Being and Systemacy

4th supplemented edition, ver. 4.02 (en)

16.07.2020

Igor Furgel
(office@furgel.com)

Current thoughts consider being as one of the property of systemacy.
Having introduced the 'assembling' operation ('making sth. to a system'), we could show that the complementarity principle (by N. Bohr [1]) results from the existence and applicability of this operation; furthermore, categorially complementary terms (e.g. {being, non-being}, {structure, function}) generated by application of this operation relate to the resulting system as a whole, but not to its single parts.
Further considerations have shown that
- existing objects/processes can only be systems and nothing else;
- basically, 'the very elementary bricks' of nature, i.e. those, which could not be represented as an ensemble of other entities do not exist.
Moreover, it has succeeded in closing the question, whether complementarity is immanent in objects themselves or a property of the consciousness of contemplator, namely: this question is <u>principally undecidable</u>.
In the second chapter, we also discuss the notions of being, non-being, infinity and time. It is shown that being, time and finiteness are tightly linked to each other.

Compared to the first edition, the second edition is supplemented by chapter "Being and 'Existential Triads'" and by Annex. In this chapter, we consider necessary and sufficient conditions for the existence of a system. There, we define the term 'existential triad' and showed that the presence of the 'existential triad' being reducible to the set {substrate, property, relation} represent such a necessary and sufficient condition of the related system.
In the Annex, we discuss an important concomitant topic of the conjunction of systems in a system hierarchy.

Compared to the second edition, the third edition was supplemented by the notion 'relation-control-information', which we called 'enmorphya of relation'. The connection of 'relation-control-information' with the Principle of Least Resources Consumption is analysed as well as the general notion of 'resource of a system' is discussed.

Compared to the third edition, the current edition is complemented by the notions of truly-stochastic and quasi-stochastic systems as well as by an extended consideration of the concept of "enmorphya" and its role in system variativeness. In this context, we also considered the legal system.
On the basis of the extended consideration it is assumed that there is a new physical particle, which is a mechanism of implementation of the Principle of Least Action in the physical world. We called this hypothetical boson "enmorphyon".

This work may attract attention of an audience who is interested in philosophical topics in general and in the complementarity principle and the system approach in particular.

This issue is published on 23.06.2020, Deutsche Nationalbibliothek,
https://d-nb.info/121247628X/, urn:nbn:de:101:1-2020062315352620756574.

The original edition in Russian is issued on 21.06.2020 (version 4.00 (ru)).
Оригинал работы на русском «Бытие и Системность», вер. 4.00 (ru), опубликован 21.06.2020, Deutsche Nationalbibliothek,
http://d-nb.info/1212333942, urn:nbn:de:101:1-2020062112480232083025

The third issue is published on 11.08.2018, Deutsche Nationalbibliothek,
http://d-nb.info/1164297767/, http://d-nb.info/1164297767/34.
The original third edition in Russian was issued on 11.08.2018 (version 3.00 (ru)), Deutsche Nationalbibliothek,
http://d-nb.info/1164297694/, http://d-nb.info/1164297694/34.

The second issue is published on 28.06.2015, Deutsche Nationalbibliothek,
http://d-nb.info/1073106837/, urn:nbn:de:101:1-201506281754.
The original second edition in Russian was issued on 28.06.2015 (version 2.00 (ru)).
Оригинал второго издания работы на русском «Бытие и Системность», вер. 2.00 (ru), опубликован 28.06.2015, Deutsche Nationalbibliothek,
http://d-nb.info/1073106829/, urn:nbn:de:101:1-201506281747.

The manuscript of the first issue was written down in the period from 21.07.2013 to 06.02.2014.

The original first edition in Russian was issued on 24.04.2014 (version 1.0).
Оригинал первого издания этой работы на русском «Бытие и Системность», вер. 1.0, опубликован 24.04.2014, Deutsche Nationalbibliothek,
http://d-nb.info/1050236424/, urn:nbn:de:101:1-2014042311216.
There was also the first English edition (ver. 1.0), published on 25.04.2014, Deutsche Nationalbibliothek, http://d-nb.info/1050284054/, urn:nbn:de:101:1-201404249447.

Table of Contents

1 Rationale for the complementarity principle

1.1 Definitions

Def. 1:

Let there exist a confined population (set) of terms comprising more than one term. Terms out of the population are called *categorially complementary* to each other if:

1) These terms can exist exclusively jointly, in concert, i.e. the existence of a term necessarily causes the existence of all other terms of the population, and
2) A term out of the population cannot be defined by using any subset of other terms of the population.

Def. 2:

Let there exist a confined population (set) of properties comprising more than one property. Properties out of the population are called *attributive opposites* if each item of the population represents merely a specific extreme value of one and the same attribute, and, hence, can be defined by using another item of the population.

Distinguishing between *attributive opposites* (e.g. {high, low}) and *categorial complementarities* (e.g. {form, content}), let it be said that attributive opposites are basically not categorial complementarities because each item of an attributive pair can be defined by using another member of the pair. For example, the attribute 'size' can take extreme values {big, small}; these values can be expressed by each other.
Attributive opposites always describe properties/qualities, i.e. values of an attribute, but never – terms. Thereby, changing the value of this attribute at the transition from one to another extreme occurs without 'jumps', i.e. without a change of symmetry degree (without 'second-order phase transitions'). Attributive opposites often imply the presence of an etalon, i.e. a 'norm', what the estimation of the value of the respective attribute relates to (e.g. {expensive, cheap}, {good, evil}).
Attributive opposites almost always are reflected in language by antonymous pairs, whereas categorial complementarities are by no means always representable by them.

1.2 Philosophy and Algebra: Assembling Operation

The properties of categorial complementarities in **Def. 1** have induced a working hypothesis about a possible parallel between categorial complementarities and certain algebraic structures, namely – linear symmetric operators.

Linear symmetric operators:

1) possess only real eigenvalues,
2) their eigenvectors related to different eigenvalues are orthogonal to each other (i.e. they are linearly independent and, hence, cannot be mutually defined).

Thus, a linear symmetric operator induces a basis (i.e. a population) of linearly independent (i.e. not mutually definable using each other) eigenvectors.

This property of linear symmetric operators exactly coincides with the properties of categorial complementarities in **Def. 1**.

If this parallel is a substantial one, the following question arises: ‘Is there a ‘philosophic’ analogy to the linear symmetric operator? Or in other words, does an operation (or operations) exist inducing single pairs (or greater sets, e.g. triples) of categorial complementarities?’

If such an operation does exist, then, in analogy to a linear symmetric operator,

1) it shall induce a set of categorial complementarities, and
2) its application to each single term out of this set shall not change this term, i.e. shall retain it.

A first attempt to answer this question is to introduce the operation of ‘assembling’ of something, i.e. ‘making sth. to a system’, ‘organising single items into a system’.

The term *system* is defined according to Uemov (see chap. 5 and [2], chap. 4, § 1):

Def. 3:

A *system* (ensemble - IF) is any given entity, at which a relationship, possessing an arbitrarily taken certain property, is implemented.
Or equivalent:
A *system* (ensemble) is any given entity, at which some properties, being in an arbitrarily taken certain relationship, are implemented.

Let us define now the *assembling* operation:

Def. 4:

The *assembling* operation with regard to an entity is that this entity is considered not disconnectedly, but as part of a system (ensemble) with a suitable ‘system-constituting concept’[1].

Note that a system according to **Def. 3** is always self-consistent, i.e. properties (attributes) and relationships implemented in the system correspond to each other.

There is also an inverse operation *disassembling*, such that a sequential application of the operations *assembling* and *disassembling* to the respective entity retains this entity invariable: ‘*assembling*’ * ’*disassembling*’ = ‘*identity*’.

Def. 5:

The *disassembling* operation with regard to a system (ensemble) with a given system-constituting concept is that one distinguishes isolated entities in this system, which possess the properties (attributes) and are able to enter into relations corresponding to the constituting concept of this system.

[1] the original term by Uemov in Russian: ‚системообразующий концепт’

Note that entities themselves can also be systems.

Returning to algebra and linear symmetric operators, let us remark that if an operator **A** is invertible, then all its eigenvalues are non-zero, $\lambda_i \neq 0$; thereby, the eigenvalues of the inverted operator $\mathbf{A}^{-1}$ are numbers $(\lambda_i)^{-1}$, and the corresponding eigenvectors both of the operators are identic.

Since eigenvectors both of such operators are identic, the *disassembling* operation, similarly to inverted operator,

1) shall retain the entire set of the categorial complementarities being inherent to the initial system, and
2) its application to each single term out of this set shall not change this term, i.e. shall retain it.

1.3 Assembling Operation and Complementarity Principle

Let us consider now the pair {properties, relations} as an example. It is really generated by the assembling operation applied to any entity: whatever is included in a system shows within the latter certain properties and enters into the corresponding relationships with other elements of the system.
A dedicated application of the assembling operation to the term ‘property’ does not change this term: it does not become a ‘relation’ and, moreover, does not bear any characteristics of ‘relations’. This is due to the fact that a system is always already self-consistent, i.e. all the relations necessary for this system exist already and the system does not need any additional ‘relations’ because they would be superfluous.
A similar reasoning is also valid concerning the application of assembling operation to the term ‘relation’.

Thus, the assembling operation (= ‘making sth. to a system’) generates the pair of categorial complementarities {properties, relations}, and its application to each of these terms retains them.

This pair of categorial complementarities obviously relates to the system, which has evolved as a result of the ‘assembling’, as a whole, but not to each single entity of the system.

Considering other categorial complementarity {cause, effect} similarly, we come to a conclusion that the assembling operation generates also this pair if one means here by system a process unifying cause <-> effect. Also, this pair of categorial complementarities relates to the system, which has evolved as a result ‘assembling’ (i.e. to the process as a whole), but not to each single entity of the system.

It is interesting to consider the relationship of the assembling operation to the pair {matter, information}[2]: here, this operation – applicable to an entity – means that the entity is considered as an element of Nature, i.e. the system is the entire Nature in this context. Matter shapes itself according to the related information, and the existence of this information is only

[2] Aristotle understood matter as the opposite to form

perceptible due to the matter possesses a shape, i.e. it is inhomogeneous, asymmetric. That is, matter and information become observable, see [7], sec. 2.4.
This means that the assembling operation, if applied to the elements of nature, is equivalent with the operation 'making observable', 'making existent', see also sec. 2 below. The pair {matter, information} generated by ‚making observable' relates to nature as a whole[3].

STM. 1:

In this regard, **the complementarity principle is a result of the <u>existence</u> of the *assembling operation* and its <u>applicability</u> to different entities. Categorial complementarities being generated by this operation relate to the resulting system as a whole, but not to the single entities constituting the system.**

Since the pair {being, non-being} represents categorial complementarities, and since the latter always relate to a system as <u>a whole</u>, the pair {being, non-being} also relates to any system as a whole, but not to its single elements.

STM. 2:

Thus, **if it is possible to claim the mere existence (= being) of an object/process, then this object/process can <u>only be a system</u>**. That is, **existing objects/processes can only be a system, but nothing else**.

It can directly be inferred from this knowledge, among others, that there cannot be non-disassemblable, 'elementary' entities. A non-disassemblable entity does not represent any system (else, one could disassemble it) and, hence, it is impossible to ascribe to it any categorial complementarities including {being, non-being}[4].

One of the practical consequences of this inference is that **there are no the 'very elementary bricks' of nature, i.e. those, which cannot be represented as an ensemble of other entities** (in other words, which cannot be disassembled anymore).
In this sense, the search for 'the very elementary particle' seems to be without prospects: it just cannot exist.

1.4 Complementarity: the Property of Object or Observer?

The assembling operation can be applied an unlimited number of times. I.e., it is being applied to any entities the first time. As the result of this application, the system of first order arises. Then the assembling operation is being applied to these systems of first order representing now entities for the assembling operator. As a result, the system of second order arises, and so on.

According to **Def. 4** and **Def. 5**, a multiple application of the assembling or disassembling operation to an arbitrary term out of a population of categorial complementarities does not change this term, as such a term is an eigenvalue of these operations.

[3] assembling operation has here statically-dynamic character, as the system (= nature as a whole) in this case encompasses objects and processes, as well
[4] Categorial complementarities in themselves represent a special case: concerning a pair from among them, it is impossible to ascribe to it other categorial complementarities.

In this regard, categorial complementarities as notions could have aspired to the role of 'elementary entities' if the latter had existed. As often as the assembling or disassembling operations are being applied to them, it does not change categorial complementarities.
In contrast to this, any other than categorial complementarities entities[5] definitely change by the application of assembling or disassembling operations, as such entities are not the eigenvalues of these operators, see detailed examples in sec. 4.1.

Is it possible to take an entity in and of itself, separately, i.e. is it feasible to isolate an entity[6]?
We proceed from the assumption that entities exist and are observable. The operation 'observation' necessarily presumes an interaction between the observer (actual, participant) and the observable (here: entity). An interaction, in turn, necessarily presumes including the object of observation in an observation system. Thus, the fact of observation itself makes the observation object – in our case assumed 'isolated entity' – part of the system with the system-constituting concept 'observation'. Please note that the system-constituting concept 'observation' exists even then, when there are no other system-constituting concepts, as the system-constituting concept 'observation' is immanent, by definition, in any observable entity.
That is, the observation operation itself assembles any observation object (including any observable entity) in a system, and, thus, enables ascribing categorial complementarities to the system.

Therefore, **any observation process – as an observation system – can be described by categorial complementarities**, for example, in terms of form and content, cause and effect, purpose and means, and several other dependent on the concrete observation situation (system), cf. sec. 4.2.
For example, for the literary analysis of a text (= observation process), a literary critic may use terms form and content, structure and function, purpose and means, rationality and emotionality and other.

STM. 3:

> Since categorial complementarities relate to the arisen system as a whole, it is **principally impossible** to discern, whether the pair of categorial complementarities being perceived by observer is an **attribute of the observable or an attribute of the observer**, as the latter represent merely single entities of the observation system.

If the observer is, in particular, a human being, this inference is commensurate with the existential *Dasein* by Heidegger: the human being (Dasein) is such a specific being, for whom in its being it deals with the very being itself, i.e. understanding of being is itself a determination of being of human being. That is, the human being as Dasein perceives all the existing about itself being part of it[7].

---

[5] which can only be systems, see chap. 1.3

[6] In the sense Ding an sich (thing in itself) of Kant, см. [3], I. Transzendentale Elementarlehre, Erster Teil, Transzendentale Ästhetik, Zweiter Abschnitt, Von der Zeit, § 8, Allgemeine Anmerkungen zur transzendentalen Ästhetik

[7] see [4], § 4: „Das Dasein ist ein Seiendes, das nicht nur unter anderem Seienden vorkommt. Es ist vielmehr dadurch ontisch ausgezeichnet, daß es diesem Seienden in seinem Sein *um* dieses Sein selbst geht. ... *Seinsverständnis ist selbst eine Seinsbestimmtheit des Daseins.*“

STM. 4:

That is, **the long-standing question, whether complementarity is immanent in objects themselves or it is attributed to the process of cognition by observer, is closed, namely in such a way that this question is basically undecidable**.

2 Being, Non-being, Infinity and Time

As already mentioned in chap. 1.3 and being discussed in more detail in [7], sec. 2.4, *being* and *non-being* are obviously connected with *symmetry/asymmetry*. Being of material objects is observable, only if they possess at least one asymmetry, as absolutely symmetric objects cannot react to any action.
In order to react to an action, i.e. in order to somehow modify a material object by the interaction, this object must be asymmetric with respect to this action. If an object is absolutely symmetric, no action can change it, hence, also no interaction is possible with such an object.

The interaction process between material objects and information has a direct affinity to asymmetry:

– presence of asymmetry is information, i.e. asymmetry is to equate with in*formation*,
– being of material objects is observable, if and only if they possess at least one asymmetry.

Thus, in*formation* provides matter with a *form* of its existence and matter gives information a *content* of its existence.

Is it possible to define the notions of *being* and *non-being* on a less abstract level than their relation to symmetry and asymmetry?
Yes, it is possible based on the ideas set forth in [7]. Here, we merely briefly regive the corresponding results.

In each moment, nature is in a 'state'[8]. These microstates can be indeterministic (probabilistic) and deterministic, cf. sec. 4.2, table C) above; a detailed statement is given in sec. 2.1.3, [7].
Only probabilistic microstates are principally *observable* and *differ from each other* ([7], ibid). These 'microstates' of nature are being assembled in its 'macrostates', see sec. 1.4 in [7], and, thus, can constitute observable objects. It means that only the observable microstates of nature – assembled into microstates – can be as *being* distinguished from *non-being*.

Def. 6:
Objects ‚assembled' from *observable* microstates of nature are *existent*; they are in the state of *being*.

In order to give a definition for the term 'time' (the flow of time) let us regard again to the following chain: existence of information causes asymmetry, and asymmetry is a necessary condition for the observability of states. If these states had been indiscernible from each other, they would have been observed as one and the same static, constant state.
Therefore, it is just the next logical step to define the term 'flow of time' as the discernibility of observable states.

[8] termed ‚microstate of nature' in [7]

Def. 7:

The discernibility of the microstates of nature from each other is the flow of time (i.e. time itself), see sec. 1.3 in [7].

Thus, exactly *observable* microstates of nature represent a necessary condition of the existence of time.

Deterministic, equally as impossible[9] microstates of nature are basically *non-observable*, see sec. 2.1.3 in [7]. Due to their unobservability, it is impossible to judge, whether states of such a type are deterministic ‘in fact’ or impossible. Therefore, these both types of states – deterministic and impossible – just concur with each other: they are basically indistinguishable.

Def. 8:

Objects ‚assembled’ from *non-observable* microstates of nature are in the state of *non-being*.

STM. 5:

The term ‘time’ is not applicable to non-observable states as they are indiscernible from each other.

It is interesting to remark that A. Schopenhauer came to the conclusion about the impossibility of the existence of the different types of *non-being*, at least of human non-being. He writes: ‘After your death you will be what you were before your birth’[10], [6], § 135. Schopenhauer reasons this thought by assuming the contrary: if there had been a form of being after death, then this form would have been another than while being alive; i.e. then there would have been two different types of the being of man. Simultaneously, it would have assumed the existence of two different forms of non-being, from the point of view of a living man: before birth and after death. But, if one presumes the existence of only one form of being for a man – its life, then there cannot be two different forms of non-being.

Def. 8 enables only one single form of *non-being*, as objects assembled from *non-observable* microstates of nature are principally indistinguishable from each other because they are generally indistinguishable due to their non-observability.

Now, we turn to the question about the connection between finiteness/infinity and being/non-being, to be more precise – between the infinite extent of a system and the possibility of its existence.

In a material confined (finite) system being in a thermodynamic disequilibrium, the entropy is produced in its entire volume and transported to the outside through its surface.
Let us notice that the relation volume/surface area is increasing unlimitedly towards infinity if the system extent is growing unlimitedly.

[9] creating an ‚impossible’ microstate would have required infinitely much resources; impossible states can also be considered as deterministic, as they definitely cannot occur.

[10] „Nach deinem Tode wirst du sein was du vor deiner Geburt warst“

Let us assume that a system of the infinite extent is in a state of thermodynamic disequilibrium. This would lead to an inevitable growth of its entropy, as the production of latter would be bigger than it could be conveyed to the 'outside' of the system. Hence, sooner or later, the entropy would take its maximally possible value for this system. This, in turn, would mean that the system would be in the state of thermodynamic equilibrium. However, this contradicts the initial assumption.

From this it follows that a system of the infinite extent
- either cannot exist at all
- or can be exclusively in the thermodynamic equilibrium, i.e. possess the maximally possible entropy value.

What can be said about the *observability* of a system of the infinite extent?

Let us assume the existence of a system of the infinite extent. Then, it must possess the maximally possible entropy value.
A system can react to a communication attempt with it from 'outside', only if this communication signal elicits a disturbance inside the system. Any such disturbance would mean a thermodynamic disequilibrium of the system, what is impossible in a system of the infinite extent (its entropy possesses already the maximally possible value). Therefore, any communication attempt with such a system has to go unanswered by the system, cf. [7], sec. 2.2.1.
It means that a system of the infinite extent, even if it existed, would be basically *non-observable*.

STM. 6:

A logically equivalent statement is that **observable**[11] **systems must have a finite extent**.

Since our Universe is observable, it is definitely of a finite extent.

The systems of the infinite extent are either basically non-observable, if they existed, or they do not exist at all, what again leads to their non-observability. Due to their principal non-observability, it is impossible to judge, whether the systems of the infinite extent do not exist 'in fact' or they do exist, but are non-observable. Hence, these two options just concur: they are principally indistinguishable.

There is an absolutely similar situation concerning the *observability* and *existence* of the states of nature, see above in this section and in [7], sec. 2.1.3: the observable states of nature cannot be deterministic; they must be indeterministic (probabilistic).

In this respect, the property of a system 'to possess a finite extent' has the same meaning as the property of a state of nature 'to be indeterministic'.
It is currently difficult to say, whether these properties are unreservedly equivalent to each other, though there is every indication for this.

[11] observability is a necessary condition of being/existence, see **Def. 6** above.

In distinction from the pair <‘to possess a finite extent’|‘to be indeterministic’>, it is possible to make a certain statement about the equivalence of the pair <‘to possess an infinite extent’|‘to be deterministic’>:
These both properties – infinite extent of a system and determinism of a state of nature – signify the *non-observability* of such systems and states, and, hence, their *non-being*. In this regard, these properties are strictly equivalent to each other.

3 Being, Existential Triads and Enmorphya

3.1 Being and Existential Triads

Let us consider now the pair of categorial complementarities {state, process}. As already mentioned in chap. 2, the term ‘process’ can - in turn - be expressed by another pair of categorial complementarities – {information, matter}. In this manner, the categorial complementarities in the triad {state, process} ≡ {{information, matter}, interaction process between them} represent a set of the eigenvectors of the assembling operator, s. sec. 1.2.
The tuple {{information, matter}, process of interaction between them} is the equivalent of the observability of states, cf. [7], sec. 2.4, and the observability of states is the equivalent of being, s. chap. 2 above. From this we infer that

STM. 7:

The tuple {{information, matter}, process of interaction between them} **is** being.

Let us now consider the question about the necessity and sufficiency of these three elements for the state ‘being’. As already discussed in chap. 2, the elements

- information,
- matter,
- the process of interaction between them

are <u>necessary</u> for the creation of the observable microstates of nature and, thus, for the creation of objects in the state ‘being’.

These three elements taken together are also <u>sufficient</u> for the creation of the observable microstates of nature and, thus, for the creation of objects in the state ‘being’, but only if the process of interaction between information and matter

- has fundamentally *stochastic*[12] character (s. [7], sec. 2.1.3 and sec. 4.2, C) below) and

- *statistically* obeys a certain law, namely the Principle of Least Resources Consumption (PLR)[13], s. [7], sec. 2.1.5 and 2.3.2.

The evolution of nature follows this character of the interaction process between information and matter, which represents the *’interaction-control-information’, or, synonymously, the ’relation-control-information’.*

Based on the system theory, cf. [2] and summarising the above, we can state <u>the necessity of a triad of categorially complementary elements</u> for achieving observable states, and by this, for the creation of objects in the state ‚being‘[14]. For this reason, we call these triads ‘***existential***’.

[12] *probabilistic, indeterministic*
[13] the principle of most entropy, the principle of least action represent particular cases of the PLR
[14] in Hegel’s terminology, it would be a tetrad: three mutually complementary theses and a synthesis

- The first element of the existential triad shall be a medium[15] (*substrate*, matter). Medium supplies / provides multiplicity of opportunities. Theoretically, medium can be even in the absolutely homogeneous, absolutely symmetric state with unlimited multiplicity of opportunities: it is unobservable then.
- The second element of the existential triad shall be a disturbance (i.e. breaking of a symmetry, and therefore a change in the degree of uncertainty, i.e. information). This disturbance has, per definitionem, an asymmetry with respect to at least one of possible characteristics, i.e. this disturbance represents a *property*. A *property* may include both qualitative and quantitative characteristics of the substrate, as well as a possible type of interaction of these characteristics.
- The third element of the existential triad shall be the interaction process between the substrate and the disturbance, i.e. shall represent a *relation*. As the result of this interaction, the substrate loses its homogeneity, its symmetry, namely exactly according to the disturbance (*property*).

In other words, amongst all existing potential opportunities, which can be provided by a given substrate, exact the opportunity becomes the reality that corresponds to the disturbance, which interacts with this substrate. In this way, the system arose on the base of this *existential triad* becomes observable and, hence, is in the state of 'being'.

Thus,

STM. 8:

the existential triad {substrate, property, relation}[16] is necessary for creating the state of 'being' of the system based on this existential triad.

Are there such conditions under which the existential triad {substrate, property, relation} would be not only necessary, but also sufficient to create the state of 'being' of the system based on this existential triad?

STM. 9: 'the principle of sufficiency of the existential triad':

If 'relation' in an existential triad has fundamentally *stochastic*[17] character **and** *statistically* obeys a certain law (cf. [7], sec. 2.1.3, 2.1.5 and sec.4.2, C) beneath), then this existential triad is not only necessary, but also sufficient for the achievement of observability and, thus, for creating the state of 'being' of the system based on this existential triad. The evolution of this system will follow the character of the 'relation' in the existential triad.

The existential triad {substrate, property, relation} always creates a system with a *system-constituting concept* corresponding to this triad, see Glossary, cf. [2].

15 ‚Medium' acc. to Niklas Luhmann [8]; ru: среда

16 the dyad {property, relation} has different names: Avenir Uemov [2] calls it 'structural factor', Niklas Luhmann [8] – 'Form'.

17 *probabilistic, indeterministic*

3.2 Enmorphya

STM. 9 represents a ‚principle‘, i.e. an abstract rule, in this particular case – the relation-control-information[18]. This 'principle of sufficiency of the existential triad for creating the state of 'being' of a system' – the relation-control-information – represents *the property of relation*.
But if the *relation* itself possesses the property, then it means that the *relation* itself within the framework of the primary system based on the given existential triad is simultaneously a *substrate* of another (meta-)system, namely 'the system of sufficiency of the existential triad for creation of the state of 'being' of the primary system'.

In this other metasystem,
- *the substrate of the metasystem* is 'the *relation* in the frame of the primary system, based on the given existential triad',
- *the property of the metasystem* is the relation-control-information, namely 'the principle of sufficiency of the existential triad for creating the state of 'being' of the primary system', i.e. **STM. 9**,
- *the relation of the metasystem* is interaction between the *property of the metasystem* and the *substrate of the metasystem* (i.e. between 'the principle of sufficiency' and the 'relation/interaction' in the frame of the primary system), and
- the *system-constituting concept of metasystem* is 'sufficiency of the given existential triad for creating the state of 'being' of the primary system based on this existential triad'.

To terminologically mark off the difference between *the property* in the frame of primary system, i.e. information, and *the property of relation* in the frame of primary system, i.e. *the property of the metasystem*, i.e. the relation-control-information, we introduce a dedicated term for 'control-information' – the notion '**enmorphya**'[19].
In these terms, 'information' (i.e. information-about-substrate) represents the *property* of the primary system, but 'enmorphya of relation' (i.e. relation-control-information) represents the *property* of the metasystem.

The distinguishing mark between the notions 'information' and 'enmorphya' consists in the following: 'information' interacts with the material substrate, whereas 'enmorphya' interacts with the relation, the process between this 'information' and this material substrate.

[18] synonymously: interaction-control-information
[19] The term ‚enmorphya (enmorfia, enmorphy)‘ is constructed on the basis of Greek: ἐνμορφήα (ἐν-μορφή-α => (bringing) in-form)

Let us illustrate the relationship between the primary system and the metasystem in the following diagram:

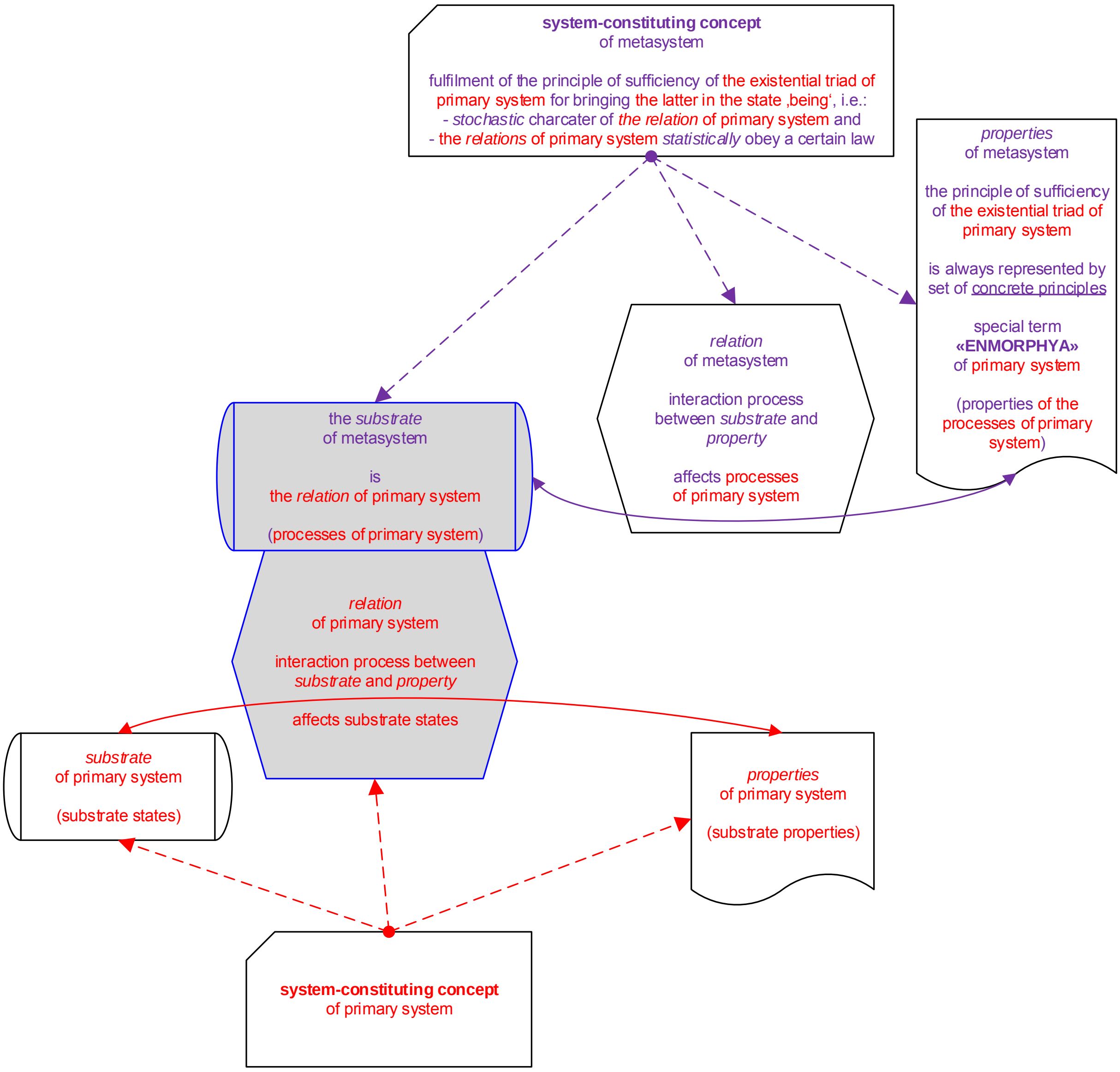

Figure 1: Relationship between the primary system and the metasystem and the place of enmorphya

Both the substrate (matter) and the property (information-about-substrate) in the frame of a system shall be affine to the characteristics of the relation (interaction) between them for the following reason: it is the only option enabling substrate and property to principally interact with each other. Thus, the characteristics of this interaction, i.e. the relation-control-information (the enmorphya of relation), leave a 'fingerprint' on the substrate (matter) and on the property (information) of this system. Therefore, 'the enmorphya of relation' (i.e. the characteristics of the interaction between substrate and property)[20] always represents the 'assemblage point' of any system.

[20] i.e. relation-control-information

Further particular properties of **STM. 9** as specific ‘enmorphya of relation’ (i.e. relation-control-information) are discussed in sec. 4.1, 4) ‘conjunction of systems‘.

Generalizing, one can state that any ‘rules’ / ‘principles’, regulating the character of *relations* (of interaction) between *substrate* and *structural factor*, always represent a relation-control-information, i.e. an ‘enmorphya of relation’.
In this context, the *substrate* of any ‘principle’ is always a *relation* (interaction) as a sub-aspect of the structural factor of the system that meets this ‘principle’, and the *structural factor* of any ‘principle’ is always the character / properties, i.e. the enmorphya of *relation* in the frame of this system. The *system-constituting concept* of any ‘principle’ is always ‘sufficiency of the given existential triad for creating the state of ‘being’ / ‘observability’ of the system, based on this existential triad’.

As for any pair {substrate, structural factor}, the following relationship is valid here: the existence of substrate (here: of interaction) enables the structural factor (here: enmorphya of interaction, i.e. interaction-control-information) to become apparent, and the existence of structural factor (here: enmorphya of interaction, i.e. interaction-control-information) makes the substrate (here: interaction) inhomogeneous and, hence, observable.
By the example of physics: the existence of physical fields (i.e. of the curvature of space) enables the Principle of Least Action (PLA) to become apparent, and PLA makes physical fields (i.e. the curvature of space) observable.

The enmorphya of relation in the frame of a system, as already discussed above, directly impacts the relation (interaction) between the property (information-about-substrate) and the substrate of this system. Therefore, a modification of the enmorphya of relation changes the entire system simultaneously on both sides: on the side of substrate and on the side of its properties.
Hence, the variations of the ‘enmorphya of relation’ between substrate and property (information-about-substrate) are ‘diversifying’ the interaction between them (between the substrate and property) much more efficient than variations of property itself or of substrate itself.

For example, a modification of didactical principles in the frame of education systems (for which these principles represent the enmorphya, see below in this chapter) changes the entire education system, connected with this enmorphya, – perhaps even replacing it by other system with a different system-constituting concept –, much faster and much more profoundly than any inadequacy of primary information (of information-about-substrate) like inappropriateness of learning materials.

For the sake of a better understanding the interrelation between the enmorphya and the system-constituting concept of a system, let us consider the marginal situation: the absence of any principles at all within a system.
The absence of any principles within a system means that the ‘enmorphya of relation’ (which is represented by ‘principles’), i.e. the ‘relation-control-information’ (the characteristics of relation), becomes arbitrary, indeterminate, what is equivalent to its non-observability, see chap. 2 above.
An arbitrary ‘enmorphya of relation’ between substrate (matter) and property (information) can correspond to only arbitrary, i.e. fundamentally uncertain information, which means its

absence. Only a perfectly homogeneous and therefore non-observable substrate may be in accordance with the absent information.
Thus, the absolute arbitrariness/indeterminacy of the 'enmorphya of relation' is equivalent to the absolute homogeneity and, hence, non-observability of the substrate of the system, and, hence, to the non-observability / non-existence of this system as a whole. It means that the absolute indeterminacy, i.e. the absence of the 'enmorphya of relation' necessarily leads to the absence of a system-constituting concept of the system.

STM. 10:

> Existence of 'enmorphya of relation' in a system, i.e. existence of principles ruling the relation in the system, is a necessary condition of the existence of at least one system-constituting concept of this system, and, by this, a necessary condition of the existence of this system as such.

The analysis of the character of the interaction between *substrate* and *structural factor* in the systems of different types – physical, social, communication, legal, see in this chapter below and in sec. 4.1 'Conjunction of Systems in a System Hierarchy' – has brought us to a reasonable assumption that

STM. 11:

> The Principle of Least Resources Consumption is relation-control-information (i.e. enmorphya of relation) and governs not only the process of interaction between matter and information in the nature[21], but also between the *substrate* and the *structural factor* of **any** system – physical, social, communicative, etc. – based on a *stochastic* process.

What does the term 'resource' mean in this context? The 'resource' of a system is the internal capacity / ability of the system to change its state or, equivalently, it is 'the residual information value' of the current state of the system[22]. The more decisions a system can make at a transition from its current state into its other given state, the higher the 'residual information value' of the system is. The amount of such decisions is product of 'the number of steps on the way to other state' into 'the number of alternative decisions/opportunities at each such step'.
'The number of steps on the way to another state' is a concrete manifestation of the philosophical concept of 'action', and 'the number of alternative decisions/opportunities at each such step' is a concrete manifestation of the philosophical concept of 'choice'.

Thus, the 'resource' of a system can abstractly be represented as the product of two categorially complementary terms:

'resource' = 'action' * 'choice',

see details in [7], sec. 2.3.2.

---

[21] as the principle of most entropy ⇔ the principle of least action, see [7], sec. 2.1.5 и 2.3.2

[22] 'the residual information value' of the current state of the system is the difference between the maximal possible entropy value of the system and its current value, see details in [7], sec. 2.2.1

A specific implementation of ‘steps on the way into other state’ and of ‘alternative decisions/opportunities at each such step’, i.e. a specific implementation of ‘action’ and ‘choice’ is individual in each system and shall be determined for each system separately[23].

For example, the ‘resource’ of physical systems is the number of action quants needed for the transition of a system in other given macroscopic state[24]; the ‘resource’ for communication (including the communicative function of language) is “the number of single positions in a message (text)” * “the number of different characters” (e.g. letters and punctuation marks) needed for conveying given content; the ‘resource’ for educative – in fact, for any social process – is “the number of particular (learning) topics” * “the number of alternative (didactical) methods” needed to be considered and applied, respectively, for the achievement of given (educational) objective.

Stochastic and Deterministic processes

To continue our analysis, we need to take a closer look at the concept of the "stochastic process", which is found in both **STM. 9** and **STM. 11**.

We will define here two types of stochastic processes: a *truly-stochastic* process and a *quasi-stochastic* process.

The distinguishing criterion here is the "Markov property": each following state of the Markov system (of the Markov process) is probabilistically dependent exclusively on its current state and does not depend on its previous states. We call such Markov systems *truly-stochastic*. This property can also be expressed in such a way that the past of the truly-stochastic, i.e. Markov systems affects their future exclusively through their present. This "true stochasticity" lies precisely in the absence of immediate "memory" of previous states: the subsequent state probabilistically depends only on the current state.
As consequence of this, relations / interactions in Markov systems statistically obey a certain law, namely the Principle of Most Entropy (equivalent to the Principle of Least Action in physical systems).

All other types of stochastic systems which do not possess "Markov property", we named *quasi-stochastic*, see Glossary.
N.B.: *Quasi-stochastic* processes are not deterministic.

Stochastic process: a process whose every next state comes with a probability other than 0 and 1, cf. chap. 4.2, section C), necessity vs contingency.

Deterministic process: a process whose every next state is unambiguously defined by its present state, i.e. every next state occurs with a probability of 1. This means that every previous state of a *deterministic* process can also be unambiguously calculated from its present state. If the next process state occurs with probability 0, then the process has stopped,

[23] the number of ‘steps on the way into other state’ shall be > 0, and the number of ‘alternative decisions/opportunities at each such step’ shall be > 1. The reason for this is that nature has to spend more than zero resources to make a state observable. For this, nature ‘must’ make at least 1 ‘step on the way into other state’, and the ‘alternative decisions at each such step’ must not be deterministic and, hence, the number of alternatives must be > 1; see details in [7], sec. 2.1.3, 2.1.4, 2.3.2.
[24] i.e. physical quantity ’action‘ ($kg \cdot m^2 \cdot s^{-1}$) / h (Planck constant – the value of the action quant)

no longer exists; it also falls within the definition of deterministic process, cf. chapter 4.2, section C), necessity vs contingency.

It is no coincidence that stochasticity and determinism are categorical complementarities, cf. chap. 4.2, section C), contingency vs necessity.

For systems based on a *truly-stochastic* process, obeying the principle of most entropy (which represents an implementation of the Principle of Least Resources Consumption) automatically ensures 'sufficiency of the given existential triad for creating the state of 'being' / 'observability' of the system, based on this existential triad'. In such systems, their true stochastiveness on one side and the fulfilment of the (statistic by its nature) Principle of Least Resources Consumption on the other side always ensure an adequate balance between 'freedom of choice' and 'freedom of action' for the *substrate* of these systems and, in such a way, their stability.

For other type of systems based not on a *truly-stochastic* process, but on the execution of the 'free will' (of the freedom of choice)[25] of their substrate[26], a fulfilment of the Principle of Least Resources Consumption **would** also ensure an adequate balance between 'freedom of choice' and 'freedom of action' for the *substrate* of these systems and, in such a way, their stability.
But, such *quasi-stochastic* systems do not possess an automatic, immanent to these systems mechanism of continuous following the Principle of Least Resources Consumption. This absence can lead to an inadequate interaction between the *substrate* and the *structural factor* of such systems and, therefore, to decreasing their ‚adequacy' compared with ideally possible one (i.e. if to follow the Principle of Least Resources Consumption). Nevertheless, as we can infer from **STM. 11**, at statistically large periods of time and at statistically big quantity of the members of population or socium, such *quasi-stochastic* systems also follow the PLR (the Principle of Least Resources Consumption), if reducing their ‚adequacy' does not destroy these systems as such.

It is interesting to note that Darwin's natural selection represents a specific implementation of the PLR for the biological ecosystem. The rules for natural selection satisfy both conditions for the sufficiency of the existential triad: stochasticity and adherence to the statistical Principle of Least Resources Consumption (PLR), cf. **STM. 11** above.

A completely separate question is why just the Principle of Least Resources Consumption represents the enmorphya of relation (the relation-control-information) for the whole Nature, see **STM. 11**.
One of the possible answers to it seems to be quite simple one: just the PLR implements self-preservation, i.e. the stability of the Nature as a global system. Obeying PLR means that the n

[25] Free will represents the freedom of choice, which has non-deterministic character, but does not represent the markov process, and takes into account at least the entire previous experience of a system; i.e. it is a certain freedom of choice, a possibility of local deviation of *quasi-stochastic* process from following the principle of Least Resources Consumption.
[26] the substrate of such systems (sociums) are living systems: the latter represent macroscopic systems with self-control that make their decisions in indeterministic and quasi-stochastic way.

Nature consumes the informational resource/reserves, which the Nature got at its nascency, in the most economizing way. If implementations of other 'natures', which do not follow PLR, even existed, they could not remain stable, could not 'survive' a statistically large period of time.

The evolution of *non-deterministic* (i.e. of *truly-stochastic* and *quasi-stochastic*) as well as *deterministic* systems follows the character of the interaction process between their substrate and structural factor, i.e. the enmorphya of relation (relation-control-information).
Thus, the enmorphya of relation of a system determines the evolution of this system and represents the 'assemblage point' of this system, as well.
Since the enmorphya of relation represents a "principle", see **STM. 11**, i.e. is the <u>fundamental</u> relation-control-information, its characteristics (attributes) should be stable throughout the whole existence of the system.

3.3 Enmorphya for Truly-Stochastic Systems

Truly-stochastic systems by definition (see Glossary) possess a "Markov property", which is that each subsequent state of the Markov process (the Markov system) is probabilistically dependent <u>solely</u> on its current state and is independent of its previous states. *Truly-stochastic* systems do not have <u>immediate "memory"</u> about previous states: the subsequent state of probabilistically depends only on its current state.

As consequence of it, the relations / interactions in *truly-stochastic* systems are *statistically* subject to certain law, namely to a principle of most entropy: *truly-stochastic* systems, i.e. the systems realising Markov process, have the greatest possible entropy and, that is equivalent, spend the minimum quantity of resources, see [7], sect. 2.1.5 и 2.3.2.

All *truly-stochastic* systems possess one more distinctive property: their evolution automatically and steadily follows the principle of most entropy in the sense that local *statistical* deviations of the *truly-stochastic* process from following this principle are statistically corrected for statistically minimal number of the following system steps (states).

Let us illustrate the application of the concept of enmorphya with the following examples of *truly-stochastic* systems.

3.3.1 Physics

Let us consider macroscopic matter in any aggregate state (gas, liquid, solid state) as a system. For this system, 'substrate' is represented by molecules, 'property' – their physical characteristics (mass, the spatial distribution of electric charge) in conjunction with specific laws of intermolecular interaction, and 'relation' – by the process of the application of these laws to particular molecules, i.e. the interaction process itself between the molecules, cf. sec. 4.1 below.
The microscopic movement (the kinetic behaviour) of particular molecules is fundamentally *stochastic* (probabilistic). At the same time, both the movement of a statistically big number of molecules (ensemble) and the movement of particular molecules in statistically big periods

statistically obey certain regularities / laws, for example the ideal gas equation, the Van-der-Waals equation (for gases) or Navier-Stokes equation (for liquids) and so on, i.e. **STM. 9** (‘the principle of sufficiency of the existential triad’) is met.

The principle of most entropy is equivalent to the Principle of Least Action (Hamilton Principle, PLA), see [7], sect.2.1.5, which in turn is a universal physical principle governing any - already known and not yet discovered - physical interactions. The PLA is only a specific case of the principle of least resources consumption (PLR).

It means that any physical system is *truly-stochastic* one.

The Principle of Least Action always meets ‘the principle of sufficiency of the existential triad’, i.e. **STM. 9**, and represents the interaction-control-information (enmorphya of interaction) for physical systems. As the enmorphya of interaction between matter and information, PLA determines the character of this interaction, see **STM. 9**. For example, PLA determines the character of (bosonic) fields, which, in turn, implement the interaction between (fermionic) substances. In this way, PLA leaves a ‘fingerprint’ on physical matter and on physical laws, as well: all (already known and still not discovered) physical laws are derivable from PLA, the entire physical matter is formed so that PLA is fulfilled.

Let us illustrate the relationship between the primary system and the metasystem by the example of the physical system "matter":

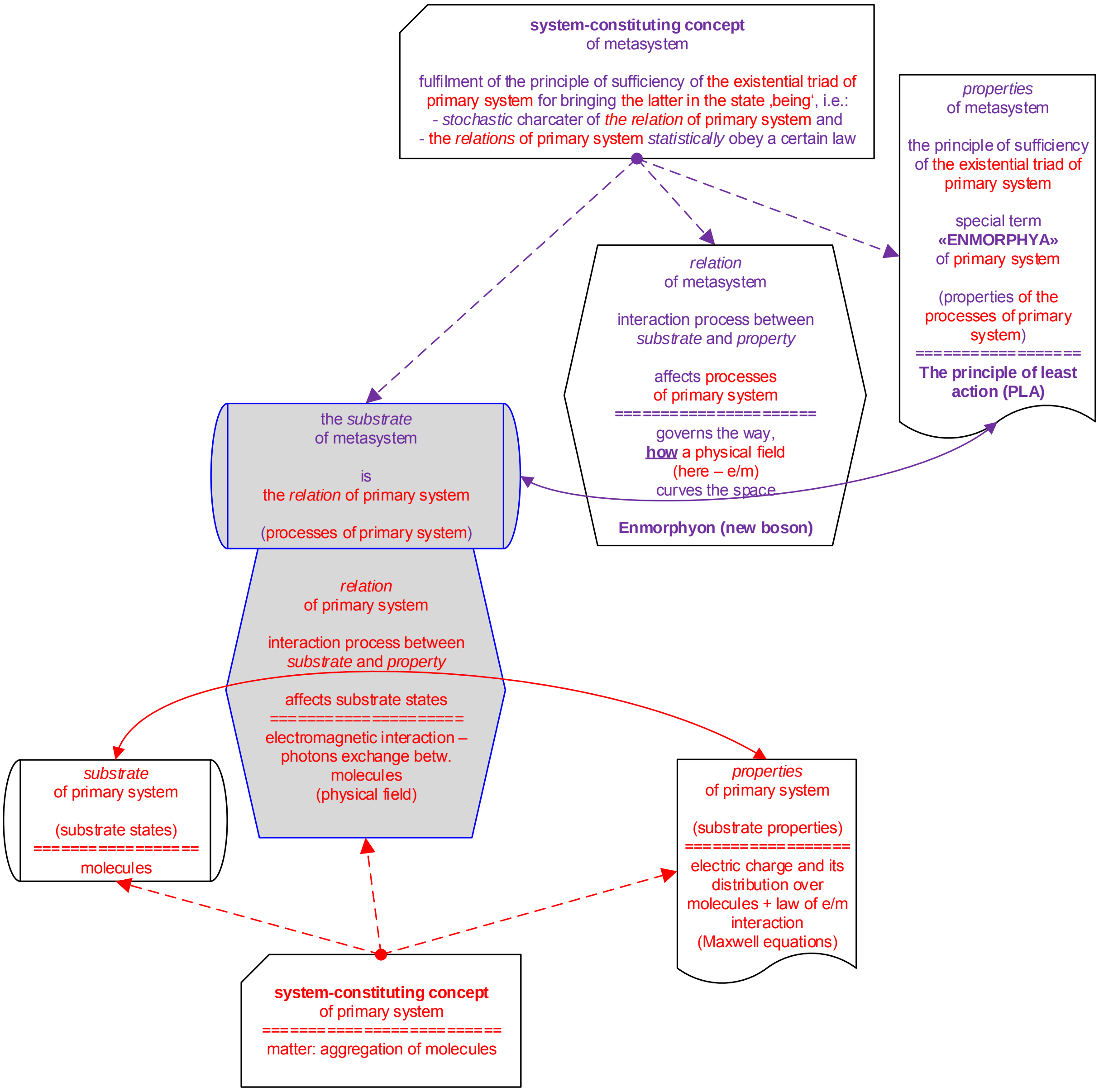

Figure 2: Relationship between the primary system “matter” and the respective metasystem

3.3.1.1 Enmorphyon

Let us pay additional attention to the "relation of metasystem" on the diagram Figure 2: this relation controls in this case **how** exactly the physical (in this example - electromagnetic) field curves the space.

In principle, any physical field **could** curve space arbitrarily, i.e. its potential **could**, in principle, have any shape satisfying the given boundary conditions, e.g. invariance conditions. However, **any** physical field does not curve space arbitrarily, but **always** so that the principle of least action (PLA) is fulfilled.

On the one hand, there is a primary interaction between matter particles (fermions). In Figure 2, they are referred to as "*substrate* of primary system". Such primary interaction, for example, is the electromagnetic interaction between charged elementary particles. This primary interaction between the particles of a matter is possible because they have certain properties, e.g. electrical charge. In Figure 2, they are referred to as "*properties* of primary system".
The primary interaction is shown in Figure 2 as "*relation* of primary system".

In physics, the presence of an interaction can always be described either by means of a corresponding physical field or, equivalent, by means of a particle as interaction carrier. The carrier particle of an interaction must necessarily be a boson.
Electromagnetic interaction between charged particles, for example, is described by electromagnetic field (Maxwell equations) or, what is equivalent, as photons exchange between charged particles. Photons are vector bosons with a spin of one.
Let us call bosons-carriers of primary interaction "bosons of the primary interaction". Then photons are the "bosons of the primary interaction" between charged particles.

On the other hand, **any** physical field **always** curves space so that the principle of least action (PLA) is followed. This means that there must be additional, specific interaction implementing the fulfilment of the PLA.

In other words, there should be not only primary interaction between matter particles (fermions), but also specific interaction between the processes of exchange of "primary interaction bosons", and it is this additional, specific, secondary interaction that the PLA implements. The secondary interaction is presented in Figure 2 as "*relation* of metasystem ".

As we can see, the difference between the primary and secondary interaction is as follows:

- the objects of primary interaction are fermions, particles of matter, whereas
- the objects of secondary interaction are the processes of exchange of "bosons of the primary interaction".

On the example of charged particles:

- the objects of primary interaction are, for example, electrons;
  this primary interaction is described by the exchange of photons ("bosons of the primary interaction") between electrons;
- the objects of secondary interaction are the processes of exchange of "bosons of the primary interaction", i.e. the processes of exchange of photons in our example.

What is the mechanism for PLA implementation on any physical field?

Since in physics the presence of any interaction can always be described either by means of the corresponding physical field or, what is equivalent, by means of a boson-carrier of interaction, the secondary interaction must be implemented by a boson specific for this interaction.

It means that

STM. 12:

> **there should be a new specific boson carrying the secondary interaction that implements the principle of least action. We called this boson "enmorphyon".**

The name "enmorphyon" is dictated by the fact that this boson carries an interaction that implements enmorphya (represented as the PLA in the case of physical objects).

What should be the properties of the enmorphyon?

1) The spin of the enmorphyon

Since the enmorphyon provides interaction between the processes of exchange of **any** "bosons of primary interaction", i.e. the objects of its application are **any** "bosons of primary interaction", for example, photons, then the enmorphyon must be a scalar boson, i.e. with a zero spin.

2) The mass of the enmorphyon

As we have defined in [7], chap. 2.2.2, Nature moves from one state to another in discrete steps, making at each such step a stochastic decision (within the limits of the principle of most entropy), what will be the next step, cf. [7], chap. 2.3.1. In this case, the time flow is postulated to be discrete and it is assumed that the value of the time quantum is Planck time, chap.1.3 ibid[27].

The principle of least action (equivalent to the principle of most entropy, see [7], chap. 2.1.5) is the *stochastic* principle that governs *truly-stochastic* processes. Local *statistical* deviations of a *truly-stochastic* process from following this principle are statistically corrected for the statistically minimal number of subsequent steps (states) of the system.

This means that the enmorphyon that provides the mechanism for implementing the PLA should correct local *statistical* deviations of a *truly-stochastic* process from following the PLA for the statistically minimal number of subsequent steps (states) of the system.

If we assume that such statistical correction takes place, for example, in 100 system steps, then the enmorphyon should have a corrective effect on the group of processes of exchange of "bosons of the primary interaction", consisting of 100 elements accumulated during these 100 system steps.
It means that the average lifetime of an enmorphyon should be about 100 Planck times t_p.
Obviously, the enmorphyon cannot be the Higgs boson, because the latter has a much longer lifetime of 10^{-22} - 10^{-24} sec. against the assumed lifetime of the enmorphyon of the order 10^{-41} - 10^{-42} sec.

[27] $t_p \equiv \sqrt{\frac{\hbar G}{c^5}} \approx 5,4 \cdot 10^{-44} s$; i.e. Nature performs $t_p^{-1} \approx 1,85 \cdot 10^{43}$ steps of time in a second

Since the mass of bosons and their lifetime are inversely proportional to each other, the mass of the enmorphyon may be about 10-2 - 10-3 Planck mass m_p[28], i.e. 10^{16} - 10^{17} GeV, whereas the mass of the Higgs boson is about 125 GeV.

3) Enmorphyon and the principle of least action

Enmorphyon arises within the metasystem, see diagram Figure 2. As we shall see further in chap. 4.1 4) “conjunction of systems”, metasystems do not build further hierarchies of systems because they simply repeat themselves in such a hierarchy, see **STM. 19**. Since the metasystem replicates itself, the function of the enmorphyon as the "relation of metasystem" repeats itself. Consequently, the enmorphyon itself must satisfy the PLA. Thus, an enmorphyon is simultaneously the mechanism of implementation of the PLA, and is itself subject to the same principle and mechanism.

Let's summarize the expected properties of enmorphyon, a new hypothetical boson that carries the secondary interaction that implements the PLA:

- enmorphyon is scalar, i.e. it has zero spin,
- its lifespan should be in the order of 100-1,000 Planck times t_p,
- its mass should be about 10^{-2} - 10^{-3} Planck mass m_p,
- it is subject to the PLA itself.

3.3.2 **Communication** (on the example of natural language)

To illustrate our conclusions on the example of communication by natural language, let us consider a sufficiently large text, i.e. a text containing statistically big number of signs. *Text* represents a system aiming fixation and perception of rational and/or emotional content. The final ‘substrate’ in this system is phonemes (signs), the ‘property’ – the totality of phonetic, word-building, syntactic and grammatical rules that apply to units of all levels of language. Each such unit has certain properties, for example, "part of speech" for lexemes. The ‘relation’ for this system is the process of application of these rules at the corresponding language levels (phonetic, morphologic, lexical, syntactic, and semantic), i.e. the process of speaking itself, cf. sec. 4.1 below.

The language means for the creation of a *text* are developed to such extent that they can capture and percept practically unlimited variety of contents in the frame of the *area of mutual understanding*, see [9], chap. 3. Thus, the possible content of *texts* in this frame is also unlimited and unpredictable. Accordingly, the sequence of phonemes (signs) representing *texts* is also fundamentally *probabilistic*.
On the other side, the phonemes alternation patterns in <u>any</u> *text* represents regular Markov chains and, hence, *statistically* obeys the respective laws the order of phonemes as A. Markov convincing demonstrated by the example of the first 20.000 signs of the poem ‘Eugene Onegin’, see [10]. Thus, **STM. 9** (‘the principle of sufficiency of the existential triad’) is met also here.

[28] $m_p = \sqrt{\frac{\hbar c}{G}} \approx 1,2209 \cdot 10^{19}$ GeV/s² = $2,176 \cdot 10^{-8}$ kg

Within the framework of the linguistic system, *the principle of linguistic economy* represents the relation-control-information (the enmorphya of relation) of this system: the process of applying phonetic, morphologic, lexical, syntactic and semantic rules on the respective language levels obeys this (statistical) principle, cf. [12].

The principle of linguistic economy is nothing else than a concrete instantiation of the principle of least resources consumption (PLR), see **STM. 11**.

As the enmorphya of relation between the substrate (phonemes (signs)) and the property (a set of phonetic, word-building, syntactic and grammatical rules impacting units of all levels of language; each such unit has certain properties, e.g. "part of speech" for lexemes), the principle of linguistic economy determines the character of this relation (interaction), see **STM. 9**. The principle of linguistic economy determines the character of the process of applying these rules, which, in its turn, implements the interaction between phonemes (signs) and the set of orthography rules. Thus, the principle of linguistic economy leaves a "fingerprint" both on the sequence, sample of alternating phonemes (signs) (the substrate of the language system from the point of view of its communicative function), and on the orthography rules (their form and content; the property of the language system): sequences, samples of alternating phonemes (signs) in <u>any</u> text represent regular Markov chains and, therefore, *statistically* subject to the corresponding laws. The systems implementing regular Markov chains, in their turn, have the maximally possible entropy and, which is equivalent, consume the minimum amount of resources, see [7], sec. 2.1.5.

This means that the system *Text* aimed at capturing and perception of rational and/or emotional content is *truly-stochastic*.

Let us illustrate the relationship between the primary system and the metasystem by the example of the communication system "text":

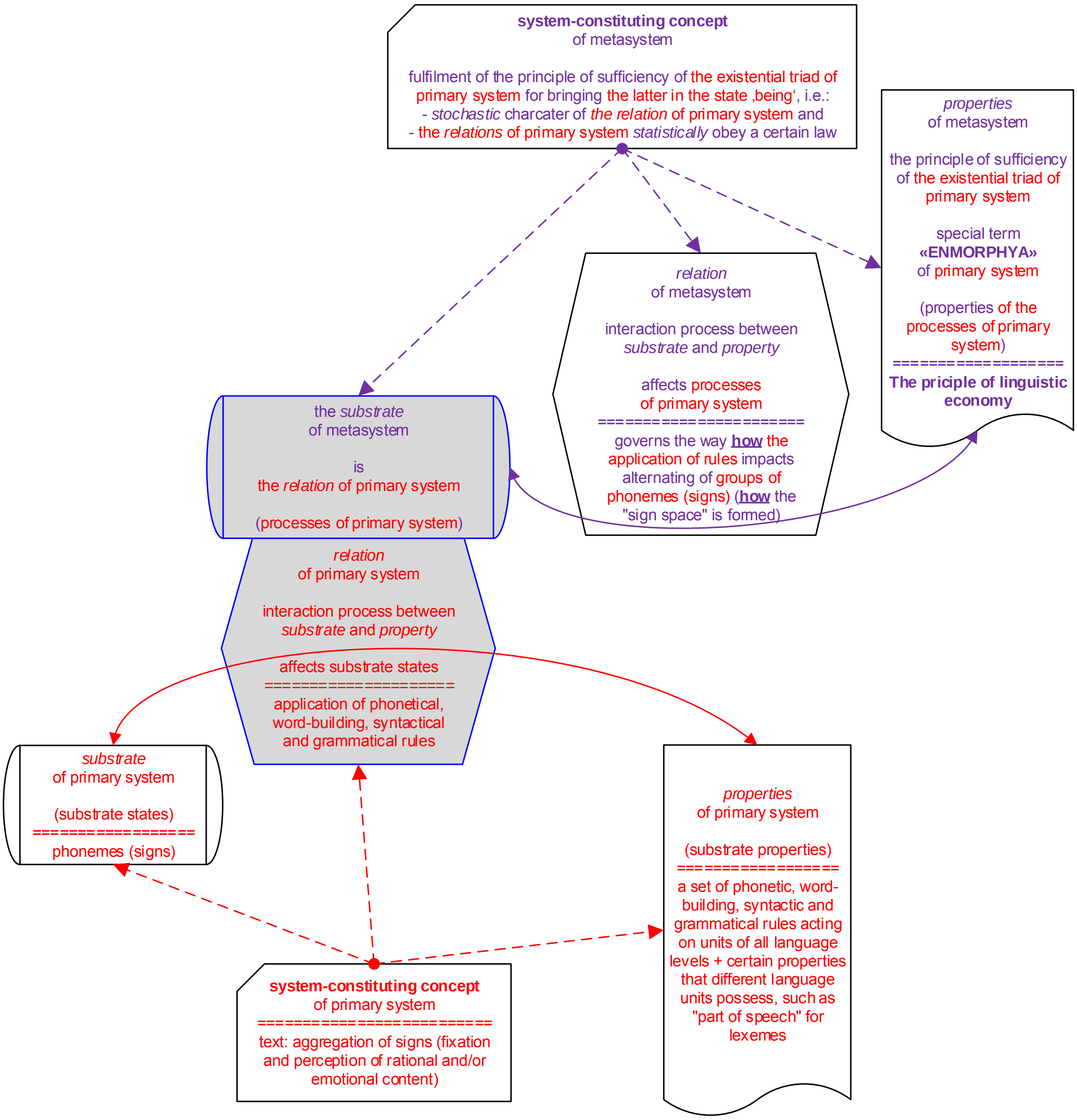

Figure 3: Relationship between the primary system “text” and the respective metasystem

3.4 Enmorphya for Quasi-Stochastic Systems

Quasi-stochastic systems are any systems realising any stochastic process which does not possess "Markov property", i.e. *quasi-stochastic* systems are any stochastic systems except "Markovian", *truly-stochastic* systems, see definition in Glossary.

As *quasi-stochastic* systems do not possess the "Markov property", each next state of the stochastic process implementing them probabilistically depends both: on its current state, and on its previous states. *Quasi-stochastic* systems shall possess immediate "memory" about previous states.

As we have reasonably suggested in **STM. 11**, the Principle of Least Resources Consumption (PLR) shall regulate the process of interaction between the *substrate* and the *structural factor* of **any** system based on a *stochastic* process.

As a consequence of this, relations / interactions in *quasi-stochastic* systems are *statistically* subject to a certain law, namely the principle of least resources consumption.

Unlike *truly-stochastic* systems, *quasi-stochastic* systems do not have an automatic, inherent mechanism of continuous following the Principle of Least Resources Consumption (PLR). This means that local *statistical* deviations of the *quasi-stochastic* process from following this principle are statistically corrected, but this correction may occur not immediately, but only through a large number of subsequent steps (states) of the system.

This may lead to an inadequate interaction between the *substrate* and the *structural factor* of such systems, and consequently to a decrease in their actual "adequacy" compared to the ideal "adequacy" (i.e., if they had followed the PLR continuously). Nevertheless, *quasi-stochastic* systems also follow the PLR on statistically long intervals and on statistically large amount of the system's *substrate*, if reducing their "adequacy" does not destroy these systems as such.

Thus, *quasi-stochastic* systems not only follow the PLR on statistically long time intervals and on a statistically large amount of the system's *substrate*, but also locally deviate from it.

If any *quasi-stochastic* system followed only the PLR, it would not be a *quasi-stochastic* system, but a *truly-stochastic* one. This means that the enmorphya of relation of *quasi-stochastic* systems shall include at least one more principle that distinguishes it from the enmorphya of relation of *truly-stochastic* systems.

What could this additional principle be?

A significant deviation from the *stochastic* following PLR in terms of intensity and/or duration may cause the *quasi-stochastic* system to cease to exist as a system, i.e. replacement or complete elimination of its system-constituting concept.
For example, changing didactic principles within an educational system (for which these principles are enmorphya, see below in this chapter) fundamentally changes the entire educational system associated with that enmorphya - perhaps even replacing it by another system with another system-constituting concept.

Thus, in order to ensure the stability of *quasi-stochastic* systems, their enmorphya shall contain at least one more principle, which we called the **Principle of Self-preservation of System**.

The Principle of Self-preservation of System consists in, that the deviation of *quasi-stochastic* system from following the Principle of Least Resources Consumption is limited by the fact that the system-constituting concept of this system remains stable.
I.e., the consumption of resources of the system is minimized (PLR), but not so much as to destroy the system-constituting concept of the system and, with it, the system as such (the Principle of Self-Preservation of System).

In this context, the PLR can be called the principle of maximizing the freedom of choice, and the principle of self-preservation of system can be called the principle of maximizing the freedom of action.

It is the Principle of Self-preservation of System as one of the characteristics of *quasi-stochastic* systems that leads to their stability, "caution" when trying something unknown, new.

The Principle of Self-preservation of System is actually valid for any system. For *truly-stochastic systems*, it is performed automatically thanks to their "Markov property", which itself brings the stochastically "out of line" systems back to the path of maximum entropy.
For *quasi-stochastic* systems, there is no such automatism. Its absence shall therefore be compensated for by the system's explicit, inherent mechanisms to help preserve the system. Usually such mechanisms are implemented through feedback within the system itself.

Thus,

STM. 13:

> at least two principles are existentially necessary components of the enmorphya of *quasi-stochastic* systems: the Principle of Least Resources Consumption (PLR) and the Principle of Self-preservation of System (PSP).

Let us illustrate the application of the concept of enmorphya by the following examples of *quasi-stochastic* systems.

3.4.1 Education

Let's look at the education system. Any education system has several functions, among which the primary ones are the acquisition of knowledge/skills (cognitive function) and the adoption of environmental/social values (educational function). For the sake of simplification of presentation we further consider only the cognitive function of education, i.e. the rational transfer of knowledge and skills from teacher to students.
In this consideration, the 'substrate' of the educational system is the learners (their 'minds'), the 'property' - the material being taught and the properties of learners' 'minds' (motivation, ability for the given subject, health, etc.), and the 'relation' is the process of interaction of this material with learners' 'minds', i.e. the very process of teaching, which includes, in addition to 'primary' teaching, both the reaction of learners to teaching and the teacher's observation of learners' reactions.

Since there are no two exactly identical psyches and "minds" of different learners (the psyche is uncopyable), the process of interaction of the taught material with the "minds" of individual learners is purely *probabilistic*. However, *statistically* large number of students tends to assimilate the material within a (statistically) certain period of time, i.e. **STM. 9** ("the principle of sufficiency of existential triad") is respected.

Both inadequate teaching didactics and low motivation on the part of a student usually result in that the material being taught is absorbed by that student for an inadequate length of time, at the limit - is not absorbed by that student at all.
This is a clear indication that the education system is a *quasi-stochastic* one.

Within the educational system, *didactic principles* represent the relation-control-information (enmorphya of relation) of this system. As the enmorphya of relation between the substrate (learners' minds) and the property (taught material), didactic principles define the character of this relation (interaction), see **STM. 9**. The didactic principles define the character of the teaching process which, in turn, implements the interaction between learners' minds and the material being taught. Thus, didactic principles leave an "imprint" both on the "minds" of students (the substrate of the educational system) and on the teaching material (on its form and content, i.e. on the properties of the educational system).

Let us illustrate the relationship between the primary system and the metasystem by the example of the educational system:

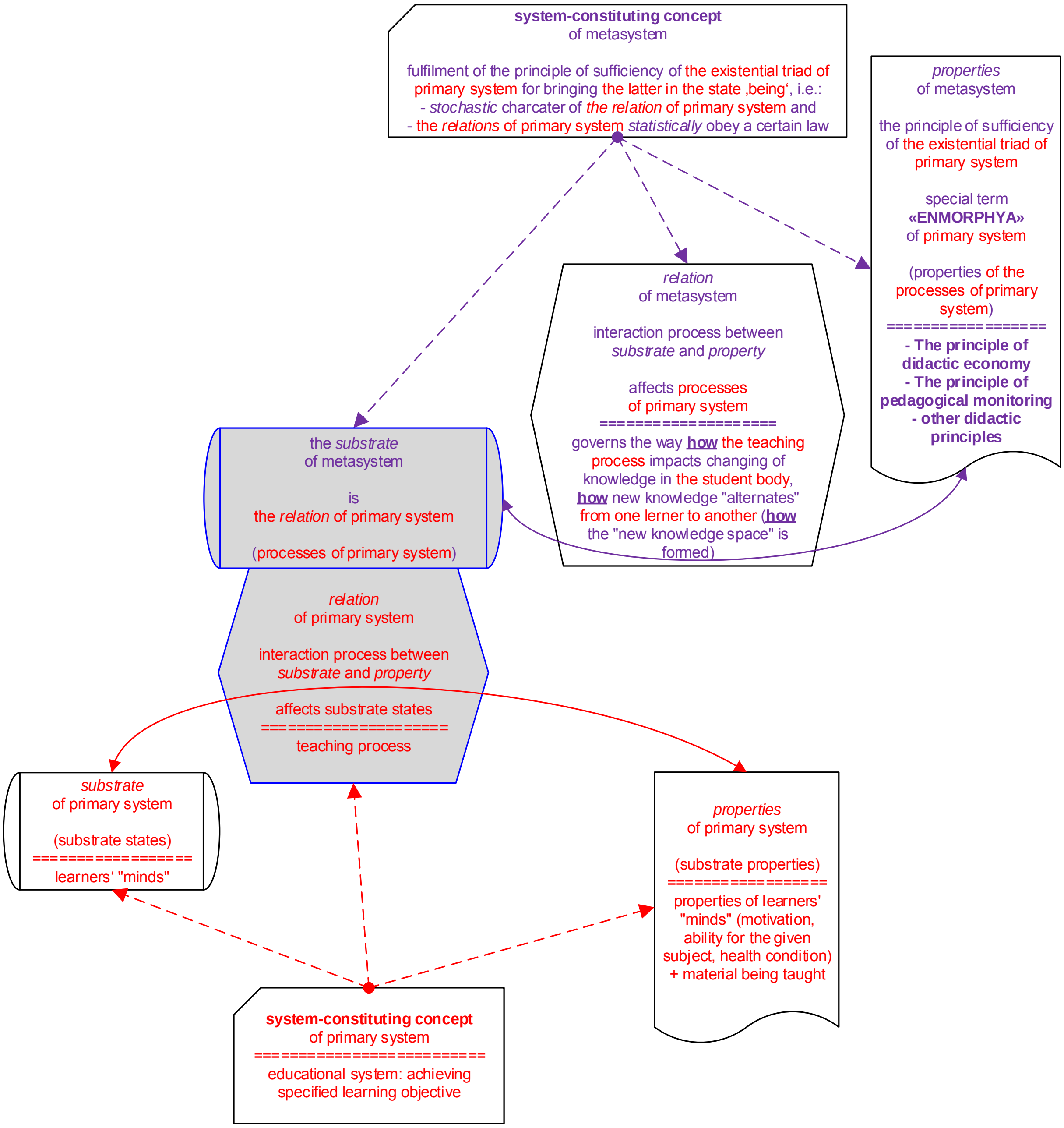

Figure 4: Relationship between the primary system "education" and the respective metasystem

Since the Principle of Least Resources Consumption shall govern the process of interaction between the *substrate* and the *structural factor* of <u>any</u> system based on a *stochastic* process (**STM. 11**), i.e., it shall be a component of the enmorphya of relation of <u>any</u> system, the PLR shall, in particular, represent at least one element of the enmorphya of relation in the education system as well.
On the other hand, as we have just found out, *didactic principles* are the enmorphya of relation in the education system.

Therefore, it follows that

STM. 14:
one of the *didactic principles* must necessarily be the Principle of Least Resources Consumption.

Let us remember (see chapters 3.2) that for the educational - and for any other social process - the "resource" is “the number of particular (learning) topics” * “the number of alternative (didactic) methods” to be considered and applied, respectively, in order to achieve a given (learning) objective. It means that within a given learning objective it is possible to minimise the consumption of educational resources in two ways: (i) to consider only such particular educational topics as are necessary for the achievement of the given educational objective and (ii) to apply only such didactic methods as most effectively lead the given educational group (learners + teacher) to the achievement of the given (learning) objective. "Effectively" includes both time savings on learning materials and all other means, such as acquiring and operating training equipment, travel for practical experience, etc.

Indeed, the various sets of didactic principles contain, explicitly or implicitly, among other principles, the principle of least resources consumption. For example, E. Pevtsova formulated, among others, the following principle:

> "The principle of saving effort, money and time in organising specific learning. In order to implement this principle, it is necessary to predict a certain result of legal learning through systemic preparation for the classroom"[29].

Thus, based on the above results and by analogy with the principle of linguistic economy, which we discussed in Chapter 3.3.2 above, we have formulated **the principle of didactic economy**:

Def. 9:
The principle of didactic economy is to minimise the consumption of educational resources within a given learning objective by
(i) addressing only such particular learning topics as are necessary to achieve a given learning objective, and
(ii) applying only the kind of didactic methods that most effectively - in the sense of economy of effort, cost and time - lead the educational group (learners + teacher) to the desired learning objective.

[29] «Принцип экономии сил, средств и времени на организацию конкретного обучения. Для реализации этого принципа необходимо прогнозировать определенный результат прововой обученности посредством системной подготовки к занятиям»;
cited after *Legal Culture of Teacher as a Basis for Legal Education of Students*, S.Yu. Besshaposhnikova, p. 53 in *Which Teacher Do We Need?*, Collection of Materials of Scientific and Practical Conference April 15, 2008, edited by L.V. Kosilova, 2014, ISBN 978-5-4458-4165-4;
Source: Pevtsova E. A. *Legal Education in Russia*: *forming legal culture of modern society*, monograph. APK and PRO, Moscow, 2002;
(*Правовая культура педагога как основа правового воспитания учащихся*, Бесшапошникова С.Ю., стр. 53 в *Какой педагог нам нужен?*, Сборник материалов научно-практической конференции 15 апреля 2008, под ред. Косиловой Л.В., 2014, ISBN 978-5-4458-4165-4;
первоисточник: Певцова Е. А. *Правовое образование* в *России*: *формирование правовой культуры современного общества,* монография. АПК и ПРО, Москва, 2002)

As we have considered above, the Principle of Self-preservation of System becomes an existentially important characteristic of *quasi-stochastic* systems. Does it manifest itself in the education system?

Indeed, the various sets of didactic principles contain, explicitly or implicitly, among other principles, the principle of self-preservation of system. For example, E. Pevtsova formulated, among others, the following principle:

> "The principle of constant and benevolent control over the system of learning legal concepts and acquiring legal skills. Timely identification of existing gaps, filling them in and verification of the selected teaching methods will help to conduct current and final monitoring of students' skills and abilities"[30].

This principle of "continuous and benevolent control" is nothing else than the implementation of the Principle of Self-preservation of System in educational systems: the sustainability of the educational system is impossible without a feedback mechanism through the monitoring of learning achievement and adjustments in didactics and/or teaching methods as a result of this control.

Thus, based on the above mentioned reasoning, we have formulate **the principle of pedagogical monitoring**:

Def. 10:

> **The principle of pedagogical monitoring** is to establish a mechanism to control the achievement of a given learning objective and a mechanism to adjust didactic methods and/or student body in such a way that the educational system remains identical to itself, i.e. to preserve its system-constituting concept: the achievement of a given learning objective.

We conclude that the enmorphya of relation of any educational system (i) is expressed by the *didactic principles* of that system and (ii) shall, among other didactic principles, contain **the principle of didactic economy** and **the principle of pedagogical monitoring**.

[30] «Принцип постоянного и доброжелательного контроля за системой усвоения правовых понятий и приобретением умений в области права. Вовремя выявить существующие пробелы, восполнить их, а также проверить верность выбранных методов обучения поможет провдение текущесго и итогового контроля заний и умений учеников»;
cited after *Legal Culture of Teacher as a Basis for Legal Education of Students*, S.Yu. Besshaposhnikova, p. 53 in *Which Teacher Do We Need?*, Collection of Materials of Scientific and Practical Conference April 15, 2008, edited by L.V. Kosilova, 2014, ISBN 978-5-4458-4165-4;
Source: Pevtsova E. A. *Legal Education in Russia*: *forming legal culture of modern society*, monograph. APK and PRO, Moscow, 2002.

3.4.2 Law

Let's look at the legal system. Any legal system performs several functions in society, among which the primary ones are integrative, regulatory, communicative and security functions. These functions are not independent of each other, but all are interconnected.
In such consideration, the "substrate" of the legal system is the subjects of law, the "property" is the applied norms of substantive law and legal properties of subjects of law (their legal capacity, capacity, delicacy, other attributes of the subject of law affecting the application of legal norms), and the "relation" is the process of interaction of these rights of norms with subjects of law, i.e. the very process of application of norms of law in all its diversity.

Since there are no two exactly identical subjects of law (the number of attributes of a subject of law influencing the application of legal norms is so great that the probability that two different subjects of law will have the same set of attributes is vanishingly small), the process of interaction of legal norms with single subjects of law is purely *probabilistic* in the transition from one subject to another. However, *statistically* a large number of subjects of law, as a rule, achieve their legal objectives within (statistically) a certain period of time, i.e., **STM. 9** ("the principle of sufficiency of the existential triad") is followed.

Both the inadequate application of legal norms and the inadequate legal properties of any subject of law usually lead to the fact that the legal objective of that subject of law is inadequately achieved for a long time, at the limit - not achieved at all.
This is a clear indication that the legal system is a *quasi-stochastic* one.

Within the legal system, the *legal principles* and *applied rules of procedural law* represent the relation-control-information (the enmorphya of relation) of that system. As the enmorphya of relation between the substrate (subjects of law) and the property (applied rules of substantive law), *legal principles* and *applied rules of procedural law* determine the nature of this relationship (interaction), see **STM. 9**. *Legal principles* and *applied rules of procedural law* determine the nature of the process of application of rules of substantive law, which, in turn, implements the interaction between subjects of law and applied rules of substantive law. Thus, *legal principles* and *applicable rules of procedural law* leave an "imprint" both on subjects of law (the substrate of the legal system) and on applicable rules of substantive law (on its form and content, i.e. on the properties of the legal system).

Let us illustrate the relationship between the primary system and the metasystem by the example of the legal system:

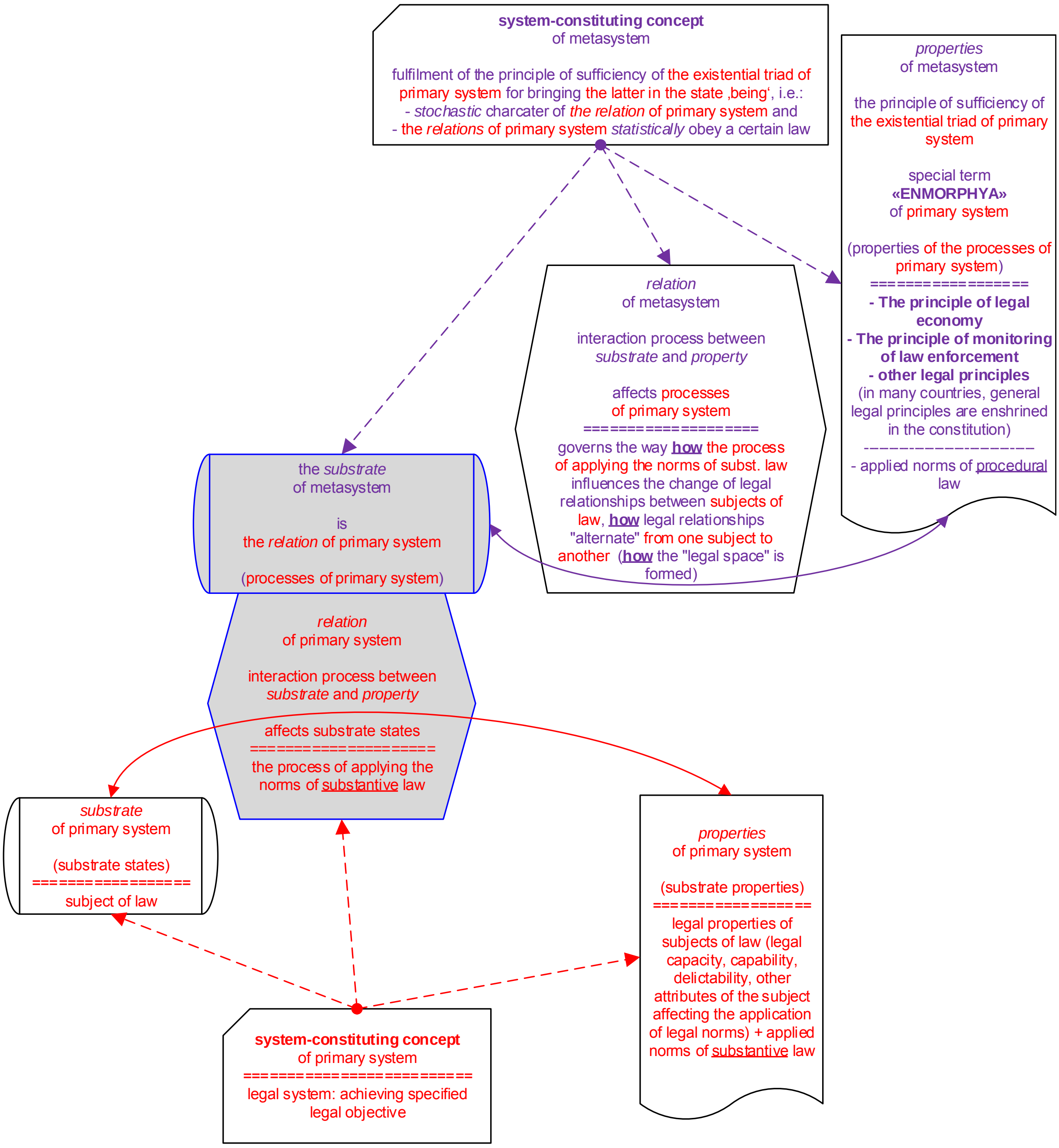

Figure 5: Relationship between the primary system "law" and the respective metasystem

Since the Principle of Least Resources Consumption should govern the process of interaction between *the substrate* and *the structural factor* of any system based on a *stochastic* process (**STM. 11**), i.e., it should be a component of the enmorphya of relation of any system, the PLR should, in particular, represent at least one element of the enmorphya of relation of the legal system as well.
On the other hand, as we have just found out, *legal principles* and *applied rules of procedural law* are the enmorphya of relation of the legal system.

Therefore, it follows that

STM. 15:

> one of the *legal principles* must necessarily be the Principle of Least Resources Consumption.

Let us remember (see chapters 3.2) that for the legal - and for any other social process - the "resource" is “the number of particular (legal) topics” * “the number of alternative (legal) methods” to be considered and applied, respectively, in order to achieve a given (legal) objective. It means that within a given legal objective it is possible to minimise the consumption of legal resources in two ways: (i) to consider only such particular legal topics as are necessary for the achievement of the given legal objective and (ii) to apply only such legal methods as most effectively lead the given subject of law to the achievement of the given (legal) objective. "Effectively" means procedural economy, i.e. time and all other procedural means to achieve the legal objective[31].

Indeed, the various sets of legal principles contain, explicitly or implicitly, among other principles, the principle of least resources consumption. For example, E. Kulikov formulated, among others, the following principle:

> "**The principle of legal economy** is the guiding idea of legal impact on social relations, according to which such impact should only be exercised when it is necessary to do so because of its content. However, the range of means of such impact should be minimally sufficient to achieve its objectives"[32].

Thus, the principle of legal economy takes its place among other principles of economy: the principle of linguistic economy and the principle of didactic economy, which we discussed above in Chapters 3.3.2 and 3.4.1, respectively.

As we have considered above, the Principle of Self-preservation of System becomes an <u>existentially</u> important characteristic of *quasi-stochastic* systems. Does it manifest itself in the legal system?

Indeed, the various sets of legal principles contain, explicitly or implicitly, among other principles, the principle of self-preservation of system. For example, N. Prokopyeva and I. Ivanov quote the following definition:

---

[31] Source: Mahmutov M. V. *The principle of procedural economy - the beginning is made*, Legality, 2010, No. 12, p. 34-36
(Махмутов М. В. *Принцип процессуальной экономии - начало положено*, Законность, 2010, № 12, стр. 34-36)

[32] «**Принцип правовой экономии** представляет собой руководящую идею правового воздействия на общественные отношения, согласно которой такое воздействие на них должно осуществляться лишь в том случае, когда оно с необходимостью вызвано их содержанием. При этом комплекс средств этого воздействия должен быть минимально достаточным для достижения его целей.»
cited after E. A. Kulikov *Category of measures and principles of law*, Izvestia Altai State University, 2.2-28 2013, DOI 10.14258/izvasu(2013)2.2-28
(Е. А. Куликов *Категория меры и принципы права*, Известия Алтайского Государственного Университета, 2.2-28 2013, DOI 10.14258/izvasu(2013)2.2-28).

> "Monitoring of law enforcement, according to the Decree of the President of the Russian Federation No. 657 "On monitoring in the Russian Federation" of 20.05.2011 (hereinafter referred to as the Decree), is a complex and planned activity carried out by federal executive bodies and state authorities of the subjects of the Russian Federation within the limits of their powers to collect, consolidate, analyse and evaluate information to ensure the adoption (publication), amendment or invalidation (cancellation) of normative legal acts (para. 2 of the Decree)" [33].

L. Berg believes that

> "the **ultimate goal of monitoring** of law enforcement practice, taking into account the subject-object composition, is the establishment of a system ensuring the implementation of the fundamental constitutional principle that defines the essence of the state, state power and state activities of public institutions of the Russian Federation: human and civil rights and freedoms determine the meaning, content and application of laws, the activities of legislative and executive power, local self-government and are ensured by justice"[34].

The monitoring of law enforcement in view of its final goal is nothing else but the implementation of the Principle of Self-preservation of System in legal systems: the stability of the legal system is impossible without a feedback mechanism through the control of law enforcement and making adjustments to the procedural and/or material legislation based on the results of this control.

Thus, **the principle of monitoring of law enforcement** takes its place among the principles of self-preservation of system alongside with the principle of pedagogical monitoring, which we discussed above in Chapter 3.4.1.

We conclude that the enmorphya of relation of any legal system (i) is expressed by *the legal principles* and *applied norms of the procedural law* of that system, and (ii) shall, among other legal principles, contain **the principle of legal economy** and **the principle of monitoring of law enforcement**.

[33] quoted after N. V. Prokopyeva, I. V. Ivanova *The concept and principles of law enforcement monitoring: theoretically-legal aspect*, Chuvash State University, Actual problems of economics and law, 2015, № 2, URL: http://hdl.handle.net/11435/2126
(Н. В. Прокопьева, И. В. Иванов *Понятие и принципы мониторинга правоприменения: теоретико-правовой аспект*, Чувашский государственный университет, Актуальные проблемы экономики и права, 2015, № 2, URL: http://hdl.handle.net/11435/2126)
[34] quoted from L.N. Berg Monitoring of Law Enforcement Practice, Business, Management and Law, http://www.bmpravo.ru/show_stat.php?stat=324, accessed 07.06.2020;
(Л.Н. Берг *Мониторинг правоприменительной практики*, Бизнес, менеджмент и право, http://www.bmpravo.ru/show_stat.php?stat=324, обращение 07.06.2020)

3.5 Role of Enmorphya in Systems' Variativity

3.5.1 Variativity of Truly-Stochastic Systems

As we have already defined in Chap. 3.3, the enmorphya of relation of any *truly-stochastic* system is always the principle of most entropy or, what is equivalent, the principle of least action of Hamilton (PLA).

Truly-stochastic systems have variable primary information (information-about-substrate), i.e. *the properties* of the system's substrate. This variation is usually possible for types (types of susceptibility[35], quality) of these *properties*, as well as for the intensity (quantity) of each particular *property*.

For example, the primary information for material objects may be the presence of mass (property type, quality) in a certain amount (xx kg) in conjunction with the law of interaction of masses (Einstein's equation), electric charge (property type) in an amount (yy Coulomb) in conjunction with the law of interaction of electric charges (Maxwell's equation), any other physical "charge" ZZ (colour, strangeness, lepton number, baryon number, etc., i.e. property type) with the corresponding amount of this or that "charge" value (quantity of this property type) in combination with the law of interaction of these "charges".
A property of one physical object, e.g. the electric charge of an electron, interacts with the property of the same type of another physical object, e.g. with the electric charge of a proton, by means of a physical field corresponding to this property type, i.e. by means of exchange of bosons specific for this property type. For example, the electric charge of an electron interacts with the electric charge of a proton (susceptibility of the same type) by means of electromagnetic field, i.e. by exchanging photons.

This interaction of properties of different physical objects IS the *relation* in physical systems. These *relations* are described by physical laws, and for each property type (for each type of susceptibility) the corresponding relation is described by a separate physical law. For example, for objects with mass it is the law of gravitation, for objects with electric charge it is Maxwell's equations, for objects with some other physical "charge" ZZ (colour, oddity, lepton number, baryon number, etc.) - the corresponding laws of a particular physical interaction.

However, **any** law of a particular physical interaction is subject to the PLA.

Primary information, i.e. the *property* for the communication system (using natural language as an example) is a set of phonetic, word-formative, syntactic and grammatical rules / laws (different *property qualities*). Quantitatively, these different *property qualities* vary from one language to another, as well as diachronically within the same language.
These rules are applied in oral and written speech to phonemes/signs (i.e. to the substrate of the communication system) and thus cause interaction between phonemes/signs, i.e. the latter enter into a *relation* with each other. This interaction between phonemes/signs, which obeys the above mentioned rules, **always** leads to the fact that the sequence, the alternation of

[35] RU: восприимчивость

phonemes/signs in any text is a regular Markov chains and, therefore, *statistically* obeys the corresponding regularities.

Systems implementing regular Markov chains, in turn, have the maximally possible entropy.

Besides the above described variativity of primary information (information-about-substrate, i.e. *properties* of the system substrate) in *truly-stochastic* systems, such systems have another type of variativity, which we describe below.

It should be noted that the same macrostate of any *truly-stochastic* system is achieved by an ensemble of its microstates, and the distribution of probabilities of these microstates can be different for a given macrostate. It means that for *truly-stochastic* systems there is one more type of variativity - variativity of distribution of probabilities of system's microstates inside the ensemble, which implements a given macrostate of this system; i.e. the distribution of probabilities of microstates of system's *substrate* varies here.

This variation in the distribution of probabilities of microstates of a *truly-stochastic* system, however, is always such that the standard deviation of these probabilities from their mean - equiprobable - value is always close to zero ($\ll$ 1). This property of distribution of probabilities of microstates of *truly-stochastic* systems is a direct consequence of the principle of most entropy, see Chap. 2.1.5 (the Postulate of Least Resources Consumption, term (2.10)) in [7]. We have already mentioned this distinctive feature of *truly-stochastic* systems in Chap. 3.3 above.

Thus, both the existence of variations in the distribution of microstate probabilities within a given macrostate of *truly-stochastic* systems (i.e. variations in the distribution of microstate probabilities of the system's *substrate*) and variations in the primary information (information-about-substrate) depending on the type of susceptibility of a particular substrate (mass, electric charge, other types of physical "charges", phonemes/characters) and on the degree of intensity, i.e. the quantity of these properties, does not change the fact that the enmorphya of **any** interaction within *truly-stochastic* systems is always invariable and implemented as the principle of most entropy (or, equivalent, the principle of least action).

3.5.2 Variativity of Quasi-Stochastic Systems

The enmorphya of any *quasi-stochastic* system (as distinct from a *truly-stochastic* one), as discussed in Chapter 3.4 above, may deviate from the principle of Least Resources Consumption (PLR).

As we have seen in the previous chapter 3.5.1, neither the variations in the distribution of probabilities for microstates of the *substrate* nor the variations in the primary information (information-about-substrate, i.e., substrate properties) affect the system type: all these variations leave the system *truly-stochastic*.

What must then be variable for a system to be *quasi-stochastic*?

Taking into account that both variations in the distribution of probabilities of microstates of the substrate and variations in the properties of the *substrate* leave a system of *truly-stochastic*, the only possible answer to this question is the variation of characteristics (attributes) of the *relation* between the *substrate* and its *properties* (information-about-substrate). But the **characteristics of the *relation*** between the *substrate* and its *properties* within a system is **the enmorphya of relation** of this system, see Chap. 3.2 above.

Thus, we come to the conclusion that

STM. 16:
in a *quasi-stochastic* system, its enmorphya shall be variative.

How can the variativity of the enmorphya of relation of quasi-stochastic systems look in practice?

In Chap. 3.4, we have concluded that, within the educational system, didactic principles represent the enmorphya of relation of this *quasi-stochastic* system.
There are 10 to 20 didactic principles, depending on the specific approach. They can (and should) be regarded as individual characteristics, attributes of a particular didactic approach, i.e. as attributes of the enmorphya of a given educational system.

As we have already found out above in Chapter 3.4, see **Def. 9** and **Def. 10**, the enmorphya of relation of any educational system expressed by *the didactic principles* of that system shall, among other didactic principles, contain **the principle of didactic economy** and **the principle of pedagogical monitoring**.

Already concrete implementation of the principle of didactic economy - which material is needed to achieve a given learning goal and which is not; which didactic methods most effectively (in terms of effort, cost and time savings) lead a given educational group (students + teacher) to achieving a given learning goal and which do not - depends on the specific curriculum developer and the specific teacher implementing the program.
In other words, the principle of didactic economy, which is present in any educational system, is variative.

The specific implementation of the principle of pedagogical monitoring - the policy of control of the acquired knowledge and adjustment of the didactics of teaching and / or student body leading to the achievement of a given learning goal - also depends on the specific organiser of the educational process and the specific institution implementing this process.
In other words, the principle of pedagogical monitoring, which is present in any educational system, is also variative.

Let us consider some other possible didactic principles. Are they variative?

For example, one generally accepted didactic principle is the principle of scientificity of learning, which is based on the natural relationship between the content of science and the subject matter of study.
How can this attribute of enmorphya of a given educational system be varied? It is very simple: the depth of the relationship between the content of the subject matter of study and the respective science can be varied. Varying this attribute will have a direct impact on both the students' 'minds' (the *substrate* of the educational system) and the teaching material (its form and content as *properties* of a given educational system).

Another such generally accepted didactic principle is the principle of linking learning to life, to the practice of different aspects of society. By analogy with the previous example, it is easy to see that the variation of this attribute will also have a direct impact on both the 'minds' of students and the teaching material (its form and content).

Other didactic principles also allow their variation within an educational system with a direct impact on both the 'minds' of learners and the teaching material (its form and content).

Let us now ask ourselves how **STM. 16**[36] above is consistent with **STM. 11**[37] и **STM. 13**[38]. If PLR and PSP are, in our opinion, components of a universal enmorphya of relation for any stochastic system, what can be variable in the enmorphya of relation of a *quasi-stochastic* system?

Let us return to the principle of didactic economy for the educational system. We have just found that this principle in itself, i.e. as a principle, should remain unchanged, but the concrete implementation of this didactic principle is variative. We have seen above that the attributes and characteristics of this principle vary: which material is needed to achieve a given learning goal and which is not; which didactic methods are most effective (in terms of effort, cost, and time savings) to lead a given educational group (students + teacher) to achievement of a given learning goal and which do not.

With regard to the principle of pedagogical monitoring for the education system, we have also found that this principle itself, i.e. as a principle, shall remain unchanged, but a concrete implementation of this didactic principle is variative. We have seen above that the attributes and characteristics of this principle vary: policies for controlling acquired knowledge and

[36] In a *quasi-stochastic* system, its enmorphya must be variative.
[37] The principle of Least Resources Consumption (PLR) is the enmorphya of relation for any system based on the *stochastic* process.
[38] at least two principles are existentially necessary components of the enmorphya of *quasi-stochastic* systems: the Principle of Least Resources Consumption and the Principle of Self-preservation of System (PSP).

adjusting teaching didactics and/or student body leading to the achievement of a given learning goal.

On this example, it becomes obvious that if a principle should be preserved as such, the only possible way to make the implementation of this principle variative is the variativity of its characteristics (attributes).

Thus,

STM. 17:
the enmorphya of relation of the *quasi-stochastic* systems shall have variative characteristics (attributes).

We conclude that the constitutive difference between *truly-stochastic* and *quasi-stochastic* systems, namely

- "the Markov process", i.e. the lack of immediate memory at the basis of the evolution of the former,

- and the stochastic, but non-markovian process at the basis of the evolution of the latter (see Glossary),

leads to the fact that the enmorphya of interaction within *truly-stochastic* systems - the principle of most entropy (or, equivalent, the principle of least action) - is always constant, non-variable, while the enmorphya of interaction within *quasi-stochastic* systems - always represented by at least universal principles of least resources consumption and self-preservation of system - shall have variable attributes, characteristics.

We remember that the principle of most entropy (or, equivalent, the principle of least action) is a specific case of the universal principle of least resources consumption.

Physical conservation laws - energy, impulse, momentum, electric charge, magnetic flux, parity, etc. - are a consequence of any symmetry existing in the physical system (the Nöter theorem) and represent a special case of the universal principle of self-preservation of system.

These two specific special cases are that the PLR and PSP here manifest themselves without any variativity in their characteristics.

As we have already discussed in Chap. 3.4 and will repeat here in the light of a new understanding, unlike *truly-stochastic* systems, *quasi-stochastic* systems do not have an automatic, immanent mechanism for these systems to continuously follow the principle of Least Resources Consumption (PLR). This means that local *statistical* deviations of a *quasi-stochastic* process from following this principle become statistically corrected, but this correction may occur not immediately, but only through a large number of subsequent steps (states) of the system.

This may lead to an inadequate interaction between the *substrate* and the *structural factor* of such systems, and consequently to a decrease in their actual "adequacy" compared to the ideal "adequacy" (i.e., if they had followed the PLR continuously). Nevertheless, *quasi-stochastic* systems also follow the PLR at statistically long intervals and on a statistically large quantity of the *substrate* of the system, if the reduction of their "adequacy" does not destroy these systems as such. Following the principle of Self-Preservation of System (PSP) includes stabilising feedback mechanisms within the system itself.

This understanding can be expressed as follows:

- *quasi-stochastic* systems "pay off" by their local inadequacy for the variativity of the characteristics of their enmorphya of interaction[39]. "Local inadequacy" we have here called inadequate interaction between the *substrate* and the *structural factor* of such systems for limited periods of time. At statistically long intervals, such *quasi-stochastic* systems also follow the PLR if their "local inadequacy" does not destroy these systems as such; following the PLR stabilises such systems by means of feedback mechanisms;
- *truly-stochastic* systems "pay off" by the non-variativity of the characteristics of their enmorphya for their "local adequacy", i.e. for their steady adherence to the principle of most entropy, for their "being Markovian"[40].

We have already written in [11], Chap. 1, that "it is the minimisation of the consumption of Nature's resources that causes that "the diversifying of the process of interaction between material and ideal objects" IS the meaning of existence of biological (self-organising) systems[41]".

Thus, the transition from the variating of primary information (information-about-substrate) in *truly-stochastic systems* (e.g. different types of properties of physical objects such as mass, electric charge, etc., different communication protocols such as a set of rules for natural languages) to the varying of enmorphya in *quasi-stochastic* systems is a natural means for the fulfilment of the PLR, i.e. its direct consequence: it is obvious that the varying of enmorphya makes an additional contribution to the production of the maximally possible amount of entropy[42].

The said above also means that the emergence of *quasi-stochastic* systems and their associations - along with the even earlier emergence of *truly-stochastic* systems[43] - is a very likely, expected path of Nature's evolution.

[39] This represents a concrete form of the “freedom of choice”
[40] This represents a concrete form of the “freedom of action”
[41] Concretely, this is done through the creation of ideal and material artefacts, i.e. for human beings - through mental and labour activity, respectively, Furgel, 2002.
[42] See chap. 2.1.5 (The Principle of Least Resources Consumption: Least Action and Most Entropy) in [7].
[43] *Truly-stochastic* systems, in our opinion, should emerge earlier in the evolution of Nature, because, due to their "being Markovian", they permanently follow the PLR.

4 Annexes

4.1 Conjunction of Systems in a System Hierarchy

Now, we consider a hierarchy of systems. i.e. a system built up on other systems. We call the systems in this system hierarchy as systems of different hierarchical orders. Per definitionem, the existence of all the systems of lower orders N-1, N-2, ..., N-N is the necessary (but not sufficient) condition of the existence of the system of order N.

Let us consider some illustrative examples of such hierarchic systems moving from the systems of lower to the systems of higher hierarchic order:

1) physics

quarks <-> elementary particles <-> atoms <-> molecules <-> matter.

2) sociology

external (in relation to living organism) physical information carriers (acoustics, optics, etc.) <-> biochemical processes in neurons <-> consciousness[44] <-> communication (society).

3) communication (on the example of natural language)

phoneme (sign) <-> morpheme <-> lexeme (word) <-> sentence <-> text.

The general statement is

STM. 18:

> **The ‚system-constituting concept'[45] of a system of given hierarchical order N shall represent either the 'substrate' or the 'structural factor' of the system of the next higher hierarchical order N+1.**

Rationale:

1) Let us assume that the system-constituting concept of the system of order N does not participate at all in building the system of order N+1. Then it is impossible to state that the system of order N+1 is 'built up' on the system of order N. That, in fact the availability of the system of order N is the necessary condition of the existence of the system of order N+1.

[44] communicative sub-process of consciousness; it includes (see I. Furgel Psychological Types: The Continuation, Deutsche Nationalbibliothek, http://d-nb.info/1209003104):
(i) reference-point-attitude: external or internal priority (authority) at decision making,
(ii) perception: intuitive understanding and sensory skill, including pre- and post-semantic processing of information: deformatting the received message and formatting an answer,
(iii) judgement (semantic processing of information): feeling and thinking, and
(iv) action-attitude: active or passive.
[45] see chap. 5 for definitions

The system of order N differs from all other systems exactly by its 'system-constituting concept'. Hence, the 'system-constituting concept' of the system of order N – as its *unique* differentia – has to participate in building the system of order N+1.

2) Let us now assume that the 'system-constituting concepts' of the system of order N and of the system of order N+1 – their *unique* differentia - are identical with each other. Then, these systems could not be distinguished from each other and, hence, they would represent one single system, what contradicts the initial premise.

But if

(i) the 'system-constituting concept' of the system of order N has to participate in building the system of order N+1 and
(ii) the 'system-constituting concept' of the system of order N+1 has to differ from the 'system-constituting concept' of the system of order N,

then the 'system-constituting concept' of the system of order N has to participate in building the system of order N+1 either as the 'substrate' or as the 'structural factor' of the system of order N+1, what fully complies with the initial statement.

We wonder if a situation were possible, where the 'system-constituting concept' of the system of order N would participate in building the system of order N+1 simultaneously as its 'substrate' and as its 'structural factor', as well?
Let us assume that such a situation has become reality. Then, the 'substrate' as well as the 'structural factor' of the system of order N+1 would be identical with each other, because they would be built on one and the same 'system-constituting concept' of the system of order N. But the identity of the 'substrate' and of the 'structural factor' of one and the same system (here: of the order N+1) is impossible according to the definitions of these terms, see chap. 5.
Therefore, a situation, where the 'system-constituting concept' of the system of order N would participate in building the system of order N+1 simultaneously as its 'substrate' and as its 'structural factor', as well, is impossible.

The next examples illustrate particular branches in different system hierarchies.

In considering these examples, note that in any hierarchy of systems (of those reviewed) the "structural factor"$_{N-1}$ of any "structural factor"$_{N}$ represents a specific implementation of the PLR (or the PLA as its special case). In other words, *the structural factor* of the system of order N, when represented through systems of a lower hierarchical order, always ends with the principle of Least Resources Consumption.
But the "structural factor of the structural factor" always includes nothing else but the "enmorphya of relation", see Chapters 3.2. Thus, we can see from the example of the systems discussed below that the enmorphya of relation always implements the PLR, cf. **STM. 11**.

1) society

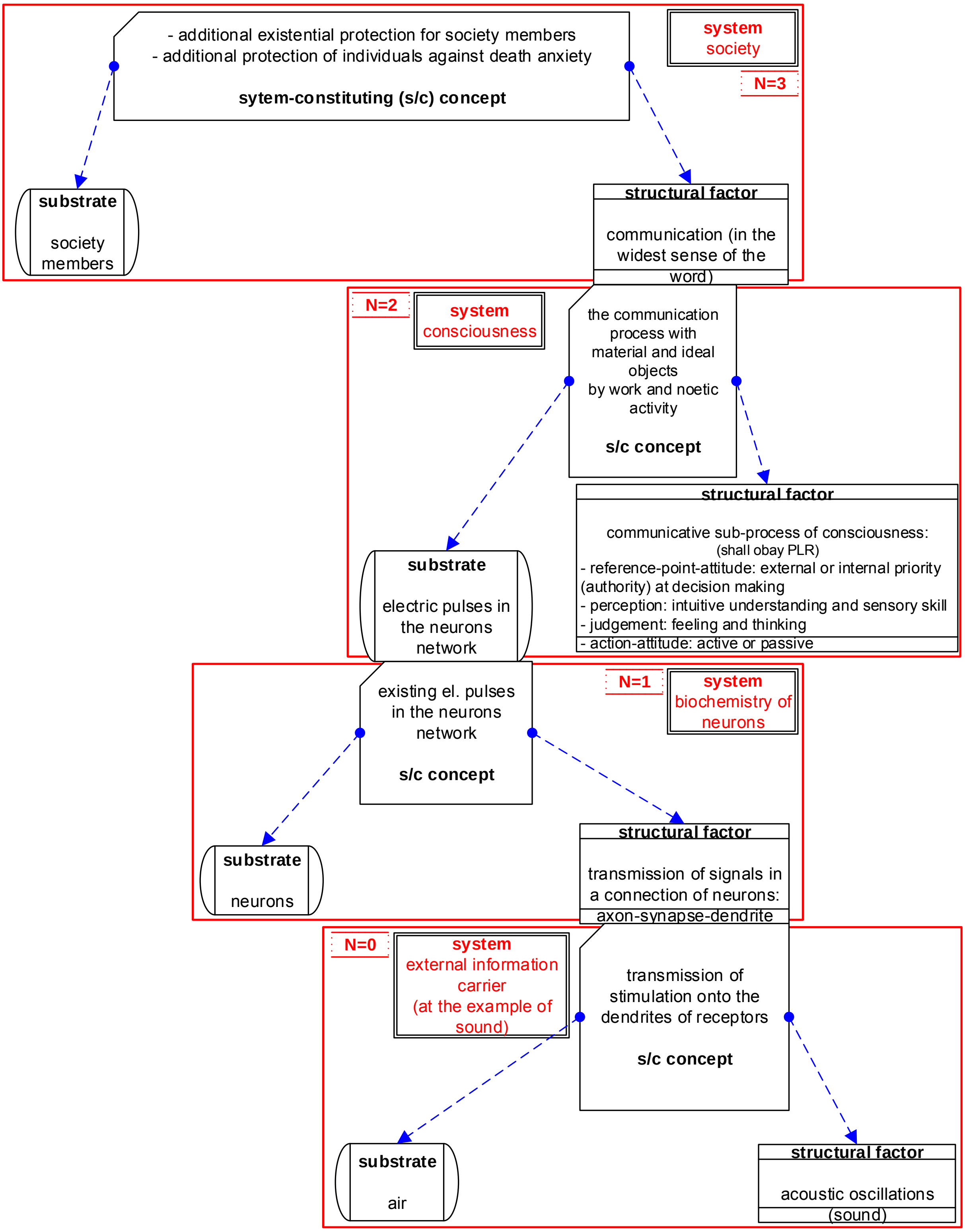

Figure 6: System hierarchy for society

2) physics

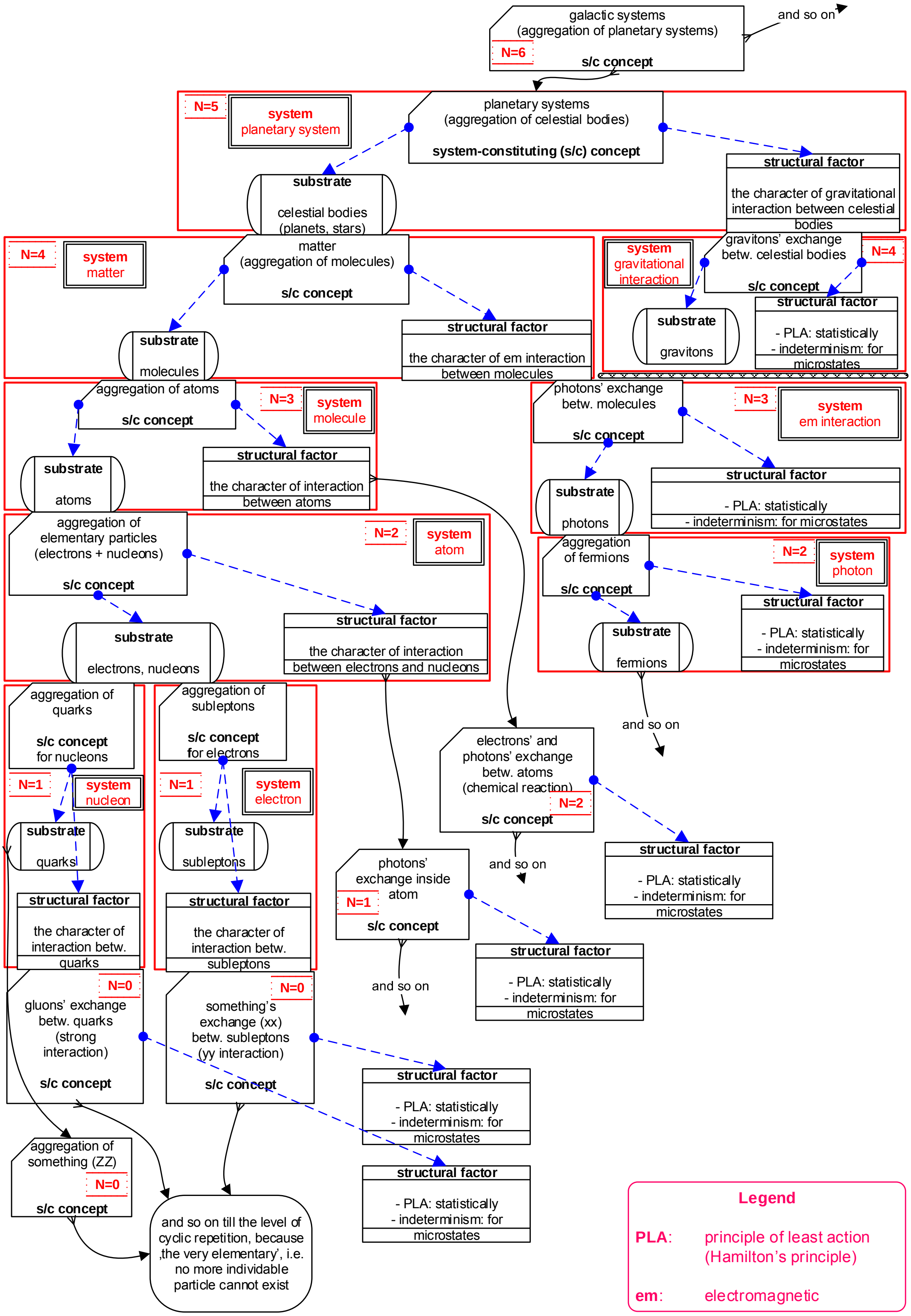

Figure 7: System hierarchy for matter

3) communication (on the example of natural language)

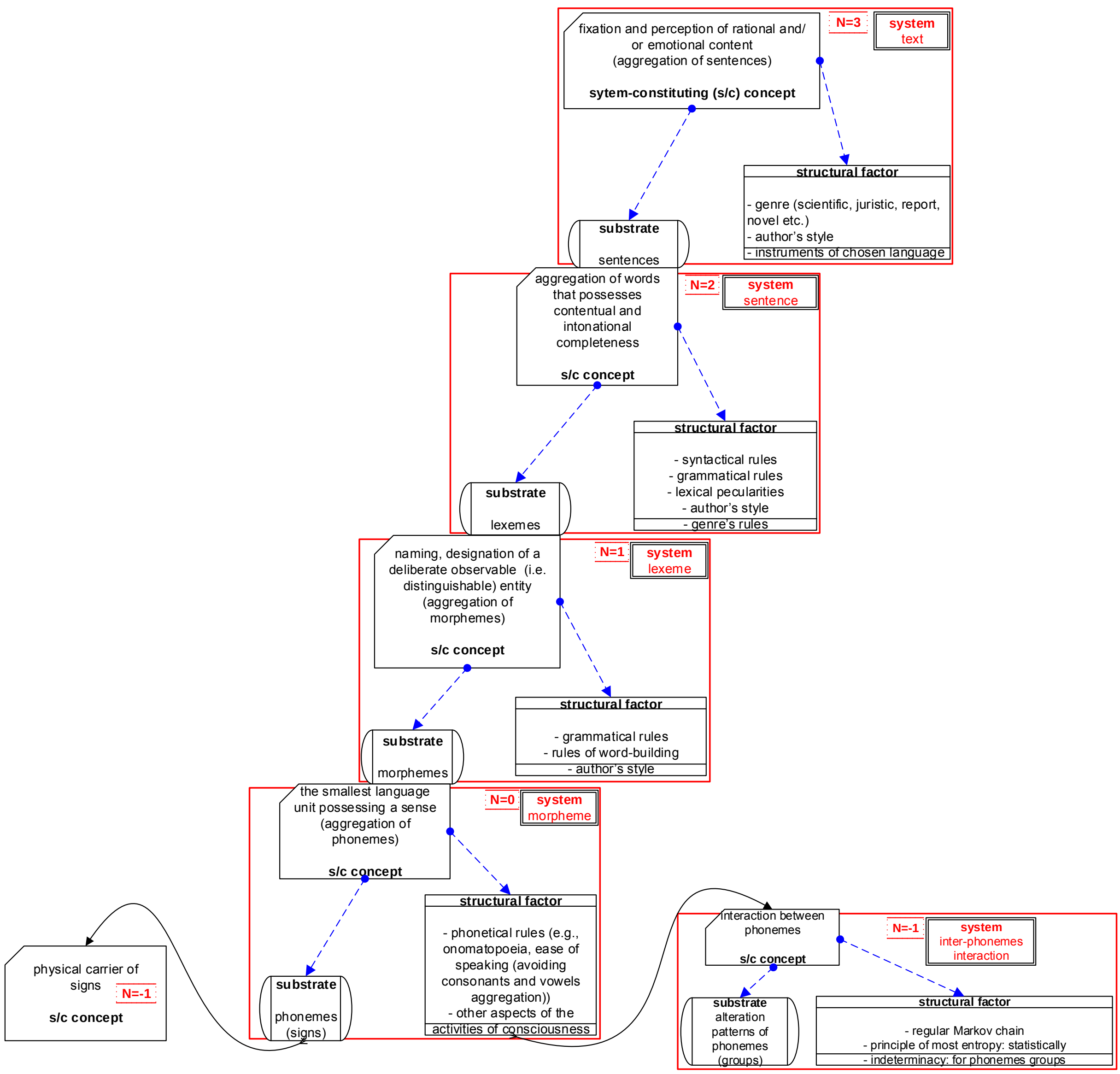

Figure 8: System hierarchy for text

4) conjunction of systems

It is interesting to notice that the **STM. 18** itself can be represented as the system that we call ‘conjunct system’ with the system-constituting concept ‘conjunction of systems in a system hierarchy’. The substrate of this system is represented by single systems in the given system hierarchy, and its structural factor is its construction rule, i.e. the **STM. 18** itself:

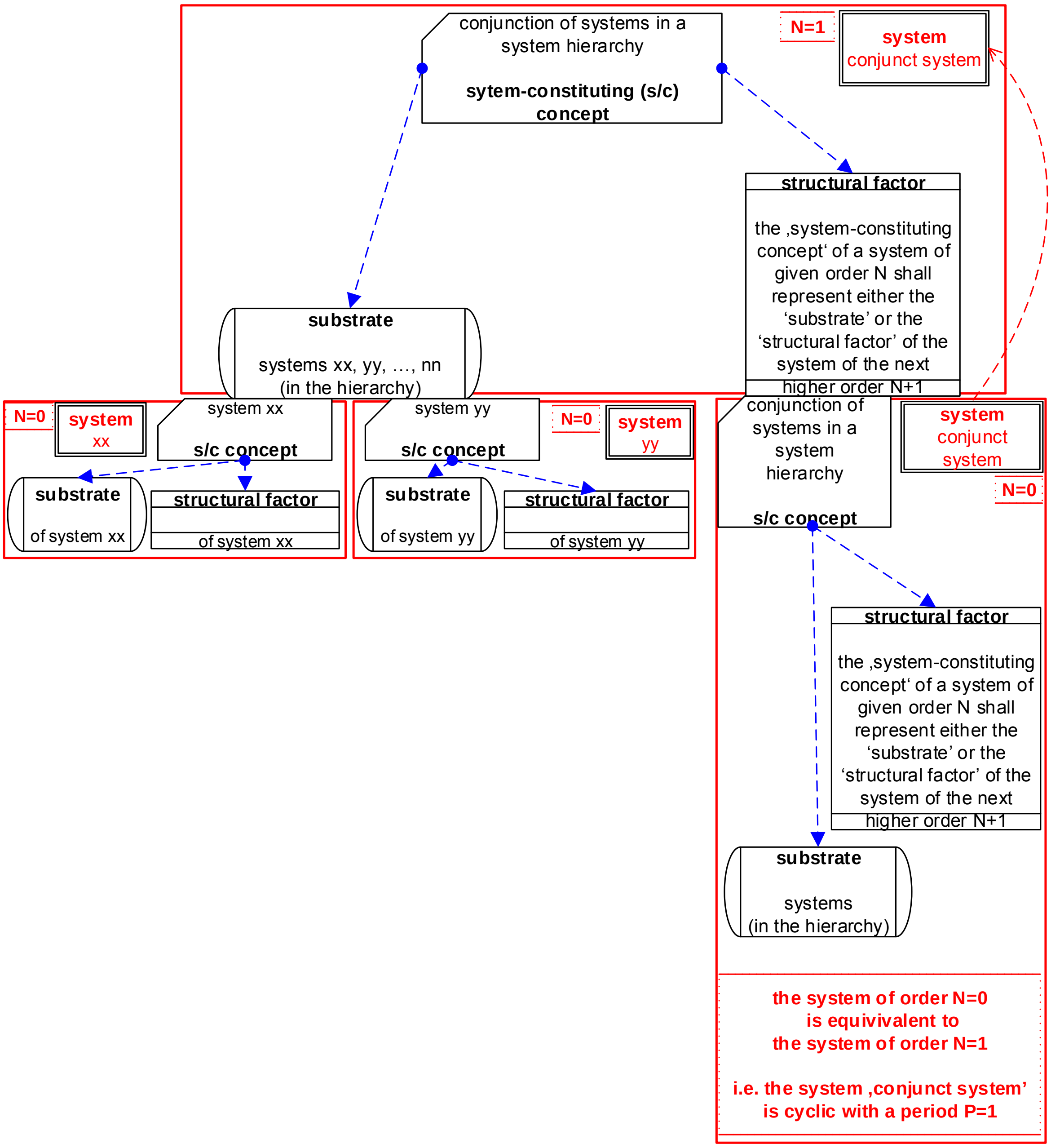

Figure 9: System hierarchy for ‘conjunct system’

As indicated in Figure 9, the structural factor of the ‘conjunct system‘ (of the order N=1), i.e. the **STM. 18** itself, is built up on the same system-constituting concept of the system of the lower order N=0 as the system-constituting concept of the current system of the order N=1. Thus, the ‘conjunct system‘ is a cyclic one with the period P=1 as it is directly based on itself (when one walks bottom-up in the hierarchy) or it directly reproduces itself (when one walks top-down).

The process of the application of the **STM. 18**, i.e. the process of the *conjunction* (coupling) of systems in a system hierarchy, represents the *assembling* (when one walks bottom-up in the hierarchy) and *disassembling* (when one walks top-down) operations. Figure 9 obviously indicates that the *conjunction* operation, when applied to any ‘conjunct system’, retains this system ‘conjunct’. In other words, the application of the operation ‘*conjunction of systems*’ (= *assembling / disassembling*) does not change the characteristic of systems ‘be conjunct’ and, thus, retains them hierarchical. This conforms to the result about the impossibility of the existence of non-disassemblable, ‘elementary’ entities, see sec. 1.3.

Let us draw our attention to the fact that the **STM. 18** represents just a certain general ‘rule’, regulating the character of *relations* (of interaction) between the system of the order N and the system of the order N+1 in a ‘conjunct system‘, whereby any ‘conjunct system‘ is subject to this rule. Therefore, **STM. 18** – as well as **STM. 9**[46] – represents a principle, i.e. an abstract rule, in this case – the relation-control-information[47].
Thus, one can state that any ‘rules’ / ‘principles’, regulating the character of *relations* (interaction) between *substrate* and *structural factor*, can always be represented as cyclic systems with the period P=1, i.e. they as a system directly reproduce themselves. It means that such **‘rules’ / ‘principles’ do not have any internal evolvement, and their *observability* bases on the process of their application to different substrates**, cf. Figure 9. This result does not astonish, if we remember that a ‘rule’ represents (relation-control-)information, i.e. enmorphya of relation, see chap. 2.

This conclusion also means that

STM. 19:

> **Enmorphya of relation does not have enmorphya of a higher order, i.e. the enmorphya of enmorphya does not exist as a distinguishable entity: the enmorphya of enmorphya is equivalent to the first enmorphya.**

To illustrate this observation at an independent example, let us represent the structural factor of the system "sentence" (see Figure 8) as an independent system. For ease of illustration we confine ourselves to the syntactical rules only, among them – to a single rule concerning the order of the members of sentence in declarative sentences in English. This rule establishes the following order of the members of sentence: subject -> predicate -> object.
The system-constituting concept of this system is ‘aggregation of words in sentences’, the substrate – ‘lexemes’, and its structural factor is its construction rule: in our simplified illustration: ‘the order of the members of sentence: subject -> predicate -> object’.
Comparison of the components of this system built for ‘syntax rules’ with the components of the system ‘sentence’ in Figure 8 makes clear that these systems are identical. So, the syntactical rules as the system directly reproduce themselves that confirms the observation made.

[46] ‘the principal of sufficiency of existential triad’
[47] synonym: interaction-control-information

4.2 Frequently Encountered Categorial Complementarities

A1) Frequently encountered categorial complementarities being perceived synchronously relating to a certain state of a system:

		comments
Information	matter	
form (phenomenon [Ger. Erscheinung])	content (substance [Ger. Substanz])	
Structure	function	
Purpose	means	
Cause	effect [Ger. Wirkung]	In fact, cause and effect occur synchronously[48]. It is especially obvious in the case of strong interaction between the participants of cause-effect process, cf. [5].
reality (action [Ger. Handlung])	possibility (choice)	
form [Ger. Gestalt, Form]	substrate, medium, vehicle [Ger. Medium]	
Property	relation	
quantity [нем. Extensität]	quality [нем. Intensität]	
Process	state	
justice [Ger. Gerechtigkeit]	mercifulness [Ger. Barmherzigkeit]	
particular, concrete	whole (entirety), abstract	
freedom (of choice / action)	responsibility (for action / choice)	
will [Ger. Wille, Rus. воля]	duty [Ger. Pflicht, Rus. долг]	will is the freedom of choice, duty is the responsibility for action
misery [Ger. Elend (Unglück), Rus. беда]	guilt [Ger. Schuld, Rus. вина]	
analysis (deduction)	synthesis (induction)	
knowledge	intuition	
rationality	emotionality	
immanence	transcendence	
practice (empiricism)	theory	
stability [Ger. Beständigkeit, Rus. стабильность]	variability [Ger. Veränderlichkeit, Rus. изменчивость]	

48 in philosophical sense

		comments
representation (of political unity) [Ger. Repräsentation, Rus. полномочное представительство]	identity (of political unity) [Ger. Identität, Rus. самоидентификация, собственное «я»]	two principles of political form acc. to Carl Schmitt, *Verfassungslehre (Constitutional Theory)*, 1927, § 16 „Bourgeois Rechtsstaat and political form“. The ‚assembling‘ operation is here the creation of political unity as a system; the source of its system-constituting concept is the political will of the members of this political unity. A real political unity as a system – dependent on the concrete proportion between ‘representation’ and ‘identity’ – can implement different political systems (state forms): - monarchy / dictatorship, - autocracy (aristocracy / oligarchy), - representative democracy / ochlocracy, - direct democracy (political liberalism) / direct ochlocracy (disintegration of political unity, political chaos). Cf. I. Furgel *Political Systems: Their Roots and Evolvement*, Deutsche Nationalbibliothek (DNB), http://d-nb.info/99768061X, 2009
subject (linguist.)	complete predicate (i.e. including all objects)	in their syntactic function can represent categorial complementarities: (1) in a sentence, they cannot exist without each other, and (2) they cannot be expressed through each

		comments
		other. Thus, they satisfy the definition of categorial complementarities **Def. 1**. In other (non-syntactic) grammatical functions, the subject and the predicate do not necessarily appear as categorial complementarities.
...	…	

A2) A subgroup of categorial complementarities relating to subjects as systems in their environment. They all can be represented as particular cases of the pair {isolation, identification}:

		comments
isolation (of subject from vicinity)	identification/unification/fusion (of subject with vicinity)	
individualism (competitiveness) of subject	collectivism (cooperativeness) of subject	
introversion	extraversion	intro: reference point is inside, isolation type: I ≠ world; extra: reference point is outside, identification type: I = world
action	contemplation	actor: an active change of world, isolation type: world ≠ me; contemplator: acceptance of world as it is, identification type: world = me
fright [Ger. Angst]	love	love = opposite_of_inverse[49] (placidity)
hate	placidity[50] [Ger. Gemütsruhe, Rus. безмятежность]	hate = antonym_of_complementary (fright)
hybris [Ger. Hochmut Rus. гордыня]	vanity [Rus. тщеславие]	hybris = antonym_of_complementary (eremitism)
eremitism (as a property of character) [Rus. отшельничество]	humility [Ger. Demut, Rus. смирение]	humility = opposite_of_inverse (vanity)
...	…	

B) Categorial complementarities arising in passing to the limit which causes a change of degree of symmetry (‘second order phase transition’). These complementarities are perceived diachronously relating to the whole life cycle of a system:

		comments
discreteness	continuity	‚continuity’ corresponds to the limiting value of the attribute ‘degree of

[49] operation opposite_of_inverse is equivalent to operation antonym_of_complementary

[50] ataraxia as by Epicureans. Sometimes terms ‚serenity‘ / „Gelassenheit“ / «душевное спокойствие» are used

		comments
		discreteness' = 0
asymmetry / inhomogeneity	absolute symmetry (i.e. with respect to all existing properties) / homogeneity	'symmetry' corresponds to the limiting value of the attribute 'degree of asymmetry' = 0
being	non-being	‚non-being' corresponds to the limiting value of the attribute 'degree of being' = 0

C) Categorial complementarities being perceived synchronously as well as diachronously:

		comments
		It is the fundamental complementarity being at the basis of the evolution of nature, of the existence and directedness of time
contingency (indeterminism; the probability of an event/state $0<p<1$)	necessity (determinism; the probability of an event/state $p = 0$ or $p = 1$)	This pair can be perceived diachronously relating to the whole life cycle of a system as well as synchronously relating to a certain state of a system. Synchronism, for example, is implemented by nature itself: there is a probabilistic transition from one microstate to the next microstate of nature, but these incidental transitions statistically obey a necessary law: the principal of most entropy (of least action), see [7].

5 Glossary

Term	Definition
Basic notions of system theory by A. Uemov [2] necessary for reading this work	
system	any given entity, on which a *relation*, possessing an arbitrarily taken certain *property*, is implemented. Or equivalently: any given entity, on which some *properties*, being in an arbitrarily taken certain *relation*, are implemented.
system-constituting concept[51]	apriori given system-constituting *property* or *relation*; dependent on this, system-constituting concept is *attributive* or *relational* one, resp.
structural factor[52]	A set of properties and relations that suffices the given system-constituting concept. Structural factor can be relational one (in the case of the attributive concept) and attributive one (in the case of the relational concept).
system substrate[53]	a carrier of relational or attributive structure.
Other basic notions necessary for reading this work	
existential triad	set of {substrate, property, relation} that is necessary for creating a system based on this set. An existential triad is sufficient for the creation of a system with its corresponding *system-constituting concept*, if the "relation" in this triad - is fundamentally *stochastic*, **and** - *statistically* obeys a certain law (in the general case - the PLR - the Principle of Least Resources Consumption). The evolution of this system follows the character of the "relation" in the existential triad.
information	a change in the degree of uncertainty
the principle of least resources consumption (PLR)	The principle of dynamics of development of any system that consists in the fact that a system at transition from state A to state B implements in statistical average such way of transition from A to B, at which the "resource" of the system is consumed at the least.

[51] the original term by Uemov: ‘системообразующий концепт’
[52] the original term by Uemov: ‘структурный фактор’
[53] the original term by Uemov: ‘субстрат системы’

Term	Definition
	PLR is a universal relation-control-information (i.e. is integral part of enmorphya of relation) and governs the process of interaction between the *substrate* and the *structural factor* of **any** system - physical, social, communicative, etc. - which is based on a *stochastic* process. In particular, the PLR governs the process of interaction between matter and information in Nature in the form of the principle of most entropy that is equivalent to the principle of least action, cf. [7], sec. 2.1.5 и 2.3.2.
resource (of a system)	the product "number of steps on the way from state A to state B" by "number of alternative solutions/opportunities at each such step". The resource of the system can be abstractly represented as the product of two categorially complementary terms: "resource" = "action" * "choice", see details in [7], section. 2.3.2. The specific implementation of "steps on the way from state A to state B" and "alternative solutions/opportunities at each such step", i.e. the specific implementation of "action" and "choice" is specific in each system and must be defined for each system separately[54]. For example, for physical systems the "resource" is the number of action quanta necessary to transition the system to another given macroscopic state[55]; for communication (including the communication function of language) - the number of positions in the message (text) * the number of different signs (for example, letters and punctuation marks) necessary to convey the given content; for educational - and for any other social process - the number of individual (learning) topics * the number of alternative (didactic) methods to be considered and applied, respectively, for the achievement of a given (learning) objective.
the principles of self-preservation of system (PSP)	The principle of stabilisation of any system, which consists in the fact that the <u>deviation</u> of the system from following the principle of Least Resources Consumption is limited by the fact that the system-constituting concept of this system

[54] the number of "steps on the way from state A to state B" must be > 0, and the number of "alternative solutions/opportunities at each such step" must be > 1. The reason for this is that Nature must spend more than zero resources to create an observable state. For this, Nature "must" make at least 1 "step to another state" and "alternative solutions at each such step" cannot be deterministic and therefore the number of alternatives must be > 1; see [7], разд. 2.1.3, 2.1.4, 2.3.2 for further details.

[55] i.e. the physical quantity "action" ($kg \cdot m^2 \cdot s^{-1}$) / h (the Planck constant is the value of action quantum)

Term	Definition
	remains stable. The principle of Self-preservation of System is valid for <u>any</u> system, i.e. it is a universal part of their enmorphya. For *truly-stochastic* systems, it is done automatically due to their "being Markovian", which in itself brings the stochastically "out of line" systems back to the path of maximum entropy. For *quasi-stochastic* systems, there is no such automatism. Its absence shall therefore be compensated for by the system's explicit, inherent mechanisms to help preserve the system. Usually such mechanisms are implemented through <u>feedback within the system itself</u>.
enmorph<u>y</u>a[56] *of sth.*	a particular term for the notion ‘control-information-*of-sth.*’, e.g. ‘enmorphya of relation’. The distinguishing mark between the notions ‘information’ and ‘enmorphya’ consists in the following: ‘information’ interacts with <u>material substrate</u>, whereas ‘enmorphya’ interacts with <u>the relation, process</u> between this ‘information’ and this material substrate.
enmorphyon	a new hypothetical boson that carries a secondary interaction implementing the PLA (the principle of least action). Enmorphyon corrects local statistical deviations of the truly-stochastic process from following the PLA. Assumed properties of the enmorphyon: - enmorphyon is scalar, i.e. it has zero spin, - its lifespan should be in the order of 100-1,000 Planck times t_P, - its mass should be about 10^{-2} - 10^{-3} Planck mass m_P, - it is subject to the PLA itself.
stochastic process	a process whose every next state occurs with any probability other than 0 and 1.
stochastic system	a system whose structural factor is based on a stochastic process
deterministic process	a process whose every next state is unambiguously defined by its present state, i.e. every next state comes with probability 1. This means that each previous state of the process can also

[56] The term ‚enmorphya (enmorfia, enmorphy)‘ is constructed on the basis of Greek: ἐνμορφήα (ἐν-μορφή-α => (bringing) in-form, (приведение) в-форму)

Term	Definition
	be unambiguously calculated from its present state. If the next process state comes with probability 0 then the process has stopped, doesn't exist anymore; it also falls within the definition of deterministic process.
deterministic system	a system whose structural factor is based on a deterministic process
Markov property (of a stochastic process)	every next state of the Markov stochastic process implementing regular Markov chains probabilistically depends solely on its current state and is independent of its previous states. This property can also be expressed in the following way: the past of the *truly-stochastic*, i.e. Markovian systems affects their future exclusively through their present.
truly-stochastic process	A stochastic process possessing the "Markov property". The "true stochasticity" is the absence of immediate "memory" of previous states: the subsequent state probabilistically depends only on the current state. The enmorphya of relation is non-variable (always the principle of least action without variable characteristics).
quasi-stochastic process	A stochastic process that has no "Markov property". *Quasi-stochastic* systems must possess immediate "memory" of previous states. The enmorphya of the relation is variable (always the principle of least resource consumption with variable characteristics). N.B.: *quasi-stochastic* processes are not deterministic.
categorial complementarities	Let there exist a confined population (set) of terms comprising more than one term. Terms out of the population are called *categorially complementary* to each other if: 1) These terms can exist exclusively jointly, in concert, i.e. the existence of a term necessarily causes the existence of all other terms of the population, and 2) A term out of the population cannot be defined by using any subset of other terms of the population.
attributive opposites	Let there exist a confined population (set) of properties comprising more than one property. Properties out of the population are called *attributive opposites* if each item of the population represents merely a specific extreme value of one

Term	Definition
	and the same attribute, and, hence, can be defined by using another item of the population. Distinguishing between *attributive opposites* (e.g. {high, low}) and *categorial complementarities* (e.g. {form, content}), let it be said that attributive opposites are basically not categorial complementarities because each item of an attributive pair can be defined by using another member of the pair. For example, the attribute 'size' can take extreme values {big, small}; these values can be expressed by each other. Attributive opposites always describe properties/qualities, i.e. values of an attribute, but never – terms. Thereby, changing the value of this attribute at the transition from one to another extreme occurs without 'jumps', i.e. without a change of symmetry degree (without 'second-order phase transitions'). Attributive opposites often imply the presence of an etalon, i.e. a 'norm', what the estimation of the value of the respective attribute relates to (e.g. {expensive, cheap}, {good, evil}). Attributive opposites almost always are reflected in language by antonymous pairs, whereas categorial complementarities are by no means always representable by them.
time	distinguishability of the microstates of Nature from each other IS the course of time (i.e. time itself). Therefore, time is discrete. Distinguishability of states is a necessary prerequisite for their observability, i.e. their being. That is why being and time are mutually connected. see chap. 1.3 in [7]
past	fixed / documented set of occurred events. Therefore, the past is deterministic, see [7].
the present	decision-making on choosing the next state from a variety of possible states. The present turns a probabilistic future into the deterministic past. It is this complementarity of the probabilistic future and the deterministic past that causes the *irreversibility* of time. see [7]
instant	a theoretical notion describing an "intermediate state" that cannot be realised in Nature. In such "intermediate state", the possibility of choice already exists but the resolution of this alternative does not exist yet.

Term	Definition
	Since time is discrete, there cannot be any "intermediate states" of entities. This definition makes the "instant", and with it the present, a relative rather than absolute notion.
future	a variety of possible states. Therefore, the future is probabilistic, see [7].
space	A discrete substrate needed for *distinguishing* between material entities, see [7], chap. 3.

6 References

[1] N. Bohr *Das Quantenpostulat und die neueste Entwicklung der Atomistik*, Die Naturwissenschaften, Nr. 16, Heft 15, 13.04.1928[57]

[2] Уемов А.И. *Системные аспекты философского знания*, Одесса, 2000[58]

[3] I. Kant *Kritik der reinen Vernunft*, 2. Auflage 1787[59]

[4] M. Heidegger *Sein und Zeit*, 19. Auflage, 2006[60]

[5] Уемов А.И. *О временном соотношении между причиной и действием*, Иваново, 1960[61]

[6] A. Schopenhauer *Parerga und Paralipomena*, Bd.2, Berlin, 1851

[7] I. Furgel *Complementarity of the deterministic past and the probabilistic future as the Nature evolution source*, Deutsche Nationalbibliothek (DNB), http://d-nb.info/995850909, 2009

[8] N. Luhmann *Einführung in die Systemtheorie*, 6. Auflage, 2011[62]

[9] I. Furgel *Cognition & Knowledge*, second edition, Deutsche Nationalbibliothek (DNB), http://d-nb.info/1142648249, 2017

[10] А. Марков *Пример статистического исследования над текстом "Евгения Онегина" иллюстрирующий связь испытаний в цепь*, доклад в Известиях Императорской Академии Наук С.-Петербурга, серия VI, том VII, выпуск 1, 1913 год (С. 153—162)[63]

[11] I. Furgel *Die Sparsamkeit der Natur und die Stabilität der Gesellschaft*, Deutsche Nationalbibliothek, http://d-nb.info/1174654813/, 02.01.2019[64]

[12] *Экономия в языке и коммуникации*: Сб. статей / сост. и отв. ред. Л.Л. Федорова, М.: РГГУ, 2018, ISBN 978-5-7281-2190-9[65]

[57] N. Bohr *The Quantum Postulate and the Recent Development of Atomic Theory*
[58] A. Uemov *Systems Aspects of Philosophical Knowledge*, Odessa, 2000
[59] I. Kant *Critique of Pure Reason*
[60] M. Heidegger *Being and Time*
[61] A. Uemov *About the temporal relation between cause and effect*, Ivanowo, 1960
[62] N. Luhmann *Introduction to Systems Theory*, 6th edition, 2011
[63] A. Markov *An example of statistic investigation upon the text 'Eugen Onegin' illustrating a connection of experiments in a chain*, the report in Proceedings of the Imperial Academy of Sciences in St.- Petersburg, series VI, volume VII, issue 1, 1913 (p. 153—162)
[64] *Economicalness of Nature and Stability of Society*
[65] *The Economy in Language and Communication*: Collected Articles / edited by L.L. Fedorova, M.: RGGU

7 Acknowledgements

I would like to express my great appreciation to my wife Irina, for our most valuable and interesting discussions about single aspects of the topic, and to my daughter Elina, for her time and for her valuable suggestions for the translation of this work into English.
Equally, I like to express my great appreciation to Avenir I. Uemov, my philosophy professor at the university, for his valuable participation in forming my style of interaction with the world.