The Issue of Psychogenesis and its Aspects

Victor D. Balin[a], Michael M. Zhmaev[b], Julia V. Stepanova[a]*

[a]St. Petersburg University, St. Petersburg, Russian Federation
[b]Albrecht Federal Scientific Centre for Rehabilitation of People with Disabilities of the Ministry of Labor and Social Protection of the Russian Federation, St. Petersburg, Russian Federation

Abstract. The article describes the main components of the model of psychogenesis, considered in several aspects: logical, evolutional (historical) and ontogenetic. It is shown that attempts to search for the basics of the mind in the structure of nervous system are meaningless; firstly, it is necessary to find out the role of nervous system in the process of organism adaptation to the environment. To solve this issue, it is required to describe the basic physical characteristics of the environment. The article claims that the process of psychogenesis is a complex multilevel phenomenon that must be considered at least in four directions: mathematical, physical, anatomic-physiological and psychological ones

Keywords: psychogenesis, logical aspect, evolutional aspect, ontogenetic aspect, four-level model of psychogenesis.

Psycho-physiology, clinical psychology, correctional psychology and some other disciplines use knowledge situated "on the border of two substrates" between the mental and the non-mental. This is the reason of questions about the essence of the mental, about its genesis (psychogenesis), about the laws of psychogenesis, about borders between the mental and the non-mental. There are some problems in studying this topic.

We suggest that psychogenesis is managed by some general laws, not only physiological and psychological ones. We will explore the laws connected (in our point of view) to psychogenesis and well-known in general sciences (mainly in mathematics and physics) and will try to connect them with psychogenesis.

Key issues of psychology and psycho-physiology

Issues solved by psycho-physiology which is situated literally "on the border of two substrates" are seen in so called key issues of psychology. There are following issues:

1. *The psychophysical issue* – place that the mind occupies in the nature, relationship between the mental and the physical.

2. *The psycho-physiological issue* – relationship between mental and physiological processes: the question whether nervous substrate of the mental exists should be answered.

The issue of borders between mental and physiological phenomena is also important. Usually it is thought that this border is the border between irritation and sensation. But this is not so. Now such borders can be discussed: 1) physiological irritations – mental sensation; 2) physiological reactions – mental state; 3) movements – action; 4) nervous system features – temperament; 5) makings – abilities.

3. *The psycho-gnostic issue* – degree of mental cognition of objects and phenomena (whether the mind reflects the environment properly).

4. *The psychosocial issue*: which is the relationship between individual and social mental phenomena? Here the connection with psycho-physiology means that the process of evolution of individual and social mental phenomena is managed by the same laws.

* Corresponding author.
E-mail address: viktorbalin@yandex.ru

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Three aspects of psychogenesis

Psychogenesis is the main issue of psychology which has several aspects:

A. *The logical aspect*. Which laws of nature lead the evolution of mind? N.A. Kozyrev, a famous physicist, said that organisms cannot create things that do not exist in nature. They can only gather and use things laid in general features of the world. These features should also exist in inanimate nature. Unusualness of the mental is explained not by unusualness of the laws of psychogenesis, but by the fact that usual laws in unusual combination take part in psychogenesis. The issue of mental disorder genesis is the reverse side of the logical aspect of psychogenesis [13].

Which natural mechanisms "participate" in realisation of mental phenomenon? The first step is such feature as integrity. It can characterise both elementary sensation and public consciousness. Consequently, if there is the whole, its elements also should be found. Elements within the whole are not equal: there are dominants among them. If there are elements within the whole there is also a structure. Elements and a structure give a function that is determined both by the elements and by the structure. A mental phenomenon is a dynamic whole existing in development and in a particular environment.

Our idea is based on the expansion of the universe after the Big Bang. It is well known that during the expansion the universe not only takes more and more space but also becomes more differentiated and acquires new features. Organisms need to create more and more accurate mechanisms of environment reflection: the more differentiation is, the better the anticipation is developed.

There are two main features of the environment: ambiguity and non-equilibrium. Ambiguity means: a) relativity; b) uncertainty; c) incompleteness. Non-equilibrium means: a) self-organisation, b) periodicity, c) dominance (attractivity), d) discreteness – continuity.

Adaptation is the instrument of man-environment interaction. It includes two processes: reflection and regulation. Reflection is highlighting of objective features in the environment (the exo-mind) and their connection with genetic memory (the endo-mind). These two currents of information are connected to each other by the meso-mind; it helps to form behaviour contributing adaptation of a subject to the environment. There is also the meta-mind responsible for psycho-social phenomena [1].

Reflection devices were formed during the evolution step by step. Evolution had more than one stage. There was nuclear, chemical, biological, social and cultural evolution. Evolution is eternal continuity of self-organisation processes.

The differentiation and integration processes are instruments of evolution. The last ones represent ambiguity and non-equilibrium on the biological level. These processes control morphogenesis, psychogenesis, socio-genesis, labour-genesis, ethno-genesis, culture-genesis. Differentiation and integration processes, changing each other periodically, contribute creation of non-equilibrium situations in the biosphere. Morphogenesis process creates such a set of elements within the organism that finally leads to creation of new functions: one of them is called "the mind".

The physical world view is the system of invariants different by level of generality (from the topological level to the metric one). Every invariant complies to a physiological functional system (FS), formed according to self-organisation laws. The invariant is one of FS activity products. Here the invariant is the attractor of self-organised FS.

Psychogenesis is managed by some fundamental laws of nature which also work in other disciplines, but their combinations in psychology are unusual. There are no specific laws of mind creation: it is possible to explore the mind using natural-scientific methods. It does not mean that psychology can adopt laws of other disciplines (for example, physiology). Psychogenesis is bifurcation point, after that the typical laws of psychology become to work. But general laws work on the stage of psychogenesis, after that irreversible changes and development of the mind occur.

The opinion that psychology is an individual case of physiology is based on an "optical illusion" and, in fact, is a typical logical error like "post hoc, ergo propter hoc" ("after that" means "because of that"). This illusion appears every time when explorers register physiological and mental phenomena together. Some physiological changes indeed occur when psychological ones do, but not as the reason of them. Both psychological and physiological laws, and also more general ones that should be mostly

connected with laws of holistic phenomena, work in psychology.

Integrity laws and mind phenomena

We are going to study cases when psychologists use data received in other disciplines for explanation of mind phenomena.

Al least, four levels can be highlighted in this case.

1. *The mathematical level*. Formally the objective of psychogenesis is that a device able to stabilise the "slipping" environment is needed. Nervous system is adjusted to distinguishing invariant features in chaotic currents of information.

Psychology and geometric invariants

There are well-known physical invariants: the Avogadro constant, the Planck constant, etc. Many physiological parameters (heart rate, blood pressure, body temperature etc.) also can be considered as invariants. The term of invariant was introduced in psychology by J. Piaget. There are Koffka's perceptive constants (invariants). According to D.V. Atkinson's law, the sum of the strategies of success ambition (Ps) and failure avoidance (Pf) equals a constant. The sum of their probabilities equals 1. L.M. Vekker's works explaining mental processes with algebraic invariants are also widely known. All these theories consider invariant as an attractor of self-organised system [1; 2].

Mental reflection (perception is a special case) can be formally considered as conversion from one coordinate system to another, and it does not depend on the mechanisms leading this conversion.

Which transformations can be done with the image of reflected object considered here as a geometric shape situated on any background plane?

The metric invariant. We can rotate the background plane of representation around the origin or move the object. Direction between two points, line segment division ratio, vector length, a scalar product, an angle between two lines, position of three points on one line, parallel and perpendicularity do not change here. Invariance of shape features connected to plane orientation is lost during such transformation.

The similarity invariant. We can multiply all coordinates of the object and a ρ coefficient. These geometric transformations have a centre in the origin and homothety coefficient ρ. Homothety ("situated equally") is straight or reverse relatively to a particular point (the centre of homothety) position of similar shapes. Segment length and triangle area will not conserve, but the relationship of segment lengths or areas will do. Linear position of points, parallel of lines and an angle between two lines conserve.

The affine invariant. A plane of representation can be stretched or squeezed along one of coordinate axis or at some angle in relation to the origin. In this case following concepts will be affine: line, line segment, midpoint, parallel lines, triangle, quadrilateral. Equation of non-parallel segments, perpendicularity of lines, equilateral triangle, right-angled triangle, rhombus, rectangle, circle, rotation of a vector around a point or an axis. All triangles and also all parallelograms are affine-equivalent.

The projective invariants. Let us turn the plane of representation on an angle. During a projective transformation planes and points lying on a line transform to points situated on the same line. In the projective plane not only two different points determine a line uniquely, but also two different cross always in the same point. Three points situated on one line are dependent, points that are not situated one a line are independent. There is no parallel principle here. Parallel lines can cross. All triangles are identical, and so are all quadrilaterals. Unlike the affine invariant, there are no terms "ellipse", "parabola", "hyperbola" here.

The topological invariant. Let us add new transformation of the projective plane: it can be, for example, wrapped to a hemisphere with unequal random edges. Only the fundamental features of a shape remain after such projection: connectivity, compactness, dimensionality, weight, fundamental group, homology groups. All circular spaces are equivalent, there are no terms "line", "curve" [6; 11].

The diagram of connection of perceptive image formation stages and the system of geometric invariants is following: 1. The opened outline stage corresponds to the topological invariant. 2. The "amorphous spot" stage corresponds to the projective invariant. 3. The stage of curvature sudden variations distinction corresponds to the affine invariant. 4. The stage of common-suitable perception corresponds to the similarity invariant. 5. The stage of suitable shape representation corresponds to the metric invariant [7; 8].

Besides invariant theory that let consider a

mental phenomenon as a holistic composition, there are mathematical theories studying structural characteristics of such objects. Graph theory, which allows describe complex objects formally is an example.

The issue of integrity and the graph theory

Many features of holistic objects do not depend on features of their elements, and mostly existence of these elements is enough, and their interaction is typical. Why graph theory is so attractive for psychologists? There are several kinds of issues that can be solved using methods of this theory.

The first group of tasks was just described above – this is studying of general laws of mind establishment that needs elements and links between them. General psychology, psychophysiology, animal psychology, differential psychology are interested in this kind of studying. The second group is represented by tasks of algorithmic phenomenon description. The language of the mentioned theory permits us to build a model of activity, to imagine processes of decision making, learning and interiorisation, formation stages of thinking actions, phonetic sounds etc. visually. The third group includes combinatory tasks of social psychology, sociology and labour psychology [10; 19; 23; 24; 25].

There are tasks connected to scheduling, organisation of transport flows, designation, reliability assessment, managing information flows etc. [4; 16; 26].

The main terms of the graph theory. Like other disciplines, the graph theory use symbols that give "economy" of thinking and makes the instrument of studying more flexible. Most of these symbols came from the set theory.

The rule setting the corresponding between set elements is called representation and meant by the letter F with indication of original and represented elements. The original element is indicated straight after the letter F, the represented one is indicated after the equal sign in curved brackets: Fa1={b1}, Fa2={b2} etc.

A kind of representation in which each element of the original set corresponds to only one element of another one is called single-valued, if there are more elements, this is a multi-valued representation. This connection of elements let us consider some of them as representations of the other ones. This is first-degree representation. We can also consider representation of higher degree and reverse representations of any degree. For graph determination we should have an *X* set and an *F* representation set.

Kinds of graphs. O-regular graph is a graph that consists only of isolated vertices. In a complete graph each pair of vertices is connected by an edge or a directed edge. In a connected graph there is a chain that connected each pair of vertices. Isomorphic graphs correspond to a particular list of vertices but their edges and vertices are situated in different ways. A graph which has at least two adjacent vertices connected by more than one edge is called a multigraph. In a planar graph its edges cross only in vertices [12; 14; 20].

Thus, there are formal procedures that permit to explore the relationships between the elements within the whole that do not depend on particular essence of these elements.

Development process of the mental whole has several levels. The second level is the physical one.

2. *The physical level*. Solving the issue of psychogenesis we have discovered that exploring anatomic-physiological organisation of nervous system and organism shows nothing until we answer the question: "What means nervous system for adaptation of an organism to the environment?". And one more question: "Which are physical features of this environment?".

In terms of physics psychogenesis is a phase change from diffuse state to structured one. Psychogenesis is a change of phase state of a combination of environmental features, like change of state of matter, for example, for water these states are: ice, liquid, vapour, plasma. We should add that in case of I. Prigozhin's non-equilibrium thermodynamics the number of possible nonlinear non-equilibrium phase changes much more than classical phase changes, because open systems demonstrate a huge number of possible spatial-temporal relationships of extremely complex nets, including chaotic meta-stable states. This permits to develop the mathematical aspect of psychogenesis considerably, using methods of nonlinear dynamics and the complex net theory for adequate modelling of real, realising approaches to psychogenesis [18].

Conservation laws and invariance of physical quantities

In physics, invariants are connected to conservation laws.

Conservation laws are some fundamental physical laws disclaiming conservation (i.e. invariance) of particular physical quantities. The most famous among them are laws of conservation of mass, energy, linear momentum, angular momentum and charge. It is also interesting that, although conservation laws were introduced in specific fields of physics (for example, laws of conservation of energy and linear momentum appeared in Newtonian mechanics), they are general.

According to *E. Noether's theorem*, conservation laws are closely related to symmetry of space and time. These laws are significant for science: they demonstrate not only the invariance principle, but also *the symmetry principle* [15; 22].

For example, the law of conservation of linear momentum is the consequence of space uniformity: all points of space are equivalent, and translation does not change the system [15; 22].

E. Noether's theorem connects the law of conservation of angular momentum with such a type of symmetry as space isotropy – constancy of space when a reference frame is turned on a particular angle [15].

According to E. Noether, the law of conservation of energy is connected with time uniformity. It means that all time segments are equivalent to each other, and the moment when an event happens is not important from the physical point of view.

E. Noether connected the law of conservation of charge with gauge invariance of phase changes. In other words, all existing phase processes are possible thanks to the law of conservation of charge [15; 22].

The term of "geometric invariants" are well connected with E. Noether's theorem that permits to explain the "symmetry" of mental phenomena. Like in physics there is a connection between conservation laws and features of space and time, geometric invariants in psychology can be connected with phase changes in a perceptive image.

The evolution of theories in organic chemistry

Compound structure theories and reactive capacity theories (i.e. theories that explain connection of atoms in a molecule, their interaction within a molecule and process of chemical reactions) form a theoretical base of organic chemistry. The development of organic compound structure concepts includes several stages which can be characterised in following way:

The theory of radicals ("the dualistic theory"). The essence of this theory: all compounds are made of oppositely charged particles (elements) by electrostatic attraction forces. In organic compounds not only atoms but also their groupings (radicals) can be called charged particles. The theory of radicals was the base for classification of organic compounds, in some cases an explanation of their features was succeeded.

The theory of types. It was created by J. Dumas on the basis of the radical theory that he rejected, but the term "atom grouping" (or "radical") was conserved. J. Dumas supposed to classify organic compounds by types. For example, acetic and chloroacetic acids belong to the same type.

The unitary theory. This theory supposed by C. Gerard and O. Loran based on the replacement principle. All organic compounds can be formed from particular types by replacement of hydrogen atoms by organic (hydrocarbon) groupings – radicals. This theory let scientists predict and synthesise new classes of compounds (organic acid anhydrides, polyoles).

The structure theory. The term "valence" that means "capacity of an element to attract a particular number of atoms of other elements" has appeared. A. Kekulé supposed carbon quadrivalence principle and proved that carbon atoms can connect to each other and form long chains. A.M. Butlerov supposed the term "structure" that reflected a sequence of atom connection in a molecule. He also supposed to use dashes between the atoms to explain a sequence of atom connection in a molecule.

Classic electronic theories of chemical bonds. In organic chemistry there are problems similar to those in psychology: in the first case we should find laws of unification of elements (atoms) in bigger groups (molecules), in the second case we should establish laws of formation of bigger

mental phenomena (images, emotions etc.) from elements, or laws of unification of people in groups and labour activity [10; 23; 24; 25]. This circumstance let us suppose that in both cases there are more general laws partly represented in chemistry and psychology. 23 V.M. Bekhterev's laws should be mentioned here [1]. To sum up, the mind phenomenon is a "legal" natural phenomenon managed by fundamental natural laws, and we can describe it in terms of given laws. The laws of chemistry and psychology can differ only particularly.

The main principles of quantum organic chemistry. The classic theory was complemented by quantum chemistry, based on physical discoveries on dual (corpuscular and wave) nature of electrons. Mechanics of microcosm (wave mechanics) was created. E. Schrödinger installed an equation linking wave nature of a moving material particle (in particular, of an electron) that has spatial coordinates and energy:

$$\frac{d^2\Psi}{dx^2}+\frac{d^2\Psi}{dy^2}+\frac{d^2\Psi}{dz^2}+\frac{8\pi^2 m}{h^2}(E-U)\Psi=0$$

Here $\Psi(x, y, z)$ is the wave electron function that depends on its spatial coordinates. Physically it means that its square (Ψ^2) characterise probability of electron location in a particular space point. E is for full energy of an electron, U is for potential energy, h is for the Planck constant, m is for mass of an electron.

Thus, chemists trying to solve the issue of unification of atoms in a molecule tend to consider that inner features of elements are driving force of this unification. These features are: electron charge, valence, atomic structure of a molecule.

Features of the whole (a molecule) depend on structure of connections between elements: basic features, quantity and chemical structure of elements; the set of initial elements and their combination; energy of given connection. The last one characterise stability of the whole. A stable state is a state that has less elements (energy minimisation principle) [17].

3. *The anatomic-physiological level.* The task to solve is stabilisation of the streams of given information. It is carried progressively and has several levels. According to G. Shepherd, there are 5 levels of nervous systems organisation: a) micronets (the lower level of nervous net organisation; it consists of particular synapses and their pre- and postsynaptic structures); b) local nets, formed by collateralisation of pathways and interneurons; c) local modules (cortical columns, glomeruli, nucleuses, ganglia); d) the areas and lobes of the brain; e) hemispheres [28].

4. *The psychological level.* Invariant searching is necessary for world view formation. The process of invariant searching stops when incoming information begins to repeat. Here an invariant is an attractor of the process of environment view by searching its stable (invariant) features. The "world view" formed in this way is highlighted thanks to using the system of individual values [1].

The issue of integrity in biological and anthropological sciences

The laws explaining existence of the whole are explored by different biological sciences, although they can be formulated in different ways. For example, there is a question in physiology and anatomy, which criteria of brain department classification should be chosen for future construction of more general brain structures (and, finally, behaviour) from these "elements". And despite basic concepts about brain structure and its division into parts are recognized, there are many discussions about the role of these parts in general brain activity [3].

In biology and physiology the question about relationship of the elements and the whole, structure of the whole in connection with the function of physiological systems is actively discussed. Indeed, discussions about role of system approach in exploration of biological objects came to psychology from physiology. However, the laws described in physiology do not permit us to explain mental phenomena on this basis. They do not consider all circumstances, in other words, the laws of the physiological whole cannot be applied to the mind, because the mind (including social phenomena), is more diverse than the physiological whole.

Concepts explaining behaviour organisation

Our aim is to begin the synthesis of all existing theories to a holistic structure that let us explain fairly cast group of mental phenomena. Let us summarise mentioned theoretic concepts

Table 1. Behaviour elements and integrity

Author	Discovered features of the hypothetical mental whole (as a phenomenon)
I.M. Sechenov	1. There are inborn and purchased types of behaviour. 2. Self-regulation is the main principle of existence of the whole that also during the evolution
I.P. Pavlov	1. Reflex self-regulation as a way of adaptation. 2. There are inborn types of behaviour (unconditioned reflexes as elements of the whole); purchased ones (conditioned reflexes) are based on them. 3. An unconditioned reflex is the base of the whole. 4. Occurrence of the whole needs synchronization of elements (unconditioned reflexes) and indifferent signals
V.M. Bekhterev	1. Mental and physical phenomena are leaded by the same laws of being (23 laws). 2. Besides the biological evolution, there is the mental one and also the mental selection. 3. There are two types of reflexes: simple (inborn) nervous one and mental (combined, purchased) one
J.B. Watson	There are inborn reactions and, based on them, integral ones, which are formed according to the laws of permutations and combinations. It is possible to change one element for another within the whole without destroying of its main function
A.A. Ukhtomsky	1. Organisms live in a probabilistic environment. For successful adaptation it forms its own image of the environment (chronotope). 2. For reflection of environmental features nervous system forms its nervous code (a constellation of nervous centres that has features of the whole). The main factor (dominant) and elements (subdominants) exist within this whole. There is compliance between the structure of environmental traits (features) and the constellation of nervous centres formed for this reason. 3. The constellation and its dominant are the essence of a physiological mechanism, needed for integration of contradictory and exhaustive information about the environment. Integration is an adaptor that allows organisms to act in a probabilistic environment.
K. Lashley	The mental whole consists of particular elements. At least, quantity of the elements and the structure of links between them are the most important for the cases of learning, not their content and features (the elements are equivalent). All the elements can be replaced by each other
E. Tolman	1. Purchased elements of behaviour (based on Watson's molecular units, known now as functional systems) are affected by genetic factors that determine motives of behaviour. A motive is concentrated past experience. 2. There are "sense" components (dominants) in the environment, that makes it non-equilibrium. 3. Behaviour is discrete
L.V. Krushinsky	1. There are inborn and purchased types of behaviour. The last ones are based on extrapolating reflexes. 2. The quantum of discrete behaviour is an unitary reaction
Ethologists (K. Lorenz, N. Tinbergen, J. Uexküll, W.	1. Behaviour is discrete. The quantum of behaviour is a set of fixed actions (SFA). 2. Many fairly complicated types of behaviour are combinations of inborn elementary ones. 3. Final objective of different types of behaviour is adaptation. Items of adaptation

Craig)	are SFA, display, inborn allowing mechanism (IAM), imprinting, offset activity, redirected activity, intentional movements, regression, hyperactivity, ritualization etc.
P.K. Anokhin	1. Behaviour is discrete. 2. The act of behaviour is holistic phenomenon. Elements of this whole are described (there are 5 of them). 3. Self-regulation of the whole is possible. 4. Phase character of existence of the whole. 5. Integrative character of the whole
N.A. Bernstein	1. Behaviour is discrete. 2. Number of elements of the mental whole is equal to six. 3. There are different levels of the whole, connected to the level of motion regulation. 4. Self-regulation of the whole. 5. Integrative character of the whole
D.O. Hebb	1. Any mental phenomenon is based on a holistic neuronal unit called "a cell assembly". There is a hierarchy of assemblies and corresponding hierarchy of mental phenomena. 2. Features of "cell assemblies": integration, convergence, equipotentiality, statistic links between the elements, invariance
G. Miller, E. Galanter, K. Pribram	1. Behaviour is discrete. 2. The nervous substrate and corresponding types of behaviour have many levels
Activation concept of D. Lindley, E. Duffy, R. Malmo etc.	1. There are different levels and types of behaviour that depend on activation level (the existence of the whole depends on its energetic charge). 2. There are three types of activation: vegetative, behavioural, cortical
M.N. Livanov	1. Integrity of nervous substrate corresponds to the mental whole. 2. The mental whole is dynamic. Character of link between the elements of the whole determines its function (mental). 3. The mental whole changes periodically. 4. The features of the mental whole are coded both in special and temporal features of the substrate (the holographic principle)
A.M. Ivanitsky	1. The subject-environment interaction is discrete. 2. The mental whole is layered: one layer is connected to non-specific assessment of events, and another one to specific assessment.
A.R. Luria	The mental whole has layered structure. There are three layers corresponding to three sections of the substrate: the energetic unit, the unit of information conversion, the programming unit
I.T. Kurtsin	The mental whole has layered structure. There are three layers corresponding to three sections of the nervous system: "the somatic brain", "the visceral brain", "the mental brain"
E.N. Sokolov	The mental reflective mechanism is necessary for reduction of ambiguity of the environment. This mechanism distinguishes events with high and low level of probability that makes the environment non-equilibrium. There are dominants in the environment

R.I. Kruglikov	1. The mental whole (the image of the environment) is a combination of elements based on present and memorised information. 2. Excessiveness of the image is necessary for consideration of different variants of the events development. The last fact is the consequence of high ambiguity of the environment.
A.S. Batuev	1. The environment is highly ambiguous. 2. There are inborn behavioural programmes, but they cannot be used properly because of the ambiguity of the environment. 3. The act of behaviour is holistic phenomenon that has elements (inborn programmes), structure and function. Union of the elements is led by the dominant motivation. The sign of the felt emotion is a signal of biological quality of the event
V.B. Shvyrkov	1. Behaviour is based on inborn programmes (IP). Number of them reflects a story of adaptive organism-environment relationships during the evolution. 2. New types of behaviour appear thanks to free ("not full" with IP) neurons that reflect the system, also conditioned by the structure of the environment. 3. The act of behaviour is holistic phenomenon that has elements (IP), structure and function

The analysis of the heritage of several generations of biologists and psychologists exploring the issue of mind genesis has highlighted several stages in development of modern approach to the issue of mental whole (MW) formation. On *the first stage* it is noted that the MW is based on "inborn atomic structures" (i.e. reactions, unconditioned reflexes etc.), the laws of interaction of the MW with the environment. *The second stage* is characterised by detailed studying of the laws of unification of elements to the whole: it was discovered that their integration needs elements "managing" this process (dominants). On *the third stage* the axiological non-equivalence of the environmental features for the whole is noted: some features are more valuable than the others, it makes the environment non-equilibrium for the subject. Behaviour is a way of connection with the environment necessary for adaptation to it. Behaviour discreteness is established. MW is considered as a dynamic system. *The fourth stage* is characterised by the statement that "the quantum of behaviour" is layered. *The fifth stage* is characterised by the statement that events happening in the environment are probabilistic, and consequently the main function of the mind is decrease of its ambiguity

B. *The historic (evolutional)* aspect of psychogenesis: "How the mind has been formed during the process of evolution"? The logical aspect explains how the formation of the mind must proceed, which logic the process has, which relationships the substrate and the mind have, which kinds of the mind are possible. The evolutional aspect demonstrates the real process of psychogenesis.

The most important issue is the connection of psychogenesis with the laws of evolution and explanation of different mental phenomena (cognitive and emotional phenomena, behaviour), stages of their development and their phylogenetic age. Another issue is the relationship between the substrate and the mind on different stages of evolution. The data we have let us consider that the relationship of an organism with the environment on different stages of evolution are led by different departments of nervous system. However, different forms of behaviour in general remain similar, and complication of substrate causes only differentiation of behaviour. All the anterior nervous devices conserve in the brain but change the function and become devices controlling the base of behaviour (the reticular formation, the thalamus) and participating in organism state control.

C. *The ontogenetic aspect:* "How does the mind develop during the process of ontogenesis, which stages does psychogenesis have"?

In psychology ontogenesis is the formation of basic mental structures of a human being during his or her childhood. If considered wider, ontogenesis is the mental development process during all life.

Basing on von Baer's laws of embryology and the biogenetic law, we can suppose that the

ontogenetic stages of mental development are the same that the evolutional ones. This rule exists, in particular, in the process of thinking development. According to the Leontyev – Fabry theory, evolution of the mind had several stages: 1. The sensor mind stage. 2. The perceptive mind stage. 3. The intelligence stage. 4. The consciousness stage.

Limitations of modelling possibility of the mind as a natural phenomenon

Psychogenesis can be considered at least in four aspects. Such representation of the process let us build models of psychogenesis in the future, what can be fairly important in the epoch of common computerisation and robotisation. We think that modelling of the "mind" resembles modelling of the nuclear. In both cases explorers deal with an invisible (for some reasons) object. Physicists gathered the knowledge received in experiments. Finally, when there was enough knowledge, E. Rutherford created the model of the nuclear that satisfied to new knowledge. Something similar can occur in psychology.

Theories of oscillatory neuronal nets are much closer to our approach [5]; they are different from mainstream deep learning and consider the role of synchronisation of neuronal oscillations appropriately (from the point of view of the psychogenesis model).

The understanding of psychogenesis (a random process) requires introduction of the term "computing irreducibility". It means that we cannot predict behaviour of the modelled mind as a complex system, except repeating of real stages of ontogenetic (and evolutional) development. When we consider coincidence of psychogenesis correctly, there is no shorter way of evolution than the natural course of time. In this case it comes to relation of the logical and the evolutional aspects of psychogenesis.

Thus, the traditional point of view considering that exact knowledge of the laws let us predict psychogenesis exactly is not correct in the case of nonlinear and random dynamics (as in our case).

We can declare that all trial of exact mind model creation that needs total intelligence algorithmisation are led by the K. Gödel's incompleteness theorem [27] and also are connected with Kolmogorov-Cheytin's statements [9] about limits of complexity, which obviously limit opportunities of these concepts. In other words, there are objective limits in mind algorithmisation. Whether mind algorithm was created by engineers, it will differ from natural version of the mind. And it means that robots cannot dominate a human being, certainly if he or she does not cease active interaction with the environment. The situation in physics is quite similar: it is impossible to create "the theory of Everything".

The issue of brain dynamics modelling is closely connected to the Many-Body Problem. Recent works of theoretical physicists developing the theory of critical phenomena (phase changes) show a close relationship of discussed issue with existing models of spatial and temporal regulating and occurrence of so called long-range correlations (neuronal assemblies synchronisation). Such explorers as Dante Chialvo note that the mind works in standard mode in a so called "critical point"; this fact let us include elaborations of nonlinear dynamics and bifurcation theory [21;29].

Anyway, invariant searching issue (invariants are order parameters of environment considered as the main aim of psychogenesis), can be solved using powerful apparatus of theoretical physics.

We can base our model of psychogenesis on the following statements.

Conclusion

1. The mental reflection of the environment corresponds to its features, as a key to a lock.

2. Exploring the features of the mental reflexive instrument, we can explore the features of the environment.

3. Exploring the features of the environment, we can discover the requirements of the environment to the mental reflexive instrument.

4. Solving the issue of psychogenesis, we have discovered that studying anatomic-physiological organisation of nervous system and organism does not give us any information until we will know the role of nervous system in the process of adaptation to the environment.

5. A mental phenomenon is holistic. It consists of elements, structure and has a particular function. A mental phenomenon is a dynamic self-organised whole which changes over time. The mental reflexive instrument is aimed at identifying invariant features of the environment.

6. The mind has layered structure. The holistic mind consists of spheres put one into another. We call them endo-mimind, meso-mind, exo-mind and meta-mind. These spheres are isomorphic.

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