Human.Animate.Inanimate

first edition, ver. 1.03 (en)

16.07.2020

Igor Furgel
(office@furgel. com)

The present work considers, from the system point of view, the categorisation of entities in the inanimate and animate and the human being as a particular species of the animate.
By applying the system approach, we were able to show that

1) *Any system, both inanimate and alive, is always a stochastic, i.e. non-deterministic system.*
2) *The systems of inanimate Nature are truly-stochastic, i.e. they implement the so-called "Markov process". Their temporal evolution is continuously subject to the Principle of Least Action. Such systems do not have the property of direct "memory".*
3) *The systems of animate Nature are quasi-stochastic, i.e. they do not implement the "Markov process". Their temporal evolution is subject to the principle of Least Resources Consumption (PLR), but only on statistically long intervals and on statistically large amount of the system's substrate. Locally, by contrast, their temporal evolution deviates from the PLR. This is why such systems possess "free will". Significant local deviations in the temporal evolution of such systems from the PLR can destroy these systems as such. Following the principle of Self-Preservation of System (PSP) stabilises such systems through feedback mechanisms. Such systems also have the property of direct "memory" and the property of "teachability".*
4) *The human, as a system of the animate Nature, has the following additional properties that distinguish him from all other living systems.*
   In addition to "memory" and "teachability", the human includes in decision-making the ***risks reflection****, i.e. the result of reflection of a part of possible (future) states that include both the world surrounding the human and the human himself, including his own finitude as a system.*
   We believe that ***risk reflection*** *is a direct cause of existential angst inherent in human beings as a biological species.*
   Due to the ***risks reflection****, the human free will is strongly pronounced and, hence, can take a person far enough in its actions and decisions, in its inadequacy in relation to the current state of its habitat. However, the further a subject goes in his actions and decisions, in his inadequacy in relation to the current state of his habitat, the more dramatic is the correction of this inadequacy back "into the mainstream" of the PLR. That is why stabilising feedback mechanisms (PSP) are most important for self-preservation of the human as a system.*

The present work may attract the attention of an audience who is interested both in questions of philosophy in general and in questions of philosophy of living, inanimate and artificial intellect in particular, and the system approach.

The current version of this edition in English (v. 1.02) has been published on 16.07.2020, Deutsche Nationalbibliothek (German National Library),
https://d-nb.info/1213939461/, https://d-nb.info/1213939461/34.

The slightly supplemented and corrected first edition in Russian (original, v. 1.02) was published on 16.07.2020, Deutsche Nationalbibliothek (German National Library),
https://d-nb.info/1213933455/, https://d-nb.info/1213933455/34

The very first edition in Russian (original, v. 1.00) was published on 21.06.2020, Deutsche Nationalbibliothek (German National Library),
https://d-nb. info/1212334906, urn:nbn:de:101:1-2020062113451524674785

The main ideas of this work emerged in the period from December 2016 to August 2018.

Contents

1 Introduction

At all times and in all cultures, which we can judge from the evidence that has reached us, the question of the difference between the animate and the inanimate and of the special role of human being in the world of the animate has occupied people. How do we distinguish one from the other, what are the criteria for this distinction?

Until now, for example, there is still a debate in the scientific world as to whether viruses - packed in DNA or RNA protein shells - should be considered living or inanimate objects. The difference in answers to this particular question is due to the different criteria applied: on the one hand, viruses multiply (though not independently, but through the mechanisms of the host cell) and evolve (mutate) - these are typical signs of living; on the other hand, viruses do not implement either material or energy metabolism or information metabolism, i.e. they do not have any (macroscopic) material or energy or information exchange with the environment. However, they interact with the environment at the molecular (microscopic) level: using the molecular mechanisms of the host cell, they are transported through the cell membrane and embedded in the host cell DNA.

Another interesting unresolved question is what distinguishes human being from all other animate creatures from an abstract, philosophical point of view.

I was encouraged to reflect on these topics by the work of J.-P. Sartre "Being and Nothingness" [1].

In the present work we want to answer the question, what distinguishes the inanimate from the animate from the *system* point of view on the one hand, and human being as a particular species of the animate from all other living - on the other.

To analyse this question, we will use the approach we have developed in [5], Chap. 3. This approach allows us to understand and define what it means "to be", "to exist" from the *system* point of view, i.e. under what conditions a system is perceived by its environment as "existing". Based on these conditions of existence, i.e. of being of a system, we will then determine under what conditions a given system can be considered as animate and under what conditions - as inanimate.
Since the approach developed in [5], Chapter 3 is fundamental to this study, we will repeat its main points for ease of reading in the next chapter.

2 Being from the System Point of View

2.1 Being and Existential Triads

How to determine the state of "being" at the system level? It is directly related to the properties of fundamental *observability* or *non-observability* of the system. Only fundamentally observable states of nature can be distinguished as *being* from *non-being*, see [5], Chap. 2, Def. 6[1].

How does the fundamental observability of a system relate to the *substrate* and the *structural factor* on which it is built (see Glossary)?

If nothing is fundamentally determinable with respect to an entity, it is equivalent to fundamental unobservability and, consequently, the non-being of that entity. The information about it is equal to zero, and fundamentally unobservable entity is absolutely homogeneous, symmetrical, see [5], Chap. 2.
Information is a change in the degree of uncertainty about an entity and is therefore equivalent to asymmetry, inhomogeneity. Information is thus one component of the *structural factor* that interacts with the *substrate* of the system (i.e. with its "carrier", matter), thus making the latter heterogeneous and therefore observable. The second component of the structural factor is the very process of interaction between information and the substrate of the system.

Thus, the set {substrate, structural factor}, i.e. {matter[2], information, process of interaction between them[3]} is equivalent to the observability of states, cf. [7], sect. 2.4, and the observability of states is equivalent to being. It follows from this that

STM. 1:

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

Let us now consider the necessity and sufficiency of these three elements for the state "being". As discussed above, the elements

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

are necessary to create observable states of nature and, thus, the entities in the state "being".

[1] Let us note here one more interesting conclusion: The distinctiveness of the states of nature from each other is the flow of time (i.e. time itself). Thus, it is the *observable* states of nature that represent necessary condition for the existence of time, see [5], Chap. 2, Def. 7 onwards.
[2] i.e. the *substrate* (Avenir Uemov [2]) or *Medium* by Niklas Luhmann, [4]
[3] the last two elements together form a *structural factor* (Avenir Uemov [2]) or *Form* according to Niklas Luhmann, [4]

These three elements, taken together, are also sufficient for the creation of observable states of nature and thus entities in the state "being", but only if the process of interaction between information and matter

- has fundamentally *stochastic*[4] character (see [7], sec. 2.1.3 and sec. 4.2 B) in [5]) and
- *statistically* obeys a certain law, namely the Principle of Least Resources Consumption (PLR)[5], see [7], sec. 2.1.5 и 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 the necessity of a triad of categorially complementary elements for achieving observable states, and by this, for the creation of objects in the state ‚being'[6]. For this reason, we call these triads '***existential***'.

- The first element of the existential triad shall be a medium[7] (*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. 2:

> **existential triad {substrate, property, relation}[8] 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?

---

[4] *probabilistic, indeterministic*
[5] the principle of most entropy, the principle of least action represent particular cases of the PLR
[6] in Hegel's terminology, it would be a tetrad: three mutually complementary theses and a synthesis
[7] ‚Medium' acc. to Niklas Luhmann [4]; ru: среда
[8] The dyad {property, relation} has different names: Avenir Uemov [2] calls it "structural factor", Niklas Luhmann [4] - "Form".

STM. 3: "the principle of sufficiency of the existential triad":

If ‘relation‘ in an existential triad has fundamentally *stochastic*[9] character **and** *statistically* obeys a certain law (see [7], sec. 2.1.3, 2.1.5 and 4.2 B) in [5]), 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].

[9] *probabilistic, indeterministic*

2.2 Enmorphya

STM. 3 represents a ‚principle‘, i.e. an abstract rule, in this particular case – the relation-control-information[10]. 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. 3**,
- *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**’[11].
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.

[10] synonymously: interaction-control-information
[11] The term ‚enmorphya (enmorfía, 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:

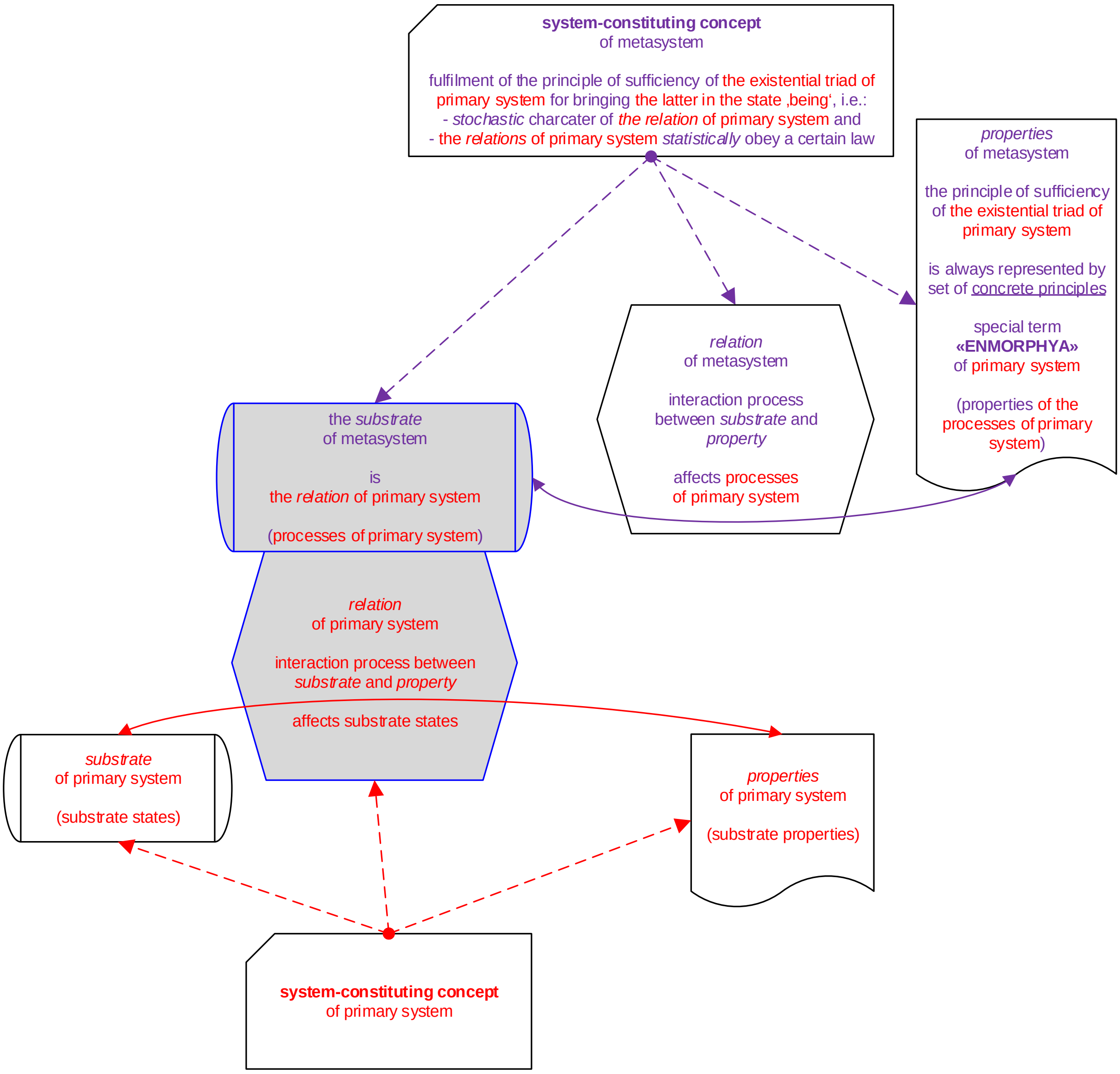


Fig. 1: The relationship between the primary system and the metasystem and the place of enmorphya

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)[12] always represents the 'assemblage point' of any system[13].

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

[13] Generally speaking, it can be stated that any "rules" / "principles" regulating the character of *relations* (interaction) between the *substrate* and the *structural factor* always represent relation-control-information, i.e. "enmorphya of relation".

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 Chapt. 2.4 below) 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. 2.1 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.

In this context, the *substrate* of any "principle" is always the *relation* (interaction) as a sub-aspect of the *structural factor* of the system satisfying this "principle", while the *structural factor* of any "principle" is always the character / properties, i.e. the enmorphya of the *relation* (interaction) within this system. The *system-constituting concept* of any "principle" is always "sufficiency of the given existential triad to create the state of "being" / "observability" of the primary 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.
Further specific properties of **STM. 3** as a specific "enmorphya of relation" (i.e. relation-control-information) are discussed in [5], sect. 4.1, 4) "Conjugation of Systems".

STM. 4:

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 Chapters 2.3, 2.4 below and Section 4.1 in [5] – has brought us to the reasonable assumption that

STM. 5:

The Principle of Least Resources Consumption (PLR) is relation-control-information (i.e. enmorphya of relation) and governs not only the process of interaction between matter and information in the nature[14], but also between the *substrate* and the *structural factor* of **any** system – physical, social, communicative, etc. – based on a *stochastic* process.

What is behind the notion of "resource" in this context? A "resource" of a system is the internal capacity / ability of the system to change its state or, equivalently, is the "residual information value" of the current state of the system[15]. 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], section. 2.3.2.

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[16].

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[17]; the ‘resource’ for communication (including the communicative function of language) is “the number of single positions in a

---

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

[15] ‘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], sect. 2.2.1

[16] 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], 2.1.3, 2.1.4, 2.3.2.

[17] i.e. physical quantity ’action‘ ($kg \cdot m^2 \cdot s^{-1}$) / h (Planck constant – the value of the action quant)

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 as in both **STM. 3** and **STM. 5**

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 direct "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 Chapter 5 Glossary.
N.B.: *Quasi-stochastic* processes are not deterministic.

A process whose every next state is unambiguously defined by its present state, i.e. every next state occurs with a probability of 1, we call *deterministic* process.
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, no longer exists; it also falls within the definition of *deterministic* process.

It should be noted that stochasticity and determinism represent categorical complementarities, see [5] Chap. 4.2, section B), 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)[18] of their *substrate*[19], 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. 5**, 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. 5** 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. 5**.
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
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. 5**, i.e. is the fundamental relation-control-information, its characteristics (attributes) should be stable throughout the whole existence of the system.

[18] 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, see chap. 3.2 below.
[19] the substrate of such systems (sociums) are living systems, see chap. 3 below.

2.3 Enmorphia 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 solely on its current state and is independent of its previous states. *Truly-stochastic* systems do not have direct "memory" 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 most 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.

2.3.1 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, see sec. 4.1 in [5].
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. 3** (‘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 adheres to the "principle of sufficiency of the existential triad", i.e. the Message**STM. 3**, and represents information-office-management-interaction (enmorphya of interaction) for any physical systems.

The Principle of Least Action always meets ‘the principle of sufficiency of the existential triad’, i.e. **STM. 3**, 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. 3**. 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[20].

[20] Let us mention here that there shall be a new specific boson carrying a secondary interaction that implements the principle of least action. We have called this boson "enmorphyon," cf. [5], Chapter "Enmorphyon."

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

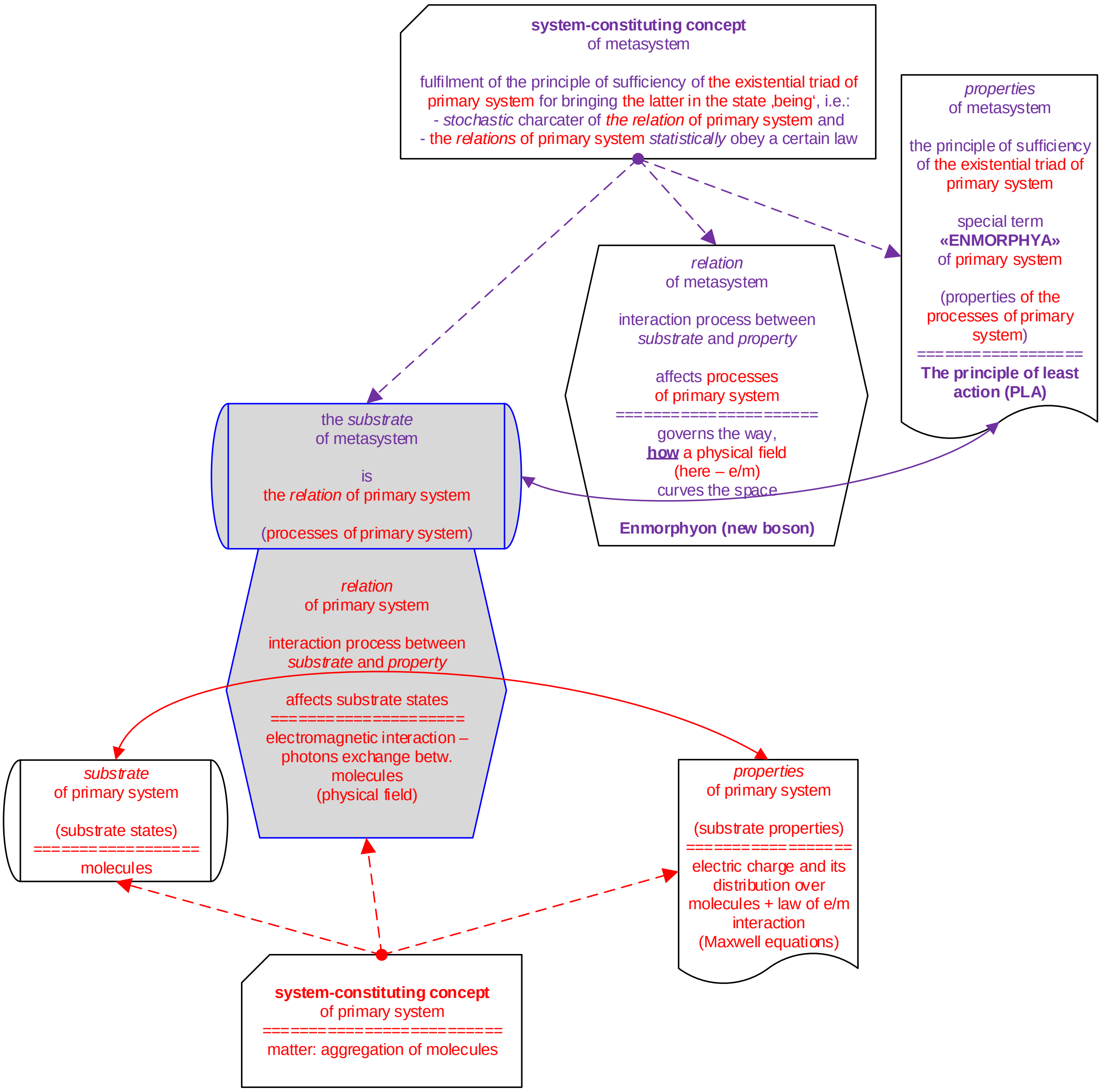


Fig. 2: Relationship between the primary system "matter" and the respective metasystem

2.3.2 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. section 4.1 in [5].

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 [6], 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 any *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 [8]. Thus, **STM. 3** (‘the principle of sufficiency of the existential triad’) is met also here.

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. [13].

The principle of linguistic economy is nothing else than a concrete instantiation of the principle of least resources consumption (PLR), see **STM. 5**.

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. 3**. 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 any 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], sect. 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’:

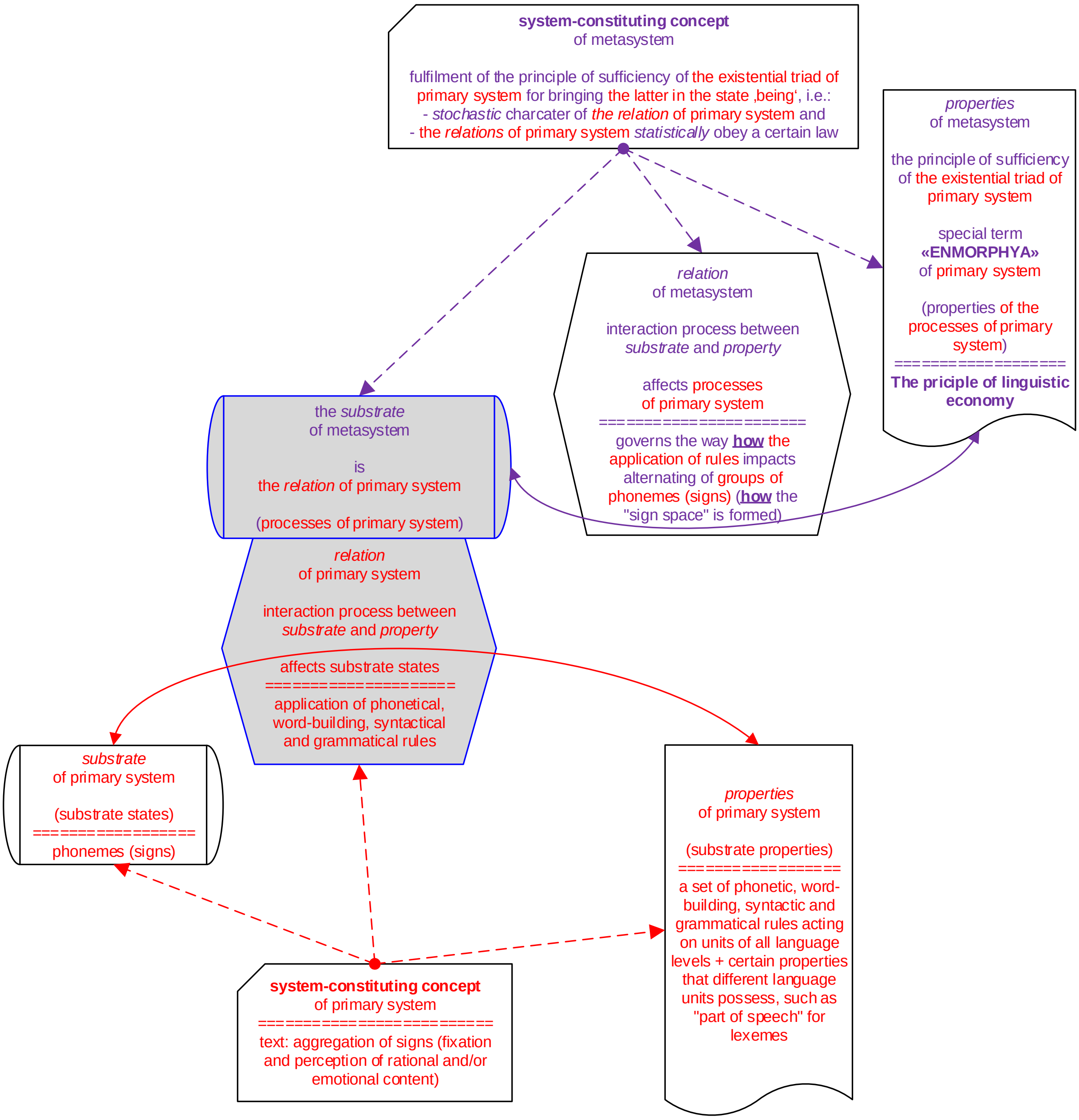


Fig. 3: Relationship between the primary system "text" and the corresponding metasystem

2.4 Enmorphia 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 chapter 5, 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 direct "memory" about previous states.

As we have reasonably suggested in **STM. 5**, 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 directly, 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* PNR in terms of intensity and/or duration may cause the *quasi-stochastic* system to cease to exist as a system, i.e. to replace or completely eliminate its system-forming 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. 6:

> 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 on the following examples of *quasi-stochastic* systems.

2.4.1 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. 3** ("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. 3**. 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:

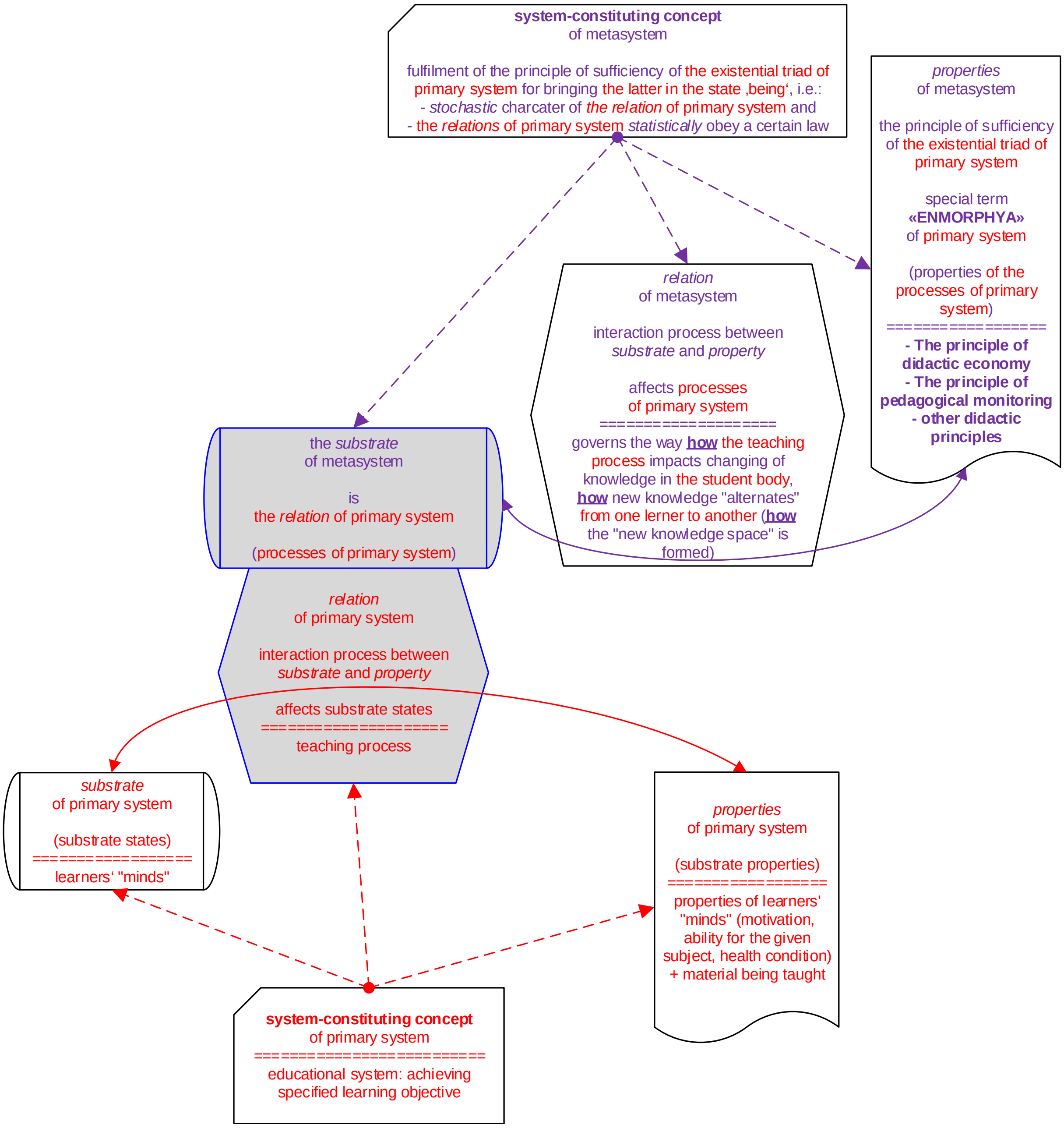


Fig. 4: Relationship between the primary system "education" and the corresponding metasystem

Since the Principle of Least Resources Consumption shall govern the process of interaction between the *substrate* and the *structural factor* of any system based on a *stochastic* process (**STM. 5**), i.e., it shall be a component of the enmorphya of relation of any 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. 7:

> One of the *didactic principles* must necessarily be the Principle of Least Resources Consumption.

Let us remember (see chapter 2.2) 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"[21].

Thus, based on the above results and by analogy with the principle of linguistic economy, which we discussed in chapter 2.3.2 above, we have formulated the **principle of didactic economy**[22].

---

[21] «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)

[22] **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;

see [5], Chap. 3.4.1.

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”[23].

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 formulated the **principle of pedagogical monitoring**[24].

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**.

2.4.2 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.

---

[23] «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.

[24] **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, see [5], Chap. 3.4.1

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. 3** ("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. 3**. *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:

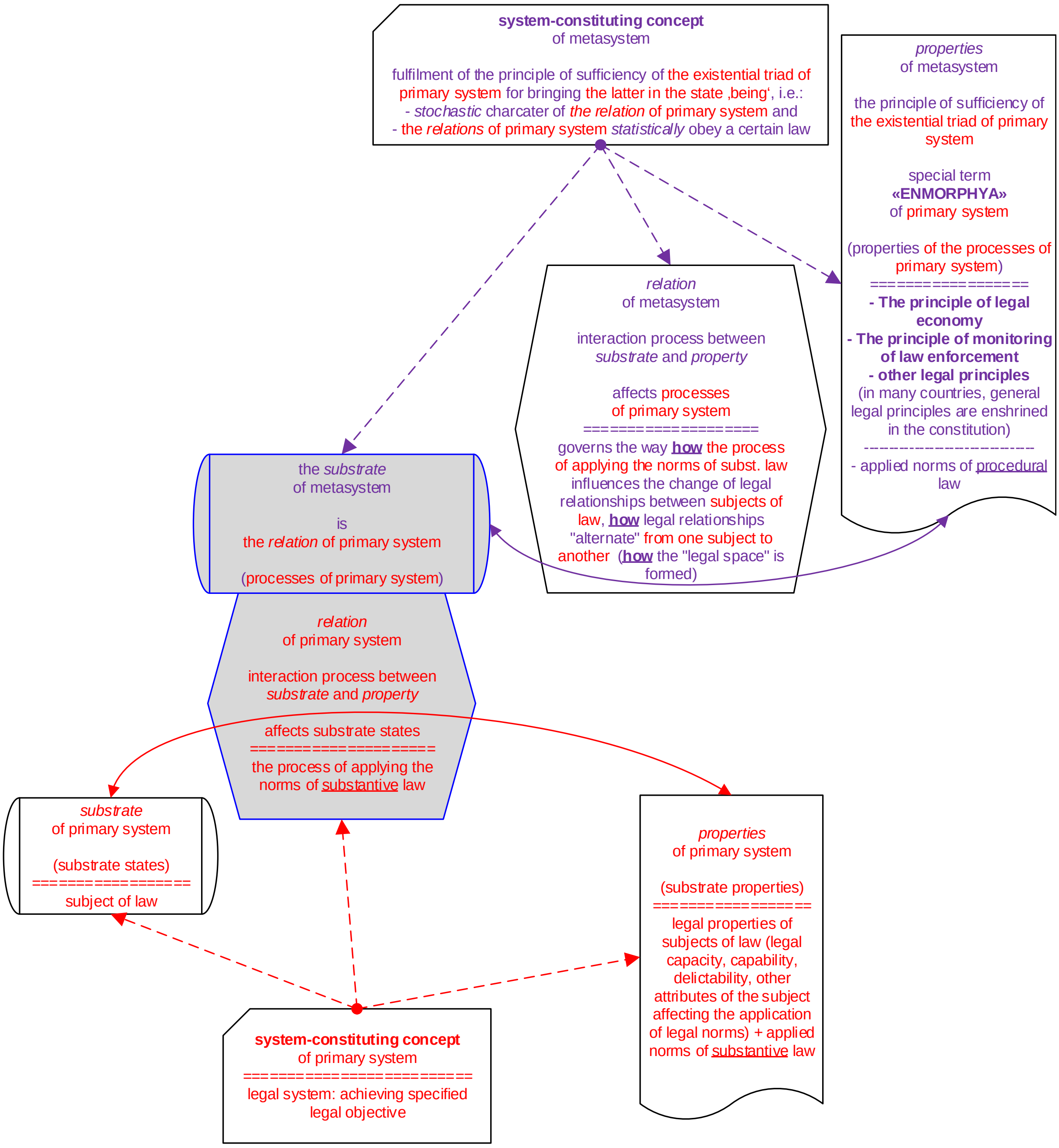


Fig. 5: Relationship between the primary system "law" and the corresponding metasystem

Since the Principle of Least Resources Consumption should govern the process of interaction between *the substrate* and *the structural factor* of <u>any</u> system based on a *stochastic* process (**STM. 5**), i.e., it should be a component of the enmorphya of relation of <u>any</u> 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 <u>procedural</u> law* are the enmorphya of relation of the legal system.

Therefore, it follows that

STM. 8:

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

Let us remember (see Chapters 2.2) 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[25].

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”[26].

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 2.3.2 and 2.4.1, respectively.

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 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:

> "**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

[25] 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)

[26] cited by 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

> the adoption (publication), amendment or invalidation (cancellation) of normative legal acts (para. 2 of the Decree)" [27].

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"[28].

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 2.4.1.

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**.

[27] 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)
[28] 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)

2.5 Role of Enmorphya in Systems' Variativity

2.5.1 Variativity of Truly-Stochastic Systems

As we have already defined in Chapt. 2.3, 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[29], 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 phonemes/signs in any text is a regular Markov chains and, therefore, *statistically* obeys the corresponding regularities.

[29] RU: восприимчивость

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 Chapt. 2.3 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).

2.5.2 Variativity of Quasi-Stochastic Systems

The enmorphya of any *quasi-stochastic* system (as distinct from a *truly-stochastic* one), as discussed in Chapter 2.4 above, may deviate from the principle of Least Resources Consumption (PLR).

As we have seen in the previous chapter 2.5.1, 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 Chapt. 2.2 above.

Thus, we come to the conclusion that

STM. 9:
in a *quasi-stochastic* system, its enmorphya shall be variable.

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

In Chapters 2.4, 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 2.4, 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).

We will consider another example of the variativity in the enmorphya of *quasi-stochastic* systems below in Chapt. 2.6.

Let us now ask ourselves how **STM. 9**[30] above is consistent with **STM. 5**[31] и **STM. 6**[32]. 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

---

[30] In a *quasi-stochastic* system, its enmorphya must be variative.
[31] The principle of Least Resources Consumption (PLR) is the enmorphya of relation for any system based on the *stochastic* process.
[32] 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. 10
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 direct 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 Chapter 5 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 Chapters 2.4 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 directly, 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[33]. "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"[34].

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[35]".

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[36].

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[37] - is a very likely, expected path of Nature's evolution.

---

[33] This represents a concrete form of the “freedom of choice”

[34] This represents a concrete form of the “freedom of action”

[35] 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.

[36] See chap. 2.1.5 (The Principle of Least Resources Consumption: Least Action and Most Entropy) in [7].

[37] *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.

2.6 Enmorphya of Living Beings

The answer to the question posed in the Introduction, what is the difference, from the system point of view, between the inanimate, the animate and human being in particular, we will be able to give only at the end of this work. However, already in this chapter we want to consider some phenomenological properties of the enmorphya of relation for living beings.

To do this, let's return to **STM. 2** and think about what is the existential triad {substrate, property, relation} for a living system. We will use the obvious thought that comes into mind in stating this question as a working hypothesis:

> The "substrate" of a living system is the (material) body.
> The "property" (i.e. information-about-substrate) is the body's properties (genotype of a particular body, its current state (of health), etc.) and a set of rules according to which the body functions. Such rules include three types of metabolism: biosynthesis (anabolism), energy (catabolism) and information[38]).
> The "relation" is the process of interaction of these rules with the body of a living system, perceived as self-awareness (ego), as self-recognition, as self-identification as a holistic personality (Ego/Self).
> It seems to us that this "relation", i.e. self-awareness (ego) correlates with the notions 'das Ich-Bewusstsein' by Jaspers and 'das Ich' by Jung. This self-awareness (ego) also seems to us to be the source of "free will" (the topic of "free will" will be discussed in detail in Chapter 3 below).

What is the *system-constituting concept* of a living system?

We have already written in [11], Chap. 1, that "It is exactly the minimisation of the consumption of Nature's resources that <u>causes</u> that "the diversifying of the process of interaction between material and ideal objects" IS the meaning of existence of biological (self-organising) systems[39]". I.e. "the diversifying of the process of interaction between material and ideal objects" represents the *system- constituting concept* of living system, see also Chapt. 2.2 above.

What is then the *enmorphya of relation* for a living system? Enmorphya of relation is the characteristics of the interaction/relation between the primary information, i.e. the information-about-substrate and the substrate itself; i.e. enmorphya is the 'relation-control-information', see Glossary.

The interaction/relation between the "rules according to which the body functions", i.e. between the laws of biosynthetic, energetic and information metabolism and the body itself is the self-awareness (ego). Therefore, the enmorphya of relation for living systems is the

[38] The concept of "information metabolism" was introduced by Antoni Kępiński in his work "*Psychopatologia nerwic* (*Psychopathology of Neuroses*)" as a parallel to the energy metabolism of the body. "Information metabolism" can be understood as the reception and processing of signals from the environment by humans and their response to these signals.
Information metabolism is inherent, of course, not only in a person, but also in any entity that exchanges signals with the environment and processes them.

[39] Specifically, this is done through the creation of ideal and material artifacts, i.e. in human beings - through spiritual and labour activity, respectively, Furgel, 2002.

characteristics, properties of self-awareness, characteristics of the Self, and hence the meta-level of the Self, i.e. it is the enmorphya of self-awareness.

The enmorphya of relation **for a living system is the enmorphya of self-awareness.**

Self-awareness as the "relation" of a living system is a process of interaction between the body and the rules of biosynthetic, energetic and information metabolism. Therefore, the *enmorphya of self-awareness* should contain characteristics, principles being affin both to the body and to the ruels of all types of metabolism.

What principles, at a minimum, should include the enmorphya of living beings? The enmorphya of any system must be such that it sustainably and effectively contributes to the achievement of the objective of that system, i.e. to the realisation of its system-constituting concept, see **STM. 4** above.

In [11], Chapter 1 we wrote using the education system as an example:

> “The same goal within the education system - to transform teaching material into students' knowledge and skills - can be achieved by using different didactic principles and methods. Each individual didactic approach forms a specific *relationship* between students and the material being taught.
>
> Thus, the *relation* between the subject of the effort (substrate, matter) and the character of that effort (property, information) is specific to each given decision. Therefore, the wider the range of possible decisions, the more there are such specific relations between the substrate and the properties, i.e. between matter and information.
>
> This means, among other things, that the less restrictive factors on the opportunities to make decisions, the more diverse the process of interaction between material and ideal objects.
>
> It should be noted that “the diversifying of the process of interaction between material and ideal objects” is based on a fundamentally non-deterministic decision-making as to which exactly opportunity to use, to realise.
> On the other hand, it is non-deterministic decision-making that contributes to entropy production, thereby minimizing the consumption of Nature's resources[40].
>
> Therefore, the degree of "the diversifying of the process of interaction between material and ideal objects" is directly related to the consumption of Nature's resources: the maximum achievable "diversifying of the process of interaction between material and ideal objects" corresponds to the minimum consumption of Nature's resources.
> It is exactly 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 sense of existence of biological (self-organising) systems. Thus, to minimise the consumption of its resources, Nature strives for greater “diversifying”: it minimizes the number of factors, for example ethical, limiting the opportunities of decisions making.”

[40] [7], chap. 2.3

As we can see, the system-constituting concept of the living system - the diversifying of the process of interaction between material and ideal objects of Nature - is a direct consequence of the principle of Least Resources Consumption (PLR).

As we noted in **STM. 5** above, the PLR is the enmorphya of relation of any system based on the *stochastic* process. But how is this general statement concretely realized in relation to living systems?

Since the enmorphya of any system must be such that it sustainably and effectively contributes to the achievement of the objective of that system, i.e. to realization of its system-constituting concept, see **STM. 4** above, the enmorphya of a living system, i.e. the enmorphya of self-awareness, must sustainably and effectively contribute to "the diversifying of the process of interaction between material and ideal objects of Nature".

As we have seen in the above cited passage from [11], chap. 1, the process of interaction between material and ideal objects is more diverse, the less restrictive factors on the opportunities of making decisions. It turns out the following causal chain: from the Principle of Least Resources Consumption follows the necessity of the diversifying of the process of interaction between material and ideal objects of Nature, whereby the necessary means of achieving this "diversifying" is minimization of restricting factors on the opportunities of decisions making, i.e. maximization of freedom of choice.

Because of the correlation shown between the PLR and the maximization of freedom of choice, the latter can be levied to the rank of "principle". We will call it the **Principle of Most Choice**. As we have seen, it represents a direct consequence of the PLR.

> Thus, in order to contribute effectively to "the diversifying of the process of interaction between material and ideal objects of Nature", the enmorphya of the living system, i.e. the enmorphya of self-awareness, must include the **Principle of Most Choice** (i.e. the principle of minimization of restricting factors on the opportunities of decisions making, the principle of maximizing the freedom of choice).

It is the Principle of Most Choice as one of the characteristics of self-awareness of living beings that leads to their flexibility, adaptability to different conditions of existence: to different environmental temperatures, to food composition, to water and air composition, to different types of communication and interaction with other individuals (one of the aspects of cognitive flexibility), etc.

Is there a need to include other principles into the enmorphya of living systems?

As discussed in Chapters 2.4, 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, see **STM. 6** above.

It is the Principle of Self-preservation of System as one of the characteristics of self-awareness of living beings that leads to their stability, caution when trying something unknown, new: unknown food (it is better to be careful - you can be poisoned), new habitat (first you need to make a reconnaissance of the area), new circle of communication (first you need to listen to what and how other individuals communicate), etc.

Thus, at least two principles are constituents of the enmorphya of living beings, i.e. the enmorphya of self-awareness, since it is they that provide a stable diversifying of the process of interaction between material and ideal objects of Nature: the Principle of Most Choice and the Principle of Self-preservation of System.

These principles govern how self-awareness (ego) affects the emotional and bodily spheres of a living being, i.e. how the "psycho-physical space" of a subject is formed. Thus, these principles leave their "imprint" both on the body of a living being and on the rules according to which the organism functions. It means, among other things, that these principles influence all types of metabolism: biosynthetic, energetic and informational.

The biosynthetic and energetic types of metabolism are well studied in biology. The influence of self-awareness on these types of metabolism is quite obvious: just remember, for example, the influence of our taste preferences (and they are also a part of self-awareness) on metabolism in our body. Diversity of taste preferences, in turn, directly follows from the principle of most choice, i.e. from the enmorphya. It is also appropriate to remember the feeling of disgust that arises obviously under the influence of self-awareness in contact with spoiled food: the feeling of disgust keeps us from consuming such food, thus directly affecting the metabolism in our body: we avoid unhealthy or even deadly metabolism that would arise in a state of poisoning.

Information metabolism is not so well researched, so we want to understand here what the attributes of entomorphya may impact this type of metabolism. We should also pay attention to the fact that information metabolism as 'reception and processing of signals from the environment and reaction to these signals' necessarily includes the form and content of communication of a living being with its environment, and for huan being, in particular, its education, socialisation, education and its ethical system.

Let us illustrate the relationship between the primary system and the metasystem for living entities:

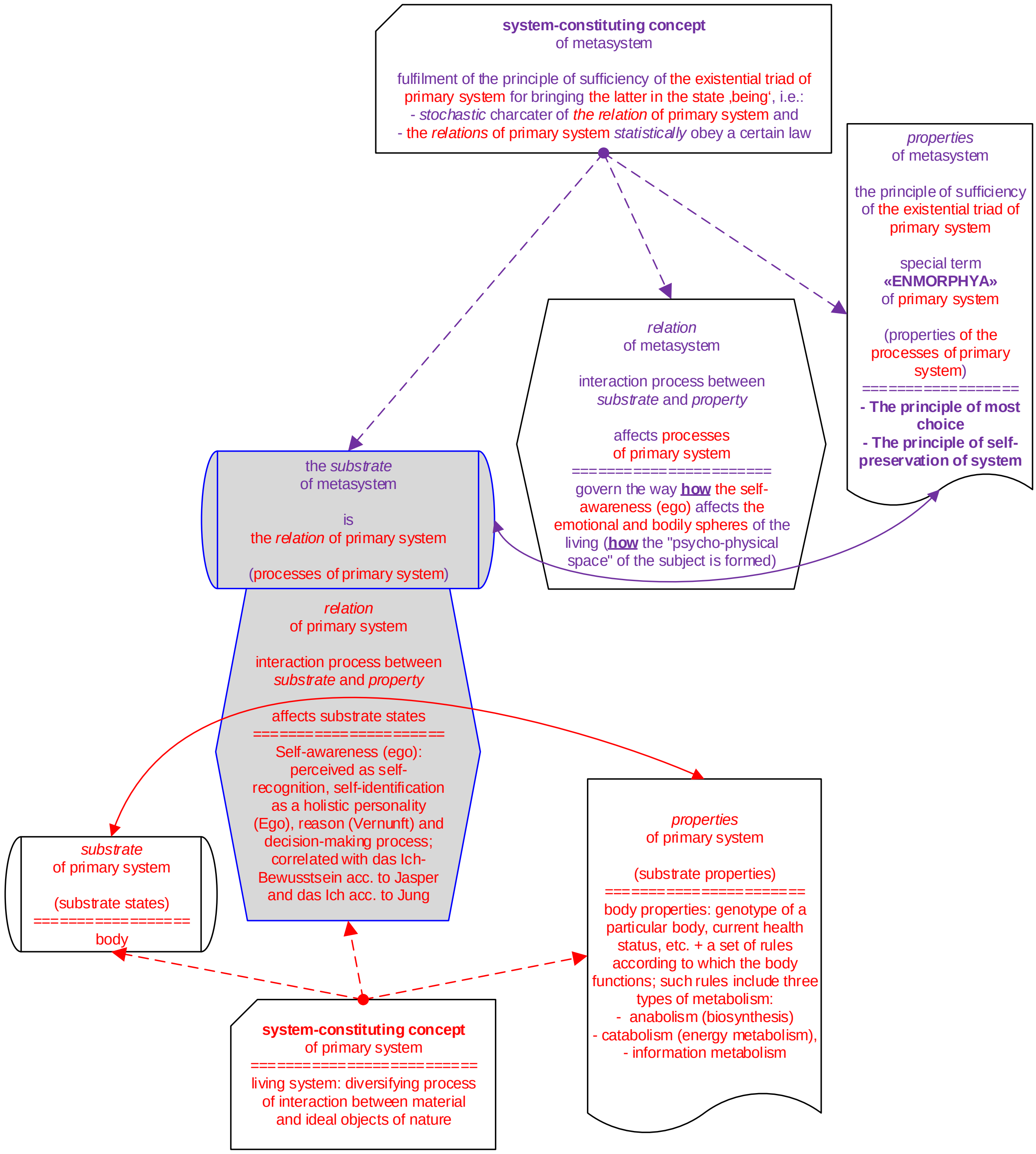


Fig. 6: Relationship between the primary "living" system and the corresponding metasystem

Since the enmorphya of self-awareness represents a particular case of enmorphya of relation, it must first possess all the general properties of enmorphya of relation, namely, it must include the principle of least resources consumption, see **STM. 5** above. As we have already discussed above, the principle of most choice directly follows from the PLR.

Self-awareness (ego) *statistically* obeys enmorphya and is fundamentally *stochastic*, see **STM. 3** above.

As we have already mentioned in Chapters 2.2 above, both the substrate (matter) and the property (information-about-substrate) within the same system must be affine to the characteristics of the relation (interaction) between them in order to be able to interact with each other in principle. Thus, the characteristics of this interaction, i.e. interaction-control-information (enmorphya of relation), leave an "imprint" both on the substrate (matter) and on the property (information-about-substrate) of this system. Consequently, the "enmorphya of relation" is always the "assembly point" of any system.

For living beings this consideration is refracted in the following way: since the enmorphya of self-awareness should make possible an adequate interaction between the body and the rules of body functioning (different types of metabolism), the enmorphya (characteristics) of self-awareness is imprinted both on the body and on the implementation of all types of metabolism. Isn't this the reason for the correlations between human appearance and his psychotype, as discovered, for example, by E. Kretchmer [9], and stated also by the Myers-Briggs type indicator (MBTI) and by socionics?

The enmorphya of self-awareness should be affine to all types of metabolism, as well as to the body, whereby the latter is specific for each biological species. Therefore, the enmorphya of self-awareness should be specific for each single biological species.

Both body and implementation of all types of metabolism are specific for each biological species (for example, different biological species have different composition of electrolytes, blood, urine, etc.).
The closer to each other are different species in the classification system, the more common there is in their implementations of all types of metabolism. This fact is the reason why, for example, all mammals have at least a small "area of mutual understanding" between them[41]. This is not the case for the representatives of different classes, such as mammals and birds, either amphibians or fishs.

We have found out above that the enmorphya of relation for living systems is the *enmorphya of self-awareness*, which clearly does not implement the Markov process (see Chapter 5 Glossary)[42]. Therefore, the enmorphya of self-awareness shall be variative, and living systems shall be *quasi-stochastic,* see Chap. 2.5.2 above.

Since the enmorphya of self-awareness is variative, then, as we have seen in Chapters 2.5.2, it must have variative attributes.

It means that the enmorphya of self-awareness is (i) specific to each single biological species and (ii) must have variative attributes.

What are these attributes?

Let's first consider what attributes in general (variative and constant) can have the enmorphya of self-awareness. To illustrate the application of this heuristic approach, let us consider what attributes the enmorphya of self-awareness should have for the biological species "human".

[41] the concept of "the area of mutual understanding" is defined in [6], Chap. 3

[42] There is a concept of Self (das Selbst), to which similar but not equivalent meanings are ascribed in different teachings. We see correlations between the concept of das Selbst in the sense of C.G. Jung and *the enmorphya of self-awareness*. Das Selbst in the sense of C.G. Jung is the main archetype (among other archetypes).

For the biological species "human", the enmorphya of self-awareness shall have at least the following attributes:

- attribute "biological species" with the value "homo sapiens"; this attribute always includes self-reflection of a person on its own future as a system, see Chap. 3 below; this attribute also defines the implementation of biosynthetic and energetic types of metabolism (for example, in cats this implemenattion differs from the human one: other values of blood, urine, electrolytes composition, etc.);
- attribute "modus" with possible values "ordinary (opportunistic)" or "ontological (ethical)" (cf. [3] and [11]);
- attribute “psychotype” (cf. psychotypic classifications by C.G. Jung, E. Kretchmer, F. Riemann, MBTI, socionics and other classifications of psychotypes; [12]);
- attribute "ethical norms";
- possibly, attribute “archetype” in the sense of Jung[43].

Which of these attributes are constant and which are variative?

- the attribute “biological species” with the value “homo sapiens”

remains unchanged for the representative of this species (here: human) throughout its life.

[43] "There are as many archetypes as there are typical situations in life. The endless repetition has engraved these experiences in our psychic constitution, not in the form of images filled with content, but at first only **as forms without content**, representing merely the **possibility** of a *certain type of perception and action*", C.G. Jung, "The Concept of the Collective Unconscious" (p. 61 in [10]).

Since archetypes are forms without content, they represent a special case of the abstract concept "principle", i.e. a set of abstract characteristics of interaction.

That is why they can be one of the attributes of the enmorphya of self-awareness (the enmorphya of relation is, by definition, a set of abstract principles).

The other attributes of the enmorphya of self-awareness for the biological species "human" are variative:

- the attribute "modus" with possible values "ordinary (opportunistic)" or "ontological (ethical)" [44, 45],
- the attribute “psychotype” [46],
- the attribute "ethical norms",
- the attribute "archetype" (we assume it exists; we will not consider it further in this work).

Now we will ask ourselves, which already known properties of personality are a reflection of the attributes of the enmorphya of self-awareness, and which are a reflection of the properties of information metabolism.
The stability of enmorphya in a given system during its life, which is necessary for the existence of any system, can serve as a criterion for understanding, whether the considered property of personality is an attribute of the enmorphya of self-awareness or an attribute of information metabolism.

For example, personality traits such as "modus", "psychotype" and "ethical norms" stay stable throughout one’s life. This indicates that these properties are attributes of the enmorphya of self-awareness.

Personal characteristics that are relatively labile and depend on a particular period of life – state of health, the surrounding atmosphere in society, etc. - can only be attributes of information metabolism. Such characteristics always depend on the emotional state of the living system.

---

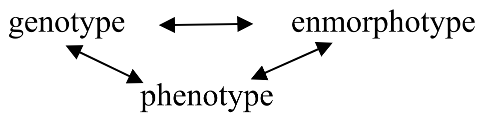
[44] In [11] we examined in detail the attribute "modus" and its possible values "ordinary (opportunistic)" or "ontological (ethical)". In general, the modus of a specific person manifests itself in the extent to which a person limits the opportunities of making his or her decisions by ethical criteria. If a person usually uses almost any opportunity given to him/her, he/she is in the "ordinary (opportunistic)" modus. If a person usually does not use any opportunities given to him/her because of his/her internal ethical criteria, he/she is in the "ontological (ethical)" modus.
In [11], chap. 1 we have shown that stratification of society into people in the "ordinary" and into people in the "ontological" modus is based on statistical necessity, since it is a direct consequence of the principle of least resources consumption.

[45] The attribute “modus” raises the following question: the principle of least resources consumption is an absolutely universal statistical principle of Nature. If the attribute “modus” of the enmorphya of self-awareness has the value "ordinary (opportunistic)", then the individual is a common person who lives in "ordinary modus", which directly implements the PLR, cf. [11], chap. 1.
Is the existence of people living in the "ontological (ethical) modus" a deviation from the PLR? No, it is not: The PLR is a statistical principle; it means that there must be local deviations from the expected value. People living in the "ontological modus" represent such local deviations that are necessary for the implementation of the Principle of Self-Preservation of System (in this case - of the social system).
A similar conclusion should be reached for all other living entities, since any enmorphya of self-awareness - irrespective of species and class - follows the principle of non-determinism in the frame of statistical PLR, cf. 2.6 above.
It means that human being, thanks to a particularly pronounced free will (see Chapt. 3.2 below), is able to most effectively practically implement the *deviations* of the attribute "modus" of his enmorphya from the expected value of "ordinary modus", i.e. is able to most effectively practically implement "ontological modus".
Based on the above, we assume that other living systems - though not as effectively as humans - can practically implement the "ontological modus". This is confirmed by the presence of communities in other species and classes: the presence of carriers of the "ontological modus" is a necessary condition for the formation of sustainable communities (cf. the principle of self-preservation of system), see [11], chap. 1.

[46] cf. the psychotypic classifications of C.G. Jung, E. Kretchmer, F. Riemann, MBTI, socionics and other classifications of psychotypes; see [12].

The fact that the state of a living system is the result of the interaction of its genotype and phenotype is an established opinion. Is there a need to expand this "formula"?
We have seen that personality traits such as the "ontological" or "ordinary" modus and various psychotypes of individuals are a reflection of the attributes of the enmorphya of self-awareness. Obviously, such personality traits directly affect the current state of a living system. Thus, the enmorphya of self-awareness also has a direct impact on this state.

Therefore, it seems to us that the interaction between genotype and phenotype should be expanded by the enmorphya of self-awareness:



Therefore, it is possible to speak of an "*enmorphotype*" as a specific set of personality attributes that interact with both its genotype and its phenotype.

We now want to return to the topic of system variativity.

As we have already noted in Chapters 2.2 above, variations in the "enmorphya of relation" between the substrate and the property of a system are much more effective in "diversifying" the interaction between them (between the substrate and the property) than variations in the property itself or variations in the substrate itself. Specifically for human being, this fact is implemented in the following way: his or her enmorphya of self-awareness has, at a minimum, variative attributes "modus", "psychotype" and “ethical norms” (and probably "archetype"), and the variation of these attributes leads to a much greater diversity of properties and relations of human being as a *quasi-stochastic* system than the diversity of properties and relations, for example, of any physical object as a *truly-stochastic* system.

From this reasoning, it becomes clear, among other things, that **a necessary condition for the creation of a true humanoid, i.e. artificial intelligence (AI) with the architecture and functions of human intelligence, is the variativity of the enmorphya of self-awareness of such a humanoid**, i.e. the variativity of attributes of the principle that constitutes the interaction (relation) between the "body" (substrate) of a humanoid and a set of rules and formulas according to which this "body" functions (i.e. its properties). The author of these lines had not heard at the time of publication that the necessity of variativity of enmorphya as the main feature of AI was discussed in the communities working on the subject of AI.

2.6.1 Terminological Dilemma: Soul, Spirit, Conscience

From antiquity, through the Renaissance to the present day, many thinkers - philosophers, theologians, psychologists - have been concerned both with the very concepts of "soul", "body", "spirit", "conscience", "Ego", "Id", "Self" and the relationships between them.

Especially for the concepts of "soul" and "spirit", the range of interpretations of their content is very wide, and the concept of "conscience" is interpreted differently by different schools. This "vagueness" is associated with the fact that a person feels the existence of certain phenomena, elements of his mental life (emotions, thinking, ethical attitudes), but is not able to accurately, rationally "grasp", to determine them. It seems to us that the reason of this "ungraspability" lies in the very nature of these elements of mental life.

Due to this immanent "ungraspability" and the breadth of the spectrum of interpretations of these concepts, we will not (in vain) try to combine the already existing interpretations together. Instead, we will define these concepts within the framework of the system approach developed in this work, which will significantly narrow the range of interpretations for these concepts and fully define the relationships between them.

For this purpose, we use the diagram in the Fig. 6 above and define "body", "soul", "Id", "spirit", "Ego", "conscience" and "Self" as separate elements of this diagram:

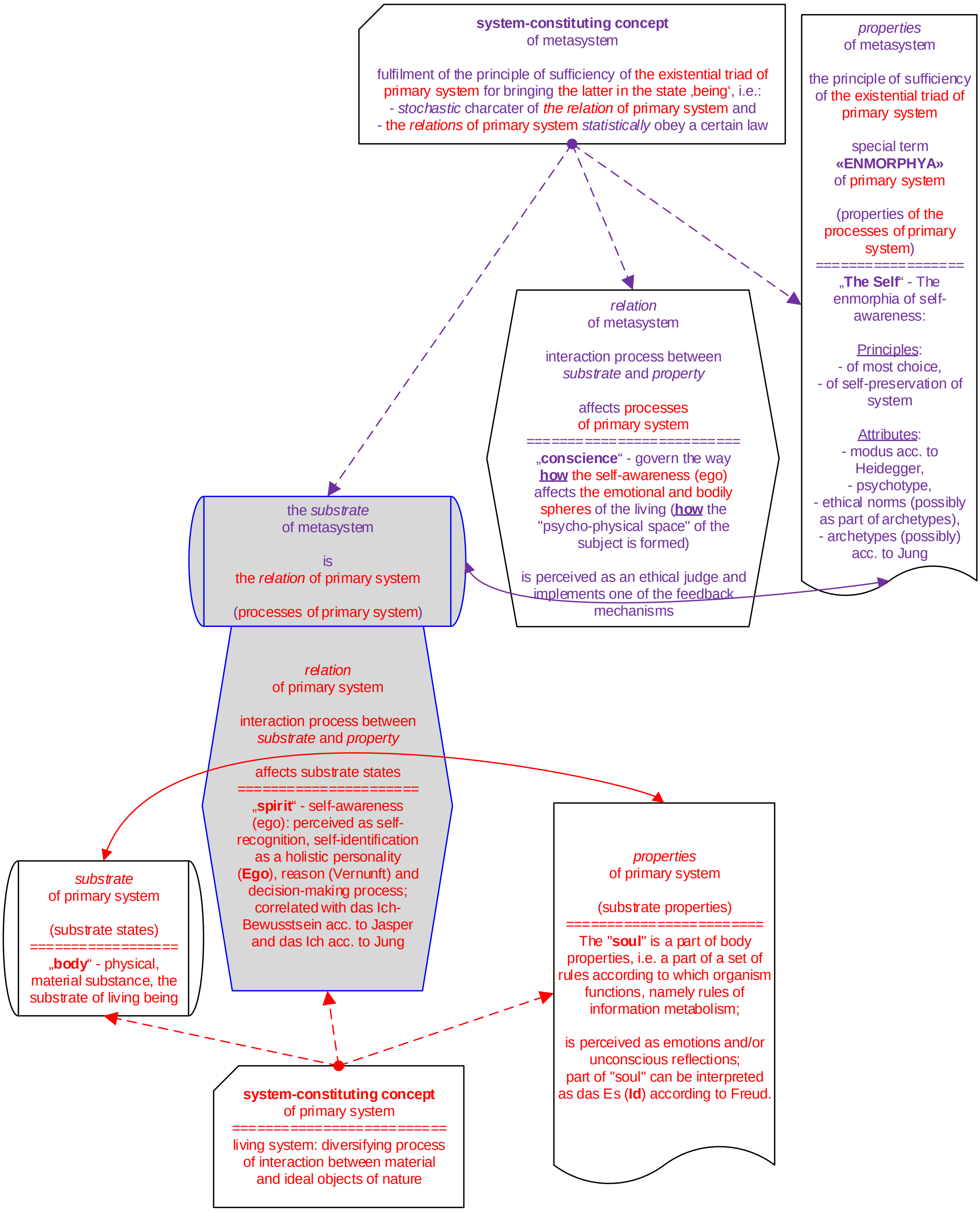


Fig. 7: Definitions of controversial concepts and the relationships between them

For the sake of clarity, we shall write down the definitions of "body", "soul", "spirit", "conscience" and "self" in the explicit form using the diagram in Fig. 7.

concept	definition
body	physical, material substance, substrate of living entity
soul	part of body properties, i.e. part of the set of rules according to which the organism functions; namely the rules of information metabolism, see Fig. 6 above; is perceived as emotions and/or unconscious reflections; part of "soul" can be interpreted as 'das Es (Id)' by S. Freud.
spirit	self-awareness (ego) is perceived as self-recognition and self-identification as a holistic personality (Ego) and a process of rational reasoning (Vernunft) and decision making; correlates with 'das Ich-Bewusstsein' by K. Jaspers and 'das Ich' by C.G. Jung. Since *free will* is the freedom of choice[47] (see chap. 3.2, **STM. 12** below), i.e., is directly related to the decision-making process, hence *free will* is a sub-process of the spirit.
conscience	controls how the self-awareness (ego) affects the emotional and bodily spheres of the living (how the "psycho-physical space" of a subject is formed); is perceived as an ethical judge and implements one of the feedback mechanisms, which are necessary for implementing the principle of self-preservation of system, see Chap. 2.4.

[47] that is *quasi-stochastic in* nature and takes into account at least all previous experience of the system

concept	definition
The Self	the enmorphya of self-awareness; The principles that make up *the enmorphya of self-awareness*: - the principle of most choice, see Chap. 2.6, - the principle of self-preservation of system, see Chap. 2.4. The varyative attributes of *the enmorphya of self-awareness*, see Chap. 2.6: - modus acc. to M. Heidegger - psychotype - ethical norms (perhaps as part of the archetypes) - archetypes acc. to C.G. Jung (possibly) The constant attributes of *the enmorphya of self-awareness*, see Chap. 2.6: - biological species.

We believe that the use of the terms "body", "soul", "spirit", "conscience" and "self" given here will lead to mutually consistent results, since the systematic approach used here has significantly narrowed the range of interpretations for these concepts and fully defined the relationships between them.

3 Inanimate - Animate – Human Being

3.1 Living and Non-living Systems

We now come close to the main theme of this work, outlined in the Introduction: what is the difference between the animate and the inanimate, and what is the role of human being in the world of the living? How do we distinguish between one and the other, what is the criterion for this distinction from the *system* point of view?

Let's go back to **STM. 3**, which determines that the existential triad is sufficient for the creation of a system with an appropriate *system-constituting concept* if

- the "relation" in this triad has fundamentally *stochastic* character **and**
- *statistically* obeys a certain law (in the general case - the PLR, i.e. the Principle of Leats Resources Consumption, see **STM. 5**).

The evolution of this system follows the character of the "relation" in the existential triad.

Then, how do living and non-living systems differ from each other? Indeed, **STM. 3** is true for any - living and non-living - systems: The "relation" in the respective existential triad must be fundamentally stochastic and statistically subject to a certain law.

It means that the difference between living and non-living systems can be only

- in the type of stochasticity of the character of the relation in the respective existential triad **and**
- in the law, what this relation statistically obeys, i.e. in the "enmorphya of relation" of the system created by this existential triad.

In order to follow these differences and understand them, let us consider different types of systems, from microscopic (quantum) systems to human being.

a) Microscopic (quantum) systems

A distinctive feature of *microscopic* (quantum) systems is (within our consideration) that the relations / interactions in these systems are based on the *stochastic* process described by the regular Markov chain[48], i.e. the interactions in these systems are based on the *truly-stochastic* process (see Chapter 2.5.1 and Glossary).

This means that the decision as to which opportunity to take in the next step of time, i.e. what their near future will be, has non-deterministic, namely truly-stochastic (Markovian) character.

[48] see «Применения функциональных интегралов в квантовой механике и теории поля», Д. И. Блохинцев, Б. М. Барбашов, гл. 2 «Цепи маркова в квантовой механике», УФН, том 106, вып. 4, 1972 ("Applications of Functional Integrals in Quantum Mechanics and Field Theory", D.I. Blokhintsev, B.M. Barbashov, chap. 2 "Chains of Markov in Quantum Mechanics", UFN, vol. 106, issue 4, 1972); see also [7], Chap. 2.2.3, 4.2.

As we have already defined in Chapt. 2.3, the enmorphya of the relation of any *truly-stochastic* system is always the principle of most entropy or, equivalent, the Hamilton's principle of Least Action (PLA).

As we have already noted in Chapt. 2.2, the past of the *truly-stochastic*, i.e. Markovian systems affects their future exclusively through their present. This "true stochasticity" consists precisely in the absence of direct "memory" of previous states: the subsequent state probabilistically depends only on the current state.

Thus, we conclude that for *microscopic* (quantum) systems:

Parameter	Parameter's value
stochasticity type of relation in the respective existential triad	*true stochasticity,* i.e. it is based on the regular Markov process, hence the absence of direct "memory" of previous states; the past influences the future only through the present of these systems (the phenomenon of physical dispersion; it can be considered as mediate "memory").
the law, to which this relation statistically obeys, i.e. the "enmorphya of relation" of the system created by given existential triad	Hamilton's principle of Least Action (PLA) (equivalent to the principle of most entropy); The PLA as the enmorphya of any interaction within the *truly-stochastic* systems is non-variable, see Chap. 2.5.1 above; The PLA represents merely a specific case of the principle of least resources consumption (PLR), see Chapter 2.3 above.

b) Macroscopic systems with self-governance

The distinctive feature of *macroscopic systems with self-governance* is (within the framework of our consideration) that they reflect a part of possible future states, including with respect to themselves.

The relations / interactions in any macroscopic system are based on a *truly-stochastic* process (see Glossary), which is observed for macroscopic systems as a *deterministic* one.
The reason for this is that stochastic deviations (fluctuations) of actually realized random states of such systems compensate themselves mutually just because of macroscopic nature of these systems. Thus, the actually observed (measured) states of macroscopic systems represent nothing else, but a series of *expected, average* values of actually realized random states of these systems, see [7], chap. 2.6. A series of *average* values is always deterministic.
In classical mechanics, for example, a series of *average* values of states of macroscopic systems is described by the Lagrange equation (or, that is equivalent, by the Hamilton equation). Both of these equations can be directly derived from the principle of least action (PLA). This means that the enmorphya of the relation of any *macroscopic* system is always the PLA.

Since a series of *average* values is always deterministic, the decision as to which opportunity to take in the next step of time, i.e. what the near future of such systems will be, is made by a deterministically specified algorithm. This includes also the situation when the decision criterion is a probabilistic parameter (e.g. route calculation by a navigation system).

The determinism of the decision-making algorithm results in absolute freedom of action and complete lack of freedom of choice.

The past of *macroscopic* systems affects their future solely through their present, as such systems represent simply a special case of *truly-stochastic* systems. That is, *macroscopic* systems also do not have direct "memory" of previous states: the subsequent state deterministically depends only on the current state.

Thus, we come to the conclusion that for *macroscopic systems with self-governance*:

Parameter	Parameter‘s value
stochasticity type of relation in the respective existential triad	*true stochasticity,* i.e. it is based on a regular Markov process, hence the absence of direct "memory" of previous states; the past influences the future only through the present of these systems (the phenomenon of physical dispersion; it can be considered as mediate "memory"). is observed as a *deterministic* process.
the law, to which this relation statistically obeys, i.e. the "enmorphya of relation" of the system created by given existential triad	Hamilton’s principle of Least Action (PLA) (equivalent to the principle of most entropy); The PLA as the enmorphya of any interaction within the *truly-stochastic* systems is non-variable, see Chap. 2.5.1 above; The PLA represents merely a specific case of the principle of least resources consumption (PLR), see Chapter 2.3 above.

c) living systems

A distinctive feature of *living* systems is (within our consideration) that

- They reflect on some of the possible future states, including with respect to themselves (as macroscopic systems with self-governance), and
- The relations / interactions in these systems are based not on the *deterministic*, but on the *quasi-stochastic* process, i.e. the process not described by regular Markov chain (see Chapters 2.5.2 and Glossary).

This means that the decision as to which opportunity to take in the next step of time, i.e. what their near future will be, has non-deterministic, but quasi-stochastic character.

As we have already discussed in Chapters 2.4 and 2.5.2 and will repeat it here in the light of the new understanding, unlike *truly-stochastic systems, quasi-stochastic systems* do not have an automatic, to these systems immanent 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 directly, 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 therefore 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. Following the principle of Self-Preservation of System (PSP) includes stabilising feedback mechanisms within the system itself, see Chap. 2.4.

Non-deterministic, namely quasi-stochastic decision-making determines a certain freedom of choice and limits the freedom of action.

However, this

STM. 11:

certain freedom of choice, the opportunity of local deviation of the *quasi-stochastic* process from following the PLR is actually the free will.

Thus, quasi-stochastic decision-making is based on the realization of free will (freedom of choice) of the *substrate* of the respective system. The free will is also subject to the Principle of Least Resources Consumption (see **STM. 5** above), but only on statistically long intervals and on statistically large amount of the system's *substrate*. Specific mechanisms to implement the relation / interaction between systems with free will are, for example, social mechanisms.

In Chapt. 2.5.2, we have already mentioned[49] 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[50]". In other words, it is "the diversifying of the process of interaction between material and ideal objects" that is the *system-constituting concept* of living system, see also Chapters 2.2 and 2.6 above.
However, "the diversifying of the process of interaction between material and ideal objects" is actually based on quasi-stochastic decision-making about what exactly the opportunity to use, in other words – on the free will.

As we have already defined in Chapt. 2.4, the enmorphya of relation of any *quasi-stochastic* system always includes the principle of least resources consumption and the principle of self-preservation of system (**STM. 6**). In addition, *quasi-stochastic* systems must have an direct "memory" of previous states.

[49] see [11], chap. 1.
[50] 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.

Thus, we conclude that for *living* systems:

Parameter	Parameter‘s value
stochasticity type of relation in the respective existential triad	*quasi-stochasticity,* i.e. the regular Markov process is **not** the basis; hence, the presence of direct "memory" of previous states.
the law, to which this relation statistically obeys, i.e. the "enmorphya of relation" of the system created by given existential triad	The principle of Least Ressources Consumption (PLR), see Chap. 2.4 above; The principle of Self-Preservation of System (PSP), see Chap. 2.4 above; PLR and PSP, as components of the enmorphya of interaction within *quasi-stochastic* systems, shall have variable characteristics, see Chapters 2.5.2 and 2.6 above.

d) Human being as a system

Distinctive feature of the *human being* as a living system: the human has all the above properties of a living system and in addition to them he reflects on a part of possible (future) states, which include both the world surrounding the human and the human himself, including his or her own finitude as a system.

So for *human being* as a system:

Parameter	Parameter‘s value
stochasticity type of relation in the respective existential triad	*quasi-stochasticity,* i.e. the regular Markov process is **not** the basis; hence the presence of direct “memory” of previous states **plus** the reflecting on a part of possible (future) states that include both the world surrounding a person and his or her own finitude as a system.
the law, to which this relation statistically obeys, i.e. the "enmorphya of relation" of the system created by given existential triad	The principle of Least Ressources Consumption (PLR), see Chap. 2.4 above; The principle of Self-Preservation of System (PSP), see Chap. 2.4 above; PLR and PSP, as components of the enmorphya of interaction within *quasi-stochastic* systems, shall

Parameter	Parameter's value
	have variable characteristics, see Chapters 2.5.2 and 2.6 above.

When comparing these four types of systems discussed above, it is striking that there is a similarity between microscopic (quantum) and living systems with respect to the non-deterministic decision-making concerning which opportunity to take in the next step of time, i.e. what is their near future. At first glance, this is surprising. However, further reflection leads to the following thought.

Microscopic (quantum) systems have both freedom of choice (randomness) and freedom of action (necessity within the frame of the Principle of Least Action). This statement is true due to the truly-stochastic decision-making as to which alternative to take; but this decision-making always remains within the frame of the PLA (which is a particular manifestation of the Principle of Least Resources Consumption).

With the transition from microscopic to macroscopic (non-quantum) systems, the actually observed (measured) states of the ensemble of statistically large number of realized states of such systems take the most probable values, because fluctuations statistically compensate each other. The most probable values of the actually observed (measured) state of the ensemble are in turn deterministic and therefore predictable in accordance with the PLA, see [7], Chap. 2.6.
This determinism of macroscopic systems results in the absolute freedom of action and complete lack of freedom of choice for them. It can be said that such systems "pay" with freedom of choice for their macroscopic nature.
However, according to the Principle of Least Resources Consumption (the Principle of Most Entropy), Nature evolves in such a way that it produces as much entropy as possible, cf. [7], гл. 2.1.5. But deterministic states do not contribute to entropy production at all: therefore, Nature could not stop at creating macroscopic systems.

Then what is the role of living systems in this context? Living systems are on the one hand macroscopic (non-quantum dissipative) systems, and on the other hand non-deterministically, namely quasi-stochastically make decisions concerning which opportunity to take in the next step of time, i.e. what their near future will be.
It is non-deterministic, stochastic decision-making that contributes to entropy production and thus minimises the use of Nature's resources.
Living systems are thus a natural and expected element of Nature: they are **macroscopic systems that non-deterministically, namely quasi-stochastically decide** concerning which opportunity to take in the next step of time, i.e. what their near future will be, cf. chap. 2.5.2 above.
The further a living system is advanced on the scale of biologic evolution, the stronger this property of non-deterministic, quasi-stochastic decision-making is pronounced, and the more complex the feedback mechanisms stabilising a living system become.

3.2 Free Will

In Chapt. 3.1, **STM. 11** we have determined that certain freedom of choice, the opportunity of local deviation of the *quasi-stochastic* process from following the Principle of Least Resources Consumption is "free will". The free will is the freedom of choice that has a non-deterministic, namely *quasi-stochastic* character, but not representing a Markov process and directly taking into account, at least, all previous experience of the system.

The next question that arises in the discussion of this topic is whether the free will is equivalent to the freedom of choice or not? If they are equivalent, it is necessary to ascribe free will not only to living (*quasi-stochastic*), but also to microscopic (quantum), *truly-stochastic* systems, see Chapters 2.2 and 3.1. However, this would contradict the generally accepted understanding of "will" as a "consciously controlled" decision-making process.

Exactly this is the difference between non-deterministic decision-making by microscopic (quantum, *truly-stochastic*) and living (*quasi-stochastic*) systems:

- *Truly-stochastic* systems make decisions within the frame of the Principle of Least Resources Consumption (e.g. the Principle of Least Action) exclusively randomly, even if each current state of the system statistically depends on all its previous states (phenomenon of physical dispersion).
  As we have mentioned above, the past of the *truly-stochastic*, i.e. Markovian systems influences their future exclusively through their present: "true stochasticity" is precisely the absence of the direct "memory" of previous states: only the current state probabilistically determines the following state, cf. Chapters 2.3 and 3.1 a), b).
- Living systems make decisions within their given environment (physical, social) *non-deterministically*, namely, *quasi-stochastically, i.e.* not on the basis of a truly random process described by regular Markov chain. Quasi-stochastic decision-making depends both on the current state of living systems (e.g., their "mood", their momentary "desire") and on their previous states. *Quasi-stochastic* systems shall have direct "memory" of previous states, see Chapters 2.4 and 3.1, c), d).

It is very important to pay attention to the fact that the current state of the living system (it is a *quasi-stochastic* one) also depends on all its previous states, but not only through its present: a living system has the property of direct memory allowing its previous states to directly affect its current state.
It is exactly this direct dependence of the current state of a living system on all its previous states – this property of direct memory – that represents the non-compliance with the "Markov property", which consists in the absence of direct memory! Thus, due to the presence of direct memory, living systems are not Markovian, *truly-stochastic* systems, but represent *quasi-stochastic* systems, see Chap. 3.1 c), d) above.

If exactly this, "living" type of non-deterministic, but *quasi-stochastic* decision-making should be called “free will”, then the **STM. 11** can be re-formulated more “humanistically”:

STM. 12:

The free will is the freedom of choice having *non-deterministic*, namely, *quasi-stochastic* character and that takes into account, at least[51], all previous experience of the system.

As we have established in Chapt. 2.4, local *statistical* deviations of the *quasi-stochastic* process from the following PLR are statistically corrected, but this correction may occur not directly, but only through a large number of subsequent steps (states) of the system.
In light of this assertion, the free will is a means of practical realisation by a living system of a local, for example, temporal deviation from the PLR. By following the principle of self-preservation of system, the free will is simultaneously limited by stabilising feedback mechanisms within the living system itself, see examples in Chapters 2.4.1 and 2.4.2.

It should be noted that the freedom of choice is always non-deterministic, as it cannot be other by definition: determinism is not the freedom of choice, but the freedom of action.

The definition of free will, as given in **STM. 11** / **STM. 12**, applies only to living systems (they are always *quasi-stochastic*). Indeed: microscopic (quantum), *truly-stochastic* systems have a truly-stochastic, based exclusively on the regular Markov process freedom of choice, limited by the PLA and adequately balanced with the freedom of action, see Chapters 2.2, 2.3 and 3.1 a). Macroscopic (non-quantum, in the state of thermodynamic equilibrium) systems, being deterministic, have no freedom of choice at all, see Chapters 3.1 b).

We would like just to notice here that if we remove the restriction that "will" cannot be based on the true, Markovian statistical randomness, then we can give the following definition: *Free will is freedom of choice.* In this case, it would be necessary to "accept" the fact that microscopic (quantum) systems within the inanimate nature would also have “free will”.

What is the distinguishing feature of the free will of a human being from the free will of other living systems?
As we have seen in Chapt. 3.1 d), the distinctive feature of a *human being* in comparison with other living systems is that the human additionally reflects on a part of possible (future) states, which include both the world surrounding the human and the human himself, including his or her own finitude as a system.

[51] see further on the human STM. 13

Therefore,

STM. 13:

> **The distinctive feature of the free will of the human is that it additionally includes the result of his or her reflection on a part of possible (future) states, which include both the world surrounding the human and the human himself, including his or her own finitude as a system:**
>
> **The free will of the human is the freedom of choice that possesses *non-deterministic,* namely *quasi-stochastic* character and that takes into account**
> **- as all previous experience of the human,**
> **- as well as the result of his or her reflection on a part of possible (future) states, which include both the world surrounding the human and the human himself, including his or her own finitude as a system.**

This means that in decision-making, i.e. in the freedom of choice of the human, not only his states in the past (which determines the "non-Markovianity" of the process) are directly included, but also the self-reflection of possible future states that include both the world surrounding the human and the human himself, including his own finitude as a system.

We have called this phenomenon *uncertainty of possible (future)* or ***risk reflection***.

This risk reflection, the reflection of the future, has not only an direct, but also a secondary effect on decision-making, i.e. on the freedom of choice of the human, namely, when a person acts in the present primarily under the influence of "memory". For example, a person does not put his or her finger on fire again because he or she remembers that it hurt, and thanks to this memory, he or she reflects the risk in the future that there will be a repetition of pain.
Such influence on the present "from the future through the past" in terms of its intensity - 2^{nd} order of magnitude in comparison with the direct risk reflection. Such an additional, 2^{nd} order influence of the risk reflection on the present "from the future through the past", i.e. as an "overlay on memory", is another difference between the human and other living systems: the latter have no influence on the present "from the future" at all.

It is this feature - the additional inclusion in the free will of the human of the result of reflection of a part of possible (future) states - that makes the free will of the human the most pronounced, expressed, strong in comparison with the free will of other living systems: the latter include in the decision-making (in their free will) only their current state and their states in the past, which do not depend on their future states.

The "risk reflection", i.e. self-reflection by the human being of his or her future is the main and decisive distiniguishing characteristic of the human from all other living systems: this is his main species difference, cf. chap. 3.1 d).
We believe that "risk reflection" is the direct cause of *the existential angst* that is inherent in the human as a species[52].

[52] The fundamental literature on the topic "existential angst" is the works of Viktor Frankl, Irvin Yalom and Fritz Riemann.

There are a few more comments on the relationship between the mechanism of risk reflection and other frequently used notions.

1) Curiosity and thirst for knowledge

These notions are quite often mixed up in everyday life. They can, however, be quite clearly distinguished from each other:
- Curiosity (what is there, what has happened?) is always directed to already accomplished events, i.e. to the past.
- Thirst for knowledge (what will happen in the future, how will something end? etc.) is always directed at events that have not yet taken place, i.e. to the future.
This is the fundamental difference between these notions, though there are "overlapping zones" in their practical use.

Since thirst for knowledge is always directed to the future, it cannot exist without the reflection of future, i.e. without the mechanism of risk reflection. Thus, the mechanism of risk reflection is a necessary, but not sufficient condition for human's thirst for knowledge.
That is why, since the risk reflection is the main species difference of the human from other living systems, the property of "thirst for knowledge" cannot be inherent in any other biological species except a human being.

2) Intelligence (the property of being perceived by others as a person with intellectual capacities)[53]

The mechanism of risk reflection, i.e. reflection of uncertainty of a possible future, has at least two quantitative, independent of each other parameters that significantly affect the quality of implementation of this mechanism:
- the adequacy of reflection, i.e. to what extent the future predicted by this mechanism deviates from or coincides with the one that actually happened in this future; and
- the foresight of reflection, that is, how many steps forward this mechanism anticipates the future.
These two quantitative parameters of the risk reflection mechanism, like all other human properties, are pronounced in different individuals to different degrees.

We believe that the more adequate and farsighted risk reflection is pronounced in a given individual, the more intelligent this person seems to us. I.e., the person, who reflects risks by many steps forward in such a way that the course of events predicted by him or her coincides quite well with the events that have actually occurred, is perceived by others as an intelligent one. Good chess players should be regarded as intelligent people.

At the same time we do not forget that the free will of the human as a living system has the *quasi-stochastic* character and takes into account all previous experience of

[53] in the Russian version of this work we do not use the term "intelligent" as it has a different meaning in Russian than, for example, in German and English; we use there the term “умность” (quality of being seen by others as an intelligent human).

the human, and the risk reflection is an additional differentiating feature of the human, see **STM. 13** above[54].

A prerequisite for having a pronounced adequacy and foresight of the reflection of the future is pronounced analytical and synthetic thinking (these two properties of the reason are also independent from each other). The presence of these two properties of the reason is a necessary condition for successful learning, as well. Therefore, it can be expected that these two different features - adequacy and foresight of the reflection of the future, on the one hand, and successful learning, on the other hand - will be encountered in a given person in a similar degree.

In the context of “risk reflection”, it shall be noted that since the human possesses the strongest free will, he or she is able to deviate (and does it) from the optimal path, from the optimal decision-making (i.e., in continuous accordance with the principle of least resource consumption (PLR)) to the greatest extent, i.e., he or she can "go the most far" in his actions and decisions, in his inadequacy in relation to the current state of his habitat, cf. Chapters 2.4 and 2.5.2 above.

It should be noted that a statistically large number of decision-making (either by one subject for a statistically long period of time or by a statistically large number of subjects (living systems) also for a relatively short period of time) always leads to "optimization", i.e. is subject to the PLR. The further a subject "goes" in his actions and decisions, in his inadequacy (in the sense of deviation from the PLR) in relation to the current state of his living environment, the stronger, more dramatic is the correction of this inadequacy back "in the mainstream" of the PLR as a result of a statistically large number of decision-making. That is why stabilising feedback mechanisms are most important for the self-preservation of the single human as a system as well as of a society of humans as a system, cf. Chapters 2.4 and 2.5.2 above.

[54] Chess is a typical game where participants should have adequate and farsighted reflection. Should good chess players then be regarded as intelligent people? Not necessarily at all. Chess pieces move according to strict deterministic rules, and though a chess player may decide to make this or that move within the framework of these rules, every next "state" of the game directly depends only on its current "state" and does not depend directly on previous moves that led to this current "state". This property of chess means that the chess game represents a regular Markov chain, i.e. it is based on a truly-stochastic process (that is why modern computers can play chess at a high level). It means that in chess adequate and farsighted reflection does not supplement the quasi-stochastic decision-making process (the property of living systems), but the truly-stochastic one. Therefore, adequate and foresighted reflection in a chess game does not fall under the notion of "intelligence" as it is defined here.

3.3 Overview: Inanimated - Animated - Human

Based on the above, we will summarise the different types of systems considered in a single table:

	microscopic (quantum) systems, i.e. *truly-stochastic* (Markovian) systems	macroscopic (non-quantum, in thermodynamic equilibrium state) systems, i.e. *truly-stochastic* (Markovian) systems with *deterministic* actually observed (measured) states	simplest living systems (instincts / reflexes significantly prevail) *quasi-stochastic* (non-deterministic and non-Markovian) systems free will is weakly pronounced	advanced living systems (instincts / reflexes and free will are balanced with an emphasis on instincts / reflexes) *quasi-stochastic* (non-deterministic and non-Markovian) systems free will is pronounced on average	human advanced living system (instincts / reflexes and free will are balanced with an emphasis on free will) *quasi-stochastic* (non-deterministic and non-Markovian) systems with additional *risk reflection* (i.e. reflection of possible (future) states) free will is strongly pronounced
type of process implemented by the system	truly-stochastic process with "Markov property": every next state of the Markov system (Markov process) is probabilistically dependent only on its current state and does not depend on its previous states.	truly-stochastic process with "Markov property"; Actually observed (measured) states are perceived as the exclusively deterministic process.	quasi-stochastic process, i.e. stochastic process without "Markov property"	quasi-stochastic process, i.e. stochastic process without "Markov property"	quasi-stochastic process, i.e. stochastic process without "Markov property"

		Therefore, every next state is unambiguously, deterministically dependent on the previous one.			
enmorphya of interaction / relation	the principle of least action (PLA)[55] non-variative	the principle of least action (PLA) non-variative	the principle of least ressources consumption (PLR)[56] the principle of self-preservation of system variative	the principle of least ressources consumption (PLR) the principle of self-preservation of system variative	the principle of least ressources consumption (PLR) the principle of self-preservation of system variative
"memory"	no direct "memory" of previous states: only the current system state probabilistically determines its next state; the past of truly-stochastic systems affects their future only through their present (the phenomenon of	no direct "memory" of previous states: only the current system state determines its next state;	direct “memory” and "teachability", i.e. using previous experience for decision-making.	direct “memory” and "teachability", i.e. using previous experience for decision-making.	direct “memory” and "teachability", i.e. using previous experience for decision-making.

[55] The PLA is a special case of the principle of least ressources consumption (PLR) for truly-stochastic processes.
[56] The PLR and the principle of most entropy are equivalent to each other.

	physical dispersion; it can be considered as mediate "memory").				
risk reflection	-	-	-	-	<u>In addition</u> to memory, the inclusion in decision-making of the result of reflection of a part of possible (<u>future</u>) states that include both the world surrounding the human and the human himself, including his own finitude as a system, i.e. ***risk reflection***.
free will	is missing because of the truly-stochastic process without direct "memory"	is missing because of the absolute freedom of action (each next state is unambiguously, deterministically depends on the previous one)	free will, i.e. local deviation from the PLR, is <u>weakly</u> pronounced (weak direct influence of the past on the present). limited by following the PSP (the priciple of self-protection of system) stabilising feedback mechanisms are important.	free will, i.e. local deviation from the PLR, is pronounced <u>on average</u> (direct influence of the past on the present). limited by following the PSP (the priciple of self-protection of system) stabilising feedback mechanisms are <u>relatively</u> important.	free will, i.e. local deviation from the PLR, is <u>strongly</u> pronounced (weak direct influence of the past and <u>future reflections</u> on the present). The well-pronounced free will can take a person far enough in his actions and decisions, in his inadequacy in relation to the current state of his habitat.

					stabilising feedback mechanisms are particularly important.
observed system behaviour	truly-stochastic, i.e. regular Markov process	deterministic process	may be perceived as a deterministic process	not perceived as a deterministic process	not perceived as a deterministic process
type of decision-making	non-deterministic, truly-stochastic decision-making within the framework of the principle of least action	There is no "decision-making" as such (the so-called deterministic "decision-making")	Non-deterministic, but quasi-stochastic decision-making within the limits set by the PLR (free will) and the PSP decision-making can be perceived as deterministic	Non-deterministic, but quasi-stochastic decision-making within the limits set by the PLR (free will) and the PSP decision-making is perceived as relatively non-deterministic	Non-deterministic, but quasi-stochastic decision-making within the limits set by the PLR (free will) and the PSP decision-making is perceived as non-deterministic
the ratio of “the freedom of choice” and “the freedom of action”	freedom of choice (true stochasticity) within the limits of the freedom of action set by the PLA	freedom of action as set by the PLA, no freedom of choice	the dominance of the freedom of action (instincts / reflexes) over the freedom of choice (free will)	freedom of choice (free will) and freedom of action (instincts / reflexes) are pronounced in approximately the same degree	through the risk reflection, i.e. the reflection on possible future consequences: more pronounced freedom of choice (stronger free will) may prevail over the freedom of action (instincts / reflexes)

4 Conclusion

4.1 Animate or Inanimate: Practical application of system approach

Let us return to the question that we posed in the Introduction to this work: What is a virus, then - animate or inanimate?

To answer this question from the point of view of the system approach developed here, let us present viruses (and prions) as a system:

- The system-costituting concept of viruses and prions is their own reproduction;
- The structural factor is the character of intermolecular interaction within the DNA or RNA of a virus or within the protein of a prion;
- The substrate is amino acids that make up the DNA or RNA of a virus or the protein of a prion.

Does this system meet the criterion for living or non-living? For an answer to this question let us refer to Chapter 3.1 above.

Since viruses and prions as systems are nothing more than amino acid molecules that interact with each other and with the environment solely through physical intermolecular interaction, this means that viruses and prions implement the Markov process and are therefore truly-stochastic systems. The enmorphya of this interaction - the principle of least action - is non-variative.

Consequently, viruses and prions merely satisfy the criteria for an inanimate system, cf. Chap. 3.1, a).
We can say that viruses and prions as the inanimate are simply chemical substances (harmful or useful or neutral) that are reproduced by the host cell.

Let us now apply a similar approach for bacteria (prokaryotes).

Let's think of bacteria as a system:

- The system-constituting concept of prokaryotes is metabolism and their own replication (binary fission); prokaryotes have various types of metabolism, thus contributing to "the diversifying of the process of interaction between material and ideal objects";
- The structural factor is the character of interaction between cell organelles,
- The substrate – prokaryote's organelles (e.g. capsule, membrane, ribosomes, mesosomes, DNA, flagellates).

Does this system meet the criterion for living or non-living? For an answer to this question let us refer to Chapter 3.1 above.

Bacteria as a system are nothing more than the aggregation of prokaryotic organelles that interact both among themselves and with the environment[57]. The control of this interaction is not the same for all types of prokaryotes, but depends on a particular type of bacteria. This means that the enmorphya of the interaction for bacteria is not constant, but variative, which in turn means that bacteria are quasi-stochastic systems.

Therefore, bacteria meet the criteria for a living system, cf. Chapters 3.1, c), but not for humans.

One of the most particular organelles of eukaryotes is mitochondrion, whose system-constituting concept is the production of adenosine triphosphate (ATP) and its own replication. ATP is used by eukaryotes as an intracellular energy source.
Mitochondria themselves possess all the major prokaryote organelles, including their own mtDNA and ribosomes. Mitochondria are replicated by binary fission.
Since mitochondria do not differ from bacteria in terms of our developed system approach, mitochondria themselves are living, i.e. a living eukaryote cell contains living mitochondria!

4.2 Animate or Inanimate: Theoretical value of system approach

Let us now return to the theoretical question that we posed in the Introduction to this work: what does distinguish the inanimate from the animate from the *system* point of view on the one hand, and human being as a particular species of the animate from all other living - on the other?

A detailed overview of these differences is provided in the table in Chapter 3.3 above. Here we will only give a brief overview of the differences found.

As part of our study of this issue from the *system* perspective, we have come to the following conclusions:

1) Any system, both inanimate and animate, is always a stochastic, i.e. non-deterministic system. This means that any system implements a stochastic process in relation to the flow of time.

2) The systems of *inanimate* Nature are truly-stochastic, i.e. they implement the so-called "Markov process", see Glossary below. Their temporal evolution is continuously subject to the Principle of Least Action, so such systems do not have "free will". Such systems also do not possess the property of direct “memory”, because only the current state of the system probabilistically determines its next state. The past of truly-stochastic systems influences their future only through their present (the phenomenon of physical dispersion; it can be considered a mediate “memory”).

   Macroscopic systems of inanimate Nature are a special case of truly-stochastic systems with *deterministic* actually observed (measured) states. The reason for this feature of such systems is simple: stochastic deviations (fluctuations) compensate themselves mutually and the actually observed (measured) states remain only the average, expected values of states.

[57] only some organelles interact with the environment, e.g. plasma membrane (metabolism), flagellates (mechanical movement).

3) The systems of *animate* Nature are *quasi-stochastic*, i.e. they do not implement the "Markov process", see Glossary below. Their temporal evolution is subject to the principle of Least Resource Consumption (PLR), but only on statistically long intervals and on statistically large amount of the system's *substrate.* Locally, by contrast, their temporal evolution deviates from the PLR. This is why such systems possess "free will". Significant local deviations in the temporal evolution of such systems from the PLR can destroy these systems as such. Following the principle of Self-Preservation of System (PSP) stabilises such systems through feedback mechanisms.
   Such systems also have the property of direct “memory” and the property of "teachability", since the next state of such systems is probabilistically and directly determined not only by their current state, but also by the previous states of these systems, i.e. such systems use the previous experience for making decisions.

4) The human, as a system of the *animate* Nature, naturally possesses all the properties listed above. He as a system, however, also has additional properties that distinguish the human from all other living systems.
   In addition to "memory" and "teachability", the human being includes in decision-making the ***risks reflection*** (see Glossary), i.e. the result of reflection of a part of possible (future) states that include both the world surrounding the human and the human himself, including his own finitude as a system.
   We believe that ***risk reflection*** is a direct cause of *existential angst* inherent in human beings as a biological species.
   Due to the ***risk reflection*** (direct influence of the past and of the future reflection on the present), the human free will, i.e. local deviations from the PLR, is strongly pronounced. The well-pronounced free will can take a person far enough in its actions and decisions, in its inadequacy in relation to the current state of its habitat.
   However, the further a subject goes in his actions and decisions, in his inadequacy (in the sense of deviation from the PLR) in relation to the current state of his habitat, the stronger, more dramatic is the correction of this inadequacy back "into the mainstream" of the PLR as a result of a statistically large number of decision-making. That is why stabilising feedback mechanisms are most important for self-preservation of the human as a system.

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[58]	apriori given system-constituting *property* or *relation*; dependent on this, system-constituting concept is *attributive* or *relational* one, resp.
structural factor[59]	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[60]	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.

[58] the original term by Uemov: ‘системообразующий концепт’
[59] the original term by Uemov: ‘структурный фактор’
[60] 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[61]. For example, for physical systems the "resource" is the number of action quanta necessary to transition the system to another given macroscopic state[62]; 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 deviation of the system from following the principle of Least Resources Consumption is limited by the

[61] 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.

[62] 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
	fact that the system-constituting concept of this system remains stable. The principle of Self-preservation of System is valid for any 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 feedback within the system itself.
the principle of most choice	the principle of minimizing the restrictive factors on the opportunities of making decisions, the principle of maximizing the freedom of choice. It is the principle of most choice as one of the characteristics of the self-awareness of living beings that leads to their flexibility, adaptability to various conditions of existence.
enmorphya[63] *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 material substrate, whereas ‘enmorphya’ interacts with the relation, process between this ‘information’ and this material substrate.
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 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.

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

Term	Definition
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 direct "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 direct "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 and the same attribute, and, hence, can be defined by using another item of the population.

Term	Definition
	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. 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.

Term	Definition
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.
enmorphotype (of a person)	set of all attributes of the enmorphya of self-awareness of an individual interacting with both his/her genotype and his/her phenotype.
free will	The free will is the freedom of choice, which is non-deterministic, but does not represent a Markov process and takes into account at least all previous experience of the 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. The decision-making process.
risk reflection (by human being) (uncertainty of possible (future))	Inclusion in decision-making, i.e. in the freedom of human choice, a self-reflection of possible future states that include both the world surrounding the human and the human itself, including its own finitude as a system.

6 References

[1] Jean-Paul Sartre *Das Sein und das Nichts*, Rowohlt, 1985[64]

[2] Уемов А.И. *Системные аспекты философского знания*, Одесса, 2000[65]

[3] M. Heidegger *Sein und Zeit*, 19. Auflage, 2006[66]

[4] N. Luhmann *Einführung in die Systemtheorie*, 6. Auflage, 2011[67]

[5] I. Furgel *Being and Systemacy*, 4th edition, Deutsche Nationalbibliothek, https://d-nb.info/121247628X/, 2020.

[6] I. Furgel *Cognition and Knowledge*, second edition, Deutsche Nationalbibliothek, http://d-nb.info/1142648249, 28.10.2017.

[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] A. 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)[68]

[9] E. Kretschmer *Körperbau und Charakter*, 5th and 6th edition, published by Julius Springer, 1926 (1st edition - 1921)[69]

[10] Jung C.G.: *Die Archetypen und das kollektive Unbewußte*, aus C.G. JUNG Gesammelte Werke, Neunter Band, Erster Halbband, herausgegeben von: Lilly Jung-Merker und Dr. phil. Elisabeth Rüf, Sonderausgabe 5. Auflage 2011, 1995 Patmos Verlag der Schwabenverlag AG, Ostfildern[70]

[11] I. Furgel *Die Sparsamkeit der Natur und die Stabilität der Gesellschaft*, Deutsche Nationalbibliothek, http://d-nb.info/1174654813/, 02.01.2019[71]

[64] Jean-Paul Sartre *Being and Nothingness*, Rowohlt, 1985
[65] A. Uemov *Systems Aspects of Philosophical Knowledge*, Odessa, 2000
[66] M. Heidegger *Being and Time*, 19th edition, 2006
[67] N. Luhmann *Introduction to Systems Theory*, 6th edition, 2011
[68] A. Markov *An example of a statistical study of the text of "Eugene Onegin" illustrating the connection of trials in a chain*, report in the Izvestia of the Imperial Academy of Sciences of St. Petersburg, series VI, volume VII, issue 1, 1913 (pp. 153-162)
[69] E. Kretchmer *Physique and Character*, 5th and 6th Edition, Julius Springer Publishing House, 1926. (1st edition - 1921).
[70] Jung C. G.: *The Archetypes and the Collective Unconscious*, from C. G. JUNG Collected Works, Ninth Volume, First Half Volume, edited by: Lilly Jung-Merker and Dr. phil. Elisabeth Rüf, Special Edition 5th Edition 2011, 1995 Patmos Verlag der Schwabenverlag AG, Ostfildern
[71] I. Furgel *Economicalness of Nature and Stability of Society*

[12] I. Furgel *Psychological Types: The Continuation*, Deutsche Nationalbibliothek, http://d-nb.info/1209003104, 25.04.2020.

[13] *Экономия в языке и коммуникации*: Сб. статей / сост. и отв. ред. Л.Л. Федорова, М.: РГГУ, 2018, ISBN 978-5-7281-2190-9[72]

7 Acknowledgements

I would like to express my deep gratitude to my wife Irina for our extremely useful and interesting discussions on certain aspects of this topic. I would also like to express my deep gratitude to my university professor of philosophy Avenir I. Uemov for his invaluable participation in shaping my style of interaction with the world.

[72] *The Economy in Language and Communication*: Collected Articles / edited by L.L. Fedorova, Moscow State University, 2018