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Some fundamental principles of living systems' functioning and their impact on human psychological systems

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Abstract: This theoretical article provides a brief description of the model of living systems' functioning by defining them as resource flows patterns. It reviews the living systems growth limitation between their development cycles by the Fibonacci sequence. Besides, there are presented systems resource base criteria, necessary for accumulating the resources and their investment. The article also considers the conditions for the formation of various systems strategies. Then we reviewed the principles of elemental analysis of information by a person as a living system according to the considered model. The study also shows the possibility of forming priorities in analyzing information for 16 combinations as maximum. At that, it remains crucial to divide a human's information analysis between the two hemispheres of the brain. The described combinations of priorities in a person's information analysis are compared with the existing differential personality models, such as the big five personality traits, the Myers-Briggs type indicator, temperaments model and Honey and Mumford Learning styles.

Keywords: living systems; the Fibonacci sequence; systems strategies; a human's information analysis; the two hemispheres of the brain; differential personality models

1. Introduction

Before studying a human, it is essential to determine what a human is and his aim according to the model reviewed in this article. At that, we should research not so much the complex of current expressions of human existence as the characteristics of the environment a person originated. To do that we have to introduce several concepts that will form the base of our further study presentation. Let us start by describing the conditions from which the environment was developed according to our model.

In some models it is considered that after the Big Bang, the process of disintegration of dense bundles of energy – including stars – began [1], but it was uneven. With the collapse of massive stars, the smaller ones that have also been decaying slowly, and planets that consisted of many chemical elements distributed unevenly appeared. These processes resulted in uneven flows of various matter and energy in space. In such flows, recurring patterns could emerge, including the sequences of chemical elements expanding by attracting similar chemicals, reproducing themselves in the environment, so-called living systems. Over time, a part of them develops more efficient mechanisms of self-replication due to random variations. Such kind of chemical elements' sequences will better spread themselves in space. The more their quantity and the wider they spread, the higher the possibility that various random variations will happen and that new and more efficient mechanisms will emerge. If the environment is inhomogeneous enough, sequences' self-replication algorithms evolve due to chaotic variations, increasing chemical diversity and the number of replication stages [2]. Along with that, the specialization of various parts of such molecular combinations also grows. Meanwhile, the described objects are remaining just patterns in flows of matter and energy, spreading in space just because of a greater possibility that copies of a particular set of elements emerge if there are enough resources for their self-replication.

Furthermore, in addition to moving around in space by external forces, such sets of chemical elements increase their structure's complexity to the extent they develop means to move in environment independently and analyze it to improve the probability to find new resources.

NASA uses the following definition of life: "Life is a self-sustaining chemical system capable of Darwinian evolution" [3]. According to our model, we will consider all forms of life, or systems, as recurring patterns in uneven flows of matter or energy. Besides, we believe that such systems evolve through random processes.

It is worth to point out several critical stages of the evolution of life. One of them is related to a high concentration of living objects. Under such conditions, organisms acquire an ability to use other organisms as resources instead of consuming primary sources. Other organisms are more complex resources, for this reason, they often are more effective to use. As a result, that requires performing a more complex analysis of the environment to identify its chemical structure and recognize individual objects. Another critical step is that the organisms considered by others as resources develop the instruments for self-protection. Such a result of evolution does not bring resources directly but allows extending the average lifetime, which increases the probability of self-replication.

One more stage that deserves to be mentioned is the emergence of coordination between several organisms of the same or different species to exercise more effective interaction with the external environment. That requires additional analysis of the external objects' behavior. As a result, new derivative patterns appear in resource flows due to repeated serial and parallel combinations of living organisms. Finally, the next critical stage of evolution that is a natural extension of the previous one is creating algorithms for changing the environment's structure to optimize the interaction with it. An example of such actions could serve various types of nests and other dwellings, stock creation and trap-buildings and devices such as web building of spiders and pit building of ant lions [4].

Living systems, starting with molecules, use several types of resources for its functioning. Thus, to increase the possibility of obtaining each of them, a living system has to use several other resources that form a single complex resource, or in other words, a complex of resources. Therefore, that is how redistribution of resource flows occurs in space through systems.

2. Fundamental principles of living systems functionality

A system is considered as any regular interaction between complex resources. Such interactions in a system are not totally symmetric and depend on the mutual distribution of resources in the environment where that particular system exists. Thus, let us introduce two main parameters on which such interaction depends. The first one is H : it indicates each resource source's intensity or the amount of resource received in the result of each interaction. The second is F : it represents the density of resources or the probability of interaction with a resource's source within one cycle.

Each interaction exchanges two types of resources; however, such resources are often complex and depend on several more plain resources. Both parameters mentioned above are relative, so it is convenient to assess them regarding the counter resource parameters.

In practice, interaction in a system of two flows of resources with equal parameters is impossible. That means that one of the resources is always excessive to support one interaction, due to either frequency or intensity. Such a resource is invested in the interaction of resource flows that exceed the volume required to recover the counter resource volume obtained within one interaction.

Then, in a case of two interacting resource flows, defined as n and k , it is convenient to use two indicators to characterize their correlation – the ratio of their quantities, that is S_n , defined by:

$$S_n = (H_n \cdot F_n) / (H_k \cdot F_k) = (H_n / H_k) \cdot (F_n / F_k), \quad (1)$$

and A_n , defined by the formula:

$$A_n = (H_n / F_n) / (H_k / F_k) = (H_n / H_k) \cdot (F_k / F_n). \quad (2)$$

If $S_n > 1$, then the resource n is excessive, and vice versa. The essentiality A_n shows in which of two resource flows the intensity of resource's source makes a more significant contribution to the exchange process than their frequency. When $A_n > 1$, the intensity is more important for a resource flow n , and vice versa. It is convenient to define S_n as a relative excess of resource n , while A_n is its relative essentiality.

When $S_n > 1$, then excessive resource n is invested to increase the resource flow k , passing through a system. If $A_n > 1$, then more essential resource n is accumulated in a system to maintain further interactions of resource flows. It must be noted that parameters S_n and A_n are quite independent. Thus, an excessive resource could be essential and therefore requires accumulation.

When interacting with resource k that is scarce but frequently encountered in small amounts, more essential but intensive resources n and accumulations are invested in changing the infrastructure of interaction with resource k to increase its intensity. And vice versa, when interacting with scarce and essential resource k , excessive and less important resources n right after being obtained are sent to expand the infrastructure of search of more useful resources k to increase the frequency of interaction with them. In this case, resources k are subject to accumulation. Relative distribution of resource flows determines the direction in which system will develop, which is extensive outward or intensive into the system itself.

Thus, the permanent core of a system (resource exchange node) is formed by accumulated essential resources that are scarce or excessive that constantly passing through themselves less essential and simpler resources, regardless of their redundancy or insufficiency for interaction. That is the way a living systems' structure works as patterns in resource flows. That is the way the structure of living systems works as patterns in resource flows. Roughly, it could be said that accumulated essential resources represent an "inner" part of a system. In contrast, more common resources that are constantly flowing through their structure constitute an "external" part. Such division is not entirely correct, since all interacting flows compose that system's structure regardless of their accumulation. Nevertheless, such a division is convenient for the brevity of description.

Lets display these relative parameters on a graph on coordinates of relative intensity and frequency (Figure 1). In that case, both interacting flows' parameters will correspond to the opposite quadrants formed by S_n and A_n lines.

The ratios $H_n / H_k = 1$ and $F_n / F_k = 1$ are also important threshold values. They show how much priority one of the resources flows has in forming a system's structure. Depending on S_n and A_n parameters, either $H_n / H_k > 1$ or $F_n / F_k > 1$ show that resource flows n are of higher priority for a system in terms of the evolution of its structure. With that, resource flows k are formed in a system more depending on the structure of resources sources n . Thus, according to their relative characteristics, it is convenient to refer the resources of living systems not only to the opposite quadrants formed by the lines $A_n = 1$ and $S_n = 1$, but to the opposite octants which formed by additional lines $H_n / H_k = 1$ and $F_n / F_k = 1$.

Now let us introduce the concept of a system development cycle. In the context of our model, it means the time between two interactions with a source of accumulated essential resources. This period is essential since, after each interaction with sources of an essential resource, a system not only accumulates it but also creates a structure on its basis, which it uses then while interacting with the counter flow of resources. However, the growth of living systems is limited to its specific maximum rate. Let us define it.

When two resource flows interact in a system, the amounts of these resources should be approximately equal. The equation of the number of resources n and k we will define as follows: the amount of resource n equal to $E_n = H_n \cdot F_n$ corresponds to the amount required to maintain the counter flow of resource k in the amount of $E_k = H_k \cdot F_k$ needed to keep the flow of resources n in an amount E_n . In this case, the condition $E_n = E_k$ must be satisfied. However, such an equation cannot be maintained at each particular moment since the exchange of resources is uneven due to the inequality of resource flows' parameters.

As mentioned earlier, excess resources flowing through a system during a specific cycle are invested in developing the system and acquiring more scarce resources. Thus, the system seeks to equalize resource flows. It should be noted that the system interacts only with that amount of resources for which a corresponding structure exists in that system. The system does not use the rest of the resources. That means that they do not flow through it. At each period, resources flow through the system in the amount for which there is a structure in it. Therefore, for the "excessive" amount of one of the resources that are still participating in the exchange, for example, n , the structure also exists at each period.

The amount of excess resource n available at the beginning of the cycle i equal to $E_n(i)$ is invested in the growth of the counter resources flow, which normally should result in a corresponding increase in resource k . However, it will be impossible to proceed increment by the beginning of the next cycle, since the amount of resource flows at the beginning of cycle $i + 1$ corresponds to the structure at the beginning of cycle i . The new structure obtained from investments in cycle i will appear only by the beginning of cycle $i + 1$. Therefore, the resource flows growth at its expense is possible only by cycle $i + 2$ beginning. At that increase in the amount of resource k corresponding to resource n investment in cycle i will appear only at the beginning of cycle $i + 2$. Then we have

$$E_k(i+2) - E_k(i+1) = E_n(i), \quad (3)$$

or

$$E_k(i+2) = E_k(i+1) + E_n(i). \quad (4)$$

The inverse expression is also true

$$E_n(i+2) = E_n(i+1) + E_k(i), \quad (5)$$

since the new amount of resource k is directed to create a new structure to obtain resource n , that will also give the result only after one cycle.

Then the total amount of resources flowing in the system at the beginning of cycle i is defined as

$$E(i) = E_n(i) + E_k(i) = E_n(i-1) + E_k(i-2) + E_k(i-1) + E_n(i-2) = E(i-1) + E(i-2). \quad (6)$$

That results in that the structure of living systems in norm grows at a rate corresponding to the Fibonacci sequence that is confirmed by multiple examples from nature [5, 6].

We have one more issue that should be considered when speaking about the fundamental principles of living systems functionality before analyzing humans' example. That is the resources themselves that are exchanged in the complex living systems. As mentioned above, with a sufficiently high evolution level, the two systems

develop ways to coordinate actions between several individuals. Over time, complicating the system, they create a large one with various individual participants' specializations. A good example is a living organism composed of individual cells and a group of social insects or animals. In such groups, the main part of resources exchange taking place in living systems that are part of them is an exchange between the complex of resources that the living system itself can obtain and the complex of resources that the living system can receive with the help of the group. They could be roughly divided into physical and social. Further, considering humans' case, we will define such resources as "physical" and "social". It is a rough division, and we use it only for the brevity of description.

According to the proposed model, these are the fundamental principles of living systems' functionality that could also be applied to humans. Now let us consider some of the particular features of human functioning as a living system.

3. Basic principles of human functioning as a living system

Simple living systems use relatively primitive reflex-based instruments to analyze the environment. However, with evolution, more sophisticated analytical tools based on experience and modelling are increasingly used to analyze the environment instead of simple reflexes. The most advanced organisms have two main analytical centers that significantly increase interaction efficiency with the environment. Humans having two cerebral hemispheres also belong to such living systems.

The two hemispheres of the brain functionally represent two quite independent computing centers. Let us make assumptions about what they are needed for.

They are often called "logical" and "imaginative", or according to Kahneman, they represent a slow and a fast system [7]. Like most similar sufficiently advanced living systems, including social systems of multiple people, a human requires long-term planning and prompt response to current events. It is impossible to perform complex calculations through logical associations to ensure quick reaction. It is more effective to do a simple search in memory for analogues to determine whether similar images are associated with positive or negative events and what actions were usually performed in such situations. This is a rough description of how the right "imaginative" hemisphere works to ensure quick reaction "here and now". In other cases, there is time for structuring information and analyzing the logical connections between its components. Among them are questions of low importance for the current situation, which is basically the system's medium and long-term strategy. Since it is more efficient to separate these two types of information processing at the hardware level (or at the analytical centers level), one common organ is not sufficient. For this reason, among others, two computing centers are required, that is two hemispheres.

Herewith, if we consider the specifics of work from the point of the analyzed information, then for the right "imaginative" hemisphere is vital to have a variety of information to expand the range of situations in which a prompt reaction is possible. This is possible in the case of interaction with resources with relatively numerous sources. Then it is required to choose the most suitable ones. At the same time, logical connections are essential for the left hemisphere to plan the achievement of goals, which is required only for resources whose sources are relatively more essential, and therefore need an increase of the probability of interacting with them. Thus, the left hemisphere primarily analyses the environment's components related to relatively more essential resources at $An > 1$. Accordingly, for the cases related to the right hemisphere's specialization, the indicator is $An < 1$.

It is also more efficient to use different processing centers that are the brain's hemispheres for separate control of two directions. The first one is a) investing relatively excess resources in obtaining relatively less available resources, and the second is b) developing interaction with relatively excess resources themselves by structuring relatively less available ones. It will be convenient to define these processes as a)

"extraverted" and b) "introverted". The first ones are aimed at changing any parameters of "external" resources by investing "internal" ones, and the second ones are aimed to adapt to the parameters of "external" for better compliance. "Extroverted" processes correspond to the condition $S_n > 1$, and vice versa, "introverted" ones correspond to $S_n < 1$.

Finally, the third and last parameter of our model that should be mentioned is the difference between "physical" and "social" resources among the objects with which a human interacts. The "physical" in general retain their qualities over time, while the "social" objects are associated with other people that is with subjects that have qualitatively less permanent functions. This means that it is possible to build static models for "physical" objects during analysis, but for "social" objects is required modelling based on some complex functions. However, the variety of "physical" objects considered constant by their characteristics is available in greater numbers, although their analysis is more superficial. That is, such division also requires a significantly different way of information structuring. That is also much more efficient with two considerably autonomous processing centers, or cerebral hemispheres.

Other ways of separating information are possible, not only into two types but also into more; however, the separation options described above are crucial for systems' effective functioning [8].

At the same time, we did not consider the physiological resources accumulated in a human body as in a node of their exchange. The reason is that although it depends on it, the exchange of simple resources proceeds at a more primitive level than the one, which requires the analysis of the environment, considered in this article. In our turn, we examine the exchange of more complex resources, including those exchanged in a human body as in a system.

Thus, we considered three pairs of parameters the control over which is favorable to divide between two hemispheres of the brain. It would be appropriate to consider how these parameters are divided between the hemispheres, besides operational and strategic information principle. The mechanism of the latter ones works under clear criteria and has already been described above.

"Extraverted" and "introverted" processes of a human as of a system correlate during a person analyze information. Therefore, they correspond in human actions with "physical" and "social" resources, depending on their relative redundancy. However, the ratio of these resources differs for each person. For this reason, the analysis of the processes associated with them cannot be so strictly divided between "extraverted" and "introverted". Likewise, due to the inevitable differences in a person's information environment concerning "physical" and "social" volumes, the analysis of relevant information cannot be divided in advance between the cerebral hemispheres.

Depending on which resource relatively more excess, "physical" and "social" resources sources, it will be determined which resources will participate in "extraverted" processes, and which ones in "introverted" ones. Along with that, how much more essential are the sources of "physical" and "social" resources, that is, information about which kind of resources requires a more structured analysis will affect the distribution of the cerebral hemispheres in the processing of relevant information. Thus, the fact in which of two quadrants formed by the lines S_n and A_n the human brain will work is determined by the rate of essentiality the sources of relatively excess resources. And the way the analysis of "physical" and "social" resources is distributed between these quadrants is determined by how the flows of these resources relate to each other in terms of essentiality and redundancy.

As we can see, there are several combinations in dividing information analyzed by a person between the hemispheres of a brain, depending on the parameters of the environment at the beginning of ontogenesis. For instance, let us assume the situation when relatively scarce resources coincide with relatively more widespread resources, for which the right hemisphere, which is more useful in direct activity is responsible. Then, one can expect that a person will show signs that are characteristic of "introverts". That

is, in short-term situations, he or she will be more adaptive and vice versa. Moreover, if these resources are "physical" resources, then, at first, a person will probably adapt to the current physical conditions. In the opposite case, a human will adapt to the needs related to the social environment's requirements at the moment.

As in the case of other living systems, important threshold values are the ratios $H_n / H_k = 1$ and $F_n / F_k = 1$, showing in the case of a person how much the structure of one of the resources has priority in the formation of the structure of the analysis of all information.

After describing the basic principles of combinations of analytical accents of a person as a living system, it should be briefly clarified which combinations could be formed according to this model.

3. Development of human information analysis mechanisms

According to our model, we have considered above that the combinations of analytical accents between the brain's hemispheres depend on the relative distribution of resources used by a person. Although the characteristics of resources are not constant, the analytical mechanisms cannot be reformed depending on a particular situation. In such a case, the entire structure of accumulated information will lose its effectiveness, and it will have to be collected almost from scratch. There is a greater possibility that it is less effective than analyzing data based on outdated accents but on essential experience. For this reason, it is possible to consider the distribution of analysis functions between the hemispheres of the human brain as quite fixed from a particular moment.

Besides, it is essential to note that a person is a living system with a minimum ratio of the number of innate mechanisms of activity to the number of acquired ones based on analysis and modelling. However, analysis requires a minimum of initially specified information and a maximum of new data. Yet, many complex phenomena cannot be understood without prior acquaintance with simpler ones. Thus, it is impossible to understand social objects (or subjects) without a preliminary examination of generally static physical objects. In this regard, the distribution of the analysis of "social" and "physical" resources between the cerebral hemispheres is impossible initially but becomes possible after their sufficient examination. Until that moment, both hemispheres are probably analyzing flows of "physical" resources that differ in abundance and essentiality.

Besides, to manipulate something, you need to get some prior knowledge since manipulation involves different properties of one object. To operate them, you need to learn to perceive a single object as one object in various conditions, not as several different objects. Moreover, it is necessary to find out which properties various objects could have.

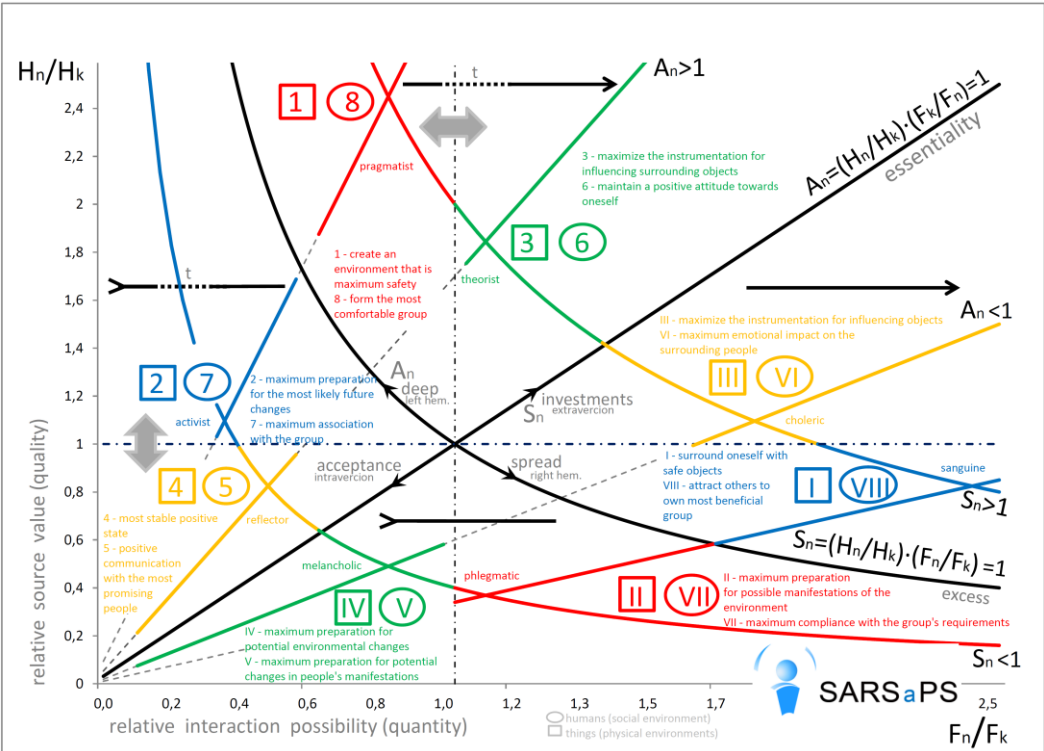
The last temporary limitation worth mentioning is that it requires a broad experience to determine any patterns in the environment. This could be manifested in that all rather complex aspects of information analysis initially could be a specialization of only the right "imaginative" hemisphere. After having collected information base sufficient for structuring in the relevant field, it becomes possible to implement the "logical" approach of the human brain's left hemisphere.

Along with that, in our model, we will assume consciousness only as a tool for the environment modelling and its system itself that depends on the general accents of information analysis. Therefore, it does not play a significant role in the distribution, it only complies to it.

Then, assuming that in addition to a small number of innate zoo-social programs other methods of analysis and modelling of the environment are acquired and developed in the process of ontogenesis, then the general sequence of stages of the environment exploration can be as follows.

4. The model sequence of stages of a human environment's examination

On the first stage, a human acquires knowledge about the surrounding environment's basic features, such as the signs of various "physical" objects, their types, usefulness or harmfulness, location and dislocation. It is quite easy to assess resource sources' relative characteristics for a given stage of human evolution as a living system. Since "social" resources are almost unknown to a person, all interaction with them can occur only due to innate zoo-social programs that manifest themselves with regard to relatively more essential "social" objects. Therefore, the sources of "physical" objects as resources are relatively excessive and not so essential, that could be defined as $S_n > 1$ and $A_n < 1$. At that, typically the "social" objects with which a person interacts at this stage are much more intense, and therefore $H_n / H_k < 1$. Thus, it is possible to determine the octants, which include the "physical" and "social" resources of a person as a living system, at this first (I), stage of development. For convenience, the right hemisphere's development stages will be designated by Roman numerals, and the ones of the left hemisphere - by Arabic.



teristics of resources of a person as a living system.

The relative parameters of the resources studied at this stage should relate to the "specialization" of the right "imaginative" hemisphere. This is quite expected since at first there will not be enough information to detect any patterns in such knowledge. Therefore, until acquiring the experience necessary to systematize information about the surrounding environment's basic properties, the left "logical" hemisphere will not thoroughly analyze this information. Thus, the right hemisphere should do the primary accumulation and analysis of information in this sphere. It can be expected that a similar order should be observed in other spheres.

With the accumulation of basic knowledge about "physical" objects, it becomes possible to examine their variable properties and the possible ways to adapt to such changes. Now let us evaluate their relative characteristics as sources of human resources. To do that, let us make an assumption about what kind of resources they should be assessed against.

With the expansion of empirically acquired knowledge and the environmental model's development, zoo-social programs' influence should decrease, replaced by activities specified by the acquired knowledge. Consequently, the initial "social" sources

of primary resources are replaced by new ones, and the interaction with them is defined by acquired mechanisms. It can be assumed that a change of the source of these resources that is relatively more essential, as shown above, means the beginning of a new cycle of human evolution as a living system.

Thereby, we can assume that after a person has accumulated sufficient basic knowledge about "physical" objects, the left "logical" hemisphere can structure this knowledge by determining patterns in them. However, in the first place, these patterns should define the "social" objects that previously were objects of innate zoo-social programs, since their importance cannot decrease sharply. Nevertheless, the interaction with them is specified by basic knowledge of "physical" objects. In other words, the left hemisphere enters the first (1) acquired stage of development.

There are significantly less variable "physical" objects, hence related to them sources of resources, than the total number of objects. However, at the same time, there are much fewer objects for which significant patterns could be found. Therefore, new to the analysis objects with variable properties, as before are determined as $A_n < 1$ and $F_n / F_k > 1$. However, the probability that their intensity as sources of resources will exceed the intensity of "social" objects is not high. Thus, they can be determined as $S_n < 1$. So, the octants of the relative characteristics of "physical" and "social" resources of this second (II) stage of development could be assessed for most cases.

After understanding the fundamental properties of "physical" objects and their change mechanisms, a person can naturally review objects' functions. By functions, we mean changes in objects' properties when interacting with other objects with some other properties. There are usually significantly fewer objects with any functions than just variable objects, but more than "social" objects, even if the latter's range expands. Therefore, $A_n < 1$. However, with the development of interaction mechanisms with the environment, a person's independence as a living system increases. Thus, a person receives fewer resources from the "patronizing" him or her "social" objects and more resources from direct interaction with "physical" sources of resources. In this case, only the specified shift in focus of analysis will occur. Then it is possible to cancel the redundancy of such objects $S_n > 1$ and $H_n / H_k > 1$, which allows determining the octants for the third (III) stage of development. As one may assume, the change in the significance of the former "social" objects which are relatively more essential sources of resources means their replacement with functionally new ones (not necessarily practically new) – consequently, a new change in the development cycle. Then the left hemisphere will probably move to the second (2) acquired stage of evolution and will be able to analyze "social" objects based on their variable characteristics. However, the analysis will continue to consider them as "physical" objects.

Having understood the concept of variable properties of "physical" objects and their possible functions, we can move on to reviewing the issue dealing with the variability of "physical" objects in time. As before, for such objects relative to the former "social" objects will be true $A_n < 1$. However, such objects are already quite rare. They mainly include living objects and some artificial ones. For this reason, for "physical" objects at this fourth (IV) stage of development is true $S_n < 1$ and $F_n / F_k < 1$. Thus, we find the stage of evolution related to the two remaining and previously not mentioned octants.

The properties emphasized during the analysis of "social" objects are changed. Now it is functional properties, which depend on other objects. In fact, a person again deals with functionally new "social" objects, which means another shift in the development cycle and the transition of the left hemisphere to a new the third (3) level of analysis.

Having reviewed everything that as we suppose a person should learn when sequentially exploring the environment on the first four model stages, we have come to an important point. Now there is everything necessary to separate "social" objects from "physical" objects with variable properties, including functional ones, that sometimes changing in time, the main property of which is a subjective relevance with the rest of the set of objects. At this stage, in addition to the historically distinguishing of several

"social" objects in the environment, their properties start to be percept as a class of objects.

At the same time, now "social" objects belong to the broader set of "physical" objects as rarer and either less abundant or just as abundant. That could be defined as $S_n < 1$ and $F_n / F_k < 1$. Since now in the described development sequence, the focus has shifted from "physical" to "social" objects then "physical" ones should become the priority of the left "logical" hemisphere. That is quite expected since earlier its attention was directed primarily to previously significant "social" objects. Obviously, they were analyzed as "physical" objects. Still, it is now possible to expand the scope of attention to all physical objects of such kind, regarding their objective essentiality, not their retrospective importance. As a result, the relative essentiality of the narrowed set of "social" objects decreases, that could be expressed by $A_n < 1$. That keeps the system at this new the fifth (V) cycle in the same octants, but with an inverted arrangement of "social" and "physical" objects. Despite the change in relatively more essential resources and the beginning of a new cycle, it cannot be claimed that the left hemisphere has shifted to a qualitatively new level of analysis. It would be more correct to assert that the previous third (3) stage's analysis mechanisms were improved.

Further exploration of the environment by a human is associated with a better understanding of "social" objects. The next stage that naturally follows from the accumulated knowledge is the shift of attention to the analysis of specific human functional properties, often associated with emotional impact. That is, knowing about the variable functional properties of "physical" objects, their variability over time and the main features of "social" objects that distinguish them among "physical" ones, we can expect that the system will need to influence the "social" objects with greater efficiency. Such mechanisms are much more favorable than interaction with "social" objects on a par with other "physical" objects, as it happens in the initial four stages due to the work of the left "logical" hemisphere.

Typically, the benefit from emotional impact is higher than from adaptation to the variable properties of "physical" objects. Along with that, the number of "physical" objects to which it is favorable to direct long-term focus of the left "logical" hemisphere is also lower than the number of people around who can be influenced through emotions. Therefore, the influence of intensity in the "social" sources of resources in this cycle is lower than the impact of frequency, and therefore their relative essentiality is lower. Then for the sixth (VI) stage of development of the right hemisphere is correct $S_n > 1$, $A_n < 1$, and $H_n / H_k > 1$. Then the left hemisphere during the transition to the fourth (4) stage of evolution corresponds to the opposite octant.

The next stage in the development of mechanisms for analyzing the environment, as can be assumed, will be the study of large social systems. Such a shift of focus in the analysis of information is possible only in quite large societies that have been able to create relatively stable social subsystems within themselves. First, the system studies the fundamental properties of groups of "social" objects, which are rather homogeneous in some aspects, and uses them in its activities. Such mechanisms of interaction with "social" objects allow enhancing standardization of "social" objects for members of the corresponding groups. However, with the expansion of the number of resources sources to such groups' size, their advantages and intensity still decrease. At the same time, we consider sources of resources not entire large social systems, but only their members individually, because a person communicates with a social system only through its participants, not through it as a whole. Thus, in the case of reaching the seventh (VII) stage, the characteristics of the resource sources analyzed by the right hemisphere will be $A_n < 1$, $S_n < 1$ and $F_n / F_k > 1$.

Along with that, the focus in the analysis of the environment on the properties of objects corresponds to "introverted" mechanisms defined as $S_n < 1$. In other words, it corresponds to the sources of resources for the properties of which the system adapts, investing counter resources to develop appropriate interaction mechanisms. In the path of development of information analysis mechanisms reviewed above, the left and right

hemispheres alternated in "extroversion" and "introversion", successively going through evolution stages. First, it was the right, and after having acquired a sufficient amount of information, the left. However, in the cycle, when the right hemisphere proceeds to the seventh (VII) "introverted" stage, the left hemisphere will not be able to move to the next fifth (5) stage, since, firstly, it is also "introverted" and secondly is also "social". Nevertheless, it should not stay at the "introverted" fourth (4) stage either. Therefore, in this case, the left "logical" hemisphere can only shift the focus of its work to those corresponding to the third (3) stage. Obviously, during the analysis, particular "social" objects will not be prioritized anymore; a single approach will be applied to all objects. Thus, the left hemisphere's mechanisms for information analyzing, which are similar to the previous ones in general principles, in this cycle are shifted to a different octant than before, that is $S_k > 1$, $A_k > 1$ and $F_k / F_n < 1$.

At the next stage of studying the environment, a person should probably shift his or her focus from the basic properties of social groups to their functional properties, so that to be able to change such properties. That, while maintaining the frequency of resource sources, will slightly increase their intensity and give relative characteristics at the eighth (VIII) stage, corresponding to the octant $S_n > 1$, $A_n < 1$ and $H_n / H_k < 1$. As expected, the left hemisphere will return to the fourth stage (4) but changing the octant again to the opposite of the right hemisphere's current octant.

We have to assume that further stages of the development of methods for analyzing the environment are also possible, for instance, by switching to the study of the time variables of the functional properties of social groups. Still, such options will not be considered in this article.

5. Other sequences of stages of a human environment's examination

In the previous chapter, we considered the model sequence of development of mechanisms for analyzing the environment by a human. This sequence is the most comfortable to understand the possible ways of attention focusing during environmental analysis. The considered model sequence of development should ultimately lead to a combination of analysis mechanisms VIII-4, which are developed further not intensively, but extensively through the expansion of information without changing its objects of study.

However, VIII-4 is only one of several possible combinations. Suppose there are not many sources of "social" resources. In that case, it is unlikely that the information will be sufficient to proceed according to the presented model sequence to the sixth (VI) stage or any of the subsequent ones. In such cases, it is impossible to increase the flows of "social" resources at the expense of such transitions. Therefore, depending on the human environment's complexity during the corresponding evolutionary cycles according to the presented model sequence, the final combination may be one of V-3, VI-4, VII-3, which corresponds to the reduced model sequence.

At that, the inability of transition from the "physical" stages to the "social" ones is low. This is related to the fact that a person functioning as a living system through which "physical" and "social" resources are exchanged is impossible without thoroughly analyzing information about one of the resource flows. It is also unlikely that both hemispheres will evolve further than the fourth stage.

There may be enough "physical" resources at the initial stages of the model sequence of development to obtain the information required for the right hemisphere to transit to the next stages. Still, the priority "social" resources that the left hemisphere initially focuses on when analyzing information are not increasing in quantity when interacting with them as with "physical" resources that possess functional properties. In this case, the left hemisphere will remain in the first two stages of development, alternating them depending on the stage of development of the right hemisphere. Such a developmental sequence differs from the model one, and in its case, the final

combination may be one of V-1, VI-2, VII-1, VIII-2. In this case, the model sequence will not be symmetrical regarding developing both brain's hemispheres.

Other cases that differ from the model sequence will be cases of development in which, for whatever reason, the transition of the right hemisphere between any stages of development, that is, a change in the mechanisms of interaction with the human environment, does not result in a qualitatively greater increase in the flow of resources. For instance, this is possible if the previous mechanisms give an extremely large flow of any resources or if it is impossible to develop new mechanisms due to the lack of corresponding sources of resources. Then the right hemisphere can stop at one of the first four stages I - IV. Nevertheless, as mentioned earlier, it is unlikely that both hemispheres will remain in the "physical" stages.

In such cases, humans' study of the environment should proceed by developing the left hemisphere's analyzing mechanisms. Then, depending on the right hemisphere's permanent stage, the left one will change priorities following stage's sequence 1 - 3 - 6 - 8 or 2 - 4 - 5 - 7. Such a sequence of development will be inverse to the model sequence. However, abbreviated versions are also possible when there is not enough information to change the initial "social" stage for the next one. Thus, the final combination may remain one of the following: I - 5, I - 7, II - 6, II - 8, III - 5, III - 7, IV - 6, IV - 8.

Thus, we assumed how all possible combinations of the analytical focus of a person as a living system can develop. We got 16 such combinations. These combinations of "social" / "physical" and "extraverted" / "introverted" priorities between the "logical" and "imaginative" cerebral hemispheres are formed in the process of ontogenesis by rather different algorithms with different duration.

Besides, each change in the development stages means a change in the cycle of human development as a living system. Therefore, the number of resources flowing through the system should increase at the rate mentioned above, hence the amount of analyzed information. Suppose any hemisphere does not change the mechanisms of analysis. In that case, the amount of data should continue to increase, which means the extensive development of analysis mechanisms due to their coverage growth. This also allows the right hemisphere to provide sufficient experience for generalization by the left hemisphere, even if it is fixed at one of the initial stages.

The described model sequence of development of the environmental analysis mechanism fits well with known periodizations of human development [9].

Let's briefly list the main types of analysis priorities reviewed above and assume the final goals of actions based on the analysis of these emphasizes.

The right hemisphere:

I – an emphasis on the features of various objects as "physical", their types, usefulness or harmfulness, as well as location and displacement. Striving to surround oneself with safe and useful objects (with positive associations) in a secure order, preserving and propagating such order, and eliminating objects with negative associations.

II – an emphasis on the variable properties of objects as "physical", and how to adapt to such changes. Striving for maximum preparation for possible manifestations of the environment, to adjust to the environment's current properties or to level their effect.

III – an emphasis on the functional properties of objects as "physical". Striving to maximize the instrumentation for influencing objects and changing the properties of objects with unwanted manifestations.

IV – an emphasis on the temporal variability of objects as "physical" through time. Striving to be prepared as much as possible for potential environmental changes and smooth out the consequences of current undesirable events.

V – an emphasis on "social" objects and their variability over time. Striving to be prepared as much as possible for potential changes in manifestations of people around and to smooth out the consequences of current unwanted emotions.

VI – an emphasis on the analysis of specific human functional properties, often associated with emotional effects. Striving for maximum emotional impact on the

surrounding "social" objects and keeping them within the framework of beneficial emotional relationships.

VII – an emphasis on the fundamental properties of "social" groups, and how to adapt to them. Striving for maximum compliance with the group's requirements regarding behaviour and proof of compliance with the group when communicating with others, to appeal to such a group in case of conflicts with others.

VIII – an emphasis on the functional properties of "social" groups, and how he or she can influence them. Striving to attract others to his or her most beneficial group.

The left hemisphere:

1 – an emphasis on various objects' features as "physical", their relationship and relative location. Striving to create an environment for yourself that is as safe as possible regarding priority "physical" aspects.

2 – an emphasis on objects' variable properties as "physical", identification of the most important trends. Striving for maximum preparation for the most likely positive future changes or deceleration of negative changes.

3 – an emphasis on the functional properties of objects as "physical", a search for common functional properties. Striving to maximize the instrumentation for influencing surrounding objects and avoid being affected by others in the future.

4 – an emphasis on variability of objects as "physical" over time, a search for long-term trends. Striving to achieve the most stable positive state and increase the probability of eliminating negative factors in the future.

5 – an emphasis on "social" objects, their variability through time. Striving to achieve positive communication with the most promising people around him or her.

6 – an emphasis on the analysis of human emotional characteristics, the patterns of their changes. Striving to establish and maintain a positive attitude towards oneself with the maximum number of people.

7 – an emphasis on the fundamental properties of "social" groups and their motives. Striving for maximum association with the group in the perception of others.

8 – an emphasis on the functional properties of "social" groups and their patterns. Striving to form the most comfortable group.

We also list combinations of priorities in the informational analysis that are possible according to the presented model:

I – 5, I – 7, II – 6, II – 8, III – 5, III – 7, IV – 6, IV – 8, V – 1, V – 3, VI – 2, VI – 4, VII – 1, VII – 3, VIII – 2, VIII – 4.

It should be noted that the relative characteristics of S_n , A_n , Q_n / Q_k , F_n / F_k can be of any essentiality in the specified ranges (within the octants), that will affect the degree of intensity of the corresponding priorities in information analysis.

6. How the considered model relates to other models

The sixteen combinations of human analytical priorities described in this study, if they occur, should manifest themselves in human actions since most of the human activity is the result of information analysis. In the following, we provide some well-known models to consider how they can coincide with the model presented in the article.

Let's consider the most basic temperament model that characterizes the response to extrinsic stimuli. We can conditionally determine four types of temperament regarding the speed of emotional excitement and inhibition [10], that affect the reaction time of a person as a system to the current resource sources manifestation or the risk of their disappearance. Since the right hemisphere is responsible for direct interaction with resource sources, it is logical to assume that it is its characteristics of information analysis that will affect a person's temperament. The more intensive resource sources prioritized by the right hemisphere's attention, the more beneficial it is to react quickly to obtain them. Respectively, when $S_n > 1$, the processes of emotional arousal will

proceed faster. In this case, the closer to the line $A_n = 1$, the higher the risks of missing a source of resources, therefore, the more prolonged activity is required, and, therefore, the slower emotional inhibition after excitation, which corresponds with the octants $A_n < 1$ and $Q_n / Q_k > 1$ or $F_n / K_k < 1$ due to their proximity to the A_n line. Nevertheless, in some cases, depending on the specific relative characteristics, the information analysis mechanisms corresponding to the mentioned above octants may be placed further from the A_n line than the mechanisms related to octants as $Q_n / Q_k < 1$ and $F_n / F_k > 1$. Thus, the octant corresponding to the III and VI stages' priorities has the highest rate of excitement and, more often, a low rate of inhibition that corresponds to a choleric temperament. The octant that includes the I and VIII stages' priorities also has a high excitement rate and usually a higher inhibition rate, that characterizes a sanguine temperament. The octant of the II and VII stages' priorities in most cases has a rate of excitement lower than that of a sanguine temperament. Still, it more often characterizes a high rate of inhibition that is designated as phlegmatic temperament. Finally, the octant, which corresponds to the IV and V stages' priorities, usually has the lowest excitation and inhibition rates, which are manifestations of a melancholic temperament.

As it was suggested, temperament reflects the mechanisms of the right hemisphere's activity. Accordingly, it is logical to assume that some kind of model exists representing the left hemisphere's mechanisms. The Honey and Mumford Learning styles model [11] might be considered such a model since the learning process is associated with the long-term accumulation of knowledge as resources, which corresponds to the criterion $A_n > 1$, that is to the characteristics of the resource sources analyzed by the left hemisphere. According to this model, the four types of learning are conventionally characterized by their propensity for active experimentation or observation and the preference for confirmed specific results over hypothetical estimated data. Investing resources in experiments is possible only when there is an excess of resources, that is when $S_n > 1$. Whereas the accumulation of information for developing hypotheses is necessary only at distancing from the state when $A_n = 1$. Then the octant corresponding to the parameters $S_n > 1$ and $F_n / F_k > 1$ should be characterized by a greater tendency to experiment with attention to specific results without complex hypotheses generating, which in the Honey-Mumford model is conceptualized as an "activist". The neighbouring octant when $F_n / F_k < 1$ is also probably more inclined to experiment, but more often with greater involvement in framing hypotheses about how to obtain resources, which defines "pragmatists". Further let's consider an octant with the parameters when $S_n < 1$ and $Q_n / Q_k > 1$, for which experimentation is unlikely, but a tendency to generate hypotheses should also appear, which corresponds to a "theorist". The last octant with $Q_n / Q_k < 1$ corresponds to the cases with the lowest probabilities of both experimentation and hypothesis, the Honey-Mumford model marks as a "reflector".

It is also worth mentioning the Myers-Briggs model [12] that is the most appropriate for the described model regarding the number of types. It describes sixteen personality types and is widely used in non-professional practice. At the same time, the validity of this model is relatively low. Still, it should be noted that this may be due to the low quality of its theory, based on a more subjective description that is overly discrete and claims that differences are innate. According to the Myers-Briggs model, which declares the development of C. Jung's theory, the personality types are divided into four pairs of parameters: extroversion – introversion (E – I), sensation – intuition (S – N), thinking – feeling (T – F) and judgment – perception (J – P). Each type is designated by the corresponding letters. Besides, each type has several "functions". The main ones are dominant, while the characteristics of auxiliary "functions" are opposite in extroversion/introversion and thinking-feeling/sensation-intuition parameters. At that, the judgment-perception parameter indicates which parameter from which pair of thinking – feeling or sensation – intuition belongs to the dominant "function". Thus, for the type ESTJ (extroversion, sensation, thinking, judgment) the dominant "function" is Te (extroversion, thinking), as indicated by J, then the auxiliary "function" has the Si (introversion, sensation) characteristics.

We will not conduct a full review of the Myers-Briggs model given parameters and "functions" since you could see the references for all details. However, we assert that although they are considerably more subjective, in general, they correspond to the model proposed by us. Thus, the dominant and auxiliary "functions" are close to the brain's right and left hemispheres' operation principles, respectively. The Myers-Briggs model extraversion-introversion personality type is fundamentally similar to those proposed in this article regarding the general direction of activity. The description of the pair of sensation – intuition parameters is identical to the difference between the priorities I, II, 1, 2 and III, IV, 3, 4, proposed by our model where the former are aimed at direct interaction with "physical" objects, and the latter are at more indirect. Finally, according to their descriptions, the pair of parameters thinking – feeling corresponds well to the specifications of which of the priorities proposed in this article – V, VI, 5, 6 or VII, VIII, 7, 8 – are primary in a person's analysis of information. Thus, each Myers-Briggs model type can be compared with a combination of priorities of the model reviewed in this article. That allows us to apply to the Myers-Briggs model less subjective justifications and descriptions we offer.

In a professional environment, more complex differential psychology methods are used. One of the most common is the big five personality model [13, 14] representing complex factors of a larger number of personality traits. These five main traits are Conscientiousness, Emotional Stability, Openness to Experience, Agreeableness and Extraversion. This model for describing the human psyche's characteristics has a relatively long practical verification history with high statistical accuracy. Let us assume how this model and the one proposed in the article can be related if the latter is correct.

The most intuitively obvious coincidence of the big five model with others is, obviously, the extraversion factor. It is reasonable to assume that this parameter coincides with the case of "extraverted" orientation of the right hemisphere proposed in our model. The characteristic of Neuroticism in the big five model is also well defined. The main features that it includes (according to the 45 AB5 facets model) are associated with poor emotional control, which correlates quite well with the octants we assigned to choleric and melancholic temperaments, corresponding to priorities III, VI and IV, V. The next big five model factor to consider is agreeableness. The traits associated with it conform to the manifestations expected in the "social", not in "physical" orientation of the right hemisphere. The conscientiousness factor, in turn, according to its features, can characterize the octants with priorities 1, 8 and 2, 7 associated with the accumulation of a relatively more complex analytical base in the goals area of the left hemisphere. Despite some possible complex intersection of the big five factors with the proposed model, the four considered factors are sufficient to describe any possible pair of accents regarding the proposed model. However, one of the big five factors we have not considered yet is openness. It is impossible to assume that this factor depends on the others' combination since the close dependence would hardly remain unnoticed by numerous model researchers, and such an element would be reduced. Along with that, the factor is associated with many features (like intellect, competence, etc.) that characterize the general cognitive development more than the characteristics of information analysis features. Thus, according to our assumption, the presented model is also consistent with the big five model.

7. Conclusion

In this article, we considered fundamental principles of the living systems' functioning, which are identified when they are defined as patterns in resource flows. These principles refer to the relative characteristics of resource flows passing through systems. In the article, significant restrictions were given for these characteristics, both at a specific time and during systems growth. The Fibonacci sequence was applied for the latter since it appropriately describes systems' growth rate between particular cycles.

The cycle duration was also specified, as well as its dependence on the system's most essential resource was revealed.

After giving a general definition and description of living systems, a person's differential characteristics were considered on their basis in the information analysis. Mechanisms for forming possible priorities in a person's analysis of information were described, and quite objective definitions were given to them based on living systems' operation. The resulting model is reasonably consistent; however, it is purely theoretical. Herewith, a small comparison of the derived 16 types of human information analysis priorities with several existing models is given in the article's final part. The mentioned comparison indirectly confirms the given theoretical model's correctness regarding its consistency with existing empirical schemes.

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