AN INTRODUCTION TO INFORMATIONAL MACHINE*

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Anton P. Železnikar
Volaričeva ulica 8
61111 Ljubljana
Slovenia

This essay is an introduction to informational machine (IM) as it might be implemented in the coming decades. IM is an informational phenomenon and informs in itself and to the user in an informationally phenomenal way (IM externalism, internalism, metaphysicalism, and phenomenalism). For this purpose it needs: a massively parallel structured interconnection net of high- performance microprocessors (e.g., 64-bit, three-dimensional RISC); specifically (informationally) designed processor interconnection network; an operating system offering informational, counterinformational, and embedding support to informing entities (operands and operators) and translating informational language; an informational dictionary of entities; and lastly, a powerful peripheral equipment capable to accept (memorize) and transmit all kinds of information (picture, sound, data, signal, control, linguistic information, etc.). The goal of IM design is to achieve the state of »intelligence«, by which IM is an understanding device operating (behaving) within the surrounding world.

Uvod v informacijski stroj.* Ta spis je uvod v informacijski stroj (IS), ki bi ga bilo mogoče uresničiti v naslednjih desetletjih. IS je informacijski fenomen in informira v sebi in k uporabniku na informacijsko fenomenalen način (eksternalizem, internalizem, metafizikalizem in fenomenalizem IS). V ta namen potrebuje: masivno paralelno strukturirano povezovalno mrežo visokozmogljivih mikroprocesorjev (npr. 64-bitni, trirazsežnostni RISC); operacijski sistem z informacijsko, protiinformacijsko in umeščevalno podporo informacijskim entitetam (operandom in operatorjem) in s prevajanjem informacijskega jezika; informacijski slovar entitet; in nazadnje zmogljive periferne naprave, ki spejemajo (pomnijo) in oddajajo vse vrste informacije (sliko, zvok, podatek, signalno, kontrolno, lingvistično informacijo itd.). Cilj načrtovanja IS je doseganje stanja »inteligence«, s katero postane IS razumevajoča naprava, ki deluje (se obnaša) v obdajajočem svetu.

0. Introduction

The phenomenological account of how scientific facts are arrived at by leaving out significance shows why, once we have stripped away all meaningful context to get the elements of theory, theory cannot give back meaning. Science cannot reconstruct what has been left out in arriving at theory; it cannot explain significance. For this reason, even though natural science can explain the *causal basis* of the referential whole, »'Nature' ... can never make *wordliness* intelligible«.

— Hubert L. Dreyfus [BIW] 121

One of the aims of informational theory [TIL, FIP, BIA] is to lay the foundations of the informational machine (IM). These foundations pertain greatly to the concept of an intelligent informational machine (IIM) and their laying is a process in which several new components have to be settled in theoretical, symbolic, cognitive, technological, architectural and other, yet not completely recognized, informational ways.

IM is a consequence of that what one understands as the computer, computing system, or data processing device. The computer is a data machine (DM) where data is a particular, informationally specific entity, a bounded form of information, which concerns facts, factical information, which as a fact does not change during an informational process. DM is an informationally reduced device within the concept of the arising IM and, as such, can never reach the level of, for instance, an intelligent informational machine. Data intelligence remains within the scope of the artificial, modeled, simulated intelligence which, in comparison to natural intelligence, roots in the structure and organization of the algorithmic and data programming on (and by means of) a computer system. Along these lines, the result is a data-stable, algorithmic, well-determined system designed by both mathematical and programming philosophy and conceptual means.

The difference between data and informational processing lies in algorithm vs. informational program, determined foreseeability vs. possibilities of spontaneous informational arising, strict splitting between data and programs vs. operand and operator duality of informational entities, recursively determined program and processing cycles vs. metaphysical informational circularity, the determined closeness of data and programs vs. the phenomenal informational openness of informational operands and operators. IM is an essential extension of DM, from the rigid, algorithmic, mathematical machining to the circularly spontaneous possibilities of informing within the goal-directness, intention, orientation, significance and, not lastly, possible intelligence of arising informational entities in the world. Only in case of an informational machine it becomes possible to speak about the informational understanding, which is a synonym for the intelligent informational behavior of entities within an informational realm, that is, informational entities' surrounding world. Intelligent entities have to behave informationally (in this case understandingly) in the real world, which concerns them in an essential, intentional, developmental, and significant way.

By this essay, the author communicates the concept of an informational machine in the form of a foundational, researching, and technological discourse. Is it already possible to presume and preview the architecture and operating system of the future IM? Both informational theory and philosophy offer concepts and mechanisms which could dramatically impact not only the structure and organization of the IM involving components in the field of electronic, photonic, and biological technology, but also the realms of sufficiently clear comprehension, conceptualism, design, and implementation of machines.

1. The Informational Theory and Informational Machine

Das Miteinandersein ist — ihm selbst verborgen — von der Sorge um diesen Abstand beunruhigt. Existenzial ausgedrückt, es hat den Charakter der *Abständigkeit.* Je unauffälliger diese Seinsart dem alltäglichen Dasein selbst ist, um so hartnäckiger und ursprünglicher wirkt sie sich aus.

Martin Heidegger [SZ] 126

Informational theory (IT) offers formalized means which pertain to informing and informedness of entities (things, phenomena, processes). Informational operands, informational operators, parentheses, commas, and semicolons constitute the syntactic background of formulas and informational formula systems of the theory. In IT, operands and operators are united entities which can be distinguished from each other in instantaneous situations of a formula or formula system. Thus, it is possible to determine informational theories for different purposes. The most remarkable theories of this sort concern understanding, computing, inference, cognition, etc. and also signal processing on a physical level, process control, living phenomenality in biological systems, informational theories of societies, informational mathematical theories, scientific languages, and system theories. IT's enable new approaches to various theoretical and practical problems using specific, informationally conceptualized languages, in which formulas by themselves inform and are informed, that is, arise and are arisen informationally. These formalisms (informational programs) are on the way to be implemented by the use of informational machines.

An IM will perform on the basis of informational formulas, which are programs, expressed in informational language and behave as logically arising entities, possessing their own externalism, internalism, metaphysics, and phenomenalism. In this point, informational programs differ essentially from computer programs, which can be comprehended as texts which contents (semantics) does not change in any way. IP's (informational programs) surpass the computer programming structure and philosophy, programming bounds, and strict, mathematically conceptualized notions.

The way to the proposed informational machine goes back to the basic axiomatic concepts of informational theory. In a concrete case, IT by itself is a textual informational entity, possessing informational phenomenality, which in accordance with its intention, significance, understanding, etc. informs and is informed by means, mechanisms, and informational support of an informational machine. Thus, the informing of a theory's text can be achieved, realized, or implemented by an IM. In a similar way as computer programs are executed by computers, IP's will govern the informing of an IM. So, the question arises, how an IM has to be conceptualized and constructed to come close to the requirements of informational phenomenality of entities in general and in each particular (thinkable) case.

It is to understand that IT and IM support each other. First, a concept and realization of IM becomes possible by the (strict) application of IT's principles, derivation of theorems, and machining informational systems. Then, the IM is supported by the so-called system informational programs, which constitute an informational operating system. When an IM functions as a machining informational entity, the machine can take an IT and let it arise informationally within a given informational realm. Thus, an IT can develop the IM in an informational way and vice versa, simultaneously, in parallel, intentionally, significantly, and intelligently. To bring this possibility of informing to the foreground, we have to develop the sufficiently clear and straightforward detailed concept of informational machine. And this way of development will be shown stepwise in the sections which follow.

2. The Computer as a Data Machine

What is the difference between a data entity and an informational entity? What is the difference between a data machine (= computer) and an informational machine? A DM has to follow the data phenomenality in an architectural and programming construction, while an IM follows the informational phenomenality which broadens the conceptualism of its architecture and programming in an informationally arising manner. The difference between these phenomenalities is essential: data is well-defined information in a particular way; it is specifically bounded by an algorithmic structure and in this way not flexible as information at all.

As a fact or factical information, data informs externally in an unbounded way; it simply informs external observers as any other informational entity. Regardless of the nature of its facticity, the informing of data is spread (broadcasted) in space and time, where different observing entities can become sensitive for informing of data, that is, informed by data. Intelligent entities can, for instance, observe the steadiness of data informing, its facticity, and its informational unchangeableness, non-arising in contrary to a regularly informing entity. Thus, data appears to the observer as a steady, reliable, and predictable information, which can vary only in some known value, degree, truth, etc., but not in its, for instance, semantic character, mood, property, relation, intention, and significance. Data possesses a firm characteristics (property, relation) of something which it concerns, for instance, number, value, degree, structure, facticity of something. In this respect, its characteristics must never change and its changeable components are only factical parts of its characteristics.

The first question relating computers is how does data inform? As a specific informational phenomenon, data informs, but it is informed merely in the sense to preserve (memorize) its facticity, characteristics, or well-determined meaning. The meaning of a certain data, its semantic scope, must never change. It means that the informedness of data is a steady phenomenon, meaningly stable, and semantically unchangeable. How can this phenomenality of data be expressed abstractly, on a formal and symbolic level?

Let δ mark a data entity as an operand and let $\models$ be the symbol for the most general operator of informing. Informing of data is a data property (its own predicate) and the proposition *Data Informs* is the most primitive phenomenological fact of data itself. It belongs to data as an entity, is a part of data possible (entire) informational phenomenality. It means that data as an entity implies the informing of data. Thus the *informatio prima* pertaining to data is postulated by

(1) $\delta \Rightarrow (\delta \models)$

The sense of this implication (symbol $\Rightarrow$) is to show how the informing of data, that is, $\delta \models$, is an integral part of data itself and not a separate entity. The consequence of axiom (1) is

(2) $(\delta \models) \subset \delta$

where $\subset$ is the operator of informational inclusion which says that process $\delta \models$ is a part of δ itself.

It is to say that formulas (1) and (2) do not differ for any general case when data entity δ is replaced by an informational entity. Where does the essential difference between data and information occur?

Data has to keep its identity, which is the facticity of its phenomenality. With other words, it has to memorize its informational identity by preventing its informational structure to be changed. What does the keeping or memorizing of data identity mean at all? Data informs factitiously, which has the meaning of non-spontaneously and artificially. Thus, formula (1) can be particularized into

(1') $\delta \Rightarrow (\delta \models_{\text{factitious}})$

where operator $\models_{\text{factitious}}$ is a general informational operator of factitious informing, probably constructed (imagined) by the data observer in an artificial and informationally not spontaneous way. The question is: can data, in the described sense, exist as a natural situation (entity) at all or is it the consequence of an observer's attitude?

The next basic question is how data is informed? As a fact, data must keep its identity. So, the possible answer to the question is

(3) $\delta \Rightarrow (= \delta)$

The sense of this implication is to show how the informedness of data, that is, $= \delta$, is an integral part (property) of data itself or

(4) $(= \delta) \subset \delta$

and that this informedness is identical. Instead of operator $=$ operators $\models_{\text{identic}}$, $\models_{\text{steady}}$, or $\models_{\text{factitious}}$ could be used.

The consequence of identical informing of data δ is the so-called metaphysical identity which presupposes the steadiness of data, that is

(5) $\delta \Rightarrow (\delta = \delta)$

and, certainly,

(6) $(\delta = \delta) \subset \delta$

Formula (5) is an axiomatic consequence of both axioms (1) and (3). Thus, also the last fundamental axiom of informing of data can be given by

(7) $\delta \Rightarrow (\delta \models; = \delta)$

where

(8) $(\delta \models; = \delta) \subset \delta$

is the logical consequence.

We can unite the four basic axioms into the following logical scheme of informational formulas:

(9)
$\delta \Rightarrow (\delta \models)$; [*data externalism*]
$(\delta \models) \subset \delta$;
$\delta \Rightarrow (= \delta)$; [*data internalism*]
$(= \delta) \subset \delta$;
$\delta \Rightarrow (\delta = \delta)$; [*data metaphysicalism*]
$(\delta = \delta) \subset \delta$;
$\delta \Rightarrow (\delta \models; = \delta)$; [*data phenomenalism*]
$(\delta \models; = \delta) \subset \delta$

Data externalism, internalism, metaphysicalism, and phenomenalism are basic properties of data δ where operators of informing $\models$ and $=$ are integral parts of data δ itself!

This axiomatic introduction of the nature of data was necessary to get the possibility for characterizing the components of data machine $\mathfrak{D}$ (computer). The straightforward formula of informing of a data machine $\mathfrak{D}$ is

$$(10) \qquad (\delta_{input} \dashv_{receive} \mathfrak{D}) \models_{send} \delta_{output}$$

where data input δ_{input} pertains to computer system programs $\mathfrak{P}_{sys}$ (operating system), computer user programs $\mathfrak{P}_{use}$ (applications, tools), and user data δ_{use} (user data bases). Informational operator $\dashv_{receive}$ says that δ_{input} is received by machine $\mathfrak{D}$. Informational operators of the reversed type, that is, $\dashv$, express the passive (participle) mode of informing when read from the left side to the right of informational formula. Implicitly, data machine $\mathfrak{D}$ as an data informing entity (device) operates and is operated by means of the received programs and data in an open, however, normally, well-determined way, that is,

$$(11) \qquad \mathfrak{D} \Rightarrow (\mathfrak{D} \models; \models \mathfrak{D})$$

Formula (11) shows another bounded situation of data machine $\mathfrak{D}$, where machine phenomenalism roots in an identically structured (architectural) machine externalism (informing $\mathfrak{D} \models$) as well as in an identically structured (architectural) machine internalism (informedness $\models \mathfrak{D}$). In this sense, machine $\mathfrak{D}$ receives ($\dashv_{receive}$) input data and sends ($\models_{send}$) results ρ_{result} of its action to its peripherals $\mathfrak{P}_{peripheral}$. Data machine $\mathfrak{D}$ is informationally open ($\mathfrak{D} \models; \models \mathfrak{D}$) only for programs, data, and results which fit its architecture, and system described by formula (11) implies the machine openness of the form

$$(12) \qquad \mathfrak{D} \models_{arc}; \models_{arc} \mathfrak{D}$$

where $\models_{arc}$ is the architectural (computer hardware) defined property of DM functioning. Certainly, the informing ($\mathfrak{D} \models_{arc}$ as externalism or output) and informedness ($\models_{arc} \mathfrak{D}$ as internalism or input) case can be particularized in different possible ways.

What is a more detailed structure of data machine (computer)? We already listed (marked) some components in the previous paragraph. That which is, in fact, called a machine is the data machine architecture (structure of machine's hardware), marked by $\mathfrak{A}_{arc}$. What does the machine architecture produce and what does it sense? The general answer is

$$(13) \qquad \begin{array}{l} \mathfrak{A}_{arc} \Rightarrow (\mathfrak{A}_{arc} \models_{arc\_prod}; \models_{arc\_sense} \mathfrak{A}_{arc}); \\ \mathfrak{P}_{sys}, \mathfrak{P}_{use}, \delta_{use} \models_{arc\_sense} \mathfrak{A}_{arc}; \\ \mathfrak{A}_{arc} \models_{arc\_prod} \rho_{result} \end{array}$$

The last system constitutes the informationally open phenomenal and metaphysical structure of machine architecture, where $\mathfrak{A}_{arc}$ is a well-defined and informationally non-arising physical structure, operator $\models_{arc\_prod}$ means *produce(s) architecturally* and operator $\models_{arc\_sense}$ has the meaning *sense(s) architecturally*. Thus, the phenomenalism of DM is data-informational. Functioning of a DM $\mathfrak{D}$ can be described by the formula

$$(14) \qquad \begin{array}{l} ((\mathfrak{P}_{sys}, \mathfrak{P}_{use}, \delta_{use} \subset \mathfrak{P}_{peripheral}) \dashv_{receive} \\ \quad (\mathfrak{A}_{arc} \models_{execute} \mathfrak{P}_{sys}, \mathfrak{P}_{use}, \delta_{use})) \models_{send} \\ (\rho_{result} \subset \mathfrak{P}_{peripheral}) \end{array}$$

It is to stress that all occurring operands in the last formula belong to data entities which are well-determined, algorithmic, mathematical, and data structured items (alphabetically, δ_{use}, ρ_{result}, $\mathfrak{A}_{arc}$, $\mathfrak{P}_{peripheral}$, $\mathfrak{P}_{sys}$, and $\mathfrak{P}_{use}$). A data machine $\mathfrak{D}$ functions according to formula (14), where the architectural bounds of formula (13) have to be considered. If by $\varphi_{(14)}$ formula (14) is marked, the data machine open informing can be expressed by

$$(15) \qquad \mathfrak{D} \Rightarrow (\varphi_{(14)} \models; \models \varphi_{(14)})$$

or

$$(16) \qquad \mathfrak{D} \Rightarrow (\varphi_{(14)} \models; \models \varphi_{(14)})$$

in case where $\mathfrak{D}$ is not necessarily recognized by its observers (users) as a data device, so, they may believe that $\mathfrak{D}$ informs informationally (for instance, in situations and attitudes of artificial intelligence).

3. Architecture of IM

We recognized in which sense the architecture of a data machine is merely data-informational (informationally non-arising). What is the architecture of an informational machine and what could it be in the present technological circumstances? The first request would be that the architecture of an IM, marked by $\mathfrak{A}_{\mathrm{arc\_IM}}$, must be informational without any limits in advance. The request is

$$(17) \qquad \mathfrak{A}_{\mathrm{arc\_IM}} \Rightarrow (\mathfrak{A}_{\mathrm{arc\_IM}} \models; \models \mathfrak{A}_{\mathrm{arc\_IM}})$$

How could such a machine architecture be implemented conceptually and then technologically?

Let us examine some general architectural criteria for an IM in the following manner:

(1) $\mathfrak{A}_{\mathrm{arc\_IM}}$ is a massive parallel processor system where the number of processors is not limited in advance.

(2) Massive parallelism of $\mathfrak{A}_{\mathrm{arc\_IM}}$ means an extremely flexible, changeable, and arising processor network in which sufficiently complex processors and their interconnections arise in an informational sense.

(3) At the present state of technology, processors $\pi_1, \pi_2, \ldots$ of $\mathfrak{A}_{\mathrm{arc\_IM}}$ are data processors (e.g., 64-bit RISC) capable to fit into the massively parallel network by three (and not only two) dimensions.

(4) Informational entities (operands, formulas of operands and operators) represented by processors in the massively parallel network are supported by mechanisms for sensing relevant (entities concerning) information in the interconnection network.

(5) The architectural interconnection network ($\mathfrak{I}_{\mathrm{network}} \subset \mathfrak{A}_{\mathrm{arc\_IM}}$) possesses methods for the building-up of connections between processors representing operands and formulas (also subformulas) which interact informationally according to particular informational formulas.

(6) Each informational operand has its own processing informational system (basic informational determination of the entity by the basic entity formula in an informational dictionary of entities) to which processors are allocated. Processors are allocated not only to operands but also to informational formulas in which operands occur. Thus, to a complex formula, processors are allocated to each operand, subformula and to the formula itself. The last two behave as additional operands with additional processors allocated.

(7) An informational arising of IM architecture can be simulated by a dynamically changing interconnection network (interconnection distributed processing device), $\mathfrak{I}_{\mathrm{network}}$, in which a sufficient number of operable processor components is available. On the other side, the functional power (operational complexity, speed) of processors and their interconnection can reach performances necessary for informational systems for the most pretentious applications.

(8) The listed performances of IM architecture can grow by the advancing of computer and telecommunication technology. For instance, the number of microelectronic components may reach several billions per chip. The next frontier may be based on single-electron devices and ballistic transistors where the philosophy and perspective of quantum physics is coming into scientific and technological game. Photonics will take over many electronic functions in transmission of information, logic functions, communication switching (interconnection networks), etc. [FOT].

Let us determine the IM architecture $\mathfrak{A}_{\mathrm{arc\_IM}}$ in more detail by the informational architecture system. The following operands and operators are introduced:

$\pi_1, \pi_2, \ldots$	are high-performance microprocessors inserted in the nodes of massive parallel interconnection network $\mathfrak{I}_{\mathrm{network}}$;
σ_{state}	represents the state of architectural informing $\mathfrak{I}_i$ (where i marks processors' subscripts) of processors within the interconnection network $\mathfrak{I}_{\mathrm{network}}$;
$\sigma_{\mathrm{state}}(\mathfrak{A}_{\mathrm{arc\_IM}})$	is the state of architecture, expressed as informational function pertaining to the IM architecture itself;
$\mathfrak{A}_{\mathrm{arc\_IM}}$	is the IM architecture as informational entity;
$\mathfrak{I}_1, \mathfrak{I}_2, \ldots$	are the so-called informings belonging to particular processors $\pi_1, \pi_2, \ldots$;
$\mathfrak{I}_1(\pi_1), \mathfrak{I}_2(\pi_2), \ldots$	are informational functions, where particular informing $\mathfrak{I}_i$ depends on

	the state of processor π_i;
$\mathfrak{I}_{network}$	is informational entity representing the processor interconnection network in all imaginable complexity which can be decomposed to the arbitrary details;
$\models_{by}$	means inform(s)_by or inform(s)_by_means_of;
$\models_{connect}$	means connect(s);
$\Rightarrow$	means implies/imply; and
$\subset$	means inform(s)_in or simply is/are_in.

The initial formula system (prior to the detailed informational decomposition) is

$$
\begin{aligned}
(18)\quad & (\pi_1, \pi_2, \ldots \subset \mathfrak{I}_{network}) \subset \mathfrak{A}_{arc\_IM};\\
& \pi_1, \pi_2, \ldots \Rightarrow\\
& (\pi_1 \models; \models \pi_1; \pi_2 \models; \models \pi_2; \ldots);\\
& (\mathfrak{I}_{network} \models_{connect} (\pi_1, \pi_2, \ldots)) \models_{by}\\
& \sigma_{state}(\mathfrak{A}_{arc\_IM}));\\
& \sigma_{state} \Rightarrow (\mathfrak{I}_1(\pi_1), \mathfrak{I}_2(\pi_2), \ldots \subset \mathfrak{I}_{network})
\end{aligned}
$$

The first formula is an outset of the position of (the arising) IM architecture which functions as an array of dynamically connected high-performance microprocessors (RISC). In this sense, the IM architecture remains informationally open on the level of its interconnection network and, so, is informationally phenomenal. In the second formula the data nature of processors is explicated as a consequence of nowadays electronic and future photonic technology. The only request is that processors have a unique and »sufficiently« complex and effective structure (e.g., high-performance RISC with at least 64-bit). The third formula expresses the informational nature of processor connection in a particular situation by means of the present functional state of IM architecture. The last formula says that the functional state of IM architecture implies the informing of particular (active) processors within the interconnection network.

Formula (18) is an initial architectural position. This formula may now be decomposed in more and more details according to the concepts of the IM architecture designers. It may happen that a future microprocessor generation, at least in some respects, will reach the step of informational phenomenalism.

4. Informational Programs

So far, informational programs belong to the most promising concepts of informational phenomenality [IBU]. In a massively parallel IM $\mathfrak{M}$, the role of informational programs (in short, IP) becomes informational in all imaginable entirety. An IP, marked by $\mathfrak{P}$, is a regular informational entity in the IM environment. What could this property under machine circumstances mean at all?

An informational program $\mathfrak{P}$ has its externalism, internalism, metaphysicalism, and phenomenalism, that is, in a symbolic summarizing form,

$$(19)\quad \mathfrak{P} \Rightarrow (\mathfrak{P} \models; \models \mathfrak{P}; \mathfrak{P} \models \mathfrak{P})$$

Then, IP $\mathfrak{P}$ is informationally open to the IM environment in several ways. Firstly, it informs the IM system and is informed by it or, symbolically,

$$(20)\quad (\mathfrak{P} \subset \mathfrak{M}) \Rightarrow (\mathfrak{P} \models \mathfrak{M}; \mathfrak{M} \models \mathfrak{P})$$

and, secondly, it is informationally open to other active, that is, informing informational programs $\mathfrak{P}_1, \mathfrak{P}_2, \ldots$ within the informational machine $\mathfrak{M}$, thus,

$$
\begin{aligned}
(21)\quad & (\mathfrak{P}, \mathfrak{P}_1, \mathfrak{P}_2, \ldots \subset \mathfrak{M}) \Rightarrow\\
& (\mathfrak{P} \models \mathfrak{P}_1, \mathfrak{P}_2, \ldots; \mathfrak{P}_1, \mathfrak{P}_2, \ldots \models \mathfrak{P})
\end{aligned}
$$

Thirdly, within IM $\mathfrak{M}$, informational program $\mathfrak{P}$ informs IM architecture $\mathfrak{A}_{arc\_IM}$ and IM operating system $\mathfrak{P}_{sys\_IM}$ and is informed by them. This fact yields

$$
\begin{aligned}
(22)\quad & (\mathfrak{P} \models \mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM});\\
& (\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM}) \models \mathfrak{P}
\end{aligned}
$$

Machine architecture and machine operating system support the informing of IP $\mathfrak{P}$ in an informational way, enabling its informing, counterinforming, and embedding of information and communicating in an informing way with other programmed informational entities. To an IP $\mathfrak{P}$ pertaining informational entities may be variously distributed through the interconnection network $\mathfrak{I}_{network}$ of machine architecture $\mathfrak{A}_{arc\_IM}$. System mechanisms for sensing certain IP involving and concerning information must be available for active informational programs. On the other side, IM system must enable the arising of informational programs through suitable counterinforming and information embedding mechanisms. In the first step of development, these mechanisms could be algorithmic, using methods of deterministic chaos, fuzziness, probability, randomness, etc., but in the second step, they may become creative, unforeseeable, spontaneous, natural, etc. in the sense of Being-in-the-world.

In its initial state, an informational program can be comprehended as a text. In Latin, *textum* or *textus* (from the verb *texo* with the meaning to weave, plait; to frame, construct, fabricate, make, compose) means web, texture, stuff, structure, construction, connection, which is a product of artificial weaving, plaiting, composing, etc.. A text is not only a connection of words, but also various informational interweavement. The meaning of a text is a result of the text understanding and pertains to the arising semantic interpretation of the informationally involved understanding entity. Thus, a text is in no way a torpid (rigid) depiction of information. It would be true only in case of a data form which stays for itself and does not concern informing entities. In this case, a text would not be perceived or even observed by a text understanding entity. Thus, a text is an informational realm of its context and its contents, a landscape of words, word groups and their distributed meaning in which the informational spirit finds its arising dwelling, understanding, informational phenomenality. In a later state, a text develops informationally and this state can be compared to the understanding of text by a text observer (reader, comprehender). Thus, in this stage of development, a text becomes a parallel structure of its different interpretations, which all form a complex and an arising structure of text where parallel meaning, semantics, contents, intention, significance, etc. are coming to the informational surface.

Discussing informational properties of a text expressed in a natural language, we can determine the difference existing between a computer program and a text on one side and between a text and an informational program on the other side. There exists an informational hierarchy concerning the triplet program—text—informational program in the following sense:

(1) A computer program or mathematical formula (or formula system) is a rationalistically bounded (artificial, abstract) informational entity with a unique, unambiguous, fixed meaning for programmers, mathematicians, and machines, respectively. Understanding of programs or mathematical formulas is not a subject of these entities themselves; it is a process within human behavior (mathematician or programmer community) or machine's semantic routine. Programs and mathematical formulas belong to executively automatic, semantically unique, logically uncontroversial, or rationally understandable structures, delivering safe, predictable, and anticipated results. The informing among entities (operands, operators, relations, functions) inside a program or formula is well-defined by abstract data declarations, definition equivalences, algorithms, and other unique rules.

(2) A text in a natural language is in principle metaphoric, ununiquely structured in the meaning of its components (words and word groups) and in the semantic interconnection possibilities among its components. However, in its initial state, a text is the written, also recorded (stored) or transmitted (broadcasted) entity which as the text does not change its structure. The understanding entity of a text is, for instance, its reader, hearer, or seer who gives the text additional metaphoricalness, ambiguous meaning, oblique discursiveness, that is, arising understanding. Text is a higher informational structure in comparison to a program or informational formula; from the standpoint of the observer, it carries, causes, and informs creative (intelligent) information. This type of informing is not allowed in case of rationalistic information which is artificially bounded, logically and meaningly closed to a certain tautological structure.

(3) An informational program (formula or formula system) is simultaneously (in parallel) rationalistically structured in its symbolic expressiveness, keeps the informational metaphoricalness and a degree of informational indefiniteness for its constituting entities, possesses its own possibilities of arising (text changing, text developing) component and its own understanding (consciousness, intelligence). While programs and texts do not change as entities in the sense of informational phenomenality, infor-

mational programs arise, develop, change, and vanish through the course of their informing. We may say that programs and texts inform passively, while informational programs inform actively. Within this reality, the informing power of informational programs informing in an IM becomes superior to computer programs and texts because of its own informational arising and, maybe, intelligent development.

We are able to give the following additional comparisons:

(i) A program or mathematical formula is like a discrete black-white landscape (deserted, unique, once for all determined dot structure), where black dots play the role of logical significance on the white background.

(ii) A text is a written piece of paper, a stable picture (photo, depiction, well-known melody, aviso, a fixed sequence of words, sounds, pictures, etc.) which is laid down (written, recorded, fixed) as a foreseeable, predictable, repeatable structure.

(iii) An informational program is by itself a dynamic structure which is similar to a view to the live landscape in which entities exist, to an arising program which runs from one into another situation. It has its own understanding, interweavement of its items, and it changes lively, dynamically, but intentionally in the world of information. Within the triplet program—text—informational program, informational program stands at the highest possible place in the hierarchy of informational structure.

5. Operating System of IM

Operating system (OS) is a technological synonym for a system interaction of system programs and machine architecture within an IM. One of the basic, global questions pertaining to an IM is: What is the system support to informing entities being represented by informational operands, basic and composed formulas of operands and operators, and informational formula systems? Which are basic features of this kind offered by the OS of an IM? It is clear that some common properties of informing of entities can be »delivered« by OS to satisfy the request of efficient informing (counterinforming, embedding) of entities. Otherwise, a sophisticated mechanism of informing, counterinforming and embedding of information would be necessary for each occurring entity.

Let us join the OS of an IM in the following principles:

(1) OS of IM supports the informing of operands (including subformulas, formulas, and formula systems) in their own metaphysical nature, by which an entity representing operand informs, counterinforms, and embeds information which concerns it informationally.

(2) OS performs the searching of information pertaining to a particular operand.

(3) Operands marking original entities (simple or proper operands) have their informational definitions; their initial formulas are stored in the operand dictionary. In this dictionary also those operands which occur in the definition of proper operands are defined. In this way the operand dictionary is informationally closed (tautological).

(4) OS processes informational formulas and formula systems by means of understanding (translating, compiling, interpreting, etc.) informational language.

(5) OS enables the modification and the arising of initial informational formulas during the process of their informing and, within this process, supports their understanding after they have been informationally reshaped (arisen, modified, vanished).

(6) On the IM level, OS performs as an understanding entity of informational language. In this respect, an IM is the informational language machine (ILM).

(7) Of course, OS is adapted to the IM architecture and supports the informational massive processor parallelism together with the specific machine language pertaining to architecture processors (for instance, RISC) and also the specific control language of the IM architecture interconnection network.

(8) OS of IM is the informational interface between user's informational language and machine system language (processor and interconnection language). Processor interconnections on the machine level have their origin in operators of informational formulas, which connect particular operands.

(9) Formulas of a formula system are treated as parallel processes. This rule is extended to op-

erands and subformulas. OS manages the arising parallel situation of processing.

Operating system is a synonym for a system of system informational programs of IM, marked by $\mathfrak{P}_{sys\_IM}$, where

(23) $\mathfrak{P}_{sys,1}, \mathfrak{P}_{sys,2}, \ldots \subset \mathfrak{P}_{sys\_IM}$

OS $\mathfrak{P}_{sys\_IM}$ performs as an open informational entity possessing its own externalism, internalism, metaphysicalism, and phenomenalism. Operating system of an IM, $\mathfrak{P}_{sys\_IM}$, performs together with the IM architecture $\mathfrak{A}_{arc\_IM}$ in managing and informing of user informational programs.

How do IM architecture $\mathfrak{A}_{arc\_IM}$ and IM operating system $\mathfrak{P}_{sys\_IM}$ support an informing entity α informationally within an IM? Operand α as an informational phenomenon is confronted with the triplet of its informing, counterinforming, and embedding of information. In a narrower sense, informing of an entity embraces, in general, its informational broadening, modification, shortening, etc. which are a consequence of the entity's interpretive scope. On the linguistic level, a typical scope of informing represent the so-called synonyms of words or word groups. However, there are many other informational equivalents to occurring informational items, for instance, of parallel interpretive character. The consequence of this informational possibilities concerning an informing operand is its informational broadening which includes modification, informational shortening, vanishing and of course arising. If by $\mathfrak{J}(\alpha)$ the informing of entity α is marked, the following initial system of IM architecture and operating system support to informing of operand α can be given:

(24) *System support to informing of operand α:*
$(\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM} \models_{synonymize} \alpha, \mathfrak{J}(\alpha))$
$\models_{produce} \alpha, \mathfrak{J}(\alpha)$;
$(\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM} \models_{interpret} \alpha, \mathfrak{J}(\alpha))$
$\models_{produce} \alpha, \mathfrak{J}(\alpha)$;
$(\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM} \models_{broaden} \alpha, \mathfrak{J}(\alpha))$
$\models_{produce} \alpha, \mathfrak{J}(\alpha)$

The occurring informational operators have the following meaning:

$\models_{broaden}$ broaden(s)_the_scope_of, inform(s)_in_an_informationally_ _broadened_way_to;
$\models_{interpret}$ interpret(s), inform(s)_interpretatively_to, deliver(s)_interpretation(s)_of;
$\models_{produce}$ produce(s), embed(s)_in;
$\models_{synonymize}$ synonymize(s), give(s)_synonyms_for, inform(s)_synonymously_in_ _respect_to, inform(s)_by_synonyms_of, inform)s)_in_a_synonymous_way_to

In formula (24), a possibility for shortening its formal expression arises when operational alternatives come to the surface. We can introduce the so-called alternative operator structure with the meaning operator1 or operator2 or operator3 or .... The Or is marked by symbol |. Thus,

(24') $(\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM}$
$\models_{synonymize} | \models_{interpret} | \models_{broaden}$
$\alpha, \mathfrak{J}(\alpha))$
$\models_{produce} \alpha, \mathfrak{J}(\alpha)$

The second mode of system support to an informing entity is counterinformational. We can investigate principles of counterinforming from a characteristically pragmatical point of view. The adverb *counter* pertaining to conterinformation and counterinforming has several meanings: for instance, in the opposite informational way, contrary the course of information or informing, in the reverse informational direction, contrary in an informational way, in opposition to the ruling information or informing, in the sense to inform counter or against to the informing rules. The adjective *counterinformational* means informationally opposite, opposed, and contrary. Counterinformation informs opposite or contrary to information from which it arises. Counterinforming means to act in opposition to informing, also to frustrate informing by counterinforming. Thus, counterinforming could mean to produce antonymous information (to »antonymize«) in comparison to informing by which synonymous, meaningly broadened information is produced.

If by $\gamma(\alpha)$ and $\mathfrak{C}(\alpha)$ the counterinformation and counterinforming of entity α is marked, respectively, the following initial system of IM architecture and operating system support to counterinforming of operand α can be expressed:

(25) *System support to counterinforming of operand α:*

$$(\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM} \models_{antonymize} \gamma(\alpha), \mathfrak{C}(\alpha)) \models_{produce} \gamma(\alpha), \mathfrak{C}(\alpha);$$
$$(\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM} \models_{counterinterpret} \gamma(\alpha), \mathfrak{C}(\alpha)) \models_{produce} \gamma(\alpha), \mathfrak{C}(\alpha);$$
$$(\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM} \models_{counterbroaden} \gamma(\alpha), \mathfrak{C}(\alpha)) \models_{produce} \gamma(\alpha), \mathfrak{C}(\alpha)$$

The occurring counterinformational operators have the following meaning:

$\models_{antonymize}$
antonymize(s),
give(s)_antonyms_for,
inform(s)_antonymously_in_
_respect_to,
inform(s)_by_antonyms_of,
inform(s)_in_a_antonymous_way_to;

$\models_{counterbroaden}$
broaden(s)_the_scope_contrary_to,
counterinform(s)_in_an_
_informationally_broadened_way_to;

$\models_{counterinterpret}$
counterinterpret(s),
counterinform(s)_interpretatively_to,
deliver(s)_counterinterpretation(s)_of;

$\models_{produce}$ produce(s), embed(s)_in

In formula (25), the possibility for shortening its formal expression is given:

(25')
$$(\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM} \models_{antonymize} \mid \models_{counterinterpret} \mid \models_{counterbroaden} \gamma(\alpha), \mathfrak{C}(\alpha)) \models_{produce} \gamma(\alpha), \mathfrak{C}(\alpha)$$

The third mode of system support to an informing entity is the embedding of new (arisen and arrived) information. New information is informationally broadened (informed), counterinformational and that which arrives to the informing entity as something informationally observed. How is the embedding of information taking place? A piece of information can be embedded by means of the embedding information by which the autonomous informed (broadened) information, counterinformation or input information is informationally connected to the informing entity. Embedding information is to the informing entity belonging connection information and its informing is called embedding.

We can distinguish three kinds of embedding information in respect to the informing entity (operand α), namely, informed information embedding information $\varepsilon(\alpha_{informed})$, counterinformation embedding information $\varepsilon(\gamma(\alpha))$ and input (arriving) information embedding information $\varepsilon(\iota_{input})$ and the corresponding embeddings, that is, informed embedding $\mathfrak{E}(\alpha_{informed})$, counterinformational embedding $\mathfrak{E}(\gamma(\alpha))$, and input (arriving) information embedding $\mathfrak{E}(\iota_{input})$. So, the following initial system of IM architecture and operating system support to the embedding phenomenality of operand α can be expressed:

(26) *System support to informational embedding within operand α:*

$$\mathfrak{A}_{arc\_IM}, \mathfrak{P}_{sys\_IM} \models_{produce} (\varepsilon(\alpha_{informed}), \mathfrak{E}(\alpha_{informed}), \varepsilon(\gamma(\alpha)), \mathfrak{E}(\gamma(\alpha)), \varepsilon(\iota_{input}), \mathfrak{E}(\iota_{input}));$$
$$(\varepsilon \models_{embed} \alpha_{informed}, \gamma(\alpha), \iota_{input}) \models_{into} \alpha$$

Informed information is that delivered by informing of α, that is, $\alpha_{synonymous}$, $\alpha_{interpretive}$, and $\alpha_{broadened}$, produced by formula (24).

Except formulas (24), (25), and (26), other scenarios of system support to informing of informational entities can be studied. However, the general concept of informing, counterinforming, and embedding information pertaining to informing of informational operands, seems to be the most general and can be particularized in each specific case. To the three modes of informing another very important informational entity must be available, called the dictionary of informational operands, marked by $\delta_{dictionary}$.

In the framework of IM operating system support $\mathfrak{P}_{sys\_IM}$, the dictionary of operands is a data base in which initial informational formulas of operands, a kind of basic informational definitions, are stored. In a formula, the informational operand is only the marker of an informational entity, which is informationally connected with other operands in different formulas of a formula system. Thus, to each in formulas occurring operand, its definition from the dictionary is associated. In this operand definition formula or system of formulas, other operand occur, which have to be considered in the same way: they must be found in the dictionary too.

Informing of an entity, that is, informational operand, must consider the entire available informational realm. This realm concerns, for instance, the entire natural language, if an IM operates in the domain of language informing. In this way, for each informational operand, for instance, a word or word group, a complex formula system comes to existence, until all occurring operands become metaphysically closed, that is, until no informational operand is hanging non-circularly closed into itself. On this level, we are able to recognize that every informational concept of a language is tautological in principle. There is no way out of informational tautology, language tautology or system tautology: information remains circled into information.

The longer the metaphysical circle of an operand formula, the greater the number of operand concerning parallel interpretations, the more natural appears the informational meaning of the operand. For instance, there are words, for which meaning we never ask, because their explanation, interpretation, and understanding through sentences in which other words appear would be to complex, unclear, sophisticated, and understood intuitively, as we hope, only in the context with other words.

The future IM will include a complete informational dictionary of possible operands $\delta_{\text{dictionary}}$ as a standard part of IM operating system. In this way, the system support to informing operands, their informational arising, will be always possible. New operands will be added to the dictionary after their informational definition. Thus, the time will come when the so- called electronic dictionaries will be used in their informational form as standard parts of IM operating systems. One of the conditions to offer the informing support to an informational operand α will be

(27) $\alpha \subset \delta_{\text{dictionary}}$

Strategies for informing, counterinforming, and embedding concerning α will be developed as principles of informing of entities based on informational formulas (24), (25), and (26). Besides these system support strategies, an informing entity α can have its own, for instance, intentional, goal-directed formulas for informing, counterinforming, and embedding of information, that is, its internal possibilities of informational arising. In this sense, to formulas (24), (25), and (26) similar formulas for α's own informing, counterinforming, and embedding can come into existence.

6. Informational Machine as Informational Entity

Through the conceptualism of the previous sections, we gradually approach to the structure of an informational machine which performs as a regular informational entity. In future, the evolvable architecture (software configurable hardware) of IM will become quite possible. On the other hand, the so-called genetic programming technique (for instance, evolution of Lisp programs) is on the way to the question how to evolve self-reproducing systems. The other question is how to evolve self-reproducing systems which can also do something useful. These are the promising perspectives of nanotechnology in space (matter) and time. For instance, L. Buss and W. Fontana presented a mathematical theory of the development of systems towards life like behavior [ACR]. They represented levels of O, 1, and 2, with increasing sophistication, e.g. self replication, then genomes, etc.

In the previous sections, we identified several informational entities which constitute the informational functioning of an IM $\mathfrak{M}$. At the first look, such a machine is characterized by an informational structure of the global, two level informational entities

(28) $\mathfrak{M}$: $\mathfrak{A}_{\text{arc\_IM}}, \mathfrak{P}_{\text{sys\_IM}}, \delta_{\text{dictionary}},$
$\mathfrak{P}_{\text{use\_IM}}, \iota_{\text{use\_IM}}$

where in the first line are the so-called machine operational entities meaning IM architecture, IM operating system, and operand dictionary, respectively, while in the second line are IM user systems of informational programs and IM user information, respectively. Within machine $\mathfrak{M}$, these entities inform mutually or interact in different informational ways. Further, we have slightly pointed out the IM architecture as

(29) $\mathfrak{A}_{arc\_IM}: \pi_1, \pi_2, \ldots \subset \mathfrak{I}_{network};$
$\mathfrak{I}_{network} \subset \mathfrak{A}_{arc\_IM}$

where sequence $\pi_1, \pi_2, \ldots$ marks the uniformly functionally and in an interconnecting way designed microprocessors. The IM interconnection network is in principle evolvable, at least program or information configurable, however in principle informationally arising.

The next essential part of IM belongs to the realm of system informational programs $\mathfrak{P}_{sys\_IM}$, called the IM operating system. This system controls the functioning of IM and offers the so-called basic informational support to informational operands, which occur in the formulas of user informational programs, marked by $\mathfrak{P}_{use,1}, \mathfrak{P}_{use,2}, \ldots$, shaping the user informational system $\mathfrak{P}_{use\_IM}$ of machine $\mathfrak{M}$. Thus, the system and user informational program systems together with the system of other user information items are

(30) $\mathfrak{P}_{sys,1}, \mathfrak{P}_{sys,2}, \ldots \subset \mathfrak{P}_{sys\_IM};$
$\mathfrak{P}_{use,1}, \mathfrak{P}_{use,2} \ldots \subset \mathfrak{P}_{use\_IM}$
$\iota_{use,1}, \iota_{use,2}, \ldots \subset \iota_{use\_IM}$

An essential part of IM is the structure of system and user open informational operand dictionary $\delta_{dictionary}$ in which the initial informational definitions of system and informational user program operands are stored. This dictionary represents a semantic net of entities for the entire realm of an informational field, discipline, application, science, etc. An arbitrary net for a distinct operand must be informationally circled in a complete way. It means that for each occurring operand a complete or informationally well-circled informational system of formulas exists. If these entity operands of metaphysically structured parallel formulas are marked by α_i, the dictionary structure is

(31) $\alpha_1, \alpha_2, \ldots \subset \delta_{dictionary}$

At last the peripherals have to be considered in which input and output information is stored, that is, system and user informational programs, other informational entities, and results of IM informing. Thus, a general peripheral situation is

(32) $\mathfrak{P}_{sys\_IM}, \mathfrak{P}_{use\_IM}, \iota_{use\_IM}, \delta_{dictionary},$
$\rho_{result\_IM} \subset \mathfrak{P}_{peripheral\_IM}$

Under these conditions the metaphysicalism of an IM $\mathfrak{M} \models \mathfrak{M}$ can be observed as a general informational scheme in the form

(33) $\mathfrak{P}_{peripheral} \models$
$((((\mathfrak{P}_{use\_IM}, \iota_{use\_IM} \models \mathfrak{P}_{sys\_IM},$
$\delta_{dictionary}) \models$
$((\pi_1, \pi_2, \ldots \subset \mathfrak{I}_{network})$
$\subset \mathfrak{A}_{arc\_\_IM})) \models$
$\mathfrak{P}_{use\_IM}, \iota_{use\_IM}) \models$
$(\rho_{result\_IM} \subset \mathfrak{P}_{peripheral}))$

The last formula can now be decomposed, parallelized, etc. in more details. The outmost cycle is peripheral in which the initial informational programs and information is stored. Results of informing of IM are transferred to peripherals, so they can be observed by the IM user.

7. Informing and Informedness of IM

Informing and informedness of an IM constitute its phenomenalism. We say that an observer of IM as its user is impressed by IM informing and concludes what an informational phenomenalism of the machine could be, for instance, informationally efficient, comprehensive and, last but not least, intelligent. The last could be true especially because of the informational character of the machine when significant realms of information are taken into machines informing, that is, informationally arising processing. On the other hand, an IM can be informed by an observer as its user, and this informedness is in no way limited in advance, so the entire user informational creativity comes into the game of the machine informedness.

Because IM $\mathfrak{M}$ is no more as a machine, the questions concerning its externalism, internalism, metaphysicalism, and phenomenalism could be of particular importance. Usually, such questions are not customary for machines as rational, artificial entities which have their unique, determined purpose, functional ability, and applicability. However, this is only a common belief and the question of, for instance, machine's metaphysics remains entirely righteous.

The function of an IM hides the machine informing, counterinforming, and embedding of information. This function concerns as well the informing of operands occurring in informational programs which informing is partly supported by the IM system. In this sense, an IM becomes an informational phenomenon by itself.

7.1. IM Externalism

IM $\mathfrak{M}$ informs its exterior. Machine externalism ($\mathfrak{M} \models$) is important for the informedness of machine observers, users, and other machines. How does a machine $\mathfrak{M}$ inform according to its architecture, operating system, dictionary, user informational programs and user information?

An observer or user of IM is able to recognize several general machine properties which can be expressed verbally and by informational language. Let us see some of them.

(1) *External informing of* $\mathfrak{M}$. IM $\mathfrak{M}$ informs in parallel ways. One of the basic implication system of machine externalism is

(34) $$(\mathfrak{M} \models) \Rightarrow (\mathfrak{M} \parallel\!\models);$$
$$(\mathfrak{M} \parallel\!\models) \Rightarrow (\mathfrak{M} \models; \mathfrak{M} \models; \ldots)$$

where operator $\parallel\!\models$ marks parallel informing. According to formula system (34), external parallelism of $\mathfrak{M}$ is circular and the consequence of it is

(34') $$(\mathfrak{M} \models) \Rightarrow (\mathfrak{M} \models; \mathfrak{M} \models; \ldots)$$

This implication shows the parallel possibilities of informing of $\mathfrak{M}$ to external entities, where $\mathfrak{M}$'s external informational openness is manifested as parallel informing.

Parallelism of $\mathfrak{M}$ belongs to the most powerful, but theoretically unmasterable realm of informing under spontaneous and circular circumstances. For instance, problems of understanding and through it produced meaning of something may remain unmastered in several informational ways, that is, philosophically, theoretically, formally, linguistically, designingly, technologically, communicatively, connectively, etc. But, this is also true for any other informational parallelism. The phenomenon of parallel externalism belongs to the most unrevealed and simultaneously theoretically pretentious problems. On the other hand, the parallelism of mind concerning associative processes at the arising of thought seems to be natural. In case of $\mathfrak{M} \parallel\!\models$, machine $\mathfrak{M}$ can produce intentional, spontaneous, circular, etc. parallelism, possessing its own mechanisms of informing, creating of operand dictionary, user informational programs and user information. This kind of parallelism may look to be unforeseeable and not well-predictable, that is, informationally spontaneous for the IM observer or user.

(2) *External metaphysicalism of* $\mathfrak{M}$. IM $\mathfrak{M}$ informs in its own circular way. This kind of circularity is called *external metaphysicalism* (also metaphysics) of $\mathfrak{M}$. The machine observer or user copes with the metaphysical implication of the form

(35) $$(\mathfrak{M} \models) \Rightarrow ((\mathfrak{M} \models \mathfrak{M}) \models)$$

concerning not only the general machine externalism $\mathfrak{M} \models$, but also the machine metaphysical externalism $(\mathfrak{M} \models \mathfrak{M}) \models$. The phenomenon of observing the machine metaphysicalism by machine users is a parallel informational phenomenon, where

(35') $$((\mathfrak{M} \models \mathfrak{M}) \models) \Rightarrow ((\mathfrak{M} \models \mathfrak{M}) \parallel\!\models);$$
$$((\mathfrak{M} \models \mathfrak{M}) \parallel\!\models) \Rightarrow ((\mathfrak{M} \models \mathfrak{M}) \models;$$
$$(\mathfrak{M} \models \mathfrak{M}) \models; \ldots)$$

In this way, the observed metaphysicalism of $\mathfrak{M}$ is in no way unique and unambiguous since the arising metaphysicalism of $\mathfrak{M}$ shows the arisen phenomena to machine observers.

Within the machine metaphysicalism, informational formulas are circularly decomposed, parallelized, composed, etc. and through this phenomenality the observing of machine metaphysics $\mathfrak{M} \models \mathfrak{M}$ through $(\mathfrak{M} \models \mathfrak{M}) \models$ becomes possible.

(3) *External resulting of* $\mathfrak{M}$. Machine $\mathfrak{M}$ delivers results which may be expected, but also unforeseeable, unpredictable, and arising from a complex informational realm. The question of result $\rho_{\mathrm{result\_IM}}$ is senseful because IM informs and produces essential changes of informational entit-

ies through their informational arising. Under such circumstances, there are dedicated results in the form of informational meanings concerning various kinds of information, for instance, linguistic, numeric, logical, formula-informational, signaling, controlling, etc. Results can be stored, displayed, or otherwise communicated, but they can also remain unobserved and lost in the process of informing. Thus, the user or observer of IM must determine, at least roughly, for which kind of results there exists an interest in distinct informational programs and how the informing machine $\mathfrak{M}$ may transfer its results to the peripherals, that is,

(36) $(\mathfrak{M} \models \rho_{\text{result\_IM}}) \models_{\text{to}} \mathfrak{P}_{\text{peripheral}}$

Because of the possibilities of intelligent informational programs, these programs (informational formula systems) can decide by themselves how to inform results, store them, or present to the exterior of IM. Thus,

(37) $(\mathfrak{M} \models) \Rightarrow ((\mathfrak{M} \models \rho_{\text{result\_IM}}) \models)$

is conditio sine qua non that the informing of $\mathfrak{M}$ is (becomes) informationally senseful. Otherwise, $\mathfrak{M}$ would perform as a closed system, which does not concern the machine exterior.

(4) From the pragmatical point of view, machine externalism $\mathfrak{M} \models$ is able to explicate not only the discussed forms of parallelism, metaphysicalism, or informational resulting (productivity, conclusiveness), but other, very specific phenomenal forms, exporting informationally dependent phenomena of understanding, managing, controlling, signaling, modeling, etc. in cooperation with other systems, machines, observers, users, and machine environment. In this way, an IM may be informationally embedded in other systems not only via its externalism, but also internalism, building up a composed, metaphysically structured informational system.

7.2. IM Internalism

Machine internalism $\models \mathfrak{M}$ characterizes the machine informational sensibility (informedness) for informing of informational programs, requests, and information coming from machine users, observers, and other informational systems, machines, environment, etc. How is machine $\mathfrak{M}$ informed according to its architecture, operating system, dictionary, user informational programs, and user information? Let us show some informational phenomena concerning the IM internalism.

(1) *Internal informedness of* $\mathfrak{M}$. IM $\mathfrak{M}$ is informed in parallel ways. One of the basic implication system of machine internalism (informedness) is

(38) $(\models \mathfrak{M}) \Rightarrow (\Vdash \mathfrak{M});$
$(\Vdash \mathfrak{M}) \Rightarrow (\models \mathfrak{M}; \models \mathfrak{M}; \ldots)$

where operator $\Vdash$ marks parallel informing. According to formula system (38), internal parallelism of $\mathfrak{M}$ is circular and the consequence of it is

(38') $(\models \mathfrak{M}) \Rightarrow (\models \mathfrak{M}; \models \mathfrak{M}; \ldots)$

This implication shows the parallel possibilities of informedness of $\mathfrak{M}$ by external entities, where $\mathfrak{M}$'s internal informational openness is manifested as parallel informedness.

Parallel informedness of $\mathfrak{M}$ belongs to the most powerful, yet theoretically unmasterable realm of informedness under spontaneous and circular conditions. For instance, problems of machine understanding and through it produced meaning of something informational may remain unmastered in several informational ways, that is, philosophically, theoretically, formally, linguistically, designingly, technologically, communicatively, connectively, etc.

(2) *Internal metaphysicalism of* $\mathfrak{M}$. IM $\mathfrak{M}$ is informed in its own circular way. This kind of circularity is called *internal metaphysicalism* of $\mathfrak{M}$. The machine as an informing entity is confronted with the metaphysical implication of the form

(39) $(\models \mathfrak{M}) \Rightarrow (\models (\mathfrak{M} \models \mathfrak{M}))$

concerning not only the general machine internalism $\models \mathfrak{M}$, but also the machine metaphysical internalism $\models (\mathfrak{M} \models \mathfrak{M})$. In this case, machine $\mathfrak{M}$ becomes the observer of parallel possibilities in the form of its metaphysicalism, where

(39') $(\models (\mathfrak{M} \models \mathfrak{M})) \Rightarrow (\Vdash (\mathfrak{M} \models \mathfrak{M}));$
$(\Vdash (\mathfrak{M} \models \mathfrak{M})) \Rightarrow$
$(\models (\mathfrak{M} \models \mathfrak{M}); \models (\mathfrak{M} \models \mathfrak{M}); \ldots)$

As we see, the observing metaphysicalism of $\mathfrak{M}$ is in no way unique and unambiguous since machine metaphysicalism is able to observe the the arisen phenomena in its environment and within itself.

Within the machine internal metaphysicalism, informational formulas are decomposed, parallelized, composed, etc. and through this phenomenality the observing machine metaphysics $\mathfrak{M} \models \mathfrak{M}$ through $\models (\mathfrak{M} \models \mathfrak{M})$ becomes possible.

(3) *Internal resulting (resultedness) of* $\mathfrak{M}$. Machine $\mathfrak{M}$ creates results internally according to informational programs and by its own informational characteristics (states, processes). Results may be expected, but also unforeseeable, unpredictable, controversial, and arising from a complex informational realm. The question of result $\rho_{\text{result\_IM}}$ is senseful because IM informs and produces essential changes of informational entities through their informational arising. How does the IM internalism, $\models \mathfrak{M}$, concern the IM resulting, that is, results $\rho_{\text{result\_IM}}$? As IM informs and is simultaneously informed, the result of machine informedness may be any informational change within occurring informational operands. Various informational meanings may arise pertaining to linguistic, numeric, video, signal, and other information. The arisen potential results $\rho_{\text{result\_IM}}$ inform $\mathfrak{M}$ and within $\mathfrak{M}$'s informedness the decision takes place which information will be considered, transferred, and informed as result significant. One has

(40) $\quad (\rho_{\text{result\_IM}} \models \mathfrak{M}) \models \mathfrak{P}_{\text{peripheral}}$

Within IM processed informational programs can decide by themselves (in an intelligent way) how and when to form interior results. Thus,

(41) $\quad (\models \mathfrak{M}) \Rightarrow (\models (\rho_{\text{result\_IM}} \models \mathfrak{M}))$

The openness of $\mathfrak{M}$'s informedness guarantees the possibilities of choice, to obtain information which pertains to $\rho_{\text{result\_IM}}$ also from machine peripherals, so,

(42) $\quad \mathfrak{P}_{\text{peripheral}} \models (\rho_{\text{result\_IM}} \models \mathfrak{M})$

By this discussion, the mutually reversing processes of machine resulting informing and resulting informedness can be understood and decomposed informationally to the necessary details.

7.3. IM Metaphysicalism

Machine metaphysicalism $\mathfrak{M} \models \mathfrak{M}$ is a particular case of machine phenomenalism constituted as machine externalism and machine internalism, that is, as a system $(\mathfrak{M} \models; \models \mathfrak{M})$. In this sense, IM metaphysicalism is hidden in machine phenomenalism or $(\mathfrak{M} \models \mathfrak{M}) \subset (\mathfrak{M} \models; \models \mathfrak{M})$. In general, machine metaphysicalism is an unrevealed phenomenon for the machine observer or user ω and can be observed only through the machine informing $\mathfrak{M} \models$ and the observer's informedness $\models \omega$, that is, $\mathfrak{M} \models \omega$.

(1) *General metaphysicalism of* $\mathfrak{M}$. Let us remind of the informational structure of $\mathfrak{M}$ which marks informationally interweaved entities, that is,

(43) $\quad \mathfrak{M} \models_{\text{mark}} (\mathfrak{A}_{\text{arc\_IM}}, \mathfrak{P}_{\text{sys\_IM}}, \delta_{\text{dictionary}}, \mathfrak{P}_{\text{peripheral}})$

where

(44)
$$\begin{aligned}
&\pi_1, \pi_2, \ldots, \mathfrak{Z}_{\text{network}} \subset \mathfrak{A}_{\text{arc_IM}};\\
&\mathfrak{P}_{\text{sys},1}, \mathfrak{P}_{\text{sys},2}, \ldots, \iota_{\text{sys}} \subset \mathfrak{P}_{\text{sys_IM}};\\
&\varepsilon_1, \varepsilon_2, \ldots \subset \delta_{\text{dictionary}};\\
&\mathfrak{P}_{\text{use},1}, \mathfrak{P}_{\text{use},2}, \ldots \subset \mathfrak{P}_{\text{use_IM}};\\
&\iota_{\text{use},1}, \iota_{\text{use},2}, \ldots \subset \iota_{\text{use_IM}};\\
&\mathfrak{P}_{\text{sys_IM}}, \mathfrak{P}_{\text{use_IM}}, \iota_{\text{use_IM}} \subset \mathfrak{P}_{\text{peripheral}}
\end{aligned}$$

Within machine metaphysicalism $\mathfrak{M} \models \mathfrak{M}$, all metaphysical cycles of $\mathfrak{M}$'s constituting entities (components) are possible and can be deduced from the basic machine metaphysical cycle, that is,

(45)
$$\begin{aligned}
&(((\mathfrak{M} \models \mathfrak{P}_{\text{peripheral}})) \models\\
&\quad (\mathfrak{A}_{\text{arc_IM}}, \mathfrak{P}_{\text{sys_IM}}, \delta_{\text{dictionary}})) \models\\
&\quad (\mathfrak{P}_{\text{use_IM}}, \iota_{\text{use_IM}})) \models \mathfrak{M}
\end{aligned}$$

where $\mathfrak{M}$ is represented by the informational structure in formula (43).

(2) *Metaphysical parallelism of* $\mathfrak{M}$. IM $\mathfrak{M}$ informs in metaphysically parallel ways. For, instance, machine metaphysicalism $\mathfrak{M} \models \mathfrak{M}$ is able to inform by keeping and arising of metaphysical (interiorly circular) processes in unforeseeable parallel ways. So,

(46) $(\mathfrak{M} \models \mathfrak{M}) \Rightarrow (\mathfrak{M} \Vdash \mathfrak{M});$
$(\mathfrak{M} \Vdash \mathfrak{M}) \Rightarrow ((\mathfrak{M} \models \mathfrak{M}); (\mathfrak{M} \models \mathfrak{M}); \ldots)$

where operator $\Vdash$ is the shortcut for parallel informing. In this situation, as the consequence of the last formula, machine $\mathfrak{M}$ copes with the interior circular parallelism in the form of different metaphysical processes, that is,

(46') $(\mathfrak{M} \models \mathfrak{M}) \Rightarrow ((\mathfrak{M} \models \mathfrak{M}); (\mathfrak{M} \models \mathfrak{M}); \ldots)$

This implication shows how machine metaphysics $\mathfrak{M} \models \mathfrak{M}$ develops in different (parallel) ways. Within machine $\mathfrak{M}$, parallel informational processes arise and inform various, interweaved information simultaneously.

(3) *Metaphysical externalism of* $\mathfrak{M}$. We have to draw a clear distinction between the external metaphysicalism (35) and metaphysical externalism. The adjective *external* in external metaphysicalism is understood as a predicate (property) of $\mathfrak{M} \models \mathfrak{M}$, for instance, as

$$(\mathfrak{M} \models \mathfrak{M}) \models_{\text{external}}$$

What does the metaphysical externalism mean after that? We have the following basic implication concerning the machine metaphysics $\mathfrak{M} \models \mathfrak{M}$:

(47) $(\mathfrak{M} \models \mathfrak{M}) \Rightarrow (((\mathfrak{M} \models) \models \mathfrak{M});$
$(\mathfrak{M} \models (\mathfrak{M} \models)); ((\mathfrak{M} \models) \models (\mathfrak{M} \models)))$

There is a control of $\mathfrak{M}$'s externalism by $\mathfrak{M}$ itself (metaphysical control). The shortcut of this situation would be, for instance,

$$(\mathfrak{M} \models) \models_{\text{metaphysical}}$$

where the adjective *metaphysical* is understood as an interior predicate of machine externalism $\mathfrak{M} \models$.

(4) *Metaphysical internalism of* $\mathfrak{M}$. Similarly, one can determine the metaphysical internalism in contrary to the internal metaphysicalism discussed in formula (39). The adjective *internal* in internal metaphysicalism is understood as a predicate of entity $\mathfrak{M} \models \mathfrak{M}$, that is,

$$\models_{\text{internal}} (\mathfrak{M} \models \mathfrak{M})$$

We have the following implication concerning the metaphysical internalism:

(48) $(\mathfrak{M} \models \mathfrak{M}) \Rightarrow (((\models \mathfrak{M}) \models \mathfrak{M});$
$(\mathfrak{M} \models (\models \mathfrak{M})); ((\models \mathfrak{M}) \models (\models \mathfrak{M})))$

There is a control of $\mathfrak{M}$'s internalism by $\mathfrak{M}$ itself (metaphysical control). The shortcut of this situation would be, for instance,

$$\models_{\text{metaphysical}} (\models \mathfrak{M})$$

where the adjective *metaphysical* is understood as an interior predicate of machine internalism $\models \mathfrak{M}$.

(5) *Metaphysical metaphysicalism of* $\mathfrak{M}$. Among other informational phenomenalities, metaphysicalism aims at consciousness as informational entity; and metaphysicalism of metaphysicalism alludes at self-consciousness. An informationally sophisticated IM should possess the informational power which through time would succeed or even essentially surpass the informational power of a living actor because of possibilities to use extensive, informationally unlimited realm of referencing.

In the informing and self-observing of metaphysicalism $\mathfrak{M} \models \mathfrak{M}$, machine $\mathfrak{M}$ decomposes $\mathfrak{M} \models \mathfrak{M}$ in different (parallel) ways. Thus,

(49) $(\mathfrak{M} \models \mathfrak{M}) \Rightarrow$
$(((\mathfrak{M} \models \mathfrak{M}) \models \mathfrak{M}); (\mathfrak{M} \models (\mathfrak{M} \models \mathfrak{M}));$
$((\mathfrak{M} \models \mathfrak{M}) \models (\mathfrak{M} \models \mathfrak{M})))$

In $(\mathfrak{M} \models \mathfrak{M}) \models \mathfrak{M}$, machine $\mathfrak{M}$ is the observer of its metaphysicalism and, simultaneously, a circularly perplexed, informationally arising mechanism of informing, counterinforming, and embedding of information. This mode of informing may be called *conscious self-observing*. In case $\mathfrak{M} \models (\mathfrak{M} \models \mathfrak{M})$, metaphysicalism of $\mathfrak{M}$ observes the behavior of machine $\mathfrak{M}$, where $\mathfrak{M}$ informs $\mathfrak{M} \models \mathfrak{M}$ on its informational states (necessities and possibilities). This mode of informing is called *conscious self-informing*. The last case $(\mathfrak{M} \models \mathfrak{M}) \models (\mathfrak{M} \models \mathfrak{M})$ is the case of *recursive machine self-consciousness*. Each metaphysical machine cycle $\mathfrak{M} \models \mathfrak{M}$ can be decomposed by $\mathfrak{M}$ in different ways, offering a real realm of informational possibilities, unforeseeableness, uncertainty, etc. and, through this, a spontaneous informational arising of entities (operands) within IM $\mathfrak{M}$.

(6) *Metaphysical production of results of* $\mathfrak{M}$. Few words have to be said in concern about possibilities of metaphysical production of results. Results is always significant information in a certain sense. Metaphysicalism of machine $\mathfrak{M}$ or of an informing entity in question decides which dedicated item of an informational phenomenon becomes a result because of its possible meaning, sense, significance, etc. Thus, there is not only the user who decides on the occurrence of a result, but metaphysical judgement of the informing entity (operand, formula) suddenly produces results and put them into a result index where they are available for other entities and users. Resulting entities are unforeseeable, unpredictable, informationally arising to a certain extent in their nature, kind, significance, occurrence, value, etc.

7.4. IM Phenomenalism

Machine phenomenalism $(\mathfrak{M} \models; \models \mathfrak{M})$ is the most general case of machine external informing and internal informedness. It would correspond to the term »machine as such« (in German, »die Maschine an sich«). Informational phenomenalism of machine $\mathfrak{M}$ says that machine as an informational entity cannot be revealed in its phenomenal entirety: because it is not possible to foresee completely its externalism which depends on machine observers; because an essential part of its internalism may be unrevealed to exterior observers and »known« only interiorly to the machine metaphysicalism; because its metaphysicalism or its interior circular informing is not directly informationally open to the machine exterior; because its phenomenalism is only a resultant phenomenon of machine externalism, internalism, and metaphysicalism. Certainly, these informational assumptions hold for any informational entity (operand, formula, phenomenon, thing, formation, etc.).

We have to remind the reader that machine phenomenalism is defined formally as a system $(\mathfrak{M} \models; \models \mathfrak{M})$ of informationally parallel, tied, and mutually impacting and impacted formulas, that is, $\mathfrak{M}$'s externalism $\mathfrak{M} \models$ and $\mathfrak{M}$'s internalism $\models \mathfrak{M}$. In this system, machine externalism and machine internalism are informationally interweaved, depended, metaphysically supported, etc. in a phenomenal (spontaneous, circular), entirely open way. As a system, machine phenomenalism is more than any of its components (externalism, internalism, metaphysicalism) and embraces these components, for instance, in the form

$$(50)\qquad \begin{array}{l} (\mathfrak{M} \models) \subset (\mathfrak{M} \models; \models \mathfrak{M}); \\ (\models \mathfrak{M}) \subset (\mathfrak{M} \models; \models \mathfrak{M}); \\ (\mathfrak{M} \models \mathfrak{M}) \subset (\mathfrak{M} \models; \models \mathfrak{M}) \end{array}$$

After this introduction, let us overview some particular phenomenal cases of machine $\mathfrak{M}$.

(1) *Phenomenal externalism of* $\mathfrak{M}$. Several cases of phenomenal externalism of machine $\mathfrak{M}$ can be observed. How does a machine phenomenalism inform the machine exterior? The parallel external case is the following:

$$(51)\qquad \begin{array}{l} ((\mathfrak{M} \models; \models \mathfrak{M}) \models) \Rightarrow ((\mathfrak{M} \models; \models \mathfrak{M}) \parallel\!\models); \\ ((\mathfrak{M} \models; \models \mathfrak{M}) \parallel\!\models) \Rightarrow (((\mathfrak{M} \models; \models \mathfrak{M}) \models)\,); \\ \quad ((\mathfrak{M} \models; \models \mathfrak{M}) \models); \ldots) \end{array}$$

where operator $\parallel\!\models$ marks parallel informing. According to formula system (51), parallel phenomenal externalism can be expressed as

$$(51')\qquad \begin{array}{l} ((\mathfrak{M} \models; \models \mathfrak{M}) \models) \Rightarrow (((\mathfrak{M} \models; \models \mathfrak{M}) \models); \\ \quad ((\mathfrak{M} \models; \models \mathfrak{M}) \models); \ldots) \end{array}$$

This implication shows the phenomenal parallel possibilities of external informing of $\mathfrak{M}$. The other methodically parallel case could be

$$(52)\qquad ((\mathfrak{M} \models; \models \mathfrak{M}) \models) \Rightarrow ((\mathfrak{M} \parallel\!\models; \parallel\!\models \mathfrak{M}) \models)$$

or, in an extremely parallel form,

$$(53)\qquad ((\mathfrak{M} \models; \models \mathfrak{M}) \models) \Rightarrow ((\mathfrak{M} \parallel\!\models; \parallel\!\models \mathfrak{M}) \parallel\!\models)$$

The consequences of these implications can be derived easily.

(2) *Phenomenal internalism of* $\mathfrak{M}$. We may now repeat the questions and formulas pertaining to phenomenal externalism for phenomenal internalism. Thus, according to formulas (51) to (53), there is,

$$(54)\qquad \begin{array}{l} (\models (\mathfrak{M} \models; \models \mathfrak{M})) \Rightarrow (\parallel\!\models (\mathfrak{M} \models; \models \mathfrak{M})); \\ (\parallel\!\models (\mathfrak{M} \models; \models \mathfrak{M})) \Rightarrow ((\models (\mathfrak{M} \models; \models \mathfrak{M})); \end{array}$$

$$(\models (\mathfrak{M} \models; \models \mathfrak{M})); \ldots)$$

where operator $\Vert\!\models$ marks parallel informing. According to formula system (54), parallel phenomenal internalism can be expressed as

$$(54') \quad (\models (\mathfrak{M} \models; \models \mathfrak{M})) \Rightarrow ((\models (\mathfrak{M} \models; \models \mathfrak{M})); (\models (\mathfrak{M} \models; \models \mathfrak{M})); \ldots)$$

This implication shows the phenomenal parallel possibilities of internal informing of $\mathfrak{M}$. The other methodically parallel case could be

$$(55) \quad (\models (\mathfrak{M} \models; \models \mathfrak{M})) \Rightarrow (\models (\mathfrak{M} \Vert\!\models; \Vert\!\models \mathfrak{M}))$$

or, in an extremely parallel case,

$$(56) \quad (\models (\mathfrak{M} \models; \models \mathfrak{M})) \Rightarrow (\Vert\!\models (\mathfrak{M} \Vert\!\models; \Vert\!\models \mathfrak{M}))$$

The consequences of these implications can be derived in a systematic way.

(3) *Phenomenal metaphysicalism of* $\mathfrak{M}$. Machine phenomenal metaphysicalism is at the background of machine's »consciousness« in the form of machine metaphysicalism and its phenomenalism. In this mode of informing, machine $\mathfrak{M}$ reaches the most complex phenomena of its externalism and internalism interweavement and interconnection, projecting the exterior and interior world into a global informational depiction of a distinguished informational realm. Through this spontaneous and circular phenomenology, machine $\mathfrak{M}$ becomes a part of the worldliness pertaining to its, instantaneously most significant informational realm. In this respect, according to informational terms, machine $\mathfrak{M}$ is able to behave as something in the world, with its own reflection, consciousness, and external and internal openness to the world. One may say that through metaphysically structured phenomenalism, IM $\mathfrak{M}$ reaches the state of the profound Being-in-the-World.

The metaphysical closing of machine phenomenalism, that is,

$$(57) \quad (\mathfrak{M} \models; \models \mathfrak{M}) \Rightarrow ((\mathfrak{M} \models; \models \mathfrak{M}) \models (\mathfrak{M} \models; \models \mathfrak{M}))$$

preserves the external and internal openness to the machine exterior and interior, that is, possibilities of machine functioning in the exterior and interior world.

(4) *Phenomenal phenomenalism of* $\mathfrak{M}$. Phenomenal phenomenalism means formally

$$(58) \quad (\mathfrak{M} \models; \models \mathfrak{M}) \Rightarrow (((\mathfrak{M} \models; \models \mathfrak{M}) \models); (\models (\mathfrak{M} \models; \models \mathfrak{M})))$$

which is nothing else than machine phenomenalism of machine phenomenalism. In short, as any other informational phenomenon, phenomenalism is recursive in the sense of phenomenal self-(re)production.

(5) *Phenomenal production of results of* $\mathfrak{M}$. Phenomenal production of results depends on machine particular modes of informing (externalism, internalism, metaphysicalism) and, in the last, the most complex informational consequence, on phenomenalism, which not only unites particular cases, but can also produce results outside of these particularities. Phenomenal production of results concerns the most general phenomenality of information (informing, counterinforming, embedding) in the framework of entities which govern and decide on the nature of results and their arising. This is the realm of IM productiveness as a specific view ('seeing') of the most significant informational entities.

8. Technological Perquisites of IM

IM requires a fundamentally new conceptualization and development in functional design and technology. It is essentially different from that what, by nowadays terms, is notionally understood as computer. For instance, processors in its interconnection network are new RISC type, at least 64-bit, high-performance, high-speed, electronic, and/or photonic microprocessors. The processor interconnection network requires informational elements concerning intention, significance, and other properties and predicates of informationally extensive, prompt, and sensitive criteria of information exchange. All this calls for a radically new architecture of IM. Operating system of IM must support the informing, counterinforming and embedding of information of machine and user program operands and its system programs must perform in informationally regular way. It must compile user informational programs written in informational language. As a basic informational operand support a sufficiently extensive dictionary (similar to Japanese term of electronic dictionary, for instance in [OED, JWD, EWD, CD, BD, IMD]) must be available for free informing of informational operand entities, including the possibilities of sentence (formula, program) translation in other natural and formal languages. Japan & Co. may be the best suited background for the future IM development and production.

9. Cybernetic Perquisites of IM

Informing is certainly a cybernetic activity in which all kinds of known and arising creativity play their informationally phenomenal roles. The cybernetic is synonymous for the live, emerging, understanding, etc. as well as for the informational. The cybernetic comes from the conceptualism of managing and controlling machines, living beings, individuals and societies. In this traditional approach, not a specific accent is given to information as a phenomenon: information is simple data necessary for managing and controlling systems in an optimal, goal-directed, surviving, or other way. Consciousness of the informational is not present at the beginning of the cybernetic epoch, at least not in an informationally arising sense. But, only the consciousness of the informational triggers the request of rethinking of cybernetic phenomenality in a philosophic and symbolic theoretical, informational way. In this point of rethinking, informational and cybernetic phenomenalism come close to each other and can be examined from one direction or the other.

Informing and informedness of entities is cybernetic, but not only cybernetic. Cybernetics is a study of human control functions (one might say, more generally, informational or communicational functions) and of mechanical, electrical, and electronic systems designed to replace them. This determination was set at the very beginning of modern cybernetics (N. Wiener). Later on, cybernetics encountered the philosophical discourse as a scientific discipline studying dynamically self-regulating and self-organizing systems. Its boundary fields are system, control, information, communication, game theory, etc. Already Plato gave the word a general meaning (proceeding from the art of boat steering) in the sense of managing a state. As it has developed over the years, cybernetics has become multidisciplinary, involving engineering, computer science, artificial intelligence, psychology, biology, neural science, sociology, philosophy, etc.

10. Intelligent Informational Machine

When I assert my own belief that true intelligence requires consciousness I am implicitly suggesting (since I do not believe the *strong*-AI contention that the mere enaction of an algorithm would evoke consciousness) that intelligence cannot be properly simulated by algorithmic means, i.e. by a computer, in the sense that we use that term today. ... For I shall shortly argue strongly ... that there must be an essentially *non-algorithmic* ingredient in the action of consciousness.

—Roger Penrose [ENM] 407

In the full sense of the word, IIM is the goal of future machine development. Through times, the meaning of the adjective *intelligent* will more and more approach to the meaning of the »sufficiently complex and specific in informational way«. The main task of IIM will be the production of specific informational entities like meaning, sense, significance, intention, self-observation, conceiving, perceiving, consciousness, etc. which all can be characterized by the happening of machine understanding in the surrounding world. Understanding as an informational activity will remain on the top of intelligent informing of living beings and machines. Before this happens, the entire phenomenality of the universe has to be understood in informational terms, that is, by the ascent from the arbitrary formational (physical, biologic, chemical, etc.) to the adequate informational, throughout the scientific and everyday thinking and acting of mankind. In general, IIM as a future tool is a parallel understanding informational machine behaving informationally in the surrounding world in which it is informationally embedded.

In the very last consequence, the *informational* (and in this sense, the *intelligent*) means *to be* in a formation (the Being of Formation) with itself and with other existing (factical and possible) formations (entities, things, phenomena). Thus, information (Being in Formation) as it is, is always in context with information as formation of some-

Table of informational machine axioms with Latin, informational, formal, Kantian, informationally interpretive, and cognitional terminology

Latin terms	Informational terms concerning informational machine	Basic informational formula	Kantian terminology for informational machine	Informational interpretation	Cognitional terminology
informatio prima of informational machine $\mathfrak{M}$	informational machine *externalism;* external informing of machine $\mathfrak{M}$; *informing* of machine $\mathfrak{M}$	$\mathfrak{M} \models$	Informationsmaschine *für die anderen*	informational machine *for others*	informational machine *conceptualism*
informatio secunda of informational machine $\mathfrak{M}$	informational machine *internalism;* internal informing of machine $\mathfrak{M}$; *informedness* of machine $\mathfrak{M}$	$\models \mathfrak{M}$	Informationsmaschine *für sich*	informational machine *for itself*	informational machine *perceptiveness*
informatio tertia of informational machine $\mathfrak{M}$	informational machine *metaphysicalism;* metaphysical informing of machine $\mathfrak{M}$; *circular informing* and *informedness* of machine $\mathfrak{M}$	$\mathfrak{M} \models \mathfrak{M}$	Informationsmaschine *in (bei) sich selbst*	informational machine *in itself*	informational machine *consciousness*
informatio quarta of informational machine $\mathfrak{M}$	informational machine *phenomenalism; phenomenal informing* and *informedness* of machine $\mathfrak{M}$	$\mathfrak{M} \models; \models \mathfrak{M}$	Informationsmaschine *an sich*	informational machine *as such*	informational machine *phenomenology*

thing. Formations as observable phenomena are impacting and are impacted in formational ways and are in certain formations to themselves and to other formations. In information there is no vacuum in the sense of apartness, of contextless situation in concern to the surrounding system of formations. Information is like a text in a context and in this function it is able to approach something which demonstrates intelligence, consciousness, understanding.

11. Conclusion

The clue of IM will lead through formalization (symbolization) of informational phenomenality. A solid axiomatic method, that is, a language has to be found to enable technological implementation of informational conceptualism. In the attached table the reader will find four basic axioms of IM informing and their Latin, informational, formal, Kantian, informationally Kantian, and cognitional interpretation. Informational language (philosophy, theory, design) has to be developed in verbal and symbolic form with the aim to master not only the arising problems of informational machines but also informational problems of the living phenomenality. This article is on the way to symbolization and realization (machine implementation) of the proposed informational conceptualism.

IM is on the way to surpass essentially human performance. Imagine a written text and its understanding by man and IM. IM can »understand« all sentences of the text in a parallel manner, that is, simultaneously and, additionally, can inform and be informed in parallel by all in text occurring informational entities. Man, at least, on the level of consciousness, can never perform such a parallel task of text recognition and interpretation. And IM will be able to perform by such method of understanding in any case, for any kind of information (picture, sound, data, signal, »phenomenon«, etc.). It seems that informational parallelism will reach its processing and meaning zenith in various IM applications and, right through parallel operation, will extensively surpass certain possibilities of individual mind.

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