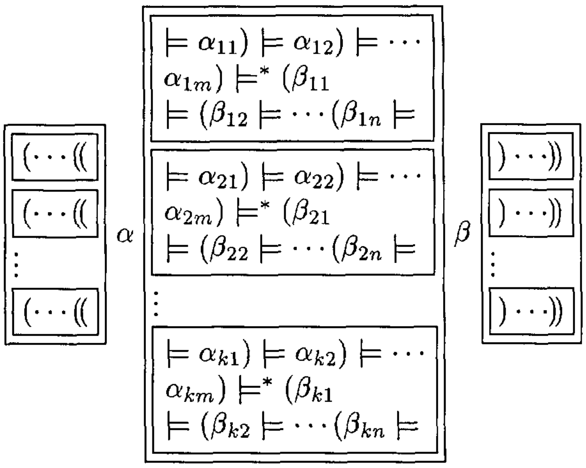
The demarked case of the discussed example brings a clear evidence how the informer, and the observer, part in a transition can be separated. There is

$$\boxed{\alpha \boxed{\begin{array}{l}\models \alpha_1 \,.\!\models \alpha_2 \\ .\!\models \cdots \alpha_m\end{array}}}_{\phi_\alpha} .\!\models . \boxed{\boxed{\begin{array}{l}\beta_1 \models .\beta_2 \models . \\ \cdots \models .\beta_n \models\end{array}} \beta}_{\phi_\beta}$$

Certainly, there can exist several different, that is parallel, decompositions of transition $\alpha \models \beta$. In this case, instead of a single operator enframed formula, there are, say, k parallel formulas of the form

$$\boxed{(\cdots((}\ \alpha \boxed{\begin{array}{l}\models \alpha_{11}) \models \alpha_{12}) \models \cdots \alpha_{1m}) \\ \models^* \\ (\beta_{11} \models (\beta_{12} \models \cdots (\beta_{1n} \models\end{array}} \beta \boxed{)\cdots))};$$
$$\boxed{(\cdots((}\ \alpha \boxed{\begin{array}{l}\models \alpha_{21}) \models \alpha_{22}) \models \cdots \alpha_{2m}) \\ \models^* \\ (\beta_{21} \models (\beta_{22} \models \cdots (\beta_{2n} \models\end{array}} \beta \boxed{)\cdots))};$$
$$\vdots$$
$$\boxed{(\cdots((}\ \alpha \boxed{\begin{array}{l}\models \alpha_{k1}) \models \alpha_{k2}) \models \cdots \alpha_{km}) \\ \models^* \\ (\beta_{k1} \models (\beta_{k2} \models \cdots (\beta_{kn} \models\end{array}} \beta \boxed{)\cdots))}$$

which results into a compact interpretation of the transition decomposition by

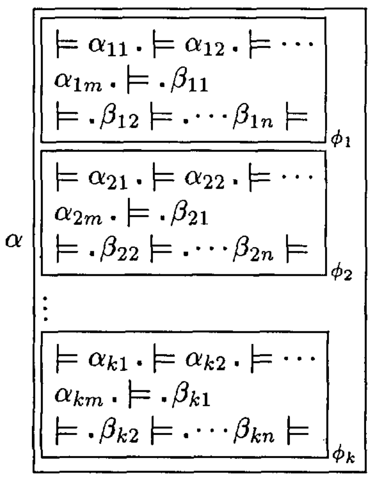


The reader can comprehend in which sense the complexity of a transition operator $\models$ can develop. In the last enframing example the split parts of a parallel decomposed transition operator are separately enframed, so that operands α and β appear only once, like in an informational graph. In the last complex parallel case, the transition gestalt includes (see Subsection 6.3)

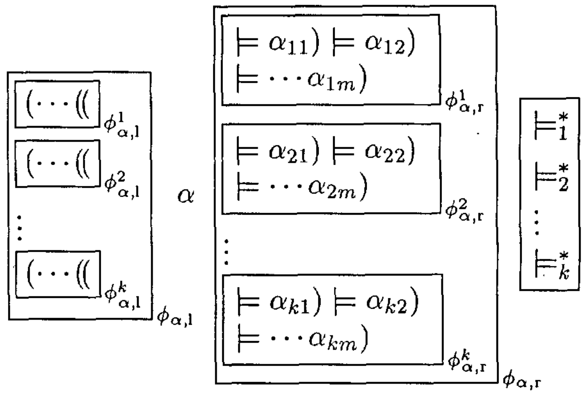
$$N^{\|}_{\alpha \models \beta} = \sum_{i=1}^{k} \frac{1}{m_i + n_i + 2} \binom{2m_i + 2n_i + 2}{m_i + n_i + 1}$$

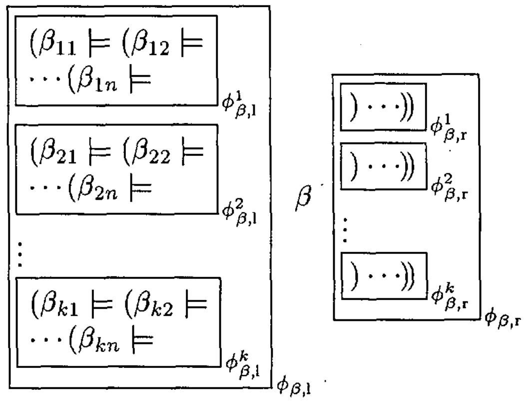
possible decompositions of transition $\alpha \models \beta$ of parallel lengths $\ell_{\alpha,i} + \ell_{\beta,i} + 1$ for $i = 1, 2, \ldots, k$.

As already ascertained, the demarked form does not need an explanation concerning the parallel frames within a frame. The demarked formula system for multiple operator (e.g. interpretative) decomposed transition is (without serially split frames)



In a compact, however virtually artificial way, the separation into the left and the right part frames can be expressed in the form



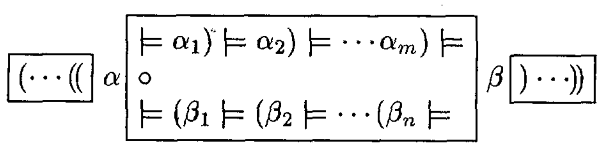


The reader can find the demarked form of the last formula system in Section 11 and Subsections 5.4 and 5.5 where the philosophy around transition $\alpha \models \circ \models \beta$ is debated. A kind of the system simplification will become evident.

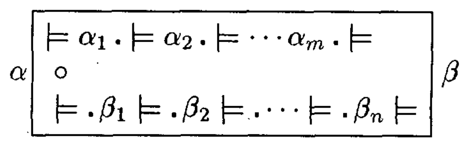
5.4 Framing the Transition $\alpha \models \circ \models \beta$

At the first look, there is a minimal difference between the presentation of transition decomposition $\alpha \models \beta$ and $\alpha \models \circ \models \beta$. However, as it is pointed out in Subsection 5.5, the difference is essential, because in the second case the informer part (α) and the observer part (β) can be separated up to the operator composition separator '$\circ$'.

In general, for the parenthesized case, the split, composed operator ($\models \circ \models$) frame example is



The demarked form of the same formula becomes



The next two examples of possible enframing come near to the goal of separation between the informer and the observer. In case of parenthesized formula, one obtains the enframing

$$\boxed{\boxed{(\cdots((}_{\phi_{\alpha,l}}\ \alpha\ \boxed{\begin{array}{l}\models \alpha_1) \models \alpha_2)\\ \models \cdots \alpha_m) \models\end{array}}_{\phi_{\alpha,r}}}_{\phi_\alpha}\ \circ$$

$$\boxed{\boxed{\begin{array}{l}\models (\beta_1 \models (\beta_2 \models\\ \cdots(\beta_n \models\end{array}}_{\phi_{\beta,l}}\ \beta\ \boxed{)\cdots))}_{\phi_{\beta,r}}}_{\phi_\beta}$$

and in case of demarked formula the enframing

$$\boxed{\alpha\ \boxed{\begin{array}{l}\models \alpha_1 \centerdot \models \alpha_2\\ \centerdot \models \cdots \alpha_m \centerdot \models\end{array}}}_{\phi_\alpha}\ \circ\ \boxed{\boxed{\begin{array}{l}\models \centerdot \beta_1 \models \centerdot \beta_2 \models \centerdot\\ \cdots \models \centerdot \beta_n \models\end{array}}\ \beta}_{\phi_\beta}$$

comes into the separation foreground.

Further examples, discussed in Subsection 5.3, can easily be constructed for the $\alpha \models \circ \models \beta$ case.

5.5 Interpreting the Transition Framing $\boxed{\alpha \models_\alpha} \circ \boxed{\models_\beta \beta}$

Framing of the form $\boxed{\alpha \models_\alpha} \circ \boxed{\models_\beta \beta}$ is essential for a proper understanding and informational regularity of the separator '$\circ$', functioning as a regular operator. Evidently,

$$(\boxed{\alpha \models_\alpha} \circ \boxed{\models_\beta \beta}) \equiv ((\alpha \models_\alpha) \circ (\models_\beta \beta))$$

In this formula, subformulas $(\alpha \models_\alpha)$ and $(\models_\beta \beta)$ are well-formed formulas, and between them an informational operator, that is, also, operator '$\circ$', can appear. In this way, separator '$\circ$' is a regular informational operator. On the other hand, in α $\boxed{\models_\alpha \circ \models_\beta}$ β, entity '$\circ$' is a member of the operator composition $\models_\alpha \circ \models_\beta$, that is, the separator between operators $\models_\alpha$ and $\models_\beta$. In both cases, the meaning of '$\circ$' is a sort of informational concatenation between the informing operand α and by it informed operand β.

5.6 A Consistent Concatenation of Frames in Complex Transition Formulas

How can arbitrary frames be linked together to keep the possibility that a final frame concatenation will represent a well-formed formula? A particular question concerns the frame concatenation which would lead to an operator frame between arbitrary two operands in a serial (or serially circular) formula. What are the characteristics of such an disharmonious (irregular, non-well-formed) operator frame?

5.6.1 A Conditional Frame Edge Syntax

How can frames be composed beginning from an initial frame $\aleph$? Let the initial frame $\aleph$ be replaced by a single basic alternative frame which is nothing else than a general symbol appearing in a well-formed formula. Thus, we introduce the initial replacement rule in the form

$$\aleph \leftarrow \alpha \mid \models \mid \circ \mid (\mid) \mid , \mid ;$$

where α represents all possible operands, $\models$ all possible operators, $\circ$ composition operator for operators. We can also introduce operand ϕ as the current occurrence of a frame which is still arising or is already arisen by the use of syntax rules. These rules can be used only at the left and the right edge of arising ϕ in such a way, that the final result of different frame concatenation delivers, at the end, a well-formed informational formula, after an arbitrary initial rule $\aleph \leftarrow \phi$ was chosen. A complete collection of frame edge syntax rules is listed in Table 1.

In this table, the aesthetical (obligatory) space symbol, ␣, is introduced, which explicitly marks the usual space between formula components. As one can see, there are seven syntactic types of symbols as given by the $\aleph$-rule. The use of rules from Table 1 is conditional. The condition which must be satisfied at the generation of frame ϕ is that ϕ is a syntactically correct part of the arising informational formula. Thus, additional conditions in the form of context dependent rules can be constructed in the following way:

$$\circ\models \leftarrow \models\circ\models \mid \models)\circ\models$$

We must not forget that the rules can be applied only at the edge of the current frame ϕ.

5.6.2 Explanations Concerning the Use of Rules in Table 1

Explanations concerning the use of concrete rules in Table 1 is necessary. As said at the very beginning of this section, the application of concrete

#	0		1	2	3	4	5	6	7	8	9	10	11	12
0	$\aleph$	$\leftarrow$	α	$\models$	$\circ$	(	)	,	;					
1	α	$\leftarrow$	$\alpha\models$	$\models\alpha$	$(\alpha$	$\alpha)$	$\alpha,$	$,\sqcup\alpha$	$\alpha;$	$;\sqcup\alpha$	$\alpha($	$\alpha\sqcup($	$)\alpha$	$)\sqcup\alpha$
2	$\models$	$\leftarrow$	$\alpha\models$	$\models\alpha$	$(\models$	$\models)$	$\models,$	$,\sqcup\models$	$\models;$	$;\sqcup\models$	$\models($	$)\models$	$\models\circ$	$\circ\models$
3	$\circ$	$\leftarrow$	$\circ\models$	$\models\circ$	$\circ\models)$	$(\models\circ$	$\circ($	$)\circ$	$\alpha\models\circ$	$\circ\models\alpha$	$\alpha\sqcup(\models\circ$	$\circ\models)\sqcup\alpha$	$)\circ\models$	
4	(	$\leftarrow$	$(\alpha$	$\alpha($	$(\models$	$\models($	$)($	$,\sqcup($	$;\sqcup\models$	((	$\circ($	$\alpha\sqcup($		
5	)	$\leftarrow$	$\alpha)$	$)\alpha$	$\models)$	$)\models$	$)($	$),$	$);$	))	$)\circ$	$)\sqcup\alpha$		
6	,	$\leftarrow$	$,\sqcup\alpha)$	$\alpha,$	$,\sqcup\models$	$\models,$	$,\sqcup($	$),$						
7	;	$\leftarrow$	$;\sqcup\alpha)$	$\alpha;$	$;\sqcup\models$	$\models;$	$;\sqcup($	$);$						

Table 1: *A conditional frame-edge context-free syntax in which some meanings are the following:* $\leftarrow$ *reads* is_replaced_by; *for example,* $(1:0 \leftarrow 1)$ *marks* $\alpha \leftarrow \alpha \models$, *or* $(4:0 \leftarrow 4)$ *marks* "$(\leftarrow \models ($"; *the visible space symbol marks an aesthetical (also obligatory) space between some elements of a formula.*

rules is conditional: the arising frame ϕ must be a part of a well-formed formula. We will refer to particular rules by (x, z) markers, for example, $(2, 12)$ $\models \leftarrow \circ\models$. The most interesting cases are those in which for a given edge symbol several rules for this symbol could be applied, but only one (or several) can generate a well-formed formula. The use of a certain rule depends on the context on the right or the left side of the edge symbol.

Additional explanations to the use of some nonevident rules (replacements) for the edge symbols are given in Table 2. The application of rules is conditional in the sense that the result of a symbol replacement must stay within the well-formed formula. The preceding (already existing) context and the intention of a formula development determine the choice of a concrete rule.

5.6.3 Examples: the Application of Conditional Frame Edge Syntax

Let us show several examples of the discussed frame syntax. This syntax enables a straightforward generation of frames from the left to the right and vice versa, but also from wherever in the middle of an arising formula and then proceeding on its left and its right side. Within such a frame generation the way to the well-formed formula as the final result must be considered, that is, the design of an adequate (syntactically correct) frame ϕ.

We can distinguish two characteristic cases of the design by the conditional frame syntax. In the first case, we are confronted with the formation of a complex operator composition, for which certain conditions of generation have to be satisfied. In the second case we discuss a general case and point out the conditions where syntax rules could violate the emerging of a well-formed formula.

Example 4 [Generation of a Complex Operator Composition] An operator composition can be begun by several rules of Table 1. The beginning symbol is $\aleph$ and rules $\aleph \leftarrow \models$ and $\aleph \leftarrow \circ$ are both adequate. The used rules can be marked by $(x : y \leftarrow z)$ where x is the line number, and y and z are the column numbers in Table 1. The shortened marker is simply (x, z) and marks uniquely the rule of the table. Thus, we will use the marked deduction arrow of the form $\overset{x,z}{\longmapsto}$. In this way, the final form of a frame ϕ can be generated in the following way:

$$
\begin{aligned}
&\aleph \overset{0,2}{\longmapsto} \models \overset{2,11}{\longmapsto} \models\circ \overset{2,12}{\longmapsto} \models\circ\models \overset{2,3}{\longmapsto} (\models\circ\models \overset{4,8}{\longmapsto} \\
&((\models\circ\models \overset{2,4}{\longmapsto} ((\models\circ\models) \overset{5,9}{\longmapsto} ((\models\circ\models)\circ \overset{3,1}{\longmapsto} \\
&((\models\circ\models)\circ\models \overset{2,4}{\longmapsto} ((\models\circ\models)\circ\models) \overset{5,9}{\longmapsto} \\
&((\models\circ\models)\circ\models)\circ \overset{3,1}{\longmapsto} ((\models\circ\models)\circ\models)\circ\models \overset{2,2}{\longmapsto} \\
&((\models\circ\models)\circ\models)\circ\models\alpha \overset{4,10}{\longmapsto} \alpha\,((\models\circ\models)\circ\models)\circ\models\alpha
\end{aligned}
$$

with the current frame ϕ at the end of the deduction chain. □

Example 5 [General Formula Generation Violating the Formula Syntax] How, by using the rules, the well-formedness of the emerging formula can be violated? Somebody being acquainted or having the feeling of formula well-formedness can immediately sense the mentioned violation. According to the Table 1, the following illegal (syntactically incorrect) frames (derivation results or their parts) can be generated:

(x,z)	Rule	Explanation
$(1,3)$	$\alpha \leftarrow (\alpha$	α begins a function argument formula or a regular serial subformula
$(1,4)$	$\alpha \leftarrow \alpha)$	α ends a function argument formula or a regular serial subformula
$(1,9)$	$\alpha \leftarrow \alpha($	α is a function of that which will follow after '(' to the corresponding ')'
$(1,10)$	$\alpha \leftarrow \alpha_\sqcup($	α with '$\sqcup$' before '(' marks the beginning of an operator composition
$(1,11)$	$\alpha \leftarrow)\alpha$	α is a simple argument (marker) of a function arising before ')'
$(1,12)$	$\alpha \leftarrow)_\sqcup\alpha$	α marks the beginning of a subformula after an operator composition
$(2,11)$	$\models \leftarrow \models\circ$	$\models$ is the left of an operator composition
$(2,12)$	$\models \leftarrow \models\circ$	$\models$ is the right of an operator composition
$(3,3)$	$\circ \leftarrow \circ\models)$	')' marks the end of a complex operator composition
$(3,4)$	$\circ \leftarrow (\models\circ$	'(' marks the beginning of a complex operator composition
$(3,5)$	$\circ \leftarrow \circ($	after '(' an operator composition will follow
$(3,6)$	$\circ \leftarrow)\circ$	before ')' an operator composition will appear
$(3,9)$	$\circ \leftarrow \alpha_\sqcup(\models\circ$	after α, a more complex operator composition can follow by '$\circ \leftarrow \circ($'
$(3,10)$	$\circ \leftarrow \circ\models)_\sqcup\alpha$	before α, a more complex operator composition can follow by '$\circ \leftarrow)\circ$'
$(3,11)$	$\circ \leftarrow)\circ\models$	before ')', an arbitrarily complex operator composition can appear
$(4,1)$	$(\leftarrow (\alpha$	α begins a subformula or a function argument in the context $)(\alpha$
$(4,2)$	$(\leftarrow \alpha($	α is a single marker of a function after '(', ')', or $\models$
$(4,5)$	$(\leftarrow)($	$)($ marks the concatenation of a function formula and function argument
$(4,10)$	$(\leftarrow \alpha_\sqcup($	α with '$\sqcup$' before '(' marks the beginning of an operator composition
$(5,5)$	$) \leftarrow)($	$)($ marks the concatenation of a function formula and function argument
$(5,10)$	$(\leftarrow)_\sqcup\alpha$	) with '$\sqcup$' before 'α' marks the end of an operator composition

Table 2: *Explanation of some contextually nonevident (critical) replacement formulas from Table 1.*

$$\aleph \xmapsto{0,1} \alpha \xmapsto{1,4} \alpha) \xmapsto{5,1} \boxed{\alpha\alpha});$$

$$\aleph \xmapsto{0,1} \alpha \xmapsto{2,1} \boxed{\alpha\alpha};$$

$$\aleph \xmapsto{0,2} \models, \xmapsto{2,5} \models \boxed{,\,,};$$

$$\aleph \xmapsto{0,1} \alpha \xmapsto{1,1} \alpha \models \xmapsto{1,2} \boxed{\models \alpha \models};$$

$$\aleph \xmapsto{0,1} \alpha \xmapsto{1,2} \models \alpha \xmapsto{1,2} \boxed{\models \alpha \models};$$

$$\aleph \xmapsto{0,1} \alpha \xmapsto{1,3} (\alpha \xmapsto{1,3} ((\alpha \xmapsto{4,3} (\models (\alpha \xmapsto{4,9}$$
$$\circ(\models (\alpha \xmapsto{1,4} \boxed{\circ(\models (}\alpha)$$

etc. Through these examples one can understand the conditionality of the edge syntax. In this way, the intermediate results of formula generation must be proved on syntactic correctness, However, this mode of correct frame generation enables a spontaneous approach in emerging of formulas, connected with semantic (interpretive) concepts of the spontaneously arising formulas. □

6 The Basic Notion of the Gestalt Belonging to an Informational Entity

6.1 Introduction

Gestalts are a kind of interpretative possibilities to a given formula. As one will learn, gestalts can be classified in various directions, the formal and the applied ones. In some respect, the concept of informational gestalt approaches the concept of an informational graph, but in a formal, especially causal and circular sense.

6.2 Informationally Phenomenalistic Gestalts

Informational entity on the formalistic level is nothing else then an informational formula. The simplest form of a formula is a marking operand which marks an entity. Thus, in the very beginning of our discourse we have to put the question concerning the gestalt of a formula (or formula system) on an intuitive level. Later, we will answer the question in an informationally formalistic way, that is, by an adequate formula expression for informational gestalts.

Gestalt of a formula describes the entire possible *structure of causality* in the framework of the informational logical consistency, that is, the well-formedness of formulas which follow (can be derived) from the original formula by all possible displacements of the parenthesis pairs.

For example, a sentence in a natural language is a grammatically correct sequence of words and each word in the sentence performs (more exactly, informs) as an autonomous and with other words informationally connected entity, that is, formally, as an informational operand or informational operator (the property, quality of operands which it concerns). Such a sentence hides all possible causal choices (cases, example) of the sentence and this sentence presentation potentiality is called the gestalt of the sentence.

In this way, a sentence can also be understood as an informational graph, which is an ordered structure (sequence, loop) of operands and operators without any parenthesis pairs (grouped informational connections) between words (operands and operators). In a practical case of a sentence understanding, only few of the possible cases of the setting of parentheses pairs are realized (constructed) by the observer of the sentence, that is, only those which fit in the best possible manner the given discourse of involved observers.

6.3 Definition of the Gestalt of a Formula and of a Formula System

In this subsection, we have to define gestalts concerning a serial and circular formula, and gestalts of parallel formula systems.

Definition 17 [Length of a Serial Formula] *The length ℓ of a serial formula is an integer being equal to the number of binary informational operators (of type $\models$) in the formula.* □

For the length ℓ, unary operators in a formula do not count. They represent the so-called internalism (input) or externalism (output) of operands occurring in the formula. For instance, the length of formula

$$\alpha \models ((\alpha_1 \models; \models \alpha_1) \models \alpha_2)$$

is, evidently, $\ell = 2$, where operand α_1 disposes of its own input and output. Evidently, the last formula can be expressed by a parallel formula system in the form

$$\alpha \models (\alpha_1 \models \alpha_2);\ \alpha_1 \models;\ \models \alpha_1$$

where from the original serial formula the unary parts are removed.

Definition 18 [Gestalt of a Serial Formula] *Let*

$$\alpha \models (\alpha_1 \models (\alpha_2 \models \cdots (\alpha_{n-1} \models \alpha_n) \cdots))$$

be a serial formula $\varphi_{\rightarrow}$ of length $\ell = n$. Then, the parallel formula system

$$\Gamma(\varphi_{\rightarrow}) \rightleftharpoons \left(\begin{array}{l} \alpha \models (\alpha_1 \models (\alpha_2 \models \cdots (\alpha_{n-1} \models \alpha_n) \cdots)); \\ (\alpha \models \alpha_1) \models (\alpha_2 \models \cdots (\alpha_{n-1} \models \alpha_n) \cdots); \\ \vdots \\ (\cdots ((\alpha \models \alpha_1) \models \alpha_2) \models \cdots \alpha_{n-1}) \models \alpha_n \end{array} \right)$$

consisting of exactly

$$N_{\Gamma(\varphi_{\rightarrow})} = \frac{1}{n+1} \binom{2n}{n}$$

formulas obtained from formula $\varphi_{\rightarrow}$ by all possible replacements of the parenthesis pairs, including $\varphi_{\rightarrow}$, is called the gestalt *of serial formula $\varphi_{\rightarrow}$.* □

A circular serial formula $\varphi_{\rightarrow}^{\circlearrowleft}$ differs from a serial formula $\varphi_{\rightarrow}$ only in its last (the rightmost) operand which is equal to its first (the leftmost) one and, in this way, performs the cycle concerning the distinguished operand or its circularity (its circular closeness).

Definition 19 [Gestalt of a Circular Formula] *Let*

$$\alpha \models (\alpha_1 \models (\alpha_2 \models \cdots (\alpha_{n-1} \models (\alpha_n \models \alpha)) \cdots))$$

be a circular serial formula $\varphi_{\rightarrow}^{\circlearrowleft}$ of the length $\ell = n + 1$. Then, the parallel formula system

$$\Gamma(\varphi_{\rightarrow}^{\circlearrowleft}) \rightleftharpoons \left(\begin{array}{l} \alpha \models (\alpha_1 \models (\alpha_2 \models \cdots (\alpha_{n-1} \models (\alpha_n \models \alpha)) \cdots)); \\ (\alpha \models \alpha_1) \models (\alpha_2 \models \cdots (\alpha_{n-1} \models (\alpha_n \models \alpha)) \cdots); \\ \vdots \\ ((\cdots ((\alpha \models \alpha_1) \models \alpha_2) \models \cdots \alpha_{n-1}) \models \alpha_n) \models \alpha \end{array} \right)$$

consisting of exactly

$$N_{\Gamma(\varphi_{\rightarrow}^{\circlearrowleft})} = \frac{1}{n+1}\binom{2n}{n}$$

formulas obtained from formula $\varphi_{\rightarrow}^{\circlearrowleft}$ by all the possible replacements of the parenthesis pairs, including $\varphi_{\rightarrow}^{\circlearrowleft}$, is called the gestalt *of serial formula $\varphi_{\rightarrow}^{\circlearrowleft}$.* □

In the next two definitions the adjective *basic* will concern the serial formula in the form of transition $\xi \models \eta$. So, the named *parallel* formula systems will consist of basic transitions. On the other hand, we have learned the gestalts of complex serial formulas are not basic in the described sense, and they will be marked in other ways.

Definition 20 [Length of a Parallel Basic Serial Formula System] *The length $\ell_{\|}$ of a parallel serial formula system is an integer being equal to the number of serially connected parallel basic transitions (of type $\xi \models \eta$) in the formula system*

$$\varphi_{\|} \rightleftharpoons \begin{pmatrix} \alpha \models \alpha_1; \\ \alpha_1 \models \alpha_2; \\ \vdots \\ \alpha_{n-1} \models \alpha_n \end{pmatrix}$$

including n serially operand-coupled basic transitions). Thus, evidently, $\ell_{\|} = n$. □

Definition 21 [Gestalt of a Parallel Basic Serial Formula System] *Let $\varphi_{\|}$ be a parallel basic serial formula system of the length $\ell_{\|} = n$ (Definition 20). The gestalt Γ of formula system $\varphi_{\|}$ is given by*

$$\Gamma(\varphi_{\|}) \rightleftharpoons \varphi_{\|}$$

The formula system $\varphi_{\|}$ means the gestalt of itself. □

This definition says a basic parallel system of the form $\varphi_{\|}$ represents the final achievement with respect to other possibilities of informational presentation (interpretation). In $\varphi_{\|}$ already all its informational possibilities are included.

Definition 22 [Gestalt of a Parallel Circular Basic Serial Formula System] *Let $\varphi_{\|}^{\circlearrowleft}$ be a parallel circular basic serial formula system of length $\ell_{\|}^{\circlearrowleft} = n+1$ where*

$$\varphi_{\|}^{\circlearrowleft} \rightleftharpoons \begin{pmatrix} \alpha \models \alpha_1; \\ \alpha_1 \models \alpha_2; \\ \vdots \\ \alpha_{n-1} \models \alpha_n; \\ \alpha_n \models \alpha \end{pmatrix}$$

The gestalt Γ of formula system $\varphi_{\|}$ is given by

$$\Gamma(\varphi_{\|}^{\circlearrowleft}) \rightleftharpoons \varphi_{\|}^{\circlearrowleft}$$

Circular formula system $\varphi_{\|}^{\circlearrowleft}$ means the gestalt of itself. □

This definition is in accordance with Definition 21 for the serial noncircular case.

6.4 Parallelization of Serial Formulas and Serialization of Parallel Formula Systems

A serial formula $\varphi_{\rightarrow}$ (each single formula is in a way serial) demonstrates possibilities of its parallelization by comprehending it into detail, where the transition from one operand to another occurs from one to the next operand in the formula sequence. For instance, in $\alpha \models (\beta \models \gamma)$, as a serial formula specimen, the detailed analysis concerns the transition from α to β and, then, from β to γ, that is, formally, $\alpha \models \beta$ and $\beta \models \gamma$, respectively. Within this view,

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

But, the consequence $(\alpha \models \beta; \beta \models \gamma)$ of this implication delivers all the possible cases (serial interpretations) of the original formula $\alpha \models (\beta \models \gamma)$. Thus, a further implication is

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

and, implication transitively,

$$(\alpha \models (\beta \models \gamma)) \Longrightarrow ((\alpha \models \beta) \models \gamma)$$

6.4.1 Parallelization of a Serial Formula

In which way a serial formula $\varphi_{\rightarrow}(\alpha, \alpha_1, \ldots, \alpha_n)$ of the length n could be possibly parallelized (when looking into its details on the operand level, and ignoring the set parenthesis pairs)? Such a view, ignoring the parenthesis pairs, searches for all possible causal cases of a serial formula presentation when operands and operator keep their places and meanings of the original formula, but the informational relations concerning the parenthesis pairs are changed in all possible manners.

Definition 23 [Parallelization of a Basic Serial Formula] *Let Pi mark parallelization and let* $\varphi_{\rightarrow}(\alpha, \alpha_1, \ldots, \alpha_n)$ *be a serial formula. Then,*

$$\Pi(\varphi_{\rightarrow}(\alpha, \alpha_1, \ldots, \alpha_n)) \rightleftharpoons \begin{pmatrix} \alpha \models \alpha_1; \\ \alpha_1 \models \alpha_2; \\ \vdots \\ \alpha_{n-1} \models \alpha_n \end{pmatrix}$$

is called the parallelization of the serial formula. □

On the other hand, the discussed serial formula $\varphi_{\rightarrow}(\alpha, \alpha_1, \ldots, \alpha_n)$ has the standardized gestalt $\Gamma(\varphi_{\rightarrow}(\alpha, \alpha_1, \ldots, \alpha_n))$, given by Definition 18.

Definition 24 [Graphical Equivalence between Parallelization and Gestalt of a Basic Serial Formula] *Two formula or formula systems are graphically equivalent (operator $\equiv_{\mathfrak{G}}$) if they have one and the same informational graph $\mathfrak{G}$, where informational graph is presented by circles (or ovals) for operands and by arrows for operators, ignoring the positions of parenthesis pairs in both formulas and formula systems.*

Under such circumstances, parallelization of a serial formula is graphically equivalent to gestalt of the serial formula, that is,

$$\Pi(\varphi_{\rightarrow}(\alpha, \alpha_1, \ldots, \alpha_n)) \equiv_{\mathfrak{G}} \Gamma(\varphi_{\rightarrow}(\alpha, \alpha_1, \ldots, \alpha_n))$$

□

This definition shows that a gestalt of a serial formula represents, according to the causal possibilities (causal structure), nothing more than the parallelization of the formula. As a consequence, the last definition and the previous ones deliver, evidently, for basic serial formulas the following graphical equivalences:

$$\begin{array}{ll} \Gamma(\varphi_{\rightarrow}) \equiv_{\mathfrak{G}} \varphi_{\parallel}; & \Pi(\varphi_{\rightarrow}) \equiv_{\mathfrak{G}} \varphi_{\parallel}; \\ \Gamma(\varphi_{\rightarrow}) \equiv_{\mathfrak{G}} \varphi_{\parallel}; & \Gamma(\varphi_{\parallel}) \equiv_{\mathfrak{G}} \varphi_{\parallel}; \\ \Pi(\varphi_{\rightarrow}) \equiv_{\mathfrak{G}} \Gamma(\varphi_{\rightarrow}); & \Gamma(\varphi_{\parallel}) \equiv_{\mathfrak{G}} \varphi_{\parallel} \end{array}$$

For circular serial formulas, there is, analogously,

$$\begin{array}{ll} \Gamma(\varphi_{\rightarrow}^{\circlearrowleft}) \equiv_{\mathfrak{G}} \varphi_{\parallel}^{\circlearrowleft}; & \Pi(\varphi_{\rightarrow}^{\circlearrowleft}) \equiv_{\mathfrak{G}} \varphi_{\parallel}^{\circlearrowleft}; \\ \Gamma(\varphi_{\rightarrow}^{\circlearrowleft}) \equiv_{\mathfrak{G}} \varphi_{\parallel}^{\circlearrowleft}; & \Gamma(\varphi_{\parallel}^{\circlearrowleft}) \equiv_{\mathfrak{G}} \varphi_{\parallel}^{\circlearrowleft}; \\ \Pi(\varphi_{\rightarrow}^{\circlearrowleft}) \equiv_{\mathfrak{G}} \Gamma(\varphi_{\rightarrow}^{\circlearrowleft}); & \Gamma(\varphi_{\parallel}^{\circlearrowleft}) \equiv_{\mathfrak{G}} \varphi_{\parallel}^{\circlearrowleft} \end{array}$$

This completes the discussion concerning parallelization and gestalts of serial and circular formulas.

6.4.2 Serialization of a Parallel System of Basic Transition Formulas

Particularized causation can be extracted from parallel formula systems by their serialization. If the parallelization of serial formulas is a sort of causal universalization, the serialization of a parallel formula systems has the meaning in a causal specialization, proceeding from a universal situation to a very particular one.

Definition 25 [Graphical Implication between Serialization of a Parallel Formula and Serial Formula Belonging to the Gestalt] *If $\varphi_{\parallel}$ and $\varphi_{\rightarrow}$ are parallel and serial formulas according to Definition 20 and Definition 18, respectively. Then,*

$$\varphi_{\parallel} \Longrightarrow_{\mathfrak{G}} \varphi_{\rightarrow};\ \varphi_{\rightarrow} \in_{\mathrm{sys}} \Gamma(\varphi_{\rightarrow})$$

Operator $\Longrightarrow_{\mathfrak{G}}$ reads 'implies graphically' and operator $\in_{\mathrm{sys}}$ means 'is a component of the system'. □

Similar definition can be set in concern to circular formulas.

Definition 26 [Graphical Implication between Serialization of a Parallel formula and Circular Serial Formula belonging to the Gestalt] *If $\varphi_{\parallel}^{\circlearrowleft}$ and $\varphi_{\rightarrow}^{\circlearrowleft}$ are parallel and serial formulas according to Definition 22 and Definition 19, respectively. Then,*

$$\varphi_{\parallel}^{\circlearrowleft} \Longrightarrow_{\mathfrak{G}} \varphi_{\rightarrow}^{\circlearrowleft};\ \varphi_{\rightarrow}^{\circlearrowleft} \in_{\mathrm{sys}} \Gamma(\varphi_{\rightarrow}^{\circlearrowleft})$$

Operators $\Longrightarrow_{\mathfrak{G}}$ and $\in_{\mathrm{sys}}$ means have the same meaning as in the preceding definition. □

This completes the discussion on the possibilities of drawing the serial consequences (possible interpretations) from parallel systems. In this respect, a serialization on the basis of parallelism has the role to investigate the details, possible particularities and the like.

6.5 Axiomatic Gestalts

The axiomatic gestalts include all the formulas obtained by the possible replacements of parenthesis pairs in given axioms. In mathematics, axioms function as the given initial and hypothesized theorems and as given rules of inference (method, deduction, induction). It would be extremely interesting to make a look into the background of the axiomatic gestalts and to observe all the possible 'axiomatic' formulas, that is those, proceeding from the given axioms by their 'gestalting'.

Mathematical axioms [7, 8] can be rewritten in an informational form. Let us take the implication axiom set ([7], p. 66) in the form

$$\begin{aligned} &1)\quad \alpha \Longrightarrow (\beta \Longrightarrow \alpha);\\ &2)\quad (\alpha \Longrightarrow (\alpha \Longrightarrow \beta)) \Longrightarrow (\alpha \Longrightarrow \beta);\\ &3)\quad (\alpha \Longrightarrow \beta) \Longrightarrow ((\beta \Longrightarrow \gamma) \Longrightarrow (\alpha \Longrightarrow \gamma)) \end{aligned}$$

For seeing the possibilities in the sense of a gestalt, informational graphs in Fig. 4 can be used. These graphs are uniquely described by the corresponding parallel systems of basic transitions, that is,

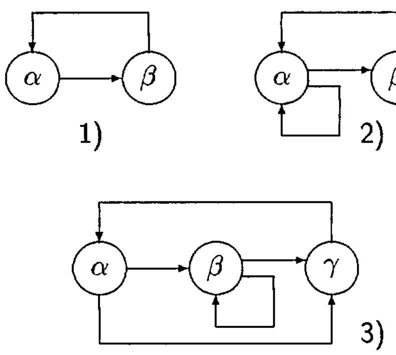


Figure 4: *A graphical interpretation of the implication axioms where graphs give an insight to the corresponding gestalts* $\Gamma(\varphi_1), \Gamma(\varphi_2)$, *and* $\Gamma(\varphi_3)$.

$$\begin{aligned} &1)\quad (\alpha \Longrightarrow \beta;\ \beta \Longrightarrow \alpha);\\ &2)\quad (\alpha \Longrightarrow \alpha;\ \alpha \Longrightarrow \beta;\ \beta \Longrightarrow \alpha);\\ &3)\quad (\alpha \Longrightarrow \beta;\ \beta \Longrightarrow \beta;\ \beta \Longrightarrow \gamma;\ \gamma \Longrightarrow \alpha;\\ &\qquad \alpha \Longrightarrow \gamma) \end{aligned}$$

The last system of formulas represents the so-called parallelization of axiom formulas by the most elementary informational-implication transitions of the form $\xi \Longrightarrow \eta$.

In the axiomatic gestalts corresponding to the axiom formulas φ_1, φ_2 and φ_3 in 1), 2), and 3), the number of the possible formulas is $N = \frac{1}{\ell+1}\binom{2\ell}{\ell}$ where ℓ is the number of $\Longrightarrow$-operators in a formula. Thus,

$$\Gamma(\varphi_1) \rightleftharpoons \begin{pmatrix} \alpha \Longrightarrow (\beta \Longrightarrow \alpha);\\ (\alpha \Longrightarrow \beta) \Longrightarrow \alpha \end{pmatrix};$$

$$\ell_1 = 2;\ N_1 = \tfrac{1}{3}\tbinom{4}{2} = 2;$$

$$\Gamma(\varphi_2) \rightleftharpoons$$

$$\begin{pmatrix} \alpha \Longrightarrow (\alpha \Longrightarrow (\beta \Longrightarrow (\alpha \Longrightarrow \beta)));\\ (\alpha \Longrightarrow \alpha) \Longrightarrow (\beta \Longrightarrow (\alpha \Longrightarrow \beta));\\ \vdots\\ (((\alpha \Longrightarrow \alpha) \Longrightarrow \beta) \Longrightarrow \alpha) \Longrightarrow \beta \end{pmatrix};$$

$$\ell_2 = 4;\ N_2 = \tfrac{1}{5}\tbinom{8}{4} = 14;$$

$$\Gamma(\varphi_3) \rightleftharpoons$$

$$\begin{pmatrix} \alpha \Longrightarrow (\beta \Longrightarrow (\beta \Longrightarrow (\gamma \Longrightarrow (\alpha \Longrightarrow \gamma))));\\ (\alpha \Longrightarrow \beta) \Longrightarrow (\beta \Longrightarrow (\gamma \Longrightarrow (\alpha \Longrightarrow \gamma)));\\ \vdots\\ ((((\alpha \Longrightarrow \beta) \Longrightarrow \beta) \Longrightarrow \gamma) \Longrightarrow \alpha) \Longrightarrow \gamma \end{pmatrix};$$

$$\ell_3 = 5;\ N_3 = \tfrac{1}{6}\tbinom{10}{5} = 42$$

Novikov ([8], p. 75) replaces axioms 2) and 3) by a single axiom of the form

$$\begin{aligned} 4)\quad &(\alpha \Longrightarrow (\beta \Longrightarrow \gamma)) \Longrightarrow\\ &\qquad ((\alpha \Longrightarrow \beta) \Longrightarrow (\alpha \Longrightarrow \gamma)); \end{aligned}$$

$$\ell_4 = 6;\ N_4 = \tfrac{1}{7}\tbinom{12}{6} = 132$$

The graph of this axiom is presented in Fig. 5 and, as one can see, differs from graphs 2) and 3) in Fig. 4, substantially. The basic parallel formula system for this graph is

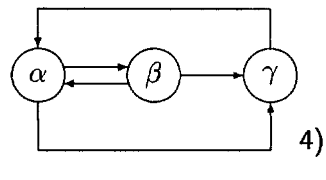


Figure 5: *A graphical interpretation of the implication axiom* 4) *where the graph gives an insight to the corresponding gestalt* $\Gamma(\varphi_4)$.

$$\begin{aligned} &4)\quad (\alpha \Longrightarrow \beta;\ \beta \Longrightarrow \gamma;\ \gamma \Longrightarrow \alpha;\ \beta \Longrightarrow \alpha;\\ &\qquad \alpha \Longrightarrow \gamma) \end{aligned}$$

The gestalt $\Gamma(\varphi_4)$ includes 132 formulas of length $\ell_4 = 6$. Another presentation of the graph in Fig. 5 uses a system of all circular formulas (graph loops), so, system

$$\alpha \Longrightarrow (\beta \Longrightarrow (\gamma \Longrightarrow \alpha));$$
$$\alpha \Longrightarrow (\gamma \Longrightarrow \alpha); \alpha \Longrightarrow (\beta \Longrightarrow \alpha)$$

describes the situation in a particular case.

6.6 Serial and Reversely Serial Gestalts

A serial decomposition of an informational entity roots in the causal nature of entities and its informational components. For instance, the analysis of an entity progresses into the direction of discovering its informational details, stepping deeper and deeper into the structure. But, commonsensically, when reaching a deep informational detail, the process can be reversed, so that the analysis proceeds in the opposite direction, for example, verifying the obtained analytical (decompositional) results and accomplishing them informationally. On the level of conscious thought, such a forward and backward informational processing is thoroughly possible.

Let us discuss in short the case of a serial and, simultaneously, reversely serial decomposition of an entity, marked by α_1, as shown in Fig. 6. At the first look, this structure is a multiloop

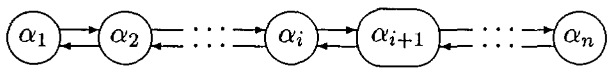


Figure 6: *A graphical interpretation of the serially and reversely serially [$\frac{1}{2}n(n-1)$-tuple-loop] structured decomposed system for entity α_1.*

one. There is, for example, the longest cycle [$\ell_{\max} = 2(n-1)$], in which operands appear in the sequence $\alpha_1, \alpha_2, \ldots, \alpha_i, \alpha_{i+1}, \ldots, \alpha_n, \alpha_{n-1}, \ldots, \alpha_{i+1}, \alpha_i, \ldots, \alpha_2, \alpha_1$, and there are all the possible other shorter cycles [$\ell = 1, 2, \ldots, 2n-3$]. A short analysis shows that the decomposition structure in Fig. 6 has a number of loops (L)

$$L = \frac{1}{2}n(n-1)$$

that is, numerically,

n	1	2	3	4	5	6	7	8	9	10
L	0	1	3	6	10	15	21	28	36	45

A parallel formula system for the graph in Fig. 6 is, certainly,

$$\begin{pmatrix} \alpha_1 \models \alpha_2; & \cdots & \alpha_i \models \alpha_{i+1}; & \cdots & \alpha_{n-1} \models \alpha_n; \\ \alpha_2 \models \alpha_1; & \cdots & \alpha_{i+1} \models \alpha_i; & \cdots & \alpha_n \models \alpha_{n-1} \end{pmatrix}$$

Let us define, precisely, the kinds of different "loops" and their numbers according to the graph, formula, and causal situation.

Definition 27 [A Concept of Graphical, Formula, and Causal Loop for Simultaneously Serial and Reversely Serial Case] *Let $\mathfrak{G}$ be a graph in Fig. 6. Let us distinguish three kinds of loops:*

1. *A* graphical loop *is a loop visible through the circumspection of the graph which, regardless of its circular structure, is considered as graphically different from all the other possible loops in the graph.*
2. *A* formula loop *is a loop which, in any appropriate form (arbitrary displacements of parenthesis pairs and arbitrary choice of the leftmost operand of the loop) corresponds to the graph loop.*
3. *A* causal loop *follows from a formula loop by an arbitrary displacement of the parenthesis pairs.*

The are three different numbers of loops for the graph in Fig. 6:

1. *The number $L_{\mathfrak{G}}$ of all graphical loops is*
$$L_{\mathfrak{G}} = \frac{1}{2}n(n-1)$$
2. *The number L_φ of all formula loops amounts to*
$$L_\varphi = 2n^2$$
3. *The number $L_{\varphi()}$ of all causal loops attains*
$$L_{\varphi()} = \sum_{i=1}^{2n^2} \frac{1}{\ell_i + 1}\binom{2\ell_i}{\ell_i}$$
where ℓ_i marks the length of the corresponding formula loop.

Evidently, $L_{\varphi()}$ corresponds to the number of all the formulas included in all the gestalts corresponding to the graph in Fig. 6. □

6.7 Circular and Reversely Circular Gestalts

Circularly serial decomposition of an informational entity roots in the causal and metaphysicalistic nature of informational entities and its informational components. The reversal circularity brings something new into the discourse of the possible circular structures and its practical implications.

Let us see in short the case of a circularly serial and, simultaneously, circularly reversely serial decomposition of an entity, marked by α_1, as shown in Fig. 7. A parallel formula system for the graph

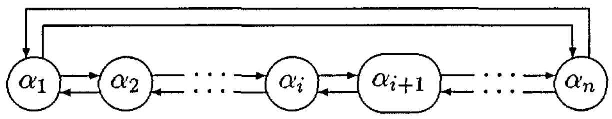


Figure 7: *A graphical interpretation of the circularly serially and circularly reversely serially [$\frac{1}{2}n(n+1)$-tuple-loop] structured decomposed system for entity α_1.*

in Fig. 7 is

$$\begin{pmatrix} \alpha_1 \models \alpha_2; & \alpha_2 \models \alpha_1; \\ \alpha_2 \models \alpha_3; & \alpha_3 \models \alpha_2; \\ \vdots & \vdots \\ \alpha_{n-1} \models \alpha_n; & \alpha_n \models \alpha_{n-1}; \\ \alpha_n \models \alpha_1; & \alpha_1 \models \alpha_n \end{pmatrix}$$

The n longest serial loops and their counterloops are determined as

$$\begin{array}{l} \alpha_i \models (\alpha_{i+1} \models \cdots (\alpha_{n-1} \models (\alpha_n \models \\ \quad (\alpha_1 \models (\alpha_2 \models \cdots (\alpha_{i-1} \models \alpha_i) \cdots)))) \cdots); \\ \alpha_i \models (\alpha_{i-1} \models \cdots (\alpha_2 \models (\alpha_1 \models \\ \quad (\alpha_n \models (\alpha_{n-1} \models \cdots (\alpha_{i+1} \models \alpha_i) \cdots)))) \cdots); \\ i = 1, 2, \ldots, n \end{array}$$

respectively. The length of each of $2n$ circular formulas is n and, thus, the gestalts for these formulas only include, altogether,

$$\frac{2n}{n+1}\binom{2n}{n}$$

formulas (with all the possible displacements of the parenthesis pairs).

Evidently, according to Definition 27, for the circular case, there is

$$L^{\circlearrowleft}_{\mathfrak{G}} = \tfrac{1}{2}n(n+1); \quad L^{\circlearrowleft}_{\varphi} = 2(n+1)^2;$$

$$L^{\circlearrowleft}_{\varphi()} = \sum_{i=1}^{2(n+1)^2} \frac{1}{\ell_i + 1}\binom{2\ell_i}{\ell_i}$$

6.8 Metaphysicalistic and Reversely Metaphysicalistic Gestalts

Metaphysicalistic formulas concern the interior (internal states) of an informing entity and, in this way, replace the reductionistic and rigidly (algorithmically) determined propositions and predicates. In such a context, metaphysicalistic formulas can behave informationally, that is, as circularly and intentionally spontaneous entities. One can imagine how a metaphysicalistic formula—on the level of the conscious informational phenomenalism in the living brain (mind)—models the nervous processes constituting the essential conscious entity. In neural systems, the one-way (direction) propagation of information—from synapses, dendrites, neuronal somata, axons to the synapses, and so forth—is a commonly recognized phenomenon (scientific philosophy). However, on the conscious or artificial (constructionist) level, the direction of information propagation can be reversed in the form of the thought flow or a machine processing[2]. Such a reverse metaphysicalistic process can represent an essentially different interpretation of the original process, particularly in the sense of specifically changed causalism where, in a cycle, causes and effects interchange their roles. One has to remind that the original and the reversed process take place in a circularly interweaved environment where a strict distinction of causes and their effects (consequences) is no longer possible.

A metaphysicalistic direct and reversal structure is graphically presented in Fig. 8. The bidirectional metaphysicalistic system is much more cycled than a standard metaphysicalistic system of an entity, represented in Fig. 10. While the original system has only 6 loops, the additional reversing causes a 30–loop structure, according to the formula $\frac{1}{2}n(n+1)$ and Fig. 8, $\frac{1}{2}n(n+1)+4 = 32$ for $n = 7$. The reader can calculate the entire complexity of the circularly structured me-

[2] See, for instance, the thermodynamic theory of thought processes [11].

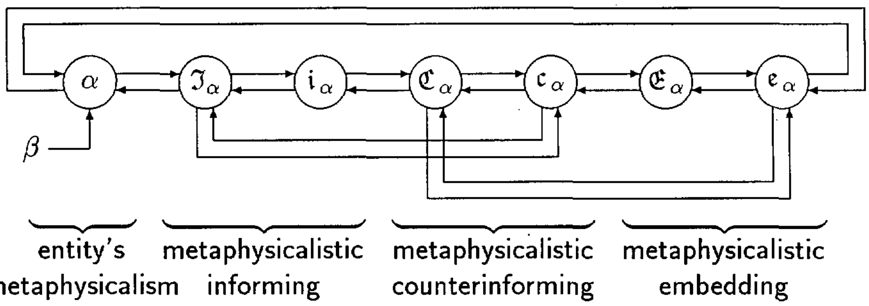


Figure 8: *A graphical interpretation of the circularly (32-tuple-loop) structured basic metaphysicalistic system of informational entity α being informationally impacted by the exterior entity β.*

taphysicalism and its reverse in the form of particular informational gestalts by himself/herself.

6.9 Parallel Gestalts

Parallel gestalts are nothing other than gestalts of gestalts. One can imagine in which way such a situation appears when examining parallel systems of arbitrarily structured (e.g., circularly circular) serial formulas.

Parallel gestalts concern systems of serial formulas where each formula has its gestalt and the possibilities of different serial formulas included in different gestalts has to be considered. Evidently, in such a case, the sum of the gestalt possibilities can be taken into account.

For a gestalt of a gestalt as a parallel system and a gestalt of parallel systems of basic transitions, there is evidently,

$$\Gamma(\Gamma(\varphi_{\rightarrow})) \equiv \Gamma(\varphi_{\rightarrow});\ \Gamma(\Gamma(\varphi_{\rightarrow}^{\circlearrowleft})) \equiv \Gamma(\varphi_{\rightarrow}^{\circlearrowleft});$$
$$\Gamma(\varphi_{\parallel}) \equiv \varphi_{\parallel};\ \Gamma(\varphi_{\parallel}^{\circlearrowleft}) \equiv \varphi_{\parallel}^{\circlearrowleft}$$

7 Inference Gestalts

Besides axioms, inference rules build up the skeleton of logical inferetialism, consisting of processes of deriving, deducing, inducing, abducing, etc. in the framework of logical reasoning and theories constructing.

Modi informationis (modes of informational inference) can be used in different informational deduction processes. The basic rules (principles) of inference in the propositional and predicate logic are, for instance, substitution, modus ponens and modus tollens, which perform in the framework of truth and falseness (the principle of tertium non datur). The reader can imagine how these rules can be transferred in the realm of informational entities (a kind of informational logic). Beside these principles, other inference rules can be introduced, known in the common speech as modus agendi, essendi, rectus, operandi, obliquus, vivendi, possibilitatis, etc., as already constituted in the Latin language. *Informational modus*

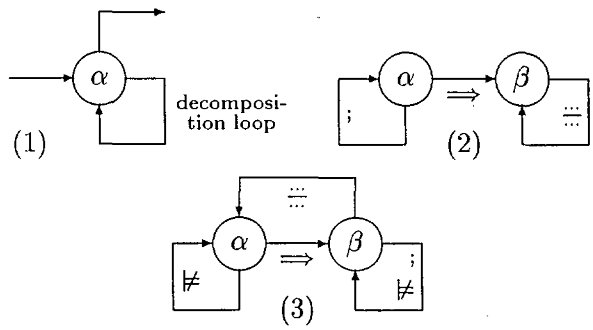


Figure 9: *Informational graphs for informational modus agendi* (1), *modus ponens* (2), *and modus tollens* (3).

agendi (informational phenomenalism) of an entity, marked by operand α, is shown by graph (1) in Fig. 9 and represents the mode in which an informational entity (operand, phenomenon, thing, process) acts or operates (informs and is informed), that is,

$$\alpha \rightleftharpoons \begin{pmatrix} \models \alpha; \\ \alpha \models; \\ \alpha \models \alpha \end{pmatrix} \quad \begin{matrix} \text{input (internalism)} \\ \text{output (externalism)} \\ \text{interior (metaphysicalism)} \end{matrix}$$

The 'feedback' arrow (vector) hides the potentiality of α's decomposition (the α's metaphysicalism $\alpha \models \mathring{\alpha}$), the input arrow presents the α's internalism $\models \alpha$, and the output arrow the α's externalism $\alpha \models$.

Informational modus ponens represents the interpretation of the logical (philosophical) modus ponens into informational realm. Similarly, the *informational modus tollens* represents the interpretation of the logical (philosophical) modus tollens into informational realm. The detachment (modus ponendo ponens and modus tollendo tollens) formulas are, respectively,

$$(\text{MP})\ \frac{\alpha; \alpha \Longrightarrow \beta}{\beta} \quad \text{and} \quad (\text{MT})\ \frac{\alpha \Longrightarrow \beta; \beta \not\models \beta}{\alpha \not\models \alpha}$$

Their graphs (2) and (3) are drawn in Fig. 9. The arrows are marked by ';' (informational parallelism), $\Longrightarrow$ (informational implication), $\stackrel{\cdot\cdot}{\dots}$ (informational detachment), and $\not\models$ (particular noninforming). It is to stress that $(\xi \not\models \xi) \Longrightarrow (\xi \not\models; \not\models \xi)$ expresses the modus existendi of a certain noninforming of the entity presented by the informational operand ξ.

Evidently, the gestalts for MP (rule marker ρ_{MP}) and MT (rule marker ρ_{MT}) are, respectively, equal to the rules themselves, that is,

$$\Gamma(\rho_{\text{MP}}) \equiv \rho_{\text{MP}} \quad \text{and} \quad \Gamma(\rho_{\text{MT}}) \equiv \rho_{\text{MT}}$$

because the parallel structured premises $\alpha; \alpha \Longrightarrow \beta$ and $\alpha \Longrightarrow \beta; \beta \not\models \beta$ have to be treated as indivisible entities.

Several other forms of modi informationis can be discussed. The one concerning the intention of an informational entity is the so-called *modus rectus*, by which the detachment of the intention of an informing entity would be possible.

8 Intelligent Gestalts

Intelligent gestalts are a consequence of intelligent informational formulas. Which kind of a formula could be comprehended as informing in an intelligent way? What is intelligent informing?

Definition 28 [Intelligent Informational Formula] *An intelligent informational formula possesses its specific intelligent metaphysicalism [13]. The rough structure of an intelligent formula, not being decomposed to the necessary details yet, is given by Fig. 10 and expressed as intelligence ι concerning α (functionally) by the parallel system of basic transitions.* □

How can the graph in Fig. 10 be described in a form embracing all possible formalistic phenomenalism? The answer is: by a parallel system of basic transition formulas determined by the paths between two entities. So, let us construct the parallel system (Fig. 10) in the form

$$\iota(\alpha) \rightleftharpoons \begin{pmatrix} \alpha \models \iota; & & \\ \iota \models \mathfrak{I}_\iota; & \mathfrak{I}_\iota \models \mathfrak{i}_\iota; & \mathfrak{i}_\iota \models \mathfrak{C}_\iota; \\ \mathfrak{C}_\iota \models \mathfrak{c}_\iota; & \mathfrak{c}_\iota \models \mathfrak{E}_\iota; & \mathfrak{E}_\iota \models \mathfrak{e}_\iota; \\ \mathfrak{i}_\iota \models \mathfrak{I}_\iota; & \mathfrak{c}_\iota \models \mathfrak{C}_\iota; & \mathfrak{e}_\iota \models \mathfrak{E}_\iota; \\ \mathfrak{c}_\iota \models \mathfrak{I}_\iota; & \mathfrak{e}_\iota \models \mathfrak{C}_\iota; & \mathfrak{e}_\iota \models \iota \end{pmatrix}$$

Let us write only one formula for each of the six loops in Fig. 10, considering the input operand α. For the shortest loops to the longest one, there is,

$$\begin{pmatrix} \alpha \models \iota; \\ \mathfrak{I}_\iota \models (\mathfrak{i}_\iota \models \mathfrak{I}_\iota);\ \ \mathfrak{C}_\iota \models (\mathfrak{c}_\iota \models \mathfrak{C}_\iota); \\ \quad \mathfrak{E}_\iota \models (\mathfrak{e}_\iota \models \mathfrak{E}_\iota); \\ \mathfrak{I}_\iota \models (\mathfrak{i}_\iota \models (\mathfrak{C}_\iota \models (\mathfrak{c}_\iota \models \mathfrak{I}_\iota))); \\ \quad \mathfrak{C}_\iota \models (\mathfrak{c}_\iota \models (\mathfrak{E}_\iota \models (\mathfrak{e}_\iota \models \mathfrak{C}_\iota))); \\ \iota \models (\mathfrak{I}_\iota \models (\mathfrak{i}_\iota \models \mathfrak{C}_\iota \models (\mathfrak{c}_\iota \models (\mathfrak{E}_\iota \models (\mathfrak{e}_\iota \models \iota))))) \end{pmatrix}$$

This system consisting of the input formula $\beta \models \iota$ and the six circular formulas of lengths $\ell = 2, 4$, and 7, describes only a very small part of the informational graph in Fig. 10. The length ℓ of a formula is determined by the number of binary operators occurring in it. The subgraph corresponding to the system of circular formulas in parallel cannot be drawn in a usual form because the informational graph (without parenthesis pairs) expresses the entire parallelism and, in this respect, informational gestaltism. But, this reduced or specifically particularized system already determines the discussed parallel system which can be constructed out of the reduced system of circular formulas and formula $\beta \models \iota$.

8.1 Interpretive Gestalts

Interpretive gestalts are a consequence of interpretive formulas by which existing formulas are "interpreted" by the introduction of additional parallel formulas or by further serial decomposition of the existing formulas. The process of interpretation is not limited in advance because at each system situation a new interpretive detail concerning the system constituents can be added.

8.2 Understanding Gestalts

The understanding system υ in Fig. 11, understanding and producing the meaning of something

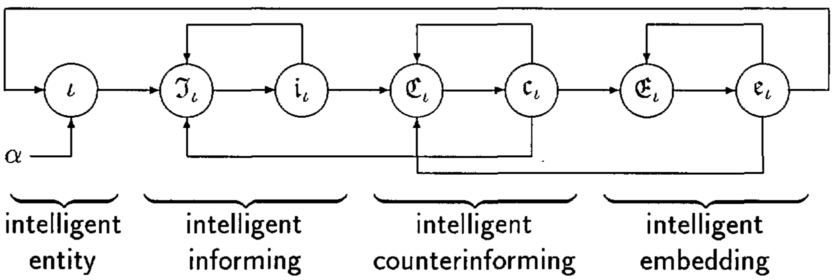


Figure 10: *A graphical interpretation of the circularly (sextuple-loop) structured parallel metaphysicalistically intelligent system of informational entity* ι.

β, is a paragon of a sufficiently complex understanding device, concerning various phenomenalisms in philosophy, psychology, cognitive science, artificial intelligence and, first of all, the general theory of the informational.

Let us introduce the following markers (entities) of understanding (subscribed by υ) and their initial meanings:

υ understanding;	β to be understood;
$\mathfrak{I}_\upsilon$ intending;	$\mathfrak{i}_\upsilon$ intention;
$\mathfrak{S}_\upsilon$ sensing;	$\mathfrak{s}_\upsilon$ sensibility;
$\mathfrak{O}_\upsilon$ observing;	$\mathfrak{o}_\upsilon$ observation;
$\mathfrak{B}_\upsilon$ being conscious;	$\mathfrak{b}_\upsilon$ consciousness;
$\mathfrak{U}_\upsilon$ being unconscious;	$\mathfrak{u}_\upsilon$ unconsciousness;
$\mathfrak{C}_\upsilon$ conceiving;	$\mathfrak{c}_\upsilon$ conception;
$\mathfrak{X}_\upsilon$ signifying;	$\mathfrak{x}_\upsilon$ significance;
$\mathfrak{Y}_\upsilon$ making sense;	$\mathfrak{y}_\upsilon$ reasonableness;
$\mathfrak{P}_\upsilon$ perceiving;	$\mathfrak{p}_\upsilon$ perception;
$\mathfrak{Z}_\upsilon$ concluding;	$\mathfrak{z}_\upsilon$ conclusion;
μ_υ meaning	

The longest loop in Fig. 11 has 22 binary operators, that is, $\frac{22}{23}\binom{44}{22} \approx 201\ 261\ 630\ 000$ possible interpretations alone within its informational gestalt.

9 Gestalts of an Informational Machine

A formal informational machine [19] is a formula system which can handle informational formulas in an informational manner. To set a formal machine conceptually means to make possible the design of a physical informational machine by which informational formulas can be processed informationally. This means that the faculty of informational arising (emerging and appearing of informational formulas) is offered to any informational formula representing an informational entity within the informational machine.

The question which arises is what is the basic formal structure of the informational machine. Which entities must enter into the machine concept to enable the informing of the processed formulas by the machine? Answers to this question are given on some other place [10, 19]. But, for our discussion concerning informational gestalt, it is important to stress that among other features, informational machine must be able to produce and observe the gestalts of appearing and processed informational formulas.

On the other hand, complex circular formulas, being a part of the informing machine itself, are, as any informational entity, observed by the machine also through the gestalt possibilities and being adapted consequently in dependence of the arising circumstances.

10 Star Gestalts

The idea of the star gestalt roots in the formula circularity, although it can be defined for straightforwardly serial formula too.

Definition 29 [A Concept of Star Gestalt of a Serial and Circular Formula] *For the star gestalt,* $\Gamma^\star$, *of a serial formula,* $\varphi_\rightarrow$, *that is* $\Gamma^\star(\varphi_\rightarrow)$, *there is*

$$\Gamma^\star(\varphi_\rightarrow) \rightleftharpoons (\Gamma(\varphi_\rightarrow); \Gamma^<(\varphi_\rightarrow))$$

where $\Gamma^<(\varphi_\rightarrow)$ *is a system of all gestalts for formulas* $\varphi_{\overset{<}{\rightarrow}}$ *(subformulas) obtained from formula* $\varphi_\rightarrow$ *as possible, in respect to* $\varphi_\rightarrow$ *shorter formulas. Formula* $\varphi_{\overset{<}{\rightarrow}}$ *is any formula which follows (is constructed) from the graph of formula* $\varphi_\rightarrow$, *starting from an arbitrary operand in the direction of*

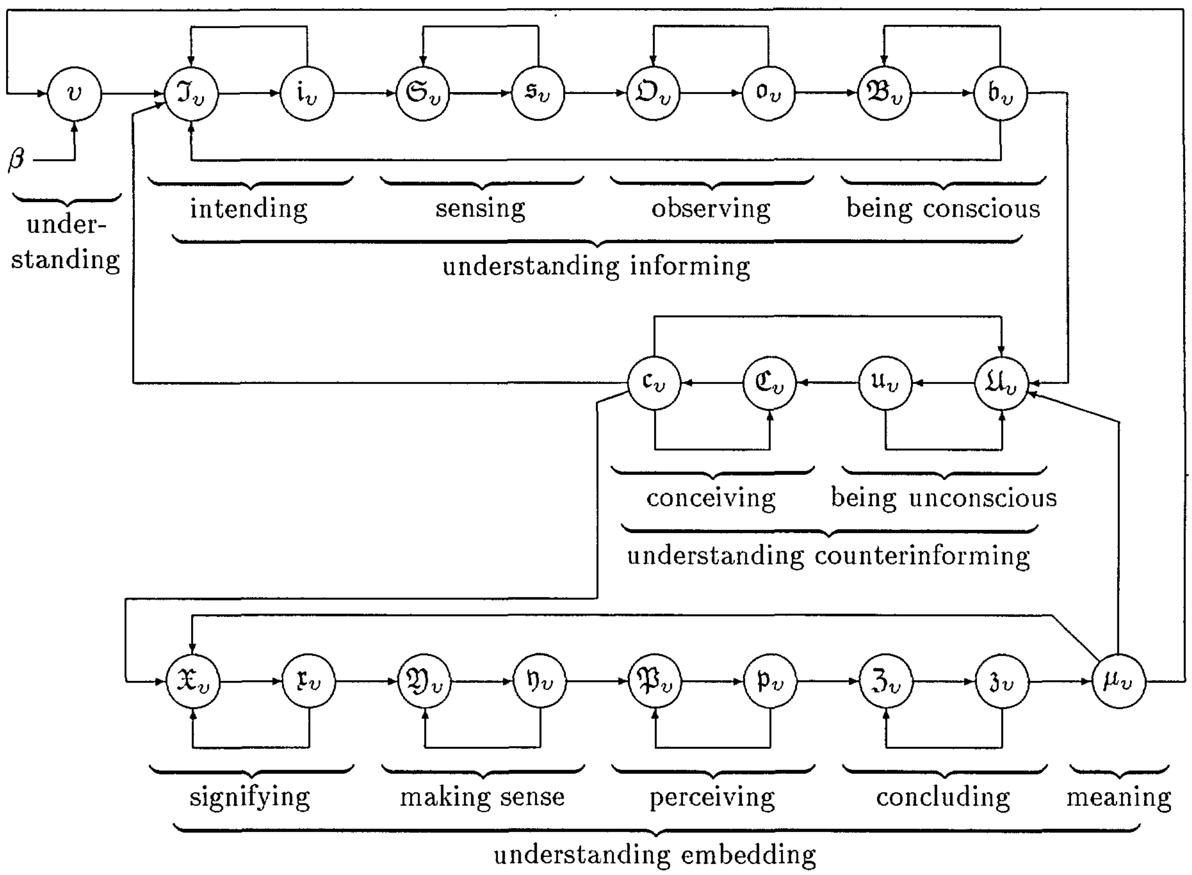


Figure 11: *A graphical interpretation of the circularly (16-tuple-loop) structured (metaphysicalistic) parallel understanding system v of entity β.*

arrows (operators) to an arbitrary point (operand or operator).

The star gestalt of a circular formula, $\varphi^{\circlearrowleft}_{\rightarrow}$, includes an infinite number of formulas obtained in the following manner:

(a) *Let $\mathfrak{G}(\varphi^{\circlearrowleft}_{\rightarrow})$ denote the graph of circular formula $\varphi^{\circlearrowleft}_{\rightarrow}$, that is a circular informational graph.*

(b) *Let the construction of a formula begin at the place of any graph operand (circle, oval).*

(c) *A formula φ, serial or circular, of the star gestalt $\Gamma^{\star}(\varphi^{\circlearrowleft}_{\rightarrow})$, is any formula obtained by moving from a starting circle (operand) along the graph arrows (operators) and ending at the arbitrary circle or arrow.*

□

The example which follows shows how formulas can come to existence within a star gestalt, using an informational graph. Let us show how, according to the given informational graph, an informational formula can arise. In [14], p. 63, Formula (63), the following formal situation of the understanding $\mathfrak{U}$ and metaphysicalism μ_ι within an intelligent ι entity is discussed:

$$\underbrace{(\iota \models ((\overbrace{(\mathfrak{U} \models \mu_\iota) \models \mathfrak{U})}^{\mathfrak{U}\text{-loop}} \models \overbrace{((\mu_\iota \models \mathfrak{U}) \models \mu_\iota)}^{\mu_\iota\text{-loop}})) \models \iota}_{\iota\text{-loop}}$$

This formula is a step towards the decomposition of entity ι. The underlying graph for this formula is shown in Fig. 12.

The $\mathfrak{U}$-, μ_ι-, and ι-loop are not meant to be informationally (causally) isolated loops. Markers $\mathfrak{U}$, μ_ι, and ι can appear in other formulas of a system. In this way, they can stay open in respect to any actual environment, being changed by the exterior influences.

The reader can see how different informational formulas can arise from the informational graph

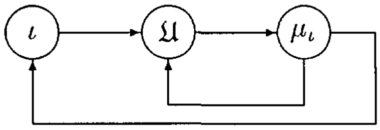


Figure 12: *A graphical interpretation of the circularly (double-loop) structured parallel transitional system* $(\iota \models \mathfrak{U}; \mathfrak{U} \models \mu_\iota; \mu_\iota \models \iota; \mu_\iota \models \mathfrak{U})$.

in Fig. 12. To obtain regular informational formulas, arbitrary transitions, for example, from a beginning entity in the graph, say ι, to an entity are necessary. The following formula system (a part of the star gestalt) shows the emerging of formulas using the graph in Fig. 12:

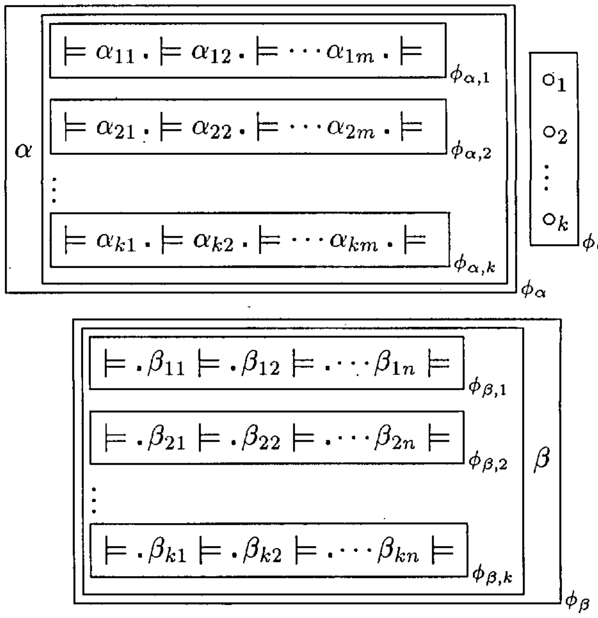
$$
\begin{array}{l}
\iota; \\
\iota \models \mathfrak{U}; \\
\iota \models (\mathfrak{U} \models \mu_\iota); \\
\iota \models ((\mathfrak{U} \models \mu_\iota) \models \mathfrak{U}); \\
\iota \models (((\mathfrak{U} \models \mu_\iota) \models \mathfrak{U}) \models \mu_\iota); \\
\iota \models (((\mathfrak{U} \models \mu_\iota) \models \mathfrak{U}) \models (\mu_\iota \models \mathfrak{U})); \\
\iota \models (((\mathfrak{U} \models \mu_\iota) \models \mathfrak{U}) \models ((\mu_\iota \models \mathfrak{U}) \models \mu_\iota)); \\
(\iota \models (((\mathfrak{U} \models \mu_\iota) \models \mathfrak{U}) \models ((\mu_\iota \models \mathfrak{U}) \models \mu_\iota))) \models \iota; \\
\vdots
\end{array}
$$

In such a transition through the graph, the choosing of parenthesis pairs is spontaneous and, in this respect, different informational formulas can come into existence. Looking causally, each of the listed formula represents a special case and can deliver, for example, different semantics concerning the involved entities of a formula.

11 Conclusion

The introduced informational frame and informational gestalt view have brought new insight into the possibilities of a general informational theory [13, 14, 15, 16, 17, 18, 19, 20].

The informer-observer problem can be exhaustively analyzed through the study of framing of the transition $\alpha \models \circ \models \beta$, for instance, in the form



What is α's informing and what is β's observing? How does phenomenon α inform its reality and how does phenomenon β observe the α's reality? Is the informing of α nevertheless observingly preunderstood by β and, in this way, is α's reality comprehended in advance by β? The last enframed and formalized formula system offers not only various possibilities for such interpretations, but also much more than it can be said by words.

The reader can observe that both ϕ_α and ϕ_β are harmonious frames, that is well-formed formulas. In this respect, α is an independent informer and β is an independent observer. Phenomenon α informs its reality by k different phenomenalisms, so phenomenon β can observe these k phenomenalisms of α by the k properly chosen observational phenomenalisms, when frames ϕ_α and ϕ_β are concatenated by the separator frame $\phi_\circ$ (performing as a concatenation operator) into the resulting transition of the form $\alpha \models \circ \models \beta$.

Let us suppose that α informs its reality by k different phenomenalities and that β has chosen k adequate phenomenalities for observing of α. The number of different phenomenalities is not limited and, in some way, it depends on the observing capabilities of β, so, in principle, $k \to \infty$.

What are the observing phenomenalisms of β? Let α represent a physical phenomenon in the sense of the contemporary physical sciences. The observing entity (observer, apparatus) β can use different theoretical and experimental concepts, methodologies, and methods for observation of α, for example, mathematical (formalistic, recursive), Euclidean (geometrical), Newtonian (gravitational), Hamiltonian (mechanical), Maxwellian (electromagnetical), Lorenzian (particle-motional), Einsteinian (relativistic), quantum, Hilbertian (axiomatic, spatial), Schröderian, cosmological, Weylian (quantum-gravitational), computational, mind-informational [9], Slechtanian (informationally thermodynamical [10, 11]), etc. All these theories and methods belong to scientifically accepted forms of informationalism (artificialisms, methodologisms, scientisms, cybernetism) and depend on human consciousness, intuition, and 'reality-adequateness'. By development of science, theories and methods will improve, change, and their number will increase. *But, the observer entity will observe only the phenomenalisms for which it is theoretically, methodologically, and experimentally capable* [4]. In this sense, the preunderstanding of α's phenomenalism will be, in a way, preunderstood by the observer.

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